

Jan. 13, 1931.

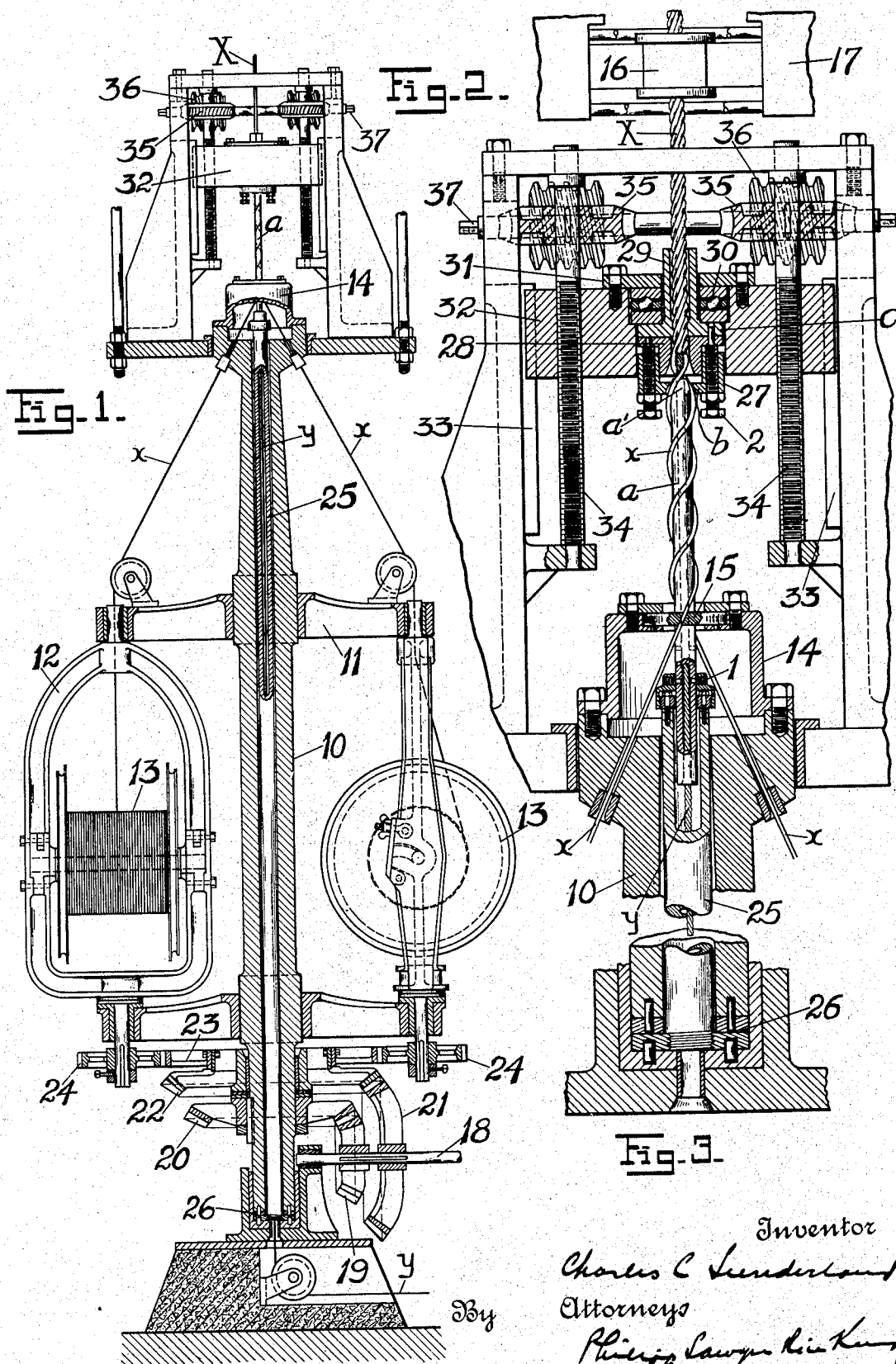
C. C. SUNDERLAND

1,788,641

ROPE MAKING MACHINE

Filed Aug. 30, 1927

2 Sheets-Sheet 1



Inventor
 Charles C. Sunderland
 Attorneys
 Philip, Sawyer & Co. New York

Jan. 13, 1931.

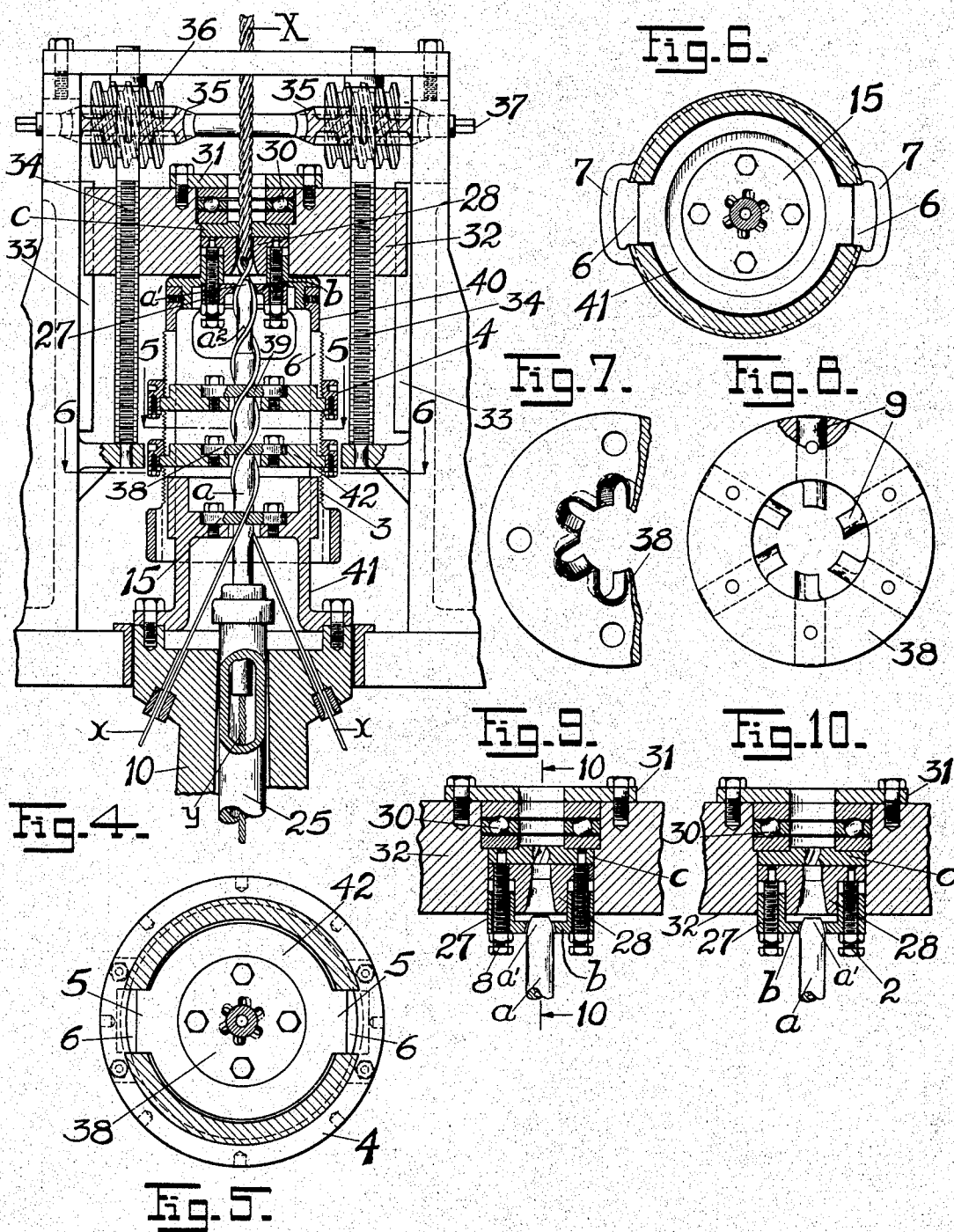
C. C. SUNDERLAND

1,788,641

ROPE MAKING MACHINE

Filed Aug. 30, 1927

2 Sheets-Sheet 2



Inventor
Charles C. Sunderland
 By his Attorneys
Philip Lawton Rice & Co.

UNITED STATES PATENT OFFICE

CHARLES C. SUNDERLAND, OF TRENTON, NEW JERSEY, ASSIGNOR TO JOHN A. ROEBLING'S SONS COMPANY, OF TRENTON, NEW JERSEY, A CORPORATION OF NEW JERSEY

ROPE-MAKING MACHINE

Application filed August 30, 1927. Serial No. 216,369.

This invention relates to machines for making wire rope and wire strands of that class in which a number of wire strands or wires are wound helically, usually on a metal or hemp core, the especial object being to improve that part of the mechanism in which the wires or strands are laid up on the core and the rope strand or rope closed.

The principal object of the invention is to provide improved tension and closing means by which the desired high uniform tension may be assured and properly adjusted and the rope closed under tension conditions uniform on all the wires or strands and so that the fabricated rope or strand will be in a condition similar to that when under its operating tension in service.

The usual method of applying tension to the wires or strands, has been to equip the bobbins with adjustable brakes, so that the tension can be regulated. When these brakes are applied so that the resulting tension on the wires or strands leaving the bobbins is comparatively light, the workman is able to adjust the tension on all the wires or strands with a fair degree of uniformity, so that the fabricated rope is formed under fairly uniform tension conditions. Under the high tension required in heavy duty ropes, so that the tension in the rope will secure conditions substantially similar to the rope conditions when under its operating conditions in services, it is very difficult, if not impossible, for the workman to adjust the brakes on the individual bobbins so as to give the required high tension, and still maintain uniformity of tension on the individual wires or strands, this determination by the workman of the amount of tension being made by the feel of the wires to the hand, and a difference in tension on the individual wires or strands under such high tensions being difficult to detect and correct, although sufficient to give an unbalanced rope condition such that the ropes in service will not have a uniform tension on the individual wires or strands, with the result that the rope will show ununiform wear and the wires or strands will have ununiform

breaking points, so that the full strength of the rope is not secured.

In accordance with the present invention, I employ a stationary mandrel around which the wires or strands are wound in laying them up to form the rope and close the rope as the strands or wires pass off the mandrel under the mandrel tension so that the twisting of the strands or wires is done on the mandrel, with the result that all strands being in contact with and wrapped around the same mandrel, the desired uniformity of tension on the wires or strands is secured and maintained in closing the rope, and this tension is readily adjustable without interfering with uniformity, so that the rope may be finished at a tension and under conditions nearly approaching the operating conditions of the rope in service. With this stationary internal mandrel assuring the closing of the rope with the wires or strands formed and closed on a fixed helical curve, it is entirely practical, also, to assure the desired helix in the finished rope, and in such manner that the retention of this helix in the rope will be assured and the rope will lie straight when released and have no tendency to twist or unwind.

The invention has, in addition to the above general objects, other more specific objects and includes, in addition to the features above referred to, various features of construction and combinations of parts which will be more particularly described hereafter.

For a full understanding of the invention, a detailed description of constructions embodying the features of the invention in preferred forms will now be given in connection with the accompanying drawings forming a part of this specification, and the features forming the invention then be specifically pointed out in the claims.

In the drawings, which show the invention applied to a rope machine of common type—

Figure 1 is a diagrammatic sectional elevation of the bobbin carrying and rope closing portion of the machine;

Figure 2 is a sectional elevation of the

rope closing portion of the machine, similar to Fig. 1 but on an enlarged scale;

Figure 3 is a detail vertical section of the flyer mounting and mandrel support;

5 Figure 4 is a sectional elevation of the rope closing portion of the machine, similar to Fig. 2, showing a modification;

Figures 5 and 6 are cross sections on the lines 5 and 6 of Fig. 4;

10 Figure 7 is an enlarged plan view of a portion of the guide disc of Figs. 5 and 6;

Figure 8 is a broken plan view of a guide disc, showing a modification;

Figure 9 is a detail section similar to Fig. 2, showing a modification;

15 Figure 10 is a cross section on the line 10 of Fig. 9.

Referring to the drawings, the flyer is shown as of common form, consisting of a 20 central rotating standard 10 carrying the spiders 11 in which are mounted the bobbin frames 12 carrying the bobbins 13, this flyer being shown as carrying at the top of the standard 10 the cap 14 having guide plate 25 15 through which the outer wires or strands x and the center or core y pass to the tension and closing devices of the present invention, and from which the finished rope X passes through the squeezer 16 of common form, 30 held in fixed position by the supports 17, and to the usual draw-off rolls and wind-up reel. The flyer and the bobbin frames are shown as driven by the usual planetary gearing, 18, being the driving shaft, which 35 drives the flyer through gears 19, 20 and the bobbin frames through gears 21, 22, 23, 24. Any other suitable means for giving the flyer and bobbin frames the required movement may be used, the reverse movement of 40 the bobbin frames relatively to the flyer acting to prevent or regulate the torsion on the individual wires or strands as usual in such machines.

Referring now to the parts especially 45 embodying the present invention, a is a hollow mandrel which is mounted in a stationary hollow standard 25 fixed at the base of the machine and around which the flyer standard 10 revolves, the flyer standard 10 50 being shown as having a foot bearing consisting of wear plates 26. The mandrel a is held stationary in the mandrel standard 25, as by being splined therein, but is adjustable longitudinally, being held in adjusted 55 position by set screws 1 in the mandrel standard cap. The center or core y passes upward through the mandrel within the mandrel standard 25 and flyer standard 10. The mandrel is shown as of uniform diameter 60 throughout, except that it is tapered off at the upper end to reduce the diameter of the helix and bring the wires x onto the center or core y as they leave the mandrel.

Around this tapered portion or nose a' 65 of the mandrel a is a closing plate b formed

with guiding grooves through which the strands or wires x pass about the mandrel nose, the mandrel thus forming an inner guide and the plate b external guides in closing the wires x upon the center or core 70 y . This closing plate b is adjustable longitudinally of the mandrel by screws threaded in the sleeve 27 carrying the plate b and surrounding a guide block 28 through which 75 the rope X passes from the mandrel and which may act as a squeezer to compress the strands on the center. Above the block 28 is a setting plate c provided with guiding grooves for the strands or wires of the rope 80 X , this plate c being formed with an angular stem 29 by which the plate c may be rotated for adjustment relatively to the mandrel a . This plate c , after adjustment, is locked in position by the end of one or 85 more of the screws 2 entering openings in the plate so that, by withdrawing these screws, the plate may be adjusted and then locked in position by returning the screws.

The plate b , block 28, and plate c are 90 rotated by the rope strands and for ease of movement a ball bearing 30 is preferably inserted above the plate c , this ball bearing being held in position by cover plate 31. The ball bearing 30 and the parts above 95 mentioned as rotating thereon, are all mounted in block 32 which slides longitudinally of the mandrel on guides 33 and is adjusted and held in adjusted position by screws 34 having gears 35 thereon through 100 which the screws 34 are rotated by worm gears 36 engaging gears 35 and carried by hand operated shaft 37. The closing plate b , block 28 and setting plate c may thus be adjusted longitudinally of the mandrel a , as 105 desired.

The operation of the machine as shown in Figs. 1 to 3 and above described, and its adjustments, are as follows—

The wires or strands x from spools 13 are 110 led through the inclined passages in the flyer head and in the guide plate 15 to and around the mandrel a with the rope center or core y led through the mandrel. Interchangeable 115 guide plates 15 are used, so that by the insertion of different guide plates, the angle at which the strands or wires x are led to the mandrel may be varied. The strands or wires x pass from the nose a' of the mandrel under the control of the guiding grooves in 120 closing plate b and the closed rope then passes through the guide block 28 and through the guiding grooves in setting plate c . The setting plate is formed to compress the strands or wires x upon the center or 125 core y and compact the rope, while at the same time tightening the helix of the rope, as formed, on leaving the mandrel. There is no twisting of the strands or wires x upon the center or core y after leaving the man- 130

mandrel except such tightening of the helix as may be secured by setting plate *c*.

Accurate adjustment of the parts for the formation of the exact helix desired and the laying of the strands or wires *x* upon the center or core *y* in this helix, so that the rope will lie straight when released and not tend to twist or unwind, is secured by the adjustments shown. The mandrel may be adjusted longitudinally and the closing plate *b* adjusted longitudinally of the mandrel so as to secure just the closing effect desired as the strands or wires leave the mandrel. The block 32 with all the closing and setting devices carried thereby may be adjusted longitudinally with the mandrel, so as to vary the number of turns of the wires or strands *x* upon the mandrel and thus vary the tension, which may be adjusted, also, by the angle at which the strands or wires are laid on the mandrel from the interchangeable guide plates 15. The setting plate *c* may be adjusted by its angular stem 29 and then locked in position so as to vary and fix accurately the tightening of the helix as the rope passes through the setting plate *c*.

The machine shown in Figs. 1 to 3 and above described is entirely satisfactory for many strands or ropes, but for ropes used under very high tensions, a fuller control of the strands or wires *x* in passing over the mandrel and during the operation, is desirable. A construction adapted especially for such high tension ropes is shown in Figs. 4 to 8, and this construction, of course, may be used in making low tension ropes.

The construction shown in Figs. 4 to 8 is generally the same as shown in Figs. 1 to 3 and above described, except that the strands or wires are positively controlled and guided by rotating guides as they pass over the mandrel. As shown, a series of adjustable guide plates is used between the rotating guide plate 15 on the flyer, and the closing plate *b* at the end of the mandrel, these adjustable and closing plates rotating with the flyer standard 10, so as to hold the strands or wires in position on the mandrel throughout its length, and assure the proper guiding of the strands or wires and the accurate formation of the strands or wires to the helix desired. These guide plates are interchangeable, as in the case of guide plate 15, so that different plates may be used according to the lay of the strands or wires on the mandrel and thus a wide variety of ropes made. Two such guide plates 38, 39 are shown, although any desired number of such plates, or a single plate extending over a sufficient portion of the mandrel, may be used. With a single plate or sleeve, however, interchangeable plates or sleeves must be used for different lays. These guide plates 38, 39, are adjustably mounted in a sleeve 40 secured to the sleeve 27 carrying the closing plate *b*, and

this sleeve 40 extends downward outside a sleeve 41 extending upward from the flyer and carrying guide plate 15. Sleeve 40 is formed with screw threads 3 on the outside on which work nuts 4 carrying plates 42 in which guide plates 38, 39 are mounted. The plates 42 carrying the guide plates 38, 39, are held against rotation, while free to move vertically with the sleeves or nuts 4 by lugs 5 at opposite sides of the plates 42 running in slots 6 in the sleeve 40, the two halves of the sleeve formed by the slots being connected at the lower end by loops 7. The sleeve 40 is free to move vertically along flyer extension 41 but is splined thereto so as to rotate with the flyer, and thus the flyer rotates all the rope guiding and closing parts about the mandrel up to the setting place *c*, which is rotated by the rope strands. The sleeve 40 and guide plates 38, 39, carried thereby are thus adjusted vertically with the other parts by the vertical movement of the block 32, and the guide plates 38, 39, as well as the closing plate *b*, are all adjustable longitudinally of the mandrel independently of the other parts.

In the constructions shown in Figs. 4 to 8, the angular adjustment of the setting plate *c* is not provided for, and the setting place *c* may simply compress the strands on the center, but in the construction shown in Figs. 9 and 10, the block 28 is adjusted longitudinally of the mandrel, thus varying the action of the plate *c* according to the space left between it and the block 28. This result is secured by adjusting screws 8 running freely through the sleeve 27 and screw-threaded in annular flange on block 28, as shown in Fig. 9, so that the rotation of these screws adjusts the block 28 as desired, while the plate *b* is adjusted relatively to the block 28 by the screws 2 previously described.

In some cases it may be found desirable to reduce the size of the mandrel *a* for a portion of its length near the closing plate so that a large mandrel with the increased tension thus secured may be used, while at the same time the strands or wires are brought closer together on a smaller mandrel before closing, with the resulting advantage of better forming the strands or wires on a helix approximately that of the finished rope and such as to secure maintenance of the desired helix in the finished rope. Such a construction is shown in Fig. 4 in which the mandrel *a* has a reduced portion *a'* extending for a considerable length between the larger part of the mandrel and the tapering nose *a''*.

There is shown in Fig. 8 a preferred construction for the plates with guiding grooves, this construction being cheaper to manufacture, because of the difficulty of forming the guiding grooves accurately in

the body of the plates. In this construction, plate 38 of Fig. 7, for instance, is shown as provided with guides formed by pins 9 set into the plate, which guiding pins may be manufactured readily and cheaply. This construction also avoids the expense of substitution of new plates after wear of the guiding surfaces, it being necessary only to substitute new pins. The guiding grooves in all the plates and pins herein described for guiding the strands or wires in the helix are helical theoretically, and will be helical if the guiding surfaces are of considerable length. By making the plates thin, however, the guiding surfaces need not be helical but tangential to the helix on the mandrel at that point, and this is the preferred construction because of the difficulty of making helical passages.

While the invention has been illustrated in a construction embodying all its features in the form now preferred by me, and certain modifications thereof, it will be understood that the invention is not limited to the specific constructions or arrangement of parts shown, but that many modifications other than those shown or described may be made by those skilled in the art, while retaining the invention defined by the claims.

What is claimed is:

1. In a wire rope strand or rope making machine, a stationary tension mandrel having a passage for the strand or rope core and about which the wires or strands are wrapped helically and in coils arranged to tension the wires or strands uniformly, and means for drawing the helically wrapped wires or strands over the mandrel under such tension, in combination with strand or rope closing means.

2. In a wire rope strand or rope making machine, a stationary tension mandrel having a passage for the strand or rope core and about which the wires or strands are wrapped helically and in coils arranged to tension the wires or strands uniformly, and means for drawing the helically wrapped wires or strands over the mandrel under such tension, in combination with adjustable means for varying the angle of the wires or strands on the mandrel, and strand or rope closing means.

3. In a wire rope strand or rope making machine, a stationary tension mandrel having a passage for the strand or rope core and about which the wires or strands are wrapped helically and in coils arranged to tension the wires or strands uniformly, and means for drawing the helically wrapped wires or strands over the mandrel under such tension, in combination with adjustable means for varying the number of wraps of the wires or strands on the mandrel, and strand or rope closing means.

4. In a wire rope strand or rope making

machine, a stationary tension mandrel having a passage for the strand or rope core and about which the wires or strands are wrapped helically and in coils arranged to tension the wires or strands uniformly, and means for drawing the helically wrapped wires or strands over the mandrel under such tension, in combination with adjustable means for varying the angle and number of wraps of the wires or strands on the mandrel, and strand or rope closing means.

5. In a wire rope strand or rope making machine, a stationary tension mandrel having a passage for the strand or rope core and about which the wires or strands are wrapped helically and in coils arranged to tension the wires or strands uniformly, and means for drawing the helically wrapped wires or strands over the mandrel under such tension, in combination with strand or rope closing means, and means for adjusting the closing means longitudinally of the mandrel.

6. In a wire rope strand or rope making machine, a stationary tension mandrel about which the wires or strands are wrapped helically and in coils arranged to tension the wires or strands uniformly, and means for drawing the helically wrapped wires or strands over the mandrel under such tension, in combination with strand or rope closing means, a wire or strand guide enclosing the mandrel and adjustable longitudinally of the mandrel, and means for adjusting the closing means longitudinally of the mandrel.

7. In a wire rope strand or rope making machine, a stationary tension mandrel having a passage for the strand or rope core and about which the wires or strands are wrapped helically and in coils arranged to tension the wires or strands uniformly, and means for drawing the helically wrapped wires or strands over the mandrel under such tension, in combination with strand guides enclosing the end of the mandrel.

8. In a wire rope strand or rope making machine, a stationary tension mandrel having a passage for the strand or rope core and about which the wires or strands are wrapped helically and in coils arranged to tension the wires or strands uniformly, and means for drawing the helically wrapped wires or strands over the mandrel under such tension, said mandrel being formed with the end tapering inward to the rope core, in combination with strand guides enclosing the end of the mandrel.

9. In a wire rope strand or rope making machine, a stationary tension mandrel having a passage for the strand or rope core and about which the wires or strands are wrapped helically, in combination with strand guides enclosing the end of the mandrel, and a setting plate with guides for

the rope to which the rope passes from the first mentioned guides.

10. In a wire rope strand or rope making machine, a stationary tension mandrel about which the wires or strands are wrapped helically, in combination with strand guides enclosing the end of the mandrel, and rotating guides extending along the mandrel for controlling the strands or wires.

11. In a wire rope strand or rope making machine, a stationary tension mandrel about which the wires or strands are wrapped helically, in combination with strand guides enclosing the end of the mandrel, and rotating guides consisting of a series of adjustable plates extending along the mandrel for controlling the strands or wires.

12. In a wire rope strand or rope making machine, a stationary tension mandrel about which the wires or strands are wrapped helically, in combination with a closing plate having wire or strand passages enclosing the end of the mandrel and rotating about the mandrel.

13. In a wire rope strand or rope making machine, a stationary tension mandrel about which the wires or strands are wrapped helically, in combination with a closing plate rotating about the mandrel and having wire or strand passages enclosing the end of the mandrel and adjustable longitudinally of the mandrel.

14. In a wire rope strand or rope making machine, a stationary tension mandrel about which the wires or strands are wrapped helically, in combination with a closing plate rotatable with the strands or wires and having strand passages enclosing the end of the mandrel, and a setting plate having guides beyond the closing plate and rotatable relatively to the closing plate.

15. In a wire rope strand or rope making machine, a stationary tension mandrel about which the wires or strands are wrapped helically, in combination with a closing plate rotatable with the strands or wires and having strand passages enclosing the end of the mandrel, a setting plate rotatable with the strands or wires and having guides beyond the closing plate and rotatable relatively to the closing plate, means for adjusting the mandrel longitudinally, and means for adjusting the closing and setting plates longitudinally of the mandrel.

16. In a wire rope strand or rope making machine, a stationary tension mandrel, in combination with a flyer, by which the strands or wires are wrapped about the mandrel, rope closing means, and a guide with passages for the strands or wires extending along the mandrel and carried by the flyer.

17. In a wire rope strand or rope making machine, a stationary tension mandrel, in combination with a flyer, by which the strands or wires are wrapped about the man-

drel, rope closing means, and a guide consisting of a series of plates adjustable relatively to each other along the mandrel with passages for the strands or wires and carried by the flyer.

18. In a wire rope strand or rope making machine, a stationary tension mandrel, in combination with a flyer, by which the strands or wires are wrapped about the mandrel, a closing plate carried by the flyer and coacting with the end of the mandrel, and a guide consisting of a series of plates adjustable relatively to each other along the mandrel with passages for the strands or wires and carried by the flyer.

19. In a wire rope strand or rope making machine, a stationary tension mandrel, in combination with a flyer, by which the strands or wires are wrapped about the mandrel, a closing plate carried by the flyer and coacting with the end of the mandrel, a guide consisting of a series of plates adjustable relatively to each other along the mandrel with passages for the strands or wires and carried by the flyer, and a setting plate with guides beyond the closing plate.

20. In a wire rope strand or rope making machine, the combination with stationary mandrel *a*, of closing plate *b* having strand passages enclosing the end of the mandrel, setting plate *c* having strand passages, a spacing block between the plates, and means for adjusting the closing plate toward and away from the setting plate.

21. In a wire rope strand or rope making machine, the combination with stationary mandrel *a*, of closing plate *b* having wire or strand passages enclosing the end of the mandrel, setting plate *c* having wire or strand passages, a spacing block between the plates, means for adjusting the closing plate toward and away from the setting plate, and means for adjusting the plates and block as a unit longitudinally of the mandrel.

22. In a wire rope strand or rope making machine, a stationary tension mandrel *a* having a passage for the strand or rope core and about which the wires or strands are wrapped helically and in coils arranged to tension the wires or strands uniformly, and means for drawing the helically wrapped wires or strands over the mandrel under such tension, said tension mandrel having the reduced section *a'* next the closing end, in combination with strand or rope closing means.

23. In a wire rope strand or rope making machine, a stationary tension mandrel *a* having a passage for the strand or rope core and about which the wires or strands are wrapped helically and in coils arranged to tension the wires or strands uniformly, and means for drawing the helically wrapped wires or strands over the mandrel under such tension, said tension mandrel having tapered closing end *a'* and the reduced section *a''*

next the closing end, in combination with strand or rope closing means.

24. A wire strand or wire guide plate having detachable pins mounted in the guide plate transversely to the path of the strand or wire, said pins having strand or wire guide surfaces formed in their ends.

In testimony whereof, I have hereunto set my hand.

CHARLES C. SUNDERLAND.