

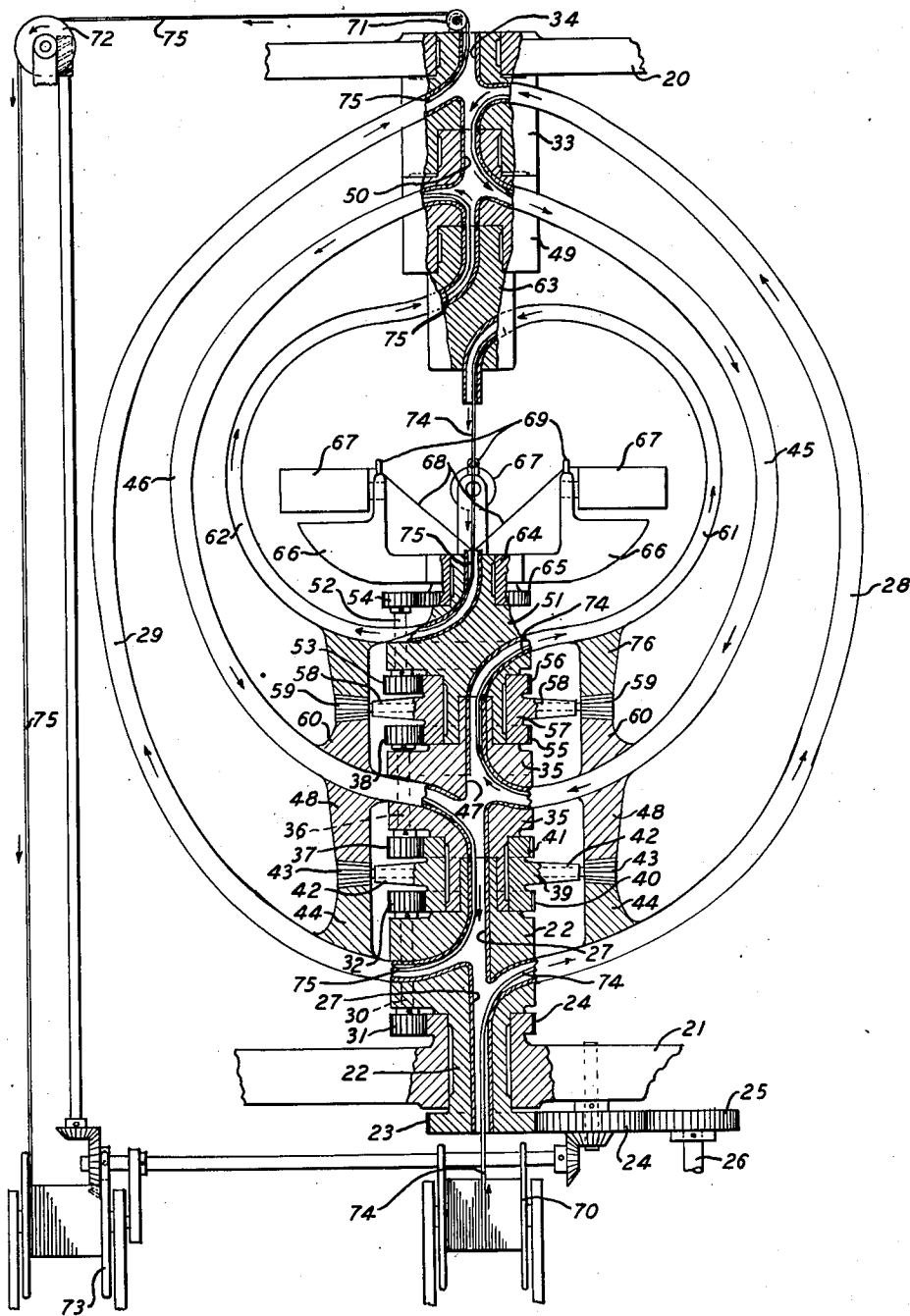
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L. L. WEAVER

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STRAND HANDLING APPARATUS

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INVENTOR

L. L. WEAVER

BY

E. R. Nowlan

ATTORNEY

UNITED STATES PATENT OFFICE

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STRAND HANDLING APPARATUS

Leo L. Weaver, Cranford, N. J., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York

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7 Claims. (Cl. 117-9.5)

This invention relates to strand handling apparatus, and more particularly to a high speed serving head for winding a cover strand spirally upon a core strand.

5 An object of the invention is to provide an apparatus for covering core strands by imposing a high speed of rotation upon a restricted portion only of a continuously advancing and substantially torsionally rigid core and applying a cover strand to the rotating part of the core.

10 With this and other objects in view, one embodiment of the invention contemplates a serving head on a winding machine, which comprises a set of two or more duplex fliers concentrically mounted to revolve about a support on which one or more cops or other supplies of cover strand are mounted so as to be rotatable on their own axes for the withdrawal of strand therefrom but to be stationary in space with respect to the core strand. A substantially torsionally rigid core strand passes through the arms of the set of fliers in succession and the cover strand is applied to the core strand at a point between the inner ends of the arms of the innermost flier. While the advancing core enters and leaves the serving head devoid of rotational motion, the action of the fliers is to impress a rotation upon the portion of the core at the serving point which rotation is so much the more rapid as the number of fliers in the set is greater.

Other objects and characteristics of the invention will appear from the following detailed description of one embodiment thereof in a high speed serving head, taken in connection with the accompanying drawing which is a semi-diagrammatic broken view in elevation and partly in central vertical section of a high speed serving head constructed in accordance with the invention.

As herein disclosed a frame is provided having spaced horizontal parallel rigidly positioned upper and lower members 20 and 21. A hub 22 is rotatably mounted in the lower member 21 and has its lower end formed with a gear 23 driven through intermediate gears 24 and 25 from a shaft 26 which is driven from any approved power source (not shown).

55 The hub 22 is further formed with a vertical central bore 27 extending throughout the hub. The lower ends of two opposed generally symmetrical tubular flier arms 28 and 29 are rigidly mounted in the hub 22 and their bore communicate with the bore 27, the end of the arm 28

facing downwardly and that of the arm 29 upwardly.

A vertical shaft 30 journaled in the hub 22 carries rigidly thereon lower and upper planetary gears 31 and 32, gear 31 meshing with a stationary gear 24 concentric with hub 22 and formed on or carried by support member 21.

The upper ends of the flier arms 28 and 29 are rigidly mounted in a hub 33 journaled in the member 20 to rotate coaxially with hub 22. This hub 33 has a vertical axial bore 34 extending throughout its length and the bores of the flier arms 28 and 29 communicate with the bore 34 as shown.

A hub 35 is mounted to rotate on the upper end of the hub 22 and carries a vertical shaft 36 rotatably mounted therein and provided at its lower and upper ends with planetary gears 37 and 38. A rotary spider 39 is mounted to rotate on the lower end of the hub 35 and is formed with integral lower and upper gears 40 and 41 which mesh respectively with the planetary gears 32 and 37. The spider is further provided with two or more arms 42 on which are journaled planetary bevel gears 43 which mesh underneath with a bevel ring gear 44 rigidly mounted on the flier arms 28 and 29.

A pair of opposed generally symmetrical tubular flier arms 45 and 46, dimensioned to rotate freely within the arms 28 and 29, have their lower ends rigidly mounted in the hub 35 which latter is formed with a vertical axial bore communicating at its lower end with the upper end of the bore 27 in the hub 22. The bores of the arms 45 and 46 communicate with the bore 47 35 as shown. A bevel ring gear 48 rigidly mounted on the under side of the arms 45 and 46 meshes with the upper side of the planetary gears 43. The upper ends of the flier arms 45 and 46 are rigidly mounted in a hub 49 journaled in the hub 33 and having a vertical axial bore 50 communicating at its upper end with the lower end of the bore 34. The bores of the arms 45 and 46 also communicate as shown with the bore 50.

A hub 51 is rotatably mounted on the upper end of the hub 35 and carries a shaft 52 rotatably mounted therein and provided at its lower and upper ends with planetary gears 53 and 54.

A spider 57, like the spider 39, is journaled on the lower end of the hub 51 and has gears 55 and 56 meshing respectively with gears 38 and 53. The spider 57 also has arms 58 carrying planetary bevel gears 59 rotatable thereon which mesh underneath with a bevel ring gear 60 rigidly mounted on the flier arms 45 and 46.

Opposed generally symmetrical tubular flier arms 61 and 62 have their lower ends rigidly mounted in the hub 51 and are proportioned to rotate freely within the flier arms 45 and 46.

5 The bottom end of arm 61 communicates coaxially with the top end of the bore 47, while the lower end of arm 62 is curved so that it opens upwardly from the center of the top face of the hub 51. The upper ends of the arms 61 and 62 are rigidly mounted in a hub 63 journaled in the hub 49. The upper end of the arm 62 communicates coaxially with the bottom end of the bore 50, while the upper end of the arm 61 is curved so that its extremity opens downwardly from the center of the bottom of hub 63. A bevel ring gear 76 rigid on the arms 61 and 62 meshes with the gears 59.

A hub 64 is rotatably mounted on the upper end of the hub 51 and carries an integral gear 65 which meshes with the planetary gear 54. The hub 64 also carries an integral or rigidly mounted spider having one or more arms 66 each provided with means to carry a cop 67 or reel or other supply of cover strand 68 which is drawn off from the cop through a strand guide 69. The details of the supply and its support and of the guide are irrelevant to the present invention and may be of any well known and appropriate construction.

A core strand supply reel 70 may be mounted under the lower end of the bore 27 in any convenient fashion. A guide sheave 71 may be mounted on the support member 20 adjacent to the upper end of the bore 34. A capstan 72 to draw the strands through and out of the head may be provided and conveniently located, and a take-up reel 73 may also be provided and appropriately positioned. The capstan and the take-up reel may be driven as indicated in the figure from the shaft 26. However, the construction and mode of operation of the supply reel 70, guide sheave 71, capstan 72, and take-up reel 73 are no part of this invention and so are not particularized further, such mechanisms being well known and of various kinds.

In operation, a substantially torsionally rigid core strand 74 drawn from any convenient supply such as the reel 70 is threaded up through the flier arm 28, down through the bore 50 and the arm 45, up through the bore 47 and the arm 61, down across the gap between the down facing upper end of the arm 61 and the up facing lower end of the arm 62, up through the arm 62, down through the arm 46 and the bore 27, up through the arm 29, over the sheave 71, around the capstan 72 as many times as may be necessary, and down to the take-up reel 73.

Cover strands 68 are drawn from the supplies 66 and attached to the core strand 74 at some point in the gap between the down facing upper end of the arm 61 and the up facing lower end of the arm 62.

Power is then applied to the shaft 26 and the capstan draws the covered core out of the machine. The bare core passes up the bore 27 into the lower or entrance end of the arm 28 and emerges from the top or exit end thereof rotating on itself with an angular velocity twice that of the flier arm 28, i. e. the arm 28 impresses two rotational turns on the strand for each revolution of the arm. The strand then passes down through the arm 45 which is rotating in the opposite sense to the rotation of the arm 28 and, for simplicity in illustration will be assumed to have the same angular velocity as the arm 28.

The arm 45 impresses two further turns on the strand for each revolution of the arm so that the strand emerges from the lower or exit end of the arm 45 rotating on itself with an angular velocity four times that of the arm 28. In the same way the strand emerges downwardly from the down facing upper or exit end of the arm 61 rotating on itself with an angular velocity six times that of the arm 28.

The gearing between the spider 66—66 and the gear 24 is so arranged that the spider 66—66 is held stationary and hence the cover strand supplies 67 are stationary. Thus the cover strands 68 do not revolve and are wound on the core strand 74 by the rotation of the latter, and the covered strand 75 enters the up facing lower end of the flier arm 62 rotating on itself at the rate of six turns for each revolution of the flier 61, 62.

In passing through the flier arm 62 and moving longitudinally in the opposite direction to its passage through the arm 61 while being revolved therein in the same circular sense, the covered core loses or has nullified in itself two turns of rotation for each revolution of the flier arm 62. Two more are nullified in passing through the arm 46 and the last two turns are nullified in passing through the arm 29, so that the covered strand 75 emerges from the up facing top end of the arm 29 devoid of rotation and passes over the sheave 71 to the capstan 72 and take-up reel 73.

As herein illustrated and disclosed, the fliers 28, 29 and 45, 46 and 61, 62 all rotate with the same angular velocity, but 45, 46 revolves in the opposite sense to 28, 29 and 61, 62 since the strands 74 and 75 move through 45, 46 in a direction opposite to that pursued in the other two.

Evidently, therefore, it is ideally possible to increase the speed of rotation of the core at the winding point to any desired value by mounting a sufficient number of such duplex fliers in concentric sequence. Each flier will in one arm impress and in the other arm nullify two turns of rotation of the core for each revolution of the flier, regardless of the rotational state of the core on entering either side of the flier. The angular velocity of the core at the winding point is dependent on the rotational speed of the several fliers it is true, but it is also proportional to the number of fliers through which it is passed, and hence the speed of any one flier can be held down to any practical limit while the core speed at the winding point can be increased theoretically to any value, being limited only by the increasing diameter of the outermost flier and by the increasing drag of the core being pulled through an increasing number of flier arms.

The apparatus as disclosed is furthermore so arranged that only the inner one or the inner two fliers may be used if desired, the outer two or one then running idle. Thus the core may be led directly from the supply 70 up to the whole length of the bores 27 and 47 and into the flier arm 61, thence across the gap and winding point and via the arm 62 and the bores 50 and 34 to the sheave 71. In this case fliers 28, 29 and 45, 46 will run idle and the core at the winding point will have an angular velocity twice that of the flier 61, 62. Or the core may be brought from 70 up the bores 27 and 47 and into the flier arm 46, thence through flier arm 62 (in the reverse longitudinal direction to the other cases) across the gap and winding point, into the arm 61 and via bore 47, arm 45 and bore 34 to the sheave 71.

In this case the core will rotate at the winding point in the opposite sense to that of the other cases and with an angular velocity four times that of any one of the fliers, while the flier 28, 29 will run empty.

Thus far it has been continuously assumed that the absolute angular velocities regardless of sense of the three duplex fliers are equal. This is not necessary, for the various elements of the mechanical train between the elements 24 and 76 may be arranged and proportioned to drive each duplex flier at any desired individual speed since what rotation is impressed on the core in passing through one arm of any one flier is annulled in passing through the opposite arm of the same flier.

Thus it may be worth while in some instances to drive the fliers at individual speeds bearing some inverse relation to the over all diameter or mass of the fliers so that the larger or heavier fliers may revolve more slowly than the smaller or lighter.

As herein disclosed the apparatus is shown with three concentric successively operative duplex fliers rotating around a stationary supply support. However, it may be built with only two fliers, or with four, five or any number desired within practicable limits, each additional flier adding two units of rotation to the core at the winding point without necessitating any increase of angular velocity in any part of the machine.

For simplicity in illustration only one shaft with planetary gears 31 and 32 has been shown in the hub 22, but in practice it may be preferable to provide another shaft and gears on the opposite side of the hub 22 to give dynamic balance. The same is true also of the hubs 35 and 51.

As shown there are four cover strand supplies 67 arranged symmetrically about the winding point in opposed pairs; since, however, the supply support 64, 66 is stationary it need not be symmetrical nor limited to any specific number of supplies.

The apparatus is limited to use with a core strand which is substantially torsionally rigid and which therefore will not accept any twist or torsional deformation in passing through the fliers. Rotation and twist are opposed effects of the flier and the rotation is diminished in proportion as the core strand accepts twist and thus reduce the effectiveness of the apparatus.

The embodiment of the invention herein disclosed is merely illustrative and may be modified and departed from in many ways without departing from the spirit and scope of the invention as pointed out in and limited solely by the appended claims.

What is claimed is:

1. In a high speed serving head for winding a cover strand on a substantially torsionally rigid core strand advancing through the head, means to impose high speed rotation upon the core strand comprising a plurality of duplex fliers, the arms of the plurality of fliers defining a path for the core strand passing successively through one arm of each of the fliers to a winding point and passing from the winding point in inverse order through the respective other arms

of the fliers, and means to supply a cover strand to the core strand at the winding point.

2. In a high speed serving head for winding a cover strand on a substantially torsionally rigid core strand advancing through the head, means to impose high speed rotation upon the core strand comprising a plurality of concentric duplex fliers, the arms of the plurality of fliers defining a path for the core strand passing successively through one arm of each of the fliers to a winding point and passing from the winding point in inverse order through the respective other arms of the fliers.

3. In a strand handling apparatus for putting a cover strand on a substantially torsionally rigid core strand, two coaxial duplex fliers having the exit end of one arm of each of the fliers communicating with the entrance end of one arm of the other flier to define a single path through both arms of both fliers for the core strand.

4. In a serving head for winding a cover strand on a substantially torsionally rigid core strand advancing through the head, a first revolving means to impress axial rotation upon a limited portion only of the advancing core strand, a second revolving means to impress additional axial rotation upon a part only of the limited rotating portion, means to annul the total rotation of the core, and means to supply a cover strand to the part of the rotating portion of the core strand which has added rotation.

5. In a serving head for winding a cover strand on a substantially torsionally rigid core strand advancing through the head, a first revolving means to impress axial rotation upon a limited portion only of the advancing core strand, a second revolving means to impress additional axial rotation upon a part only of the limited rotating portion, means to annul the additional rotation, means to annul the first impressed rotation, and means to supply a cover strand to the part of the rotating portion of the core strand which has added rotation.

6. In a serving head for winding a cover strand on a core strand advancing through the head, stationary cover strand supply means, first revoluble means to guide the advancing core strand in a loop and to revolve the loop to pass repeatedly over the supply means, and second revoluble means to guide the advancing core strand in a second loop and to revolve the second loop to pass repeatedly over both the first loop and the supply means.

7. In a serving head for winding a cover strand on a core strand advancing through the head, a stationary cover strand supply means, a revoluble duplex flier to guide the advancing core strand in opposite directions through two successive loops and to revolve the loops to pass successively repeatedly over the supply means, and a second revoluble duplex flier concentric with the first flier to guide the advancing core strand in a half loop before the same enters the first flier and in another half loop after the core strand leaves the first flier and to revolve the two half loops successively repeatedly over the first flier and the supply means.

LEO L. WEAVER.