This invention relates to the making of long, narrow, flexible articles such as cable wire products which require a wrapping of flexible strand material to be wound around the article during manufacture thereof, and more particularly to a method and apparatus for making such articles in continuous form.

In the prior art, machines of various types are known for wrapping a strand of flexible material about one or more stranded members such as, for example, wires which are parallel to one another and which may or may not be spaced apart a predetermined distance. In such machines the wires may be moved in a direction along their length as the flexible material is wrapped around them. In such an arrangement where the wires are merely moved longitudinally and are not rotated, the wire is wrapped by means of a rotating member on which is mounted a reel of the wrapping material, which of course revolves with the rotating member.

Machines of such construction are subject to a number of disadvantages, one of which is that when the flexible wrapping material on the reel becomes exhausted the machine must be stopped in order to remove the empty reel and replace it with another reel of wrapping material. As a consequence the wire wrapping process must be interrupted, resulting in machine-down time and also requiring an operator for changing the reels. Additionally, the presence of the reel on the rotating member limits the speed at which this member may be rotated. Considered from another viewpoint, assuming a given speed for the rotating member, the amount of wire on the reel will necessarily be limited due to the centrifugal forces involved. As a still further disadvantage, it will be recognized that the reel must be securely fastened to the rotating member while being readily changeable, and in some cases the reel may tend to fly off due to poor design or improper insertion of the reel. This is of course a dangerous condition and can result in considerable damage, loss of material, and loss of production time.

Accordingly, it is an object of this invention to eliminate the above and other disadvantages of the prior art.

It is a further object of the invention to provide apparatus in which a product made with long, narrow, flexible members such as wire, is formed by a continuous machine process.

Another object of the invention is to provide a method for continuously producing articles which utilize long, narrow, flexible members and which involves the step of wrapping the members with a flexible strand material.

A further object is to provide a method and apparatus for continuously producing wire products which includes the use of a novel strand wrapping technique.

A still further object is to produce a method and apparatus for continuously producing a twisted wire product which involves wrapping a strand of flexible material about some of the wires prior to the twisting operation.

All of the objects, features and advantages of this invention and the manner of attaining them will become more apparent and the invention itself will be best understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawing, in which

FIG. 1 illustrates a view in elevation of an apparatus in accordance with one embodiment of the invention.

FIG. 2 is a plan view of the apparatus of FIG. 1.

FIG. 3 shows an end view of the apparatus of FIG. 1 taken along the line 3-3 thereof.

FIGS. 4a, 4b and 4c are elevation, plan and end views respectively of a wire guide tube arrangement constituting a part of the apparatus of FIGS. 1, 2 and 3.

FIG. 5 is an enlarged view of a portion of the apparatus of FIG. 3 showing details of a knife cutting arrangement, and

FIG. 6 is an enlarged view of a portion of the apparatus of FIG. 1 showing details helpful in explaining the operation of the apparatus.

Briefly, the invention is directed to the manufacture of an elongated article in continuous form and includes the method and apparatus for accomplishing this purpose. In accordance with an aspect of the invention, a pair of wire-like members is fed into wire guides means for causing these wires to travel in a given direction while a strand of flexible material is wrapped about these wires by a suitable strand wrapping assembly. In accordance with a further embodiment of the invention, the wires may continue to advance in a longitudinal direction with the strand material wrapped around them so as to engage suitable cutting means for separating the strands in the regions between the two wires. As the strand material is cut, each of the wires is joined by another wire to provide two separate sets of wires comprising one of the original wires and a further wire with short pieces of strand material sandwiched between them. Immediately after the cutting process, each set of wires, is fed into a separate twisting assembly for twisting each set to thereby form two continuously moving products each comprising a core of twisted wire having a mass of resilient strand material in the form of individual short strands held securely between the twisted wires.

The invention will now be described with particular reference to the manufacture of pipe cleaners, however, it is to be understood that the principles of the invention may be employed for other purposes as well, such as, for example, to produce wrapped cable or other products.

Referring now to FIGS. 1, 2, 3 and particularly 4a and 4b, of the drawings, there is shown an apparatus in accordance with the invention having a pair of stationary wire guides 10 and 12 in the form of curved metal tubing. Tubing 10 has an input section 10a, an output section 10b, and a curved section 10c connecting the input and output sections. Guide 12 has an input and output sections 12a and 12b, respectively, and a curved section 12c.

A first continuous wire 14 is fed into the end of the input section 10a of the guide 10 and emerges from its output section 10b. A second continuous wire 16 is fed into the input section 12a of the guide 12 and emerges from its output section 12b. The output sections 10b and 12b of the guides 10 and 12 have their outer portions cut away, as at 10d and 12d, respectively, thus exposing the wires 14 and 16, so that a wrapping may be applied to them.

Referring again to FIG. 2, the continuous wires 14 and 16 are preferably, although not necessarily, driven from storage reels, not shown, into the wire guides 10 and 12 by friction drive rollers 18 and 20 which are rotated by means, not shown, in synchronism with each other to produce a desired wire feed rate. The friction drive rollers 18 and 20 are pressed against their respective wires 14 and 16, these wires being supported by idler rollers 22 and 24 (FIG. 3).

As the wires 14 and 16 are advanced, a wrapping 25 of flexible strand material 26 is wound around these wires as they move along in the output sections or channels 10b and 12b of the wire guides 10 and 12.
complished by a winding assembly 28. The winding assembly 28 includes a shaft like member 30 adapted to rotate on the bearing 31 at its left end and another bearing 32 at its right end. The right end of the shaft 30 is formed as an enlarged hollow cylindrical member 34 which substantially encompasses the curved intermediate sections 10c and 12c of the wire guides 10 and 12. A portion of the shaft 30 and the hollow cylindrical portion 34 is cut away to receive a piece of curved tubing 36 which is held in position by means of a locating collar 38 to rotate as a part of the winding assembly 28. The tube 36 receives the flexible strand material 26 through an axial bore 40 in the rotatable shaft 30 from a reel 41, and serves as a conduit and guide for wrapping the strand material about the wires 14 and 16.

In the region near the ends of the wire guide output sections 10b and 12b, there is provided a cutting mechanism comprising a pair of circular cutting knives 42 and 44 (Figs. 1, 2, 3 and 5). These knives 42 and 44 are secured in fixed position on mounting members 46 and 48 by suitable means, such as screws 43 and 45. The members 46 and 48 may also serve to mount the wire guides 10 and 12 (Fig. 2). The knife 42 severs the strand material 26 on one side of the wrapping 25, see particularly Fig. 5, and the knife 44 severs the strand material 26 on the other side of the wrapping. This produces a pair of upper group of short strand pieces 26a on the wire 14 and a lower group of short strand pieces 26b on the wire 16. The knives 42 and 44 are provided with beveled cutting edges around their peripheries so that as particular portions of the cutting edges become dull, sharp areas can easily be rotated to the cutting position merely by loosening the screws 43 and 45 and rotating the knives 42 and 44 to new positions. Although the use of circular knives 42 and 44 is preferred, it will be apparent that other forms of cutting devices could also be employed, such as, for example, razor blades.

Referring again particularly to Figs. 1 and 3, there is provided an upper wire feed tube guide 50 and a lower wire feed tube guide 52, above and below, respectively, the level of the knives 42, 44. These wire guides 50 and 52 are employed to feed wires 54 and 56, into a position adjacent the wires 14 and 16, respectively, at a position approximately where the knives 42 and 44 sever the strand material and wrapping 25 into upper and lower groups of short pieces 26a and 26b, see particularly Fig. 6. In a similar manner as described above in connection with the wires 14 and 16, the wires 54 and 56 (Fig. 3) are driven from storage reels, not shown, into their corresponding feed tube guides 50 and 52, respectively, by feeding drive for the cutters 42 and 44. The speed of the wheels 66 and 68 is preferably the same as the speed of the wires 54 and 56 so that the individual turns of the wrapping 25 are engaged by the knurled surfaces 74 and 76 of these wheels, beginning at the points 50a and 52a of the tubes 50 and 52, respectively, to give the knives 42 and 44 a straight cut. As the wires 14, 16, 54 and 56 continue to advance, the wrapping 25 is severed by the cutting action of the knives 42 and 44. The individual short pieces of strand material 26a and 26b are loosely held, respectively, between the wires 14 and 16, 54 and 56 as the wires being severed the upper individual pieces 26a become positively held between the wires 14 and 54 as the upper twisting mechanism 78 forms the twisted set 82. In similar fashion, the lower individual pieces 26b become positively held between the wires 14 and 56 as the lower twisting assembly 80 forms the twisted set 84. The twist is produced by simply rotating the crank arms 78, 80.

It will be appreciated that the method and apparatus taught herein can be employed to make a variety of products which require a wrapping of flexible material to be wound about a plurality of elongated members during manufacture. The flexible material may be a variety of materials as for example, cotton, nylon, metal, insulation coverings, etc., and may also take a variety of shapes such as circular wire, flat ribbon, etc. The invention is particularly useful for making articles in long uninterrupted lengths and provides substantial economy of manufacture and packaging. Prior to the present invention, the reduced manufacturing cost is that frequent stopping of the machine to replace reels of manufacturing material is no longer necessary. Additionally a machine operator is no longer required for changing the reels.

With the foregoing description set forth the principles of the invention in connection with specific apparatus, it is to be understood that the description is made only by way of example and not as a limitation of the scope of
the invention as set forth in the objects thereof and in the accompanying claims.

What is claimed is:

1. Apparatus for manufacturing an elongated article in continuous form comprising means for continuously feeding a first wire-like member in a given direction along a first path, means in a given location for reversing the direction of movement of said first member and to cause the same to pass along a path adjacent the portion of said first member traveling in said given direction, means for continuously feeding a second wire-like member in said given direction parallel to said first member,

further means also in said given location for reversing the direction of said second member and to cause the same to pass along a path adjacent the portion of said second member traveling in said given direction, the portions of said first and second members traveling in said reverse direction being located outwardly of the portions thereof traveling in said given direction, and means for continuously wrapping a flexible strand around the portions of said members traveling in said reverse direction.

2. The invention described in claim 1 wherein said means for continuously feeding said wire-like members includes a set of rollers for driving each member.

3. The invention described in claim 1 wherein said means for feeding said wire-like members in a given direction and said means for reversing the direction of movement of said members includes a guide in the form of a piece of tubing having a pair of substantially parallel portions with a curved section between said portions, one guide being provided for receiving said first member and another guide being provided for receiving said second member.

4. The invention described in claim 1 wherein said strand wrapping means includes a strand guiding means for receiving said flexible strand from a stationary reel, said strand guiding means being rotatable about the means in said location for reversing the direction of movement of said first and second wire-like members.

5. Apparatus for manufacturing an elongated article in continuous form comprising means for continuously feeding a first wire-like member in a given direction along a first path, means for continuously feeding a second wire-like member in a second path adjacent to said first path, means for continuously wrapping a flexible strand around said continuously fed wire-like member, means for continuously feeding a third wire-like member along a path adjacent said first wire-like member in proximal relationship with the turns of wrapping of the flexible strand material, means for continuously feeding a fourth wire-like member along a path adjacent said second wire-like member in proximal relationship with the turns of wrapping of the flexible strand material, means for severing the turns on opposite sides of said wrapping whereby to provide a first pair of adjacently arranged wire-like elements with portions of strand material held theretwixt and a second pair of adjacently arranged wire-like elements with portions of strand material held theretwixt, means for twisting said first pair of wire-like elements about their axes, and means for twisting said second pair of wire-like elements about their axes whereby to form twisted wire-like products.

6. Apparatus for manufacturing an elongated article in continuous form comprising a first wire guide for receiving a moving first wire and reversing its direction of movement, a second wire guide adjacent said first guide for receiving a second moving wire and reversing its direction of movement to thereby cause the same to travel in a direction substantially parallel to the reversed direction of movement of said first wire, said first and second wires when moving in said reverse direction being spaced apart a predetermined distance, a winding assembly for winding a continuous wrapping of said flexible strand material about said wires as they are moving in said reverse direction, said winding assembly including a strand guiding means for receiving said flexible strand from a stationary reel, said strand guiding means being rotatable about the wire reversing portions of said first and second wires, cutting means for severing the turns of said wrapping between said wires as they advance with said wrapping to thereby form a plurality of individual pieces of strand material in contact with each of said first and second wires, a third wire guide for feeding a third wire along a path adjacent the portion of said first wire traveling in said reverse direction, a fourth wire guide for feeding a fourth wire along a path adjacent the portion of said second wire traveling in said reverse direction, means for receiving and twisting said first and third wires together with the pieces of said strand material associated with said first means held therebetween, and means for receiving and twisting said second and fourth wires together with the pieces of said strand material associated with said second means held therebetween.

7. The invention described in claim 6 wherein each of said first and second wire guides comprises an input section and an output section having portions substantially parallel to one another and being joined by a curved section for reversing the direction of the wire passing therethrough, the curved sections of both of said first and second guides being located within the locus of rotation of said strand guiding means.

8. The invention described in claim 6, wherein said winding assembly further includes a rotatable shaft having a central bore for cooperating with said strand guiding means to form a conduit for said strand material.

9. The invention described in claim 6, wherein said cutting means comprises a curved knife edge positioned to sever one side of said wrapping and a curved knife edge positioned to sever the opposite side of said wrapping.

10. The invention described in claim 6, which further includes a set of rollers located adjacent the input ends of each of said first, second, third and fourth wire guides for driving the wires into their respective guides.

11. The invention described in claim 6 which further includes first means adjacent the portion of said first wire traveling in said reverse direction for engaging the turns of strand material in contact with said first wire, and second means adjacent the portion of said second wire traveling in said reverse direction for engaging the turns of strand material in contact with said second wire.

12. The invention described in claim 11, wherein said first and second means comprise first and second rotatable wheels each having an annular recess at its outer circumferential boundary, said third wire guide being curved and located within the recess in the first wheel, and said fourth wire guide being curved and located within the recess in the second wheel.

13. A method for continuously manufacturing an elongated article comprising the steps of continuously feeding a first wire-like member in a given direction along a first path, reversing the direction of movement of said first member to cause the same to pass along a path adjacent the portion of said first member traveling in said given direction,
continuously feeding a second wire-like member in said given direction parallel to said first member,
reversing the direction of movement of said second member to cause the same to pass along a path adjacent the portion of said second member traveling in said given direction,
causing the portions of said first and second members traveling in said reverse direction to move substantially parallel to one another,
and continuously wrapping a flexible strand around the portions of said members traveling in said reverse direction.

14. A method for continuously manufacturing an elongated article comprising the steps of continuously feeding a first wire-like member in a given direction along a first path, reversing the direction of movement of said first member to cause the same to pass along a path adjacent the portion of said first member traveling in said given direction,
continuously feeding a second wire-like member in said given direction parallel to said first member, reversing the direction of movement of said second member to cause the same to pass along a path adjacent the portion of said second member traveling in said given direction,
causing the portions of said first and second members traveling in said reverse direction to move substantially parallel to one another,
continuously winding a wrapping of flexible strand material around the portions of said members traveling in said reverse direction,
cutting the turns of said wrapping to thereby provide individual pieces of strand material on each of said first and second members,
continuously feeding a third wire-like member along a path adjacent the portion of said first member traveling in said reversed direction,
continuously feeding a fourth wire-like member along a path adjacent the portion of said second member traveling in said reversed direction,
twisting said first and third member together with the pieces of strand material associated with said first member held therebetween,
and twisting said second and fourth members together with the pieces of strand material associated with said second member held therebetween.

15. The invention described in claim 14 which further includes the step of engaging the individual turns of said wrapping by rotating means for preventing bunching of said turns at said cutting means.

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