United States Patent

Yucel

[15] 3,648,835

[45] Mar. 14, 1972

[54] MARKING TAPE

[72] Inventor: Edgar K. Yucel, Edina, Minn.

[73] Assignee: Minnesota Mining and Manufacturing Company, St. Paul, Minn.

[22] Filed: Nov. 12, 1969

[21] Appl. No.: 875,701

[52] U.S. Cl. ..... 206/59 C, 117/25, 117/37 R, 117/44, 117/68.5, 117/122 P, 33/137

[51] Int. Cl. B44c 1/08, A611 15/06

[58] Field of Search ..... 117/37, 15, 44, 122 P, 68.5, 117/25; 33/137; 156/247, 249; 206/59 C

[56] References Cited

UNITED STATES PATENTS

2,049,030	7/1936	Strauss	117/44
2,177,627	10/1939	Gurley	33/137
2,500,549	3/1950	Ketay et al.	117/44
2,932,897	4/1960	Huber	33/137
3,470,574	10/1969	Heitman	33/137

FOREIGN PATENTS OR APPLICATIONS

1,199,996	9/1965	Germany	33/137

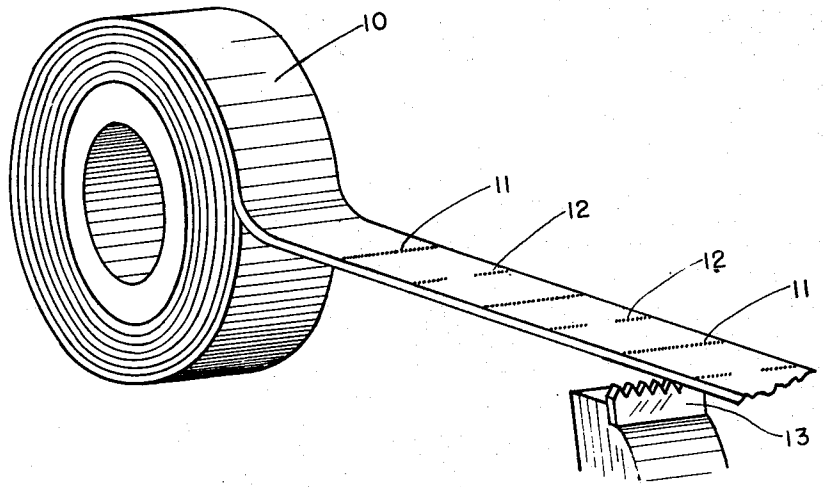
Primary Examiner—Alfred L. Leavitt
Assistant Examiner—M. F. Esposito
Attorney—Robert C. Baker

[57] ABSTRACT

Pressure sensitive adhesive tape of the transparent type is marked with visually distinguishable light-reflecting structural markings at uniformly spaced unit intervals along its length in a roll. Light reflected from these markings as the tape is withdrawn from a roll makes the markings readily distinguishable by the naked eye from other portions of the tape not so marked. Thus, the unit interval markings permit a person to measure directly the length of a strip of tape being withdrawn from a roll as it is withdrawn.

But these markings are also such that, after the withdrawn strip of tape is applied under light finger pressure to a substrate, the special markings essentially disappear. They become essentially invisible and unnoticeable in the transparent tape on the substrate.

10 Claims, 8 Drawing Figures



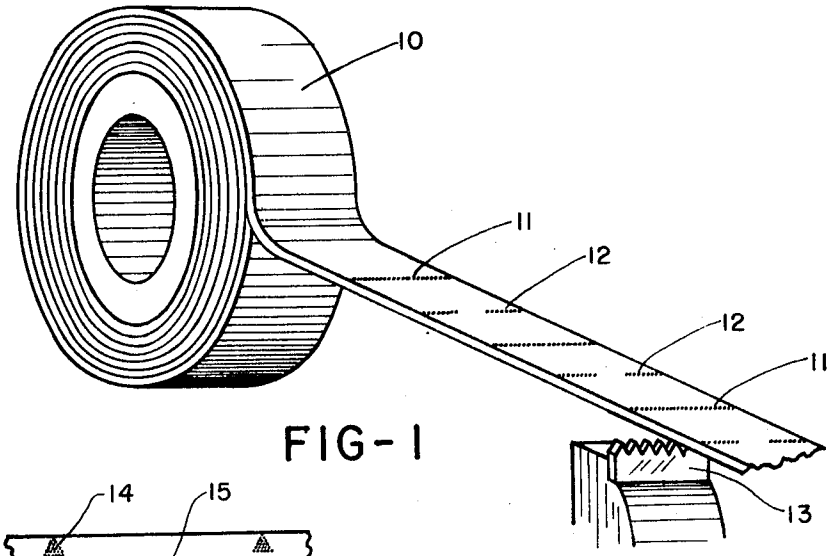


FIG-1

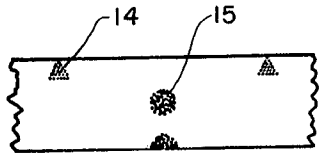


FIG-2

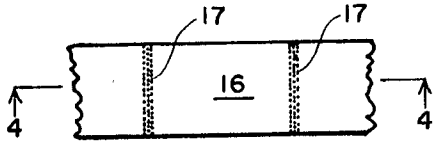


FIG-3

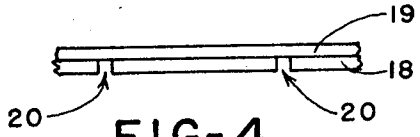


FIG-4

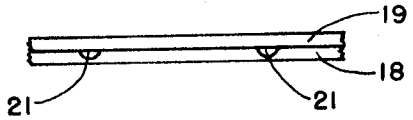


FIG-5

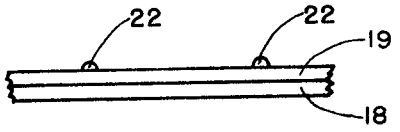


FIG-6

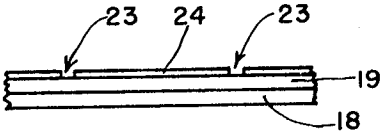


FIG-7

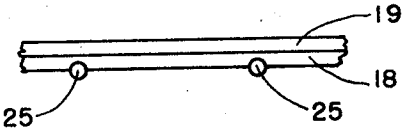


FIG-8

INVENTOR.
EDGAR K. YUCEL
BY
Robert C Baker

MARKING TAPE

SPECIFICATION

This invention relates to a novel roll of pressure sensitive adhesive tape of the transparent type marked with distinguishably light-reflecting structural markings at uniformly spaced unit intervals along its length in the roll. These markings are such that light reflected therefrom as the tape is withdrawn from the roll makes the markings readily visible and distinguishable by the naked eye from other portions of the tape not so marked. Thus, the markings at unit intervals permit a person to measure directly the length of a strip of tape being withdrawn from a roll as it is being withdrawn.

But after the withdrawn strip of tape is applied under light finger pressure to a substrate, these special markings appear to be essentially invisible inasmuch as the light transmission of the total tape on the substrate appears to the naked eye to be substantially uniform throughout, with any residuum of the light-reflecting markings themselves essentially unnoticeable and with the underlying surface of the substrate appearing to be essentially uninterruptedly visible through the tape.

Pressure sensitive adhesive tapes of the transparent type are, of course, well known. They have a light-transmitting non-fibrous backing film which may be either fully transparent in the roll form (e.g., as in the case of cellophane backings) or somewhat translucent when viewed apart from a substrate but transparent upon application to a substrate apart from the roll (e.g., as in the case of matt finished backings of polyethylene terephthalate, or "Mylar"). The backing film of these tapes is coated with an aggressively tacky adhesive (normally at weights of at least about 5 grains per 24 square inches; or normally at thicknesses from about 2 or 3 microns up to 20 or 30 microns or more) which in its normal dry form readily adheres to dissimilar surfaces upon mere contact or light finger-pressing of the tape. Sometime a primer coating is interposed between the backing film and adhesive coating; and a low adhesion backsize treatment may be applied to the nonadhesive back surface of the backing. These pressure sensitive adhesive tapes are conventionally sold in the form of a roll of a length of tape (e.g., at least 10 feet or 3 meters and usually between about 25 feet or 5 meters and 300 feet or 100 meters) wound upon itself on a circularly cylindrical core, with the tacky side of the tape inwardly in the overlapping convolutions of the tape on the core.

The adhesive layer of these tapes is also light-transmitting and is of the rubber-resin type. Examples of typical adhesives of this type may be found in U.S. Pat. Nos. 2,177,627; 2,236,527; 2,410,078; 2,410,089; 2,438,195; 2,553,816; 2,884,126; and Re. 24,906, here incorporated by reference. Characteristically, these adhesives have a base of rubbery material, either natural or synthetic, which provides cohesion (internal strength), and elasticity (a retractive force when stretched and retraction upon release after stretching). The rubbery material is modified by blending it with a compatable tackifier resin (such as a rosin or ester gum) which serves to increase adhesion (tackiness) and decrease cohesion with an attendant increase of stretchiness (elongation at low stresses) and decrease of elasticity. These rubber-resin type adhesives have a balance of adhesion, cohesion, stretchiness and elasticity, which permits adhesive tape coated therewith to be aggressively and stably tacky and yet capable of being stripped back from a smooth surface to which temporarily applied without delamination, splitting or offsetting of adhesive. Certain synthetic polymers are inherently pressure sensitive and possess the noted four-fold balance of properties, thus being equivalents of the rubber-resin adhesives and regarded as rubber-resin type. An example is 75:25 copolymer of 2-ethyl-butyl-acrylate and ethyl-acrylate. Among the synthetic polymers which are inherently pressure sensitive and regarded as rubber-resin type adhesives, the most preferred are those having an acrylic-type radical.

To use these tapes, one withdraws a length or strip from a roll and then applies the tape by adhesive contact and light

finger pressure upon an underlying substrate. If, however, a predetermined measured length of the tape is desired for an especially neat mending job (e.g., neatly mending a tear in a valuable document or book), much waste of tape can take place before a proper measured length substantially free of finger smudge marks is made ready for careful application. Generally it is quite easy to measure the length of a tear in a book or a length of a joint between two substrate surfaces to be joined with tape; but the aggressively tacky character of the tape itself causes difficulties to arise whenever an attempt is made to secure an accurate measurement of a withdrawn length from a roll, as, for example, by using a ruler to secure the measurement. The tape sticks to one's fingers and to the ruler upon slightest contact. Where the predetermined length desired is of any significant length (e.g., over about 5 centimeters) one is apt to end up with various surfaces of the desired length stuck together before the measurement is completed; and this can mean frustration and the waste of three or four strips before reaching mediocre success in one's measurement attempts. Accurate measurements of a withdrawn length can, of course, be accomplished after a person has acquired some skill in doing so; but most users are less inclined to strive for that skill than they are to settle for a different solution or a neatness level below their original objective. Children particularly find it frustrating to measure and neatly apply a length of the tape in their work on school projects and hobbies. The result is that their wastage of tape can be astonishing if they are not closely supervised. They may attempt to use scissors to shape an accurate length prior to application to a limited area of a substrate, frequently with the result that the scissors become well taped (which may after a few attempts even become a collateral objective for them), but little of the consumed tape is constructively used in accomplishing their original objective.

Readily available to home consumers are a variety of economical tape dispensers which have a simple serrated cutting edge over which the tape, after a strip is withdrawn from a roll, is placed and then pulled downwardly to sever a portion of the withdrawn length. Not so available to the average home consumer, and not sufficiently economical to be of much interest to the average home consumer, are certain industrial tape dispensers having tape measuring means as an integral part thereof. Therefore, the average home consumer has for years accepted unwanted wastage of tape occasioned by lack of convenient measuring means as an inherent characteristic accompanying use of tape, even when that use is from a popular (and suitably economical) dispenser with a serrated cutting edge.

The present invention presents the home consumer and others with a convenient and economical means whereby a strip or length of pressure sensitive adhesive tape of the transparent type may be accurately measured as it is being withdrawn from a roll without need for employing a ruler or any other device for accomplishing measurement. Measurement of the length of tape withdrawn from a roll is accomplished according to this invention by mere visual observation of special unit markings visible in the tape structure itself as the tape is withdrawn from a roll. These markings are of a special structural character making them readily visible to the naked eye only when the tape is held apart from a base substrate. Thus these markings are truly visible as the tape is withdrawn from a roll, but become essentially invisible or unnoticeable after the tape is applied to a substrate.

The invention will further be described by reference to a drawing, made a part hereof, wherein:

FIG. 1 is a schematic illustration of the tape in roll form, with a length or strip being withdrawn from the roll in a conventional manner, and with the serrated cutting edge of a dispenser sketched under the withdrawn expanse of the tape;

FIG. 2 is a top plan view schematically illustrating varied visual shapes for unit indicia markings in a length of tape according to the invention;

FIG. 3 is a schematic top plan view of a length of a tape carrying markings according to the present invention;

FIG. 4 is a schematic side view (or a cross-sectional view along line 4—4 of FIG. 3) of a length of tape such as illustrated in FIG. 2; and

FIGS. 5, 6, 7 and 8 are schematic side views (or cross-sectional views such as along line 4—4 of FIG. 3) illustrating alternate structures for unit indicia markings in a length of tape according to the invention.

Referring to FIG. 1, it will be noted that the showing of the tape in roll form 10 on a circular core does not indicate that the special markings are visible while the tape is in the roll form. The special structural markings of the present invention are present in the tape while it is in roll form, but usually are not especially evident to the naked eye upon inspection of the bulk roll. The markings 11 and 12, however, do become apparent to the naked eye as a length of tape is pulled out and withdrawn from the roll, as is illustrated in FIG. 1.

The spacing or distance between the marks 11 is maintained uniform. Suitably the structural markings 11 are at 1 inch intervals, possibly with intermediate interrupted or dash lines such as marks 12 at ½-inch intervals. The uniform spacing or unit intervals of marking may even be as short as one-fourth inch; but in usual practice, the intervals of marking will not be much less than one-fourth inch (or one-half centimeter) nor more than about 2 inches (or 5 centimeters). Markings at 1 inch intervals or 1 centimeter intervals, whether or not with other intermediate markings, are preferred from the standpoint of convenience of use by most home consumers.

During use, the consumer measures the length of tape as it is withdrawn from a roll (e.g., a roll held for rotation in a dispenser having a serrated cutting edge 13) by visual inspection of the markings. The length of tape outwardly from the serrated cutting edge is quickly ascertained from visual observation of the markings; and when the proper length extends outwardly from the cutting edge 13, the measured tape length is severed over that cutting edge without any serious problem of getting it stuck to itself or to a ruler and without any serious problem of getting it tangled and therefore rendered useless.

Instead of continuous or discontinuous (or dash) line-like minute markings extending transversely to the longitudinal length of the tape, one may employ, as illustrated in FIG. 2, such shapes as minute dots in the shape of triangles 14 or circles 15, or for that matter, any of a variety of minute shapes at uniformly or regularly spaced unit measurement intervals. The width of markings, taken along the longitudinal length dimension of the tape, preferably should not exceed about 1 millimeter (or rarely possibly 2 or 3 millimeters). "Minute" as used herein in connection with the markings refers to this narrow width, which is maintained not over about 100 or 200 microns in most cases and may be as low as but a few microns.

For the purpose of illustrating various three-dimensional structural details for markings, reference will be made to FIGS. 4 through 8, inclusive, which are cross-sectional or side views of the tape of FIG. 3. The showing in FIG. 3 is that of a strip of tape 16 with illustrative markings 17 visible thereon.

In FIG. 4, the marking structure is confined to the layer coating of pressure sensitive adhesive 18 on the backing 19. The marking structure is formed by modifying the thickness of the pressure sensitive adhesive coating at unit intervals.

One way to form this FIG. 4 structure is to coat the layer of pressure sensitive adhesive (e.g., by roll coating a solvent solution of the adhesive) on the backing after first laying filaments of material insoluble in the coating adhesive on the backing at, for example, 1-centimeter intervals. Removal of these filaments after sufficient solvent has been evaporated from the coating to prevent complete flowing together of the applied adhesive layer leaves line-like differences 20 in the thickness of the adhesive layer. Even if some adhesive finds its way under such filaments, the thickness of adhesive in the filament location is less than about 50 percent as great as the otherwise essentially uniform thickness of the adhesive coating.

Another way by which the thickness of the adhesive may be substantially reduced (e.g., below about 50 percent of its usual thickness) to form these markings is that of passing a conventional transparent pressure sensitive adhesive tape structure over a drum or the like, with its adhesive coated side exposed, while simultaneously pressing solely into or through that adhesive coated side (and not through the backing) die-like elements suitably heated and treated with a release coating of material (e.g., a silicone release coat) to which the particular pressure sensitive adhesive layer undergoing treatment does not readily adhere. The die-like elements are suitably mounted about the periphery of a cylinder at uniformly spaced intervals to provide the unit intervals of marking in the adhesive layer. A straight knife edge may be employed for the die-like elements; but a discontinuous or saw-toothed knife-like edge is generally to be preferred. (Spaced dots or triangles, such as shown in FIG. 2, of reduced adhesive layer thickness may also be formed by this technique).

After mark-modifying or deforming the otherwise essentially uniform thickness of adhesive layer as discussed, the tape is rolled upon a circular core with the tension of rolling maintained at a level insufficient to cause remerger of the "-broken" adhesive layer into the minute areas of "break," that is the minute areas of reduced thickness. In essence, this approach to marking is characterized as a "breaking" of the otherwise continuous and essentially uniformly thick adhesive layer; and the marks so formed are termed "break-like" marks. These breaks may extend completely through the adhesive layer; but in the unusual case, at least a thin web of adhesive extends through the area of the break-like marking. Thickness reduction of the adhesive in the area of the mark, however, is at least 50 percent.

Marks so formed are translucent in that light is transmitted through them, even though a good portion of the light striking such marks along a length of tape as it is withdrawn from a roll is reflected in a most disrupted manner. This disruptive light reflection makes the marks readily distinguishable and visible to the naked eye. Other portions of the tape, as it is withdrawn from a roll, also obviously reflect light (at least sufficiently for a person to see the tape), but the reflection from other portions is relatively or approximately uniform (even though it may be somewhat random, it is still "uniform" and apart in character from the uniformly spaced and truly disruptively reflecting markings). Thus, the truly disrupted light reflection (and possibly also some of the disrupted light rays transmitted through the location of the marks) makes those uniformly spaced marks readily distinguishable from other parts of the tape.

However, once a length of tape marked as just described is applied to a substrate apart from the roll and pressed down with light finger pressure, these marks in the adhesive layer become essentially invisible. Partially, this result comes about because the pressure of application contributes to some destruction of the marks. The adhesive is more or less forced to flow somewhat together in the area of the marks when pressure is applied; and any residuum of the structural unit markings of the adhesive layer as may be left after light finger pressure application is essentially unnoticeable to the naked eye.

An additional phenomenon contributing to the apparent or substantial disappearance of the marks on application of the tape to a substrate is related to the phenomenon illustrated by considering frosty glass panes. Such frosty panes obscure objects spaced from the opposite side of them, but when an object is immediately adjacent the opposite side of such panes from a viewer, the viewer is usually able to make out not only the shape of the object but even variations in its color and the like. Since the flexible tapes of interest are extremely thin and placed in even more intimate contact with an underlying substrate surface than is possible with a rigid pane of glass, the result is that the light-transmitting but disruptively light-reflecting markings, as observed when the tape is applied to a substrate, tend to impart only relatively slight or insignificant refraction to light passing through them on its way to and from the substrate surface. Further any slight refraction of light on its way through the marked areas to the underlying substrate surface is essentially equal to any slight refraction of the light

leaving the underlying substrate surface through the marked areas on its way back to a viewer. Thus, the originally marked areas tend to go unnoticed by the viewer.

As illustrated in FIG. 5, light-transmitting disruptively light-reflecting markings may also be formed by applying (to the backing prior to application of the adhesive layer) at spaced unit intervals a minute quantity 21 of material (e.g., a plastic or resin, even a dissimilar rubber-resin type composition) having a slightly different refractive index (n_D) from that of the main adhesive coating 18 on a backing 19. Such markings refract light as well as disrupt its reflection as the tape is withdrawn from a roll; but they become essentially unnoticeable in a tape after application of it upon a substrate for reasons as just discussed. A difference in refractive index possibly as low as 0.01 up to as high as 0.5 or even somewhat higher (such as 1.0) can be useful for this approach. Since many pressure sensitive adhesive compositions are about 1.5 in refractive index, the material for minute dot-line markings may be, for example, a transparent fluorocarbon having a 1.3 refractive index. At the small quantities required, the adhesion properties of the marking composition itself are not generally significant for consideration. Also to be noted is that a structure such as illustrated in FIG. 4 may, after deformation of the adhesive to form the markings, be coated with an adhesive of refractive index different from the originally applied layer.

Although less preferred, minute markings 22, of material of dissimilar refractive index according to the just noted principles may be applied on the back side (that is, the nonadhesive side) of the non-fibrous backing film of the tape, as illustrated in FIG. 6. However, any great additional thickness of material on the back side should be avoided as it may sometimes be objectionable in use applications. Also, the slightly further spacing of the material from the subject matter to be viewed after application of the tape to an underlying substrate makes markings of this character, if over about 0.5 difference in refractive index, sometimes detectable on close inspection, if one is intent on looking for them, even though they are essentially unnoticeable unless one makes an effort to look for them.

A preferred back side unit marking approach having structural similarities to the showing in FIG. 6 is that of forming a matt finish in the shape of spaced unit marks on the back side of tape having an otherwise essentially smooth back side. This may be done by embossing or indenting the backing itself with a shallow pattern of serration marks in the shape of dots or lines; and these are sufficient to disrupt the light reflection in the marked areas as the tape is withdrawn from a roll but become essentially unnoticeable (for reasons as aforediscussed using a frosty glass as comparison) after application of the tape to a substrate. Equivalent matte finished markings as illustrated may, of course, be formed by any suitable well known technique.

In FIG. 7, the markings 23 for unit measurement are formed in a transparent tape by applying a matte finish 24 (e.g., a coating of low-adhesion backsize which upon drying disrupts light reflection) to all portions of a backing except the minute areas of the markings 23 themselves. Markings 23 therefore are readily visually distinguishable from the other parts of the tape as it is withdrawn from a roll, since the other parts are essentially uniformly disruptive in light reflection; but upon application to a substrate, the tape appears to be essentially uniformly transparent, for reasons as discussed above with reference to frosty glass.

The form of marking illustrated in FIG. 8 is accomplished by applying minute particles 25 of light-transmitting material below 200 microns (and preferably below 50 microns) in size at spaced intervals to or within the adhesive layer 18. Suitably, the applied particles (which preferably are rigid or even brittle) are of dissimilar refractive index as compared to the adhesive layer (as has been discussed above). However, this is quite unnecessary where the particles are applied to the outer surface of the adhesive layer 18 or are only partially embedded therein, as illustrated. Where the applied particles are solid in character (e.g., solid resin or glass particles, whether they are irregular or cullet in character or are spheroidol) the size of the particles is preferably maintained not in excess of about 20 or possibly 50 microns. Particle size selection is made to avoid the creation of readily apparent bumps in an applied tape layer. These particles, when on the surface of the adhesive layer, may be as small as a pigment sized particle (e.g., about 2 microns or less), provided the particle surfaces are sufficiently readily wettable by the adhesive of the tape and the refractive index of the material out of which the small particles are formed is close enough to the refractive index of the adhesive so that, after the particles are merged into the adhesive layer upon finger pressure application of the tape to a substrate, the opaque effect of pigment caused by light ray disruption is substantially obliterated by virtue of the pigment sized particles being effectively completely surrounded by the adhesive of substantially equal refractive index. Generally, however, this specialized pigment particle approach to disappearing markings is so critical that it will be used only where some special benefit dependent upon pigment sized particles is also needed.

Large particles 25 for the structure of FIG. 8, even particles as large as 200 microns or so in size, are useful for marking when the light-transmitting particles 25 are hollow and crushed (e.g., brittle plastic or glass microballoons or hollow particles) at the time of application of the tape to a substrate. Refractive index considerations for these particles is not particularly critical but may be as aforediscussed in connection with the structure of FIG. 5. The hollowness of the particles themselves provides an interior interface for light disruption prior to the rupture of the particles. Of importance in this embodiment, as in the others, is that the light-transmission of the markings (or translucency thereof) must be such that they become essentially completely transparent after the tape is applied to a substrate.

A variety of modifications may be made in the illustrative structures hereof while still retaining the fundamental benefits of the invention. An interesting, although less preferred modification is that of applying a material (such as a matte finish coating on the backing or a scattered pattern of hollow particles on the adhesive) over alternate 1-inch lengths (or other alternate limited lengths such as one-fourth inch or 1 centimeter) along the tape. In this manner, alternate unit lengths along the tape are visually distinguishable from the intervening unit lengths when the tape is drawn from a roll, but become essentially indistinguishable upon application of the tape to a substrate. Still other variations may be employed; but by far the most dramatic benefits of the invention are realized when the visually essentially disappearing markings are confined to minute areas (e.g., discontinuous lines oriented transversely to the length of tape or minute dots or triangles at unit intervals, etc.).

That which is claimed is:

1. As a new tape article: A roll of a length of pressure sensitive adhesive tape of the transparent type having a light-transmitting non-fibrous backing film substantially continuously coated with a light-transmitting rubber-resin type pressure sensitive adhesive, said length of tape being wound upon itself in overlapping convolutions in said roll, light-transmitting and distinguishably light-reflecting structural markings on said tape at uniformly spaced unit intervals along the length of said tape in said roll, the thickness character of said tape at said distinguishably light-reflecting structural markings being different from thicknesses of said tape at other locations, any residuum of said structural markings after application of said tape under light finger pressure to a substrate surface apart from said roll as well as all other portions of said tape as so applied being en toto transparent and substantially uniformly light-transmitting on said substrate, wherefore in said substrate applied condition said markings appear essentially unnoticeable to the naked eye, but said markings being such that light reflected therefrom as said tape is withdrawn from said roll is readily distinguishable from light reflected from other

portions of said tape not so marked and makes said markings readily visible and distinguishable by the naked eye from said other portions, permitting therefore direct visual unit measurement of the tape as it is withdrawn from said roll.

2. The tape article of claim 1 wherein said structural markings comprise structural features on the pressure sensitive adhesive coated side of said tape.

3. The tape article of claim 2 wherein the adhesive coating, apart from said structural markings, is substantially uniformly thick and continuous on said backing and wherein said structural markings consist of a break-like difference in the thickness of said adhesive coating, said thickness difference being in excess of 50 percent from the thickness of said adhesive coating apart from said markings.

4. The tape article of claim 3 wherein said break-like difference in thickness consists essentially of dots.

5. The tape article of claim 3 wherein said break-like difference in thickness consists essentially of line-like shapes oriented transversely to the longitudinal length of said tape in said roll.

6. The tape article of claim 2 wherein said structural markings consist essentially of rigid light-transmitting material.

7. The tape article of claim 6 wherein said material consists essentially of hollow and brittle particles.

8. The tape article of claim 1 wherein said structural markings comprise structural features on the back side of the backing of said tape.

9. The tape article of claim 8 wherein said markings consist essentially of a matte-finished surface structure on the back side of said backing.

10. The tape article of claim 8 wherein the back surface of said tape backing is matte-finished except for limited uniformly-spaced portions thereof.

* * * * *