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FILAMENT PACKING APPARATUS AND METHOD

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FIG. 1

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Jan. 9, 1968

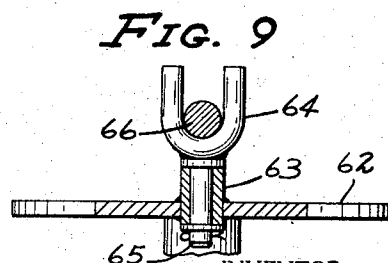
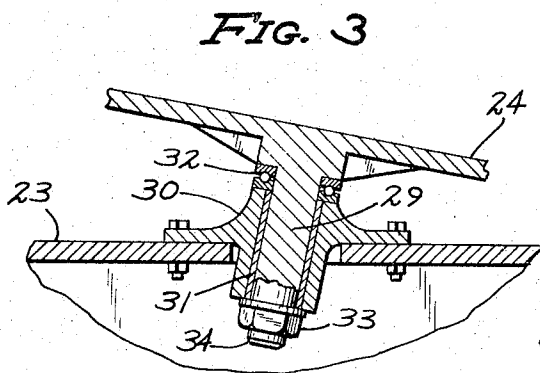
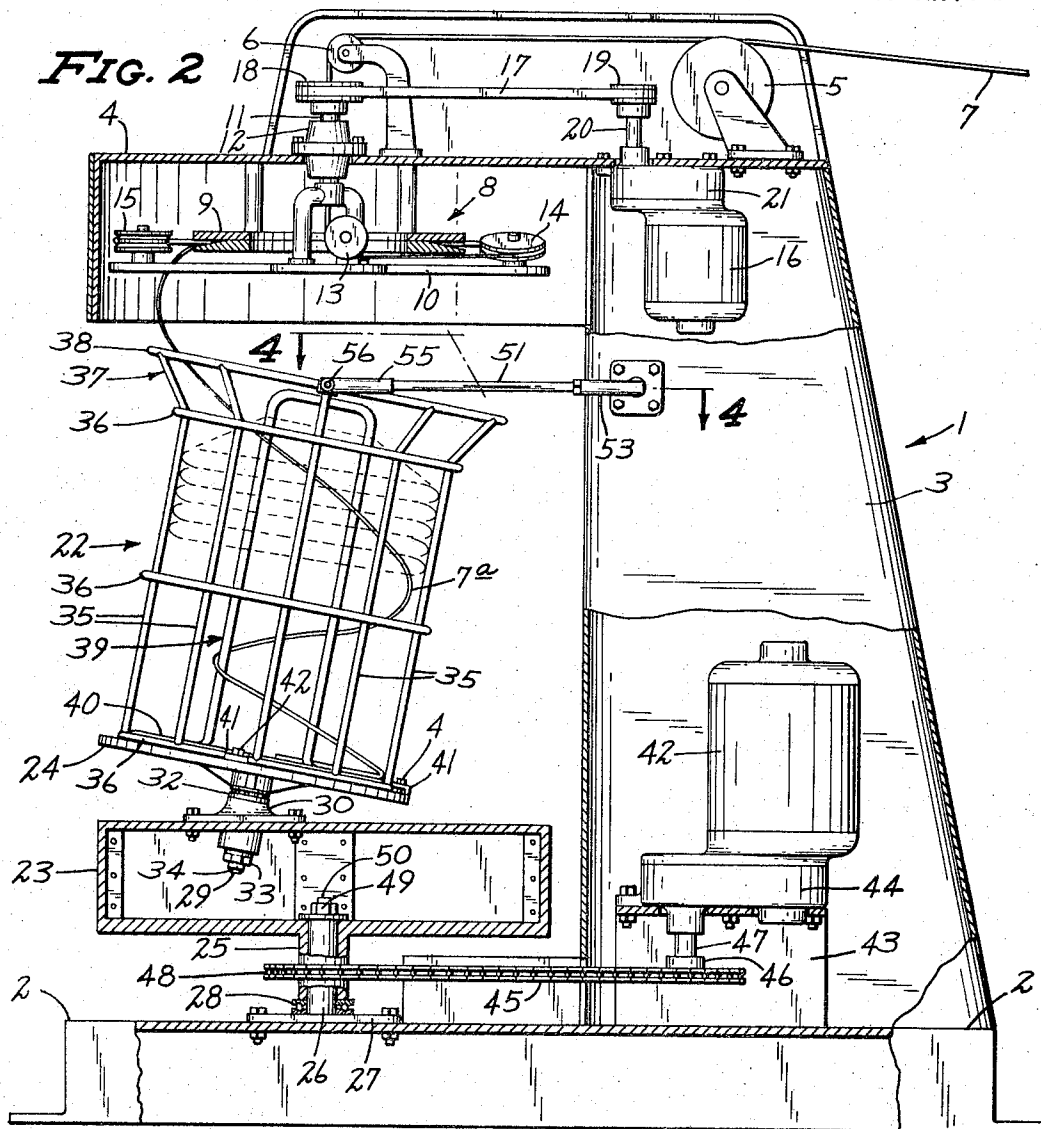
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3,362,654

FILAMENT PACKING APPARATUS AND METHOD

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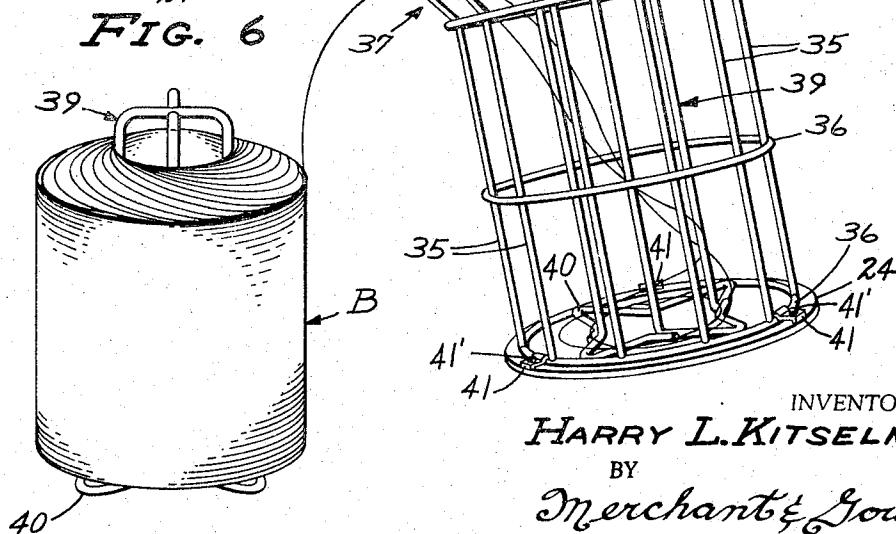
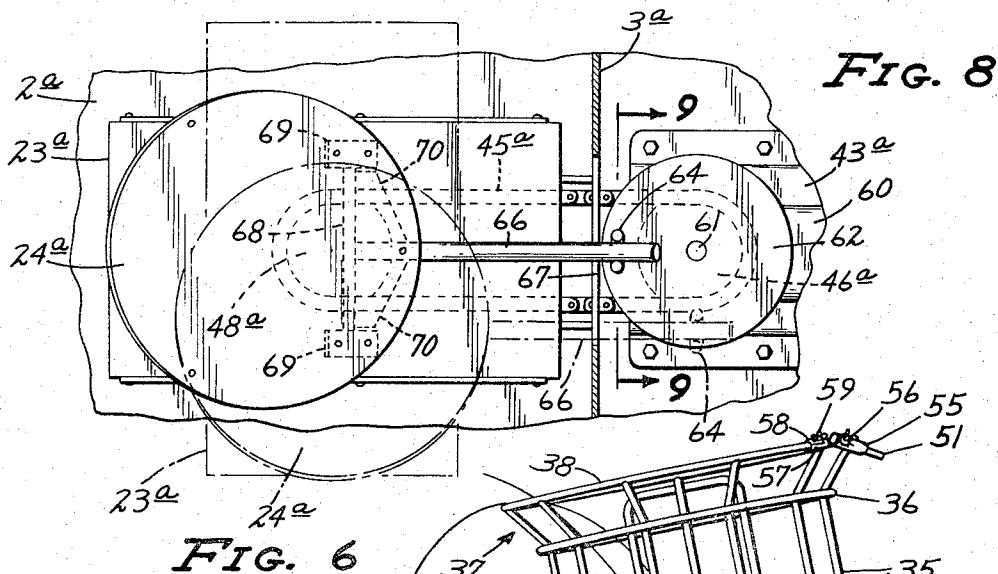
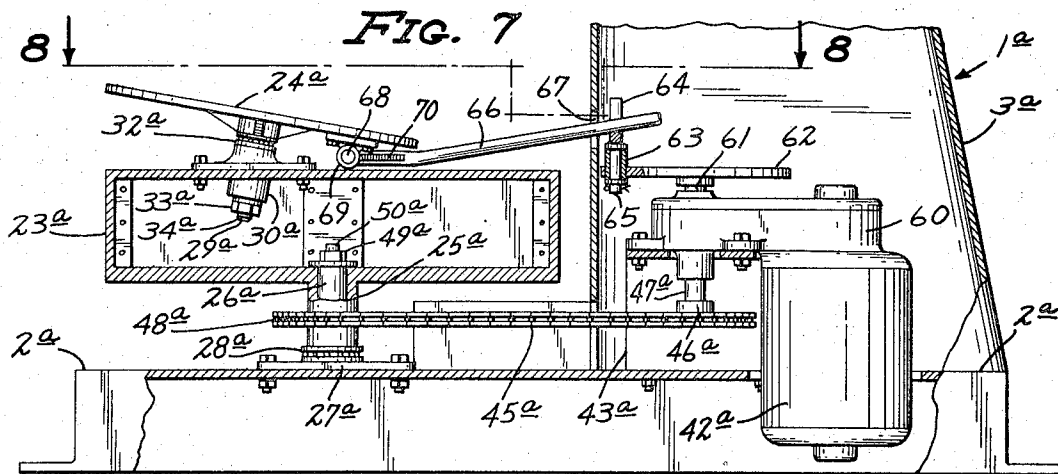
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FILAMENT PACKING APPARATUS AND METHOD

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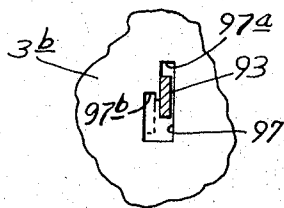
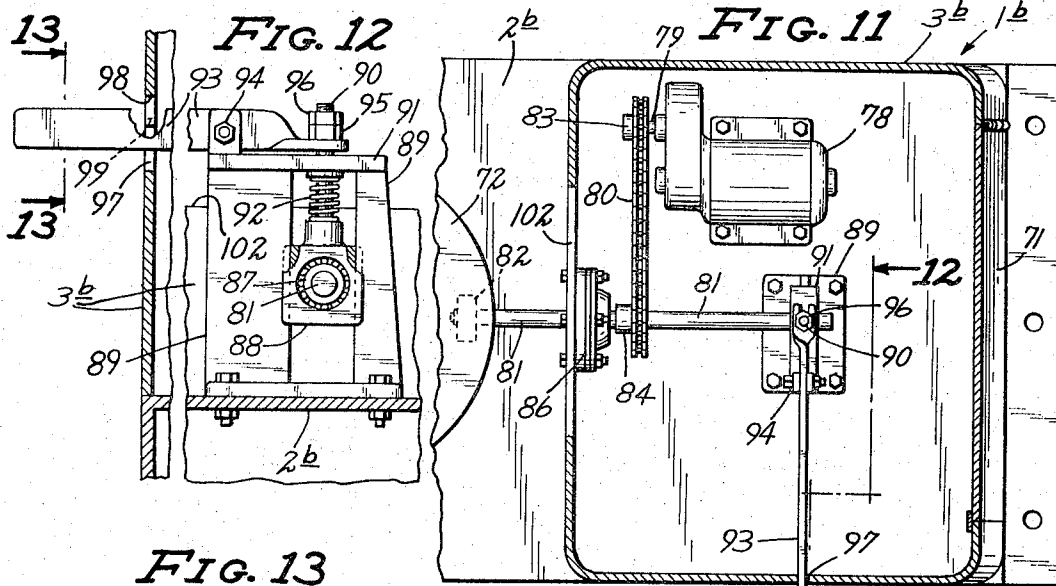
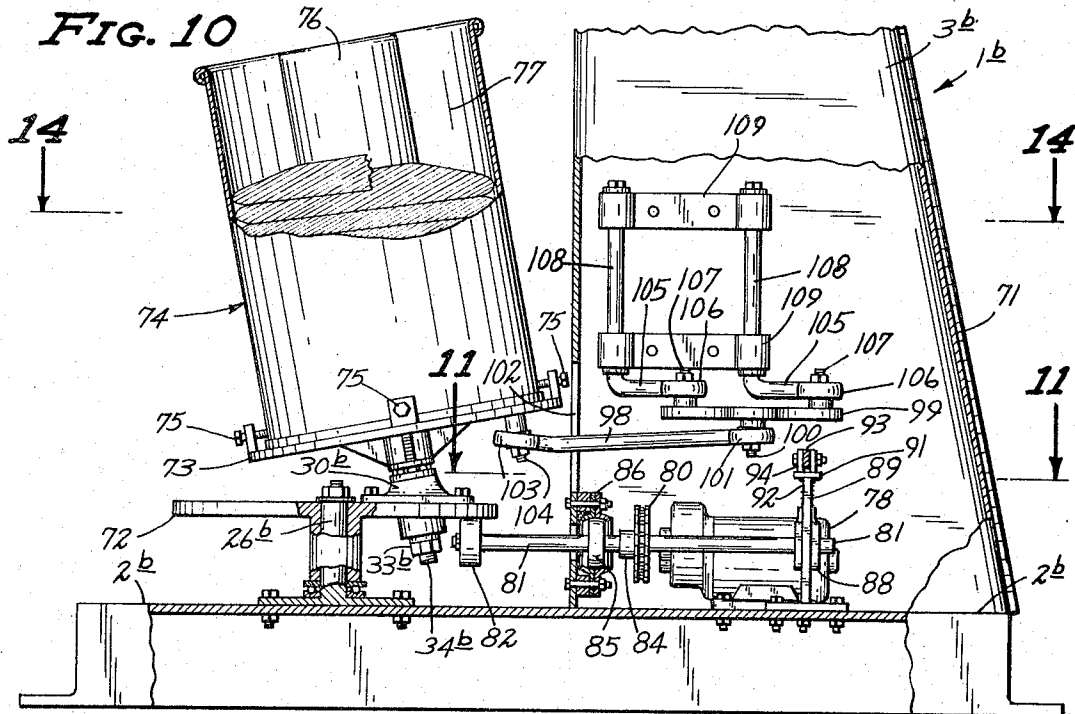
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FILAMENT PACKING APPARATUS AND METHOD

Filed Sept. 26, 1966

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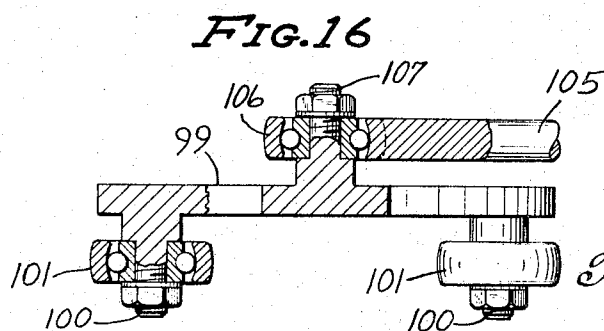
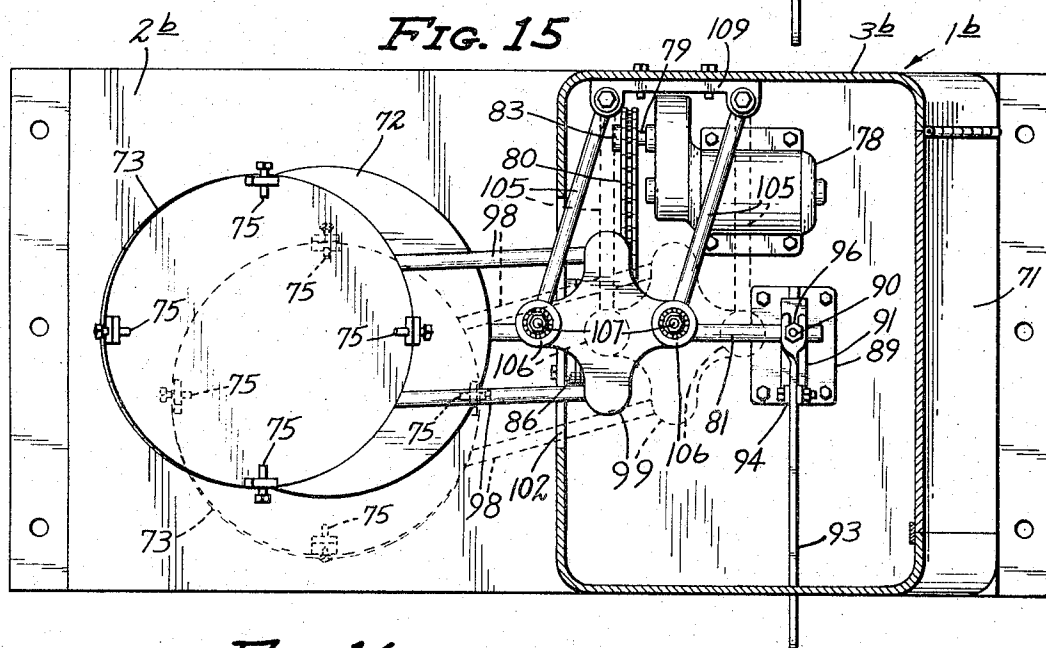
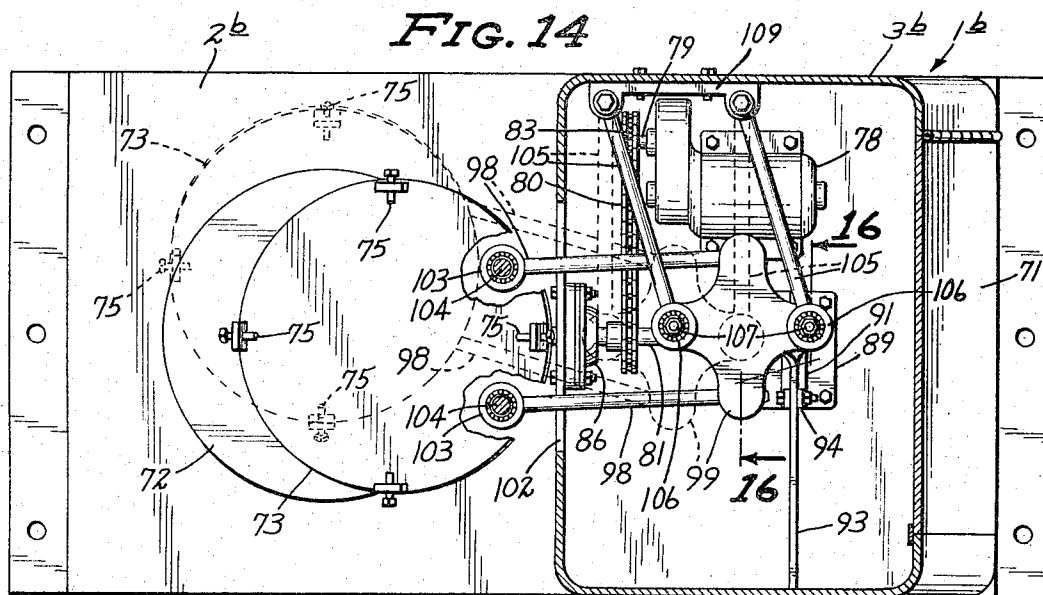


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3,362,654

FILAMENT PACKING APPARATUS AND METHOD

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19 Claims. (Cl. 242—83)

ABSTRACT OF THE DISCLOSURE

Filament coiling and packing apparatus having filament coiling mechanism and an underlying receiver for loops or coils of filament delivered from said device; and means for mounting the receiver and moving the same in an orbital path relative to the coiling mechanism, whereby to provide a circumferential progression of convolutions of the filament on the receiver. The receiver is held against rotation on its own axis relative to space.

Apparatus heretofore produced for coiling and packaging filament, such as wire, either in drums or on central cores, as receivers, have utilized means for imparting rotation to the receiver on its own axis to obtain an orderly progression of convolutions of the wire around the axis of the receiver. Some of these machines tilt the axis of the wire receiving core or drum relative to the axis of the convolutions delivered thereto, while rotating the receiver on its own axis, to further aid in properly placing the convolutions in the package. Machines of the above types are disclosed in U.S. Patents Nos. 3,013,742, 3,064,919 and Reissue 25,477.

A disadvantage of machines utilizing rotating receivers is that successive packages of wire cannot be connected or joined by an unbroken or continuous strand of wire, due to rotation of the receivers on their own axes during deposit of the convolutions thereon. The primary object of this invention, is therefore, the provision of coiling and packaging apparatus having means for moving the receiver in a circular or orbital path relative to the axis of the convolutions of the wire being packaged, while positively holding the receiver against rotation on its own axis.

Another object of this invention is the provision of apparatus as set forth, which can be as easily used in connection with a receiver disposed on a tilted axis as with one disposed on an axis parallel to the axis of the descending convolutions.

Another object of this invention is the provision of an improved method of packaging filamentary material, such as wire.

The above, and still further highly important objects and advantages of this invention will become apparent from the following detailed specification, appended claims and attached drawings.

Referring to the drawings, in which like reference characters indicate like parts throughout the several views:

FIG. 1 is a view in perspective of a filament coiling and packaging machine produced in accordance with this invention;

FIG. 2 is a view in side elevation of the machine of FIG. 1, some parts being broken away and some parts being shown in section;

FIG. 3 is an enlarged fragmentary detail, corresponding to a portion of FIG. 2, some parts being shown in axial section;

FIG. 4 is an enlarged fragmentary detail partly in top plan and partly in section, taken substantially on the line 4—4 of FIG. 2;

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FIG. 5 is a fragmentary section taken on the line 5—5 of FIG. 4;

FIG. 6 is a view in perspective of a completed package of coiled wire and a substantially empty wire receiver, illustrating the method of forming connected bundles or packages of wire in accordance with the present invention;

FIG. 7 is a view corresponding to a portion of FIG. 2 but showing a modified arrangement;

FIG. 8 is a fragmentary view, partly in plan and partly in horizontal section, taken on the line 8—8 of FIG. 7;

FIG. 9 is an enlarged fragmentary section taken on the line 9—9 of FIG. 8;

FIG. 10 is a fragmentary view corresponding to a portion of FIG. 2 but showing a still further modified arrangement;

FIG. 11 is a fragmentary view partly in top plan and partly in section, taken on the line 11—11 of FIG. 10;

FIG. 12 is an enlarged fragmentary section taken on the irregular line 12—12 of FIG. 11;

FIG. 13 is a fragmentary section taken on the line 13—13 of FIG. 12;

FIG. 14 is a view partly in top plan and partly in section, taken on the line 14—14 of FIG. 10;

FIG. 15 is a view corresponding to FIG. 14 but showing different positions of some of the parts; and

FIG. 16 is an enlarged fragmentary section taken on the irregular line 16—16 of FIG. 14.

In the embodiment of the invention illustrated in FIGS. 1—6, a frame structure, indicated generally by the reference numeral 1, is shown as comprising a base 2, a generally vertically disposed hollow column 3 projecting upwardly from the rear end of the base 2, and a head 4 projecting forwardly from the upper end portion of the column 3. A pair of aligned guide pulleys 5 and 6 are suitably journaled on the upper end of the column 3 and the head 4 respectively, and are adapted to guide filament, such as wire 7, to a coiling device 8 mounted in the head 4. The coiling device may be of any one of the types disclosed in the above-mentioned patents, but is preferably similar to the coiling device illustrated in my prior United States Letters Patent No. 3,106,354. As shown in FIG. 2, the coiling device 8 comprises a stationary annular pulley or block 9, and a rotary flyer 10 that is mounted on the lower end of a tubular shaft 11 journaled in a bearing 12 on a vertical axis. The wire 7 extends downwardly through the tubular shaft 11 and is entrained over guide pulleys 13, 14 and 15 mounted on the flyer 10 for common rotation therewith, the wire 7 also being entrained over the block 9. Rotary movement is imparted to the flyer 10 by a conventional motor 16 through an endless drive belt 17 that is entrained over a pulley 18 mounted on the upper end of the tubular shaft 11, and a drive pulley 19 mounted on the output shaft 20 operatively associated with the motor 16, through power transmission gearing, not shown, but contained within a transmission housing 21. The coiling device 8 forms the wire 7 into a succession of connected circular loops or convolutions 7a which descend vertically from the coiler 8 substantially on the vertical axis thereof.

Support means for a coiled wire collecting receiver 22 is shown as comprising a rigid box-like support element 23 and a receiver mounting table 24 carried by the support element 23. The support element 23 includes a depending central hollow boss 25 that is journaled on a stationary vertical shaft 26 provided with a mounting flange 27 that is bolted or otherwise rigidly secured to the base 2, the axis of the shaft 26 being aligned with the common axis of the coiling device 8 and the descending convolutions 7a. A rolling friction bearing 28 is shown as being interposed between the lower end of the boss 25 and the flange 27. With reference to FIG. 3, it will be seen that

the table 24, which is preferably circular in form, is provided with a depending central shaft 29 that is journaled in a bearing bracket 30, bolted or otherwise rigidly secured to the support element 23, the axis of the shaft 29 being radially spaced from the axis of the stationary shaft 26, and angularly displaced relative thereto. The table 24 is supported in the bearing bracket 30 by means of a sleeve bearing 31 and a rolling friction thrust bearing 32, and is held in place against axial removal by a washer equipped nut 33 screw threaded on the lower threaded end 34 of the shaft 29.

The receiver 22 may be of any conventional design, the same being shown as comprising a plurality of circumferentially spaced axially extending rods or bars 35 welded or otherwise rigidly secured to a plurality of axially spaced hoops or rings 36. The rods 35 are bent outwardly adjacent their upper ends to provide a generally funnel-like portion 37, the upper ends of the rods being welded or otherwise rigidly secured to a top ring 38. The form of receiver shown in FIGS. 1 and 2 further includes an axial core 39 of conventional design, made from commercially available rod stock and formed to provide a base portion 40 which rests on the top surface of the table 24 within the lowermost ring 36. The receiver 22 is mounted on the table 24, coaxial therewith and is removably secured in place by suitable means such as a plurality of circumferentially spaced clamps 41 and cooperating clamping screws or bolts 41' screw threaded into the table 24, see FIGS. 1 and 2.

Preferably, the height of the receiver 22 and the angular displacement thereof and the table 24, relative to the common axis of the shaft 26 and the convolutions 7a, is such that the axis of the receiver intersects said common axis at a point above the level of the upper end of the receiver 22.

Means for imparting rotation to the receiver supporting element 23 comprises a motor 42 mounted on a supporting bracket or shelf 43 within the column 3, and having speed reduction gearing, not shown, but contained within a gear housing 44, and an endless link chain 45 entrained over a sprocket wheel 46 fast on the output shaft 47 of the motor 42, and over a second sprocket wheel 48 rigidly mounted on the tubular boss 25. With further reference to FIG. 2, it will be seen that the support element 23 is held against axially upward movement by a washer equipped retaining nut 49 screw threaded on the threaded upper end 50 of the stationary shaft 26. The motor 42 rotates the support element 23 at a rather slow speed relative to the speed of coil or convolution forming rotation of the coiling device flyer 10, so that, as each convolution 7a is formed, it is deposited around the core 39 in closely circumferentially spaced relationship to the preceding convolution 7a.

From the above, it should be evident that, as the support element 23 rotates on the axis of the shaft 26, the receiver supporting table 24 partakes of orbital movement around the axis of the shaft 26. For the purpose of holding the receiver 22 against rotation on its own axis, relative to space, and during rotation of the support element 23, I provide a rigid link 51 having one end portion 52 screw threaded into a socket member 53 containing a ball element 54 that is bolted or otherwise rigidly secured to the column 3, see particularly FIG. 4. The opposite end of the link 51 is formed to provide an enlarged head 55 that is loosely journaled on a trunnion 56 which projects laterally outwardly from one of a pair of cooperating clamping members 57 and 58 that are adapted to be clamped to the receiver ring 38, by means of a nut-equipped clamping screw or the like 59, see particularly FIGS. 4 and 5. It will be appreciated that, to the inclination of the axis of the receiver 22, the top ring 38 thereof gyrates or tips, that portion of the top ring 38 engaged by the clamping members 57 and 58 moving generally upwardly and downwardly, during orbital movement of the receiver 22, in an arc about the axis of the

ball element 54. This movement causes the receiver to oscillate on its own axis, the extent of oscillatory movement being governed by the length of the link 51 and the angle of inclination of the receiver 22 from the vertical, and is less than 10° of circular arc.

It will be appreciated that the receiver 22, together with its supporting table 24 and shaft 29 may, if desired, be disposed on a vertical axis radially offset from the axis of the shaft 26 and convolutions 7a, the amount of radial offset being substantially equal to the radius of the convolutions 7a. Such an arrangement works satisfactorily in some instances, but I have found that by disposing the receiver 22 on a tilted axis, as shown, the convolutions 7a are gravity assisted to assume a truly circumferential progression in the receiver 22. This does not necessarily occur when the receiver is disposed on a vertical axis, particularly during the initial building up of the wire bundle. With the instant arrangement, as the wire bundle builds up, the axis thereof approaches the axis of the descending convolutions 7a. However, the bundle tends to build up more rapidly adjacent the core 39 than at the outer periphery of the bundle, with the result that the upper surface of the bundle becomes cone-shaped, as shown by dotted lines in FIG. 2. The cone-shaped top surface causes descending convolutions 7a to gravitate toward the outer periphery of the bundle.

By positively holding the receiver 22 against rotation relative to space, two or more connected bundles or packages of coiled wire can be produced. In FIG. 6, a bundle B of coiled wire is shown as being removed from the machine and supported on a core 39, the outer cage-like portion of the receiver 22 being removed. A second receiver 22 with its core 39 is shown as being mounted on the table 24, the wire 7 extending from the bundle B into the annular space defined by the receiver 22, and from thence upwardly toward the coiling device. That portion of the wire 7 extending from the bundle B to the second receiver 22 extends downwardly adjacent the outer cage portion of the receiver 2 and does not interfere with coils descending thereinto from the overlying coiling device 8. Thus, a plurality of joined bundles may be provided, eliminating the necessity for frequent splicing of wire lengths together during subsequent use of the filament.

In the modified form of the invention shown in FIGS. 7-9, parts corresponding to like parts of FIGS. 1-5 are designated by like reference characters with the suffix *a* added. In this modified form, the motor 42a is connected to a transmission housing 60 of slightly different shape than the transmission housing 44, the output shaft 47a extending upwardly through the transmission housing 60, as indicated at 61. A plate-like crank member 62 is mounted on the extended portion 61 of the shaft 47a for common rotation therewith, and is provided with a bearing member 63 in radially spaced relation to the shaft extension portion 61. A generally U-shaped yoke 64 is provided with a depending stub shaft 65 that is journaled in the bearing 63 on a vertical axis, and forms a swivel connection for one end portion of a rigid arm 66. The arm 66 extends forwardly through an opening 67 in the column 3a and is provided at its forward end with a cross bar 68 that is journaled at its opposite ends in bearings 69 secured to the bottom surface of the table 24a. A pair of bracing webs 70 are welded to the cross bar 68 and front end portion of the arm 66 to provide a rigid structure.

Preferably, the distance between the axes of the shafts 47a and 65 is substantially equal to the distance between the axis of the shaft 26a and the axis of rotation of the table 24a adjacent its bottom surface. Thus, as shown by dot and dash lines in FIG. 8, rotation of the support element 23 and crank member 62 in a common direction imparts common orbital movement to the table 24a and arm 66 whereby to positively hold the table 24a against rotary movement on its own axis relative to space. The

above described modified arrangement permits the use of the receiver 22 with or without the core 39, or use of the core 39 may be mounted on the table 24a to be used as a receiver without the cage-like cylindrical portion of the receiver 22.

In the modified form of the invention illustrated in FIGS. 10-16, frame structure 1b is shown as including a generally upright column 3b supported on a base 2b, the column 3b being provided with an access door or the like 71. A support element in the nature of a heavy circular supporting plate or disk 72 is journaled on a shaft 26b identical to the shafts 26 and 26a. A receiver supporting table 73, similar to the tables 24 and 24a is provided with a shaft journaled in a bearing bracket 30b rigidly secured to the support element 72, and terminating in a lower threaded end 34b having a washer equipped retaining nut 33b screw threaded thereon. An open topped cylindrical receiver 74 is mounted on the table 73 and anchored in place by a plurality of clamping screws 75, the receiver 74 being provided with a central cylindrical core 76 whereby to define an annular packing space 77 similar to the annular packing space between the outer cage-like portion of the receiver 22 and the core 39 thereof. It will be appreciated that the tables 24a and 73, with their respective support elements 23a and 72 are disposed relative to overlying coiling devices, not shown, in the same manner that the table 24 and support 23 relate to the coiling device 8.

Means for imparting rotation to the support 72 on the axis of the shaft 26b comprises a conventional geared head drive motor 78 mounted within the column 3b and having an output shaft 79, and endless drive chain 80, a drive shaft 81, and a drive wheel 82 mounted fast on one end of the drive shaft 81. The chain 80 is entrained over a sprocket wheel 83 on the motor output shaft 79 and over a second sprocket wheel 84 mounted fast on the drive shaft 81 adjacent a self-aligning or pivoted bearing 85 mounted on the adjacent wall of the column 3b and journalling the shaft 81 intermediate its opposite ends. The bearing 85 and mounting means 86 therefore are of a commercially available type which permits angular displacement of the shaft 81 whereby the drive wheel 82 may be moved into or out of operative engagement with the bottom surface of the support element 72. At its opposite end, the shaft 81 is journaled in a second pivoted or self-aligning bearing 87 contained in a mounting head 88 that is slidably mounted in a bracket 89 bolted or otherwise rigidly secured to the base 2b within the column 3b. The mounting head 88 is provided with a generally vertical stem 90 that projects upwardly through an opening in a top plate 91 of the bracket 89, a coil compression spring 92 being interposed between the mounting head 88 and the bracket top plate 91 and yieldingly urging the mounting head 88 in a direction to angularly move the shaft 81 toward engagement of the drive wheel 82 with the support element 72. An actuating lever 93 is pivotally mounted intermediate its ends to the top plate 91, as indicated at 94, the inner end of the lever 93 having an opening through which the stem 90 projects. The upper end of the stem 90 is screw threaded to receive an adjustment nut 95 overlying the inner end of the lever 93 and a lock nut 96. The actuating lever 93 extends outwardly through an opening 97 in a side wall of the column 3b and is movable upwardly and downwardly in the opening 97. The pivot connection 94 is sufficiently loose to permit limited lateral movement of the actuating lever 93 within the opening 97, the opening 97 being defined in part by a pair of downwardly opening recess portions 97a and 97b, see FIG. 13. The arrangement is such that, when the actuating lever 93 is disposed in the recess 97a, the spring 92 operatively moves the drive wheel 82 into driving engagement with the support elements 72. When the outer end of the actuating lever 93 is depressed and the lever moved into the recess 97b, the inner end of the lever 93 raises the mounting

head 88 against bias of the spring 92 to move the drive wheel 82 out of operative engagement with the support element 72.

Means for anchoring the table 73 and parts carried thereby against rotation relative to space during rotary movement of the crank-acting support element 72 comprises a pair of generally horizontally disposed parallel rigid links 98, a plate-like control member 99, and means mounting and guiding the control member 99 for horizontal movements generally toward and away from the axis of the shaft 26b. The control member 99 is provided with a pair of depending stub-shafts 100 on which are mounted swivel or self-aligning bearings 101, see FIG. 16, each of these bearings 101 being welded or otherwise rigidly secured to the inner end of a different one of the links 98. The links 98 extend outwardly through an opening 102 in the front wall of the column 3b and terminate in self-aligning bearings 103 mounted on downwardly projecting stems 104 secured to the undersurface of the table 73, the distance between the axes of the stems 104 being equal to the distance between the axes of the shafts 100, whereby the table 73, links 98 and control member 99 cooperate to form a parallelogram arrangement.

The aforementioned means mounting and guiding the control member 99 for said movements toward and away from the axis of the shaft 26b comprises a pair of horizontally disposed parallel arms 105 having outer ends terminating in self-aligning bearings or the like 106 that are mounted on laterally spaced vertical stems 107 extending upwardly from spaced portions of the control member 99. The inner ends of the arms 105 are upturned to provide a pair of vertically disposed shafts 108 that are suitably journaled in vertically spaced bearing brackets 109, bolted or otherwise rigidly secured to the inner surface of the column 3b. As shown in FIGS. 14 and 15, the arms 105 are angularly displaced with respect to the rigid links 98, the distance between the axes of the stems 107 being equal to the distance between the axes of the shafts 108. The arms 105 are of equal length between their respective stems 107 and their respective shafts 108, whereby the arms 105, control member 99 and bearing brackets 109 cooperate to provide a second parallelogram arrangement. Thus, as will be seen by the full and dotted line showing in FIGS. 14 and 15, the receiver supporting table 73 is rigidly held against rotation relative to the axis of the crank-acting support element 72.

In addition to the several structures above-described, this invention further involves a method of packaging filamentary material, such as wire, either stranded or solid castable wire.

While structures other than those above-described, might be devised to carry out the above-described method of packaging filamentary material, it should be understood that my invention may be further modified without departure from the spirit and scope of the invention, as defined in the claims.

What is claimed is:

1. Apparatus for packaging filamentary material on a receiver including a core having an upper filament receiving end and a lower end and providing an annular packing space comprising:

- (a) a frame structure,
- (b) a coiler carried by said frame structure for forming a filament into convolutions of predetermined diameter and for discharging said convolutions successively downwardly on a generally vertical axis,
- (c) support means for mounting the receiver below said coiler with the axis of said annular packing space disposed in laterally spaced relation to said generally vertical axis,
- (d) means for imparting movement to said support means in a direction wherein said receiver partakes of bodily orbital movement relative to said generally vertical axis, the axis of said packing space describ-

ing a circular orbit around said generally vertical axis,

(e) and means for anchoring said receiver against rotation relative to space during said orbital movement of the receiver.

2. The apparatus defined in claim 1 in which said receiver is so disposed on said support means that the axis of said packing space is inclined with respect to said generally vertical axis of the convolutions and intersects said generally vertical axis at a point above the upper end of the receiver mounted on said support means, that portion of the packing space axis, below the intersection thereof with said generally vertical axis, describing said circular orbit.

3. The apparatus defined in claim 2 in which said means for anchoring the receiver against rotation relative to space comprises, a link, attachment means connecting one end of said link to said receiver, and connection means for operatively connecting the opposite end of said link to said frame structure.

4. The apparatus defined in claim 3 in which said attachment means comprises a releasable locking member pivotally connected to one end of the link and detachably connected to said receiver.

5. The apparatus defined in claim 3 in which said attachment means includes a member pivotally connected to said one end of the link and having a locking portion engaging said receiver adjacent its upper filament receiving end and releasably locked thereto.

6. The apparatus defined in claim 5 in which said means for operatively connecting said link to the frame structure includes a movable member pivotally connected to said opposite end of the link, characterized by a power driven element operatively connected to said movable member for imparting limited longitudinal reciprocatory movement to said link whereby to oscillate said receiver on said inclined axis during orbital movement thereof relative to said generally vertical axis.

7. The apparatus defined in claim 5 in which said means for operatively connecting said link to the frame structure comprises a head on said opposite end of the link, and a pivot connection between said head and said frame structure, said pivot connection permitting tipping movement of the upper end of said receiver during orbital movement thereof but limiting oscillatory movement of said receiver relative to said frame structure to less than 10° of circular arc.

8. The apparatus defined in claim 2 in which said frame structure includes a base, said support means comprising, a crank acting member having a portion journaled on said base on said generally vertical axis, a table journaled on said crank acting member on said inclined axis and having a top surface disposed in a plane normal to said inclined axis, and means for releasably holding said receiver on said table coaxial with said inclined axis.

9. The apparatus defined in claim 2 in which said support means includes a crank acting member having a portion journaled in the frame structure on said generally vertical axis, a table journaled on said crank acting member on said inclined axis and having a receiver supporting top portion disposed in a plane normal to said inclined axis, and means for releasably holding said receiver on said table coaxial with said inclined axis, said means for anchoring the receiver against rotation relative to space comprising a pair of generally horizontal laterally spaced parallel links of equal length each pivotally secured at one end to said table on laterally spaced generally vertical axes, a control member, and means mounting and guiding said control member in said frame structure for generally horizontal movements toward and away from said generally vertical axis, said links having their other ends pivotally connected to said control member on generally vertical axes spaced apart a distance

equal to the distance between the axes of pivotal connection of said links to said table.

10. The apparatus defined in claim 9 in which said means mounting and guiding the control member comprises a pair of generally horizontal parallel arms having inner ends pivotally secured to said control member on generally vertical axes and outer end portions pivotally mounted in said frame structure on vertical axes spaced apart a distance equal to the distance between the axes of pivotal connection of said arms to said control member, said arms being angularly displaced relative to said links.

11. The apparatus defined in claim 1 in which said support means includes a rotary element mounted in said frame structure for rotation on said generally vertical axis, and having a receiver supporting bearing radially spaced from said generally vertical axis.

12. The apparatus defined in claim 11, in which said means for imparting movement to said support means includes a power driven shaft journaled in said frame structure, a drive wheel mounted on said shaft for common rotation therewith and engageable with said rotary element, and means for moving said drive wheel toward and away from driving engagement with said rotary element.

13. The apparatus defined in claim 1 in which said support means includes a receiver supporting table, said means for anchoring the receiver against rotary movement comprising a rigid arm having one end connected to said table and extending radially therefrom, and means for moving the opposite end of said arm in a path similar to the path of orbital movement of the receiver and synchronously therewith.

14. The apparatus defined in claim 13 in which said last-mentioned means comprises a crank member, means journalling said crank member in said frame structure for rotation on a generally vertical axis, a bearing element pivotally connecting said opposite end of the arm to said crank member on an axis in radially spaced generally parallel relation to the axis of rotation of said crank member, and transmission mechanism operatively connecting said crank member to said means for imparting orbital movement to said support means.

15. The apparatus defined in claim 14 in which said bearing element includes a swivel connection to said arm permitting swinging movements of said arm on a generally horizontal axis as well as pivotal movements on its own axis relative to said bearing element.

16. The apparatus defined in claim 1 in which said support means includes a receiver supporting table and means for releasably holding said receiver on the table, said means for anchoring the receiver against rotary movement relative to space comprising a pair of generally horizontal laterally spaced parallel links of equal length each pivotally secured at one end to said table on spaced generally vertical axes, a control member, and means mounting and guiding said control member in said frame structure for horizontal movements toward and away from said generally vertical axis, said links having their other ends pivotally connected to said control member on generally vertical axes spaced apart a distance equal to the distance between the axes of pivotal connection of said links to said table.

17. A method of packaging filamentary material comprising:

- (a) passing a length of filament through a coiler to form the filament into a plurality of convolutions of predetermined diameter and discharging said convolutions in succession downwardly on a generally vertical axis,
- (b) disposing a receiver, having a filament receiving upper end and a filament supporting lower end and defining an annular packing space, so that said annular packing space is laterally offset from said generally vertical axis,

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(c) accumulating said convolutions on said receiver while imparting bodily movement to said receiver in an orbital path wherein the axis of said annular packing space moves in a circular orbit around said generally vertical axis,

(d) and holding said receiver against rotary movement on its own axis relative to space during said orbital movement of the receiver.

18. The method defined in claim 17 further including, removing the receiver from its path of orbital movement when a predetermined number of said convolutions have been deposited in said annular space and placing an empty second receiver in said path, leading at least one of said downwardly discharged convolutions from the upper end of the removed receiver to the lower end of said empty second receiver and moving said second receiver in said orbital path while discharging successive convolutions downwardly thereon, and holding the second receiver against rotation relative to space, whereby to provide a pair of connected packages of unbroken coiled filament.

19. A method of packaging filamentary material, comprising:

(a) forming a length of filament into a plurality of convolutions of predetermined diameter and discharging said convolutions in succession downwardly on a generally vertical axis,

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(b) disposing a receiver, having a filament receiving upper end and a filament supporting lower end and providing an annular packing space, so that the axis of said packing space is inclined toward said generally vertical axis above the upper end of said packing space,

(c) accumulating said convolutions on said receiver while imparting bodily movement to said receiver in an orbital path wherein said packing space axis, below the intersection thereof with said generally vertical axis, describes a circular orbit around said generally vertical axis,

(d) and holding said receiver against rotary movement on its own axis relative to space during orbital movement of said receiver.

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STANLEY N. GILREATH, *Primary Examiner*.

N. L. MINTZ, *Assistant Examiner*.