

June 10, 1969

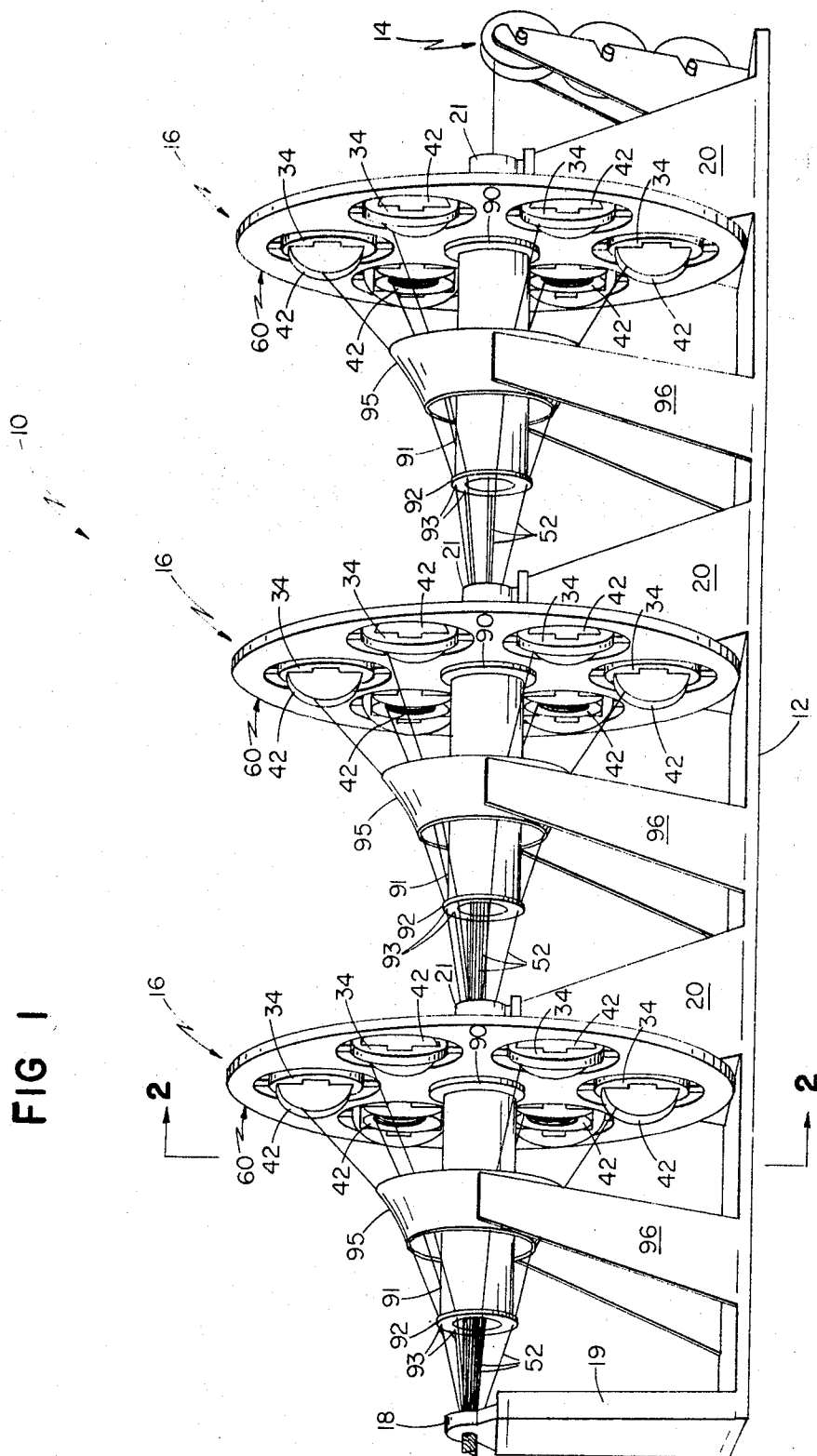
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3,448,569

CABLING APPARATUS

Filed Feb. 15, 1968

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FIG 6

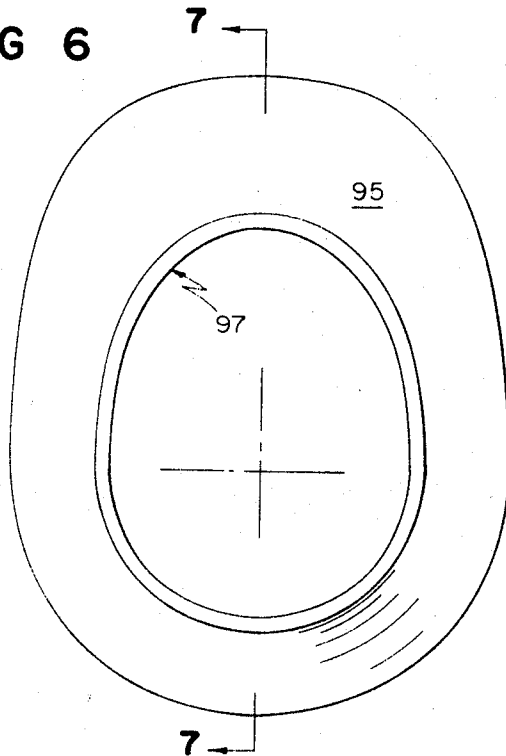
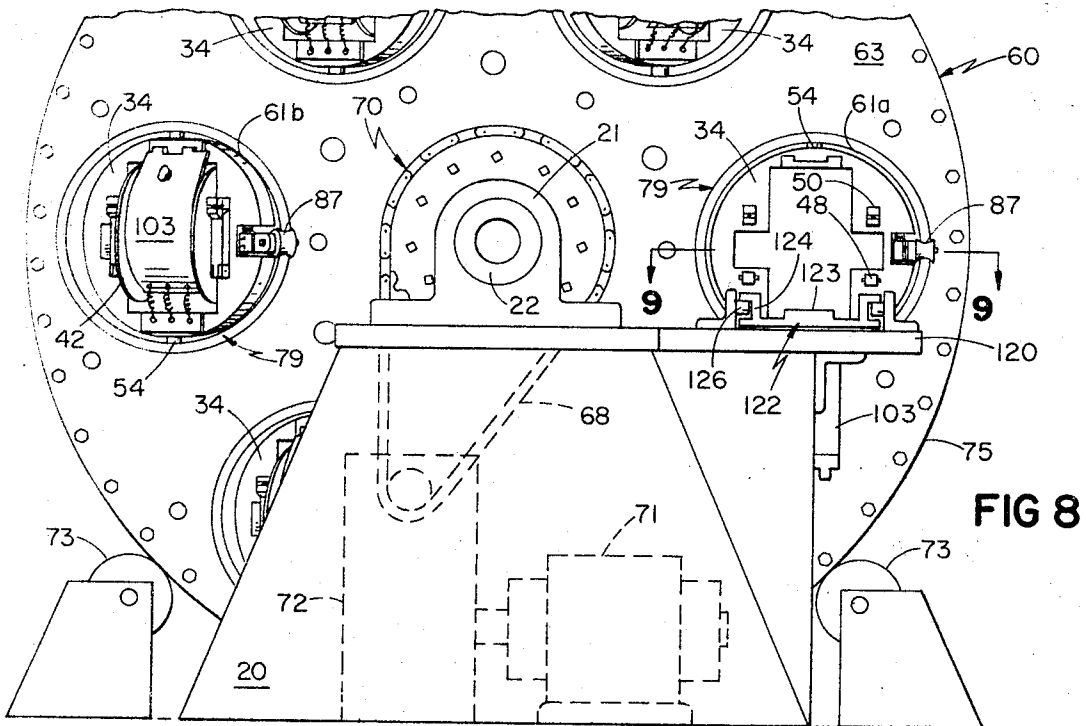
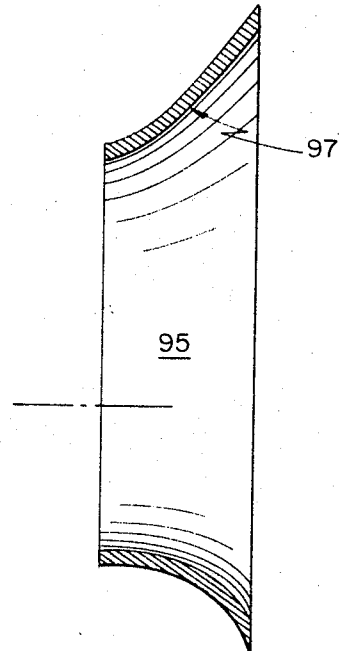


FIG 7



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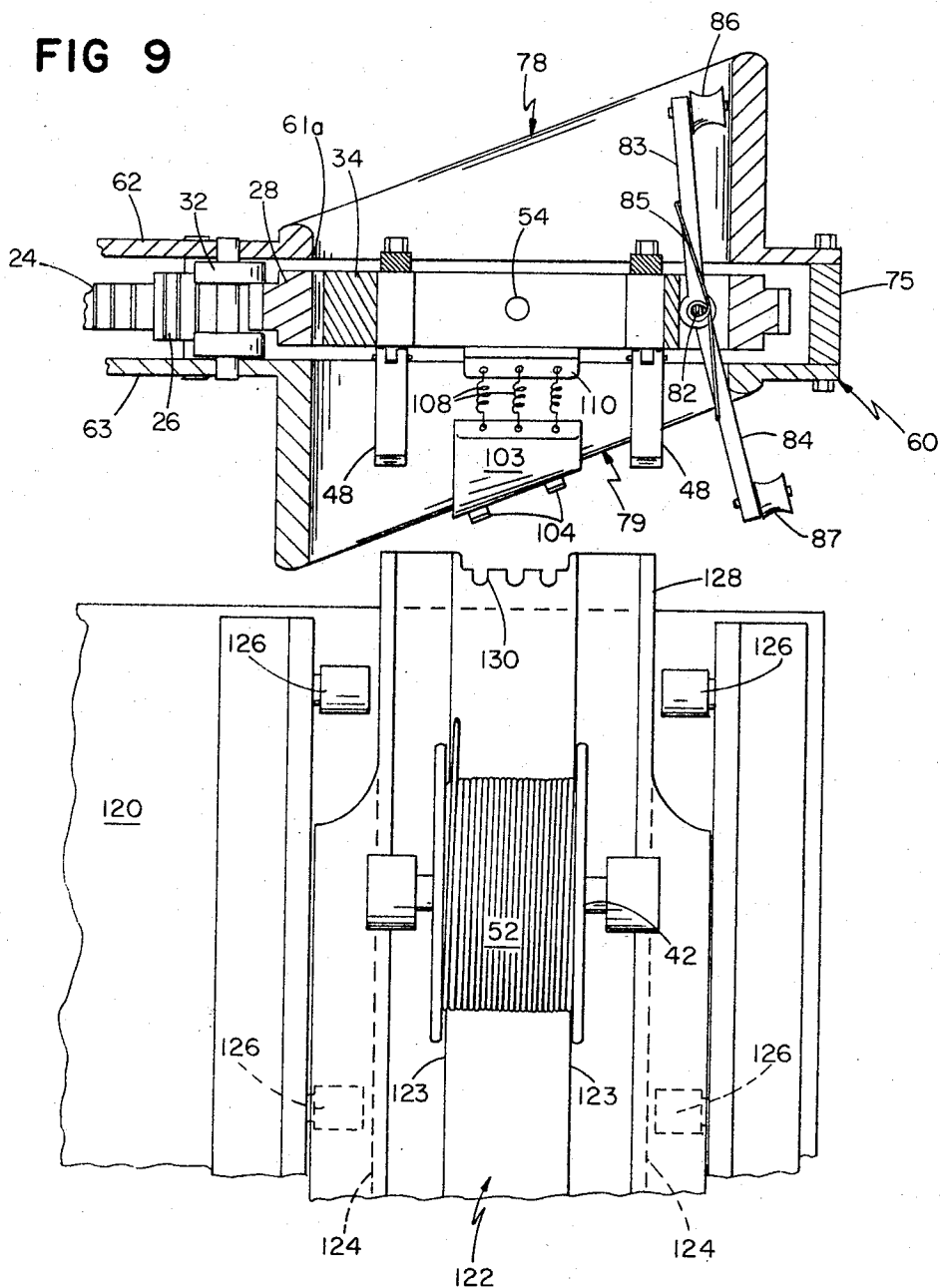
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FIG 9



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CABLING APPARATUS

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U.S. Cl. 57—15

22 Claims

ABSTRACT OF THE DISCLOSURE

A horizontal cabling apparatus for forming wire cables having a series of wire-feed assemblies, each assembly with a fixed stationary central shaft, and a stationary gear ring attached concentrically to the shaft, and a plurality of planetary gear rings sized identical to the stationary gear ring, radially spaced around it, and communicating with it through a plurality of radially spaced intermediate gears. Each planetary gear ring has a central bore for supporting a wire spool for integral movement with it and is attached to a housing which rotates about the central shaft, the planetary gear ring thus, through the intermediate and fixed gears, keeping the wire spools continually horizontal, and the wire spools remaining exposed for easy removal throughout the cable-forming procedure. In some embodiments, the wire is continually fed inwardly towards a centrally located die, and the length and tension of the wire feed is controlled by an open asymmetric conical control member with an inwardly concave wire-contacting surface, preferably in combination with a threading plate, wires travelling from spools, through the control member and eyelets in the threading plate, to the die.

This invention relates to wire cable-forming devices.

It is an object of this invention to provide an improved horizontal cabling device for making wire cable by drawing together a series of strands each fed from a horizontally maintained spool. It is a further object to provide a horizontal cabling device wherein the wire spools are continuously totally exposed, both on the side facing the cable-forming device (e.g., the die member) and on its opposite side, for easy and rapid replacement of depleted wire spools without lengthy interruption of the cable-forming procedure caused, for example, by the cumbersome and time-consuming removal of surrounding or supporting structures or by the utilization of complicated hoisting devices for replacing the depleted spools. It is a further object to provide a horizontal cabling device having these readily accessible spools for easy and rapid changing, and capable of forming a uniform cable construction while reducing strain and shear on and weakening of individual strands, all in a simple, reliable, durable and economical structure.

The invention features a horizontal cabling apparatus having a central cable-forming die and at least one wire-feed assembly for feeding a plurality of wire strands to the die; each wire-feed assembly comprises a stationary central gear ring, a plurality of idler gear rings radially spaced around the central gear ring and meshing with the central gear ring, a plurality of planetary gear rings sized identical to the central gear ring, arranged around it, and communicating with it through the idler gear rings, a wire spool support secured in the central bore of each planetary gear ring for integral movement therewith, the central gear ring, planetary gear rings, and idler gear rings each having a central vertical axis in approximately the same vertical plane, and structure for rotating the idler gear rings about the central gear ring. The invention also features a horizontal cable-forming device comprising a cable-forming die for receiving wire from a plurality of

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sources rotating about a single axis, a number of planetary gear rings, each gear ring having a central bore peripherally enclosing a structure for supporting a wire spool, this structure being secured in the bore for integral movement with the planetary gear ring, and structure for driving the spools, along with the supporting structure and gear ring, about that single fixed axis while maintaining the spools horizontal, the spools being continuously entirely exposed in directions parallel to the enclosing peripheral surface of the gear ring. In preferred embodiments the cabling apparatus includes a fixed stationary central shaft concentric with the stationary central gear ring and secured thereto through a central bore in this stationary gear ring; a narrow cylindrical housing for each wire-feed assembly, the housing being secured to the idler gear rings, enclosing all gear ring surfaces, and having a series of circular apertures for receiving the spool supports, each aperture having a diameter at least slightly larger than the maximum axial dimension of the wire spool meant to be supported by the corresponding spool support, and means for driving this housing about the central stationary shaft; structure for moving wire spools into and out of the spool supports, this structure comprising a slidably mounted horizontal platform movable adjacent the housing into substantial alignment with one of the circular apertures for positioning a wire spool in proximate vertical and lateral alignment with the corresponding spool support; structure for directing wires fed from the wire spool mounted on spool supports into the central die (preferably in the form of a threading plate of small diameter placed between the spools and the die and having a series of arcuately-spaced apertures for receiving wire from the spools) including a control member, mounted between the spools and the die (or between the spool and the threading plate) to equalize the length of wire between the spools and the die (or plate), and in the shape of an open asymmetric conical section having an inwardly concave wall; structure for reducing lateral wire movement on the spools comprising a flexible tension sheet about as wide as the spool and stretched across the wire coil in the direction of coil and on the side opposite the direction of feed, and secured at each end (preferably at one end by suitably sized springs) to the spool support (and preferably maintaining a constant pressure on the wire coil throughout unwinding); and, feed directing means secured to each wire-feed assembly for selectively rotating each spool support about its central vertical axis so that the direction of wire feed remains continuously substantially perpendicular to the vertical plane of the spool support. In a particular embodiment, the feed directing means comprises a series of front (facing the die) and rear annular camming members peripherally arranged on outer sides of the housing faces, surrounding the spool support slots, each camming member having a flat surface adjacent the housing and an opposite camming surface having a maximum and a minimum at 180° displacement, and mean camming surfaces at 90° from the maximum, each front camming member being 180° displaced from its corresponding rear camming member and having its maximum camming surface furthest toward the periphery of the housing; and, a pair of spring pivoted roller arms attached at the pivot to the spool support, the roller arms each urging a terminal roller portion to pinch said camming surfaces throughout rotation of the camming surfaces about the spool support.

Also in a particular embodiment, a series of wire-feed assemblies are arranged with respective fixed stationary central shafts having a common longitudinal axis; and, each shaft has a hollowed portion to receive wires from adjacent wire-feed assemblies and corresponding adjacent shafts which are more distant from the central die.

Other objects, features and advantages will appear from the following description of a preferred embodiment

of the invention, taken together with the attached drawings thereof, in which:

FIG. 1 is a perspective, partially diagrammatic view of a horizontal cabling apparatus embodying the present invention;

FIG. 2 is a front view of a single wire-feed assembly embodying the present invention;

FIG. 3 is an enlarged sectional top view of a single wire spool and surroundings, with the spool at the 9 o'clock position of FIG. 2;

FIG. 4 is a rear elevational, partially broken away view of a wire spool and surroundings showing particularly means for restricting lateral wire movement, and a catch assembly;

FIG. 5 is a side sectional view of the structure of FIG. 4, along lines 5—5 of FIG. 4;

FIG. 6 is a front view of a preferred control member of a cabling apparatus embodying the present invention;

FIG. 7 is a side view of the control member along line 7—7 of FIG. 6;

FIG. 8 is a rear view, partially broken away, of a single wire-feed assembly embodying the present invention; and

FIG. 9 is a top sectional view along line 9—9 of FIG. 8.

Referring to FIG. 1, horizontal cabling apparatus 10 includes a base 12, core supply 14 and a series of wire-feed assemblies 16. Cable-forming die 18 is mounted on vertical support 19.

Referring now to FIGURES 1 and 2, wire-feed assembly 16 includes support 20 having a block 21 for rigidly mounting hollow stationary shaft 22, upon which is fixedly mounted stationary central gear ring 24 having a gear surface 25. Each idler gear ring 26 has a gear surface 27 which meshes with central gear ring surface 25 and with the gear surfaces 29 of adjacent planetary gear rings 28. Guide spools 32 are provided to bear against flanged surfaces 30 of planetary gear rings 28 (see FIG. 4).

Each planetary gear ring 28 has a central bore 31 for enclosing a disc-like spool support 34 for rotatably supporting the feed spools 42. As shown in FIGS. 4 and 5, a series of catch assemblies 46 maintain each spool 42 in its support 34; and, each assembly 46 includes a hinged latch 48 which swings open to admit spool 42 and then swings closed against spring-loaded cam 50 to secure spool 42 against forward or rearward movement during wire feeding. As seen in FIG. 8, then, these catches may be provided on either or both sides of housing 60. Spool 42 of course supports coiled wire 52 and rotates to permit wire 52 to be fed to cable-forming die 18.

As best shown in FIGS. 2, 3, and 4, spool support 34 is mounted for rotation within gear wheel 28 by and about pins 54, and includes outer bearing portions 56 which bear against bearing portion 58 on the inner surface of gear wheel 28.

Housing 60 encloses the gear wheels and includes a series of circular apertures 61, in its front 62 and rear 63 faces, for receiving the spool supports 34. Idler gear rings 26, as well as guide spools 32, are secured between faces 62 and 63. Housing 60 is also rotatably supported on outer bearing 66, on stationary shaft 22. Referring to FIG. 8, a chain drive 68 is mounted opposite rear face 63 of housing 60 and engages lugs 69 on face 63. Suitable drive means 70 including motor 71 and a variable-speed mechanism 72 for varying the speed of rotation are provided for driving chain 68 and thus rotating housing 60. Brakes 73 bear against cylindrical surface 75 of housing 60 to provide for smooth rotary movement of the housing.

A series of annular cam members 78 are secured to front face 62 of housing 60, one surrounding each aperture 61, and a second series of annular cam members 79 are secured to rear face 63 of housing 60. Each cam 78, 79 has a plane surface 80 next to face 62 or 63, and an opposing symmetrical cammed surface 81 having a high point 115, a low point 116 opposite the high point, and two midpoints each at 90° from points 115 and 116. Each

opposing set of cam members 78 and 79 are mounted on housing 60 so that the respective high points 115 are 180° apart. In addition, cam members 78 and 79 are so oriented on housing 60 that when the center of any spool 42 is at 3 o'clock or 9 o'clock all high points 115 and low points 116 of the opposing cam members 78 and 79 surrounding the spool and also the center of hollow stationary shaft 22 lie in a single horizontal plane. Moreover, front cams 78 are mounted so that their high points 115 are always toward the outer periphery 75 of housing 60, whereas rear cams 79 are mounted so that their low points 115 are always toward the outer periphery of housing 60.

Front and rear roller arms 83, 84 are secured to spool supports 34 and are pivoted at joints 82. A spring 85 is provided to urge the arms toward each other to pinch cams 78, 79. Each roller arm 83 terminates in a roller member 86 which bears against surface 81 of a front cam 78 and each roller arm 84 terminates in a roller member 87 which bears against surface 81 of a rear cam 79.

Front face 62 of housing 60 also supports inner circular plate 90 which is also secured to rotating sleeve 91 for rotation with housing 60 (FIG. 1). Also mounted on rotating sleeve 91 is a threading plate 92 having arcuately-spaced eyelets 93 for receiving wire from spools 42.

Asymmetric control ring 95 is mounted between rotating housing 60 and rotating threading plate 92 on a stationary mounting structure 96 and does not rotate; it has an inner wire feed surface 97. Surface 97 is so sized and shaped and ring 95 so mounted that the lengths of wire between the point of release on end spool 42 and the corresponding eyelet 93 are approximately equal.

As best seen in FIGS. 4, 5, and 8, lateral shifting of the wire on each spool is prevented by a series of wire brake assemblies 102, one for each spool 42. Each brake assembly 102 includes a flexible, preferably plastic strip 103 which continually exerts an elastic pressure on wire 52 of spool 42. Strip 103 is mounted on one end by rigid support hooks 104 to a supporting flange 106 on spool support 34, and at the other end to a series of springs 108, having their ends also secured to a second supporting flange 110 on spool support 34. The springs are sized to enable strip 103 to exert an approximately constant elastic pressure on wire 52 as the wire is fed and the resultant diameter of the wire coil is decreased.

Rapid changing of spools 42 upon exhaustion of the wire 52 coiled thereon is accomplished, as shown in FIGS. 8 and 9, by means of loading platform 120, supported on wire feed assembly support 20, and located, for convenience, opposite rear face 63 of housing 60. As shown at the extreme right hand aperture 61a (from which a spool has been removed) of housing 60, which may be compared with the extreme left hand aperture 61b showing an operating spool assembly, a spool 42 is removed simply by releasing hinged latches 48 from spring loaded cams 50. Support 34 is conveniently made coplanar with rear face 63 by, e.g., disengaging spring-biased roller arms 83 and 84. It will be understood that platform 120 may be secured at any position of housing 60, the 3 o'clock position being chosen here because of the position and height of support 20, and the rear face 63 being chosen because, e.g., of the position of control member 95. Loading at positions other than 3 o'clock may be easily accomplished by providing a suitable support for platform 120.

The spool 42 having wire 52 coiled thereon is placed onto sliding member 122 having a raised track 123 for guiding spool 42 into support 34. Member 122 also includes longitudinal slots 124 for sliding along supporting rollers 126, and a front tapered portion 128 for clearing camming member 79 to permit sliding member 122 to be moved adjacent spool support 34, insets 130, e.g., being provided to clear springs 108.

This rapid and efficient means of replacing depleted spools is made possible by the positioning of the spools

within the planetary gear rings in such a way that the spools are continuously removably exposed throughout the cable-forming process.

In operation each housing 60 is rotated about stationary shaft 22 by drive means 70. The rotation of housing 60 moves idler gear rings about stationary central gear ring 24; at the same time, idler gear rings 26 mesh with planetary gear rings 28 causing rotation counter to that of central ring 24. Since gear rings 28 are each of the same effective diameter as central gear ring 24, when each idler gear 26 has completed one full planetary rotation about central gear ring 24, one complete rotation of a planetary gear ring has occurred counter to the movement of housing 60. As a result, gear rings 28 remain stationary with respect to central gear ring 24; and spool supports 34 and hence spools 42 remain horizontal throughout rotation of housing 60.

Rotation of housing 60 also causes rotation of camming members 78, 79 with respect to horizontally held spool supports 34, and also with respect to roller members 86, 87, of roller arms 83, 84. Thus, roller members 86, 87, turn, respectively, on cams 78, 79, each member 86, 87, exactly traversing the entire annular cammed surface of camming members 78 and 79, respectively, per revolution of housing 60. The movement of roller members 86, 87 causes roller arms 83, 84 to swing each spool support 34 from a neutral position when at 6 o'clock and 12 o'clock gradually to maxima at 3 o'clock and 9 o'clock thus continually directing the feed of wire 52 from spool 42 toward the center of the feed assembly (toward die 18). This structure decreases tension on the wire and aids to equalize the distance, at all times, between the point of wire feed from spool 42 and e.g., threading plate 92, as well as reducing the possibility of lateral slippage of the wire. The structure does not, however, in any way interfere with the ease of access to the wire spools. The camming members 78, 79 are sized to keep the central vertical plane of each spool 34 substantially perpendicular to the direction of wire feed throughout rotation of housing 60.

Depending on the strength and thickness desired in the resultant wire cable, wires may be fed from several axially spaced wire feed assemblies into the cable-forming die 18. Wire from assemblies other than the frontmost assemblies may proceed, from rotating threading plates 92, into the interior of the stationary shaft 22 of the next-forward wire feed assembly. The wires are thus collected through succeeding shafts 22 for feeding into die 18 where they are twisted about one another by rotation of housing 60. A core material about which wire is wound is also continually fed from core supply 14, also through shafts 22 to die 18.

During operation, asymmetric control ring 95 controls the length of wire between the point of release from the spool and the corresponding eyelet of threading plate 92. The purpose of this plate is to account for the fact that the circle traced by the point of release of the wire, i.e., the top of each spool of wire, is not concentric with the axis of rotation (the central axis of shaft 22) or with circular threading plate 92, but is slightly upwardly displaced therefrom. The angle between the feeding wire and threading plate 92 will thus change as housing 60 rotates, leading to possible changes in wire tension at die 18, and thus possibly to nonuniform cable formation; by virtue of the constantly changing wire length. Control ring 95 is shaped to correct for this discrepancy in feed length and equalize the angle between feeding wire and plate 92. In the embodiment shown, control ring 95 takes the form of an asymmetric conical section having an inwardly concave wall for bearing against wires fed from the rotating spools 42.

When the wire supply on any spool is exhausted, the spool may be readily and easily changed by rotating housing 60 until the spent spool is on a line with platform 120 (FIGS. 8 and 9). Suitable indexing means may be provided in association with each aperture 61

on the rear face 63 of housing 60 and on platform 120 to facilitate "lining up" the spools for easy changing. The spent spool is removed by simply disengaging flexible strip 103, unhooking latches 48, and disengaging roller arms 83, 84 to allow support 34 to be set coplanar with housing 60. Platform 120 is moved on rollers 126 until tapered portion 128 touches spool support 34. Spool 42 is then removed from support 34 and rolled along platform 120, guided by track 123. The old spool is then replaced with a full spool which is rolled back along platform 120 and into spool support 34. Latches 48, roller arms 83, 84, and strip 103 are re-engaged and platform 120 rolled back to permit immediate operation of the wire-feed assembly.

Other objects, features, and advantages will be obvious to those skilled in the art and are within the following claims.

What is claimed is:

1. A horizontal cabling apparatus having a central cable-forming die and at least one wire-feed assembly for feeding a plurality of wire strands to said die, each said wire-feed assembly comprising

- a stationary central gear ring,
- a plurality of idler gear rings radially spaced around said central gear ring and meshing with said central gear ring,
- a plurality of planetary gear rings, sized identical to said central gear ring, arranged around said central gear ring and communicating therewith through said idler gear rings,
- a wire spool support secured in the central bore of each said planetary gear ring for integral movement with said gear ring,
- said central gear ring, said idler gear rings, said planetary gear rings and said spool supports each having a central vertical axis in approximately the same vertical plane, and
- structure for rotating said idler gear rings about said central gear ring.

2. The apparatus of claim 1 including a fixed stationary central shaft concentric with said stationary central gear ring and secured thereto through a central bore in said gear ring.

3. The apparatus of claim 2 wherein said wire-feed assembly also includes a narrow cylindrical housing secured to said idler gear rings, enclosing all said gear ring surfaces, and having a series of arcuately-spaced circular apertures for receiving said spool supports; and means for driving said housing about said central stationary shaft.

4. The apparatus of claim 1 wherein said wire-feed assembly includes structure for moving said wire spools into and out of said spool supports, said structure comprising a slidably mounted horizontal platform movable adjacent said housing into substantial alignment with one of said circular apertures for positioning a wire spool in proximate vertical and lateral alignment with said corresponding spool support, said circular apertures having a diameter at least slightly larger than the maximum axial dimension of said wire spool.

5. The apparatus of claim 2 wherein said cable-forming device is substantially centered in the vertical plane through the longitudinal axis of said stationary shaft, and wherein each said wire-feed assembly also includes feed directing means for selectively rotating each of said spool supports about its central vertical axis when, during the rotation of said housing about said shaft, said corresponding spool support occupies a position on either side of said vertical plane, said rotation being towards said cable-forming die and sufficient to maintain the direction of wire feed from any spool continuously substantially perpendicular to the vertical plane of said spool support.

6. The apparatus of claim 5 wherein said feed directing means comprises

- a series of front and rear annular camming members peripherally arranged on said housing faces, surround-

- ing, respectively, said spool support apertures, said camming members each having a flat surface adjacent said housing faces, and a camming surface having a maximum and a minimum camming surface at 180° displacement and a mean camming surface at 90° displacement from said maximum, each front camming member being mounted opposite and at 180° displacement from each rear camming member, and having its maximum camming surface toward the periphery of said housing,
- a string-pivoted pair of roller arms for each spool, one roller arm having a terminal roller portion bearing on a front camming member, and the pivotally attached second roller arm having a terminal roller portion bearing on a rear camming member, said roller arms attached to a pivot and spring-urged toward said housing and said pivot attached to said spool support.
7. The apparatus of claim 6 wherein said roller portions each bear on a mean camming surface when the rotation of said housing causes said spool support to occupy its uppermost position.
8. The apparatus of claim 6 wherein one of said roller portions rests on a maximum camming surface and the other of said roller portions rests on a minimum camming surface whenever the rotation of said housing causes said spool support to occupy its outermost horizontal position.
9. The apparatus of claim 1 wherein said wire-feed assembly includes structure for directing wires fed from wire spools on said spool supports inwardly toward said central cable-forming die.
10. The apparatus of claim 9 wherein said structure for directing wires from said spools inwardly toward said die comprises
- a threading plate of substantially smaller diameter than the circle defined by the centers of said spools, mounted between said spools and said die and having a series of arcuately spaced apertures for receiving wire from said spools, and
- a control member mounted between said spools and said threading plate to equalize the length of wire between each of said spools and said plate, said control member being in the shape of an open asymmetric conical section having an inwardly concave surrounding wall.
11. The apparatus of claim 2 having a series of said wire-feed assemblies, mounted on a series of said fixed stationary central shafts having a common central longitudinal axis.
12. The apparatus of claim 11 wherein each of said fixed stationary shafts has a hollowed portion for receiving wires from an adjacent wire-feed assembly for feeding to said central cable-forming die.
13. The device of claim 12 wherein each fixed stationary shaft receives wires fed from all wire assemblies more distant from said central die than the wire feed assembly supported on said fixed stationary shaft.
14. In a horizontal cabler having a central cable-forming die and a series of horizontal spools of wire mounted for rotation about the center of said die,
- structure for directing wires from said spools inwardly toward said die comprising a control member mounted between said spools and said die to equalize the length of wire between each of said spools and said die, said control member being in the shape of an open asymmetric conical section having an inwardly concave surrounding wall.
15. The apparatus of claim 14 wherein said structure for directing wires from said spools inwardly toward said die comprises
- a threading plate of substantially smaller diameter than the circle defined by the centers of said spools, mounted between said spools and said die and having a series of arcuately spaced apertures for receiving wire from said spools, and

- a control member mounted between said spools and said threading plate to equalize the length of wire between each of said spools and said plate, said control member being in the shape of an open asymmetric conical section having an inwardly concave surrounding wall.
16. In a cabling device for fashioning wire cable fed from several wire sources, each source comprising a coil of wire wound on a spool rotatably mounted on a spool support,
- a structure for reducing lateral wire movement comprising a flexible tension sheet of width substantially equal to said wire coil, mounted across said wire coil in the direction of coil and on the surface opposite the direction of feed, and secured at either end to said spool support under sufficient tension to continually contact and press upon said wire coil throughout said feeding, so as to restrict movement of said wire in a direction perpendicular to the direction of feed, without substantially interfering with said feed.
17. The device of claim 16 wherein at least one end of said sheet is mounted to said support through a series of springs.
18. The device of claim 17 wherein one end of said sheet is mounted to said support through a series of springs of sufficient size to maintain a constant pressure on said wire from said sheet throughout feeding of said wire.
19. A horizontal cable-forming apparatus comprising a cable-forming die for receiving wire from a plurality of sources rotating about a single axis,
- a plurality of planetary gear rings, each gear ring having a central bore peripherally enclosing a structure for supporting a wire spool, said structure secured in said bore for integral movement with said planetary gear ring, and
- structure for driving said spools, integrally with said respective supporting structure and gear ring, about said single axis, while maintaining said spools horizontal,
- said spools being continuously entirely exposed in directions parallel to the enclosing peripheral surface of said gear ring.
20. The apparatus of claim 19 including means for moving said wire spools into and out of said supporting gear ring, said means comprising
- a slidably mounted horizontal platform movable substantially adjacent said gear ring into substantial alignment therewith for positioning a wire spool in proximate vertical and lateral alignment with the supporting structure enclosed by said planetary gear ring.
21. The apparatus of claim 19 including a housing for surrounding a series of planetary gear rings arranged in parallel about said fixed axis,
- said housing having circular apertures in both front and rear faces at least slightly larger than the maximum axial dimension of said wire spools and aligned with said spools for continuously entirely exposing said spools in directions parallel to the enclosing peripheral surface of said gear ring.
22. A horizontal cabling apparatus comprising a central cable-forming die,
- a series of wire-feed assemblies for feeding wire strands to said die,
- each of said wire-feed assemblies comprising
- a fixed stationary central shaft
- a stationary central gear ring secured to the shaft and concentric therewith,
- a plurality of idler gear rings radially spaced around said central gear ring and meshing with central gear ring,
- a plurality of planetary gear rings, sized identical to said central gear ring, arranged around said central gear ring and communicating therewith through said idler gear rings,

a series of wire spool supports, one centrally secured in a central bore of each said planetary gear ring for integral movement with said gear ring,
 said spool supports mounted to continually entirely expose wire spools held therein in directions parallel to the peripheral surface of said central bore,
 said central gear ring, said idler gear ring, and said planetary gear rings being substantially coplanar, and,
 structure for rotating said idler gears about said central gear ring,
 a number of structures for reducing lateral wire movement, one secured to each spool support on the side opposite the direction of wire feed, and each comprising a flexible tension sheet of width substantially equal to a wire coil sized to fit in said spool support, and stretched across said coil in the running direction under sufficient tension to continually contact and press upon said wire coil during feeding,
 feed directing means for selectively rotating each of said spool supports about its central vertical axis when said spool support occupies a position on either side of the central vertical plane through said stationary shafts, said rotation being towards said cable-forming die and sufficient to maintain the direction of wire feed from any spool continuously substantially perpendicular to the said central horizontal axis of said spool support,
 a series of control members, one mounted between each wire-feed assembly, of substantially smaller diameter

than the circle defined by the centers of said planetary gear rings, spaced from said assembly and concentric with said stationary central shaft of said assembly, and
 a series of control members, one mounted between each said wire-feed assembly and each said threading plate, said members structured to equalize the length of wire between each of said spools and said plates, said members each being in the shape of an open asymmetric conical section having an inwardly concave surrounding wall.

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DONALD E. WATKINS, *Primary Examiner.*

U.S. Cl. X.R.

57—65, 58.36, 106

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,448,569

June 10, 1969

Charles Perrin Brown et al.

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

Column 9, line 29, "control members, one mounted between" should read -- threading plates, one associated with --.

Signed and sealed this 14th day of April 1970.

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

WILLIAM E. SCHUYLER, JR.

Commissioner of Patents