

Aug. 5, 1952

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2,605,536

REEL

Filed July 12, 1947

5 Sheets-Sheet 1

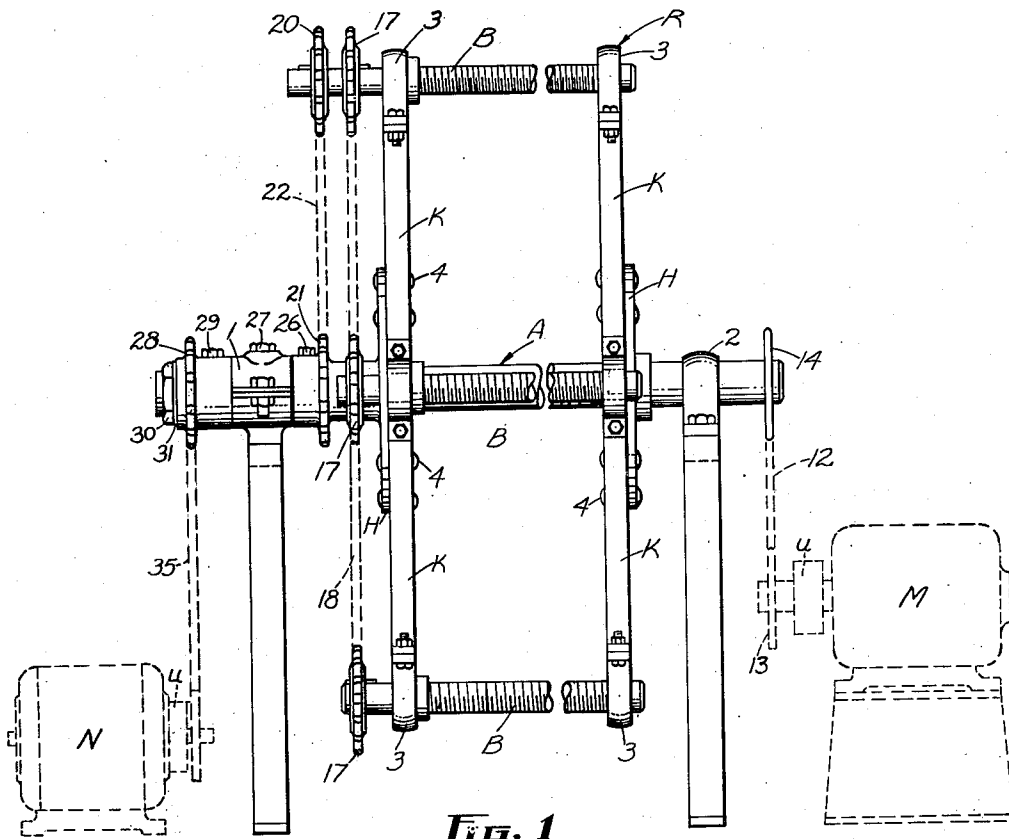


FIG. 1

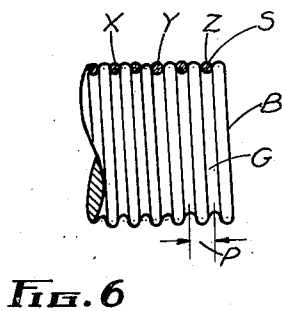


FIG. 6

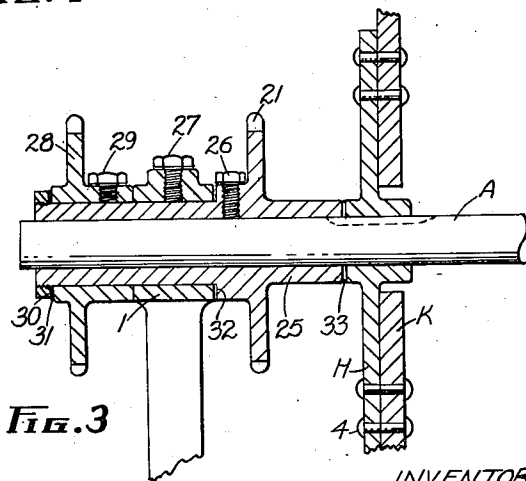


FIG. 3

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REEL

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5 Sheets-Sheet 2

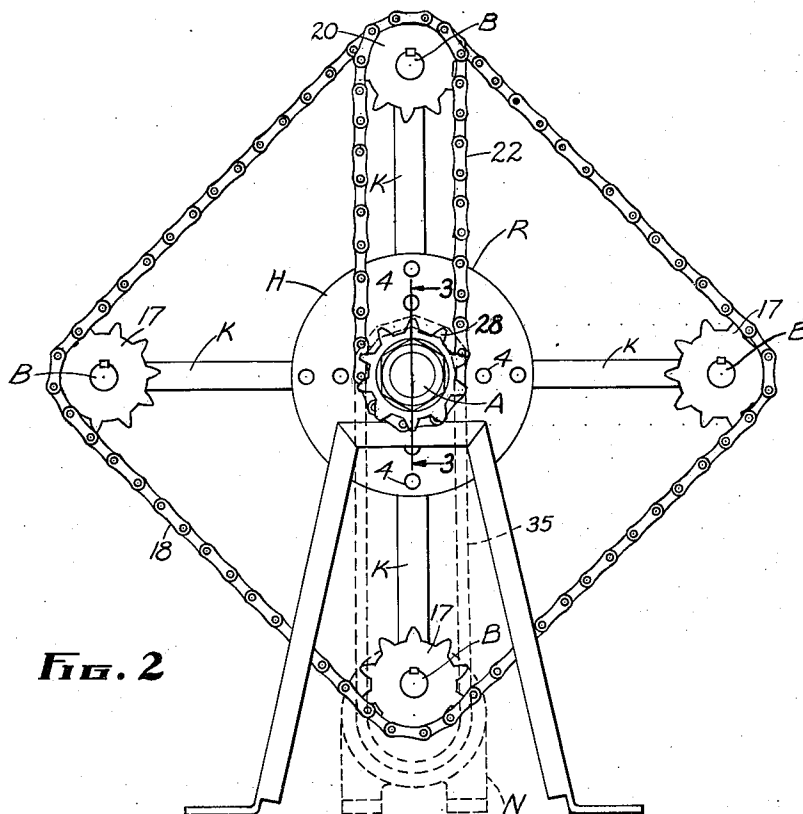


FIG. 2

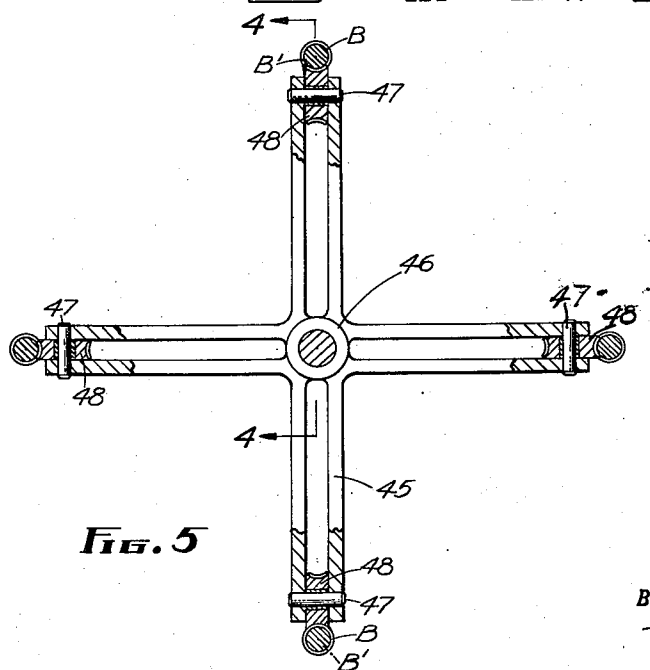


FIG. 5

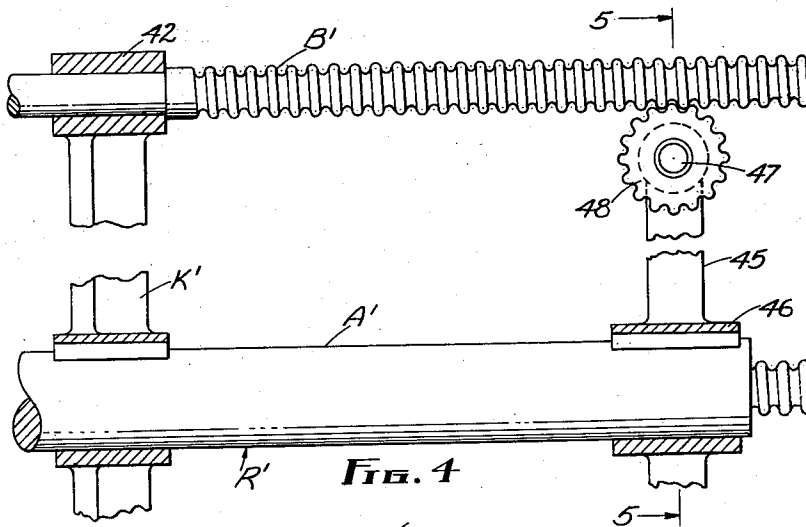
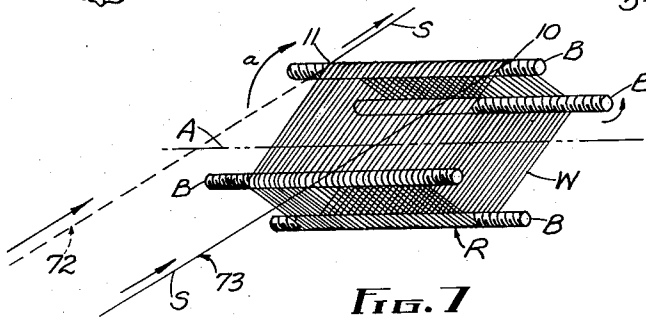
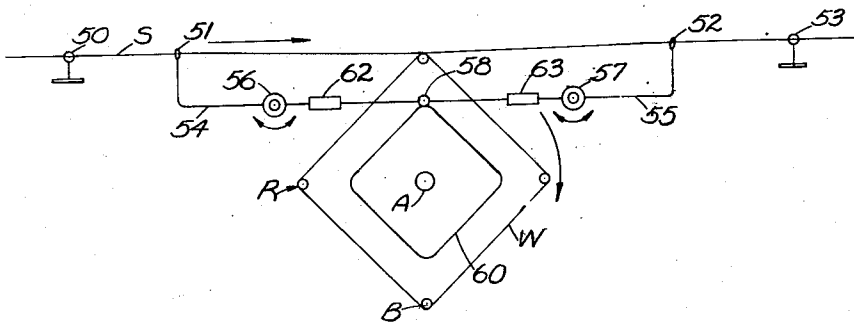
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5 Sheets-Sheet 3



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REEL

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5 Sheets-Sheet 4

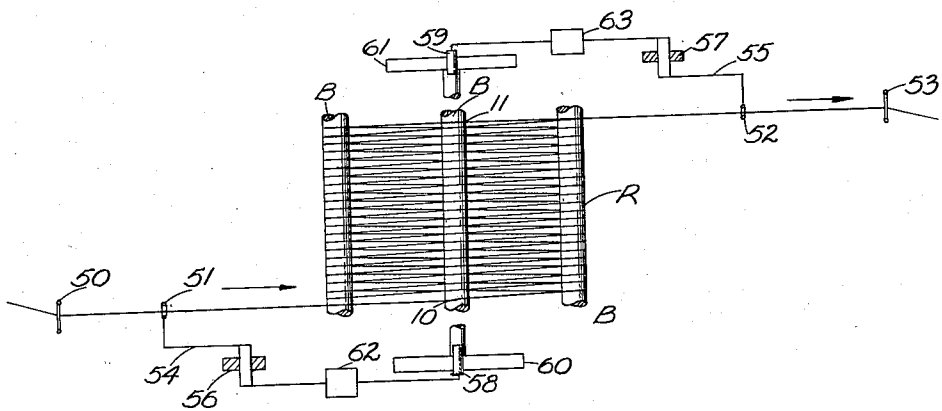


FIG. 9

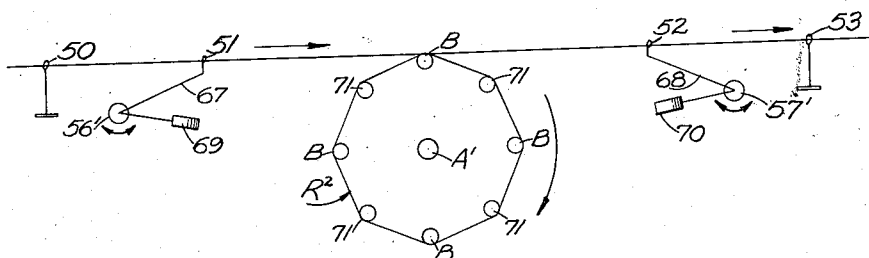


FIG. 10

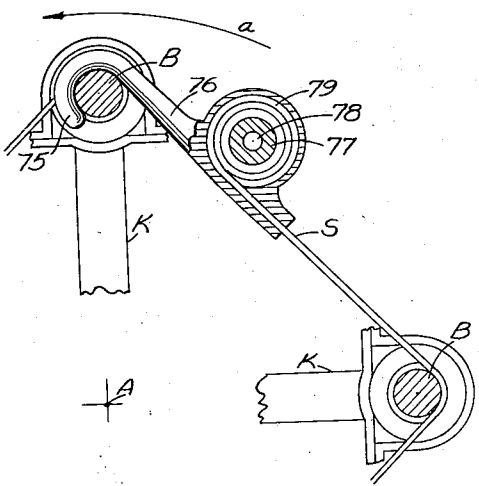


FIG. 11

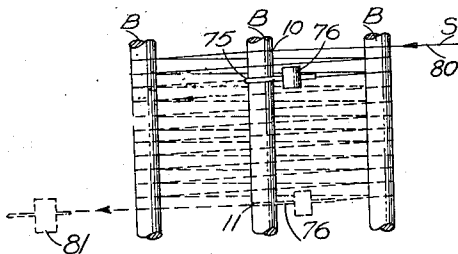


FIG. 12

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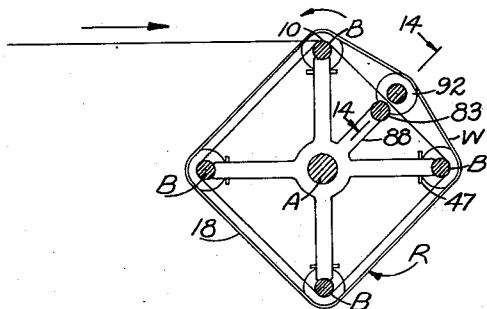


FIG. 13

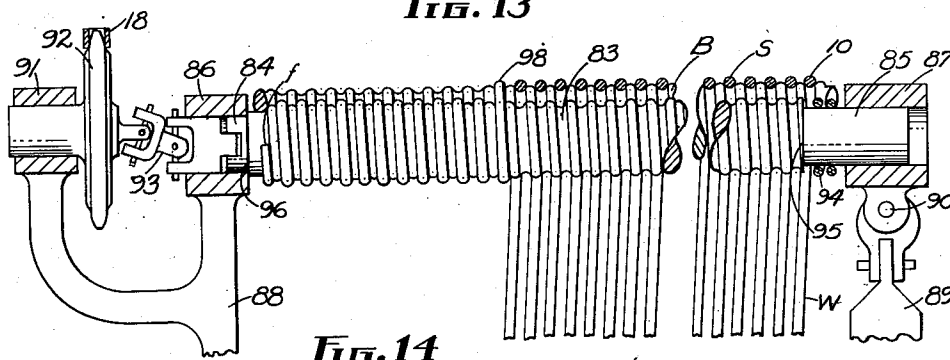


FIG. 14

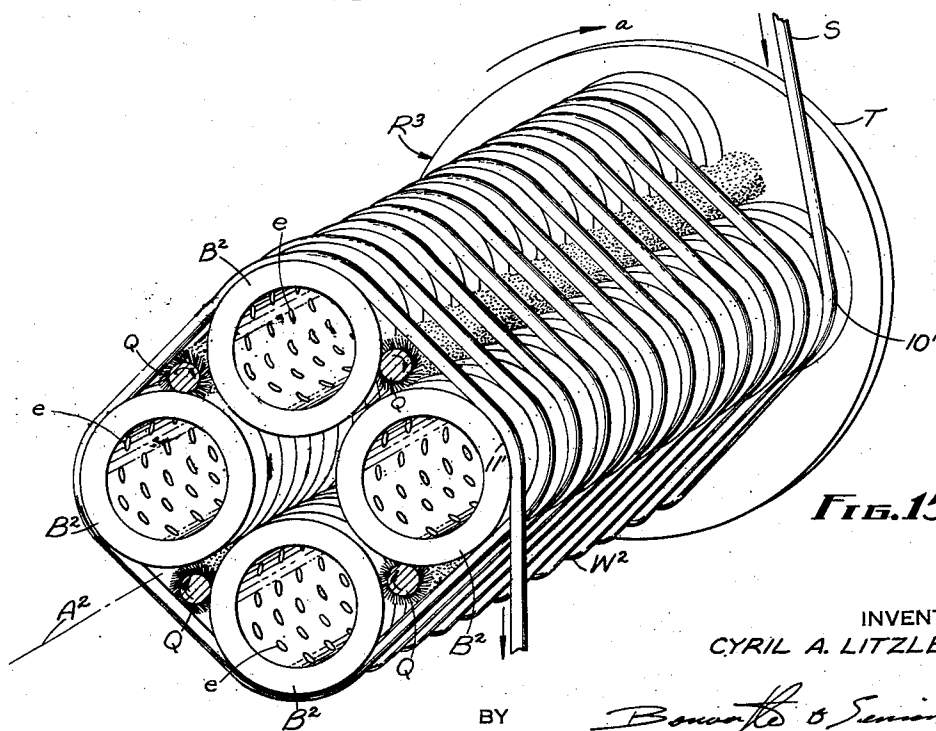


FIG. 15

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UNITED STATES PATENT OFFICE

2,605,536

REEL

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Application July 12, 1947, Serial No. 760,589

7 Claims. (Cl. 28—71.7)

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This invention relates to winding and reeling and more particularly to the improvements in thread or strand storage, strand advancing reels on which a strand or plurality of strands of any flexible material in the form of thread, yarn, string, cord, wire or strip may be continuously fed, stored, advanced and/or treated for such time and in such amount as may be desired, and from which reel the strand or strands, after desired storage and/or treatment, may be simultaneously and continuously unwound.

It is among the objects of my invention to provide an improved strand storage, strand advancing reel to which the strand may be continuously paid on and paid off and upon which a desired load or web or length of the strand may be continuously maintained for storage or treatment as may be desired. Another object of my invention is to provide such a reel comprised of simple, easily manufactured and assembled parts adapted to a long and useful life and adapted to a wide variety of applications and uses. Another object is to provide a continuous pay-on, pay-off reel that is capable of performing its strand storage, strand advancing function with equal or advantageous facility in substantially all manner of positions and conditions, whether its axis be vertical, inclined or horizontal; whether its load be subjected to heat or cold, or wetness or dryness, or submerged or partially submerged in liquids or other strand treating fluids. Another object is to provide a reel of the above mentioned type in which the locus of the load or web of strands on the reel may be moved without interrupting the continuous pay-on, pay-off, strand storage and advancing operation thereof; a reel which may be loaded with facility, operated at a wide range of speeds and in which the tension of the strand or strands on the reel may be varied and controlled. Another object of my invention is to provide a reel of the strand advancing, strand storage type having at least one screw threaded strand supporting reel bar, the rotation of which about its own axis may be determinably and adjustably related to the rotation of the reel. Another object of my invention is to provide a strand storage, strand advancing reel that will operate with the same or substantially the same efficiency on double or multiple strands as with single strands or may operate with strands or strips of a wide variety of flexible materials and cross-sectional shapes ranging from small diameter threads on the one hand to such things as continuous strips for Venetian blinds on the other hand.

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Another object of my invention is to provide continuous pay-on and pay-off reel having helically grooved strand supporting reel bars in which the web of strands on the reel is advanced axially and rotated about the reel axis at a greater or lesser speed than the rotation of the reel. Another object is to provide a continuous pay-on, pay-off reel for single or multiple strands in which the strands or convolutions of one or more strands may be desirably spaced on the reel to facilitate treatment thereof whether by the application of gases or liquids thereto or the removal therefrom. Another object of my invention is to provide a continuous pay-on, pay-off reel having screw threaded strand supporting surfaces which by their rotary and bodily movements admit continuous pay-on, pay-off strand storage, strand advancing operation.

Another object of my invention is to provide methods and means for loading a reel responding to the foregoing objects. Another object is to provide a self-loading and/or self-unloading strand storage, strand advancing reel of the continuous pay-on, pay-off type. A further object is to provide a loading device having a supply of or capacity for a leading portion of a strand which will compensate for relative movement between the load and the reel during loading thereof. Another object is to provide improved methods of storing, advancing, and handling strands for strand storage, strand advancing and related operations.

Other objects and advantages will appear from the following description of certain exemplary and preferred forms and embodiments of my invention reference being had to the accompanying drawings in which Figure 1 is a broken side elevation of one form of reel embodying my invention; Figure 2 is an end elevation of the reel of Figure 1; Figure 3 is a fragmentary longitudinal vertical section taken in the plane 3—3 of Figure 2; Figure 4 is a fragmentary longitudinal section of a cantilever form of a reel embodying my invention taken on the line 4—4 of Figure 5; Figure 5 is a transverse section of the reel of Figure 4 taken along the plane of the line 5—5 of Figure 4; Figure 6 is a side elevation of part of a threaded strand supporting reel bar; Figure 7 is a diagrammatic isometric view of the strand supporting reel bars in operative relation one to the other and with the strand supported thereupon; Figure 8 is a diagrammatic end elevation of a reel of my invention with one form of strand guiding and tensioning compensating means therefor; Figure 9 is a diagrammatic top plan

view of the parts shown in elevation in Figure 8; Figure 10 is a diagrammatic end elevation of a modified form of the embodiment of my invention illustrated in Figures 8 and 9; Figure 11 is a fragmentary transverse sectional view of a reel of my invention having one form of loading device operatively associated therewith; Figure 12 is a diagrammatic plan view of the type of reel shown in Figure 11, showing the relation of the loading device and the strand to the reel in different stages of and relating to the loading operation; Figure 13 is a diagrammatic transverse section of a form of reel embodying my invention and also embodying a threaded type loading device; Figure 14 is an enlarged fragmentary section taken in the plane of the line 14-14 of Figure 13, showing a removable threaded strand loading mechanism; Figure 15 is a perspective view of another cantilever form of my invention.

An exemplary embodiment of my invention is illustrated in part in Figures 1, 2 and 3 wherein a reel R is mounted for rotation about its axis A supported in suitable bearings 1 and 2; the reel in this form comprising four screw threaded reel bars B spaced at 90° angles from each other and extending parallel to and equidistant from the axis A of the reel and supported for rotation about their own axes in bearings 3 which bearings in turn are supported at the radially outward ends of spokes K, the inner ends of which are fixedly secured to the axis A as through hub plates H via rivets 4 or other positive means of attachment. As shown diagrammatically in Figure 7 the reel R having the direction of rotation as indicated by the arrow *a*, i. e., clockwise about its axis A as viewed from the right in Figure 7, receives a strand S as upon the uppermost of the reel bars B at the pay-on point 10 whence the strand passes in a substantially helical path around the several reel bars forming the load or web W on the reel and is led from the reel at the leftward end thereof as viewed, as from the pay-off point 11. Each of the reel bars B is externally screw threaded, i. e., contains a continuous helical external groove G, the radially outward disposed portions of which receive the strand S, see Figure 6, wherewith to guide and space the strands and to give the web of strands supported on the reel the desired axial motion wherewith to facilitate the continuous paying on to the reel and paying off from the reel without changing the locus of the web or load W axially of the reel. In the form shown in Figure 7, each of the reel bars is caused to rotate in a counterclockwise direction as viewed from the right in Figure 7, whilst the reel as a whole and the reel bars move bodily in a clockwise direction. When each reel bar makes one counterclockwise revolution for each clockwise revolution of the reel then as each bar comes up to the pay-on point 10 it will expose an unoccupied portion of its thread groove G to the paying-on portion of the strand S for the reception thereof. Then as the reel and the reel bars continue their simultaneous movement the web W of strands will have an axial movement leftward as viewed in Figure 7, at the rate of one pitch P, Figure 6, for each revolution of the reel and accompanying revolution of each of the reel bars. This axial movement of the web or load on the reel is accompanied by a relative circumferential movement of the web relative to the reel in a counterclockwise direction as viewed from the right in Figure 7, at a rate of movement which equals pi times the pitch diameter of the reel bars for each complete revolution thereof,

i. e., each complete revolution of the reel. The leftward movement of the web W, as viewed in Figure 7, maintains the pay-off point of the strand at the point 11 whence it follows that the reel embodying my invention admits of continuous pay on and continuous pay off at points substantially fixed in planes respectively normal to the axis of the reel throughout an endless and continuous operation at any speed that may be desired or found practicable. While Figure 7 suggests that the web W does not necessarily cover the whole length of the reel bars the extent to which the reel is loaded is a matter of choice to be more fully discussed below and the time that any given part of the strand is carried on the reel is a matter which can be readily determined for a reel of any given size by the speed of the reel and by the number of convolutions of the helix of the web W with which the reel is loaded.

Referring now again more particularly to Figures 1, 2 and 3, I show by way of illustration exemplary means by which the reel and the reel bars may be given desired and desirable movement and relative movements for the practice of my invention. Thus a main driving motor M may be connected to the rightward end of the axis A of the reel as through a chain or belt 12 and driving and driven sprockets or pulleys 13 and 14 wherewith to give the reel its desired movement of rotation about its own axis. In this exemplary drawing of my invention each of the reel bars B has fixedly secured to its leftwardly extending journaled end a driving sprocket 17 through which rotation of the reel bar about its own axis is induced or restrained as may be desired. As shown in Figure 2, a continuous chain 18 passes over each of the sprockets 17, and each of the sprockets 17 having the same number of teeth, the chain 18 controls their like and simultaneous rotation about their own axes.

In securing the sprockets 17 to the several reel bars and in securing the chain 18 to the several sprockets it is desirable to have the reel bars properly angularly related to each other in respect to the threaded surfaces thereof. That is to say, the thread of each reel bar, where four threaded reel bars are employed equally spaced about the periphery of the reel, should preferably be 90° out of phase with respect to the adjacent bars circumferentially ahead and behind it. In this way each reel bar will in turn squarely present the groove of its thread to the strand feeding onto the reel at the pay-on point, for example, in the same plane normal to the axis of the reel. Preferably the reel bars have their threads of the same root diameter when rotating at the same speeds so that the web of strands supported on the several bars will have rolling contact with all the bars rather than part rolling and part slipping contact with any of them, albeit if a burnishing of the strands were desired as by a slipping contact between the web and one or more of the reel bars such an effect could be so obtained. It may be mentioned in this connection, however, that the axial movement of all the thread supporting grooves which support the same strand or the same helical convolution of a strand, should be at the same rate to avoid distortion of the strand or convolution or the rupture thereof. For example, if it were desired to have reel bars of different diameter without slippage of the web on the bars and without distorting the convolution of the helix of the web; then a bar with one inch root diameter threads with 20 threads per inch might be run at twice the speed of rotation

of the reel while a circumferentially adjacent bar of two inch root diameter threads would have but 10 threads per inch and would be rotated at the same speed of reel rotation.

One of the reel bars B, the upper one, as shown in Figures 1 and 2, has its journaled end extended wherewith to carry a second sprocket 20 fixedly secured thereon or keyed thereto through which this reel bar directly, and the other reel bars indirectly through the chain 18, are given their rotation or are restrained from rotation. A sprocket 21, see also Figure 3, is connected with a sprocket 20 by a chain 22 wherewith to transmit force and motion from the former to the latter. As shown in Figure 3 the sprocket 21 preferably has a widely elongated hub 25 within which the axis A is freely rotatable and to which the sprocket 21 may be secured for rotation therewith as by a set screw 26. The hub 25 passes through the bearing 1 and is rotatably supported therein and when desired may be held against rotation therein by appropriate adjustment of the set screw 27. The hub 25 of the sprocket 21 also extends through the hub of a driving sprocket 28 which in turn may be secured in driving relation therewith or released from driving relation therefrom by a set screw 29. A nut 30 threaded onto the end of the hub 25 with a thrust washer 31 secures the assembly of the parts, drawing the shoulder 32 of the hub against the end of the bearing 1 wherewith to keep the parts in alignment. A thrust washer 33 may be interposed between the rightward end of the hub 25 and the juxtaposed end of the reel hub H.

When it is desired that the sprocket 21 rotate with the axis A of the reel the former is secured to the latter as by adjustment of the set screw 26; the set screws 27 and 29 being backed off to give the sprocket freedom of rotation in the bearing 1 and preferably freedom of rotation with respect to the driving sprocket 28. In this condition the reel bars B will be held against rotation about their own axes while the reel rotates about the axis of the shaft A. Such a condition may be employed for one manner of loading the reel as will be discussed more fully below.

With the set screws 26 and 29 backed off and the set screw 27 screwed down to hold the sprocket 21 against rotation, the rotation of the reel will induce rotation of the reel bars about their own axes after the manner of planet gears in an epicyclic train under the influence of the chains 18 and 22. More specifically if the sprockets 17, 20 and 21 are of the same size, i. e., of the same pitch diameter with the same number of teeth, each of the reel bars B will be induced to turn one complete revolution for each complete revolution of the reel; the reel bars taking a direction of rotation opposite to that of the reel. Securing the driving sprocket 28 to the sprocket 21 as by the screw 29, while releasing the sprocket 21 from engagement with the axis A and the bearing 1, permits the sprocket 21 and the reel bars B to be driven independently of the reel or the axis thereof as by the auxiliary motor N through the belt or chain drive 35 connecting the motor and the sprocket 28. Preferably the motors M and N are adequately provided with speed controlling and synchronizing means, not shown, through which any desired speed relationship between the reels and the reel bars can be established, modified or maintained as may be desired. Reverse gearing U shown diagrammatically with each of the motors M

and N is also preferably provided wherewith the relative direction of rotation of the reel with respect to the reel bars may also be controlled.

Referring back to the condition in which the sprocket 21 is held against rotation and disconnected from both the axis A and the driving sprocket 28 it will be appreciated that I do not necessarily limit myself to the choice of sprockets which give the same speed of rotation to the reel and reel bars. For example when it is desired to have the reel bars rotate at twice the speed of rotation of the reel and in the opposite direction of rotation with respect thereto one may substitute for the sprocket 21 a sprocket of twice the pitch diameter and twice the number of teeth, substituting also an appropriately lengthened chain 22 whereupon the reel bars will be caused to rotate two revolutions for each revolution of the reel and in the opposite direction with respect thereto. As will more fully appear below it may well be desirable to have the reel bars rotate in the same direction as the direction of rotation of the reel without recourse to driving the reel bars by the auxiliary motor N. To this end it is practicable to substitute for the sprocket 21 a sun gear meshing with a planet gear, the latter being substituted for the sprocket 20. Thereupon when the sun gear is held against rotation as by such means as have been suggested above and the reel is rotated, the planet gear will induce rotation of the reel bars in the same direction as the direction of rotation of the reel, and if the gears be of the same pitch diameter the speed of rotation of the reel bars will be the same as the speed of rotation of the reel. The art of planetary gearing is well enough understood so that I need not elaborate upon the means by which other speeds and directions of rotation can be established and maintained by the substitution of appropriate gear trains for the planetary and sun gears whether geared together directly or through idlers. Similarly my specific illustration of and reference to the means characterized by the set screws 26, 27 and 28 for selectively engaging or disengaging the sprocket 21 or planetary gear with or from the axis, the bearing, or the auxiliary driving means should not be taken as a teaching excluding the use of well-known and more appropriate engaging and disengaging mechanisms such as clutches, brakes and the like for carrying out the principles of my invention.

In the embodiment of my invention shown in Figures 1 and 2, the reel bars B are supported at both ends as is useful for many purposes. However my invention readily adapts itself to cantilever form as suggested in Figure 4 wherein the reel axis A' would have its cantilever supporting bearings, not shown, to the left as viewed of the reenforced spokes K'; the reel bars B being journaled preferably in appropriate elongated bearings 42 at their leftward end as viewed in Figure 4. In this form of my invention the reel axis A' would be driven from its extreme leftward end and the reel bar driving mechanism would be preferably disposed and arranged in substantially the same way that it is illustrated and described with reference to Figures 1 and 2. In the cantilever form of my invention it may well be desired to have the pay-on point for the strand of the reel adjacent the bearing end thereof, i. e., the leftward end as viewed in Figures 4 and 7, with the pay-off point of the reel at the rightward or unsupported end of the reel wherewith the pay off may take place automati-

cally by virtue of the strand being dispensed from the extreme end of the threaded groove of one of the reel bars. When free pay off is contemplated at the unsupported end of a cantilever reel it may well be advantageous to shave off the last turn or two of the threads to permit the strand to rest on an unthreaded part of the reel bar for at least a fraction of a revolution to facilitate a gravity pay off at a point which might not necessarily coincide with the exact end of the helical groove of a thread bar. Changing the direction of movement of the strands on the reel incident to paying on or paying off from one end or another of the reel will depend on the "hand" of the threads of the reel bars, the direction of rotation of the reel bars and the direction of rotation of the reel as will be more fully explained below.

My invention lends itself to the cantilever form by virtue of the peculiar facility with which the screw threaded reel bars may be supported other than at the journaled ends thereof. As shown in Figures 4 and 5, I provide a spider 45, the hub 46 of which is fixedly secured to the axis of the reel and the arms of which extend toward and proximate to the reel bars. Pivottally supported on axes 47 which lie transversely of the planes that are determined by the axis of each reel bar and the axis of the reel are mounted for free rotation worm wheels 48 which mesh with the threads B' on reel bars B as if the bars were the worm elements of a worm drive; the teeth of the worm wheels 48 being shaped to have smooth and wide bearing engagement with the threads of the reel bars wherewith to support them radially of the reel and also to extend in a peripheral direction of the reel bars for such a substantial distance as to steady the bars against circumferential movement relative to the supporting spider 45. Preferably the worm wheels or at least the tooth portion thereof are made of low friction material in respect to the material of the reel bars wherewith to have a self-lubricating relation therewith. Where the reel bars are made of steel it may well be practicable to employ graphite bronze worm wheels wherewith to obtain a self-lubricating engagement. The spider 45 with its worm wheels 48 may also be advantageously employed in the form of reels shown in Figures 1 and 2 to support middle portions of the reel bars B where the same by virtue of their length, strength and diameter in relation to the load and tension of the strand on the reel needs support in addition to the support of their end bearings. Similarly whether my reel takes the form in which the reel bars are journaled, Figure 1, at both ends or are journaled in cantilever fashion only at one end, Figure 4, any desired number of supporting spiders 45 with their worm wheels for engagement with the reel bars may be provided along the axis of the reel for supporting the bars at any desired plurality of points where support may be employed advantageously.

Another cantilever form in which my invention may be embodied is shown in perspective in Figure 15 wherein the threaded reel bars B2 may be supported in cantilever bearings, not shown, in or behind, as viewed, the plate T which with appropriate driving mechanism similar to that hereinabove described comprises the reel R3. In this form I prefer that the reel bars B2 be large with respect to the size of the reel and preferably be hollow wherewith to admit the ingress or egress of treating fluids or gases that they may pass transversely through the walls of the

hollow reel bars through appropriate apertures *e.* Piping, spray heads or the like, not shown, may be disposed in the central space along the axis A2 between the bars to conduct treating fluids to or from the web or strands on the reel. In this form the axis of rotation A2 of the reel R3 takes no tangible form in the neighborhood of the strand supporting portions of the reel bars B2 but may and appropriately should take tangible form rearwardly of the plate T to facilitate the driving and rotatable mounting of the reel as a whole. In this form of my invention I prefer that when the reel rotates clockwise, as viewed in Figure 15, see arrow *a*, about its axis A2 each of the reel bars will rotate counterclockwise about its own axis. I prefer also that the hand of the threads of the reel bars be such that the strand S being paid on at the point 10' will be advanced into the helical convolutions of the web W2 and, if desired, may pay off by gravity at or adjacent the pay-off point 11'. In this form of my invention the reel may be self-loading particularly if the strand S is wet or otherwise adhesive to the reel bars so that if the free end of the strand is lowered by gravity toward the reel from a point approximately above the axis A2 it will be carried by movement of the reel and reel bars through a self-loading operation until the free end of the strand passes the free ends of the reel bars whence, as suggested above, it may pay off by gravity if that be desired. My reel in this form may have especial utility where self-loading strand storage, strand advancing reels are employed in the treatment incident to the manufacture of synthetic threads or yarns and where the wetness of the strand facilitates the adherence of the leading free end of the strand to the reel. The negative direction of rotation of the reel bars with respect to the positive direction of rotation of the reel facilitates self-loading because the leading end of the strand will tend to adhere to the first exposed portion of the thread of the bar that it first contacts wherewith to begin the paying-on operation, leading the next adjacent portion of the leading end of the strand into contact with the next following reel bar and so on whilst the helical convolutions of the web take form on the reel and are advanced as above described, clearing the pay-on point for accretion to the load. The web of the load including the leading end of the strand will move relative to the axes of the reel bars contrary to the direction of rotation of the reel from one reel bar to another so that the leading end of the strand will be drawn rearwardly of itself from one reel bar to the other, never tending to wrap around any one reel bar because whenever the leading end of the strand is passed from contact with one reel bar it is directly and continuously drawn back onto the following bar.

Where it is desired to advance the strand more rapidly with respect to the speed of rotation of the reel about its own axis as by rotating the reel bars in the same direction as the direction of rotation of the reel then I prefer to provide rotary brushes Q mounted for rotation in the plate T and rotating in the same direction of rotation as the reel bars with which the brushes have contact so that the bristles of the brushes will enter the grooves of the screw thread on the reel bars preventing the leading end of the strand from adhering to the bars beyond the lines of contact with the brushes so that the leading end of the strand is passed from one bar to another to facilitate a self-loading operation. The

brushes Q underlie the web W2 of strands on the reel and are out of contact therewith unless brushing the strands is desired for its own sake.

As shown in the diagrammatic view of Figure 8 when a reel embodying my invention employs but four small diameter reel bars widely spaced the web W of the strands on the reel takes a substantially square form in the plane transverse the axis of the reel as shown in Figure 8, with the result that when the reel is rotated at a uniform velocity of rotation the speed of the strand paying on to and paying off from the reel will vary, rising to a maximum and declining to a minimum four times each revolution. While I am aware that thread or strand tensioning devices have been used for the purpose of maintaining substantially constant tension as against varying velocities of lineal movement I prefer to maintain substantially constant velocity of lineal movement of the strand to and from the reel by specific means shown in Figures 8 and 9. To that end the strand is fed through a fixed eyelet 50 from its source of supply, not shown, thence through a movable eyelet 51, thence to the reel R and is led from the reel R through the movable eyelet 52 and then through a fixed eyelet 53 to the place of consumption or collection of the strand. As shown in Figure 9, I prefer that the eyelets 50 and 51 lie in and/or move in the plane of the pay-on point 10 that is transverse to the axis of the reel and that the eyelets 52 and 53 move in and lie respectively in the plane transverse to the axis of the reel which includes the pay-off point 11. Each of the movable eyelets 51 and 52 are preferably supported at the ends of arms 54 and 55 respectively, which arms are mounted on fixed pivotal supports 56 and 57 wherewith the swinging of the arms about the pivot points raises and lowers the eyelets 51 and 52 wherewith to modify the lineal distance between the points of contact between the strand and reel and the fixed eyelets 50 and 53 respectively. To effect the swinging movement of the arms 54 and 55 their inner ends are preferably provided with cam engaging rollers 58 and 59 which are induced to follow the cams 60 and 61 under the influence of weights 62 and 63 respectively so that the raising and lowering of the eyelets 51 and 52, as viewed in Figure 8, is controlled by the contour of the cams 60 and 61; the contour of which being not necessarily accurately presented in the diagrammatic view of Figure 8 is shaped for the purpose above stated and gives the result of a substantially constant lineal speed and tension to the strand as through the fixed eyelets 50 and 53 by virtue of its balancing out the inherent tendency of the reel to induce a variable lineal speed to the strand as the latter comes to and departs from the reel.

Alternatively I contemplate that substantially constant lineal speed and tension may be maintained in the strand being paid on and off my reel by increasing the number of reel bars as shown in Figure 10 with or without the provision of means not shown for inducing a desirable and compensating variable angular velocity in the rotation of the reel axis. As suggested in Figure 10 the employment of 8 instead of 4 reel bars in the reel R2 will of itself very much reduce the variations in lineal speed of the strand under conditions of maintenance of constant tension therein for geometric reasons well appreciated, and in such event I have found it practicable to bring the strand in through the eyelet 50 to the movable eyelet 51 thence onto and

off the reel through the movable eyelet 52 and fixed eyelet 53, but in this instance the movable eyelets 51 and 52 are supported on arms 67 and 68 which are pivoted about fixed points 56' and 57' and carry counterweights 69 and 70 tending to hold the eyelets 51 and 52 downwardly thereby stressing the strand to impose a desirable tension and at the same time tending to modify the length of strand between the pay-off and pay-on points respectively and the fixed eyelets 50 and 53 in a manner to preserve constant or substantially constant lineal speed and tension in the strand. In the form of reel R2 shown in Figure 10 all the reel bars may be identical or substantially identical with the screw threaded bars B or some of the reel bars may be externally screw threaded to correspond with the bars B and some of the bars may have smooth cylindrical exteriors throughout the portions which contact and support the web of the strands. In a reel employing 8 reel bars, as suggested in Figure 10, I prefer that alternate bars B correspond exactly to the bars B, as shown in Figures 1 and 6, when the non-cantilever form of reel is employed, and the bars 71 have merely smooth cylindrical external surfaces. In such a construction I prefer that the reel bars 71 have their smooth external surface formed on a diameter substantially corresponding to the root diameter of the threads of the reel bar B, that the axes of the bars 71 be spaced the same distance from the axis A' of the reel as are the axes of the bars B, and that the smooth bars 71 be supported for free rotation about their own axes as the same may be induced by contact with the web of the strands which bear thereupon. It is not without the teaching of my invention, however, that the bars 71 be held against rotation about their own axes particularly if their strand supporting surfaces are smooth and polished wherewith to permit the web of strands supported thereupon to have smooth substantially frictionless sliding movement thereover as the latter is induced by rotation of the threaded reel bars 8.

In the operation of my reel reference has been made above to the direction of rotation of the reel bars with respect to the "hand" of the threads and the direction of rotation of the reel as the same influence the movement of the web of the helix of the strands on the reel and the relative positions of the pay-on and pay-off points. In the example shown in Figure 7 with the reel rotating clockwise and the reel bars rotating counterclockwise as viewed from the right, and the pay-on point 10 rightwardly of the pay-off point 11, reel bars having right-hand threads induce the web W to move leftwardly as mentioned above. It follows, therefore, as a first variant that were all other factors kept the same that changing the "hand" of the thread from right-hand to left-hand would induce the web W to move from left to right as viewed in Figure 7, wherefore it would follow that the strand should be paid on at the leftward end of the reel and paid off from the reel at the rightward end.

A further variant of the situation described with reference to Figure 7 has to do with the direction of rotation of the reel bars. Assuming that the situation shown in Figure 7 as first above described with clockwise rotation of the reel but with clockwise rotation of the reel bars then if the reel bars have right-hand threads the strands of the web W on the reel will be moved from left to right wherewith the strands should be paid on at the left end of the reel and paid off at

the right end. When the reel bars have the same direction of rotation as the reel the web on the reel will advance faster than the peripheral speed of the reel since for each revolution of the bars the web will be advanced on the reel and in reference to the reel a circumferential distance equal to approximately pi times the root diameter of the threads on the bars B upon which the strands are supported.

In considering the operation of the reel of my invention not only the direction of rotation of the reel bars and the "hand" of the threads thereupon is to be considered but also consideration should be given to the advantageous results that may be obtained from modifying the speed of rotation of the reel bars with respect to the speed of rotation of the reel. Thus if the reel in an installation as above described with reference to Figure 7 is operated with a single strand but with the reel bars rotating at twice the speed of the speed of rotation of the reel then only alternate thread grooves will receive the strand as at X, Y and Z in Figure 6, whereby the pitch of the helix of the web W will be doubled. Similarly both the axial and circumferential movement of the continuous helical strands constituting the web will be doubled in relation to the speed of rotation of the reel, the spacing between adjacent lengths of the strand in the web will be substantially doubled, the load on the reel for the same overall axial length of the web will be reduced substantially in half and the time that the strand will lie upon the reel for a given speed of rotation of the reel will be reduced approximately by half. Similarly when threaded reel bars such as those above described having single-thread screws as shown in Figure 6, with both lead and pitch equal to P as shown, are rotated at twice the speed of rotation of the reel, double strands side by side can be paid on, stored, and advanced and paid off from the reel with the same facility of operation described for the single strand. In such a double strand operation all of the radially outwardly disposed portions of the helical grooves of the threads of the reel bars will be occupied. The reel will be fully loaded, but for a given speed of rotation of the reel the load will only remain on the reel for approximately half the time that it would have remained had the reel been fully loaded with the reel bars rotating at the same speed as the speed of rotation of the reel. That is to say, the pitch of the substantially helical path of the strand on the reel can be conveniently modified by modification of the speed of rotation of the reel bars about their own axis relative to the speed of rotation of the bars about the axis of the reel, i. e., relative to the speed of rotation of the reel.

My teaching is not limited to the employment of single thread screws in the surfaces of the threaded reel bars since the utility of double or multiple thread screws, especially for handling double or multiple strand operations will be appreciated in view of the principles above discussed and the general principles and advantages of my invention. For example double thread screws employed on reel bars running at the same speed of rotation as the speed of rotation of the reel will give the same increased rate of axial movement to the strands of the web as the single thread bars running at twice the speed of rotation of the reel but will impart to the strands constituting the web only the same circumferential movement relative to the reel as is imparted thereto by the rotation of any reel bar

whose speed of rotation is equal to the speed of rotation of the reel.

Variations in the speed of rotation of the reel bars with respect to the speed of rotation of the reel other than in the integral multiples above mentioned will have the effect of changing the axial location or the axial locus of the load on the reel including the locus of the pay-on and pay-off points. For example in the first above described operation of the reel of Figure 7 with single thread right-hand screws formed on the reel bars and the reel bars rotating counterclockwise at the same speed of rotation that the reel rotates clockwise if the speed of the reel bars were reduced down to 80% the speed of rotation of the reel, as by control through the auxiliary motor N etc., then correspondingly the axial movement of the helical convolutions of the web W would be reduced whereby the locus of the web W would shift from left to right shifting the pay-on and pay-off points 10 and 11 correspondingly. It also follows that if it were desired to shift the locus of the web leftwardly that the same would result by increasing the speed of rotation of the reel bars above that speed at which the locus of the web is held in an axially fixed position.

The locus of the web will continue to shift position, so long as the speed of the bars remains at the non-integral value and will ultimately leave the reel or jam up at the ends. In order to maintain the locus at the desired position the speed should be restored to its normal value. The utility of this ability to shift the locus of the web might be illustrated by the example of a vertical cantilever reel substantially one half of which including the free end thereof is immersed in a treating liquid. The reel may be conveniently and easily loaded and the web formed on the upper half of the reel which is exposed to the open air; the speed of the bars may then be varied as described above to move the locus of the web onto the submerged half of the reel with the pay-off point located just at the surface of the liquid. The speed may then be restored to normal operating speed with the result that the web will be maintained in submerged position. If for any reason it should be desired to temporarily stop the operation, the web can be shifted clear of the liquid in the manner described and the reel then halted, leaving the web free from the action of the liquid which otherwise might have a harmful effect on the web.

My teaching is not necessarily limited to the positive driving and rotation of the reel bars as by the sprockets 17 and chain 18 etc. for strand storage, strand advancing operation since it is not impracticable under some conditions including those to be mentioned below to operate my reel satisfactorily with the reel bars supported for free rotation about their own axes. Referring for example to Figure 7, if the reel as therein first described is rotated about its own axis in a clockwise direction as viewed from the right, the reel bars being free from the driving or restraining mechanism whereby to be freely rotatable about their own axes, and the reel being loaded as suggested in Figure 7, then if the reel be rotated about its own axis the web W of the strand on the reel may be induced to move with respect to the reel and the axes of the reel bars by control of the relative tension in the portions of the strand leading to and leading from the reel respectively. If the reel bars be so threaded that

negative movement of them with respect to the reel will advance the web from the pay-on to the pay-off point then a controlled tension in the portion of the strand leading to the pay-on point in excess of the tension in the portion of the strand leading away from the pay-off point such as to induce negative rotation of the reel bars about their own axes at the speed required to facilitate the operations above described will produce the desired strand storage, strand advancing operation of the reel. Similarly if the threads of the reel bars be such that the desired movement of the web axially of the reel requires that the web advance circumferentially with respect to the reel in the direction of reel rotation then a proper excess of tension in the strand leading away from the reel with respect to the tension in the strand leading to the reel may be availed of to provide the necessary rotation of the reel bars about their own axes. As presently advised this mode of operation appears to have a limit of practicability at the point where the tensions required to rotate the bars via the strand would exceed the tensions that may be advantageously or desirably imposed hereupon.

Another mode of operating my reel, or a plurality thereof in series, which may be mentioned as a practical variant of one of the modes first above described is that the reel or one or more of a series of reels be given its or their bodily rotation about its or their own axis or axes essentially or in part through the tension in the strand leading from one or more of the reels as distinguished from driving the reel or all the reels in a series about its or their own axes by the motor M or similar motors for each reel in a series. In such a circumstance it is entirely practicable to cause the reel bars to have a certain speed of rotation about their own axes relative to the speed of rotation of the reel or reels about its axis or their axes, as for example by securing the sprockets 24 of all such reels against rotation whereby to facilitate the desired axial and circumferential movement of the convolutions of the helix of the web with respect to the reel or reels while the same and the rotation of the reels and reel bars are induced wholly or partly by tension in the payed-off strand. Again the desirability and practicability of working the reel or reels wholly or partly through tension in the strand may well be governed by the nature of the strand, the number of reels in a series and the desirability of imposing the necessary tension upon the strand at some or all parts of its length or condition.

While it is suggested in Figure 6 that the width of the thread grooves be equal to about half the pitch of the threads more or less according to known thread forming practice, I do not limit myself to the conventional thread forms, but contemplate that both the forms of the threads with respect to their roundness or angledness as well as with respect to the relation of the width of the groove to the pitch thereof may be conveniently, advantageously and judiciously selected according to the needs and purposes to which my invention is put. For example, if it be desired to use my reel for the purpose of drying strands it would ordinarily be advantageous to space the strands more widely wherewith to permit the circulation of air or gases therebetween than might be the case if it were desired to wet the strands as by partial or total submergence of the web in a fluid or liquid wetting agent. Similarly considerations of design will guide one skilled in the art in his choice of the diametrical size of reel

bars not only with regard to the desired strength thereof but also with regard to the receptivity of the radially outwardly disposed portions of the thread grooves to the strands. For example, if it were desired to support but three strands per inch and the strands were but an eighth inch in diameter then a screw thread of such high pitch with its thread grooves approximately an eighth inch in width would but poorly receive the strands especially where the pitch of the helix of the web is the same as the pitch of the screw and the screw is of small pitch diameter such for example as three-fourths inch. Under such circumstances the strand receiving portion of the thread groove might well receive the strand more satisfactorily if the screw were two or three inches in diameter.

My invention also lends itself with peculiar advantage to the control of the tension of the strands in the web that comprise the load on the reel during the path of movement of the strand on the reel from the pay-on to the pay-off point. This has especial utility where the treatment of the strand while it is stored on the reel involves or may advantageously provide either a shrinkage or stretching of the strand. Where for example it is desired that the strand be shrunk during its treatment on the reel then it is eminently practicable in my invention to employ tapered threaded reel bars having decreasing pitch diameter from or adjacent the pay-on point to or adjacent the pay-off point. Such reel bars mounted with their axes parallel to the axis of the reel and otherwise similar to the threaded reel bars above discussed and employed in reels similarly operated will define the helix of the web with the turns of the helix of greater length at the pay-on point than the length of the turns at the pay-off point wherewith the shrinking strand may be maintained under a substantially constant or desirably variable tension during the time it is stored and advanced on the reel and will be free from any deleterious tendency to slip or bind with respect to the points or areas upon which it is supported on the reel. Conversely when it is desired to stretch or accommodate for stretching of the strand supported on the reel the pitch diameter of the screw thread form of the reel bars may be correspondingly or appropriately increased in the direction from the pay-on point to the pay-off point of the reel. I am not unaware that a desirable change in the relative length of the turns of the helix of the web might also be affected by permanently, adjustably or yieldingly inclining the axes of the reel bars with respect to the axis of the reel and in the plane thereof, regard being had for a corresponding modification of the driving mechanism as by the employment of angled drives or universal joints between the ends of the reel bar journals and the driving gears or sprockets associated therewith.

One of the advantages of my invention is that the strand or strands are supported on the reel and/or make contact therewith in the groove of the threaded reel bar or bars which taken with the tension in the strand or strands locates and/or secures the load or web of strands against undesirable shifting movement on the reel. Therefore a reel embodying my invention lends itself to employment in substantially any position as with its axis horizontal, vertical or inclined from the vertical. Especially when my reel takes cantilever form as shown in Figures 4 and 15 its free, i. e. unsupported end, may when desired

be immersed with its axis vertical submerging all or part of the load supporting portions of the reel and reel bars into liquid with which it may be desired to treat the strand.

Loading the reel is preferably accomplished in ways wherein the principles of my invention are most fully enjoyed.

One practicable method of loading my reel is suggested above with especial reference to Figure 15, wherein the adherence of the leading end of the strand being paid onto the reel is taken advantage of whereby to induce the strand to be led to form the helical convolutions of the web by its adherence to a first and to succeeding reel bars, while both the reel and the bars are being rotated about their respective axes as in the normal or intended strand storage, strand advancing operation. With reels of the forms more specifically suggested in Figures 1, 2, 4 and 7 wherein the reel bars are of small diameter with respect to the space between them adhesive loading tends to be encumbered by reason of the length of strand that may dangle between bars. Having regard however for the greater facility afforded by closely spaced reel bars and particularly in the forms wherein the reel bars are rotated on their own axes in a direction opposite the the direction of rotation of the reel, it is practicable and often desirable to load the reel by adhesion of at least a leading portion of the strand longer than the peripheral spacing between reel bars to the grooves of the reel bars. When the strand does not naturally tend to adhere a leading length may be treated with a fluid which will give at least temporary adhesive qualities, the residuum of which fluid as may be left in the grooves of the reel bars perferably being such as to have no deleterious effect upon the remaining lengths of the strand or the desired treatment thereof. Alternatively static electricity may be used for loading adhesion. Similarly an adhesive leader may be attached to the leading end of the strand to perform the same function as an adhesively treated leading portion. In either event it is practicable to lay or squeeze the adhesive leading end or leader of the strand to the groove of the reel bar at the pay-on point and thereafter to begin the rotation of the reel about its axis and the rotation of the reel bars about their axes in the relation for the intended strand storage, strand advancing operation wherewith the adhesive portion of the leading end of the strand will at approximately the first quarter turn (where four reel bars are employed) make adhesive contact with the outwardly exposed portion of the groove of the thread of the next following reel bar and thereafter until the reel is loaded with the desired number of convolutions of the web, the adhesive portion of the leading end of the strand will have adhesive rolling contact with at least one reel bar, laying onto and adhering to following bars while peeling off leading bars, as the strand and web are moved "backwardly" with respect to the reel bars. When the extreme end of the strand loses contact with the initial reel bar it will tend to fall toward the axis of the reel at least in one position of the reel and to increase its adhesive bond on the next following bar wherewith to continue to hold the leading portion of the strand in its desired position at the advance end of the helix of the web as the same is being formed on the reel. Where a cantilever reel is being loaded from its supported end, the leading end of the strand may be permitted to pay off by gravity

when it has advanced to the free end of the reel, or in either the cantilever or non-cantilever forms the leading end may be drawn from the reel when it reaches the pay-off point after stopping the reel, or alternatively without stopping the reel preferably with the aid of a brush or air blast or both as convenience suggests in view of the nature of the strand and other circumstances of operation.

A variant of this method of loading consists in winding the leading end portion of the strand in the groove of the thread of one of the reel bars from the pay-on point a few turns, if the leading portion of the strand tends to adhere to the reel bar, or preferably all the way to the plane of the pay-off point if the strands have no substantial tendency to adhere to the bar. Then as the reel is rotated with the reel bars turning "backward" relative to the reel in the normal and intended strand storage, strand advancing relation the strand that is wound on the bars will pay off the bar and into the leading convolution of the web at exactly the desired and proper rate to supply and give a uniform tension in the strand and to facilitate laying succeeding convolutions of the helix of the web onto the reel at the pay-on point. The "few turns" of adhesive lead should preferably contain a portion of strand long enough to reach and adhere to the next following reel bar before detaching from the bar on which it is first wound for the reasons above described. Where the groove of the bar is wound from the pay-on to the pay-off point the extreme end of the strand will roll out of its thread groove just at the moment that the helix of the web becomes completely formed. Thereupon the extreme leading end of the strand may be conducted away from the reel and the loading cycle is completed; the reel being running or ready for running in its intended fashion.

Another way to load the reel is to removably secure the leading end of the strand to one of the reel bars at or adjacent the pay-off point as at 11, Figures 7 and 9, either by looping the strand around the pay-off groove of the bar or by attaching the strand to a hook, the curved end of which partially encircles the pay-off groove, see the hooked end 75 of the member 76, Figure 11, then, while restraining the reel bars from rotation about their own axes, to rotate the reel about its axis, traversing the guide for the incoming strand as from the point 72 to the point 73, Figure 7; the rate of traverse being equal to the desired pitch of the helix of the load or web as the same is thereby formed on the reel. When the desired load has been wound onto the reel the leading end of the strand is disconnected from the pay-off point, the reel bars connected to rotate about their own axes, and with the leading end appropriately led and guided from the reel, the reel may be started up and operated in the intended strand storage, strand advancing manner above described.

Another practicable means of loading the reel is illustrated in Figures 11 and 12 wherein for the sake of illustration a partial quadrant of a reel such as the reel shown in Figures 1 and 2 is illustrated with the reel bars B mounted on the end of the spokes K. Here the hooked loading member 76 has its hooked end 75 formed to lie in the groove of the threaded reel bar wherewith to be given axial movement along the bar when the bar is rotated as from the upper full line position to the lower dotted line position shown in Figure 12. Thus upon rotation of the reel

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bars about their own axes the loading member 76 while held substantially in the transverse position shown in Figure 11 by the tension of the strand S will have axial movement carrying the leading end of the strand axially of the reel and reel bars to facilitate paying on to the reel of the helical convolutions of the web at the pay-on point 10, Figure 12. Assuming the reel is rotating counterclockwise as shown in Figure 11, and indicated by the arrow *a* thereof and the reel bars are rotating clockwise as viewed in Figure 11, then the loading member 76 is required to furnish a supply of the strand wherewith to permit the leading end of the strand along with the convolutions of the web to have that clockwise movement relative to the reel bars as the same is induced by rotation of the bars about their own axes. To provide the proper supply of strand material at the leading end thereof a spool 77 is pivotally mounted on an axis 78 carried by the member 76 and the spool is wound with an appropriate length of strand as at 79 wherewith to carry sufficient strand to pay out to the reel a length approximately equal to pi times the root diameter of the reel bars times the number of revolutions that the reel bars will make during the loading operation. That is, if it be desired to load the reel with 50 single pitch convolutions of the web, then a reel bar of single thread form will take 50 turns, and, having a one inch root diameter, the spool 77 will be provided with approximately 50 times pi inches of strand. Preferably the spool resists rotation about its axis 78 either by an appropriate friction brake, clock spring or the like, not shown, wherewith to provide the desired tension in the leading end of the strand S. The loading operation requires merely that the member 76 be hooked onto one of the reel bars at the pay-on point 10 with the strand emanating from the spool 77 connected with the strand to be paid on to the reel, the latter being led onto the reel in the transverse plane of the pay-off point as shown in Figure 12. Then normal operation of the reel for strand storage, strand advancing operation will carry the loading member 76 axially and circumferentially as above described and will provide the necessary quantity of strand material at the leading end of the strand whilst the main body of the load is being paid on as from the point 30, Figure 12, from the main source of supply of strand material. When the member 76 has reached the pay-off point 11, as shown diagrammatically in dotted lines in Figure 12, the reel is stopped, the member 76 removed from the bar and preferably carried off the reel in the plane of the pay-off point as shown in the second dotted position 81 where the strand may then be connected to be drawn in its path to consumption and use after first being separated or severed from the loading member 76.

The loading member 76, modified in function as hereinbelow described, may also be advantageously employed to load that form of my reel in which and while the reel bars rotate in the same direction as the direction of rotation of the reel; the member 76 with its spool 77 in this instance taking up instead of paying out the leading portion of the strand to maintain the desired tension thereof and of the web or load during the loading operation. For such service I prefer that only the extreme leading end of the strand be secured to the spool 77 after the spool has been "wound up" against

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such means as a clock spring or the like, not shown, wherewith the spool under the influence of the stressed spring will draw upon itself the leading portion of the strand as the same with the web is advanced relative to the axes of the reel bars in the direction of reel rotation. Otherwise the operation of loading the reel in this circumstance will be much the same as that next above described, excepting that the spool 77 will tend to be loaded with strand when it arrives at the pay-off point wherefor it may be conveniently unloaded and its spring rewound by merely carrying it manually past the position 81 while holding the reel against rotation.

A last and sometimes preferred form of method and means for loading my reel is now described with reference to Figures 13 and 14. In this form of my invention I provide an auxiliary externally threaded loading screw or bar 83 the purpose, function and results whereof are in many respects similar to those pertaining to the loading member 76 insofar as the screw 83 is availed of to provide a supply of or storage space for the leading portion of the strand as well as to position correctly the leading convolution of the helix of the load as the load is being paid on to the reel. In a reel R of the general form shown in Figures 1 and 2, and diagrammatically in Figure 13, the loading screw 83 is preferably disposed about midway between adjacent reel bars B with its axis parallel to the axis A of the reel and slightly below the plane of the axes of the said bars wherewith to underlie the web W when the reel is loaded and/or loaded and operated, see also Figure 14; the screw 83 having its threads preferably identical in all respects, including diameter, pitch, lead, singleness or multiplicity, taper, if any, and form with the threads of the reel bars B and being induced or permitted to have the same speed and direction of rotation as the reel bars at least during the loading operation. Preferably the ends 84 and 85 of the screw 83 comprise smooth journals which are rotatably mounted in bearings 86 and 87 carried on the ends of spokes 88 and 89 radiating from the hubs H. The spoke 89 carries the bearing 87 on a universal pivotal support 90 by virtue of which the screw 83 may be quickly removed from or inserted in the reel for reloading or unwinding as the case may be. The spoke 88 also carries a bearing 91 in which the journal of the sprocket 92 is supported; the sprocket preferably being identical with the sprockets 17 and engaged by the chain 18. The axis of the sprocket is preferably disposed radially outward of the axis of the screw 83 wherewith to have workable engagement with the chain, and an angled drive 93 detachably connects the sprocket and the screw to drive the latter at the speed of the reel bars. A spring 94 surrounding the journal 85 and interposed between the bearing 87 and the shoulder 95 on the screw urges the screw leftwardly as viewed in Figure 14, causing the shoulder 96 to bear on the end of the bearing 86. The journal 84 being shorter than the exposed part of the journal 85 within the spring 94, forcible manually induced movement of the screw rightwardly removes the journal 84 from the bearing 86 whereupon the screw may be swung about the pivot 90 and, when desirably inclined more or less toward or from the axis of the reel may be withdrawn from the bearing 87 and then removed from the reel; a reverse procedure permits quick insertion of the screw into its operative position shown in Figure 14.

To load the form of my reel in which the reel bars rotate oppositely of the direction of reel rotation strand is wound on the screw for a distance corresponding to that from the plane of the pay-off to the plane of the pay-on point as viewed with the screw positioned as in Figure 14; the winding being done, preferably, while the screw is detached from the reel. The screw is then inserted in the reel and the strand led from the screw over the adjacent and following reel bar and the pay-on point 10 thereof; the extreme leading end *f* of the strand lying at the opposite end of the screw 83 and in approximately the end of the thread groove thereof, but more particularly substantially in the plane of the intended pay-off point for the load to be put on the reel. Thereupon normal rotation of the reel, with the bars B and screw 83 turning oppositely of the direction of the reel rotation, pays the leading portion of the strand off the screw 83 and into the leading convolution of the web on the reel as that convolution advances axially away from the pay-on point whilst the major portion of the web is paid on at the point 10. Figure 14 shows the parts with the reel approximately half loaded, the part 93 of the strand passing from the mid portion of the screw 83 to the mid portion of the following reel bar. Continued rotation of the reel as above described will continue the operation of paying off the strand from the screw 83 to the reel bars B until the reel is loaded for substantially the same axial distance that the screw 83 was wound with strand in the first instance.

To load the form of my reel in which the reel bars rotate in the same direction of rotation as the direction of rotation of the wheel, the screw 83 is positioned in the reel devoid of strand or more particularly, devoid of strand throughout that portion of its axial length corresponding to the axial length of the load which is intended to be put on the reel. Thereupon the incoming strand is led to the pay-on point of the reel and therebeyond in the direction of reel rotation to the screw 83 where it is secured, preferably adhesively, to the screw in approximately the plane of the pay-on point which is normal to the axis of the reel. Thereafter rotation of the reel and reel bars in their normal strand storage, strand advancing relation and rotation of the screw 83 in the same direction of rotation as the reel bars will effect the loading of the reel and the simultaneous loading of the screw 83 since the portions of the strand following the extreme leading end thereof will be advanced to the screw 83 from the following reel bar from the leading end of the leading convolution of the helix of the web as the web is formed on the reel whilst in this instance the web will be advanced around the reel by virtue of the positive direction of rotation of the reel bars which support the web. Thus for each revolution of the reel a length of strand approximately equal to π times the root diameter of the threads of the reel bars and the threads of the screw 83 will be paid from the web of the reel to the screw and the latter will receive the same amount of strand that is paid out of the web incident to its loading. Thus when the reel is half loaded for example the situation will be different from that shown specifically in Figure 14 since the screw 83 will be loaded in the same axial zone that the reel is loaded as the loading progresses. When the reel is fully loaded or has its desired load and has come to rest, the screw 83 may

then be removed and the leading end of the strand transferred from the screw to or toward the point of consumption of the strand or alternatively that portion of the strand which will then lie between the pay-off point on the reel and the screw 83 may then be severed; leading the strand from the reel away in the direction of and for consumption and permitting the screw 83 in its fully wound condition to remain idly present and rotating on the reel as a matter of convenience.

While the foregoing description of certain preferred and modified forms, embodiments and practices of my invention will have exemplified the fundamental principles thereof in specific forms and applications, it must be taken as illustrative and not exclusive of other forms, embodiments and practices in which my invention may be employed advantageously. For example the matter of a rolling support for the web of the load in the moving helical grooves of some or all the reel bars taken with the bodily movement of the reel bars around an axis wherewith to provide a "free" groove at the pay-on point as each grooved bar comes to the pay-on point does not necessarily require the symmetrical relation of the bars to such axis nor the number or arrangement thereof herein specifically illustrated. Changes, modifications and improvements in the forms and embodiments of my invention herein exemplified and discussed will occur to those skilled in the art when they come to understand the principles of my invention and the teachings hereof, wherefore I do not care to be limited in the scope of my patent to any such specific forms and embodiments nor in any manner other than by the claims hereof fairly construed.

I claim:

1. A continuous pay-on and pay-off reel having strand supporting reel bars mounted for rotation about their own axes and for bodily movement about a common axis, said reel bars having threads in which the strand is supported, means for rotating said bars about their own axes, means for moving said bars bodily about said common axis, and means comprising worm wheels mounted on axes transverse to the axes of said threaded bars and engaging the threads of said bars for supporting said bars against inward deflection.

2. A continuous pay-on and pay-off reel having strand supporting reel bars mounted for rotation about their own axes and for bodily movement about a common axis, said reel bars having threads in which the strand is supported, means for rotating said bars about their own axes, means for moving said bars bodily about said common axis, the axes of said strand supporting bars being substantially parallel to and substantially equally spaced from said common axis, said reel bars being supported at one end of the reel and having their ends exposed at the other end of the reel and worm wheels engaging the threads of the bars and supporting said bars against inward deflection, and means supporting said worm wheels on axes transverse to the axis of said bars.

3. A strand storage, strand advancing reel mounted for rotation about an axis comprising a plurality of threaded strand supporting bars rotatable about their own axes and rotatable bodily about the reel axis, means to drive said reel to rotate said bars, and supporting means engaging only the inner surfaces of said bars to support said reel bars against inward deflection.

4. A reel according to claim 3 in which said supporting means is of low friction material.

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5. A reel according to claim 3 in which said supporting means comprise members rotatable about axes transverse the axes of said bars.

6. A reel according to claim 3 in which said bars are supported at one end of said reel independently of said supporting means and have their ends exposed at the other end of said reel.

7. A reel according to claim 3 which includes a plurality of bearings associated with said reel and disposed at longitudinally spaced positions along the axis of said reel, said bars being journaled in said bearings and said supporting means being located intermediately of said spaced bearings.

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