April 15, 1969

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3,438,461

METHOD AND MEANS FOR DISPENSING CABLE-PULLING LUBRICANT

Filed Dec. 1, 1965

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Fig. 1

Fig. 2

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METHOD AND MEANS FOR DISPENSING CABLE-PULLING LUBRICANT

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Filed Dec. 1, 1965, Ser. No. 510,770
Int. Cl. F01m 9/12, B65c 7/08, B65d 35/28

U.S. Cl. 184—1

Claims

Abstract of the Disclosure

This invention relates generally to the dispensing of fluent material within extended conduits, and is concerned particularly with the dispensing of cable-pulling lubricant incident to the pulling of electrical cables for installation in conduits therefor, although the dispensing principles involved are adaptable for any analogous purpose as will appear from the following description of their use in pulling cables.

Cable-pulling operations are normally carried out by first installing a pulling strand in the conduit through which the cable is to be pulled, then attaching the cable to be pulled to the trailing end of this pulling strand, and using the pulling strand to pull the cable into place within the conduit while manually applying a cable-pulling lubricant to the cable as it enters the conduit, if the pulling conditions are at all difficult, in order to ease its pulled movement therein sufficiently to prevent cable damage in the course of the pulling operation; as well as to minimize the time required for pulling and thereby avoid excessive labor costs; and to allow use of conventional pulling equipment without abusive strain; and even to make the cable pulling possible in certain circumstances.

Commercial and industrial buildings are commonly designed with electrical cable conduits in which it is usual to pull the cable in the foregoing manner, and in which the pulling is usually rather difficult because adaptation to the building structure almost always requires the conduits to change direction substantially at least once intermediate their length, either by way of offsets to avoid elements of building structure or at bends needed to reach lateral areas or to connect different levels. When the pulled cable must pass through such changes in conduit direction, the pulling difficulties are considerably intensified by reason of the greater pulling tension required to move the cable through the direction changes and the consequent localized increase in frictional contact within the conduit as the cable being pulled passes through the change in conduit direction. It is principally to lessen the possibility for cable damage during pulling that cable-pulling lubricant is used, and the principal purpose of and need for the lubricant use is to ease the cable passage through the conduit direction changes so as to avoid undue frictional attrition thereof and to maintain the required pulling tension at reasonable levels. However, the normal practice of applying the cable-pulling lubricant to the cable as it enters the conduit provides no certainty that the applied lubricant will be made available at the direction change for effective action there, particularly if the direction change is spaced substantially from the conduit entrance. To compensate for such lack of certainty, the tendency has been to apply the lubricant excessively as a troublesome and messy aspect of cable-pulling operations, while still not obtaining fully adequate results from the lubricant where the pulling conditions were particularly difficult or unusual.

The present invention makes it possible to use the cable-pulling lubricant at full effectiveness and with certainty by dispensing it within the conduit as an incident of the cable-pulling operation. This result is accomplished by providing a flexible dispensing package of the lubricant that is shaped for pulling through the conduit and that is peripherally contractible upon extension thereof so as to decrease in volumetric size or capacity when extended to force lubricant therefrom; and by further arranging this dispensing package so that it may be attached first to the cable pulling strand and then have the cable to be pulled attached at the trailing end thereof, so that the dispensing package is subjected to the pulling tension during the cable installation and is thereby extended to dispense lubricant in the path of the cable within the conduit in response to the pulling tension.

A particular advantage of this arrangement is that the dispensing result is selectively or commensurately responsive to the pulling tension, so that as the cable reaches a change in conduit direction and requires a greater pulling effort to continue its movement, the resulting increase in pulling tension causes the automatic increased dispensing of the lubricant at exactly the point where it is needed most to ease the pulling effort and avoid adverse pulling conditions. In addition, the pulling tension has a sufficient effect on the dispensing package from the outset to eliminate any usual need for manual application of lubricant to the entering cable, and the result is an exceptionally effective and efficient use of the cable-pulling lubricant.

These and other features and advantages of the present invention are described in further detail below in connection with the accompanying drawings, in which:

FIG. 1 is a diagrammatic view illustrating a typical arrangement of conduits through which electrical cables are pulled for installation thereof;

FIG. 2 is a partially sectioned side elevation view illustrating a flexible sleeve structure and a collapsible dispensing package disposed in a storage container, as suitably provided for use according to the present invention;

FIG. 3 is a side elevation view illustrating the collapsible dispensing package being disposed in operative relation within the sleeve structure;

FIG. 4 is a partially sectioned side elevation view illustrating the sleeve structure carrying the collapsible dispensing package and installed between a pulling strand and the cables to be pulled;

FIG. 5 is a partially sectioned side elevation view similar to FIG. 4 but illustrating the dispensing action of the sleeve structure and collapsible dispensing package incident to pulling through a bend in a conduit; and

FIG. 6 is a transverse section illustrating the disposition of electrical cables as they are pulled through a conduit in which cable-pulling lubricant has been dispensed according to the present invention.

Referring now in detail to the drawings, FIG. 1 is a riser diagram for a typical commercial or industrial building illustrating a plurality of conduits C which run under the main floor from an outside transformer station (not shown) to the main switchboard S located on an elevated mechanical room floor within the building, and additional secondary conduits C' which run from switchboard S to...
a plurality of electrical panels P and to other equipment such as an emergency generator G. As illustrated in FIG. 1, the conduits C and C' make substantial changes of direction in running to their destination as, for example, at quarter bends B in conduits C thereby enabling them to run from their underground disposition to switchboard $S$ along a predetermined path dictated in greater detail later in the building. Similar changes of conduit direction such as offset bends are also frequently encountered in typical installations because of equipment locations and general interior design requisites which must be satisfied in providing the necessary electrical facilities while at the same time locating the conduits so as not to detract from the overall appearance of the building.

As previously described, these changes of direction in the conduit offer increased resistance to pulling electrical cables therethrough, and FIG. 2 illustrates a preferred embodiment of the present invention by which cable pulling lubricant is dispensed within such conduits during the cable-pulling operation at points where it is needed to facilitate passage of the cable.

A sleeve structure, generally indicated by reference numeral 10, includes an elongated body portion 12 formed of thin plastic film material, suitably braided nylon cord, sewn together at spaced locations as at 14 so as to be arranged in a reticulated fashion which renders the sleeve 10 longitudinally extensible and consequently peripherally contractible when pulling tension is applied thereto during the cable-pulling operation in a manner to be described in greater detail presently. The cord material of body portion 12 is brought together to form a closed end 16 and worked into a loop 18 therein, while at the opposite end 20 the cord material is divided and worked into a pair of loops 22 so as to leave end 20 open (see FIG. 3).

Also illustrated in FIG. 2 is a relatively rigid tubular storage container 24, including end caps 26, suitably formed of cardboard or the like and containing therein a collapsible dispensing package 28 comprised of a flexible container or inner bag 30 formed of thin plastic film material and upon which is disposed a supply of conventional cable-pulling lubricant having a paste-like consistency. One end of the inner bag 30 is fitted with a tapered dispensing nozzle 32 formed with a closed end 32' so that lubricant cannot flow therefrom until collapsible dispensing package 28 is properly installed for cable-pulling operation. The end 32' may be cut off or broken open; the nozzle taper rendering it possible to select a larger or smaller opening for lubricant flow depending on where the cut or break is made along the lengthwise extent of dispensing nozzle 32.

FIG. 3 illustrates a convenient manner by which the collapsible dispensing package 28 may be removed from storage container 24 and disposed within sleeve 10 without exposing the collapsible dispensing package 28 to any unnecessary danger of tearing or rupture during handling. The end caps 26 are removed from storage container 24 and it is inserted into the open end 20 of sleeve 10 until the closed end 16 thereof is reached whereupon storage container 24 is withdrawn from sleeve 10 by sliding it over collapsible dispensing package 28 which is then left within sleeve 10 with dispensing nozzle 32 directed toward open end 20. It will be recognized that since inner bag 30 is flexible and preferably not tightly packed with lubricant for a reason to be hereinafter explained, insertion of collapsible dispensing package 28 in sleeve 10 would be very difficult in the absence of the rigid support provided by storage container 24 in holding the sleeve 10 in an opened position as illustrated in FIG. 3.

FIG. 4 illustrates sleeve 10 carrying collapsible dispensing package 28 and installed for cable pulling operation between a pulling strand or fish tape T and three electrical cables E. Fish tape T, which may be a wire cable or polyethylene rope, has been introduced into a conduit at a pullbox or the like to which the cables E are to be pulled, and then threaded through the conduit in a conventional manner until the end thereof extends from an opening in the conduit, which may be at another pullbox or the like where cables E are located in preparation for installation.

In conventional cable-pulling operation, fish tape T would then be connected directly to the cables E for pulling them through the conduit, and cable-pulling lubricant would be manually applied to the cables E in generous quantities as they are passed into the conduit. According to the present invention, however, the aforementioned difficulties with this method are avoided by interposing sleeve 10 and collapsible dispensing package 28 between fish tape T and cables E prior to the introduction of cables E into the conduit. Thus, as illustrated in FIG. 4, fish tape T is attached to loop 18, and the three cables E are held together by a wire rig $34$ having a loop 36 formed at the end thereof for attachment to the two loops 22 in sleeve 10. A piece of fabric 38 may be wrapped about the rig 34 to facilitate its passage over the inner surface of the conduit and to assist in spreading lubricant dispensed from the collapsible dispensing package 28 as will be described in further detail below. With sleeve 10 installed in this manner and nozzle 32 opened for dispensing operation, fish tape T is then pulled through the conduit by hand or, when necessitated by more difficult pull conditions, by a winch or the like. FIG. 5 illustrates the sleeve 10 as it is being pulled through a quarter bend in conduit C which is a typical change in conduit direction where pulling becomes more difficult and, therefore, where it is desirable to have a large supply of cable-pulling lubricant disposed to facilitate passage of the cables E. The increased resistance to pulling at bend B causes extension of sleeve 10, such extension being allowed by the flexible nature of sleeve 10 and, as a consequence of this extension, it also contracts peripherally with a resulting decrease in volumetric capacity which causes collapsible dispensing package 28 to collapse commensurately and thereby to dispense cable-pulling lubricant therefrom through dispensing nozzle 32 in the immediate path of cables E as indicated by reference numeral L in FIG. 5. Moreover, during this contraction of sleeve 10, localized bursting of the relatively thin collapsible dispensing package 28, which may result in undesirable discharge of lubricant other than from dispensing nozzle 32, is counteracted by the even distribution of the squeezing force applied by sleeve 10 and by the substantial supporting effect provided at the external surface of collapsible dispensing package 28 as the diamond shaped openings 40 in sleeve 10 are reduced in area by extension thereof (compare Figs. 4 and 5).

It is apparent that the quantity of lubricant dispensed from collapsible dispensing package 28 will increase proportionately to the increase in pulling tension applied to sleeve 10 so that more lubricant is supplied at points of greater resistance to pulling. Moreover, dispensing is not limited solely to changes of conduit direction but may occur also along straight horizontal runs or at any other point in conduit C where sufficient pulling tension is present to cause extension of sleeve 10. Additionally, it should be pointed out here that there is usually an advent of not initially filling the inner bag 30 to capacity with lubricant since this would tend to render the collapsible dispensing package 28 rigid and possibly cause it to burst at the first substantial change of conduit direction rather than selectively dispense lubricant through the dispensing nozzle 32 during the entire cable-pulling operation.

Another significant feature of the present invention, as illustrated in FIG. 6, is that dispensable lubricant L is disposed over a relatively large area of the inner surface of conduit C overlapping the path of pulled cables E whereby a large lubricant supply is provided which may be spread first by fabric 38 at the leading end of cables E and then continuously worked by the cables E at the area of
their contact with conduit C as they are pulled through lubricant L. This continuous working of the lubricant L prevents accumulations at the bottom of conduit C and spreads it over the area of contact to maintain lubrication thereof during the entire cable-pulling operation.

This method of dispensing the lubricant selectively within conduit C rather than directly to the cables B as is done in the conventional method of manually "soaping" the cables prior to pulling avoids this disadvantage of the latter method whereby a large portion of the applied lubricant simply remains unused on the cables at areas which never contact the conduit and, additionally, the lubrication at the area of contact is soon dissipated as the lubricant wears off the cables and is not replaced.

It will be understood, of course, that the sleeve 10 and collapsible dispensing package 28 may be of any desirable size as dictated by the requirements of the particular cable-pulling operation. Moreover, in especially difficult pulling operations, it always remains possible to supplement the lubricant supply by manual "soaping" or otherwise, although such supplemental addition of lubrication will almost always be a matter of caution and is normally unnecessary whenever the lubricant dispensing is done suitably in accordance with the present invention.

The present invention has been described in detail above for purposes of illustration only and is not intended to be limited by this description or otherwise except as defined by the appended claims.

1. A method of dispensing fluent material within an extended conduit, said method comprising the steps of providing a flexible dispensing package containing a flexible outer portion and a collapsible inner container portion substantially filled with said material, pulling said flexible dispensing package containing said material through said conduit while causing selective extension of said outer portion and consequent peripheral contraction thereof so that the volumetric capacity of said collapsible inner container portion is reduced to dispense said material therein selectively within said conduit.

2. A method as defined in claim 1 and further characterized in that said fluent material is a cable-pulling lubricant, and in that said flexible dispensing package is pulled through said conduit with a cable attached at the trailing end thereof.

3. A method of dispensing cable-pulling lubricant within an extended conduit as defined in claim 2 and further characterized by the step of dispensing said lubricant at the trailing end of said package in the immediate path of the cable being pulled.

4. A method of dispensing cable-pulling lubricant within an extended conduit as defined in claim 2 and further characterized in that said conduit changes direction substantially at least once intermediate its length, and in that the increased resistance to pulling at said change of direction is utilized to cause selective extension of said package and consequent peripheral contraction thereof to dispense lubricant therefrom at said change of direction for facilitating the cable pulling thereof.

5. A method of dispensing cable-pulling lubricant within an extended conduit as defined in claim 2 and further characterized in that the lubricant dispensing is done within said conduit incident to the pulling of cable therethrough and in that said method additionally comprises the steps of installing a pulling strand in said conduit, attaching the cable to be pulled at one end of said flexible outer portion and said pulling strand at the other end thereof, and employing said pulling strand to pull said cable with said flexible outer portion attached therebetween and thereby subjected to the pulling tension so as to contract peripherally with resulting decrease in volumetric capacity causing said inner container portion to collapse commensurately and dispense said cable-pulling lubricant therefrom in the path of the cable being pulled.

6. Means for dispensing a fluent material within an extended conduit comprising a flexible dispensing package structure including a flexible outer portion and a collapsible inner container portion substantially filled with cable-pulling lubricant, said package being shaped for pulling through said conduit and said outer portion being peripherally contractible upon extension thereof by pulling tension so as to decrease in volumetric size to dispense said lubricant from said inner container portion whenever pulling tension causes said extension.

7. Means as defined in claim 6 for dispensing a cable-pulling lubricant within an extended conduit incident to the pulling of cable therethrough, and further characterized in that said package structure comprises a sleeve structure of flexible material and elongated form suitably for pulling through said conduit and rendering it longitudinally extensible and consequently peripherally contractable under pulling tension, with the said sleeve structure having a closed end portion formed for attachment of a pulling strand therewith and an opposite open end portion formed for attachment thereon of the cable to be pulled, and further comprises a collapsible dispensing package of said cable-pulling lubricant proportioned for disposition within said sleeve structure by insertion through the open end portion thereof prior to attachment of the cable to be pulled.

8. Means for dispensing a cable-pulling lubricant as defined in claim 7 and further characterized in that said sleeve structure is formed of a cord material arranged in a reticular fashion.

9. Means for dispensing a cable-pulling lubricant as defined in claim 7 and further characterized in that said sleeve structure is formed of a textile cord material, has a body portion of reticular construction, and has said cord material worked into loops at the respective end portions of said sleeve structure for respective attachment of said pulling strand and said cable to be pulled.

10. Means for dispensing a cable-pulling lubricant as defined in claim 7 and further characterized in that said collapsible dispensing package is arranged for disposition within said sleeve structure to dispense said cable-pulling lubricant toward said open end portion.

11. Means for dispensing a cable-pulling lubricant as defined in claim 7 and further characterized in that said collapsible dispensing package comprises a flaccid container formed of plastic film material and fitted with a normally closed dispensing nozzle that is subject to opening upon disposition of said package in said sleeve structure.

12. Means for dispensing a cable-pulling lubricant as defined in claim 11 and further characterized in that said dispensing nozzle is fitted to said plastic film container so that said package may be disposed within said sleeve structure with said nozzle directed toward said open end portion.

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U.S. Cl. X.R.

15—104.16; 118—254; 184—14; 222—95
CERTIFICATE OF CORRECTION

Patent No. 3,438,461 Dated April 15, 1969

Inventor(s) A. G. MacPherson

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In Column 6, line 14, "6" (first occurrence) should read -- 7 --.

SIGNED AND SEALED

OCT 21 1969

(Seal)

Attest:

Edward M. Fletcher, Jr.
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WILLIAM E. SCHUYLER, JR.
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