Nov. 1, 1932. E. E. KELLEMS 1,886,026

OPEN MESH WOVEN WIRE TUBE

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Fig-1.

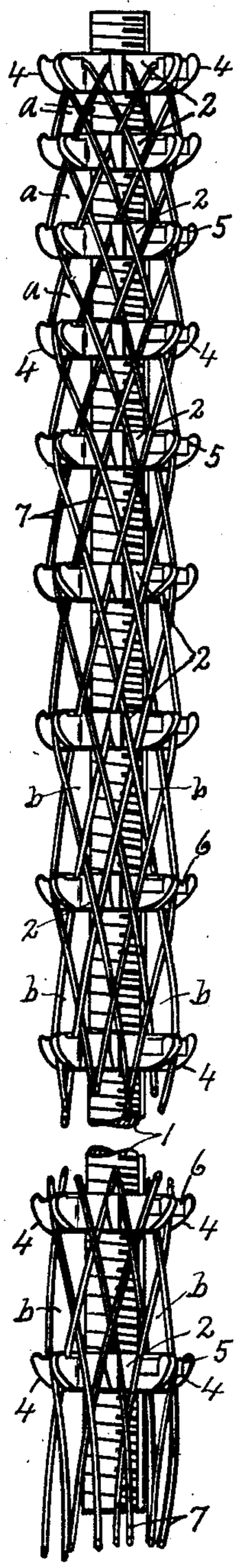

Fig-2.

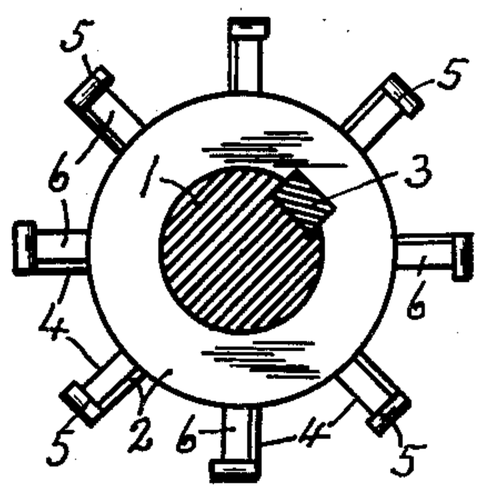

Fig-3.

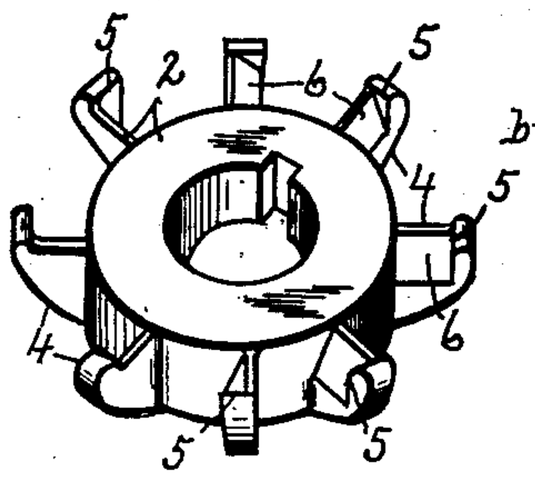

Fig-4.

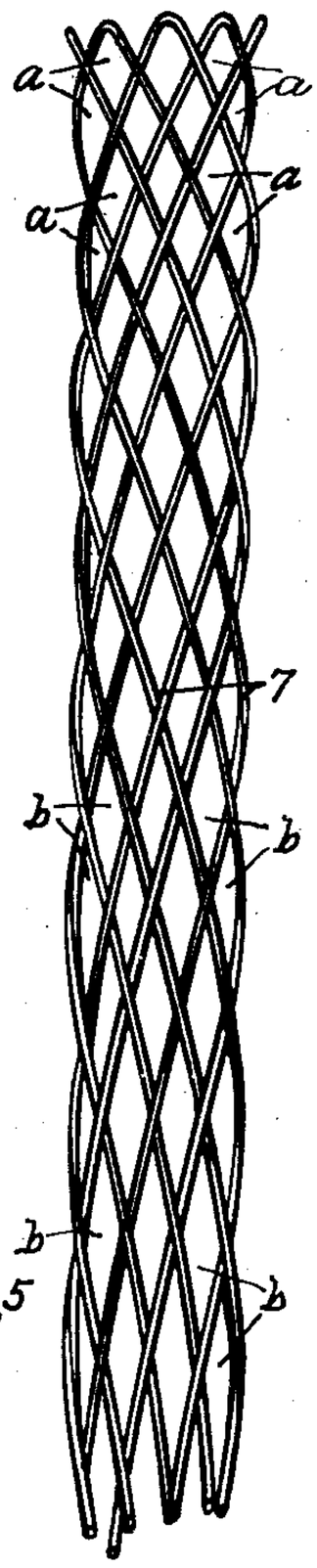

Fig-5.

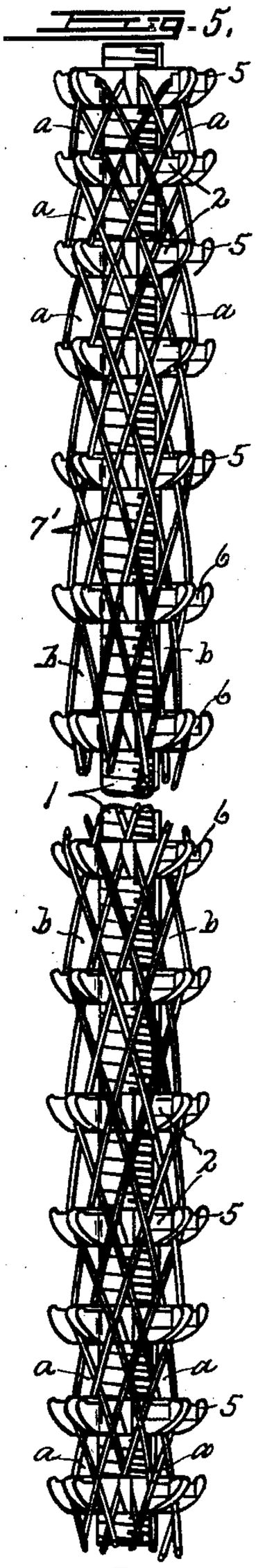

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Fig. 6.

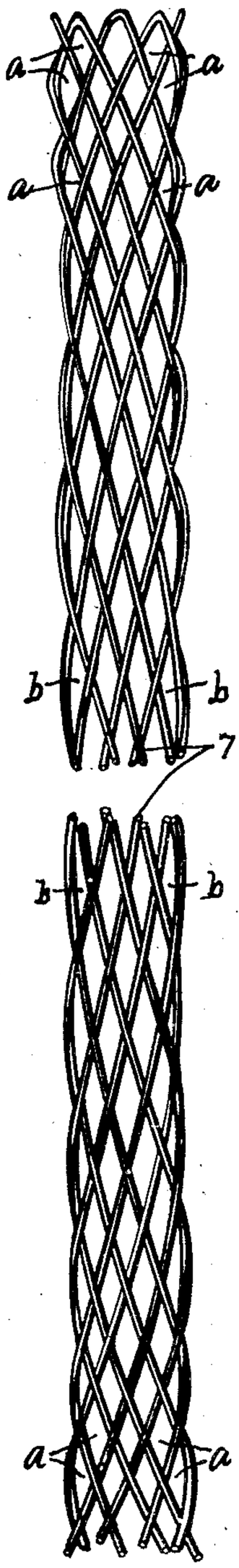


Fig. 7.

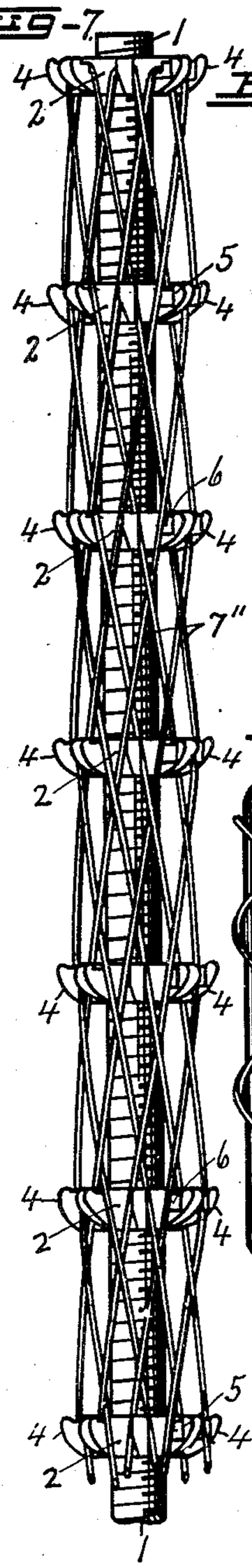
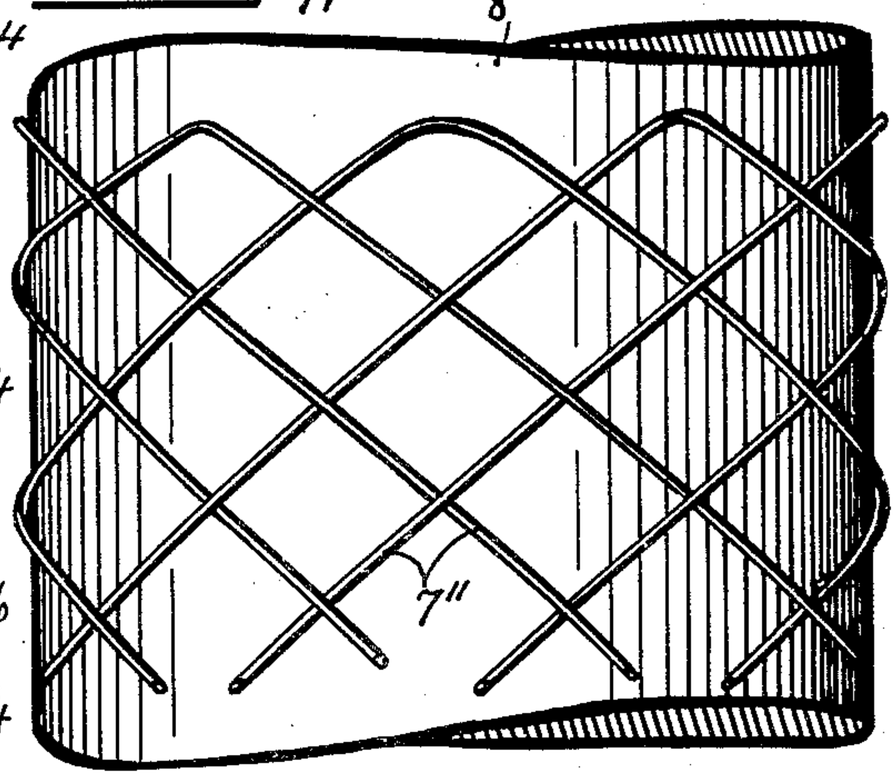


Fig. 8.

Fig. 9.



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UNITED STATES PATENT OFFICE

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OPEN-MESH WOVEN WIRE TUBE

Application filed March 30, 1931. Serial No. 526,349.

This invention relates to open-mesh woven wire tubes, commonly known as cable-grips, adapted to be expanded and contracted radially by endwise compression and extension, and to the method of and apparatus for making the same.

These gripping devices are extensively used for drawing metal or fabric covered and other cables through underground conduits and along overhead supports but obviously may be used for many other purposes as, for example, in the installation and removal of hoisting and conveyor cables, house wiring, cable anchors and any other uses to which they might be put, and are usually formed around and upon a mandrel of predetermined diameter so that when completed they will automatically assume a normal size and shape corresponding approximately to that of the mandrel upon which they are formed.

The diameter of the mandrel and size of the mesh of the tube are predetermined not only by the diameters of those portions of the body of the mandrel to which the lugs or hooks are secured, but also by the relative arrangement of the lugs or hooks upon the body of the mandrel at which the spiral strands are crossed during the weaving operation.

The mandrels upon which these tubes are woven are made in standard sizes determined by the diameter of the object to which the tube is to be applied so that the diameter of the tubes woven on the mandrels will be of corresponding standard sizes, but after the tube has been removed from its mandrel it automatically assumes a neutral diameter slightly less than that of the mandrel due to the inherent resiliency of the spirally wound wire strands which tend to straighten with the resultant slight reduction in diameter which varies with the size or length of the mesh.

When applying the woven-wire tube to an object, it is compressed endwise to enlarge its diameter beyond that of the object a distance required to give the proper gripping area, whereupon the endwise compression will be released to allow the tube to expand axially and to contract radially upon the object under its own tension ready for use.

Heretofore the general practise has been to make the diameter of the mandrel the same size or larger than the object to which the tube woven thereon is to be applied and therefore when the tube is removed from the mandrel and assumes its neutral diameter, the latter is slightly less than that of the object, thereby rendering it capable of automatically tightening itself upon said object without the use of extraneous means for distending the same axially.

Inasmuch as the means for distending the tube axially is usually applied to one end thereof, it is evident that the draft end of the strands will be first to compress radially upon the object, while the remaining portions of the tube may entirely fail to establish a tight grip thereon, with the result that only a short portion adjacent the draft end of the tube will be brought into close gripping engagement with the object, under which conditions the tube is more or less liable to slip endwise from the object and, if the object is sheathed, the portion of the sheathing engaged by the draft end of the tube is liable to be stripped from the object, all of which is seriously objectionable.

On the other hand, if the diameter of the mandrel upon which the tube is woven is appreciably less than that of the object to which it is to be applied, it is obvious that when the tube is removed from the mandrel it will automatically assume a neutral diameter appreciably less than that of the object so that when compressed endwise to enlarge its diameter and placed telescopically over and upon the object, it will automatically and firmly grip said object throughout its length as soon as the endwise compression is relieved and irrespective of any mechanical force for distending the same.

One of the objects, therefore, of the present invention is to weave the tube upon a mandrel of appreciably smaller diameter than that of the object to which it is to be applied so that when placed upon the object it will automatically distend axially and contract radially under its own tension and

thereby firmly tighten upon said object throughout its length with the assurance that when drawn endwise from one end the object will also be drawn endwise with a minimum liability of slippage or stripping of the sheathing.

It has been found that the amount of radial expansion of a woven wire tube of this character from its normal or neutral diameter by endwise compression is proportionate to the axial length of its mesh as determined by the axial spacing of the lugs of the mandrel around which the strands are wound, and it therefore follows that the rapidity of radial contraction of the tube upon the object, under its own tension or by mechanical force, will be inversely proportionate to the length of the mesh.

The present invention is based upon these facts in that one of its objects is to produce a woven wire tube having a uniform neutral diameter from end to end and the mesh of different lengthwise portions thereof of different axial lengths or sizes according to the nature of the object to which it is to be applied so that when placed upon the object the portions of the smaller mesh will be the first to tighten and hold upon said object by endwise distension and thereby to assure a firm tightening of the remaining portions of the tube upon the work as the tube is drawn endwise by mechanical force from one end.

One of the specific objects is to provide a differential mesh woven-wire grip in which the smaller size mesh are formed at the work-receiving end and gradually increased in length toward the other end so that when applied to the work and distended endwise under its own tension, the portion having the smaller mesh will instantly grip and hold the work while the remaining portions of the tube will gradually and firmly tighten upon the work as mechanical force is applied to the other end for drawing the tube and work endwise.

Another object is to provide a mandrel with lug-supporting members capable of being adjusted axially to different positions for varying the lengths of mesh of different lengthwise portions of the tube woven thereon and particularly to enable the mesh at one end of the tube to be made relatively shorter than the others or, to gradually increase the lengths of the mesh from one end toward the other as the strands are wound around and upon the mandrel.

A further object is to provide an open-mesh tube of this character having a relatively small neutral diameter and abnormally elongated mesh so that it may be expanded radially by endwise compression to receive a comparatively large cylindrical object.

In other words, briefly stated, the main object is to provide an open mesh woven-wire tube capable of quickly and firmly engaging the object to which it is applied under its own tension for drawing said object endwise when mechanical force is applied to one end of the tube, and thereby to reduce to a minimum the liability of slippage of the tube axially of the object or stripping of the sheathing in which the object is encased.

Other objects and uses will be brought out in the following description.

In the drawings:—

Figure 1 is an elevation, partly broken away, of one form of my improved mandrel with the strands of the open-mesh tube woven thereon.

Figure 2 is an enlarged transverse sectional view taken in the plane of line 2—2, Figure 1, omitting the wire strands.

Figure 3 is a perspective view of one of the detached nuts having the radial lugs across which the strands are woven.

Figure 4 is an elevation, partly broken away, of the detached woven wire tube shown in Figure 1.

Figure 5 is an elevation, partly broken away, of the mandrel shown in Figure 1, with a slightly modified tube woven thereon, in which the nuts have been adjusted to gradually diminish the spaces between them from the center toward both ends, whereby the nuts adjacent each end will be closer together than those approaching the center, to produce a correspondingly reduced mesh.

Figure 6 is an elevation, partly broken away, of the woven wire tube formed on the mandrel, shown in Figure 5.

Figure 7 is an elevation of the mandrel shown in Figures 1 and 5 with the open mesh tube woven thereon, except that the nuts are arranged abnormal but uniform distances apart, whereby the meshes of the tubes will be correspondingly long as compared with their circumferential widths.

Figure 8 is an elevation of a portion of the woven wire tube shown in Figure 7 mounted upon an object of about the same diameter as the normal diameter of the tube.

Figure 9 is an elevation of a portion of the woven wire tube shown in Figure 8, except that it is compressed axially to a considerable extent and correspondingly expanded radially and engaged with a correspondingly large cylindrical object.

The mandrel shown in Figure 1 comprises a vertically elongated screw shaft —1— upon which is mounted a multiplicity of nuts —2— which are adapted to be adjusted axially by individual rotary movement in one direction or the other, relatively to and upon the screw shaft —1—, and are locked in their adjusted position against further turning movement by means of a key —3— engaged in registering lengthwise keyways in the

screw shaft —1— and nuts —2—, as shown more clearly in Figure 2.

Each of these nuts is provided with a series of, in this instance eight, radially projecting lugs —4— arranged in uniformly spaced relation circumferentially thereon for regulating the weaving of the wire strands spirally around the mandrel.

The outer ends of the lugs —4— of each nut —2— are provided with shoulders —5— to hold the adjacent portions of the outermost strands against radial displacement from the lugs, while the intervening portions of the lugs between the shoulders —5— and periphery of the hub of the nut is beveled at —6— to conform to the spiral arrangement of the strands, and also to permit the adjacent portions of the innermost strands to cross those portions of the strands —1— engaging the shoulders —5—, and thereby to hold the inner strands against radial displacement from the lugs.

When the nuts are all assembled upon the screw shaft —1— and locked in place by the key —3— to form the mandrel, the corresponding lugs of each nut will be in vertical alignment and the distance between adjacent nuts and corresponding lugs will determine the points of intersection of the spirally wound strands to form the open mesh woven wire tube as —7— and incidentally determine the length of the mesh of the tube, it being understood that the diameter of the nuts adjacent the lugs constitute the diameter of the mandrel and determine the initial diameter of the tube woven thereon.

This diameter of the mandrel is, however, slightly less than that of the object to which the tube woven thereon is to be applied so that when the tube is removed from the mandrel it will automatically contract radially under its own tension to a diameter slightly less than that of the object and, therefore, when placed upon the object will automatically and firmly grip the same.

As shown in Figure 1, the nuts at the upper end of the mandrel are arranged in relatively close relation and the spacing between the nuts gradually increased from the upper end toward the other end of the mandrel so that when the strands are woven around and upon the mandrel from the top downwardly, the meshes between the uppermost nuts will be relatively short axially and will gradually increase in axial length from the top downwardly without altering the circumferential width of the mesh.

It will be observed that each of the lugs of the uppermost nut is adapted to receive and support a pair of strands, and that the corresponding ends of each pair of strands are integrally united or continuous over the corresponding lug, the strands of each pair being then woven spirally around the mandrel from the top downwardly which is found to be a convenient and expeditious method of weaving the strands for the reason that the loops of each pair of strands may be hung upon the corresponding lug with its opposite strands hanging downwardly where they are easily accessible for weaving purposes.

Furthermore, these continuous or looped ends of the strands enable the corresponding end of the woven wire tube to be more easily slipped over and upon the object to be gripped and also reduces the liability of injury to the hands of the operator during the operation of placing the woven wire tube upon and removing it from said object as set forth in my Patent No. 1,670,543, March 22, 1928.

An important feature, however, of the invention consists in the differential mesh of different lengthwise portions of the woven wire tube, and to the means for producing the differential weave so that the variations in the size and spiral angularity of the mesh may be made in different lengthwise parts of the tube as may be required for different uses to which the tube may be put.

For example, the mesh —*a*— of the tube —7— may be made relatively short at one end and gradually increased in axial length at —*b*— toward the opposite end, as shown in Figures 1 and 4, in which case the end of the tube having the relatively small mesh might be used to firmly grip a corresponding length of one end of a cable or other object to draw the latter endwise.

Or, the entire length of the tube might be placed over and upon the object with the assurance that the tube will automatically and firmly grip the enclosed portion of the object throughout the length of the tube and with the further assurance that the end of the tube having the smaller mesh will be the first to quickly and positively grip the object and thereby firmly hold the same against slipping thereon when the other end of the tube is drawn endwise by any suitable mechanical force.

In some instances, it may be necessary or desirable to use the woven wire tube for connecting the ends of two cables or other objects so that one of the cables or objects may be used for drawing the other cable endwise, and for this purpose both ends of the tube as —7′—, Figures 5 and 6, may be made of relatively smaller mesh —*a*— than the intervening portions, to assure a quick and positive grip of said ends upon the enclosed portions of the cables and cause the latter to move endwise in unison as one of them is drawn endwise by any mechanical force.

It will also be noted that the nuts —2— may be adjusted axially uniform but abnormal distances apart so that when the gripping tubes as —7″—, are woven thereon, the mesh of the tubes will be correspondingly elongated to abnormal lengths, thereby permitting the tube to be expanded radially from its approx-

imately neutral diameter, shown in Figure 8, to an abnormally large diameter, as shown in Figure 9.

That is, the woven wire tube —7''— may be used effectively upon a cable or other object —8— having a diameter slightly greater than the neutral diameter of the tube —8—, or, it may be expanded radially by axial compression to effectively grip and hold a much larger object as —8'—, as shown in Figure 9, it being understood that however much the tube may be expanded radially from its neutral diameter it will always tend to return to its neutral diameter under its own tension.

Referring again to Figures 1 and 4, it will be observed that the end of the woven wire tube having the relatively smaller mesh —*a*— could not be caused to expand radially by endwise compression to as large a diameter as the remaining part of the tube having the relatively longer mesh —*b*—, and it is therefore evident that the end having the smaller mesh could be used to grip an object of correspondingly small diameter, while the remaining portions might be expanded radially to grip another object of much larger diameter, thereby increasing the range of usefulness of the woven wire tube having the mesh of different portions thereof of different axial lengths.

It will be understood from the foregoing description that when the gripping tube is woven upon the mandrel in the manner described, so that its neutral diameter will be appreciably less than that of the object to which it is to be applied with the mesh at the receiving end of a size, considerably less than that of the draft end, the length of the tube may be greatly reduced without sacrificing its gripping efficiency, thereby effecting a corresponding reduction in the amount of wire stock used in the formation of the tubes and resultant decrease in the cost of manufacture, and at the same time reducing the cost of transportation and storage of the tubes in relatively large quantities with less liability of deformation or other injury.

It is also evident under this construction irrespective of the length of the tube which may be varied according to the gripping area required upon the object, the gripping effect will be substantially uniform throughout the length of the tube with the additional advantage that the portion of the tube having the smaller mesh will always more forcibly grip the object and prevent slippage of the tube thereon when mechanical distending force is applied to the draft end of the tube, thereby reducing the liability of stripping the sheathing from, or otherwise marring the surface of the object.

Furthermore, the provision of means for adjusting the lug-supporting members or nuts —2— axially of the mandrel in differentially spaced relation and weaving of the tubes thereon enables the smaller size mesh to be placed wherever it may be necessary or desirable according to the nature of the work to which the tube may be applied so that tubes of widely varying mesh may be made upon without departing from the spirit of the same diameter or, objects of different diameters as previously explained.

It is evident, however, that various changes may be made in the construction of the mandrel to carry out the several objects specified without departing from the spirit of the invention.

What I claim is:—

1. An open-mesh woven wire tubular grip having the size of its mesh gradually diminishing from one lengthwise portion toward another lengthwise portion thereof.

2. An open-mesh woven wire tube having intersecting portions of the strands of one lengthwise part of the tube appreciably closer to each other than those of other lengthwise parts.

3. An open-mesh woven wire tube having the mesh of one lengthwise part appreciably longer than that of other lengthwise parts.

4. An open-mesh woven wire tube having different lengthwise portions thereof of different size mesh but of equal diameter.

5. An open-mesh woven wire tubular grip having a portion thereof expansible radially to a greater diameter than other portions when subjected to endwise compression.

In witness whereof I have hereunto set my hand this 16th day of March, 1931.

EDGAR E. KELLEMS.