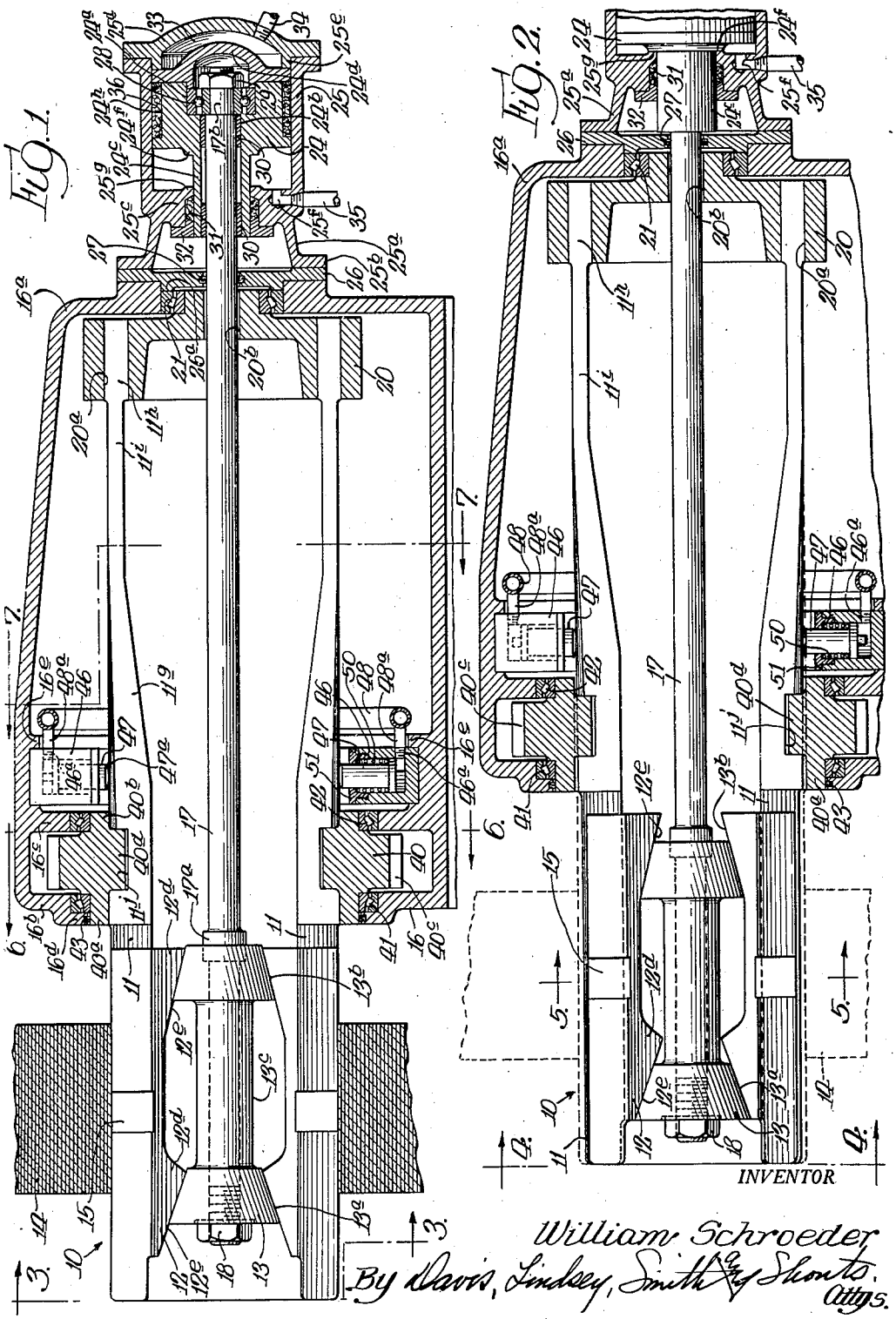
Feb. 5, 1946. W. SCHROEDER 2,394,504

WINDING REEL

Filed Oct. 19, 1942 2 Sheets-Sheet 1



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WINDING REEL

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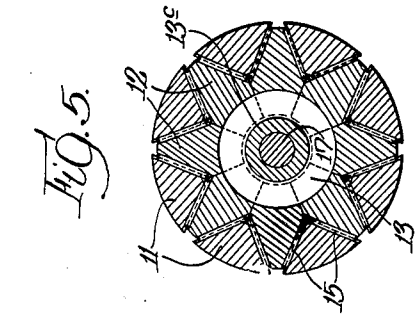


Fig. 5.

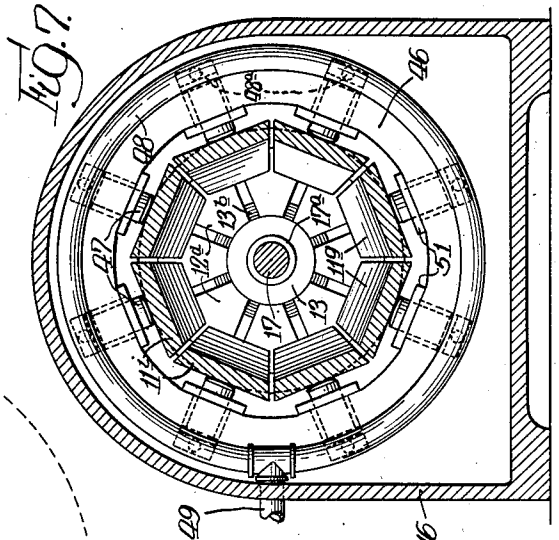


Fig. 7.

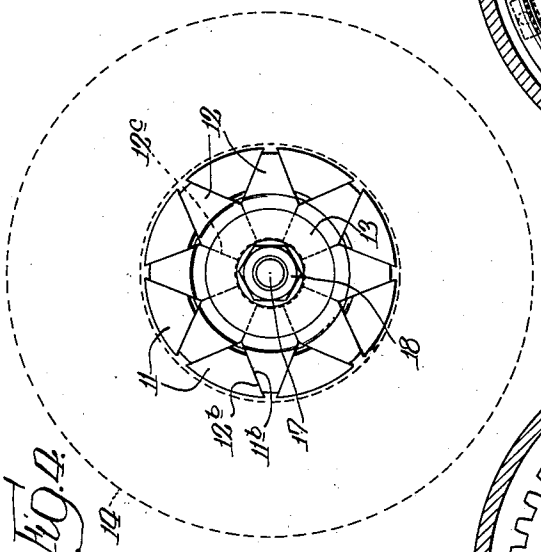


Fig. 4.

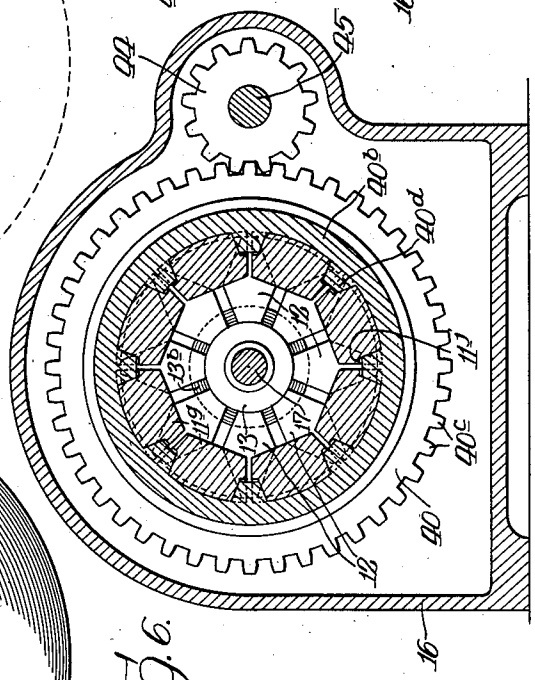


Fig. 6.

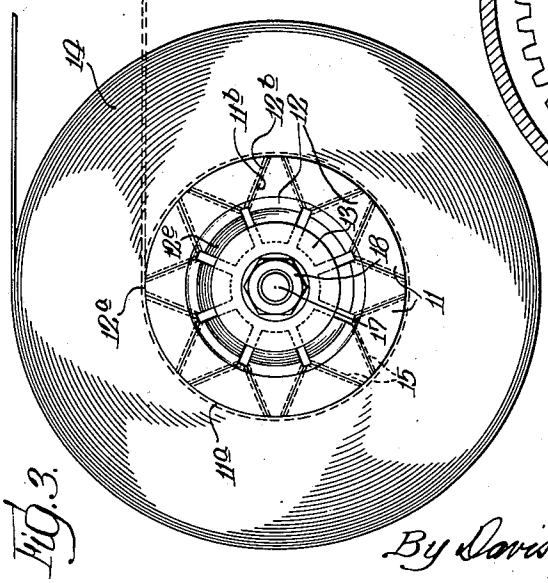


Fig. 3.

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2,394,504

UNITED STATES PATENT OFFICE

2,394,504

WINDING REEL

William Schroeder, Chicago, Ill., assignor to Acme Steel Company, Chicago, Ill., a corporation of Illinois

Application October 19, 1942, Serial No. 462,465

4 Claims. (Cl. 242—72)

This invention relates to improvements in winding reels and its purpose is to provide an improved reel for winding strip steel and the like in spiral coils. The present invention is an improvement upon that described in the copending application of Chester M. MacChesney for Letters Patent of the United States, Serial No. 395,967, filed May 31, 1941, Patent No. 2,299,101, October 20, 1942, and upon the invention described in the copending application of Allen B. Wilson, Serial No. 462,457, filed October 19, 1942.

In said application of Chester M. MacChesney there is disclosed an improved winding reel in which the power for effecting rotation 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 and the power for rotating the core of the reel 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 may correspond to the expanded condition of the core, so that the resistance to 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 permit the core to be contracted when it is desired to remove 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 are bent slightly where they pass over the edges of the segments and may have their surfaces marred. In the said application of Allen B. Wilson, there is disclosed an improved winding reel of the type referred to in which the spaces between the segments are occupied by auxiliary members or segments when the core is expanded, thus forming a continuous annular surface for engagement with the inner convolution of the coil being wound. In the said improvement of said last-named application, a continuous annular surface may be obtained in the expanded condition of the core by employing an annular series of segments, some of which are expanded and contracted in such timed relation to the independent expansion and contraction of the others that a continuous annular surface is formed only when all of the segments are fully expanded.

The principal object of the present invention is to provide a winding reel of the improved type referred to having a core comprising inner and outer segments, the inner segments being adapted by their outward movement to effect the expansion of the outer segments and being provided with outer surfaces which form continuations, in effect, of the outer surfaces of the outer segments when all of the segments are in their outer positions. A further object is to provide a winding reel comprising a core made up of a plurality of annular series of radially expansible and contractible segments, the segments of one series having wedging engagements with those of the other series. Still another object is to provide a winding reel having a core made up of a plurality of series of segments in combination with an axially movable expanding member having an annular wedging surface arranged to coact with wedging surfaces formed on the inner sides of the segments of one series, the segments of each series having wedging engagements with adjacent segments of another series, whereby the longitudinal movement of the expanding member effects radial expansion of the segments of all of the series. Another object is to provide a winding reel having a core made up of an inner series and an outer series of segments having wedging engagements with each other on their lateral sides adapted to effect relative radial movement of the segments of the two series in combination with an expanding device having wedging engagements with the inner sides of the segments of the inner series only. Other objects 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 one embodiment is illustrated. In the drawings,

Figure 1 shows a longitudinal vertical section through a winding reel having its core expanded for engagement by a coil of strip material which is being wound thereon;

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 which is illustrated by dotted lines;

Fig. 3 shows an end elevation of the core and coil of strip material illustrated in Fig. 1, with the core expanded;

Fig. 4 shows an end elevation of the core in the contracted condition illustrated in Fig. 2, with the coil of strip material illustrated by dotted lines;

Fig. 5 shows a sectional view taken on the line 5—5 of Fig. 2;

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

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

As illustrated in the drawings, the winding reel comprises a core 10 made up of a plurality of outer segments 11 and a plurality of inner segments 12 arranged to be expanded by an axially movable expanding member 13. The outer segments 11 are provided with arcuate surfaces 11a and the inner segments 12 are provided on their outer sides with arcuate surfaces 12a and, when the core is expanded, as shown in Figs. 1 and 3, the surfaces 11a and 12a, being arranged alternately, form a continuous cylinder upon which a coil of strip steel 14 or the like is adapted to be wound. The outer end portions of the segments 11, upon which the winding takes place, are substantially triangular in cross section, being each provided with inwardly converging wedging surfaces 11b which are adapted to coact with similarly inclined outwardly converging wedging surfaces 12b formed on each of the inner segments 12. These wedging surfaces may preferably make angles of about 45 degrees with the radii of the core. The opposite contacting faces 11b and 12b of adjacent segments are provided with complementary keyways and a key 15 is secured in one keyway and arranged to have a sliding engagement with the keyway of the adjacent segment in order to hold the inner segments 12 against relative axial movement with respect to the outer segments, which is desirable when the inner segments are not extended longitudinally and secured at their inner ends as the outer segments are.

The outer segments 11 project through the open end of a housing 16 and are of considerable length but the inner segments 12 and the expanding member 13 preferably terminate short of the end of the housing 16 and it is these parts located without the housing which constitute the core proper on which the coil is formed. The inner segments 12 project radially inward beyond the outer segments 11 and are provided on their lateral sides with radial faces 12c which are adapted to contact with each other on adjacent segments when the core is contracted as shown in Figs. 4 and 5. The inner segments 12 are also provided with inwardly extending projections 12d on which are formed wedging surfaces 12e inclined longitudinally of the core. These wedging surfaces are arcuate transversely of the axis of the core and are adapted to coact with the annular wedging surfaces 13a and 13b which are formed on the expanding member 13. This expanding member has two annular enlargements upon which these wedging surfaces are formed and each enlargement is in the form of a truncated cone. The two enlarged portions on which the wedging surfaces 13a and 13b are formed are connected by an intermediate cylindrical portion 13c of reduced diameter and these annular wedging surfaces and the complementary wedging surfaces 12e formed on the inner segments of the core are preferably so formed that there will be a complete surface contact between the wedging surfaces 12e and the wedging surfaces 13a and 13b only in one position of the expanding member 13, which is preferably the position corresponding to the expanded condition of the core, thus giving adequate support to the segments during the time when a transverse load is put upon the core due to the tension in the strip being wound, to the weight of the coil being formed and to the contractile force set up by the coiling of the coil. At other times, the surfaces 12e will have only more limited contacts with the surfaces 13a and 13b, thus materially reducing the frictional area resisting axial movement of the expanding member. The expanding member is adapted to be moved axially by the rod 17 which fits within a tubular bore formed within the expanding member 13 and which is provided at the inner end of that member with an enlargement 17a partially fitting within an enlargement of the bore in the member so that a seat is formed against which the expanding member may be held against endwise movement. The expanding member is held in this position with respect to the rod by a nut 18 which engages the threaded end of the rod and which may be pinned or otherwise located in position to prevent its accidental removal.

The outer segments 11 are provided with rearwardly extending integral supporting arms 11g which project into the housing 16 and which are provided at their rear ends with enlarged portions 11h secured in apertures 20a formed in a spider or drum 20. The inner segments could also be thus extended and connected to the drum 20 but it is now preferred to terminate the inner segments short of the housing and secure them against longitudinal displacement by the keys 15. This spider 20 has a hub portion provided with a bore 20b in which the rod 17 is slidably and rotatably mounted and this hub portion of the spider is journaled in a roller bearing unit 21 secured in the rear end wall 16a of the housing. The portions 11i of the arms 11g of the outer segments which are adjacent to the spider 20 are curved in cross section transversely of the rod 17 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 changes in position of the expanding member 13.

The movement of the expanding member 13 for the purpose of controlling the expansion and contraction of the core 10 is effected by a piston 24 which is connected to the rod 17 and which is mounted to reciprocate in a cylinder 25. This cylinder has a forward extension 25a provided with an annular flange 25b which seats against the outer face of a plate 26, the flange and the plate being secured to the rear end of the housing 16 with a circular projection 26a of the plate fitting partially into the aperture in which the roller bearing unit 21 is mounted. The plate 26 has a central opening through which the rod 17 extends and a packing ring 27 is mounted in a groove around this opening to bear against the rod and thus form a dust-tight connection between the rod and the plate.

The piston 24 is loosely engaged by the rod 17 so that this rod may rotate within the piston during the normal rotation of the winding reel and a ball bearing unit 28 is mounted on the reduced end 17b of the rod within an annular recess 24a which is formed in the rear end of the piston. A nut 29 engages the threaded end of the rod

17 to hold it in fixed longitudinal position with respect to the ball bearing unit 28 and the piston 24. The central passage 24b of the piston is loosely engaged by the rod 17 and is provided with bushings 30 in which the rod is adapted to rotate. The piston is provided at its forward end with a tubular extension 24c which slidably engages an aperture formed in the end wall 25c of the cylinder. This end wall of the cylinder is provided with a stuffing box surrounding the tubular extension 24c of the piston and this stuffing box is filled with packing material 31 which is adapted to be compressed by the packing gland 32 attached to the end face of the cylinder, thus forming a fluid tight connection around the tubular extension 24c of the piston. A metal cap 24d closes the rear end of the piston 24 and extends over the end of the rod 17 and the nut 29. When the piston 24 is in its retracted position, as shown in Fig. 1, corresponding to the expanded condition of the core, a space 33 is provided between the cap 24d of the piston and the head 25d of the cylinder. This head has an inwardly extending flange 25e which fits within the cylinder and limits the rearward movement of the piston. Compressed air or the like is adapted to be admitted to the space 33 through a pipe 34 leading from an air compressor or the like and another supply pipe 35 is adapted to supply compressed air through a passage 25f in the front wall of the cylinder to the space between that front wall and the forward end of the piston 24. In order to insure an annular space between this end wall 25c of the cylinder and the adjacent end face of the piston, these parts are provided adjacent the extension 24c of the piston with annular projections 24f and 25g which are adapted to contact each other when the piston 24 is in its extreme forward position. The piston 24 is provided with an annular circumferential recess 24h occupied by a quantity of packing material 36 which provides a fluid tight connection between the piston and the surrounding wall of the cylinder.

By admitting compressed air or the like through the pipe 35 to the forward end of the cylinder 25, the piston 24 may be moved to the right as viewed in Fig. 1, thus expanding the segments of the core by the wedging action of the expanding member 13 upon the wedging surfaces 12e of the inner segments and the resulting wedging action of the surfaces 12b of the inner segments on the wedging surfaces 11b of the outer segments. When that condition is brought about, the outer surfaces 12a of the inner segments form continuations of the outer surfaces 11a of the outer segments so that a continuous cylindrical surface is formed to receive the winding of strip material 14. When a full coil of strip material has been formed, compressed air is admitted to the space 33 at the rear end of the cylinder through the pipe 34 and the piston 24 is then actuated to move the expanding member 13 toward the left to the position shown in Fig. 2 in which position the segments of the core are permitted to contract, as hereinafter described, by the relative sliding movements of the inner and outer segments upon each other and by the sliding of the inner segments upon the expanding member 13 so that the core is thereby contracted from the condition shown by dotted lines in Fig. 2 to the condition shown by full lines in that figure. During this contraction, the arms 11g of the outer segments are flexed about their resilient parts 11i and the outer projecting portions of the segments assume positions which are somewhat inclined toward the axis of the core, thus giving the core a slight taper toward its outer end which facilitates the removal of the coil of wound material.

The driving force for effecting the rotation of the core is applied to the outer segments adjacent the forward end of the housing 16 and this force is thus applied at a place which is in proximity to the region where the coil of strip material is wound on the core. For this purpose, a driving gear 40 is located in the forward end of the housing 16 with its annular flanges 40a and 40b journaled in ball bearing units 41 and 42, respectively, which are mounted at the inner margins of the flanges 16b and 16c which are formed on the housing 16 to extend radially inward from its outer wall. The flange 16b has an extension 16d provided with an annular groove in which is mounted a sealing ring 43, formed of felt or the like, by which the access of dust to the roller bearing unit 41 and to the interior of the housing is prevented. The driving gear 40 is provided on its outer side with teeth 40c which mesh with the teeth of the driving pinion 44, shown in Fig. 6, this pinion being secured upon a driving shaft 45. This shaft is adapted to be connected to an electric motor or other source of power by which the core may be rotated during the winding operation. In order to form a driving connection between the gear 40 and the outer segments of the core, the gear is provided on its inner side with a series of spaced teeth 40d which enter the notches 11j formed in the segments 11, these notches or recesses being located at the marginal edges of the segments with the two registering notches of two adjacent segments arranged to receive one of the teeth 40d. 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 longitudinal movements of the expanding member 13. The teeth 40d are tapered and have wedging engagements with the inclined sides of the notches 11j so that, when the core is expanded, the segments 11 and the ring gear 40 form, in effect, a unitary structure to which the driving force is applied. 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 reduced.

As heretofore stated, the movement of the rod 17 and of the expanding member 13 toward the left, as shown in Fig. 1, permits the segments of the core to be contracted inwardly to the contracted condition shown in Fig. 2. The contraction of the segments when the expanding member 13 is thus moved to its forward position is effected by fluid pressure mechanism which includes a series of cylinders 46 which extend radially inward from the outer wall of the housing 16 with their outer ends secured between the flanges 16c and another annular inwardly extending flange 16e which is formed on the inner wall of the housing. A series of cylindrical pistons 47 are mounted to reciprocate in these cylinders 46 and they have inner rounded ends 47a which are adapted to contact with the outer faces of the arms 11g of the outer segments 11 of the core. The outer ends of these cylinders are provided with a series of ports 46a having

connections with supply pipes 48a leading from an annular supply pipe 48 positioned within the housing 16 adjacent to the flange 16e. Compressed air or the like is adapted to be supplied to the pipe 48 through a supply pipe 49, shown in Fig. 7, and when compressed air or the like is admitted to the cylinder 25 for the purpose of moving the expanding member 13 to the position illustrated in Fig. 2, compressed air or the like is simultaneously admitted through the pipe 49 to the various cylinders 46 so that the pistons 47 are actuated to move the segments 11 inwardly as the expanding member 13 moves toward its forward position. As this action takes place, the wedging surfaces 11b on the outer segments 11 coact with the surfaces 12b on the inner segments to force these inner segments inwardly as permitted by the sliding of the surfaces 12e of the inner segments on the inclined wedging surfaces 13a and 13b of the expanding member. In order that the pistons 47 will occupy retracted positions out of contact with the segments during the rotation of the expanded core, a coil spring 50 is mounted in each cylinder 46 around the reduced middle portion of the piston. One end of the spring engages a shoulder of the piston and its other end engages a retaining ring 51 detachably mounted in the end of the cylinder so that the spring acts normally to retract the piston. The bore of each cylinder 46 is reduced at its outer end, thus limiting the outward movement of the piston and forming a chamber through which compressed air from one of the ports 46a is applied to the end of the piston.

Although one form of the invention has been shown by way of illustration, it will be understood that it may be constructed in various other embodiments coming within the scope of the appended claims.

I claim:

1. The combination in a winding reel, of a rotatable core comprising an annular series of segments, each segment being spaced from the adjacent segments and having inwardly converging wedging surfaces, an annular series of inner segments each having outwardly converging wedging surfaces coacting with two of said wedging surfaces formed on adjacent outer segments, an expanding member movable longitudinally of said core, said expanding member and said inner segments having coacting wedging surfaces inclined longitudinally of said core for moving said inner segments radially outward upon movement of said expanding member longitudinally in one direction, and fluid pressure operated means operating independently of said expanding member and engaging said outer segments for moving all of said segments radially inward upon movement of said expanding member longitudinally in the opposite direction.

2. The combination in a winding reel, of a core comprising a plurality of outer segments of substantial length mounted for angular radial movement about their inner ends, the outer end portions of said segments being adapted to receive a coil of strip material wound thereon, a series of inner segments extending along the coil receiving portion only of said outer segments and having wedging engagement with said outer end portions of said outer segments, and means engaging said inner segments for effecting the radial expansion of both series of segments.

3. The combination in a winding reel, of a core comprising a plurality of outer segments of substantial length mounted for angular radial movement about their inner ends, the outer end portions of said segments being adapted to receive a coil of strip material wound thereon, a series of inner segments extending along the coil receiving portion only of said outer segments having wedging engagement with said outer end portions of said outer segments, means engaging said inner segments for effecting the radial expansion of both series of segments, and means engaging said outer segments for effecting rotation of said core.

4. The combination in a winding reel, of a core comprising a plurality of outer segments of substantial length mounted for angular radial movement about their inner ends, the outer end portions of said segments being adapted to receive a coil of strip material wound thereon, a series of inner segments extending along the coil receiving portion only of said outer segments having wedging engagement with said outer end portions of said outer segments, means engaging said inner segments for effecting the radial expansion of both series of segments, means having a fixed position lengthwise of said core and engaging said outer segments for effecting radial inward movement of both series of segments, and means engaging said outer segments for effecting rotation of said core.

WILLIAM SCHROEDER.