Sept. 10, 1957 H. BURR 2,805,539

HELICAL LAPPING APPARATUS

Filed Dec. 3, 1954 2 Sheets-Sheet 1

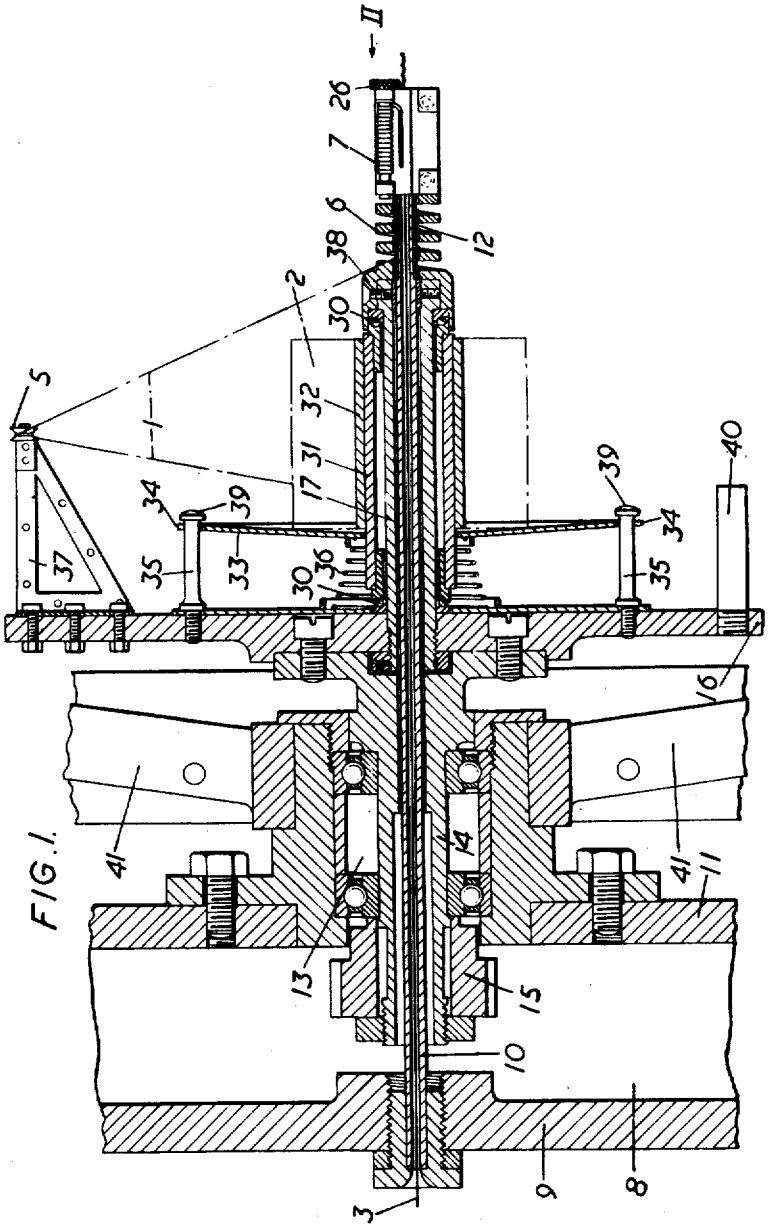


FIG. 1.

Inventor
Harvey Burr
By
Wolf Mackay & Burden
Attorney

Sept. 10, 1957 H. BURR 2,805,539

HELICAL LAPPING APPARATUS

Filed Dec. 3, 1954 2 Sheets-Sheet 2

FIG. 2.

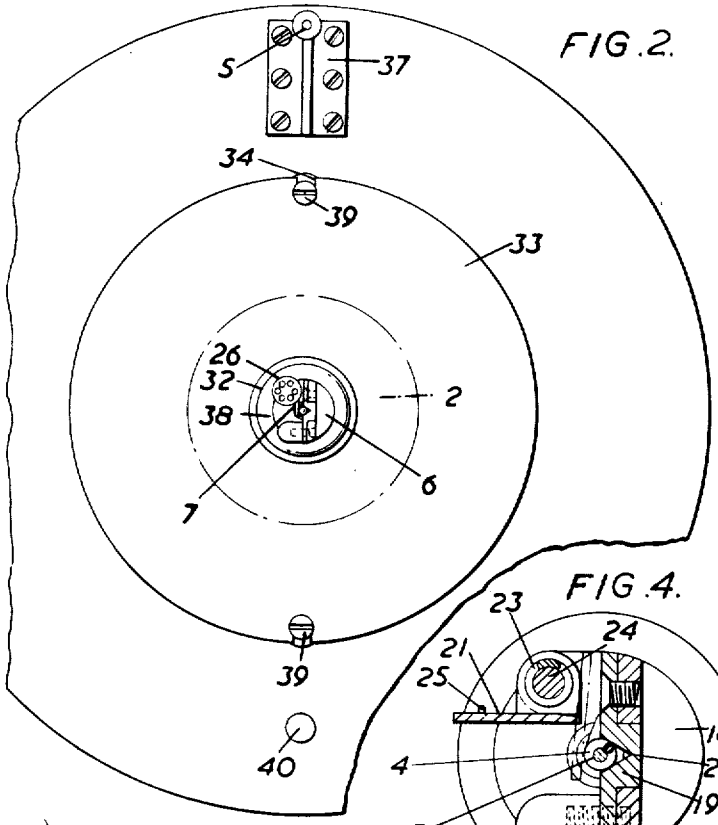
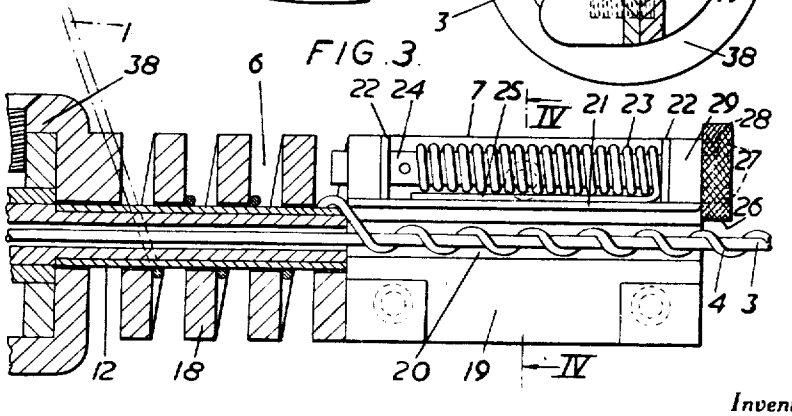


FIG. 4.

FIG. 3.



Inventor
Harvey Burr
By
Wells Mackey & Burden
Attorney

United States Patent Office 2,805,539 Patented Sept. 10, 1957

2,805,539

HELICAL LAPPING APPARATUS

Harvey Burr, Liverpool, England, assignor to British Insulated Callender's Cables Limited, London, England, a British company

Application December 3, 1954, Serial No. 472,993

Claims priority, application Great Britain December 8, 1953

5 Claims. (Cl. 57—18)

This invention is concerned with apparatus for applying a helical lapping of string or similar flexible member on a wire or similar longitudinally extending body. The wire may be a single wire or more than one wire stranded together to form a single body and it may have been previously provided with a covering, for instance of insulating material. The string may be composed of fibrous material, such as cellulose fibres, or of non-fibrous material, for instance a polymeric material such as polyethylene. Hereinafter the terms "string" and "wire" respectively will be used to cover, in the first case, the member to be applied as a lapping and, in the second case, the member to which the lapping is to be applied. A typical example of the use of the invention is the helical lapping of a spacing string on to a copper wire which is to form part of a cable for telephone or other communication service.

In apparatus to which the invention is applied string from a coil is carried by a guide in rotation about a stretched wire as the latter is drawn forward axially taking the string with it. Accordingly, helical lapping of the string on the wire results, the lapping usually being in the form of an open helix with widely spaced turns. The invention is concerned with means which is placed at or near the point of application of the string to the wire to ensure uniformity of application by producing constant tension in the string where it passes into the helix which is formed on and carried forward by the wire.

The applying means forming the invention comprises two parts in combination, the first of which draws the string from the coil through the rotating carrier guide and delivers it at zero tension or at negligibly small tension to the second part which applies by means of a friction brake constant tension to the string as it is drawn forward by the wire and preferably also serves to apply the string to the wire and guide it thereon. The string, when in this second part, is separated by the action of the first part from the influence of changes or irregularities of tension which occur in the drawing of the string from the coil so that the tension under which the string is applied to the wire is determined solely by the second part and, therefore, can readily be made substantially constant.

It may be advantageous in some cases to adopt an arrangement of the mounting of the coil of string which reduces, to some extent, the changes in tension due to the withdrawal of the string therefrom. This may, for instance, be the known arrangement in which a coil of string with a flat bottom rests on or is pressed on a slightly concave disc (which may be spring-supported) on the surface of which the coil slides in its rotation about its axis as the string is withdrawn from it. The coil in such an arrangement is in contact with the disc only near the outer surface of the coil so that the radius of application of friction to the coil decreases as the size of the coil decreases.

The first part of the applying means above mentioned

is a device of the capstan type in which the string is lapped in a large arc of contact (e. g. two or more complete turns) round a smooth body of circular section and is caused to slip axially thereon so that feed on to the body can take place near one end thereof while delivery therefrom takes place at the other end. The smooth circular surface is coaxial with the wire and the string is lapped on it by rotation of the carrier guide about that axis, the grip of the string on the surface providing the force to draw the string from the coil and through the carrier guide. While this arrangement differs from the usual arrangement of a capstan in that in the present case the barrel is stationary and the string is lapped round it by a rotating guide, the relative motion of the parts is the same and the same results follow.

The diameter of the smooth circular body and the lay of the helix which the string follows on that body are such that one turn of this helix is longer than one turn of the helix which the string forms on the wire. Hence there is a tendency for the operation of this device to over-feed the string towards the wire. This is corrected by the backward slipping of the string round the smooth body which is associated with the existence of negligibly small or zero tension in the string at the point where it leaves this smooth surface on its way to the second part of the applying means.

The axial movement of the string on this smooth circular body can be produced by a member having a helical guide surface closely surrounding the smooth surface of the circular body but preferably not making contact with it, this helical member being made to rotate about the axis of the wire and acting as a long fleeting knife and at the same time determining the regularity of the pitch of the helix of the string on the smooth body.

The second part of the applying means may be in the form of a spring-loaded brake shoe and a support surface between which the string is drawn by the wire as it passes from the first part of the applying means to the point of formation of the helix on the wire.

The invention will be further described with reference by way of example to the accompanying drawings of an arrangement for applying an open turn helical lapping of string to a wire, wherein:

Figure 1 is a part sectional view of the string applicator;

Figure 2 is an end view of the same arrangement as seen in the direction of the arrow II in Figure 1;

Figure 3 is a part sectional view of a portion of the apparatus upon an increased scale, and

Figure 4 is a section taken on the line IV—IV in Figure 3.

The purpose of the apparatus shown is to wrap a string **1** about a wire **3** in the form of an open turn helix **4** as the wire is drawn through the axis of rotation of the device. The string **1** is drawn from a bobbin **2** over a guide **5** rotated about the advancing wire. The arrangements for forming the helix **4** under conditions of constant tension comprise two parts **6** and **7** in combination. The first part **6** draws the string **1** from the coil **2** through the rotating carrier guide **5** and delivers it at negligibly small tension to the second part **7**. The second part **7** applies, by means of a friction-brake, a constant tension to the string as it is drawn forward by the wire and at the same time serves to apply the string to the wire and guide it thereon.

The apparatus is designed to rotate in the usual manner about the wire travelling vertically upward as the string is applied to it and the coil **2** is mounted coaxially with the wire and rotatable about it. The device is supported on a double base plate **8** in the lower part **9** of which is fixed a stationary tube **10** which extends upward through

the upper part **11** of the base. This tube **10** extends completely through the centre of the support for the coil **2** and at its upper end is in the form of a smooth surfaced cylinder **12** which constitutes a member of the first part **6** of the tension controlling arrangement. In a bearing **13** in the upper part **11** of the base **8** there is mounted a hollow spindle **14** to the lower end of which is fixed a gear wheel **15** through which can be applied a drive to rotate the spindle **14**. To the upper end of this spindle **14** is fixed a plate **16** which forms a base for the support of the coil **2** and the rotating parts by which the string is applied to the wire. The rotating parts are enclosed in the usual manner in a stationary cylindrical guard, not shown, attached to the base **8** by means of a radial bracket **41** of which parts are shown in Figure 1.

An extension **17** of the rotatable hollow spindle **14** above the plate **16** closely surrounds the fixed tube **10** and is carried forward to a point above the level of the top of the coil **2**. To the upper end of this tubular extension **17** is fixed a cap **38** carrying a rigid cylindrical helix **18** the inner surface of which just clears the smooth surface of the fixed cylinder **12**. This helix **18**, as shown in Figure 3, makes three complete turns about its axis and carries at its upper end the second part **7** of the tension controlling arrangement.

The second part **7** of the tension controlling system comprises a plate **19** extending parallel with the axis of the wire **3** and rotatable with the helix **18** to which it is fastened. One face of this plate lies in a plane substantially through the centre line of the path of the wire. The face of the plate is formed with a V-shaped groove **20** parallel with and symmetrical about the wire axis. The transverse dimensions of the groove are such that about half of the section of the conductor **3** with its helical covering of string **4** lies within the groove with the string in contact with both faces of the groove. A small rectangular plate **21** is carried on two hinges **22** fixed to the grooved plate **19**. The axis of the hinges **22** extends parallel with the axis of the wire and in such a position relative thereto that the small plate can be turned to engage the helically covered wire lying within the groove as shown in broken line in Figure 4 or can be moved into the position shown in that figure, in full lines, to give access to the groove. A coiled compression and torsion srping **23** concentric with and anchored at one end to the hinge pin **24** engages at its free end **25** the back of the plate **21** and presses it into engagement with the helically wrapped conductor as shown in Figure 4. To the upper end of the hinge pin **24** there is fixed a knurled head **26** provided with a number of angularly spaced apertures **27** adapted to engage one at a time over a pin **28** extending axially upwards from the upper hinge mounting **29**. By raising the knurled head **26** out of engagement with the pin **28** and against the longitudinal force of the spring **23** the head can be turned one way or the other to increase or reduce the force of the spring on the plate **21** and can be locked in this position by allowing the head to be pulled downwards by the spring into re-engagement with the pin **28**.

In bearings **30** on the tubular extension **17** there is supported a sleeve **31** which receives the tubular centre **32** of the coil **2**. This tubular centre is of cardboard and of such dimension that it can be pushed by hand on to the sleeve and grips it tightly enough not to be pushed off by the undermentioned spring. The lower part of the sleeve is surrounded by a slightly concave disc **33**, the concave side being uppermost. At the outer edge and in two diametrically opposite positions there are provided grooves **34** in the disc through each of which there extends a guide-pin **35** which is fixed to and stands vertically on the main supporting plate **16**. The concave disc **33** is pressed upwards by a coiled spring **36** arranged co-axially with the axis of the machine and extending between the underside of the disc and the upper side of the main supporting plate **16**. Heads **39** on the

ends of the pins **35** prevent disengagement of the disc **33** when no coil **2** is in position. The pins **35** ensure that the disc **33** cannot rotate relative to the plate **16**. When a coil **2** is placed in position on the sleeve **31** it is pressed downwards into engagement with the disc which is depressed until the spring **36** is compressed to the desired extent. The coil **2** being of a regular cylindrical shape engages the disc **33** along its lower outer edge and the friction between the disc and the edge of the coil is determined by the spring **36**. The free length of the spring **36** is relatively long so that the force which it exerts does not alter greatly as the disc **33** rises a small distance as the coil is consumed and its diameter consequently decreased. Mounted on a bracket **37** towards the outer edge of the rotating base plate **16** is the guide **5** which is in the form of a freely rotatable wheel having its axis vertical. Diametrically opposite the bracket **37** on the plate **16** is fixed a counter-balance weight **40**. As shown in Figure 1 the string passes from the coil **2** over this guide wheel **5** to the first part **6** of the tension controlling device. The dimensions of the bracket **37** are such that the guide wheel **5** is in a position approximately level with the mean height of the coil **2**.

The operation of the device is as follows: The string passes outward from the coil **2** to the guide pulley **5** and then inward from this pulley to the lower end of the helix **18** rotating with the guide about the wire. Here, as shown in Figure 4, it is wound on the smooth surface of the fixed tubular member **12**, following the three turns of the helix **18**, and from the other end of the helix it enters along an approximately vertical path between the two pressure plates **19** and **21**. The smooth surface of the stationary cylindrical member **12** acts as a capstan which draws the string from the coil **2** over the guide wheel **5** as the latter rotates about the axis of the device. The rotating helix **18**, the sides of which are substantially radial to the cylindrical member, acts as a long fleeting knife to produce a continuous axial movement of the turns of the string along the stationary cylindrical surface. The helix **18** at the same time determines the regularity of the pitch of the turns of string. The initial tension in the string is determined by the friction between the coil **2** and the concave disc **33**. The grip of the string on the surface of the cylindrical member **12** provides the necessary force to draw the string from the coil **2**. The diameter of the cylindrical member **12** is greater than that of the wire **3** and the pitch of the helix **18** is so chosen in relation to the pitch of the turns of string on the wire that one turn of the string on the member **12** is longer than one turn of the string on the wire. Hence there is a tendency for the string to be overfed to the wire. This is corrected by backward slipping of the string round the smooth cylinder **12**, and the conditions along the string between the points of entry to and exit from the helix **18** are such that where the string leaves the first part **6** to enter the second part **7** the tension is reduced to a negligibly small value. When the device in operation is illuminated stroboscopically the loop of string just about to enter the second part **7** can be observed to be just clear of the cylindrical surface of the member **12** indicating that the tension here is of very small value. Consequently, in the actual step of wrapping the string on the wire the final tension is constant, being determined only by the pressure of the two plates **19** and **21** under the action of the spring **23**. Thus the string entering the last part **7** is completely isolated, by the first part **6**, from the influence of changes or irregularities of tension which may occur in the drawing of the string from the coil **2**.

From the preceding description of the invention it will be seen that the invention is applicable to a number of cases of the helical lapping of a flexible member about a circular core. The member to be lapped must have appreciable thickness so that the helical fleeting device can act upon its side so as to move it axially along the

smooth surface on which it is supported in the first part of the applying means.

What I claim as my invention is:

1. In apparatus for applying a helical lapping of string to a longitudinally moving wire, a friction brake for applying the string under constant tension to the wire, a capstan coaxial with the path of the wire for drawing the string from a coil, the capstan barrel being a stationary non-rotatable smooth surfaced cylinder, a carrier guide rotatable about said capstan to lap the string on said cylinder from one end in a large arc, and means rotatable with said carrier guide for moving the string axially along said cylinder to deliver it at the other end to said friction brake, said capstan accommodating in one turn of string a greater length than in one turn of string on the wire so that there is a tendency for said capstan to overfeed the string with consequent slipping of the string on said cylinder and reduction of the string tension to a negligible value at its delivery from the capstan.

2. In apparatus for applying a helical lapping of string to a longitudinally moving wire, a friction brake for applying the string to the wire under constant tension, a capstan coaxial with the path of the wire for drawing the string from a coil, the capstan barrel being a stationary non-rotatable smooth surfaced cylinder, a carrier guide rotatable about said capstan to lap the string on said cylinder from one end in a large arc, a fleeting member surrounding said cylinder and rotatable with said carrier guide, said fleeting member having a helical guiding face to engage and move the string axially along said cylinder to deliver it at the other end to said friction brake, said capstan accommodating in one turn of string a greater length than in one turn of string on the wire, so that there is a tendency to overfeed the string to the wire with consequent slipping of the string on said cylinder and reduction of the string tension to a negligible value at its delivery from the capstan.

3. In apparatus for applying a helical lapping of string to a longitudinally moving wire, a capstan coaxial with the path of the wire for drawing the string from a coil, the capstan barrel being a stationary non-rotatable smooth surfaced cylinder, a carrier guide rotatable about said capstan to lap the string in a large arc from one end on said cylinder, means rotatable with said carrier guide for axially moving the string along the surface of said cylinder to deliver the string to a friction brake, said friction brake consisting of two members and a spring pressing them together to receive between them the wire and the

string delivered by said capstan and both rotatable about the wire to apply the string thereto, said capstan accommodating in one turn of string a greater length than in one turn of string on the wire, so that there is a tendency to overfeed the string to the wire with consequent slipping of the string on said cylinder and reduction of the string tension to a negligible value at the entry to the friction brake.

4. In apparatus for applying a helical lapping of string on a longitudinally moving wire, a capstan having a stationary non-rotatable smooth surfaced cylindrical barrel coaxial with the path of the wire and having a rotatable fleeting guide to continuously displace axially along said barrel string lapped thereon, a carrier guide rotatable with the fleeting guide to lap string drawn from a coil in a large arc from one end on said barrel, a friction brake rotatable with the fleeting guide to receive the string from said capstan and lap it about the wire, said friction brake consisting of a support plate having a groove coextensive with the path of the wire and a spring-loaded plate acting towards said support plate to exert pressure on the lapping of string passing between and in rubbing contact with the surfaces of the groove and pressure the spring loaded plate, the capstan accommodating in one turn of string a greater length than in one turn of string on the wire so that slipping of the string on said barrel reduces the string tension to a very low value at the entry to the friction brake.

5. In apparatus for applying a helical lapping of string from a coil on a longitudinally moving wire, a capstan with a stationary smooth surfaced cylindrical barrel enclosing the path of the wire, a carrier guide rotatable about the barrel to lap the string over a large arc on the barrel from one end thereof, means rotatable with said carrier guide for producing axial sliding movement of the string along the barrel to deliver it therefrom at the other end, a friction brake to receive the string from the capstan and to helically lap the string with constant tension on the wire, and the barrel accommodating more string in one turn than in one turn on the wire so that the string tension is negligible as it leaves the capstan.

References Cited in the file of this patent

UNITED STATES PATENTS

1,537,638	Jenny	May 12, 1925
1,934,363	Littlefield	Nov. 7, 1933
1,949,484	Mayer	Mar. 6, 1934
2,782,138	Olson et al.	Feb. 19, 1957