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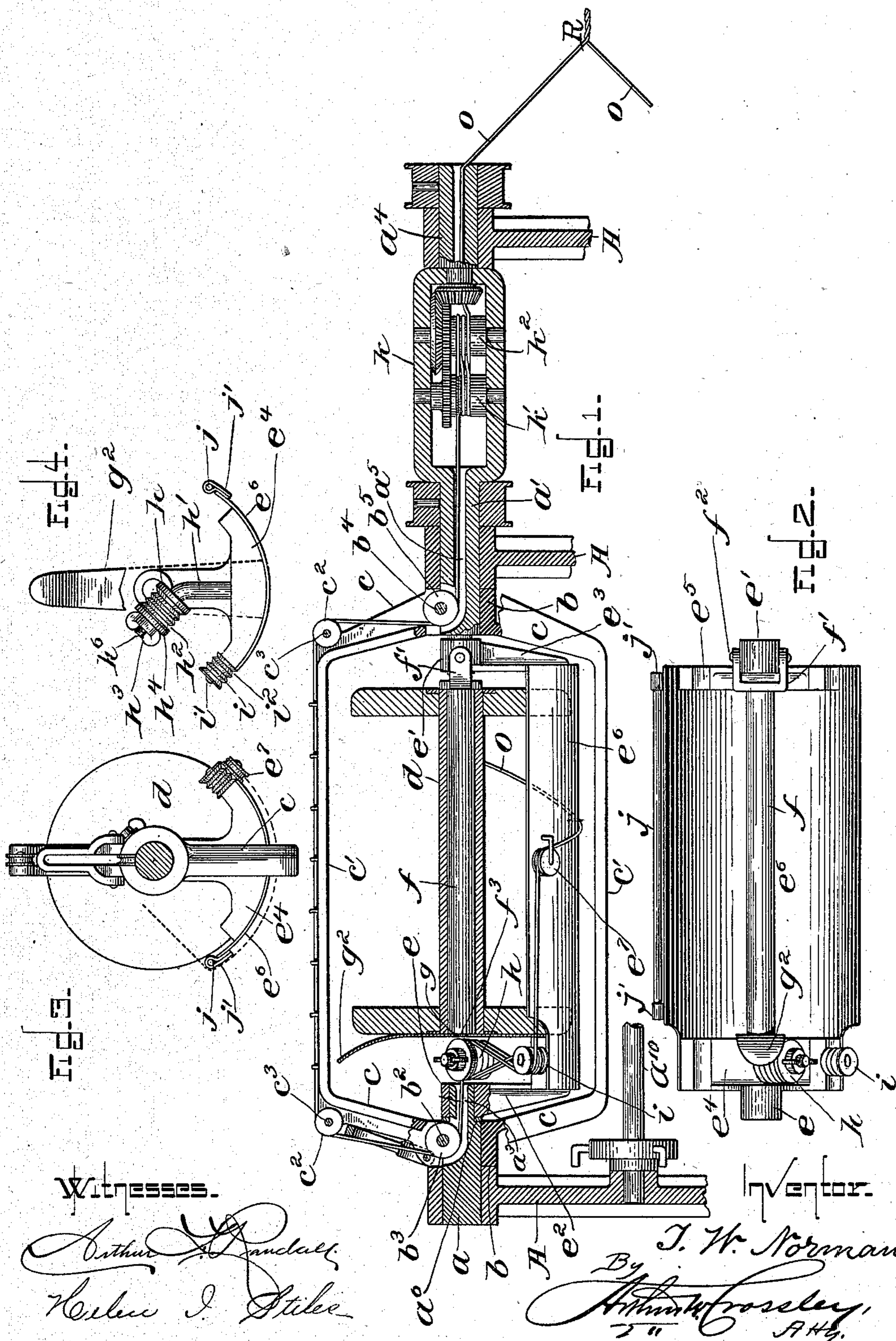
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T. W. NORMAN.
CORD OR ROPE MAKING MACHINE.

APPLICATION FILED MAR. 5, 1897.

NO MODEL.

2 SHEETS—SHEET 1.



UNITED STATES PATENT OFFICE.

THOMAS W. NORMAN, OF BOSTON, MASSACHUSETTS.

CORD OR ROPE MAKING MACHINE.

SPECIFICATION forming part of Letters Patent No. 723,178, dated March 17, 1903.

Application filed March 5, 1897. Serial No. 625,949. (No model.)

To all whom it may concern:

Be it known that I, THOMAS W. NORMAN, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Rope or Cord Making Machines, of which the following is a description sufficiently full, clear, and exact to enable those skilled in the art to which it appertains or with which it is most nearly connected to make and use the same.

This invention relates to machines for manufacturing cords, twines, lines, and ropes; and the object of the invention is to provide a mechanism superior and more effective than the mechanism now in use for this purpose; and with this object in view improved means, among others, are provided for holding the stock or yarn and for guiding it to the flier, improved tension means for preventing the kinking or corkscrewing of the yarn prior to the twisting thereof by the flier, and improved take-up mechanism effective simply as a take-up, whereby the product is taken up only as fast as it is fed thereto, the several improved mechanisms forming an improved organization effective to give the yarn two twists to each revolution of its flier, to feed the cord in a uniform manner, and to likewise twist such cord twice for each revolution of a single take-up flier and to take up such cord only as fast as it is fed to the take-up flier.

In the drawings accompanying and forming part of this specification an embodiment of a form of my invention is illustrated, wherein—

Figure 1 is a longitudinal sectional view of a spinning-frame. Fig. 2 is a top view of a cradle removed from a spinning-frame. Fig. 3 is an end view of the cradle viewed from the left-hand side of Fig. 2. Fig. 4 is a view in the plane at the right-hand side of the spring at the left-hand end of Fig. 2, looking from the right, the spring being partly broken away. Fig. 5 is a longitudinal sectional view of the finishing and take-up mechanism. Fig. 6 is an end view of a flier looking from the left-hand side on the line 6 6 of Fig. 5. Fig. 7 is a detail sectional view of the cradle and gearing carried thereby, taken on line 7 7 of Fig. 5 looking toward the left; and Fig. 8 is also a sectional view on the line 8 8 of Fig. 5 looking toward the right.

In carrying out my invention I employ a plurality of devices for holding and paying off yarn, each of which devices is adapted to give a plurality of twists to the yarn and which devices cooperate to lay up their respective yarns into cordage, from which the cordage will be received by a suitable pull-down device and delivered to a take-up reel, and as illustrated in the present instance the several twisting devices are supported by a frame designated in a general way by A.

As a convenient means for holding and paying off the stock of the raw yarns to be twisted into strands a suitable spool or reel d may be employed, which is shown as rotatably mounted upon a spindle f , which spindle is provided with a bifurcated end or bracket f' , pivoted at f^2 upon a hub e' of a cradle, which cradle is adapted to be suspended by means of its hub $e e'$ upon reduced ends of shafts $a a'$, journaled in the main frame A.

The cradle is shown as comprising end arms $e^2 e^3$, depending from the respective hubs $e e'$, and is provided with a curved bottom portion e^6 , and the arms may be provided with weighted portions $e^4 e^5$ for maintaining the cradle in an upright position. Secured to the bottom or some suitable part of the cradle is a spring g^2 , provided with an opening g to receive a pintle f^3 of the spindle, the spring being effective to hold the reel and spindle in place and also to apply friction to the reel to tension the yarn as it is drawn therefrom. The yarn (designated in a general way by o) is shown as being drawn from the reel d and passing over an antifriction-roller j of substantially the length of the holding or barrel portion of the reel and mounted in suitable bearings j' , provided at each end of one side of the bottom portion of the cradle. Upon the opposite side of the cradle is provided a roller or guide e^7 , having its axis in a plane substantially transverse to the axis of the roller j , which is shown as substantially parallel to the spindle f . By this organization the yarn in passing from the spool or reel will always be drawn at substantially the same angle therefrom irrespective of the portion of the spool from which it is drawn, and to those skilled in the art the advantages to be derived from forming the cradle with the bottom e^6 , as shown and described, and passing

the yarn o around the same to the guide-roll e^7 , will be obvious. The greater distance is obtained from the said roll to the point where the yarn leaves the supply-spool, thereby increasing the angle at which the yarn is drawn away from the spool and causing the said yarn to free itself more readily therefrom. The under side of the bottom e^6 of the cradle forms a smooth surface over which the yarn is free to slide as it unwinds from different portions of the spool.

The yarn after passing from the roller e^7 is shown as having tension applied thereto. In the present instance a roller i is mounted upon a pin i' and is shown as having circumferential grooves i^2 thereon and a roller h , mounted upon an arm h' . The roller h is also provided with circumferential grooves h^2 . For the purpose of applying friction to one of the rollers, in the present instance the roller h , a suitable wing-nut h^3 may be provided, between which and the roll may be interposed a washer h^4 , splined to the end h^5 of the pin h' for the purpose of preventing the screw being moved by the rotation of the roller. These rollers are shown as mounted upon the cradle and as having the yarn passed back and forth from one to the other and crossed between them, forming what may be designated as a figure 8. The roller h is shown as located adjacent to the mouth of the channel a^3 and as larger than the roller i . The relative size of the rollers, however, may be varied. Both rollers are free from means rotating them, which peculiar feature adds materially to the effective working of the device. By means of this tension means the corkscrewing, snarling, and kinking of the yarn as it passes from the reel to the flier are prevented. This is an important part of the present organization.

The yarn after passing the tension device is given its first twist, in the present instance by means of a flier mounted upon the shafts a a' by means of hubs b b' . The flier is shown as comprising arms c , radiating from the hubs and connected by longitudinal portions c' . The hubs are shown as secured to the shafts by means of pins b^2 b^4 , respectively, mounted upon which pins are shown guides or rollers b^3 b^5 . The hubs and shafts are shown as recessed or cut away for the accommodation of these rollers and the shafts as provided with axial channels for the passage of the yarn. The peripheries of the sheaves or guides are, at the point of contact with the yarn, on a plane with the axis of the shafts. The shaft a' is connected with suitable driving means (not shown) and imparts rotary motion to the flier, whereby the yarn is given a twist between the tension device and the roller b^3 , from which roller the yarn is shown passing to rollers c^2 c^3 , journaled at c^3 c^3 , the juncture of the arms c and bar c' . Suitable guards are shown along the bar c' to prevent the yarn, in case any slackness arises, from twisting out of place. The yarn then passes under the roller b^5 , before mentioned, through the

channel a^5 of the shaft a' . The shaft a' is also shown as provided with a pull-down flier k , which in the present instance is shown as comprising a pair of capstans k' k^2 , positively driven by means of suitable gearing in mesh with a pinion fast upon the shaft a^4 , which may be driven by a suitable pulley or other device. The yarn or strand is given its second twist as it passes through the tubular shaft a^4 .

The resistance offered by the tension-rolls h and i to the passage of the yarn as it is drawn along by the pull-down may cause the cradle to be forced up against the shaft a , and as the said shaft is in constant rotation during the operation of the machine there is liability, unless precaution is taken against such an emergency, of friction occurring between the bracket e and the shaft a to such an extent as to cause the cradle to be carried around in unison therewith. In order to provide against the rotation of the cradle with the shaft, I interpose an antifriction-washer a^6 between the hub b and shaft a , which washer acts to reduce the friction between the two parts to such an extent as to allow the weighted cradle to remain stationary or to maintain an upright position and prevent the rotation of the same with the flier c .

A plurality of twisting devices similar to that above described may be employed and a strand of yarn o from each be laid up into a rope R . From the point of laying up the rope may pass through suitable power-driven twisting means and be received from that by a pull-down, (designated in a general way by 2,) illustrated similar to that shown and described in my Patent No. 693,887, dated February 25, 1902. By means of this pull-down, which is shown rotating with the take-up flier and which comprises a triple-roll mechanism comprehending a pair of driven rolls and an intermediate movable roll, a uniform pulling down of exactly the same extent of twisted cord or rope for every repetition of a specified number of rotations of the pull-down rolls and for every corresponding number of twisting revolutions is obtained. This insures absolute uniformity in the product as to number of twists per unit of length, so that the take-up mechanism acts simply as a take-up and is not required to exert a powerful forward draft on the cord or rope as it emerges from the pull-down. From this pull-down the rope is received by a suitable take-up device. Before it is wound upon the reel 37 it is further twisted, which twisting in the present instance is imparted thereto by means of the take-up flier, which also acts to impart the first twist to the cord, which first twist is given as the cord passes through the capstans of the pull-down, and which flier is designated in a general way by t' , shown mounted upon suitable journals 4 4^a , provided with bearings in the frame A' of the machine, and which flier is shown as comprising end or head portions 5 and 8, secured

upon the shafts, respectively, by means of pins 6 and 9. The heads are shown connected by longitudinal bars 10, which may be tubular, if desired, thus constituting a flier which extends substantially from end to end of the mechanism, so that the cradle and reel are located longitudinally of and within such flier, being surrounded thereby, through one of which tubes the rope may pass, the rope being received in the present instance by the flier through the shaft 4, which is shown as hollow at 3 and cut out for the accommodation of a roller 7, mounted upon pin 6, between which roller and the pull-down 2 the rope is given a twist. The rope passes from the roller 7 to a roller or guide 11, mounted upon a pin or stub-shaft 13 on the head 5, from which roller or guide the rope passes through one of the bars 10 to a roller 12, mounted upon a pin or stub-shaft 14 on the head 8. Thus it will be seen that the rope or cordage is received by the flier from the pull-down axially of itself. After passing to the roller 12 the rope passes over a roller 47, mounted upon the pin 9. The shaft 4^a is shown as cut out for the accommodation of such roller and as provided with an axial opening 45 for the passage of the rope, whereby the rope may be delivered from the flier axially of itself and be delivered to a suitable laying-on device for the take-up reel. The cord or rope may be given its final twist between the roller 47 and the laying-on device, which in the present instance is shown as carried by a cradle 15, provided with bearings mounted upon the shafts 4 4^a, the flier in the present instance having imparted to it rotary motion by means of a pulley *p*", keyed upon the shaft 4.

In the present organization, as illustrated, it is desirable that the laying-on device remain substantially stationary in relation to the flier, and for this purpose there is provided a fixed pinion 40, secured to the frame A', and a pinion 44, fixed to the hub of the cradle. Such pinions are respectively in mesh with pinions 41 43, fast upon a shaft 42, carried by a bearing in the end 5 of the flier.

In the present instance the pinions are shown as of the same size and constitute a train of gear which may be characterized as "planet-gearing," whereby the movement of the flier is not imparted to the cradle, although it is suspended by bearings engaging directly the shafts of the flier.

The reel for taking up the finished product may be mounted upon a spindle 33, which in the present instance is provided at its ends with pins 34, adapted to be held between pins 35 35 and a latch 36, carried by the bearing or hub of the cradle, the latch 36 being provided with a suitable set-screw. If the reel should be driven at a fixed rate of speed and the rope pull-down is driven at a fixed rate of speed, there will ordinarily be greater tension upon the rope as the reel becomes larger

in diameter by means of the rope laid on. To avoid such variation in tension and breakage incident thereto, I employ suitable friction driving means, which in the present instance is shown as comprising a disk or wheel 28, provided with internal teeth 29, meshing with a gear-wheel 17, mounted upon shaft 16, carried by the cradle, which gear-wheel is in mesh with a gear-wheel 18 upon the shaft 4.

A bracket 26 is secured by bolts 62 to the end portion of the cradle and is provided with a projecting stud 27, upon which is loosely mounted the disk or wheel 28, to which the gear 17 imparts constant rotation during the operation of the machine. The disk 28 is formed with a threaded hub 29', upon which is loosely mounted a disk 30, between which latter and the disk 28 are clamped several disks 31 by means of nuts 32, fitted to the threaded hub 29' outside the disk 30. It will thus be seen that by means of the nuts 32 any desirable degree of frictional contact may be obtained between the several disks just mentioned. As the cradle is held stationary by means of its planet-gearing the shaft 4, of course, upon rotation will positively rotate the wheel 28 and frictionally rotate the wheel or disk 30. From the disk 30 an arm 38 projects for engaging a recess in the reel, whereby upon rotation of the shaft the wheel will be rotated; but upon tension being applied by the rope the disk 30 will be permitted to slip relatively to the wheel 28, thus permitting the reel to adjust itself to the varying diameters of the reel incident to the layers of material which have been wound upon it, so that a substantially uniform degree of tension may be had and so that the reel will be rotated to take up the cord only as fast as it is fed thereto by the pull-down.

For the purpose of feeding the rope to the reel a suitable reverse-threaded worm 24 may be employed, upon which is mounted a traveler 25, having a roller or sheave 48, over which the rope passes. From a roller 46, carried by the cradle, the rope passes over the roller or sheave 48 directly to the reel 37. The worm is rotated by means of a worm-gearing 22 23, the worm 22 being shown as mounted upon a shaft 21, carrying a bevel-gear 20, in mesh with a bevel-gear 19, carried by the gear 17, whereby upon the rotation of the shaft 4 the worm 24 will be made to rotate and the traveler 25 to reciprocate thereon.

For the purpose of stopping the machine in case any undue slackening of the rope takes place or that the rope breaks, an arm 49 (shown in the present instance as U-shaped and pivoted at 50 to a lug or projection on the flier) may be held normally in place by the rope, in the present instance that portion of it passing from the roller 7 to the roller 11, which arm upon being released by the breaking or slackening of the rope will by gravity fall and engage a pin 51, mounted upon a

disk 52, carried by a shaft 53, which may be connected in any suitable manner with means for stopping the mechanism. Similar devices may be employed in connection with
 5 each strand for stopping the mechanism in case of breakage of a strand.

I do not limit myself to the details of construction, as it will be apparent that many equivalent forms may be employed without
 10 departure from the spirit of my invention. It is desired to state that the term "cord," as used herein and in the claims, is to be interpreted to include yarn, lines, twine, cord, rope, and various kinds of cordage, this explanation being made to avoid unnecessary
 15 repetition of words in the claims.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a cordage-machine, the combination
 20 of a plurality of means for severally twisting yarns into strands to be laid into cordage; a pull-down for each strand; a pull-down for the cord; means for twisting the cord twice; means for frictionally driving a reel by the
 25 twisting means; means for laying the cord onto the reel; and means comprising planet-gearing for maintaining the laying means in a fixed plane.

2. In a cordage-machine, the combination
 30 of a plurality of means for severally twisting yarns at two points to form strands to be laid into cordage; a positively-driven pull-down for each strand; a positively-driven pull-down for the cord; means for twisting the
 35 cord twice; means for frictionally driving a reel by the twisting means; means for laying the cord onto the reel; and means in gear with the twisting means for maintaining the laying means in a fixed plane and causing it
 40 to travel to and fro in such plane.

3. In a cordage-machine, the combination of a plurality of means for severally twisting yarns, each comprising means for holding the yarn-stock; a tension device; means for guid-
 45 ing the yarn to the tension device; a pull-down for each strand; means for giving the yarn a plurality of twists to form a strand to be laid into cordage; a pull-down for the cord; a take-up for the cord; and means for twist-
 50 ing the cord a plurality of times.

4. In a cordage-machine, the combination of a plurality of means for twisting yarns into strands, each embodying a spool-spindle carrying a spool; means for guiding the yarn
 55 from the spool at the same angle irrespective of the portion of the spool from which it is drawn; means for applying tension to the yarn and means for twisting the yarn into a strand to be laid into cordage; a pull-down
 60 for the cord; means for placing the cord onto a reel; means for twisting the cord between the pull-down and the means for placing the cord upon the reel, and for receiving and delivering the cord axially of itself; means for
 65 rotating the reel; and means for rotating the twisting means on an axis parallel with the axis of rotation of the reel.

5. In a cordage-machine, the combination of a plurality of means for severally twisting yarns into strands to be laid into cordage; a
 70 pull-down for each strand comprising a pair of positively-driven capstans; a pull-down for the cord; a flier for twisting the cord twice and receiving and delivering the same axially of itself; shafts forming journals for the flier;
 75 means for rotating one of the shafts; a cradle having its hubs freely mounted upon the shafts; means carried by the hubs above the axis thereof for supporting a reel axially parallel with the flier and cradle; means for
 80 guiding the cord to the reel; a traveler supporting the guiding means; means for reciprocating the traveler upon the cradle; and a train of gears for rotating the reel, maintaining the cradle stationary and actuating the
 85 traveler-reciprocating means.

6. The combination with a flier, of means for rotating the flier; a cradle; means for supporting a reel upon and longitudinally of
 90 the cradle; planet-gearing carried in part by the flier for maintaining the cradle stationary; and means for rotating the reel embodying gears in part carried by the flier and friction-disks interposed between the reel and
 95 gears.

7. In a cordage-machine, the combination of means for severally twisting a plurality of yarns to be laid into cordage, each embodying means for holding yarn, &c., and comprising a hanging holding portion carrying a
 100 reel-spindle; an antifriction-roller for the yarn of substantially the length of the holding portion and substantially parallel to the spindle; an antifriction-roller for the yarn having the plane of its axis transverse to the
 105 plane of the axis of the first roller; a smooth curved portion stationarily disposed in relation to both rollers and affording a bearing for the yarn when passing from one roller to the other; a tension device for the yarn; a
 110 pull-down; a flier for twisting the yarn twice after it has passed the tension; a pull-down for the cord or rope; a spindle capable of holding a take-up reel in axial parallelism with the yarn-reel spindles; means for laying
 115 the rope onto the reel; and means for twisting the rope twice before it is delivered to the laying-up means.

8. In a cordage-machine, the combination of means for severally twisting a plurality of
 120 yarns to be laid into cordage, each embodying means for holding yarn, &c., and comprising a hanging holding portion carrying a reel-spindle and weighted for maintaining it upright; an antifriction-roller for the yarn of
 125 substantially the length of the holding portion and substantially parallel to the spindle; an antifriction-roller for the yarn having the plane of its axis transverse to the plane of the axis of the first roller; a smooth curved
 130 portion stationarily disposed in relation to both rollers and affording a bearing for the yarn when passing from one roller to the other; a tension device for the yarn; a pull-

down; means for twisting the yarn once after it has passed the tension and before it is delivered to the pull-down and once after it has passed the pull-down; a pull-down for the cord or rope; a spindle capable of holding a take-up reel in axial parallelism with the yarn-reel spindles; friction mechanism for rotating the reel; means for laying the rope onto the reel; and means for twisting the rope twice, before it is delivered to the rope-laying means.

9. In a cordage-machine, the combination of means for severally twisting a plurality of yarns to be laid into cordage, each embodying means for holding yarn, &c., and comprising a hanging holding portion carrying a reel-spindle and weighted for maintaining it upright; an antifriction-roller for the yarn of substantially the length of the holding portion and substantially parallel to the spindle; an antifriction-roller for the yarn having the plane of its axis transverse to the plane of the axis of the first roller; a smooth curved portion stationarily disposed in relation to both rollers and affording a bearing for the yarn when passing from one roller to the other; a tension device for the yarn; a pull-down; means for twisting the yarn once after it has passed the tension and before it is delivered to the pull-down and once after it has passed the pull-down; a pull-down for the cord or rope; a spindle capable of holding a take-up reel in axial parallelism with the yarn-reel spindles; means for rotating the reel and compensating in the rotation thereof for difference in diameter as the body of rope on the reel is increased; means for laying the rope onto the reel; and means for twisting the rope twice after it is laid up and before it is delivered to the rope-laying means.

10. In a cordage-machine, the combination with means for severally twisting a plurality of yarns, each embodying a spindle for holding a yarn-reel; a cradle for supporting the spindle; means for holding the reel upon the spindle and applying friction thereto; a curved surface upon the bottom of the cradle; an antifriction-roller of substantially the length of the reel located upon one edge of the bottom in substantial parallelism with the spindle; an antifriction-roller located upon the curved bottom near the other edge thereof and having its axis transverse to the axis of the first roller, the organization of antifriction-rollers, spindle and curved surface being such that the yarn will be located upon the cradle at a fixed point, and drawn from all parts of the reel at substantially the same angle; a tension device carried by the cradle and comprising rolls of different diameters and means for applying friction to one of the rolls; a pull-down comprising a pair of positively-driven capstans; a flier for twisting the yarn once after it has passed the tension and before it is delivered to the pull-down and once after it has passed the pull-down; means for stopping the mechanism upon the

breaking of the yarn, of a pull-down for the cord; means for taking up the cord embodying means for holding a take-up reel supported in axial parallelism with the yarn-spindles; means for laying the cord onto the reel; friction mechanism for rotating the reel; a flier for receiving the cord axially of itself from the pull-down and delivering the cord axially of itself to the laying means and for giving the cord two twists for each revolution of the flier; means for rotating the flier; and means for stopping the machine upon the breaking of the cord.

11. In a cordage-machine, the combination with means for severally twisting a plurality of yarns, each embodying a spindle for holding a yarn-reel; a cradle for supporting the spindle; means for holding the reel upon the spindle and applying friction thereto; a curved surface upon the bottom of the cradle; an antifriction-roller of substantially the length of the reel located upon one edge of the bottom in substantial parallelism with the spindle; an antifriction-roller located upon the curved bottom near the other edge thereof and having its axis transverse to the axis of the first roller, the organization of the antifriction-rollers, spindle and curved surface being such that the yarn will be located upon the cradle at a fixed point, and received by it from all parts of the reel at substantially the same angle; a tension device carried by the cradle and comprising rolls of different diameters and means for applying friction to one of the rolls; a pull-down comprising a pair of positively-driven capstans; a flier for twisting the yarn twice; means for stopping the mechanism upon the breaking of the yarn, of a pull-down for the cord; means for taking up the cord embodying a spindle for holding a take-up reel; a cradle for supporting the spindle in axial parallelism with the yarn-spindles; means for laying the cord onto the reel; means for causing the laying means to travel to and fro longitudinally of the reel; friction means for rotating the reel; a flier mounted in the axis of the cradle for receiving the cord axially of itself from the pull-down and delivering the cord axially of itself to the laying means and for giving the cord two twists; means for rotating the flier; planet-gearing for holding the cradle in a stationary position; and means for stopping the machine upon the breaking of the cord.

12. In a rope-making machine; a cradle embodying a smooth bottom the outer surface of which in cross-section is in the form of a segment of a circle concentric to the axis of the cradle; an antifriction-roll upon one edge of the cradle; and a yarn-guide upon the outside of the cradle at the other edge thereof.

13. A cradle for a rope-machine embodying a smooth unobstructed bottom, the outer surface of which has in cross-section the form of a segment of a circle concentric to the axis of the cradle; a roll upon one edge of

the bottom; and a yarn-guide or roll upon the outer side of the bottom at the edge opposite the roll and medially disposed thereon.

14. A cradle embodying hubs; arms secured thereto; a bottom carried by the arms and capable of embracing the ends of a spool; and a roll carried by the bottom of the cradle and not shorter than the spool to be embraced thereby.

15. A cradle embodying a smooth bottom portion and an antifriction-roll or yarn-guide located at one edge and upon the outer side of the bottom.

16. In a cordage-machine, the combination of means for holding yarn, &c., comprising a hanging holding portion; a roll of substantially the length of the holding portion; a roll having the plane of its axis transverse to the plane of the axis of the first roll; and a smooth curved portion stationarily disposed in relation to both rolls and affording a bearing for the yarn when passed between the rolls.

17. In a cordage-machine embodying a spool-spindle, the combination of a cradle supported axially coincident with the spool-spindle; a convex surface upon the side thereof farthest from the spool; a roll at one edge of the cradle; and a transversely-disposed roll at the other edge of the cradle upon the convex surface thereof.

18. The combination with a flier, of means for rotating the flier; a cradle; means for supporting a reel upon the cradle lengthwise of the flier; means for maintaining the cradle stationary; and friction means for rotating the reel.

19. The combination with a flier, of a cradle located therein; a tension comprising a pair of idler-rolls supported by the cradle, one of said rolls being smaller than the other; and means for applying friction to one of the rolls.

20. The combination with a flier, of a cradle located therein; a tension comprising a pair of idler-rolls supported by the cradle and capable of receiving the yarn, &c., before the point at which the twist is given it; and means for applying friction to one of the rolls.

21. The combination with a flier, of a cradle supported thereby and embodying bearings; depending arms; a bottom provided with an antifriction-roll along one edge and a roll at its other edge located medially thereof; a pair of rolls about which the yarn may pass; and means for applying tension to one of the pair of rolls.

22. In a cradle for a cordage-machine, the combination of depending arms; a curved bottom forming a bearing for the yarn; a roller along one side of the bottom; a roll located upon the bottom at the other side thereof; and a pair of rolls effective to receive the yarn before it is given its first twist.

23. The combination with a take-up reel and a spindle constituting an axis for the take-up rotation of the take-up reel, of a cradle; means for holding the cradle substan-

tially stationary; and a flier surrounding the cradle in substantial axial coincidence with the cradle-axis and with its axis of rotation parallel to the axis of rotation of the reel.

24. The combination with a revoluble flier extending substantially from end to end of the mechanism; journals therefor; a cradle hanging upon said journals; a stationary gear-wheel; a gear-wheel upon the cradle; a bearing in the flier; a shaft mounted in the bearing; and pinions on the ends of the shaft in gear respectively with the stationary gear and the gear upon the cradle for maintaining said cradle against rotation with the flier.

25. The combination with a revoluble flier; a cradle; a reel-spindle longitudinally located within the flier and carried by the cradle; and means for positively maintaining the cradle in a relatively fixed position.

26. The combination with a flier mounted upon an interrupted shaft; a cradle hanging upon said shaft; a reel-spindle extending lengthwise of the flier; and means embodying a train of gearing for maintaining the cradle in a stationary position.

27. The combination of a take-up rotary reel-spindle; a cradle; means for positively maintaining the cradle stationary; and a flier, all in axial parallelism.

28. In a rope-machine, the combination with a rotary flier, of a cradle; means for positively maintaining the cradle stationary; a reel-spindle upon the cradle; a reel thereon; a friction-disk adapted to engage the reel; a friction-disk located adjacent to said first disk and carrying an internally-toothed gear-wheel; friction-disks interposed between said disks; a gear-wheel carried by the flier; and a gear-wheel carried by the cradle and in mesh with said gear-wheel and with the internal gear.

29. The combination of a flier; means for rotating the flier; a cradle; planet-gears for holding the cradle stationary; a reel-spindle carried by the cradle; means for feeding rope or cord to a reel upon the spindle; and means for reciprocating the feeding means lengthwise of the flier.

30. The combination with a rotary flier provided with journals, of a cradle hanging upon said journals; a reel-spindle mounted upon the cradle; means for maintaining the cradle stationary, comprising planet-gearing; a gear fixed upon the flier-journal; a gear in mesh therewith carried by the cradle; a disk mounted concentric to the reel-spindle and adapted to rotate the reel thereon; and an internal gear carried by such disk and in mesh with the gear-wheel carried by the cradle.

31. In a rope-machine, the combination with a pull-down organized to feed forward rope at a rate of speed unvarying relatively to the rate of speed of the machine, of means for taking up the rope, comprising a spindle and a reel mounted thereon; means for rotating the reel frictionally; a cradle carrying the spindle; a flier extending substantially

from end to end of the mechanism and surrounding the cradle; and planet-gearing carried by the flier and cradle for maintaining the cradle stationary.

32. The combination with a pull-down, of a flier for twisting cord twice and receiving and delivering the same axially of itself; shafts forming journals for the flier; means for rotating one of the shafts; a cradle having its hubs loosely mounted upon the shafts; means carried by the hubs above the axis thereof for supporting a rotary take-up reel axially parallel in its take-up rotation with the flier and cradle; means for guiding the cord to the reel; a traveler supporting the guiding means; means for reciprocating the traveler upon the cradle; and a train of gears for rotating the reel, maintaining the cradle stationary, and actuating the traveler-reciprocating means.

33. The combination with reel-supporting means, of means for rotating a reel thereon, comprising a disk provided with an exteriorly-threaded hub and an internal gear; a reel-engaging plate mounted upon the hub; friction-disks between such plates; and adjusting means upon the hub.

34. The combination with a flier, of a cradle within the flier; a reel-spindle supported upon the cradle; a reel thereon; a disk provided with an internal gear and with a hub having threads upon its exterior; a plate provided with means for engaging the reel; friction-disks between the plates; adjusting means upon the hub; a gear-wheel carried by the flier; and a gear-wheel carried by the cradle and in mesh therewith and with the internal gear.

35. The combination with a flier, of a cradle within the flier; a reel-spindle supported upon the cradle; a reel thereon; a disk provided at its edge at one side with an internal gear and at its other side with a threaded hub; a plate provided with means for engaging the reel; friction-disks between the plates; adjusting means upon the hub; a gear-wheel carried by the flier; a gear-wheel carried by the cradle and in mesh therewith and with the internal gear; a reciprocatory device for laying cord upon the reel; a worm parallel with the reel-spindle and traversed by the laying-on device; and means in gear with the gear carried by the cradle for actuating the worm.

36. The combination with a pull-down of uniform delivery, of a flier for receiving from the pull-down and twisting; a stationary cradle within and surrounded by the flier for receiving from the flier; reel-supporting means carried by the cradle; reel-rotating means actuated by the flier; means for feeding to the reel; and means for reciprocating the feeding means lengthwise of the flier.

37. The combination with a rotary flier, of a cradle within the flier; a reel-spindle carried by the cradle and parallel with the axis of rotation of the flier; planet-gearing for

holding the cradle stationary; a worm carried by the cradle and parallel with the reel-spindle; a traveler upon the worm for feeding to the reel; and means for rotating the worm.

38. The combination with a pull-down, of a rotary flier; a stationary cradle in the flier; planet-gears for maintaining the cradle stationary; a reel in the cradle and extending lengthwise of the flier for taking up the product; and means for rotating the reel at variable and sufficient speed to take up the amount of rope fed forward by the pull-down.

39. The combination with a pull-down, of a rotary flier; a cradle in the flier; planet-gears for holding the cradle stationary in the flier; means for supporting a take-up reel on the cradle, located parallel to the axis of rotation of the flier; means for rotating the reel at variable and sufficient speed to take up the rope which passes through the pull-down; and means for imparting a double twist to the rope at each revolution of the flier.

40. The combination with a rotary take-up flier, of a cradle located within said flier, a reel also located within the flier and extending longitudinally thereof; and positively-acting means for maintaining the cradle stationary.

41. The combination with a rotary take-up flier, of a cradle located within said flier, a reel also located within the flier, and extending longitudinally thereof, and planet-gearing for maintaining the cradle stationary.

42. The combination with a rotary take-up flier, carrying a rotary reel located lengthwise of the flier, of a cradle located within said flier, means for maintaining the cradle stationary, means for laying up the cord upon the reel, and means for controlling and imparting a variable movement to said reel.

43. The combination with a rotary take-up flier carrying a rotary reel located lengthwise of the flier, of a cradle located within said flier, means for maintaining the cradle stationary, means for laying up the cord upon the reel, and friction means for controlling and imparting a variable movement to said reel.

44. The combination with a flier extending substantially from end to end of the mechanism carrying a reel located lengthwise thereof, of a cradle within the flier, means for holding the cradle stationary, driven friction means for controlling the movement of the reel, and means for reciprocating the cord upon the reel.

45. The combination with a rotary flier, of a reel located lengthwise thereof, a cradle within the flier, means for holding the cradle stationary, positively-driven means for controlling and imparting a variable movement to the reel, and means for laying up the cord upon the reel.

46. The combination with a rotary flier, of a cradle within said flier, a reel also located within said flier lengthwise thereof, means

for maintaining said cradle against rotation with the flier, and means for reciprocating the cord upon the reel.

47. The combination with a rotary flier, of a reel therein located lengthwise thereof, a cradle within the flier, means for holding the cradle stationary, friction means for controlling the movement of the reel, means for positively driving one member of said friction means and including a part carried by said stationary cradle, and means for reciprocating the cord upon the reel.

48. The combination with a flier, of a reel therein located lengthwise thereof, a cradle within the flier, means for holding the cradle stationary, friction means for controlling the movement of the reel, means for positively driving one member of said friction means and including a part carried by said stationary cradle, and means carried by the cradle for reciprocating the cord upon the reel.

49. A take-up mechanism comprising a rotary flier, a cradle located within said flier, a reel also located within and lengthwise of the flier, planet-gearing for maintaining the cradle stationary, and a positively-driven driver and friction-driven means driven by such driver for rotating the reel at a variable speed.

50. A take-up mechanism comprising a flier, a cradle extending lengthwise thereof within said flier, planet-gearing for maintaining the cradle stationary, a reel likewise located within and extending lengthwise of the flier, and means including friction means for rotating the reel at a variable speed.

51. The combination with a pull-down for feeding cord at a uniform speed, of take-up mechanism comprising a flier, a cradle within said flier, means for maintaining the cradle stationary, a take-up reel likewise located within and lengthwise of the flier, and means including friction means for rotating the reel to take up the cord corresponding with the amount thereof fed forward by the pull-down.

52. The combination with means for feeding cord at a uniform speed to the take-up reel, of a rotary take-up flier, a take-up reel supported therein lengthwise thereof for the cord, means for rotating said flier, means for imparting movement from the flier to the reel, and means comprising parallel friction-disks for controlling the movement of the reel so that the rotation thereof will correspond with the amount of cord fed thereto.

53. The combination with rotary means for supplying the cord to take-up mechanism, of a single rotary take-up flier, rotating in a different direction and receiving and delivering the cord endwise of itself, means for rotating said flier, a take-up reel for the cord located within and lengthwise of the flier, means for rotating the reel, means for controlling the speed of the reel, and means stationary with relation to said flier for laying up the cord upon said reel, the organization being such

that two twists are given to the cord for each revolution of the flier.

54. The combination with means for feeding cord at a uniform speed to the take-up reel, of a rotary take-up flier, a take-up reel supported therein and lengthwise thereof for the cord, means for rotating said flier, means including friction means for imparting movement from the flier to the reel, and for controlling the movement of the reel so that the rotation thereof will correspond with the amount of cord fed thereto.

55. The combination with means for feeding cord at a uniform speed to the take-up reel, of a rotary take-up flier, a take-up reel supported therein and lengthwise thereof for the cord, means for rotating said flier, means including friction means for imparting movement from the flier to the reel, and for controlling the movement of the reel so that the rotation thereof will correspond with the amount of cord fed thereto, said friction means comprising a positively-driven friction-disk in gear with the flier, a driven friction-disk in positive connection with the reel, and an intermediate friction member.

56. The combination with a rotary take-up flier, of a reel supported therein for the cord; means for rotating said flier; and means for rotating said reel at a variable speed, comprising an internal gear, a friction member connected to said reel and a friction member intermediate said gear and member.

57. The combination with a rotary take-up flier, of a reel supported therein for the cord; means for rotating said flier; and means for rotating said reel at a variable speed, comprising an internal gear, a friction member connected to said reel and a friction member intermediate said gear and member, and means for adjusting the frictional engagement of said friction members relatively to each other.

58. The combination with a rotary take-up flier, of a reel supported therein for the cord, means for rotating said flier, and means for rotating said reel at a variable speed, comprising an internal-gear friction-disk, means for imparting movement from the flier to said internal-gear disk, a friction-disk connected to said reel, and one or more friction members intermediate said disks.

59. The combination with a rotary take-up flier, of a reel supported therein for the cord, means for rotating said flier, and means for rotating said reel at a variable speed, comprising an internal-gear friction-disk, means for imparting movement from the flier to said internal-gear disk, a friction-disk connected to said reel, one or more friction members intermediate said disks, and means for adjusting the frictional engagement of said disks relatively to said members.

60. The combination with means for feeding the cord, of a single rotary take-up flier carrying take-up means located lengthwise

thereof, means for reciprocating the cord upon the take-up means, means for holding said reciprocating means against rotary movement with the flier, and means for rotating said feeding means and flier, the organization being such that two twists are given to the cord for each revolution of the flier.

61. The combination with means for supplying cord to the take-up mechanism, of a single rotary take-up flier receiving and delivering the cord endwise of itself, means for rotating said flier, a take-up reel for the cord located within and lengthwise of the flier, means for rotating the reel, means for controlling the speed of the reel, a cradle located within said flier lengthwise thereof, positively-acting means for holding said cradle stationary, and means carried thereby for reciprocating the cord upon the reel, the organization being such that two twists are given to the cord for each revolution of the flier.

62. The combination with means for feeding cord at a uniform speed, of a single rotary take-up flier, take-up means located within and lengthwise of said flier, means for reciprocating the cord upon the take-up means, means for holding the reciprocating means against rotary movement with the flier, means for rotating said feeding means and flier together, a part of said feeding means having its axis of rotation transverse to the axis of rotation of said flier, the organization being such that two twists are given to the cord for each revolution of the flier, and means for rotating the take-up means at a variable speed corresponding to the amount of cord fed thereto by the feeding means.

63. The combination with a pull-down for feeding cord at a uniform speed, of a rotary take-up flier, a reel extending longitudinally thereof, means for reciprocating the cord upon the reel, means for holding said reciprocating means against rotation with the flier, and means for rotating the pull-down and flier, the organization being such that two twists are given to the cord at each revolution of the flier.

64. The combination with a pull-down for feeding cord at a uniform speed, of a rotary take-up flier, a reel extending longitudinally thereof, means for reciprocating the cord upon the reel, means for holding said reciprocating means against rotation with the flier, means for rotating a part of the pull-down and flier in different directions relatively to each other, the organization being such that two twists are given to the rope at each revolution of the flier, and means for rotating the reel at a variable speed corresponding to the amount of cord fed thereto by the pull-down.

65. The combination with a pull-down for feeding cord at a uniform speed, a reel for taking up such cord as it is fed forward by said pull-down, a rotary flier extending substantially from end to end of the mechanism, means for rotating said flier, and means stationary with relation to such flier for feeding

cord to the reel, the organization being such that the cord is given a plurality of twists for each revolution of the flier.

66. The combination with a pull-down for feeding cord at a uniform speed, a reel for taking up such cord as it is fed forward by the pull-down, a rotary flier surrounding said reel, means for rotating said flier, and means stationary with relation to such flier for feeding the cord to the reel, the organization being such that the cord is given a plurality of twists for each revolution of the flier, and means for imparting movement from said flier to said reel comprising means for rotating said reel at a variable speed.

67. In a machine of the class described, the combination with a single rotary take-up flier extending substantially from end to end of the mechanism, of means for rotating said flier, and mechanism cooperating therewith and so organized that the material is twisted twice for each revolution of said flier, substantially as described.

68. In a machine of the class described, the combination with a single rotary flier, of means for feeding cord, a take-up means located lengthwise of and surrounded by said flier, and mechanism cooperating with said flier and said means, the organization being such that the cord is fed forward at a uniform speed and taken up in a uniform manner and during such steps given two twists for each revolution of the flier, substantially as described.

69. A take-up mechanism comprising a horizontally-rotating reel, means for laying up cordage thereon, and a triple-roll mechanism organized to supply thereto cord at a uniform speed so that such reel acts simply and solely as a take-up means and not as a pull-down.

70. A take-up mechanism comprising a rotary flier, a rotary take-up reel located longitudinally of and within said flier, means for laying up cord upon said reel, and triple-roll mechanism organized to supply to said reel cord at a uniform speed so that the said drum acts simply and solely as a take-up means and not as a pull-down.

71. The combination with means for feeding cord, of a single rotary take-up flier receiving and delivering the cord axially of itself, a reel within and extending lengthwise of said flier, means for rotating said reel, means stationary with relation to said flier and reciprocating lengthwise thereof for laying up the cord upon the reel, and means for controlling the speed of said reel so that it will be retarded as its diameter increases during the laying up of such cord, to correspond with the amount thereof fed thereto, the organization being such that the cord is twisted twice for each revolution of the flier.

72. The combination with a pull-down for feeding cord at a uniform speed, means for rotating the pull-down at a certain speed, a flier located endwise to said pull-down, means for rotating said flier and pull-down, a reel

within and extending lengthwise of said flier, means for imparting movement from said flier to said reel, comprising friction means for rotating said reel at a variable speed, a cradle
 5 also supported within said flier, means for maintaining the cradle stationary, and reciprocating means carried by said cradle for laying up the cord upon the reel.

73. The combination of a pull-down rotating at a certain speed for feeding cord, a flier
 10 rotatable with said pull-down, a reel within and extending lengthwise of the flier and rotatable at variable speed, and mechanism co-operating with these elements so that the cord
 15 is twisted twice for each revolution of said flier and is laid upon the reel according to the amount fed forward by the pull-down regardless of the increasing diameter of such reel.

74. In a cordage-machine, the combination
 20 with means for twisting yarn into a strand to be laid into cord, of a pull-down rotating at a certain speed for feeding the cord, a flier rotatable with said pull-down, a reel within and
 25 extending lengthwise of the flier and rotatable at a variable speed, and mechanism co-operating with these elements so that the cord is twisted twice for each revolution of the
 30 flier and is laid upon the reel according to the amount fed forward by the pull-down regardless of the increasing diameter of such reel.

75. In a cordage-machine, the combination with means for twisting yarn into a strand to be laid into cord, of a pull-down for feeding
 35 the cord at a uniform speed, a horizontally-rotating reel for taking up such cord as it is fed forward by said pull-down, a rotary flier, and means for rotating said flier, the organization being such that the cord is given a
 40 plurality of twists for each revolution of the flier.

76. In a cordage-machine, the combination with means for twisting yarn into a strand to be laid into cord, of a pull-down for feeding
 45 the cord at a uniform speed, a reel for taking up such cord as it is fed forward by said pull-down, a rotary flier extending lengthwise of the axis of such reel, means for rotating said
 50 flier, the organization being such that the cord is given a plurality of twists for each revolution of the flier, and means for imparting movement from said flier to said reel, comprising means for rotating said drum at a variable speed.

77. In a cordage-machine, the combination
 55 with means for twisting yarn to be laid into cord, comprising a flier and mechanism co-operating therewith, for twisting yarn twice for each revolution of the flier, a pull-down for feeding the cord at a uniform speed, a reel
 60 for taking up such cord as it is fed forward by said pull-down, a rotary flier extending lengthwise of the axis of such reel, and means for rotating said flier, the organization being such that the cord is given a plurality of twists
 65 for each revolution of the flier.

78. In a cordage-machine, the combination with means for twisting yarn to be laid into

cord, comprising a flier and mechanism co-operating therewith for twisting the yarn
 70 twice for each revolution of the flier, a pull-down for feeding cord at a uniform speed, a reel for taking up such cord as it is fed forward by said pull-down, a rotary flier extending lengthwise of the axis of such reel, means
 75 for rotating said flier, the organization being such that the cord is given a plurality of twists for each revolution of the flier, and means for imparting movement from said flier to said take-up means, comprising means for rotating
 80 said take-up means at a variable speed.

79. In a cordage-machine, the combination with means for twisting yarn into strands to be laid into cord, of a pull-down for the cord,
 85 means for twisting the cord a plurality of times, a reel located lengthwise of the twisting means for taking up the twisted cord, means for frictionally driving the reel from the twisting means, means for laying up the
 90 cord upon the reel, and means for maintaining the laying-on means in a fixed plane.

80. In a cordage-machine, the combination with means for twisting yarn a plurality of times, a tension device, means for guiding the
 95 yarn to the tension device, a pull-down for the cord, a take-up for the cord, and means for twisting the cord a plurality of times.

81. A cradle having a smooth curved bottom and an antifriction-roll carried thereby and extending in parallelism therewith and
 100 around which the yarn is adapted to pass transversely.

82. In a cordage-machine, the combination with means for holding yarn, a roll around which the yarn passes transversely from said
 105 holding means, a roll having the plane of its axis transverse to the plane of the axis of said first roll, a member having a smooth curved portion stationarily disposed relatively to such rolls and affording a bearing for the
 110 yarn while passing from one to the other of said rolls.

83. A cradle having a smooth bottom, and a roll carried thereby with its axis transverse to the plane of the axis of said cradle.

84. The combination with a cradle, of a tension comprising a pair of rolls supported by
 115 said cradle one above the other.

85. The combination with a cradle, of a tension comprising a pair of rolls supported by
 120 said cradle one above the other, and means for applying friction to one of said rolls.

86. The combination with a cradle, of a tension comprising a pair of rolls supported by
 125 the cradle one above the other, each with the plane of its axis transverse to the plane of the axis of the cradle.

87. The combination with a cradle, of a tension comprising a pair of rolls supported by
 130 the cradle one above the other, each with the plane of its axis transverse to the plane of the axis of the cradle, and means for applying friction to one of said rolls.

88. The combination with a rotary flier, of a spool, and a tension comprising a pair of

rolls located within said flier and supported with the planes of their axes substantially parallel, and around which the yarn passes intermediate its passage from said spool to the flier.

89. The combination with a rotary flier, of a spool, and a tension comprising a pair of rolls located within said flier and supported with the planes of their axes substantially parallel and around which the yarn alternately passes intermediate its passage from said spool to the flier, and means for applying friction to one of said rolls.

90. The combination with a rotary flier, of a spool, and a tension comprising a pair of idler-rolls located within said flier, one located above the other, each located with its axis transverse to the plane of the axis of said flier and around which the yarn passes intermediate its passage from said spool to the flier.

91. The combination with a rotary flier, a spool located therein, a tension comprising a pair of idler-rolls located within the flier and around which the yarn alternately passes to form a figure 8 before passing to the flier.

92. The combination with a rotary flier, of a spool located therein, a cradle supported within said flier and around which the cord passes from the spool, and a tension comprising a pair of idler-rolls located within the flier and to which the yarn passes from the cradle and around which it alternately passes to form a figure 8 before passing to the flier.

93. The combination with a rotary flier, of a spool located therein, a cradle supported within said flier, a guide carried by and extending parallel to said cradle at one part thereof and a guide carried at another part thereof for guiding the yarn as it passes from the spool, and a tension comprising a pair of idler-rolls located within the flier and to which the yarn passes from the cradle and around which it alternately passes to form a figure 8 before passing to the flier.

94. The combination with a single rotary flier, of a spool carried therein, tension means located within said flier for preventing the cork-screwing and kinking of the yarn, and mechanism cooperating with said flier, the organization being effective to give the yarn two twists for each revolution of said single flier.

95. The combination with a single rotary flier, of a spool carried therein, tension means located within said flier, a pull-down for the yarn, and mechanism cooperating with said flier, the organization effective to give the yarn two twists for each revolution of said single flier.

96. In a machine of the class described the combination with a pull-down for feeding the cord uniformly, of mechanism including a single end-to-end-extending take-up flier effective to give two twists to the cord for each revolution of such flier.

97. The combination of a single rotary flier,

a spool carried therein, tension means located within said flier, mechanism cooperating with said flier, the organization effective to give the yarn two twists for each revolution of said single flier, a pull-down for feeding the cord in a uniform manner, a take-up mechanism comprising a flier and a reel, and means cooperating therewith, the organization being such that the cord is likewise given two twists for each revolution of the flier.

98. The combination with a flier, of a guide located near the hub thereof, a guide located near the periphery of said flier, and a stop member carried by said flier and through which the cord passes during its passage from one guide to the other, and means in position to be engaged by said stop member on the breakage of said cord thereby to stop the mechanism.

99. The combination of a flier, having a head, of yarn or strand guide rolls carried by said head one adjacent to the hub thereof and the other adjacent to its periphery, a U-shaped arm or loop pivoted upon said head with its free end extending between said guide-rolls, a rock-shaft and a disk or collar upon said shaft provided with fingers with which said U-shaped arm when free may engage, thereby to stop the mechanism.

100. The combination with a flier, of a cradle supported therein; a reel-spindle pivotally supported by said cradle at one end for swinging movement; and a spring carried by said cradle for maintaining said spindle in its normal position.

101. The combination with a flier, of a cradle supported therein; a reel-spindle pivotally supported by said cradle at one end for swinging movement; a spring carried by said cradle for maintaining said spindle in its normal position and tension means comprising a pair of rolls also carried by said cradle.

102. The combination with a flier, of a cradle supported therein; a reel-spindle pivotally supported by said cradle at one end for swinging movement, a spring carried by said cradle for maintaining said spindle in its normal position; and yarn-guiding means located at each side of said cradle.

103. The combination with a two-part shaft, a rotary flier fixedly secured thereto, a depending cradle loosely supported at its ends upon said shaft and carrying a reel-spindle, and means for preventing the rotation of said cradle with said shaft on the rotation of the flier.

104. The combination with a rotary flier, of a reel or drum supported therein with its axis of rotation in a plane parallel to the plane of the axis of rotation of said flier; means for rotating said flier; a stationary cradle; positively-acting means for maintaining said cradle stationary; and means carried thereby for laying up the cord on said drum.

105. The combination with a rotary flier and its shaft, of a friction-disk having internal gear-teeth mounted within said flier; a

cradle supported within said flier; a gear carried by said cradle and in mesh with the teeth of said friction-disk; a gear carried by the flier-shaft and in mesh with said cradle-gear
5 for imparting motion to the friction-disk, a reel within said flier and friction means intermediate said reel and friction-disk gear for imparting motion to said reel.

10 106. The combination with a single rotary flier, of a pair of tubular journals therefor through which the cord passes to and from the flier, cord-holding means located within and lengthwise of said flier, a stationary cra-

dle also located within said flier, a roll carried by said cradle, located at the bore of one 15 of said journals in such manner that the cord as it passes through the bore is maintained in substantial alinement with such bore.

In testimony whereof I have signed my name to this specification, in the presence of 20 two subscribing witnesses, this 15th day of August, A. D. 1896.

THOMAS W. NORMAN.

Witnesses:

ARTHUR W. CROSSLEY,
ARTHUR F. RANDALL.