Feb. 5, 1946. A. B. WILSON 2,394,503

WINDING REEL

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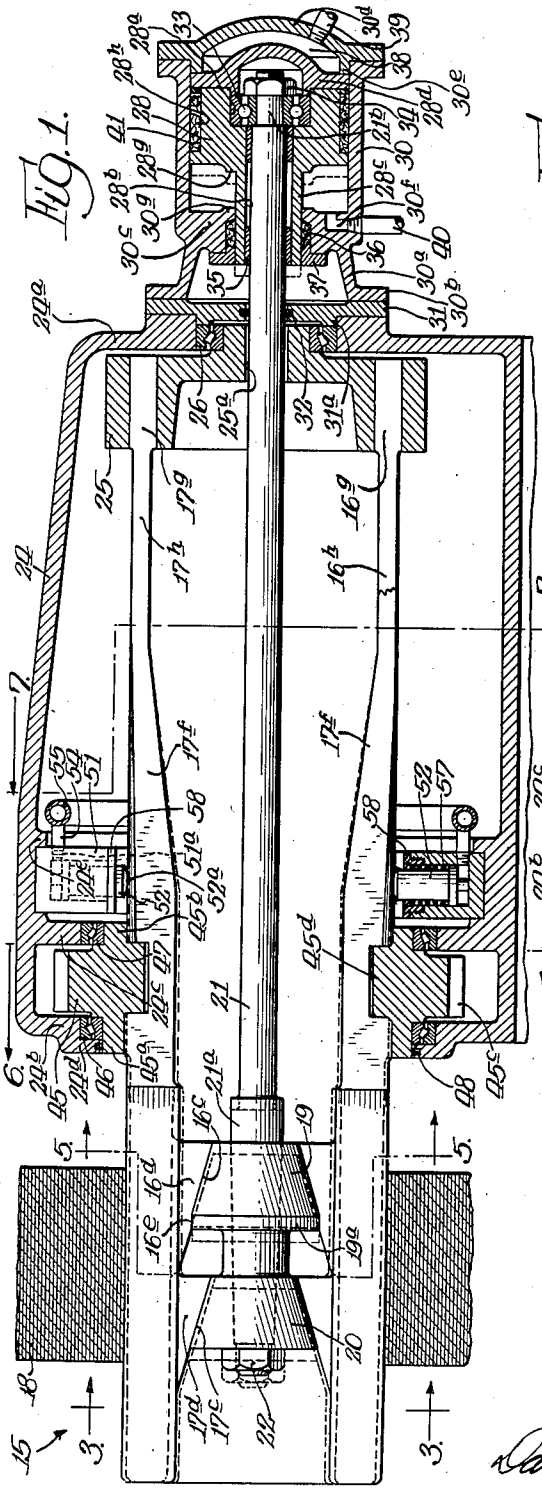


FIG. 1.

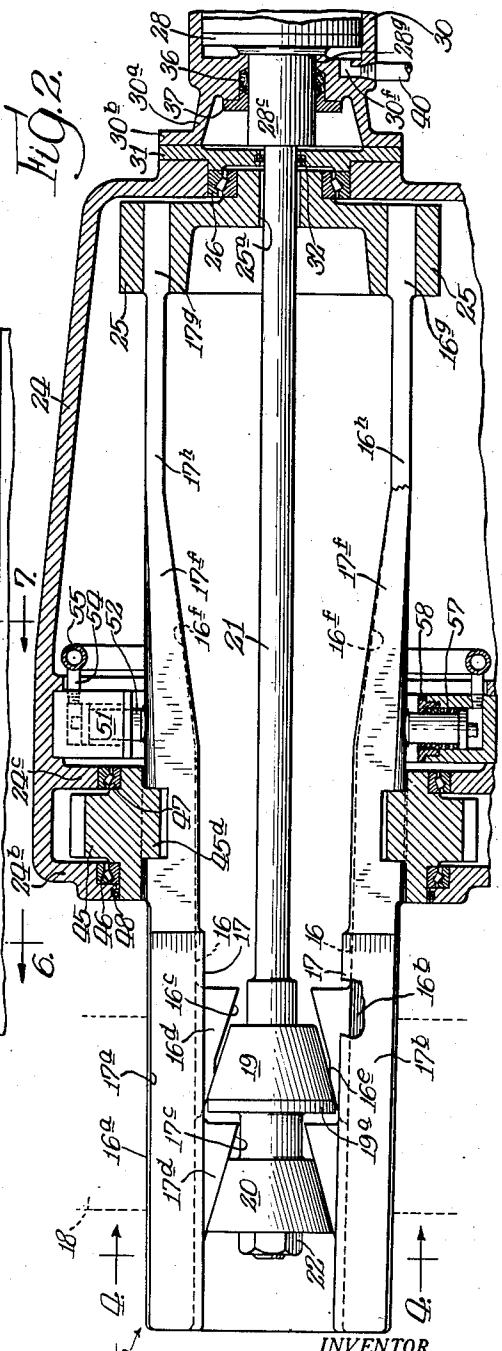


FIG. 2.

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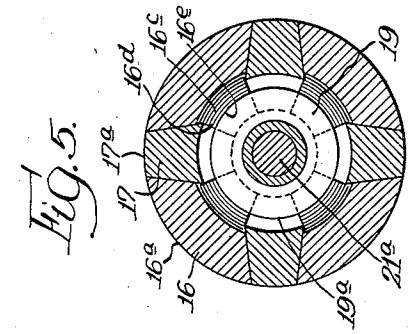


Fig. 5.

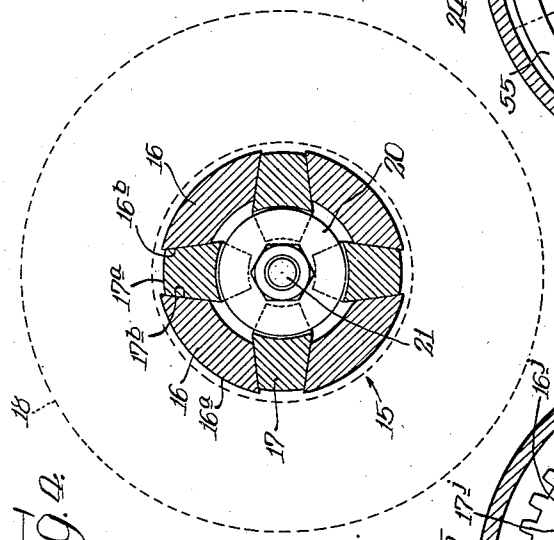


Fig. 4.

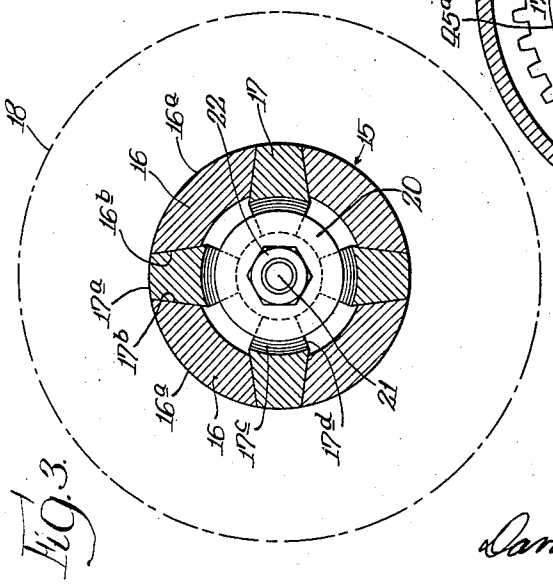


Fig. 3.

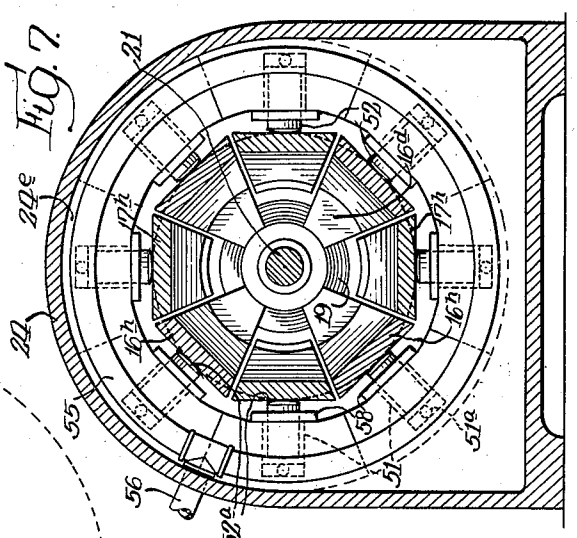


Fig. 7.

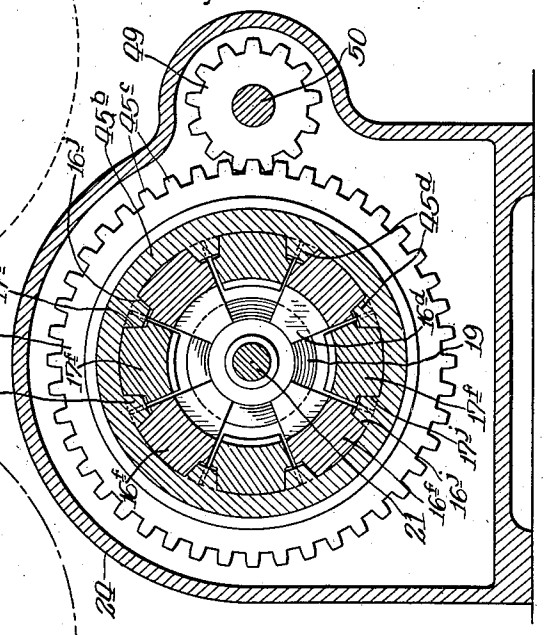


Fig. 6.

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Fig. 8.

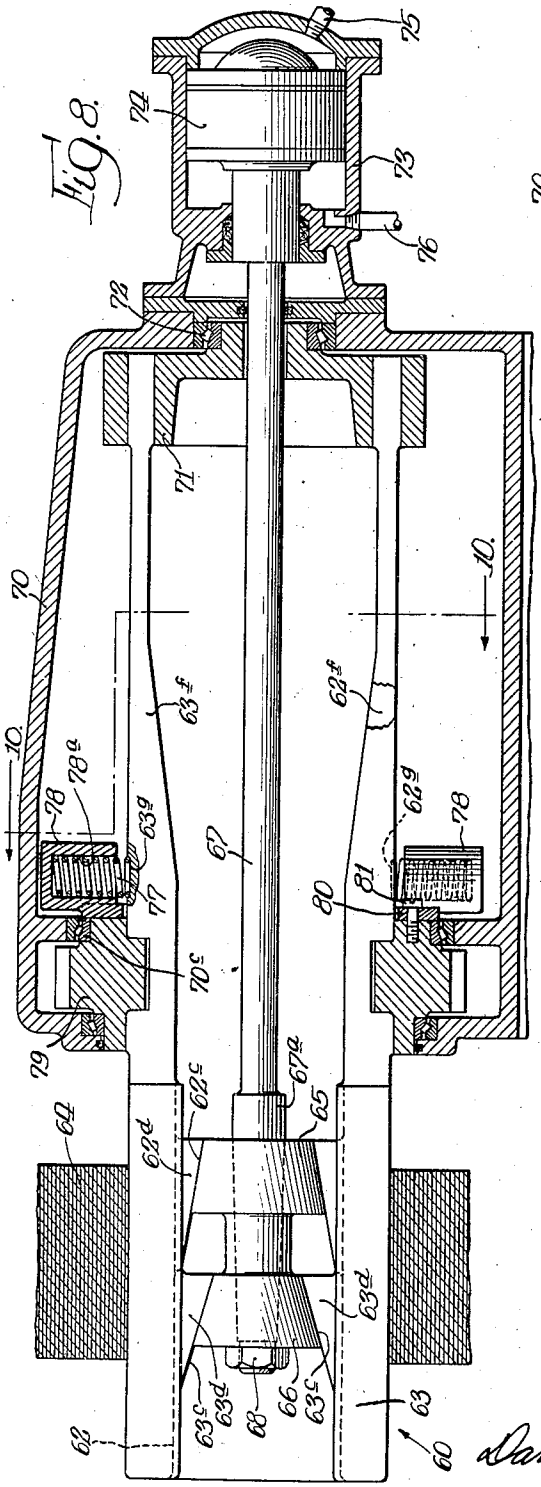


Fig. 10.

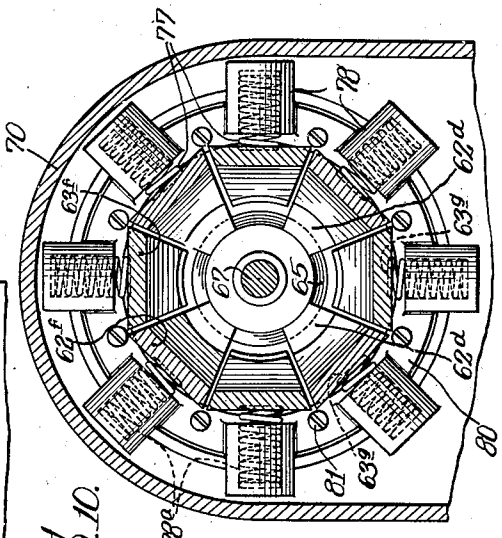
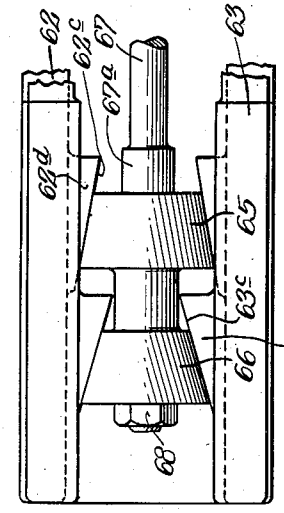


Fig. 9.



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UNITED STATES PATENT OFFICE

2,394,503

WINDING REEL

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Application October 19, 1942, Serial No. 462,457

1 Claim. (Cl. 242—72)

This invention relates to improvements in winding reels and its purpose is to provide improved means for winding strip steel and the like in spiral coils. The present invention is an improvement upon that described and claimed in the copending application of Chester B. MacChesney for Letters Patent of the United States, Serial No. 395,967, filed May 31, 1941, Patent No. 2,299,101, October 20, 1942.

In said application of Chester M. MacChesney, there is disclosed an improved winding reel in which the power for effecting rotation during the winding operation is applied directly to the segments on which the strip material is wound and in which the expansion of the annular series of segments is effected, and their contraction controlled, by a tapered expanding member mounted for movement by power means longitudinally of the axis of the reel. In that construction, the segments are anchored securely at one end to a rotating member and the power for rotating the core is applied directly to the segments at points adjacent the region where the coil of strip material is wound, thus overcoming any tendency of the segments to tilt or twist during the winding operation. The parts are preferably so formed that the segments and the expanding member have only an annular line contact with each other in all but one of the positions of the expanding member, which position may correspond to the expanded condition of the core, so that the resistance to the movement of the expanding member is comparatively limited.

In the improved type of winding reel just referred to, the lateral edges of the segments of the core on which the metal strip is wound are spaced apart when the core is expanded in order to allow the segments to close upon each other when the core is contracted for the purpose of permitting the removal of a coil of wound material, and the inner convolutions of the coil are therefore not supported by a continuous cylinder during the winding operation, with the result that the inner convolutions of the coil are bent slightly where they pass over the edges of the segments and may have their surfaces marred. The principal object of the present invention is to provide an improved winding reel which overcomes this difficulty by providing a core having a continuous cylindrical surface when it is expanded so that there is no danger of damaging the inner convolutions of the coil of strip material. A further object of the invention is to provide a winding reel having a core made up of an annular series of segments which contact with each other on their lateral sides in combination with means for expanding and contracting the core and moving adjacent segments of the series in contact with each other when the core is expanded. Still another object of the invention is to provide a winding reel having a core comprising a series of outer segments and a series of inner segments which form a continuous cylindrical surface when they are expanded and which are expanded and contracted independently of each other and in such timed relation that the segments of the two series contact with each other on their lateral sides in the expanded condition of the core. A further object of the invention is to provide a winding reel having a core made up of two annular series of segments which are positioned with the segments of one series arranged alternately with respect to the segments of the other series and in which the segments of the two series are expanded, and their contraction controlled, by separate expanding members which are tapered in different degrees so that one series of segments moves in advance of the other series. Other objects of the invention relate to various features of construction and arrangement which will appear more fully hereinafter.

The nature of the invention will be understood from the following specification taken with the accompanying drawings in which two embodiments are illustrated. In the drawings,

Figure 1 shows a longitudinal vertical section through one form of winding reel, illustrating the segments of the core in their expanded condition where they form a continuous cylindrical surface on which the strip material is wound;

Fig. 2 shows a longitudinal vertical section similar to that of Fig. 1, with the segments of the core contracted to permit the removal of the coil of strip material which is partially illustrated by dotted lines;

Fig. 3 shows a sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 shows a sectional view taken on the line 4—4 of Fig. 2;

Fig. 5 shows a sectional view taken on the line 5—5 of Fig. 1;

Fig. 6 shows a sectional view taken on the line 6—6 of Fig. 1;

Fig. 7 shows a sectional view taken on the line 7—7 of Fig. 1;

Fig. 8 shows a longitudinal vertical section, similar to that of Fig. 1, illustrating a modified form of the invention with the segments of the core expanded;

Fig. 9 shows a partial sectional view, similar

to that of Fig. 8, illustrating the positions of the parts when the core is contracted; and

Fig. 10 shows a sectional view taken on the line 10—10 of Fig. 8.

In the form of the invention shown in Figs. 1 to 7, inclusive, the winding reel is illustrated as comprising a core 15 made up of a plurality of segments including an annular series of outer segments 16 and an annular series of inner segment 17, the segments being thus designated because the segments 17 move inwardly in advance of the segments 16 when the core is contracted and at all times extend inwardly to a greater extent, although when the segments are expanded, as shown in Figs. 1, 3 and 5, their outer margins extend outwardly to the same extent and form a continuous cylindrical surface on which the coil of strip material 18 or the like is wound. The outer segments 16 are more extensive circumferentially than the inner segments and provide a more extensive support for the strip material than the inner segments, and their outer arcuate surfaces 16a are adapted to form continuations of the outer arcuate surfaces 17a of the inner segments. The outer segments are provided on their lateral sides with longitudinally extending surfaces 16b which converge inwardly and which are adapted, when the core is expanded, to coact with the outwardly converging surfaces 17b formed on the inner segments, it being understood that each inner segment is interposed between two outer segments. The surfaces 16b and 17b are inclined with respect to the radii of the core and the angle of this inclination is preferably so arranged in relation to the rate of radial movement of the segments that, when the core is expanded, the inner and outer segments will contact with each other. The segments of the two series are independently expanded and contracted without utilizing the inclinations of the contacting surfaces of the segments to effect any wedging action, that feature being the subject-matter of an independent invention described and claimed in the copending application of William Schroeder, Serial No. 462,465, filed October 19, 1942.

The expansion of the segments of the core is effected, and their contraction is controlled, by a pair of expanding members 19 and 20 which may be formed as one integral structure mounted upon the tapered end 21a of a rod 21 which is adapted to be reciprocated longitudinally during the expansion and contraction of the core. The expanding members 19 and 20 are held on the rod 21 by a nut 22 and each expanding member is constructed in the form of a truncated cone. The annular tapered surface of the expanding member 19 is adapted to contact with longitudinally inclined wedging surfaces 16c which are formed on projections 16d extending inwardly from the outer segments 16. Similarly, the annular tapered surface of the expanding member 20 is adapted to contact with longitudinally inclined wedging surfaces 17c which are formed on the inner faces of the projections 17d which extend inwardly from the inner segments 17. The expanding member 19 is provided at its larger end with an extension 19a of cylindrical form which is adapted to coact with surfaces 16e on the projections 16d which are arcuate and concentric with the axis of the core and of the rod 21 so that the expanding member 19 is capable of some longitudinal movement with respect to the segments 16, with the portion 19a contacting the surfaces 16e of the segments, without effecting any radial movement of the segments. With this arrangement, and with the expanding members moved to the right to the limit of their travel, as shown in Fig. 1, the segments of both series are fully expanded to form a continuous cylindrical surface, as indicated in Figs. 3 and 5. When the expanding members are then moved toward the left, as viewed by dotted lines in Fig. 1, the inner segments will be permitted to follow the expanding member 20 and move inwardly toward the axis of the core while the outer segments will be maintained momentarily in their expanded condition while the portion 19a of the expanding member 19 is sliding on the surfaces 16e, whereupon the outer segments are then permitted to move inwardly to the contracted position shown in Figs. 2 and 4. With this arrangement, it is possible to contract the two series of segments independently of each other even though they contact with each other on their lateral sides and form a complete cylinder when they are expanded. It will be understood that the inclined wedging surfaces of the expanding members and of the segments may be so formed that they will have a full surface contact with each other in only one condition of the core, which may preferably be the expanded condition, while in all other positions there will be only a line contact so that resistance to the movement of the expanding members is thus materially reduced.

The portions of the segments 16 and 17 which have heretofore been described are the forward portions of these segments which project beyond the housing 24 and which are adapted to receive the coil of strip material 18. Each of the outer segments 16 is provided with a rearwardly extending supporting arm 16f and each inner segment is provided with a similar rearwardly extending supporting arm 17f which projects into the housing 24. The inner ends of these arms are provided with enlargements 16g and 17g which are secured in apertures formed in a spider or drum 25. This drum has a hub portion provided with an aperture 25a in which the rod 21 is slidably and rotatably mounted and this hub portion of the spider is journaled in a roller bearing unit 26 secured in the rear end wall 24a of the housing. The portions 16h and 17h of the arms of the segments are curved in cross section adjacent the spider 25 transversely of the rod 21 and are resilient so that they permit some flexing of the segments in this region to allow the forward portions of the segments to expand and contract in response to change in the positions of the expanding members 19 and 20.

The expanding members are moved longitudinally of the core for the purpose of effecting or controlling the expansion of the segments by a piston 28 which is connected to the rod 21 and mounted to reciprocate in a cylinder 30. This cylinder has a forward extension 30a provided with an annular flange 30b which seats against the outer face of a plate 31 by which the end of the housing 24 is closed around the rod 21. The flange 30b and the plate 31 are secured to the housing and the plate has a circular projection 31a which fits into the aperture in the housing in which the roller bearing unit 26 is mounted. The plate 31 has a central opening through which the rod 21 extends and a dust tight closure is made around the rod by a packing ring 32 which seats in a groove in the plate.

The piston 28 is loosely engaged by the rod 21 so that the rod may rotate within the piston during the normal rotation of the winding reel and, to facilitate this rotation, a ball bearing unit

33 is mounted on the reduced end 21b of the rod within an annular recess 28a which is formed in the rear end of the piston. A nut 34 engages the threaded end of the rod 21 to hold it in fixed longitudinal position with respect to the ball bearing unit 33 and the piston 28. The central passage 28b of the piston is loosely engaged by the rod 21 and is provided with bushings 35 in which the rod is adapted to rotate. The piston is further provided at its forward end with a tubular extension 28c which slidably engages an aperture formed in the inner end wall of the cylinder 30. This end wall is provided with a stuffing box surrounding this tubular extension 28c of the piston and this stuffing box is filled with packing material 36 adapted to be compressed by a packing gland 37 attached to the end face of the cylinder, thus forming a fluid tight connection around the tubular extension 28c of the piston.

When the piston 28 is in its retracted position, as shown in Fig. 1, corresponding to the expanded condition of the core, a space 38 is provided between the cap 28d of the piston and the head 30d of the cylinder which are secured to the piston and the cylinder, respectively. The head 30d of the cylinder has an inwardly extending annular flange 30e which limits the rearward movement of the piston and thus defines the space 38. Compressed air or the like is adapted to be admitted to the space 38 through a pipe 39 leading from an air compressor or the like. Another supply pipe 40 admits compressed air to a passage 30f which leads through the front wall of the cylinder and communicates with the space between the piston and the forward wall or head of the cylinder. In order to insure an annular space between the piston and this end wall 30c of the cylinder, these parts are provided around the forward extension 28c of the piston with annular projections 28g and 30g which are adapted to contact with each other when the piston is in its extreme forward position. The piston is further provided with an annular circumferential recess 28h occupied by a quantity of packing material 41 which provides a fluid tight connection between the piston and the surrounding wall of the cylinder.

The driving force for effecting rotation of the core 15 is applied to the segments adjacent the forward end of the housing 24 in proximity to the region where the coil of strip material 18 is wound on the core. For this purpose, a driving gear 45 is located in the forward end of the housing 24 with its annular flanges 45a and 45b journaled in ball bearing units 46 and 47, respectively, which are mounted at the inner margins of the flanges 24b and 24c formed on the housing 24 to extend radially inward from its outer wall, as illustrated in Fig. 1. The forward flange 24b has an extension 24d provided with an annular groove in which is mounted a sealing ring 48 of felt or the like, which prevents the access of dust to the roller bearing unit 46 and to the interior of the housing. The driving gear 45 is provided on its outer side with teeth 45c which mesh with the teeth of the driving pinion 49, shown in Fig. 6, which is secured upon a driving shaft 50 adapted to be actuated by an electric motor or other source of power during the winding operation.

In order to form a driving connection between the gear 45 and the arms 16f and 17f of the segments of the core, the gear is provided on its inner side with a series of spaced teeth 45d which enter the notches 16j and 17j formed in the arms of the segments, as illustrated in Fig. 6. These notches or recesses are located in the marginal edges of the segments and those in two adjacent arms 16f and 17f register with each other to receive one of the teeth 45d. The notches are of sufficient depth to permit radial movement of the segments within the gear to the extent that may be necessary to accommodate the expansion and contraction of the segments in response to the longitudinal movements of the expanding members 19 and 20 and the action of the contracting means hereinafter described. By thus applying the driving force at intermediate parts of the outer segments of the core, any tendency of these segments to tilt or twist longitudinally or laterally under the influence of stresses applied thereto during the winding operation is overcome.

The admission of compressed air through the pipe 40 to the left hand end of the cylinder 30, as viewed in Fig. 1, moves the cylinder to the position shown by full lines, thus expanding the core 15 and forming a cylindrical surface upon which the coil 18 may be wound, the power for winding being applied through the pinion 49 and the gear 45. At the conclusion of the winding operation, compressed air is admitted through the pipe 39 to the right hand end of the cylinder, as viewed in Fig. 1, and the piston then moves the expanding members 19 and 20 toward the left to release the segments 16 and 17 and permit them to contract. In order that this contraction may be positively effected, a series of cylinders 51 are mounted within the housing 24 to extend radially inward from its outer wall adjacent the gear 45, the outer ends of these cylinders being secured between the flange 24c and another annular inwardly extending flange 24e formed on the housing. A series of cylindrical pistons 52 are mounted to reciprocate in these cylinders 51 and their inner rounded ends 52a are adapted to bear against the outer faces of the arms 16f and 17f of the core segments. The outer ends of these cylinders are provided with a series of ports 51a having connections with supply pipes 54 which lead from an annular supply pipe 55 mounted to extend around the group of segment arms 16f and 17f. Compressed air or the like is supplied to the pipe 55 through a pipe 56, shown in Fig. 7, and when compressed air is admitted to the space 38 at the end of the cylinder 30 to cause the expanding members 19 and 20 to move toward the left, as viewed in Fig. 1, compressed air is simultaneously admitted through the pipes 54 to the various cylinders 51, thus causing the pistons 52 to be actuated to move all of the segments 16 and 17 inwardly to the positions shown in Fig. 2. As this movement of the expanding members takes place, the inward movement of the segments 17 precedes the inward movement of the outer segments 16 sufficiently to allow for the contraction of the core, this timed relation of the contraction of the two series of segments being effected by the provision of the annular surface 19a on the expanding member 19 which provides a dwell period during which the outer segments 16 do not move inwardly in response to the longitudinal movement of the expanding member 19. In order to retract the pistons 52 during the rotation of the core, when the compressed air is not applied to the cylinders 51, the intermediate portion of each piston is reduced in diameter, and the annular recess thus formed is occupied by a coil spring 57 which

engages the shoulder at one end of the recess and an annular retaining ring 58 at the other so that the spring normally retracts the piston. The ring 58 is detachably secured to the associated cylinder and the outer end of the cylinder is slightly reduced in inner diameter to form a shoulder which limits the outward movement of the piston and forms a space through which compressed air is applied to the end of the piston.

Instead of causing the movement of one series of segments to precede the other by the arrangement described above, this timed relationship may be brought about by using different angles of taper on the expanding members which coact with the two different series of segments, as in the form shown in Figs. 8, 9 and 10. In this form, the core 60 comprises outer segments 62 and inner segments 63 which may be identical in construction with those previously described so far as their outer contacting portions are concerned. These portions are adapted to receive the coil 64 of strip material and the outer segments 62 are provided with longitudinally inclined wedging surfaces 62^c formed on the projections 62^d which extend inwardly therefrom and the outer segments 63 are similarly provided with longitudinally inclined wedging surfaces 63^c which are formed on the inward projections 63^d. The surfaces 62^c and 63^c coact with the outer and inner annular surfaces formed on the expanding members 65 and 66 which are constructed in the form of truncated cones, as in the form of construction previously described, and which are mounted on the tapered end 67^a of a rod 67 which is held in fixed relationship to the expanding members by a nut 68 engaging its threaded extremity. The annular surface of the expanding member 66 and the contacting surfaces 63^c of the inner segments have greater inclinations to the axis of the core and of the rod 67 than do the annular surface of the expanding member 65 and the inclined surfaces 62^c of the outer segments which contact therewith, so that upon movement of the rod 67 toward the right, as viewed in Fig. 9, the inner segments expand more rapidly than the outer segments, with the result that when the piston reaches the righthand end of the cylinder, as shown in Fig. 8, with a resulting location of the expanding members in their extreme righthand positions, both series of segments will be fully expanded and their outer arcuate surfaces will form a composite cylindrical surface. When the expanding members are moved toward the left, as viewed in Fig. 8, the expanding member 66 will permit the inner segments 63 to contract more rapidly than the outer segments 62 which engage the expanding member 65 having a lesser slope, so that the inner segments are allowed to move inwardly ahead of the outer segments to allow for the necessary contraction of the core.

In the form of construction shown in Figs. 8, 9 and 10, the segments 62 and 63 are provided with extensions 62^f and 63^f which extend into the housing 70 and which are secured at their inner ends to a rotatable hub or spider 71 mounted to revolve about the rod 67 through the agency of a roller bearing unit 72, as in the form of construction previously described. The cylinder 73 corresponds to the cylinder 30 previously described and a piston 74 is secured on the rod 67 within the cylinder to permit rotation of the rod and to effect longitudinal movement thereof when compressed air is admitted to the cylinder 73 through the pipes 75 and 76.

Instead of contracting the segments of the core by fluid pressure, when the expanding members are moved to the positions shown in Fig. 9, as in the form of construction previously described, this form of the invention includes continuously acting coil springs 77 which are mounted within the housing 70 in cylindrical bores 78^a formed in blocks or bosses 78 which are carried by a ring 80 formed as a lateral projection of the ring gear 79 by which the core is rotated and secured thereto by screws 81. The ring gear 79 is journaled in bearings 70^c carried by the housing 70 as in the form of construction previously described. The blocks 78 are located on the opposite side of the flange 80 of the housing from the gear 79 and rotate with the gear. These coil springs have their inner ends arranged to engage depressions 62^g and 63^g which are formed in the outer faces of the arms 62^f and 63^f of the arms of the segments and they are normally under compression so that when the core is expanded they tend to force the segments inwardly against the expanding members and will bring about the contraction of the core by radial pressure exerted upon the segments when the expanding members 65 and 66 are moved to the position shown in Fig. 9 which permits such contraction.

Although two forms of the invention have been shown and described by way of illustration, it will be understood that it may be constructed in various other embodiments coming within the scope of the appended claim.

I claim:

The combination in a winding reel, of a rotatable core comprising an annular series of outer segments, an annular series of inner segments arranged alternately with respect to said outer segments, the segments of each series being provided on their inner sides with longitudinally inclined wedging surfaces, and a pair of tapered expanding members movable longitudinally of said core and each coacting with said inclined wedging surfaces formed on one series of segments, one of said expanding members and one series of segments being provided with contacting surfaces which are parallel to the axis of said core whereby that expanding member may have an initial movement without effecting radial movement of the segments engaged thereby after the other expanding member has effected movement of the other series of segments.

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