

[54]	WARNING UNDERGROUND SHEATHED TAPE	3,255,875	6/1966	Tierney.....	116/DIG. 14
		3,282,057	11/1966	Prosser	116/DIG. 14
		3,504,503	4/1970	Allen.....	116/114 R
[75]	Inventor: Herschel Lee Evett , Arlington, Tex.	3,568,626	3/1971	Southworth, Jr.....	116/114 R
		3,755,032	8/1973	Higbee.....	138/125 X
[73]	Assignee: Griffolyn Company, Inc. , Houston, Tex.				

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[21] Appl. No.: **390,721**

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 [51] **Int. Cl.**²..... **G01D 21/00**
 [58] **Field of Search**..... 116/114 R, DIG. 14; 61/72.1; 138/125; 242/55.19 A

[56] **References Cited**

UNITED STATES PATENTS

2,778,636 1/1957 Eash 242/55.19 A
 3,115,861 12/1963 Allen..... 116/114 R

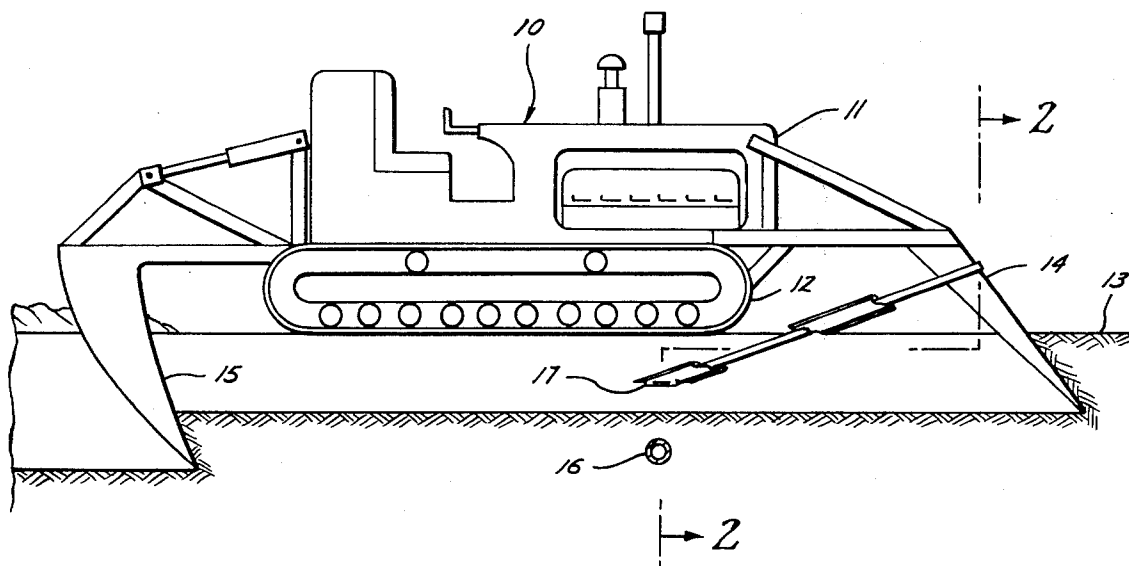
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[57]

ABSTRACT

A tape adapted to be buried beneath the ground to provide a warning to operators of equipment on which digging or probing elements are carried of the proximity of underground facilities which might otherwise be damaged by such elements.

17 Claims, 8 Drawing Figures



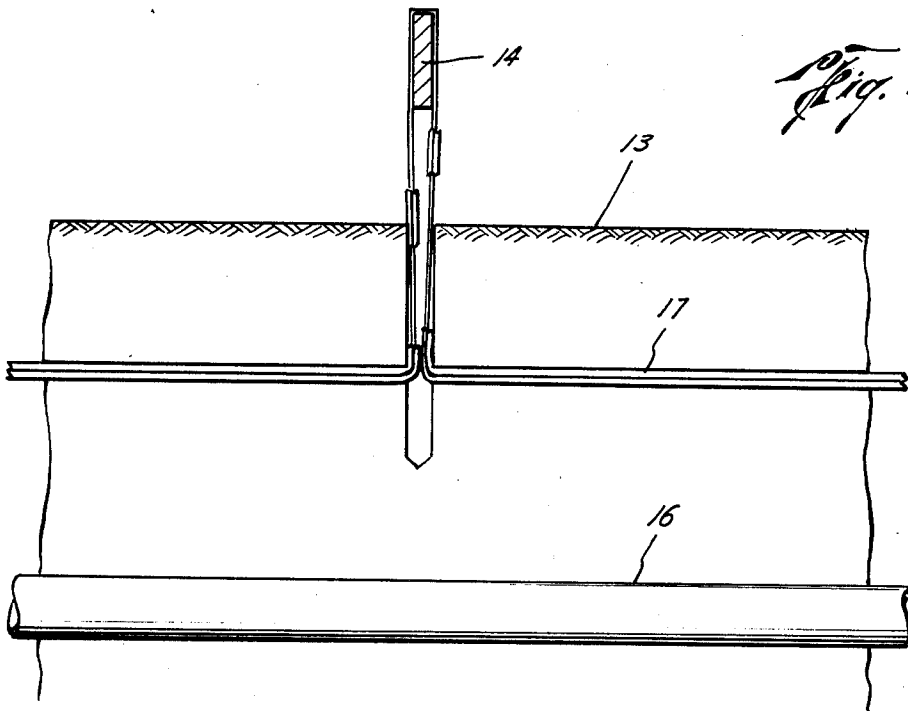
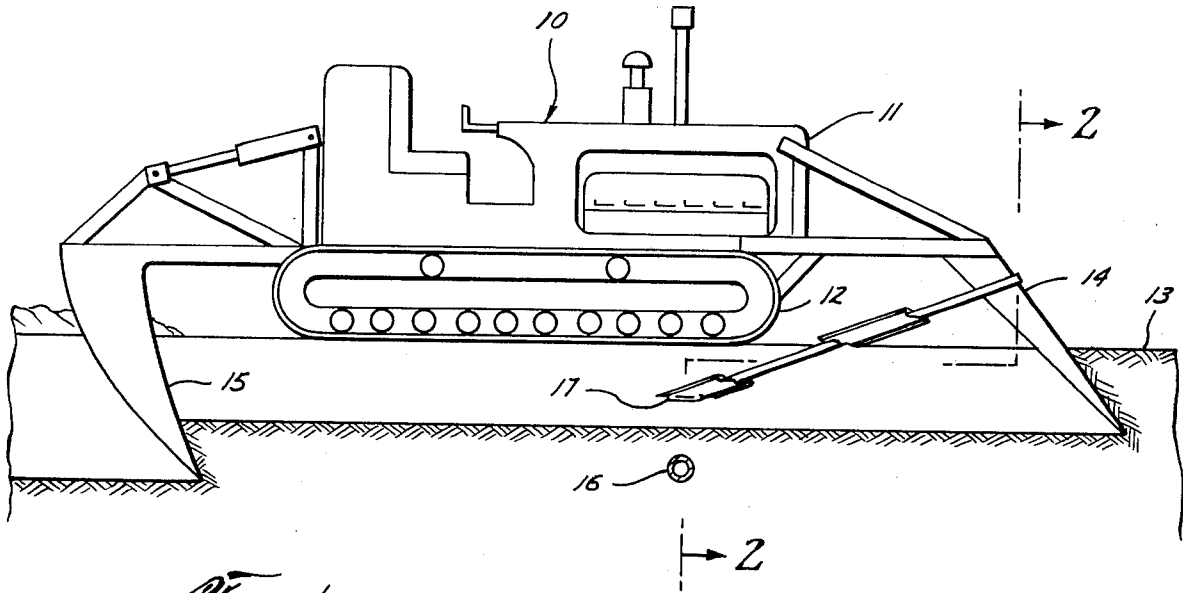
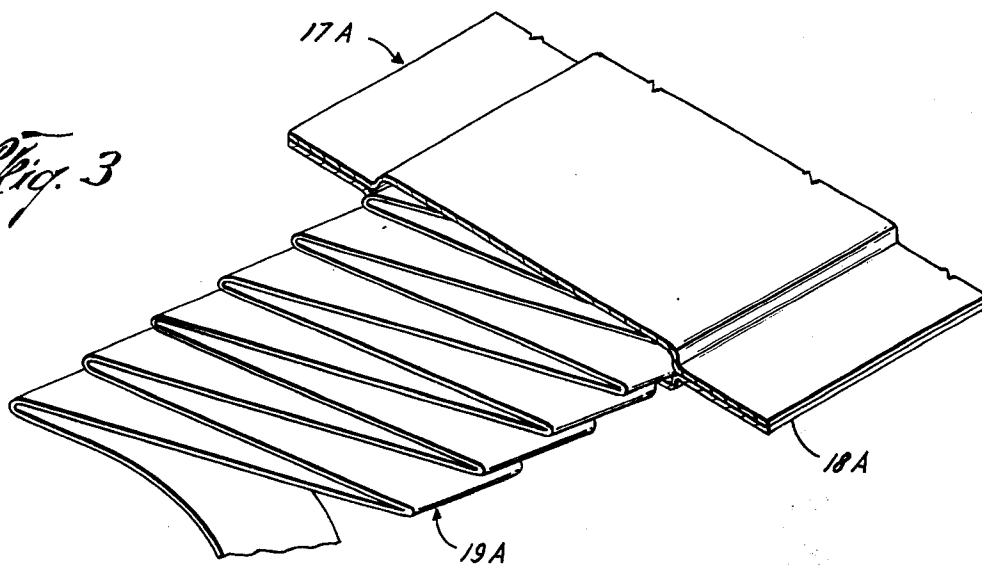
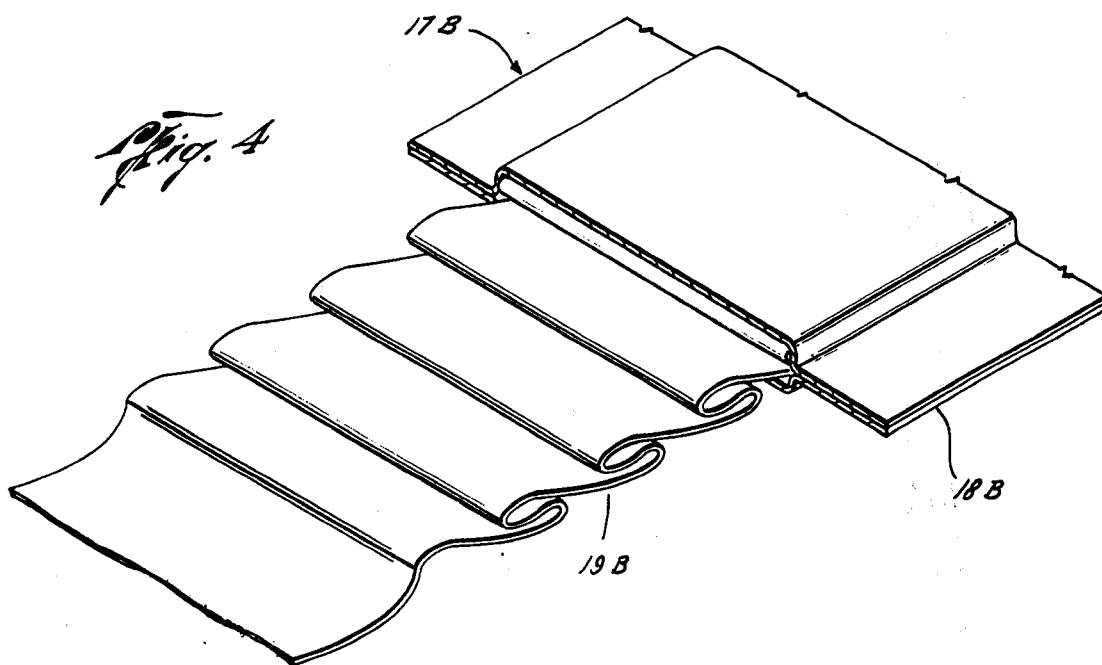
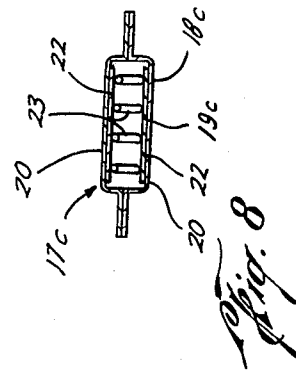
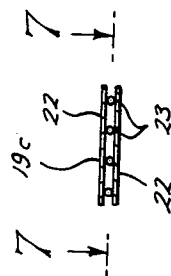
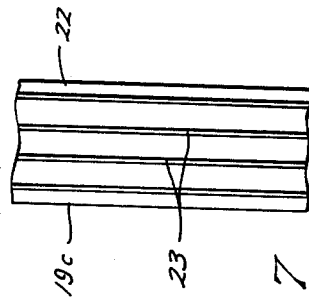
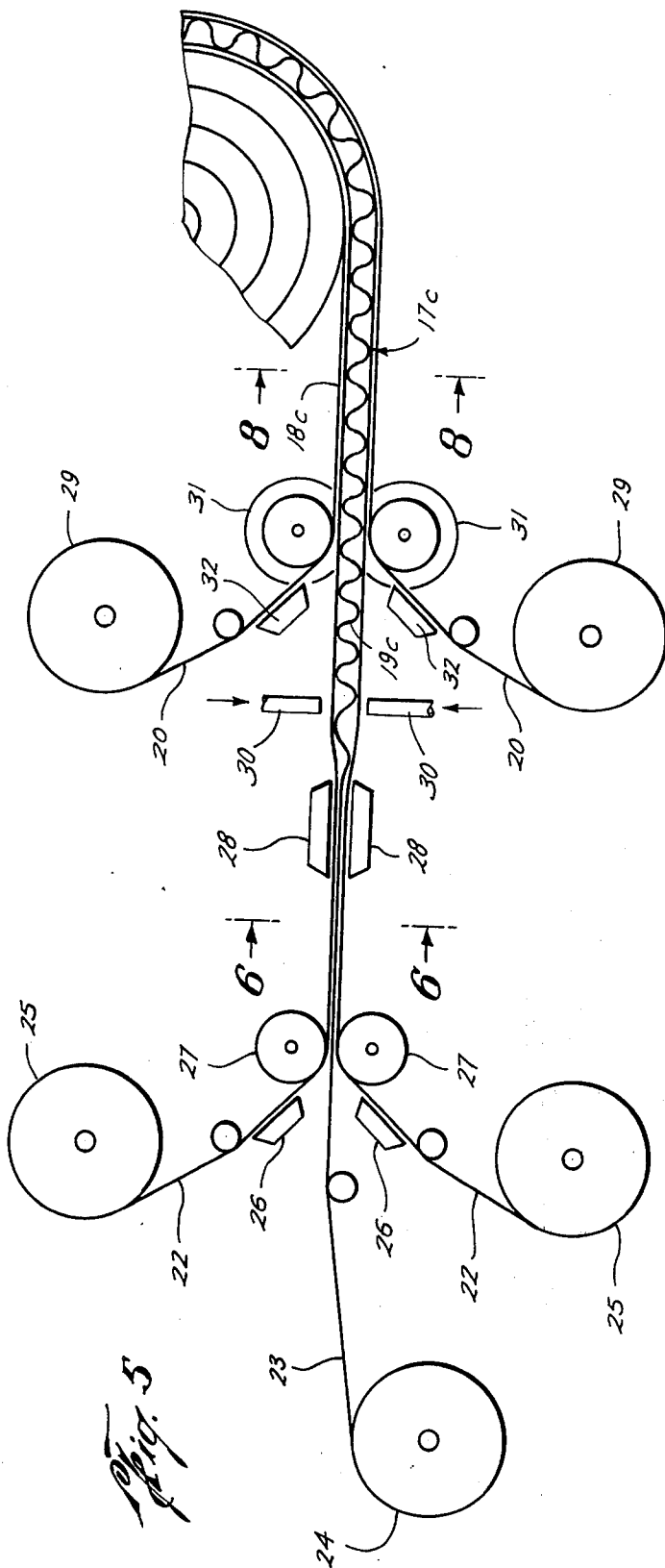


Fig. 3*Fig. 4*



WARNING UNDERGROUND SHEATHED TAPE

This invention relates to an improved tape of the type which is to be buried in the ground in the proximity of underground facilities so as to be engaged by digging or probing elements, and thus provide a visual warning to operators of equipment on which the elements are carried, of the presence of the facilities. In one of its aspects, this invention also relates to a method of manufacturing such a tape.

Prior tapes of this type which have been made of a material which is readily frangible by the digging or probing elements have not always provided good warnings because of the inability of the operator to see the torn ends or bits of the tape. Prosser U.S. Pat. No. 3,282,057 shows a tape which is folded upon itself so that, when engaged and pulled by the digging or probing element, it will be unfolded to a longitudinal extent which may be more easily observed. However, the extent to which the tape may be unfolded, and thus longitudinally extended, is quite limited, so that it may not be seen from ground level. Also, although the folded tape is initially laid between slip sheets, such sheets are decomposable in the ground in relatively short periods of time, so that the tape is not protected from the ground in which it is buried. Also, when the ground is tightly compacted, portions of the tape which are adjacent the trench dug by the digging or probing elements may shear before being pulled from the ground and thus unfolded. This is especially true since the tape is not of a material which has an especially high tensile strength, so that it may be torn before unfolding.

Southworth U.S. Pat. No. 3,568,626 discloses a tape which is intended to be infrangible by the digging or probing elements in that it is of such strength and sufficiently stretchable as to permit a substantial portion thereof to be pulled by the elements into a more observable position. However, as in the case of the tape of the Posser patent, the portions of the tape adjacent the trench dug by the elements may shear before being pulled from highly compacted soil and stretched to a readily observable longitudinal extent.

It is an object of this invention to provide a warning tape which will normally provide a readily observable warning even if the soil in which it's buried is tightly compacted.

It is another object of this invention to provide such a tape which is of such construction that at least a portion thereof is more susceptible to being pulled from the ground to a readily observable longitudinal extent without shearing.

It is yet another object of this invention to provide a simple and fast method of fabricating such a tape.

These and other objects are accomplished, in accordance with the illustrated embodiments of the invention, by a tape which comprises an elongate sheath which is decomposable in the ground in which it's to be buried and tearable when engaged and pulled by a digging or probing element, and a ribbon within the sheath which is longitudinally extendible upon release therefrom. Thus, as distinguished from the sheath, the ribbon is resistant to shearing by the digging or probing element when engaged and pulled thereby. More particularly, the exterior surface of the ribbon has a low coefficient of friction with the interior surface of the sheath, so that when the sheath is torn by the element, portions of the ribbon adjacent the tear are readily slidable from within the sheath, even though the soil may

be highly compacted, and thus longitudinally extendible into a length which provides readily observable warning of the nearness of the installation to be protected. Although the interior surface of the sheath and the exterior surface of the ribbon may be selected from a wide range of materials which have low coefficients of friction with respect to one another, a lubricant is preferably disposed between the sheath and ribbon for reducing the coefficient of friction between them.

In one embodiment of the invention, the ribbon is folded upon itself so that it is longitudinally extendible to a desired extent by unfolding. In another embodiment of the invention, the ribbon includes one or more elongate films which are longitudinally shrinkable under given conditions, and at least one filament laminated to the films along its length and being longitudinally shrinkable to a lesser extent under the same conditions. In this way, the filament is caused to wrinkle or fold when so laminated and subjected to such given conditions, so that when the films are torn by the digging or probing element, the over-all tape is longitudinally extendible to a length determined by the relative shrinking between the film and filament.

In the drawings, wherein like reference characters are used throughout to designate like parts:

FIG. 1 is a side view of a tractor having probing and digging elements carried thereon and a vertical sectional view of the ground beneath the tractor to illustrate the engagement of the probing element with a warning tape buried in the ground and above a pipeline to be protected;

FIG. 2 is an enlarged vertical sectional view of the probing element and the ground, as seen along broken line 2—2 of FIG. 1;

FIG. 3 is a perspective view of a short section of a tape formed in accordance with the first described embodiment of the invention, and with the sheath thereof broken away in part;

FIG. 4 is a view similar to FIG. 3 of another tape constructed in accordance with the first described embodiment of the invention;

FIG. 5 is a diagrammatic view of an apparatus for manufacturing tape constructed in accordance with the second described embodiment of the invention;

FIG. 6 is a cross-sectional view of a portion of the tape during one stage of its manufacture, and as seen along broken line 6—6 of FIG. 5;

FIG. 7 is a horizontal sectional view of such portion of the tape, as seen along broken line 7—7 of FIG. 6; and

FIG. 8 is a cross-sectional view of the fully manufactured tape, as seen along broken line 8—8 of FIG. 5.

Referring now to the details of the above-described drawings, the tractor shown in FIG. 1, and designated in its entirety by reference character 10, is of conventional construction including a motor 11 supported on an endless track 12 for movement over the ground level 13. A probing element 14 is mounted on the front end of the tractor, and a digging element 15 is mounted on the rear end thereof and arranged to penetrate the ground to a lesser depth than the digging element 15.

As shown in FIGS. 1 and 2, a pipeline 16 is buried in the ground and extends in a direction transversely to the direction of travel of the tractor and at such a depth beneath the ground level 13 that it would be engaged and damaged by the digging element 14 if the latter were moved against it. However, a tape 17 constructed

in accordance with the present invention is disposed within the ground longitudinally above the pipe 16 and at a depth above the digging depth of the probing element 14. Normally, the tape is arranged in this position during backfilling of the ditch in which the pipeline 16 is laid.

In any event, the probing element penetrates the earth to a depth intermediate the pipeline 16 and the tape 17 so as to engage the tape, without engaging the pipeline, and then, upon continued forward movement toward the position shown in FIG. 1, pull portions of the tape from the soil adjacent the trench it has formed, before the pipeline is damaged by the trailing digging element 15. When the tape is so pulled, its sheath is torn to release its ribbon, and the ribbon is pulled from the sheath and longitudinally extended, as illustrated in FIGS. 1 and 2 and to be described below, to a position preferably above ground level 13, in which it provides a readily observable warning, whereby the operator of the tractor can stop its forward progress before the digging element 15 damages the pipeline 16.

A portion of a tape constructed in accordance with the first embodiment of the invention, and indicated in its entirety by reference character 17A, is shown in FIG. 3 to comprise a sheath 18A and a ribbon 19A enclosed within the sheath. As will be understood by those skilled in the art, the sheath and ribbon are of substantial longitudinal extent, so as to facilitate being laid over an elongate installation to be protected, such as the pipeline 16.

The sheath 18A is made of two films of sheets of any suitable material which is non-decomposable upon being buried in the ground, and which are laminated to one another along their side edges. Suitable materials for this purpose are polyethylene, polyvinylchloride, and cross-linked polyolefins. The ribbon 19A comprises a single, narrow film or sheet which is folded upon itself along lines substantially perpendicular to its side edges. Obviously, the length to which the ribbon may be extended upon unfolding depends upon the degree to which the folds are actually perpendicular to the length of the ribbon.

The ribbon 19A is made of any suitable material which has sufficient tensile strength to permit it to be pulled by the probing element 14 from its folded to an unfolded position, when released from the sheath 18A, and which has a low coefficient of friction with respect to the inner surface of the sheath 18A. Suitable materials for this purpose are, as in the case of the sheath, polyethylene, polyvinylchloride, and cross-linked polyolefins. However, as distinguished from the material from which the sheath is made, the material of the ribbon 19A may be reinforced with suitable fibers for increasing its tensile strength.

As above noted, the low coefficient of friction between the outer surface of the ribbon and the inner surface of the sheath may be inherent in the materials of which the tape and sheath are formed. Alternatively, and preferably in addition thereto, a lubricant is disposed between the ribbon and sheath for providing a low coefficient of friction therebetween, and thus facilitating sliding of the ribbon from within the torn sheath. Suitable lubricants are silicon grease and graphite.

When engaged and pulled by the probing element 14, the sheath of the tape will normally be torn into short segments, as illustrated in each of FIGS. 1 and 2. In any event, when the sheath is torn, the ribbon is free to ex-

tend and thus to be pulled to a length that is sufficient to provide a readily observable signal or warning above ground level. Thus, due to the friction characteristics between the ribbon and the sheath, portions of the ribbon adjacent the torn portion or portions of the sheath will slide easily therefrom and thus from within highly compacted portions of the soil adjacent the trench dug by the probing element. In fact, the ribbon itself may be extendable by stretching when pulled by the probing element.

The tape 17A is preferably manufactured by disposing the folded ribbon 19A longitudinally along and between the sheets forming the sheath 18A, and then laminating the edges of the sheets to one another on opposite sides of the ribbon. The ends of the sheath may be closed about the ends of the ribbon by a similar process of laminating edges of the sheets to one another. Also, suitable warning or caution signs may be printed on one or both sheets of the sheath, and in any case, the sheath is preferably formed of a brightly colored material which is readily observable.

The other tape constructed in accordance with the first embodiment of the invention, and indicated in its entirety in FIG. 4 by reference character 17B, also includes a sheath 18B and a folded tape 19B disposed therein. However, as distinguished from the tape 19A, tape 19B is folded upon itself along lines perpendicular to its side edges. In other respects, such as the material of which they are made, the sheath 18B and tape 19B are similar to the sheath 18A and tape 19A, respectively. Also, a lubricant is preferably disposed between the tape 19B in the inner surface of the sheath 18B. Still further, the tape 17B may be manufactured in the same manner as the tape 17A, and will be usable in the same manner as described above.

A tape constructed in accordance with the second embodiment of the invention, and indicated in its entirety by reference character 17C is shown in FIGS. 5 to 8 to comprise a sheath 18C and a ribbon 19C enclosed within the sheath. Similarly to the sheaths of the tapes 17A and 17B, the sheath 18C is made of sheets 20 of any suitable material which is non-decomposable upon being buried in the ground. As previously described, the side edges of the sheets 20 are laminated to one another to form an envelope therebetween, as best illustrated in FIG. 8.

As previously indicated, and as shown in FIGS. 5 and 8, the ribbon 19C enclosed within the sheath 18C comprises a pair of elongate films 22 laminated to the opposite sides of a plurality of longitudinally extending filaments 23. More particularly, and as best shown in FIGS. 5 and 8, the filaments have, during the manufacture of the tape, been caused to fold up or become wrinkled between the films 22. Thus, and as also previously described, upon tearing of the films by a digging or probing element, the filaments 23 of the ribbon, and thus the tape 17 as a whole, is longitudinally extendible to a length determined by the stretched length of the filaments.

More particularly, in a preferred method of manufacturing the tape 17C, and as best illustrated in FIG. 5, after laminating to the filaments 23, the elongate films 22 are caused to shrink in a longitudinal direction under conditions which cause lesser shrinkage, or preferably no shrinkage, of the filaments 23. Preferably, and as will be described in connection with FIG. 5, this

is accomplished by heating the laminated films and filament to a selected temperature.

With reference now to FIG. 5, the plurality of filaments are drawn from a roll 24 between films 22 drawn from rolls 25. The inner surfaces of the films 22 are heated to render them tacky by means of heating elements 26, and then laminated to the filaments 23 by passing through nip rollers 27. As illustrated in FIGS. 6 and 7, when the laminate leaves the nip rollers, the filaments 23 extend longitudinally of the films 22 with substantially no wrinkling or folding.

The thusly formed laminate is then fed between additional heating elements 28 for heating it to a temperature which causes the above-described differential shrinkage between the films and the filaments. For example, with the films made of polyethylene shrink film, the filament made of nylon fiber wire, and the laminate being fed at the rate of about 25 feet per minute, heating elements raised to about 300°F. and spaced about twelve inches from the laminate will cause the films to shrink in a longitudinal direction approximately 50%, but will not cause the filaments to undergo any shrinking. Obviously, this is merely an example, and the desired result may be obtained with the use of other film and filament materials, temperature conditions, etc. obvious to a person skilled in this art.

The thusly formed ribbon 18C is then preferably fed between sheets 20 of the sheath 18C, which are drawn from rolls 29. However, prior to being fed between the sheets, the ribbon is passed between jets 30 which supply lubricant to its outer sides. The lubricated ribbon and the sheets 20 of the sheath are then passed through nip rollers 31 which laminate the edges of the sheets together to form the sheath about the ribbon, as best shown in FIG. 8. Preferably, the inner surfaces of the sheets 20 are rendered tacky prior to this further lamination by means of additional heating elements 32. As the completed ribbon 17C leaves the rollers 31, it may be wound on a roll for storage purposes, as indicated in FIG. 5.

The tape 17C is used in much the same manner as the tapes 17A and 17B, except that the films 20 of the ribbon 19C are adapted to be torn in much the same manner as the sheath 18C. Thus, ordinarily the films will not be reinforced or otherwise of such construction as to make them less tearable than the sheets of the sheath. Then, of course, upon tearing of the film of the ribbon, the filament is free to be extended by engagement therewith of the digging or probing element, as in the case of the folded ribbons of the tape 17A and 17B. Also, of course, the ribbon as a whole will slide easily from the sheath, even though the ground in which the tape is disposed is tightly compacted, due to the low coefficient of friction between the outer surface of the ribbon and the inner surface of the sheath.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages which are obvious and which are inherent to the article and method.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it

is to be understood that all matter herein set forth or shown in the accompanying drawing is to be interpreted as illustrative and not in a limiting sense.

The invention having been described, what is claimed is:

1. A warning tape adapted to be buried beneath the ground and in such a position near an installation to be protected from damage by a digging or probing element being moved through the ground that it will be engaged and pulled by the element before engagement of said element with said installation, said tape comprising an elongate sheath made from a plastic material which is non-decomposable in the ground in which it is to be buried and tearable when engaged and pulled by the element, and a ribbon made from a reinforced plastic material and extending longitudinally within the sheath and being longitudinally extendible upon release from the sheath so as to resist tearing by the element when engaged and pulled thereby, the exterior surface of said ribbon and the interior surface of the sheath each provided with a low coefficient of friction, so that when said sheath is torn and said ribbon is pulled by said element, portions of said ribbon adjacent the tear are readily slidable from within the sheath and longitudinally extendible into a length which provides a readily observable warning of the nearness of said installation.

2. A tape of the character defined in claim 1, including a lubricant between said sheath and said ribbon for reducing the coefficient of friction between said sheath and said ribbon.

3. A tape of the character defined in claim 2, wherein said lubricant is silicon grease.

4. A tape of the character defined in claim 2, wherein said lubricant is graphite.

5. A tape of the character defined in claim 1, wherein said sheath and the exterior surface of said ribbon are polyethylene.

6. A tape of the character defined in claim 1, wherein said sheath and the exterior surface of said ribbon are polyvinylchloride.

7. A tape of the character defined in claim 1, wherein said sheath and the exterior surface of said ribbon are cross-linked polyolefins.

8. A tape of the character defined in claim 1, wherein said ribbon is folded on itself so that it is longitudinally extendible by unfolding.

9. A tape of the character defined in claim 8, including a lubricant between said ribbon and said sheath for reducing the coefficient of friction between said ribbon and sheath.

10. A tape of the character defined in claim 8, wherein said ribbon is folded along lines substantially perpendicular to its side edges.

11. A tape of the character defined in claim 8, wherein said ribbon is folded along lines substantially horizontal to its side edges.

12. A tape of the character defined in claim 1, wherein said ribbon includes an elongate film which is longitudinally shrinkable under given conditions and at least one filament laminated to said film along the length thereof, said filament being shrinkable to a lesser extent under said conditions, so that it is caused to wrinkle when so laminated and subjected to such conditions.

13. A tape of the character defined in claim 12, wherein said ribbon includes a pair of films laminated to opposite sides of said filament.

14. A tape of the character defined in claim 12, wherein there are a plurality of filaments.

15. A tape of the character defined in claim 12, including a lubricant between said ribbon and said sheath for reducing the coefficient of friction between said rib-

bon and said sheath.

16. A tape of the character defined in claim 12, wherein said film is polyethylene and said filament is a nylon fiber.

5 17. A tape of the character defined in claim 12, wherein said film is polyethylene and said filament is wire.

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