

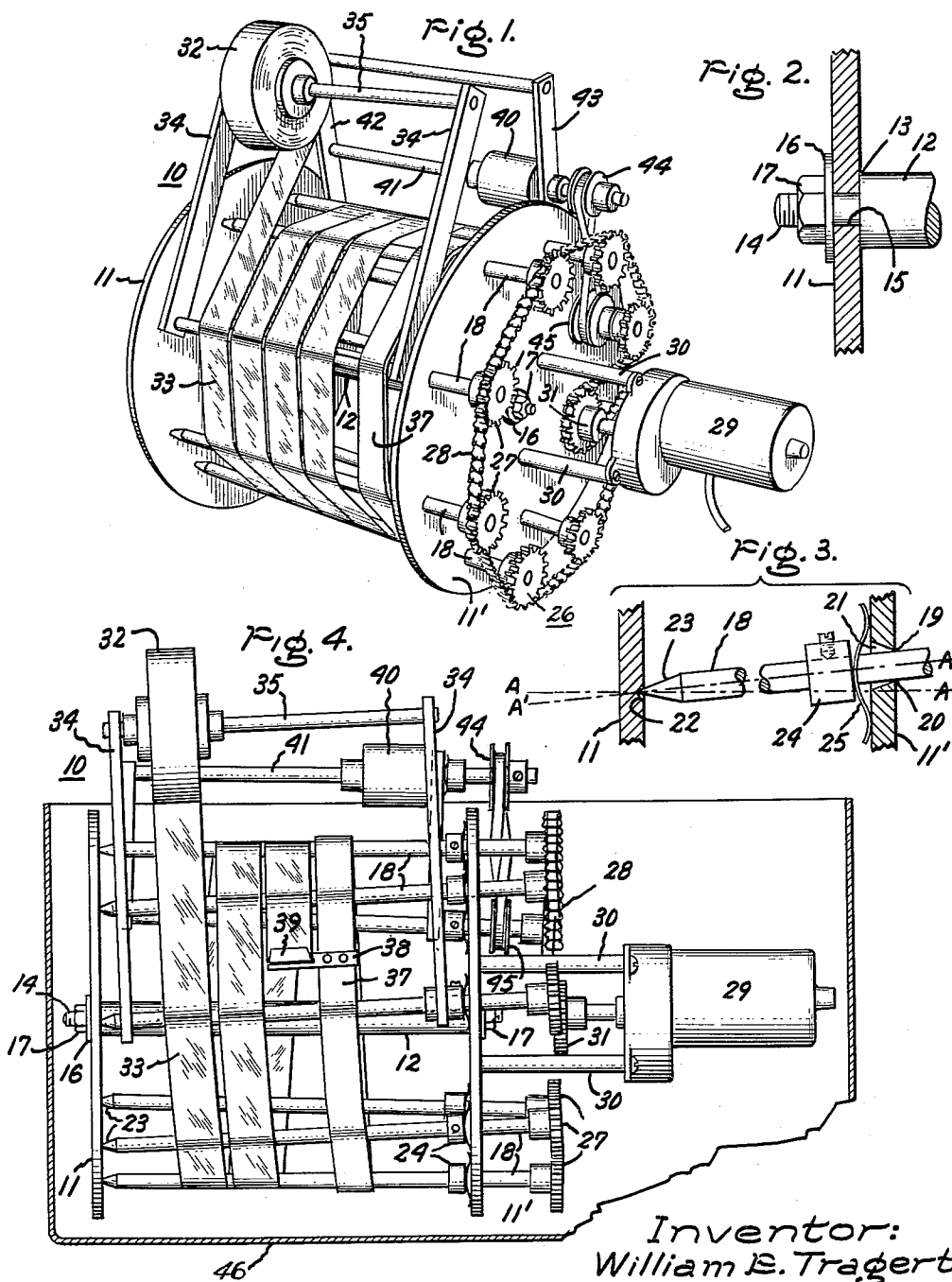
Aug. 21, 1962

W. E. TRAGERT

3,050,267

DEVICE FOR CONTINUOUS TREATMENT OF STRANDS

Filed March 16, 1960



Inventor:
William E. Tragert,
by James J. Lickiello
His Attorney.

1

3,050,267

DEVICE FOR CONTINUOUS TREATMENT OF STRANDS

William E. Tragert, Scotia, N.Y., assignor to General Electric Company, a corporation of New York
Filed Mar. 16, 1960, Ser. No. 15,493
6 Claims. (Cl. 242—47.1)

This invention relates to a device for the continuous treatment of strands, and more particularly, to a multiple-skewed roller helical winding and unwinding apparatus for submersed treatment of strand material.

The term "strand" as employed in this specification is intended to include all forms of material such as, for example, sheet, filamentary, ribbon, wire, etc., i.e., those materials which may be easily wound and unwound from spools. In many instances, such material is subjected to chemical treatment which may require submersion for extended periods of time in a chemical bath. For example, elongated ribbon-like forms of aluminum may be required to be anodized before becoming the desired and finished article. Anodization, oxidation, and other such types of treatment generally include submersion for extensive periods of time. Usually, the material is unwound from a spool, fed into a bath or solution, withdrawn, and rewound on an additional spool. However, where the chemical treatment requires, for example, 10 to 30 minutes, difficulties are encountered in maintaining the submerged condition over such a period of time where continuous operation and high output is desired. Secondly, in order to obtain the required submersion time, chemical baths are very large, extensive, and space consuming. These baths may then be necessarily equipped with a plurality of rolls. The submersion of a plurality of rolls then introduces problems of maintaining the strand on the rolls at all times, maintaining proper strand position in the bath, suitably supporting the strand with little tension, and the problem of introducing and withdrawing such a strip after having passed about a plurality of rolls in the submerged condition without damage. It would be desirable to have a simple, easily adjustable and economical device which would maintain various strands in the submerged condition over extended periods of time while yet maintaining strands separate, in proper position within the bath, and including, to utilize only minimum space.

It is, therefore, an object of this invention to provide an improved strand feeding device.

It is another object of this invention to provide a continuous treatment device for maintaining a strand in a submerged condition over extended periods of time.

It is yet another object of this invention to provide a helical storing and advancing strand winding device for strand material to maintain the strands in the submerged condition over extended periods of time.

It is another object of this invention to provide a helical strand winding device occupying a minimum space.

It is another object of this invention to provide an improved adjustable helical roller-operated strand treating and winding device.

It is another object of this invention to provide a helical strand winding and unwinding device easily adjustable for strands of various dimensions with minimum edge stress of the strand.

Briefly described this invention includes a plurality of driven rollers supported and positioned to define a general cylindrical structure with their longitudinal axes substantially parallel to the axis of the cylindrical structure. The rollers are independently driven and are angularly adjustable to be skewed relative to the longitudinal

2

axis of the cylindrical structure so that a strip will be helically wound thereabout.

This invention will be better understood when taken in connection with the following description and the drawing in which;

FIG. 1 is a perspective view of one preferred embodiment of this invention;

FIG. 2 is a partial view of the connecting shaft maintaining the end plates of FIG. 1 in position;

FIG. 3 is a partial view illustrating roller mounting; and

FIG. 4 is a front elevation view of the embodiment of FIG. 1.

Referring now to FIG. 1, there is illustrated a helical strand device 10 which incorporates the features of the invention just described. In FIG. 1 apparatus 10 includes a pair of end members, supports or plates 11 and 11'. Members 11 and 11' are supported and maintained in their spaced apart relationship by means of a central shaft 12 which under certain conditions permits limited rotational adjustment of members 11 and 11'.

FIG. 2 illustrates one member 11 being supported by shaft 12 and is exemplary of the support arrangement for member 11' also. Shaft 12 includes a shoulder portion 13 at each end thereof formed by a threaded turned down portion or extension 14. Member 11 contains a central opening 15 through which is inserted the extension 14 of shaft 12. Member 11 therefore abuts against shoulder 13 of shaft 12 and is thereafter maintained in this position by means of washer 16 and nut 17. A plurality of roller elements or shafts are positioned circumferentially within and concentric with members 11 and 11' with their longitudinal axes parallel to the axes of shaft 12. Roller elements 18 must be maintained in their described position in such a manner that either end may be partly moved in a circumferential manner with respect to the other end. In order to provide this motion, each element 18 is positioned within the disks 11 as illustrated in FIG. 3.

Referring to FIG. 3, one of said end members, for example, 11' includes a circumferential row of tapered openings 19 tapering from a smaller size opening 20 to a larger size opening 21. The other end member 11 includes a circumferential row of tapered recesses or pivots 22. Each element 18 is positioned and maintained in a pivot 22 and opening 21. Element 18 includes a tapered or frustoconical portion 23 of a somewhat less taper than the taper of pivot 22 in order to form in the first instance a pivot type bearing and also to permit rocking of element 18 in the pivot. To maintain the other end of element 18 in opening 21 in a fixed position and to prevent longitudinal sliding thereof, each element 18 includes a lock-set device 24 and a spring 25. Spring 25 may be of various well-known types, for example, of the Bellevue washer type and engages disk 11' and the lock-set device 24 to maintain a biasing force therebetween. It is obvious from this arrangement that, assuming disk 11 to be stationary, that disk 11' may be rotated about its longitudinal axes or shaft 12 and that the combination of spring 25 and tapered opening 19 permits element 18 to follow this movement. At the same time, tapered portion 23 being smaller than pivot 22 in member 11 also permits element 18 to rock about this center point. Rocking will thus skew elements 18 from their initial center line AA to line AA' as illustrated. This form of rocking action then provides for the maintenance of all elements 18 in a generally parallel relationship to each other, but at the same time elements 18 may be skewed such that their longitudinal axes will not be parallel to the longitudinal axes of shaft 12. This may also be described by saying that the ends of the roller elements 18 move over an arcuate path for adjustment. This adjust-

ment is accomplished merely by loosening nut 17, FIG. 2, on shaft 12, rotating one of the disks 11 or 11' with respect to the other, and retightening nut 17 which in this instance operates as a friction lock. While this description has described a particular mounting means, it is obvious that other mounting means well known in the art may be employed. Specifically, for example, pivot bearing assembly and the tapered opening assembly may be replaced by an adjustable, flexible or otherwise self-aligning bearing. The adjustment as described will, however, in addition to rocking elements 18 out of parallelism with shaft 12, also tend to form a conical projection of elements 18. This tendency is minimized by the described arrangement to the extent that it is negligible.

In an anodizing operation, for example, of a strand material in the form of thin aluminum foil, tension on the foil must be kept to a minimum to avoid breakage during the anodization process, and more importantly, edge stresses must be substantially eliminated or minimized to prevent wrinkling or tearing. Therefore, provision is made to rotate each of the elements 18, although, of course, it is to be understood that a lesser number may be rotated if desirable. In this respect each element 18 projects through disk 11 to have upon the end portion thereof driving means 26. Each of the drive means 26 then may be rotated by any arrangement well known in the art such as straight gearing, friction drive, or flexible drive, and in the illustrated embodiment of this invention, drive means 26 is in the form of a sprocket 27 which is to be driven by a continuous link belt or chain 28. Electric motor drive assembly 29 is employed for motive power although it is to be understood that this apparatus may be connected to any primary source of power or take-off units. Motor assembly 29 is affixed to disk 11' by means of elongated studs 30, and operates, when connected to a suitable source of electrical power, not shown, to rotate a sprocket gear 31. Link belt or chain 28 is positioned about all of gears 26 so as to also pass inwardly and around gear 31. It is thus understood that operation of the motor assembly 29 turns gear 31 and through the medium of the chain 30 rotates all elements 18 in synchronism.

This apparatus may be employed in conjunction with a fluid bath in various positions. For example, the unit may be mounted either horizontally or vertically in the submerged condition or extend through the sides of a tank, for example, where the motor drive and chain assembly may be part of the external configuration of the bath. In operation the assembly 10 is adjusted to skew elements 18, and a strip of material, for example aluminum foil, is fed circumferentially about elements 18 at one end of the unit and thereafter the foil will be fed in a helical path depending upon the skew relationship of elements 18 to be then withdrawn at the far end. It is obvious that a considerable length of foil may be maintained in the anodizing bath for prolonged periods of time depending upon the rotational speed of elements 18. The fact that the elements remain substantially in parallelism reduces, to a great extent, edge stresses in the helical form.

In order to facilitate the initial feeding of the strand, a feeding device is employed in conjunction with this apparatus. Referring to FIG. 4, there is illustrated the apparatus 10 in a fluid bath or tank 46. While the complete assembly 10 is illustrated as within the tank 46, it is obvious to those skilled in the art that various parts could be integral with the tank or positioned outside thereof, for example, the motor unit could be external. Feeding device 32 is illustrated in one form as a reel or spool of foil 33 which includes a pair of support members 34 and a shaft 35. When feeding a strand such as a foil strip 33, the longitudinal axis of the shaft 35 should be parallel to the longitudinal axes of the first element 18 over which the foil strip 33 passes. This arrangement enables the foil strip 33 to conform to the helix

dictated by the skew with a minimum of lateral stress.

In order to initially attach the foil strip strand to the helical device, one suitable means includes a band 37, more particularly of an elastic material and joined as at 38 with any suitable connector 38. The starting edge 39 of the foil strip is attached to the connector 38. Thereafter upon rotation of the device the elastic band 37 moves helically along the device while at the same time carrying with it the aluminum foil strip 33. Upon reaching one extreme of the device the band 37 is removed and the end 39 of the foil may then be attached to a suitable winding spool.

The final wind-up spool may also be part of the apparatus and in one embodiment of the invention as illustrated in FIGS. 1 and 4 as 40. Spool 40 is positioned upon a shaft 41 and together with support members 42 and 43 is suitably supported from the device 10. An extension of shaft 41 carries suitable drive means, for example, pulley 44. A further pulley 45 is positioned upon one of elements 18 and a belt between pulleys 44 and 45 operates to revolve spool 40 at the same rotational speed as that of elements 18.

It is apparent that small misalignments of elements 18, i.e., deviation from initial parallelism, is of no serious consequence in the operation of this machine because the lateral displacement of the strip is the result of the combined lateral frictional force of all roller elements 18. The total displacement per turn thus becomes the same, regardless of alignment, and the turns of the helix are maintained parallel.

This apparatus permits extended lengths of strands to be maintained in a submerged condition in various chemical processes for extended periods of time. By means of the plurality of circumferentially positioned rollers, a greater length strip may also be submerged with only a minimum volume or space required. The apparatus obviates the necessity of duplicating various pairs of adjustable rollers and the inherent problems of skew adjustment. Skew may thus be adjusted or varied for a series of rollers at one time and with one adjustment. The parallelism of roller elements 18 together with the skew adjustment between a great number of such elements permit the device to be operated and adjusted for strands of various dimensions including, for example, ribbons of foil having a very low tensile strength.

Where skewed rollers have been extensively used in the filament art, they have not been adapted to metallic foil ribbon or strip because of the fact that the helix employed imposes severe edge stresses on thin foil. Without such an apparatus as disclosed in this invention such a thin strip of foil would necessarily require various mechanical apparatuses to maintain long lengths submerged in a large tank and to effectively support it, at times without a wiping action. A 3 mil thick aluminum foil 1 inch wide has been taken off such an apparatus at the rate of 9 feet per minute after anodizing in a chemical bath. The final result is a strip of material free of wrinkles, dents, and bumps which would otherwise appear in strips from prior apparatus.

The important features of this invention, i.e., a plurality of rolling elements circumferentially supported and arcuately skewed in unison has been described in relation to one assembly or structure therefor. It will be apparent to those skilled in the art that various modifications of this apparatus and method are contemplated to be within the scope of this invention. It is, therefore, intended that the following claims include such modifications within the inventive scope thereof.

What I claim as new and desired to secure by Letters Patent of the United States is:

1. A continuous helical strand winding and unwinding apparatus comprising in combination, a pair of support means, a plurality of roller elements supported by said support means to define a generally cylindrical structure, means pivotally connecting said roller elements to said

5

support means to provide for rotation of said elements about their longitudinal axis and skewing action thereof, adjusting means causing arcuate motion of one of said support means relative to the other of said support means to skew roller elements circumferentially out of parallelism with the longitudinal axis of said cylindrical structure, and means for rotating said roller elements in synchronism to helically wind a strand thereon.

2. A helical winding and unwinding apparatus comprising in combination, a pair of end members, a plurality of roller elements supported by said end members to define a generally cylindrical cage structure, means pivotally connecting said roller elements to said end members to provide for rotation of said elements about their longitudinal axis and circumferential skewing action thereof, adjusting means causing limited arcuate rotation of one of said end members about the longitudinal axis of the said cylindrical cage structure relative to the other of said end members to skew said elements circumferentially out of parallelism with said cylindrical structure, and means to drive said roller elements in synchronism to wind a strand thereon.

3. A helical winding and unwinding apparatus comprising in combination, a shaft, a pair of end frame members positioned at each end of said shaft, a plurality of roller elements positioned circumferentially between said frame members to provide a cylindrical cage structure, self-aligning bearing means positioning said roller elements on said frame members, a driving element on each of said rotating elements, drive means driving each of said elements for synchronous rotation to wind a strand helically thereon, and means providing limited rotation of one of said frame members on said shaft relative to the other of said frame members to circumferentially skew said roller elements.

4. A helical winding and unwinding apparatus comprising in combination, a shaft, a pair of end frame members concentrically positioned at each end of said shaft, a plurality of roller elements positioned circumferentially between said frame members to provide a cylindrical structure, pivot means positioning each end of said rotating elements in said frame members, drive means positioned on each element, means providing limited rotation of one of said frame members with respect to the

6

other of said frame member to thereby circumferentially skew said roller elements, flexible drive means interconnecting said drive elements for rotation thereof in synchronism, means to feed a strand of material to said rotating elements for helical winding thereon, said means including a spool positioned with its axis parallel to the axis of a rotating element first receiving said strand.

5. The invention as claimed in claim 3 including means to take off strand from said apparatus, said means including a spool having its axis parallel with the last element to engage said strand.

6. A continuous helical metallic ribbon winding and unwinding apparatus to maintain a strand submerged in a fluid bath condition for treatment thereof comprising in combination, a pair of spaced apart end members, at least 4 rolling elements positioned between said end members to define a cylindrical cage structure means pivotally connecting said roller elements to each of said end members for rotation about their longitudinal axis and circumferential skewing about the longitudinal axis of said cage structure, means causing arcuate motion of one said end members with respect to the other of said end members to skew said elements, drive means connected to each of said elements, a flexible driving element interconnecting each of said drive means to rotate said roller elements in synchronism, a feeding spool of metallic ribbon positioned cooperatively with said apparatus and having its longitudinal axis parallel with the first roller element to engage said ribbon for winding said ribbon helically thereon, a winding spool to wind said metallic ribbon after treatment in said bath, said winding spool having its longitudinal axis parallel to the last of said roller elements engaging said ribbon, and drive means interconnecting said winding spool and one of said roller elements for synchronous rotation of said spool.

References Cited in the file of this patent

UNITED STATES PATENTS

2,037,421	Little	Apr. 14, 1936
2,652,350	Dailey	Sept. 15, 1953
2,701,717	Morrill	Feb. 8, 1955
2,781,894	Covington	Feb. 19, 1957
2,963,233	Riegler	Dec. 6, 1960