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LOCATING ELEMENTS OF CONSTRUCTION BENEATH THE SURFACE OF EARTH SOILS

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ABSTRACT OF THE DISCLOSURE

Locating of lines or elements of construction, such as telephone cables, gas mains, sewer lines, water mains and electric service lines buried beneath the surface of the earth, by disposing above said lines or elements of construction and below the surface of the earth a colored, flexiple metal foil product, particularly a steel foil in sheet or tape form and protected against corrosion, the presence and general location of said metal foil being detectable from above the surface of the earth by electronic or like detecting devices.

This invention relates to facilitating determining the presence and location of lines or elements of construction disposed beneath the surface of earth soils in order to avoid damaging said lines or elements of construction when subsequently excavating or digging into the earth.

It has heretofore been known, as disclosed in my U.S. Patent No. 3,115,861, to facilitate the location, beneath the surface of earth soils and the like, of elements of construction, such as wires, cables, conduit, sewer pipes and sewer connections, valves and like elements of construction, by digging a trench or providing an excavation in the earth, placing or locating an element of construction therein, then placing thereabove a readily frangible colored body the color of which contrasts with the surrounding earth soil, and then filling or backfilling said trench or excavation with earth. The important, practical advantages of such procedures are disclosed in my aforesaid patent, and the principles disclosed and taught therein have gone into widespread use. In U.S. Patent No. 3,282,057, the employment, specifically, of colored plastic sheets or tapes, such as those made of polyethylene, is shown, which is an embodiment of a colored frangible body, being adapted to be torn when pulled up, for instance, by a mechanical digger or the like in connection with an excavation operation. In actual commercial operations, said colored sheets or tapes have been used as the embodiment of said colored frangible bodies.

Although such colored plastic sheets or tapes have been widely and successfully used, in the manner described in the aforesaid patents, to facilitate the location of elements of construction beneath the surface of earth soils and to avoid accidental destruction and damage which commonly occur when such elements are inadvertently and unknowingly encountered when digging beneath the surface of the earth, there are, nevertheless, certain shortcomings in the use of said plastic sheets and tapes which the art has not succeeded in satisfactorily overcoming.

A major shortcoming of the use of colored plastic sheets or tapes, in the manner described, for instance, in U.S. Patent No. 3,282,057, is the fact that its presence beneath the earth surface cannot be ascertained by any detecting instruments operated from above the surface of earth and is revealed only in connection with a digging operation. The problem is particularly acute in those instances where the lines or elements of construction are nonmetallic, as in the case of clay, ceramic, concrete or

plastic pipe and conduit, for, in such cases, electronic or like metal detectors fail to reveal the presence of such lines or elements of construction.

Various suggestions have been made to attempt to meet this problem. One of such suggestions, for instance, has been to mark the plastic sheet or tape electromagnetically so that it would be possible to locate and trace the buried lines or elements of construction with electronic detecting devices operating from above the surface of the earth. This, and various other suggestions involving the same or similar concepts, and also involving other approaches, have not proved to be practical and none of such suggestions, so far as I am aware, has come into any use.

It has also heretofore been known, as shown in British Patent No. 410,900, to provide underground installations wherein a trench is excavated, a line or element of construction, such as a cable, is placed therein, and the trench is backfilled, a steel tape or sheet being positioned several inches above the cable to protect it, said steel tape or sheet functioning as an armor whereby damage to the cable is prevented by any digging or similar operations after the underground installation has been made. Such procedure is unrelated to the objectives of my present invention and is ineffective to achieve the results of my invention.

My invention results in a practical, effective and economical solution to the problem discussed above. I have found that a frangible, flexible metal foil, in the form of a sheet or tape, carrying a color to contrast with the color of the earth soil adjacent the lines or elements of construction so that said colors are readily visually distinguishable from each other, and wherein said metal foil is protected against moisture and oxidation or other deterioration when buried in the earth soil, can effectively be utilized and its presence and general location can readily be determined by means of conventional types of electronic or like metal detection devices operating from the surface of the earth. Thus, before any digging or excavation is performed, the presence and general location of the metal foil sheet or tape and, hence, the presence and location of the nonmetallic line or element of construction, can be ascertained, and the operator of the digging or excavation equipment forewarned. Various detectors which can be used are, for instance, the detector sold under the trade designation P–440 Metrotech Pipe and Cable Locator and the 220–A Metrotech Valve Box Locator, or a standard Dipping Needle. Equipment of such and other types operate, above the surface of the earth, on inductive and conductive principles to provide strong signals indicating the presence and general location of metallic lines beneath the surface of the earth.

The present invention finds its greatest utility, as has been indicated above, in those environments where the lines or elements of construction which may be sought to be located are made of nonmetallic materials.

While various metal foils can be utilized the presence and location of which can be determined by electronic or like detecting devices, as, for instance, copper foil, aluminum foil, nickel foil and so-called tin foil, I have found it to be especially advantageous to employ foils made from steels, particularly a tin-coated steel foil. The thickness of the metal foil is somewhat variable but, in general, it is desirable to use a foil having a thickness in the range of about 0.0005 to about 0.004 inch, excellent results being obtained with an approximately 0.001 to 0.002 inch thick foil made by further cold rolling a conventional tin-coated mill gauge cold rolled steel. Generally speaking, for best results, the steel foil should not be annealed since annealing tends to adversely affect the fully designed flexibility of the steel foil.

It is important that the metal foil, and particularly the

steel foil, be protected against moisture and oxidation or other attack and also that it be provided with a coloring which contrasts with the color of the earth soil surrounding or adjacent to the buried lines or elements of construction. To this end, the steel foil, for instance, can be painted on at least one side and, better still, on both sides with a long-lasting moisture- and oxidation-resistant polyester paint. If desired, the resulting painted foil can be imprinted with any desired indicia such as, for instance, are now commercially used on polyethylene tapes employed in the manner disclosed pursuant to the teachings of the aforementioned patents. Steel foils, as rolled, commonly have an oil coating. Care should be taken that said oil coating does not interfere with the proper adherence of paint or other coatings to the steel foil. Thus, for instance, generally speaking, the oil level should not exceed about 1 gram per base box. Where the oil coating interferes with the application and adherence of the paint or synthetic plastic coating, it should be removed by washing and then drying. In any event, the painted metal foil, imprinted or not, is then advantageously coated or covered on at least one side and, better still, on both sides, by extrusion, laminating or other coating techniques, with a thin film, for instance, of a thickness of about 0.0005 to 0.003 inch, especially about 0.001 inch, of a substantially transparent plastic which is resistant to deterioration in contact with moisture and other materials present in the earth soil, polyethylene being particularly desirable. The polyethylene or like plastic film serves as a further protectant of the steel foil and it also serves as a protectant for the paint, when applied over the paint, against any possible deterioration or breakdown thereof when disposed in contact with the earth soil. No novelty is claimed in the compositions of the paints, numerous formulations being available for this purpose. The term "paints," as used herein and in the claims, is intended to cover coating compositions broadly which are colored with pigments or dyes, as the case may be, and encompasses not only paints proper but, also, lacquers, varnishes and similar coating compositions. An illustrative coating which has been found to be very satisfactory is a thermosetting vinyl coating sold under the designation S-2770 (Mobil Chemical Company) which can be obtained in various colors. It may also be noted that, where the metal foil inherently has a coloration which would contrast with the color of surrounding or adjacent earth soil in which it would be embedded, then the application of a separate coloration thereto is not necessary. However, in the usual case, it will be found to be desirable actually to provide a coloration to the metal foil through the medium of a paint or a colored plastic film, as described herein. In any event, the term "coloring" is used generically, except as may otherwise specifically be stated, to encompass the color of the metal foil where it contrasts with earth soil so as to be readily visually distinguishable therefrom.

Instead of painting the steel foil, or other metal foil, with a paint, the metal foil can be coated on both sides or encased in a colored or pigmented synthetic plastic of any desired color, for instance, yellow, red, orange or green, for instance, a film, of the thickness set forth above, of polyethylene or polypropylene, and then said plastic film may be imprinted if desired. Alternatively, a film of colored polyethylene or polypropylene, having a thickness of the order of about 0.001 to 0.002 inch, can initially be imprinted and then laminated onto opposite sides of a steel foil of a thickness of the order of 0.001 to 0.002 inch. Where laminating procedures are used, such should be done employing a laminating adhesive, of which many are available commercially. A particularly satisfactory polyethylene for use in the adhesive laminating procedure is that sold commercially under the trade designation DA-3208 (Union Carbide Corporation). Particularly satisfactory polyethylenes for use in the extrusion or hot plastic procedure are those sold under the trade designations Copolymer DQDA 2300 (Union Carbide Corporation) and ZETAFIN Copolymer QX-3623-17 (Dow Chemical Company). Other synthetic plastics and protective coatings which are resistant to moisture and deterioration in earth soils can, of course, be used, among which may be mentioned polyvinylidene chloride (Saran), polyvinyl chloride, cellulose acetate-butyrate, polystyrene; and acrylonitrile, for instance, that sold under the trade designation 50S331 Film No. 203-334-36-14 (Vistron Corporation); and glassy or ceramic type coatings.

In use, the metal foil product described above, in the form of sheets or tapes, is applied in the same manner and utilizing the principles disclosed in the aforementioned patents. Depending upon the nature of the lines or elements of construction, variable widths of the metal foil product can be used, these generally ranging from about 3 inches in width to a foot or more in width. The metal foil product may be buried from 4 to 12 or more inches to several feet beneath the surface of the earth and at an appropriate height above the lines or elements of construction, as described, for instance, in the aforementioned U.S. patents. After the metal foil product is installed in position overlying the lines or elements of construction and the trench or excavation backfilled, if, for any reason, it is necessary thereafter to dig into the earth, say to reach the lines or elements of construction, their presence and general location can first be ascertained very simply by means of known types of electronic or like metal detection devices. Then, the digging or excavation can be begun and the colored metal foil product will function in accordance with the same broad principles disclosed in the aforementioned patents. It may also be noted that, although the presence and general location of the colored metal foil products can and advantageously is first ascertained by electronic or like detection devices, it is not necessary that this be done because the installation affords the dual purposes of detectability and also the protective function following the principles of said aforementioned patents where electronic detectability is not utilized.

The terms "frangible," "tearable" and "rupturable" are used interchangeably herein and in the claims to mean that the strength of the metal foil is such that, in conventional digging into the soil, in conection, for instance, with excavating, laying lines or elements of constructions or cuting into the earth for any other reasons, by means of mechanical or similar digging or excavating equipment, such as backhoes and trenchers, if the metal foil is struck and pulled up by such equipment, the teeth or the like on such equipment will shear, sever or break the metal foil and said foil will be ripped from the earth and be pulled loose for several feet along its length. The terms "lines" and "elements of construction" are used herein in the same sense in which they have been as set forth in the aforementioned U.S. Patents Nos. 3,282,057 and 3,115,-861, respectively.

I claim:

1. In a method of facilitating the determination of the presence and the location of an element of construction disposed beneath the surface of the earth which includes the steps of digging a trench in the earth, providing an element of construction therein, placing a frangible colored body in said trench and overlying said element of construction and in which said frangible body has a coloring thereon which contrasts with the color of the surrounding earth soil, the improvement in which said frangible colored body comprises a sheet or tape of a flexible metal foil having a thickness in the range of about 0.0005 to about 0.004 inch and carrying an adherent moisture- and soil-resistant coating on at least one surface thereof.

2. In a method for the installation of a line beneath the surface of the earth in which the line is placed within an excavation and subsequently backfilled and wherein there is included in the backfill at a generally predeter-

mined level adjacent the line an indicating means comprising a tearable or rupturable sheet or tape bearing a coloring thereon which contrasts with the color of the surrounding earth soil, the improvement in which the said sheet or tape is made of a flexible metal foil having a thickness in the range of about 0.0005 to about 0.004 inch and carrying an adherent moisture- and soil-resistant coating on both surfaces thereof.

3. A method according to claim 2, wherein an elongated trench is first excavated, the line is placed longitudinally along and within said trench, the trench is partially backfilled, the tearable or rupturable sheet or tape is placed in said trench and overlying said line, and then completing the backfilling operation.

4. A method according to claim 1, in which the metal foil is a steel foil.

5. A method according to claim 2, in which the metal foil is a non-annealed steel foil having a thickness of about 0.001 to 0.002 inch.

6. A method according to claim 4, in which the coating is a pigmented paint which, in turn, is coated with a film of a synthetic plastic.

7. A method according to claim 5, in which the synthetic plastic film is substantially transparent polyethylene.

8. A method according to claim 2, in which the said coating comprises a pigmented paint which, in turn, is coated with a substantially transparent polyethylene.

9. A method according to claim 2, in which the said coating comprises a colored synthetic plastic.

10. A method according to claim 9, in which the synthetic plastic is polyethylene or polypropylene.

11. A method according to claim 2, in which the line is made of a nonmetallic material.

12. In an area of earth soil which carries beneath the surface thereof at least one element of construction and a frangible colored body beneath said surface and located above and overlying said element of construction, said frangible body having a coloring thereon which contrasts with the color of the surrounding earth soil, the improvement in which said readily frangible colored body comprises a sheet or tape of flexible metal foil having a thickness in the range of about 0.0005 to about 0.004 inch and carrying an adherent moisture- and soil-resistant coating on at least one surface thereof.

13. In a backfilled trench in the earth having an elongated line adjacent the bottom thereof and, positioned intermediate said line and the surface of the earth, and generally overlying said line, a tearable or rupturable indicating sheet or tape bearing a coloring thereon which contrasts with the color of the surrounding earth soil, the improvement in which the said sheet or tape is made of a flexible metal foil having a thickness in the range of about 0.0005 to about 0.004 inch and carrying an adherent moisture- and soil-resistant coating on both surfaces thereof.

14. A backfilled trench according to claim 13, in which the metal foil is a non-annealed steel foil having a thickness of about 0.001 to 0.002 inch.

15. A backfilled trench according to claim 14, in which the coating is a pigmented paint which, in turn, is coated with a film of a synthetic plastic.

16. A backfilled trench according to claim 15, in which the synthetic plastic is polyethylene.

17. A backfilled trench according to claim 14, in which the said coating is a color polyethylene or propylene.

18. A backfilled trench according to claim 13, in which the line is made of a nonmetallic material.

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