Oct. 25, 1966 G. A. CARRUTHERS 3,280,440

APPARATUS FOR COILING CONTINUOUS FILAMENT YARN

Filed May 21, 1962 3 Sheets-Sheet 1

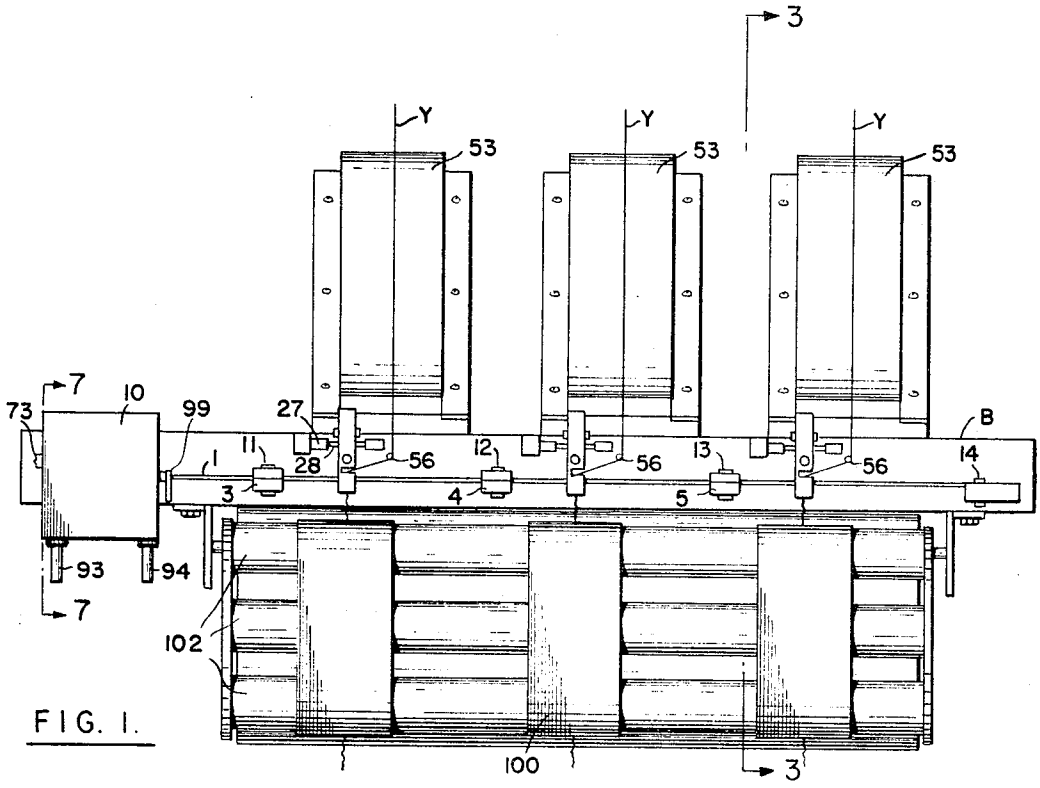


FIG. 1.

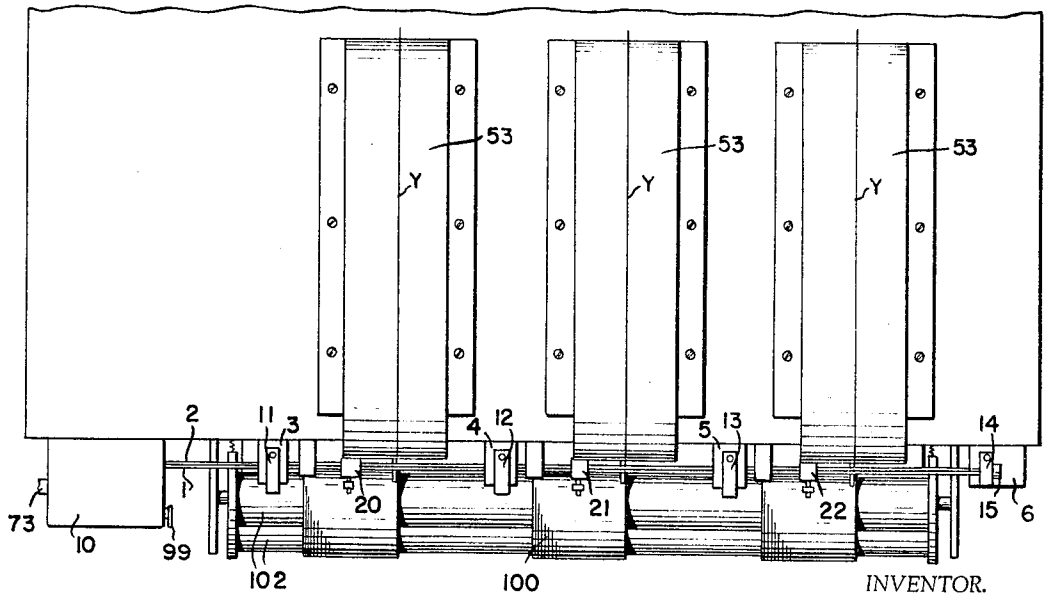


FIG. 2.

INVENTOR.
GEORGE A. CARRUTHERS
BY
ATTORNEY

Oct. 25, 1966 G. A. CARRUTHERS 3,280,440

APPARATUS FOR COILING CONTINUOUS FILAMENT YARN

Filed May 21, 1962 3 Sheets-Sheet 2

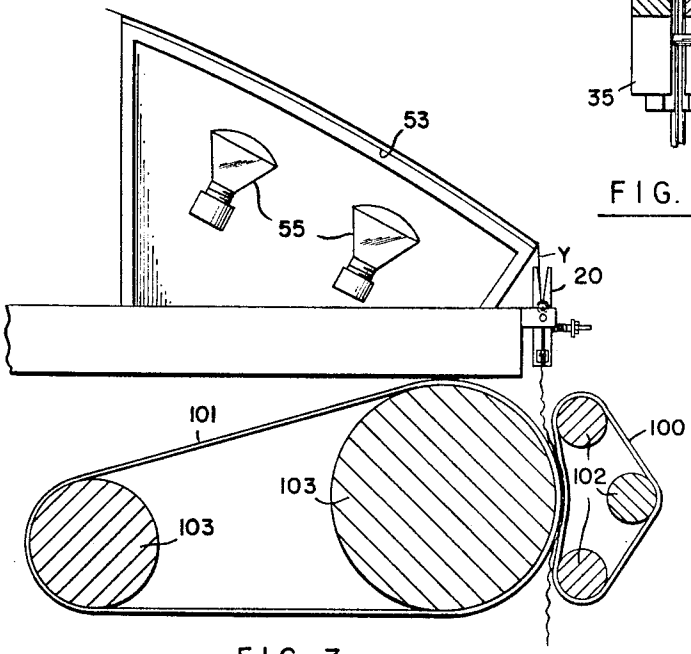


FIG. 3.

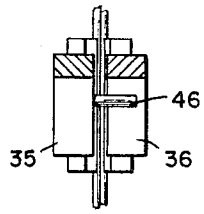


FIG. 5.

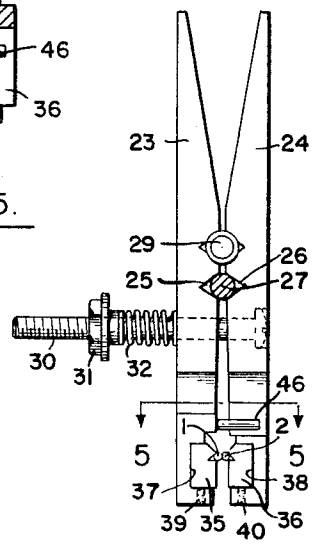


FIG. 4.

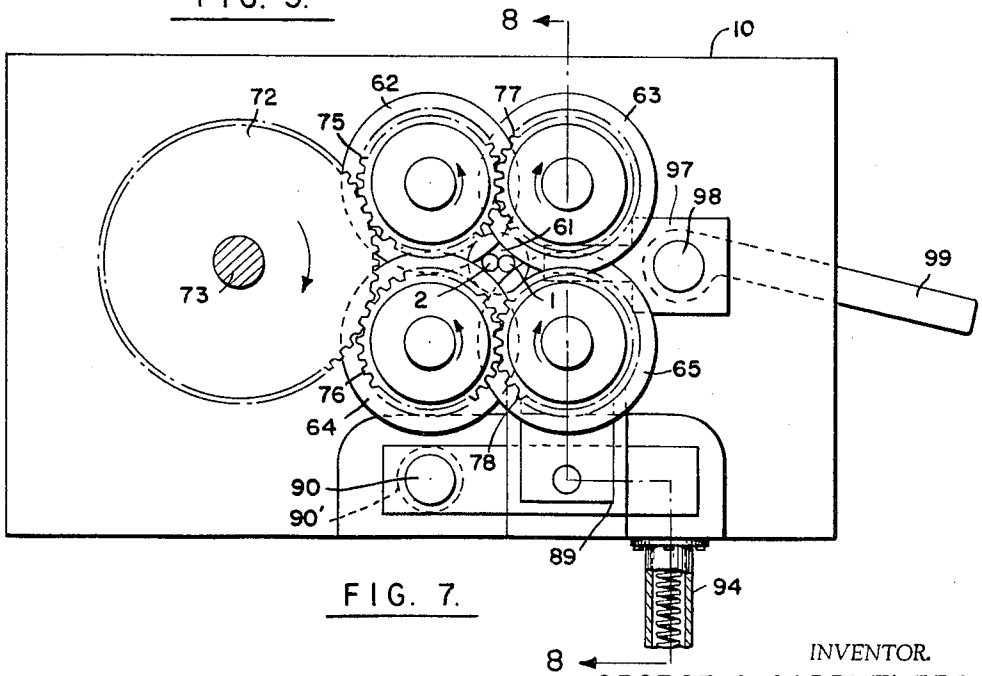


FIG. 7.

INVENTOR.
GEORGE A. CARRUTHERS
BY
ATTORNEY

Oct. 25, 1966 G. A. CARRUTHERS 3,280,440

APPARATUS FOR COILING CONTINUOUS FILAMENT YARN

Filed May 21, 1962 3 Sheets-Sheet 3

FIG. 8.

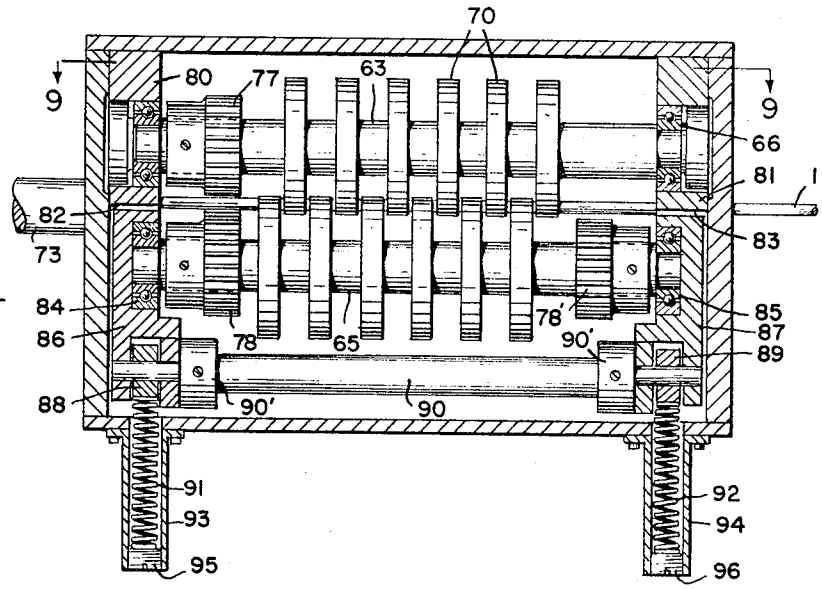
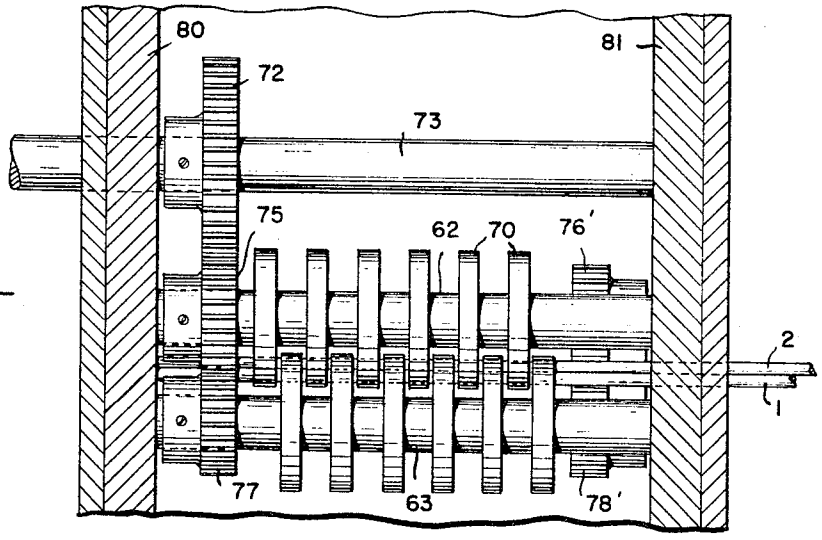


FIG. 9.



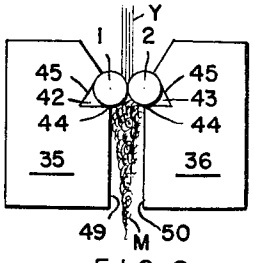


FIG. 6.

INVENTOR.
GEORGE A. CARRUTHERS
BY
ATTORNEY

United States Patent Office

3,280,440

Patented Oct. 25, 1966

3,280,440

APPARATUS FOR COILING CONTINUOUS FILAMENT YARN

George A. Carruthers, Harleysville, Pa., assignor to Turbo Machine Company, Lansdale, Pa., a corporation of Pennsylvania

Filed May 21, 1962, Ser. No. 196,215
1 Claim. (Cl. 28—1)

This invention relates to the treatment of synthetic fiber yarns, particularly those comprising a plurality of continuous filaments which may or may not be spun or twisted together about a common axis during manufacture, and is directed to producing in these filaments a uniform deformation corresponding substantially to elongated helices of small diameter which on subsequent heat treatment may become a permanent characteristic of the filaments.

In my prior copending application, Serial No. 164,270, now U. S. Patent 3,128,794, granted April 20, 1965, I disclosed and claimed a method and apparatus for treating synthetic yarn to produce such helix therein and the present invention, operating in accordance with said method, is directed to a different and novel apparatus including means for simultaneously treating a plurality of yarns by passing them between elongated small diameter rolls at stations spaced axially of the rolls.

In that application, it is pointed out that when yarn is passed axially between rotating rolls of small diameter exerting pressure upon it and restrained or obstructed against issuance therefrom by an accumulation of the yarn itself adjacent the exit side of the roll nip the yarn becomes compacted in a helix of small diameter in which it may be permanently set by subsequent heat treatment, at least one of the rolls being of the order of ¼" or ½" in diameter to enable restrictor guides frictionally retaining an obstructing mass of the curled yarn to be disposed close enough to the roll nip to produce the desired result, but in the present apparatus I prefer to use even smaller diameter rolls enabling the elements retaining the yarn mass to be located even closer to the roll nip than when rolls ¼" to ½" diameter are used, for securement of maximum production a plurality of pairs of such elements being arranged in spaced relation along small rolls greatly elongated axially as compared with those disclosed in said application.

It is therefore a principal object of the present invention to provide apparatus for coiling or curling continuous filament yarns to enable them by subsequent heat treatment to accept permanently a helical conformation whereby when alternately axially extended and relaxed a number of times the individual helical filaments become separated, producing an open yarn of overall diameter many times that of the original yarn and desirable for weaving or knitting into light, soft, elastic fabrics of many kinds.

It is a further object of the invention to provide a plurality of means adapted for association with a single pair of rolls whereby a number of separate yarns may be simultaneously treated by said rolls as aforesaid.

Still another object is to provide novel driving means for elongated rolls of small diameter whereby through frictional power transmission they may be rotated in opposite directions at high speeds of the order of many thousand r.p.m.

Other objects, purposes and advantages of the invention will hereafter more fully appear to be understood from the following description of a preferred embodiment of it, reference being had to the accompanying drawings in which:

FIG. 1 is a diagrammatic front elevation of the apparatus;

FIG. 2 is a fragmentary top plan view thereof, and

FIG. 3 is a diagrammatic transverse section on line 3—3 in FIG. 1.

FIG. 4 is an enlarged side view of one of the yarn curling clips shown in the preceding figures;

FIG. 5 is a section on line 5—5 in FIG. 4;

FIG. 6 is a further enlarged detail of the yarn curling elements illustrated in FIG. 4;

FIG. 7 is an enlarged vertical section on line 7—7 in FIG. 1 showing the roll driving mechanism included in the apparatus;

FIG. 8 on a slightly smaller scale is a section on line 8—8 in FIG. 7, and

FIG. 9 is a fragmentary section on line 9—9 in FIG. 8.

More particularly said apparatus as shown may be considered as comprising fundamentally two units correlated through their relationship to a pair of elongated rolls **1**, **2** which may be full finished hardened rods of 1/16" drill stock, resting in spaced supports **3**, **4**, **5**, received at one end in a driving unit **10** hereinafter more fully described and at the other in an end bearing **6**, said supports, bearing and driving unit being fixed to a suitable base B. The supports **3**, **4**, **5** are provided with transverse grooves receiving the rolls and overlaid by spring tongues **11**, **12**, **13** retaining the rolls in the grooves, bearing **6** at the free end of the rolls having a similar tongue **14** and an abutment **15** aligned with the roll axes to prevent their axial translation in one direction.

Preferably in each of the spaces between adjacent pairs of said supports are disposed curling clips **20**, **21**, **22** of which but one, clip **20**, is illustrated in detail (FIGS. 4 and 5) as all the clips are identical; it will be understood any convenient number of them with corresponding repetition of accessory elements may be associated with a single pair of rolls for simultaneously treating a corresponding number of yarns.

Each clip comprises a pair of spring pressed opposed bars **23**, **24** having transverse V-shaped grooves **25**, **26** embracing a rod **27** fixed to the base B and having a short portion **28** of reduced diameter to limit migration of the clip axially of the rod. Bars **23**, **24** are pivoted on a short fulcrum stud **29** and held together in embracing relation to rod **27** by a bolt **30**, nut **31** and spring **32** whereby the pressure exerted by the roll receiving members **35**, **36** proximate the adjacent ends of the bars may be regulated. These members, fixed in transverse grooves **37**, **38** near the bar ends with the aid of set screws **39**, **40** have oblique angular or V-shaped grooves **42**, **43** respectively receiving the rolls with an accurate sharp lower edge **44** of each groove engaging the adjacent roll while the opposite face **45** of the groove provides lateral support to it, the bars thus forcing the rolls together under the bias of spring **32** to exert pressure on the yarn Y fed between them over a guide **46** on one of the bars. Below the lower edges of grooves **42**, **43** roll receiving members **35**, **36** present opposed substantially parallel plane faces **49**, **50** which function as restrictor guides to retain frictionally adjacent the nip of the rolls a mass M of the helically formed yarn after its passage through the rolls.

The yarn is supplied preferably under low tension to a plate **53** over which it passes in contact therewith whereby it is heated on its passage to the rolls, infra red lamps **55** or other convenient means for heating the plate being provided, and an intermediate, preferably ceramic or ceramic-coated guide **56** supported from base B helps to maintain the yarn properly aligned with the plate and under slight tension to insure good contact therewith.

The driving means for coiling rolls **1**, **2** comprise supporting housing **10** into which they extend through an

opening 61 and in which are disposed cooperative pairs of drive rolls 62, 63 and 64, 65. Each of these latter rolls, which may be identical and turned integrally from bar stock or the like, has reduced ends receivable respectively in a suitable bearing, those on rolls 62, 63, 64 being exemplified by bearing 66 adjacent one wall of the housing while those on roll 65 are movably supported as will hereinafter more fully be described. Between their reduced ends the drive rolls are grooved to provide a plurality of spaced integral discs or lands 70 on each, so disposed with respect to the roll ends that when two of the rolls are turned end for end and their ends mounted in transversely aligned supports the lands of each roll project within the imaginary cylinder defined by the lands of the other, as shown in FIGS. 7, 8 and 9, the lands on rolls 62, 64 to the rear of rolls 63, 65 in FIG. 8 and those on rolls 64, 65 below rolls 62, 63 in FIG. 9 being omitted from these latter two figures for clearness of illustration.

The driving rolls are driven from gears, including a main driving gear 72 fixed to a shaft 73 driven from any suitable prime mover (not shown), gear 72 meshing with spur gear 75 adjacent one end of drive roll 62 and with a similar gear 76 adjacent the corresponding end of drive roll 64 the other end of which carries a gear 76'. Like gears 77 on drive roll 63 and 78, 78' proximate the ends of drive roll 65 mesh with and are driven by gears 75, 76, 76' respectively. These several rolls have reduced ends projecting as stub shafts into adjacent antifriction bearings, those supporting drive rolls 62, 63, 64 being received in suitable apertures in plates 80, 81 fixed to the adjacent walls of housing 10, the said plates defining openings 82, 83 adjacent the bearings 84, 85 supporting drive roll 65 and its gears 78, 78'. These bearings are disposed in movable blocks 86, 87 pivotally carried by levers 88, 89 supported pivotally at one end from a transverse rod 90 carried by the housing walls and provided with collars 90' which prevent axial movement of the levers. At their other ends the levers are engaged by compression springs 91, 92 disposed in tubes 93, 94 depending from the housing and provided with threaded plugs 95, 96 whereby the pressure of the springs against the levers may be appropriately adjusted to control in turn the pressure of the lands on the drive rolls against coiling rolls 1, 2 when the latter are disposed in the housing in engagement with the driving rolls in the manner best illustrated in FIG. 7. Pivoted stops 97 may be mounted on a transverse shaft 98 adjacent roll 65 at each end of the housing so that when actuated by a lever 99 fixed to shaft 98 outside the housing roll 65 can be depressed to enable the coiling rolls to be removed from or replaced in the housing, the stops, lever and shaft being omitted in FIGS. 8 and 9 to facilitate illustration of other parts.

As shown in FIG. 7 the intermeshing of the lands and grooves of rolls 62–65 enables them in effect to define a space bounded by arcs intersecting in four cusps in an opposed pair of which the drive rolls frictionally engage the surfaces of the coiling rolls to rotate the latter at the high speed essential for most effective production of coiled yarn, the direction of rotation of the several driving rolls as well as that of gears 72, 72' being indicated by arrows in FIG. 7 from which it will be evident the coiling rolls are turned in opposite directions so as to pass the yarn through their nip from top to bottom in said figure, i.e., roll 2 turning clockwise and roll 1 counterclockwise therein.

Auxiliary mechanism not an essential part of this invention is diagrammatically indicated in FIGS. 1–3 for carrying the coiled yarn from the coiling mechanism and may comprise pairs of endless belts 100, 101 respectively associated with the coiling units and carried by elongated rollers 102 over which run one belt of each pair while rollers 103 drive the other, said rollers being adjustably mounted to permit control of the pressure exerted by the belts against the yarn and preferably driven by separate prime movers (not shown).

The operation of the apparatus will in general be understood from the foregoing in the light of my said prior application but certain details thereof may advantageously be more fully explained to enable those skilled in the art to obtain maximum benefits from the invention.

Thus, while the temperature at which the heating plates are maintained is dependent to some extent on the denier of the yarn being treated, the material of which it is made, the speed at which it is drawn over the plates and other factors, it is desirable it be sufficient to impart a sensible heating to the yarn so it will pass into the coiling unit at a temperature appreciably above the ambient one, although not so hot as materially to impair its tensile strength. Moreover, in some installations it may be desirable to provide a tensioning device other than the guides herein mentioned to impose on the yarn additional tension as it passes to the heating plates and thence to the rolls but as many specifically different kinds of such devices are known it is unnecessary herein to describe any of them more fully. As has been noted, however, rolls 1, 2 are preferably driven at peripheral speeds of the order of a thousand feet per minute or more and when a yarn end after passage through or over the guides and heating plate and through a tensioning device, if any, is presented to the rapidly revolving rolls it normally is immediately drawn through them and discharged from the opposite side of the roll nip. Occasionally just after start up the yarn may pass freely and relatively unchanged between the restrictor guide surfaces in which case a small rod or the like may be manually introduced until yarn mass M has accumulated between them sufficiently to frictionally engage the surfaces, following which the manually held obstruction may be withdrawn and the progressively changing mass M of curled yarn is thereafter normally maintained by the restrictor guides closely adjacent the roll nip to effect coiling of the succeeding yarn which as it accumulates extrudes the yarn previously curled and accumulated from the restrictor guide zone and thence, if take-up belts are used, between them and into a receptacle, or to a heating chamber if heat treatment for setting the coils is immediately to follow.

The driving rolls which, as noted, have roll driving lands many times the diameter of the coiling rolls, are driven of course at peripheral speed corresponding to that of the latter but due to their larger diameter, at a much lower rotational speed. They, as well as the gears driving them, are supplied with lubricant in any convenient manner and I prefer to keep the drive unit housing 10 fully enclosed during operation as the high speed of the moving parts tends to atomize the lubricant and an atmosphere in the housing well occupied by submicroscopic particles of it tends to insure its adequate distribution over the surfaces of the moving parts.

Since the mechanism herein shown and described is convenient and eminently effective for driving rolls 1, 2 at the high peripheral speeds essential for volume production of curled yarn I normally prefer to employ it for that purpose for which it primarily has been designed. It will be recognized, however, that it may be used for driving roll elements adapted for different purposes if desired, while other driving mechanism may be employed for rolls 1, 2 since that aspect of the invention having to do with the coiling of the yarn fed to these rolls is substantially independent of the mechanism utilized for rotating them.

Hence while I have herein shown and described the driving mechanism preferably associated with the yarn engaging rolls and have otherwise disclosed one embodiment of the invention in specific detail, it will be understood I do not desire or intend to be limited or confined thereto or thereby in any way as changes and modifications in the form, structure, arrangement and relationship of the

several components and parts thereof will readily occur to those skilled in the art and may be utilized if desired without departing from the spirit and scope of the invention as defined in the appended claims.

Having thus described my invention, I claim and desire to protect by Letters Patent of the United States:

Apparatus for coiling yarn comprising a pair of elongated parallel rolls adapted to progressively receive yarn and project it from their nip, means for driving the rolls in opposite directions, means engaging the rolls affording lateral support thereto and presenting substantially parallel plane faces adjacent the nip of the rolls, said faces each being disposed to frictionally engage the yarn discharged from said nip to thereby progressively obstruct passage of subsequent yarn therefrom until it has assumed helical form, said last mentioned means comprising opposed elements each presenting a substantially V-shaped groove for reception of the adjacent one of said rolls, and an acute edge adjacent its said plane face engaging the surface of said one roll, said driving means for the rolls comprising spaced pairs of grooved rollers, lands between

adjacent grooves on each roller frictionally engaging one of the rolls and extending into the grooves in an adjacent roller and means for rotating the rollers.

References Cited by the Examiner

UNITED STATES PATENTS

2,765,665	10/1956	Pickels et al.	74—206
2,793,418	5/1957	Pfau	28—1
2,970,491	2/1961	Bertsch	74—206
3,037,260	6/1962	Pike	28—1
3,046,633	7/1962	Ohashi et al.	28—1
3,067,480	12/1962	Crocker	19—66 X
3,139,664	7/1964	Carruthers	28—1
3,164,882	1/1965	Rosenstein et al.	28—1
3,174,208	3/1965	Saito et al.	28—72

MERVIN STEIN, *Primary Examiner.*

RUSSELL C. MADER, *Examiner.*

H. S. JAUDON, H. G. GARNER, *Assistant Examiners.*