No. 751,816. PATENTED FEB. 9, 1904.

A. J. STRONG.

PROCESS OF WINDING.

APPLICATION FILED MAY 15, 1903.

NO MODEL.

Fig. 1.

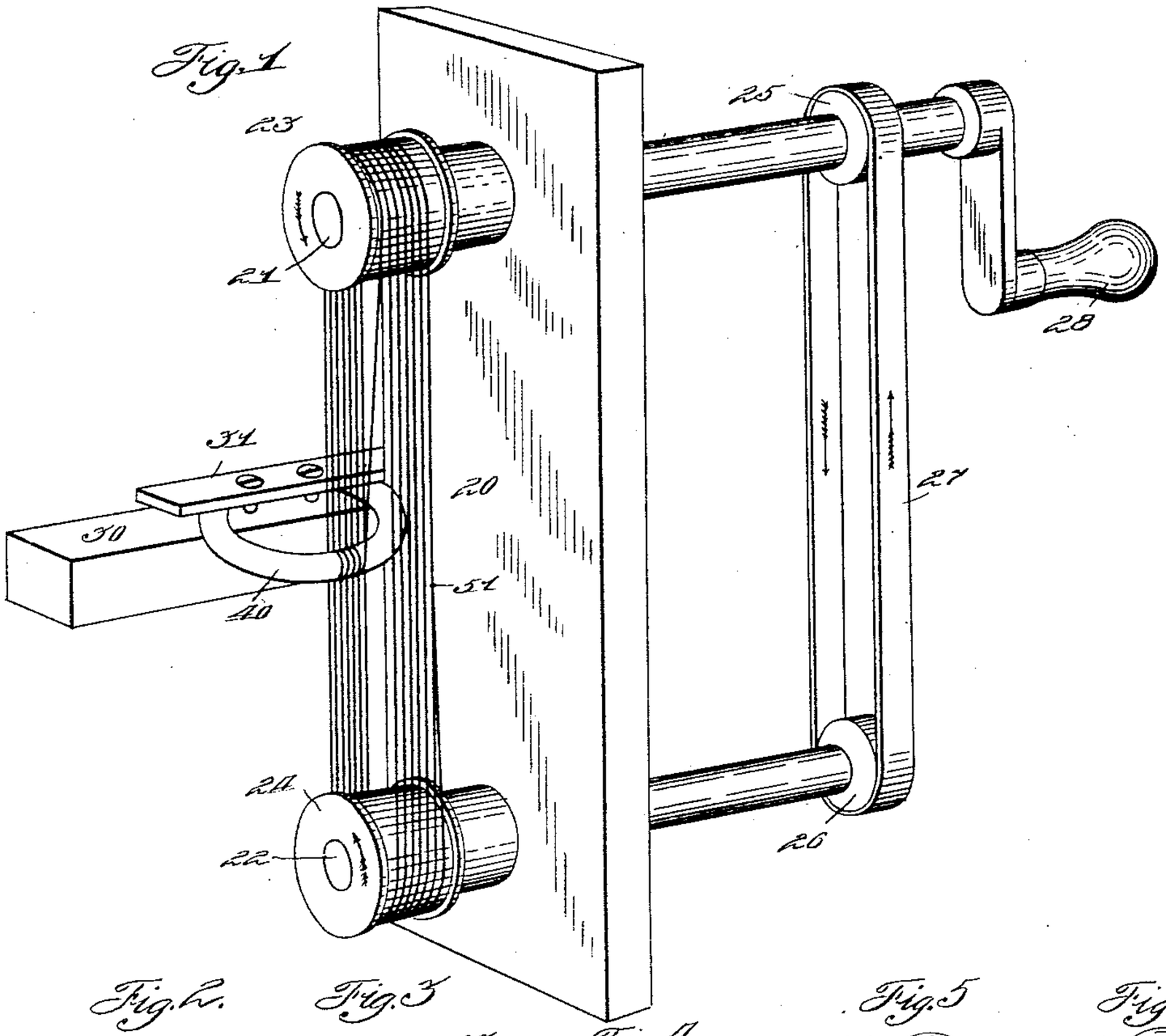


Fig. 2.

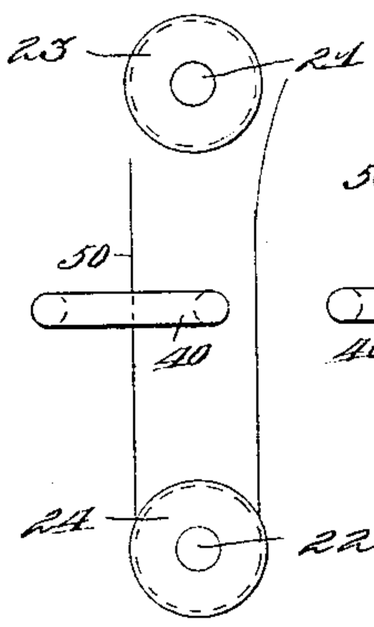


Fig. 3.

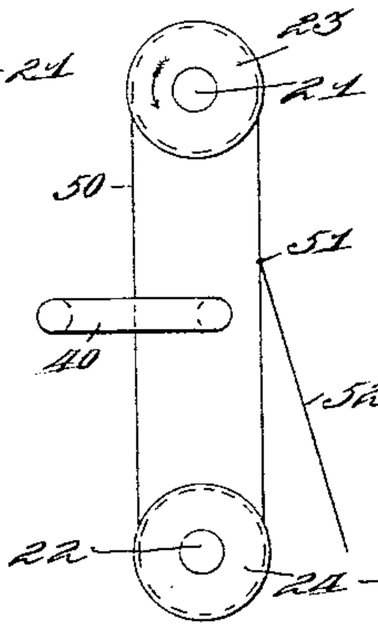


Fig. 4.

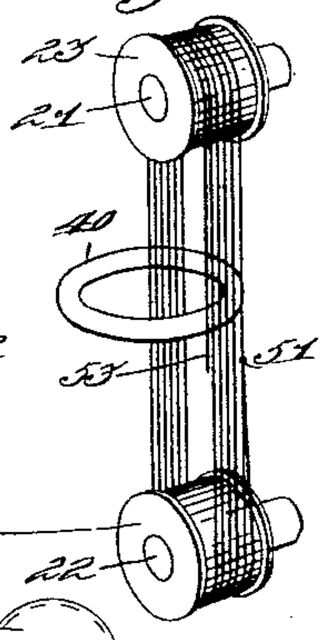


Fig. 5.

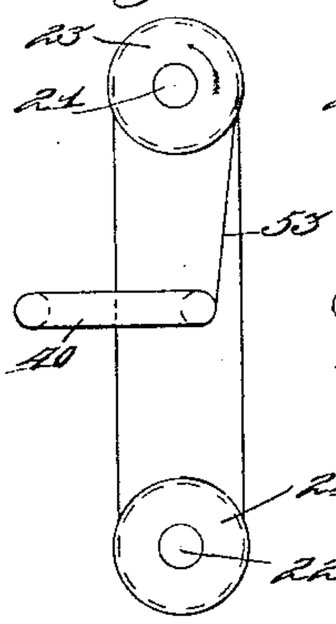


Fig. 6.

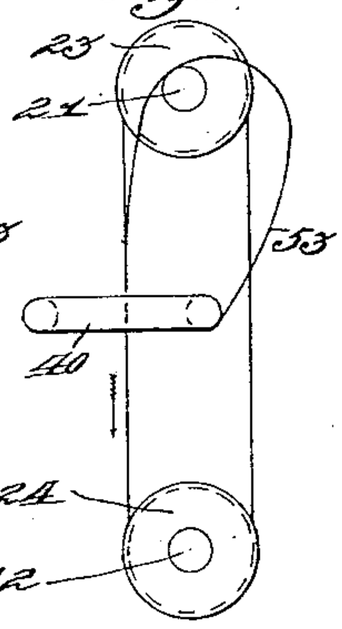


Fig. 7.

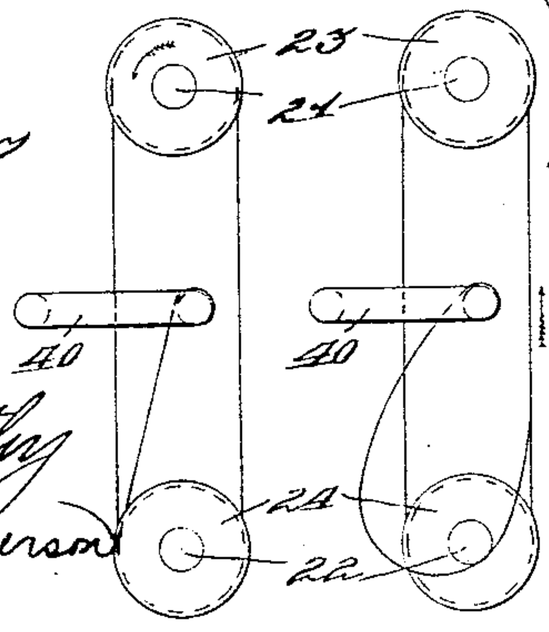
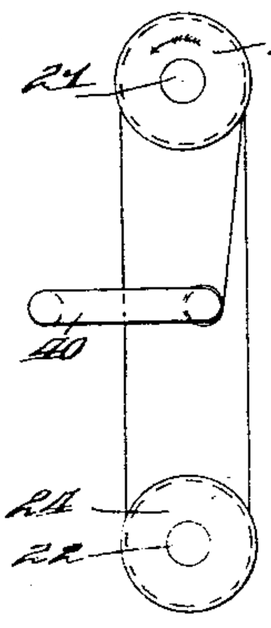


Fig. 8.

Fig. 9.



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No. 751,816. Patented February 9, 1904.

UNITED STATES PATENT OFFICE.

ARTHUR J. STRONG, OF DAYTON, OHIO, ASSIGNOR OF ONE-HALF TO JONATHAN B. HAYWARD, OF DAYTON, OHIO.

PROCESS OF WINDING.

SPECIFICATION forming part of Letters Patent No. 751,816, dated February 9, 1904.

Application filed May 15, 1903. Serial No. 157,301. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR J. STRONG, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Processes of Winding, of which I declare the following to be a full, clear, and exact description.

My invention relates to an improved method of winding successive convolutions of continuous material upon any desired object or work; and it is among the purposes and objects of my invention to provide an economical and rapid method of winding any desired length of such material upon work of various shapes, and it is particularly advantageous and applicable to the winding of material, such as wire, upon ring-shaped objects or cores.

Referring to the accompanying drawings, Figure 1 represents a specific form of device which may be advantageously used in carrying out my improved method or process. Figs. 2 to 9 represent various diagrammatic views showing the various steps of my process.

Journaled in a stationary frame 20 are two shafts 21 and 22, fast to the outer ends of which are pulleys 23 and 24, respectively. Upon the other ends of the shafts 21 and 22 are made fast pulleys 25 and 26, respectively, over which extends a belt 27. A crank-handle 28 is made fast to the end of the shaft 21, and it is thus obvious that when the crank-handle is rotated in the direction shown by the arrow the pulley 23 will be rotated and the belt 27 will impart a similar and simultaneous rotation to the pulley 24.

Fast to the central portion of the stationary frame 20 is a supporting-arm 30, provided with a suitable clamping device 31, which is adapted to have clamped beneath it any desired work which is to be wound—such, for example, as the ring 40. (Shown in Fig. 1.) As will be seen in Fig. 1, this ring is situated between the pulleys 23 and 24, preferably in the middle, and, if desired, the supporting-frame 30 may be adjustably attached to the stationary frame 20, so as to swing the ring 40 in any desired position in a horizontal plane or in a vertical plane.

Although my improved process is of course by no means limited to the winding of wire material, however, for convenience I wish to refer to the material as "wire," and I will now describe the method by which the winding is to be effected.

Referring to Fig. 2, the free end 50 of the wire which is to be wound upon the ring is first passed under the lower pulley 24 and then upward through the ring 40. The end 50 is then led over the upper pulley and is then tied or made fast in any suitable way to that portion of the wire immediately following in such manner as to make a continuous band of wire leading over both pulleys, as shown in Fig. 3, and from the knot 51 the remaining portion of the wire 52 extends outward ready to be used in the manner to be described. It will be observed from Fig. 3 that the ring 40 is so situated with reference to the pulleys 23 and 24 that one of the strands of wire may pass through the central portion of the ring and the other strand may pass outside of the ring without coming in contact therewith. As soon as the wire is tied, so as to form a continuous band in the manner just described, the pulleys 23 and 24 are then rotated in the direction shown by the arrows in Figs. 1 and 3, and it is obvious that by having the band of wire reasonably tight upon the pulleys the friction of the wire upon the pulleys will cause the band to run along with the pulleys just as a belt would do, and thereby the remaining portion of the wire 52 is carried along by means of this running band in such manner that successive convolutions of wire will be wound upon the pulleys, as shown in Fig. 4, and the wire may thus be wound on to the pulleys until the desired length of wire which is to be used in winding has been reached and there remains the other free end 53 of the wire. As soon as this point has been reached this free end 53 is firmly made fast to that portion of the ring included between the convolutions of wire in the manner shown in Fig. 5. As soon as this has been done if the pulleys 23 and 24 are continued to be rotated in the direction shown by the arrow in Fig. 5 it is obvious that the end 53 will be

drawn taut and the rotation would be stopped unless perchance the friction between the wire and the pulleys is so slight that the pulleys may still rotate without carrying the convolutions of wire with them. However, at this point the strand 53 is taken hold of by the fingers of the operator and is removed from the upper pulley 23 in the manner shown in Fig. 6. The pulleys are then continued to be rotated in the direction shown by the arrows, and it is apparent that the continued rotation of the entire set of convolutions of wire will immediately take up this slack portion caused by so removing the strand 53 from the pulley 23, and the downward movement of this strand in the direction shown by the arrow in Fig. 6 will then bring the wire into the position shown in Fig. 7, in which the strand 53 now extends downward to the pulley 24. Then by repeating this operation of plucking off this strand 53 from the lower pulley 24 in a similar manner more slack is left, as shown in Fig. 8, and the continued rotation of the convolutions of wire about the pulleys will again cause this slack to be taken up until the position shown in Fig. 9 is reached. At this point it will be observed that a complete smaller or contracted convolution 60 has been wound upon the ring, and it is apparent that by simply continuing this operation of rotating the pulleys 23 and 24, and thereby continuously rotating the bands or enlarged convolutions of wire and at the same time plucking off the winding strand from the pulleys in the manner described the slack caused by so plucking off this strand will be taken up by the continued travel or rotation of the enlarged convolutions, and there will result a series of contracted or smaller convolutions wound upon the ring, as shown more in detail in Fig. 1.

Of course the operator may vary the speed of rotation to suit his facility in handling the various winding-strands, and he may guide the winding and force together the various smaller convolutions as they are wound upon the ring if it be desired to wind these convolutions closely. Furthermore, the ring 40 may be held somewhat loosely beneath the clamp 31, so that it may be rotated in a horizontal plane to bring new winding-surface into play as fast as desired. The belt 27 is not essential to be used, for the strands of wire themselves will act as a belt ordinarily; but if the belt is used the strands will not have to be drawn so tight at the start, but will be naturally rotated by the combined rotation of the pulleys 23 and 24.

Of course various forms of machines may be used to rotate these pulleys, to provide friction-drives for the pulleys, if desired, or to provide an automatic feeding device for the ring adapted to bring the unwound surface of the ring into winding position; but my invention does not concern the form of machine to be used for such a purpose, but is intended to cover broadly this improved process of winding, and my invention covering the machine for use in such a process will be reserved for a future application.

It is to be understood, of course, that the process herein described is applicable not only to ring-shaped bodies, but also to bodies of other curved shapes which cannot be rotated in order to do the winding, owing to the fact that other portions of the body would cross the path of travel of the winding material, or is even applicable to the case of straight bodies which ordinarily could be wound by rotating the body itself and allowing the material to be wound thereon, but which it may be impossible or else undesirable to rotate either because of their unwieldy nature or of their frail nature or for other reasons.

The process herein described is particularly adaptable to the winding of insulated wire upon circular ring cores, for in methods heretofore in use it has been customary to wind upon a bobbin all of the wire desired to be wound upon the core and then pass the bobbin through the core time after time, unwinding the wire from the bobbin onto the core as fast as the successive cycles of movement were made, and of course if much wire is to be wound upon the ring the size of the bobbin is so great that the bobbin could not in such case be passed through the ring, whereas in my case the ring need be only large enough to receive the various strands of wire which pass through it at the start, and it is evident that for any given length of wire which it is desired to wind upon the core the number of strands passing through the ring may be decreased by increasing the distance between the pulleys, thereby making fewer separate strands, but compensated for by increase in the length of these strands. It is also evident that the pulleys may be of any desired diameter, being merely so situated that the inner set of strands shall not interfere with the inner sides of the ring, and in case of such larger diameter of the pulleys a greater contact-surface is obtained between the pulleys and the wire, whereby the wire is less liable to slip upon the pulleys.

It may be noted that the same result may be reached by starting with the free end of the wire to be wound, passing this free end through the ring, around the upper pulley 23, down outside the ring, around the lower pulley 24, through the ring again, and thus continue this operation and so wind up upon the pulleys successive strands or convolutions, as before, and when the other end of the wire is reached there will thus be two free ends. Either of these free ends may now be attached to the ring, and the other end may be made fast to its immediately adjacent strand, so as to follow around with it when the pulleys

are subsequently rotated, and as to which end is attached to the ring depends the direction of rotation of the band of strands, it being evident that if the first free end (which has just been passed through and through the ring) is now attached to the ring, ready for winding, the direction of rotation of the band of strands must be the reverse to that which it had in the preparatory process of winding the strands upon the pulleys, for it is necessary that the direction of rotation be such that the slack caused by successively plucking the winding-strand from the pulleys may be taken up by reason of the direction of rotation; but if the other end of the wire were attached to the ring the rotation of the strands must be continued in the same direction as in the preparatory winding in order to take up the slack, as above described.

It is of course more convenient to use the method first described for the preparatory winding; but the other method would serve the purpose, and it is to be understood that my invention is not to be limited necessarily to one or the other of these specific methods, but is intended to cover a broad process of forming around the work these enlarged convolutions of material and then contracting these enlarged convolutions successively into smaller convolutions upon the work by continued rotation of the enlarged convolutions to take up the slack material.

Having thus described my invention, what I claim as my invention, and desire to secure by Letters Patent, is—

1. The method of winding successive convolutions of continuous material upon any desired work, consisting of first surrounding said work with enlarged convolutions of the continuous material, with one of the free ends of said material attached to the work; and then separating the successive enlarged convolutions and rotating the entire set of said enlarged convolutions in such manner as to take up the slack material upon the contracting of the enlarged convolutions into the smaller convolutions wound upon the work.

2. The method of winding successive convolutions of continuous material upon any desired work, consisting in first surrounding said work with enlarged convolutions of the continuous material with one of the free ends of said material attached to the work and the other end attached to its adjacent convolution; and then separating the successive enlarged convolutions and rotating the entire set of enlarged convolutions in such a manner as to take up the slack material upon the contracting of the enlarged convolutions into the smaller convolutions wound upon the work.

3. The method of winding successive convolutions of continuous material upon any desired work consisting in first winding upon suitable supports successive enlarged convolutions of the continuous material comprising two sets of strands which pass upon opposite sides of said work; and then attaching one of the free ends of said material to the work; and then separating the successive enlarged convolutions in such manner as to take up the slack material upon the contracting of the enlarged convolutions into the smaller convolutions wound upon the work.

4. The method of winding successive convolutions of continuous material upon any desired work consisting in first winding upon suitable supports successive enlarged convolutions of the continuous material comprising two sets of strands which pass on opposite sides of said work; and then attaching one of the free ends of said material to the work; and the other end attached to its adjacent convolution; and then separating the successive enlarged convolutions and rotating the entire set of said enlarged convolutions in such manner as to take up the slack material upon the contracting of the enlarged convolutions into the smaller convolutions wound upon the work.

5. The method of winding successive convolutions of continuous material upon any desired work; consisting in first surrounding said work with a continuous band of said material, said band being led over suitable supports, and to one portion of which band is attached one of the ends of the remaining material; and then rotating said band in such manner as to wind upon said supports successive convolutions of said material; and then attaching the other end of the remaining portion of the material to the work; and then separating the successive enlarged convolutions and continuing the rotation of the entire set of said enlarged convolutions in such manner as to take up the slack material upon the contracting of the enlarged convolutions into the smaller convolutions wound upon the work.

6. The method of winding successive convolutions of continuous material upon a ring-shaped body, consisting in first forming enlarged convolutions of said material which are all interlinked with the ring with one of the free ends of said material attached to the ring; and then separating the successive enlarged convolutions and rotating the entire set thereof in such manner as to take up the slack material upon the contracting of the enlarged convolutions into the smaller convolutions wound upon the ring.

7. The method of winding material upon a ring, consisting in first forming a continuous band of the material led over suitable supports, one strand of said band being led through the ring and the other strand being led outside the ring; and then rotating said band with one end of the remaining portion of material attached thereto in such manner as to wind upon the said supports successive enlarged convolutions, one set of strands of which extend through the ring and the other set of

strands of which extend outside the ring; and then attaching to the ring the other end of the remaining portion of the material; and then separating the successive enlarged convolutions from the supports and rotating the entire set of said enlarged convolutions in such manner as to take up the slack material upon the contracting of the enlarged convolutions into the smaller convolutions wound upon the ring.

8. The method of winding material upon a ring, consisting in first forming a continuous band of the material led over suitable supports, one strand of said band being led through the ring and the other strand being led outside the ring; and then rotating said band with one end of the remaining portion of material attached thereto in such manner as to wind upon the said supports successive enlarged convolutions, one set of strands of which extends through the ring and the other set of strands of which extends outside the ring; and then attaching to the ring the other end of the remaining portion of the material; and then separating the successive enlarged convolutions from the supports and rotating the entire set of said enlarged convolutions in such manner as to take up the slack material upon the contracting of the enlarged convolutions into the smaller convolutions wound upon the ring; and simultaneously feeding the ring in such manner as to bring into position the new portions to be wound.

In testimony whereof I affix my signature in the presence of two witnesses.

ARTHUR J. STRONG.

Witnesses:
H. C. WOOD,
J. B. HAYWARD.