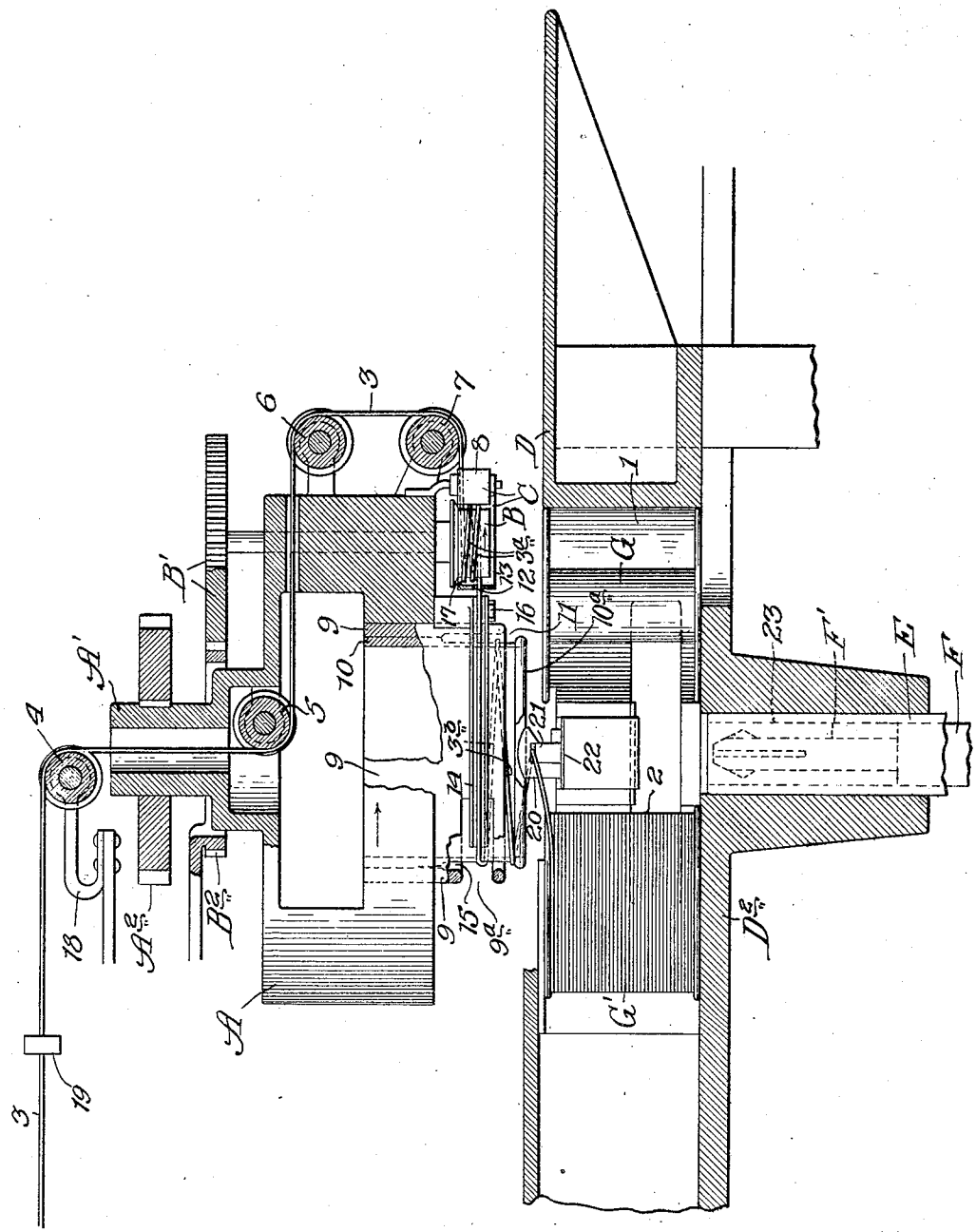
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TAKE-UP METHOD

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Inventor:
Frank Honig,
By Dyer, Tompkins & Dyer, Christy and Wilks,
Attys.

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FRANK HONIG, OF OAK PARK, ILLINOIS, ASSIGNOR TO CYCLO CORPORATION, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS

TAKE-UP METHOD

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This invention relates particularly to a method of taking up a flexible strand and forming the same into a succession of coils. These coils may be deposited upon suitable cores. The cores employed may be spools, and thus, more specifically, the invention comprises a method of spooling a flexible strand, as, for example, wire.

The improved method can be best described in connection with a suitable form of device for enabling the method to be practiced. Such a device is illustrated diagrammatically in the accompanying drawing, and the method will be described with reference thereto.

It may be stated preliminarily that in the method illustrated in the accompanying drawing, the flexible member, or strand, is drawn to a planetary path and there formed into convolutions while being carried through the planetary path, and then is discharged in convolute form to a winding zone which is substantially concentric with the planetary path.

The strand which is being discharged in convolute form accumulates as convolutions which form a coil, and the coils are periodically removed from the winding zone, in succession, without interrupting the convolution-forming process. This enables a continuous take-up process to be carried out. Where the method is applied to spooling a strand of material, the wire is caught back of the loaded spool as it is being discharged, is severed, and one end is held while the first windings are being made on the freshly introduced spool.

In the drawing, A represents a rotary head having a tubular shaft A′ equipped with a gear A^2, through the medium of which the head is rotated; B, a planetary capstan journalled in said head and positively rotated on its own axis during its planetary movement by means of a planetary gear B′ which meshes with a stationary gear B^2; C, a combined guard and gripping device associated with the capstan B; D, a spool-shifter which reciprocates in a guide D′ having a bottom wall D^2; E, a constantly reciprocating tubular distributor slide; and F, an arbor depressibly mounted in the slide E, the member F having a reduced upper portion F′ adapted to enter and impale the spool.

An empty spool designated G is shown, and a loaded spool designated G′ is shown. The shifter D which may be actuated periodically, at suitable intervals, is shown provided with a vertical chamber 1 for the fresh spool and a chamber 2 for the loaded spool.

The wire, or flexible strand 3, passes over a guide roller 4 mounted on a stationary support, thence through the shaft A′, thence under a roller 5, thence over rollers 6 and 7, and thence to the capstan B. On the capstan, convolutions 3^a of the strand are caused to grip the capstan by means of spring-held presser rollers 8 (one shown) of the device C. The lower end of the tubular head A has its bore fitted with a sleeve 9, within which is another sleeve 10. The inner sleeve projects somewhat below the outer sleeve and is provided at its lower end with an annular bead or curved lip 10^a. There is thus left between the sleeves an annular orifice 11. The strand is payed from the capstan B through a guide perforation 12 with which the guard 13 of the device C is provided. Said guard is of cylindrical form, but it is provided with recesses to enable the gripping rollers 8 to extend therethrough and grip the convolutions 3^a. One wall of the perforation 12 of the guard serves as a bending shoulder adapted to deflect the strand away from the capstan B as it is payed out from the capstan.

The outer sleeve 9 is provided near its lower end with a segmental slot 9^a, which accommodates one end of a curved, segmental guide-member 14 which has a groove through which the strand passes from the capstan B to the annular passage 15 which is formed between the lower ends of the sleeves 9 and 10. The orifice of this annular passage has been designated 11.

In the illustration given, the strand has been represented as forming a convolution 3^b about the lower end portion of the inner sleeve 10. In practice, there may or may not be a complete convolution about the member 10, but in any event, the strand is dis-

charged in convolute form, the axis being at the center of rotation of the head A. The member 10 is of relatively large diameter as compared with the capstan B, and the spool, while being loaded, can be reciprocated within the sleeve 10 while the wire is being payed out over the annular lip 10^a. In other words, the spool reciprocates vertically through the winding zone while the spool is being loaded.

The segmental guide member 14 is pivotally mounted at the point 16, while the free end of the guide member extends into the slot 9^a and guides the strand to the annular passage 15. If desired, the member 10 of the rotary head may itself be regarded as an auxiliary capstan from which the strand is payed, with a trailing action to the spool while the winding of the spool takes place. It may be stated, however, that the planetary capstan B will form convolutions about the vertical center line of the rotary member A as an axis, regardless of whether the sleeves 9 and 10 be employed or omitted. In practice, said sleeves are desirable to serve as guides and steady the convolutions. In any event, the strand is carried about the core or spool and wound on the spool by the action of the capstan.

The guard 13 is separated from the capstan by a space 17 which allows sufficient freedom to the strand. In the case of any incipient buckling of the strand, however, the guard confines the strand sufficiently to prevent serious buckling.

The supporting member 18 for the roller 4 may be a spring member or a yielding member, if desired. The rollers 4 and 5 are so disposed as to center the strand which enters through the shaft A'. Preferably said rollers are of the same size, so in case of any variation from the center, the length of the strand being drawn into the apparatus will not be caused to vary to any objectionable extent.

If desired, the strand 3 may consist of a wire taken directly from a wire-drawing machine equipped with reducing dies. In such case, if desired, a finishing die 19 may be interposed between the last capstan of the wire-drawing machine and the mechanism illustrated. Also, the mechanism illustrated may be driven from the capstan of the wire-drawing machine and may have a definite gear ratio with respect to a capstan of the wire-drawing machine.

The spool-shifter D is shown equipped with a strand-catcher or hook 20, an associated clamping bar 21, and an associated wire-severing knife 22. The wire-catching, holding and severing device may be actuated in any suitable manner at the desired moment to catch the wire back of the loaded spool during discharge of the loaded spool, sever the wire, and hold one end while the convolution-forming mechanism carries the discharging wire about the freshly introduced spool and makes the first wrappings on the spool. At the proper instant, the end of the wire may be released.

In practice, metal spools are employed, each spool comprising a hollow barrel portion, or core, and end flanges, both external and internal. The internal end flanges are ordinarily provided with perforations of suitable diameter to permit the reduced end F' of the arbor F to enter. The head portion of the arbor may be provided with spring grippers 23 adapted to grip the upper internal flange of the spool. The distributor slide E may be reciprocated constantly by a suitable cam (not shown); and another cam (not shown) may serve to quickly depress or withdraw the arbor at the moment when the shifting of spools is to occur. The spool-shifter may be actuated by a suitable cam (not shown). Any suitable means may be provided for periodically actuating the spool-shifter D and depressing the arbor to strip the spool from the arbor. The control mechanism (not shown) may have means for regulating the period between actions, so that any number of layers of wire may be deposited on the spool before the action of ejecting the loaded spool and introducing a fresh spool occurs.

The head A may be assumed to rotate in the direction indicated by the arrow thereon, and the capstan B may be assumed to rotate, on its own axis, in the direction indicated by the arrow thereon. As the strand is discharged from the lower end of the rotary head in convolute form, it is wrapped upon the spool which is normally reciprocated vertically within the winding zone. The capstan B preferably has a diameter slightly less than the diameter of the core of the spool; and if we assume the gear ratio to be such that the capstan rotates once on its own axis during each movement through its orbit, the length of the strand payed out from the capstan will be slightly less than sufficient to encircle the core of the spool. Therefore, the spool will tend to be rotated on its own axis as the strand is wound thereon. At first, the spool may have little or no rotation, but as the layers of windings accumulate thereon and the diameter increases, the spool will be rotated more and more rapidly by the dragging action of the strand which is being payed to the spool while the strand is being carried about the spool and payed thereto over the annular lip 10^a. The arbor may be caused to grip the spool in such a manner that the arbor will be rotated with the spool, that is, the arbor will rotate within the distributor slide E, and suitable friction may be applied to the lower end of the arbor to enable a retarding action to be communicated to the spool through the medium of the arbor so that the tightness of the winding of

the strand on the spool may be thus regulated.

It will be understood that the gear ratios may be such as to cause the capstan to rotate once during its planetary movement, or more than once, and the length of the strand payed out by the capstan depends, of course, upon the diameter of the capstan and its rate of rotation. Where the core of the spool is of small diameter, it is convenient to have the capstan of approximately the same diameter and to give to the capstan one rotation on its own axis during each planetary movement. The wire is payed back from the capstan into the annular passage of the rotary head and from there to the spool, while the capstan continues to draw the wire onto itself and discharge it from itself, while carrying the wire about the axis of the spool. The segmental guide 14 may be yieldingly held in position by a suitable spring (not shown). This spring may tend to hold the free end of the guide inwardly, while the centrifugal action may tend to throw the guide outwardly about the pivot point 16. The spring tension may be sufficient to overcome all but a small portion of the centrifugal action, so that there will remain a small portion of the centrifugal force holding the free end of the segmental guide 14 slightly away from the outer surface of the inner shell 10, and thus the centrifugal action may be utilized to serve the function of a spring, so that the member 14 is free to vibrate slightly about its own pivot to compensate for any slight inaccuracies of winding on the spool and obviate the danger of breakage.

The invention enables wire to be drawn by a continuous process, taken up, and formed into a succession of coils, which may be deposited upon the spools. In its broadest aspect, the invention provides for forming a flexible member into convolutions and discharging the convolutions to form a coil, the convolutions being received by a suitable core or spool, and removing the coils periodically from the winding zone. The invention may be applied to various purposes. For example, it may be employed for recoiling wire, taking it from a large spool and depositing it upon a plurality of smaller spools. The take-up mechanism may be employed for drawing wire through an annealing furnace, or through a coating bath, or it may be employed for taking up any flexible strand and subdividing the strand into a plurality of coils. During the winding action, the strand is under a certain amount of tension between the spool and the capstan. There may be a momentary relaxing of the tension during the period of spool-shifting. At such time, the shoulder of the guide perforation 12 functions to deflect the strand away from the capstan, and through the segmental guide member 14 so that the strand continues to pay into the annular passage 15 and to be discharged therefrom in convolute form. However, no relaxation of the tension on the strand back of the capstan B occurs. In other words, the strand is drawn continuously with uniform tension to the planetary capstan C, is formed into convolutions on said capstan, said convolutions gripping the capstan, and is payed out from the capstan to the rotary head. This renders the method of particular value in a continuous wire-drawing operation, and is especially valuable where the wire is wound upon a succession of spools. The spools may be received in the spool-shifter D from a suitable magazine (not shown).

The present application constitutes a division of my application 693,264, filed February 16, 1924. A modification of the process described in the present application is disclosed in my application 695,477, filed February 27, 1924.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, but the appended claims should be construed as broadly as permissible, in view of the prior art.

What I claim as new, and desire to secure by Letters Patent, is:

1. In taking up a flexible strand and forming therefrom a plurality of coils, the method which comprises drawing the strand with uninterrupted tension to a convolution-forming zone and forming it into convolutions without depending for tension upon stress transmitted from the convolutions, allowing the convolutions to accumulate in a coil, and successively removing the coils from the coil-forming zone, without interrupting the convolution-forming process.

2. In taking up a flexible strand and forming therefrom a plurality of coils, the steps which comprise forming the strand into convolutions while maintaining a uniform tension in drawing said strand to the convolution-forming zone, without depending for tension upon stress transmitted from said convolutions, accumulating said convolutions in coils of desired sizes, and removing coils successively from the coil-forming position without interrupting the convolution-forming process.

3. Drawing a strand to a center of rotation and from thence to a planetary path while maintaining it under uniform tension by gripping and pulling action until it reaches said planetary path and then discharging it from said planetary path in convolute form regardless of whether or not the discharging portion of the strand is under tension.

4. In taking up a flexible strand and forming therefrom a plurality of coils, the steps which comprise drawing the strand to a center of rotation and from there to a planetary

path, while maintaining it under uniform tension by gripping and pulling action until it reaches said planetary path and then discharging it from said planetary path in convolute form to form a coil of desired size, and successively removing the coils periodically from the coil-forming position without interrupting the convolution-forming process, said gripping and pulling action being sufficient, without any stress transmitted from the coil being formed, to maintain the uniform drawing tension.

5. Drawing a strand under uniform tension to a convolution-forming zone, forming the strand and discharging it in convolute form to a winding zone, periodically shifting cores to and away from the winding zone to load said cores in succession, without discontinuing the drawing operation, and catching the strand between the loaded core and the fresh core and holding the strand until the first wrappings are made on the fresh core.

6. Drawing a strand under uniform tension to a convolution-forming zone, forming the strand and discharging it in convolute form to a winding zone, periodically shifting cores to and away from the winding zone to load said cores in succession, without discontinuing the drawing operation, and catching the strand between the loaded core and the fresh core and severing it and holding one of the severed ends until the first wrappings are made on the fresh core.

FRANK HONIG.