Sept. 11, 1951 R. C. PIERCE 2,567,347

STRANDING MACHINE

Filed July 30, 1949 6 Sheets-Sheet 1

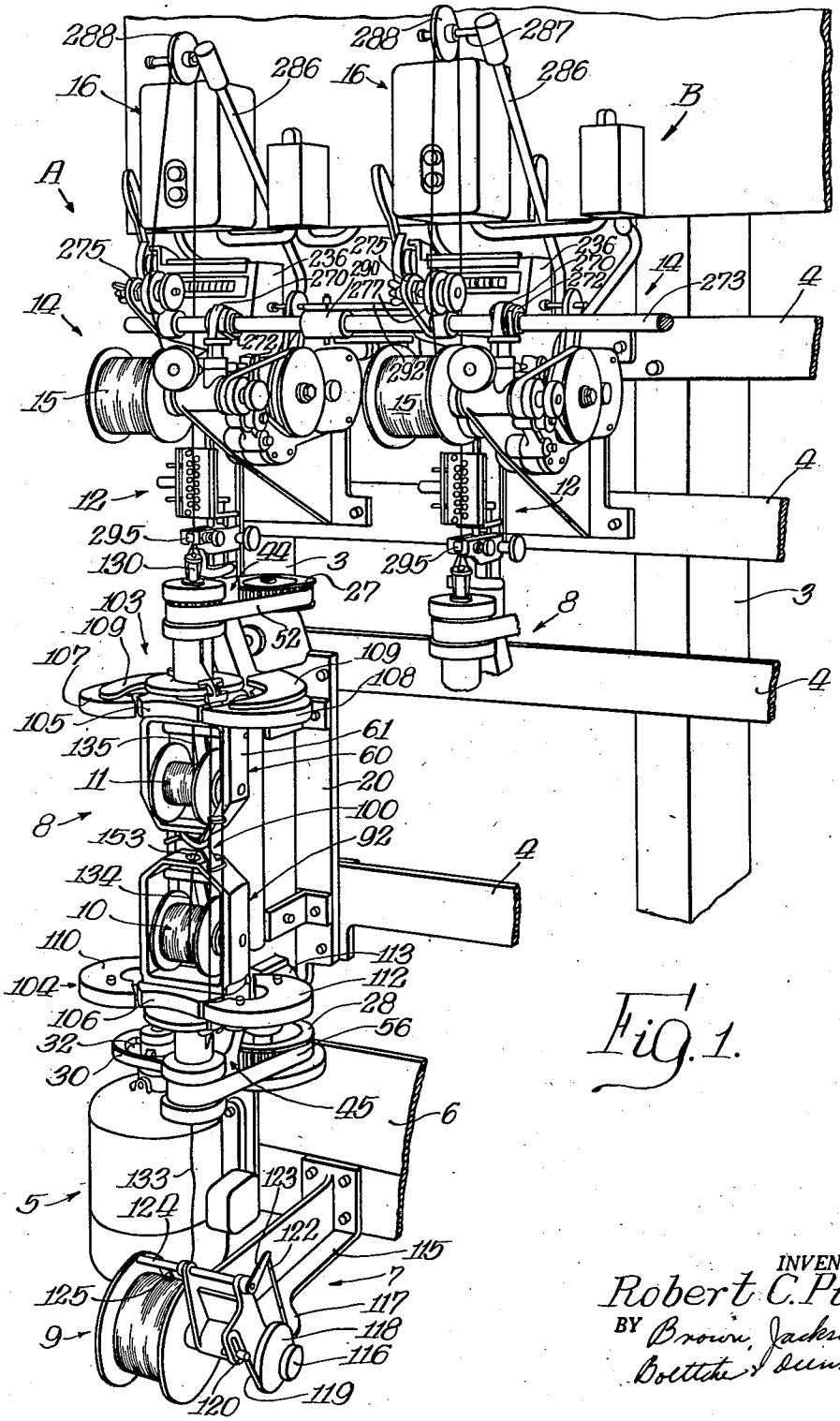


Fig. 1.

INVENTOR.
Robert C. Pierce,
BY Brown, Jackson, Boettcher & Dunner
Attys.

Sept. 11, 1951 R. C. PIERCE 2,567,347

STRANDING MACHINE

Filed July 30, 1949 6 Sheets-Sheet 2

Fig. 2.

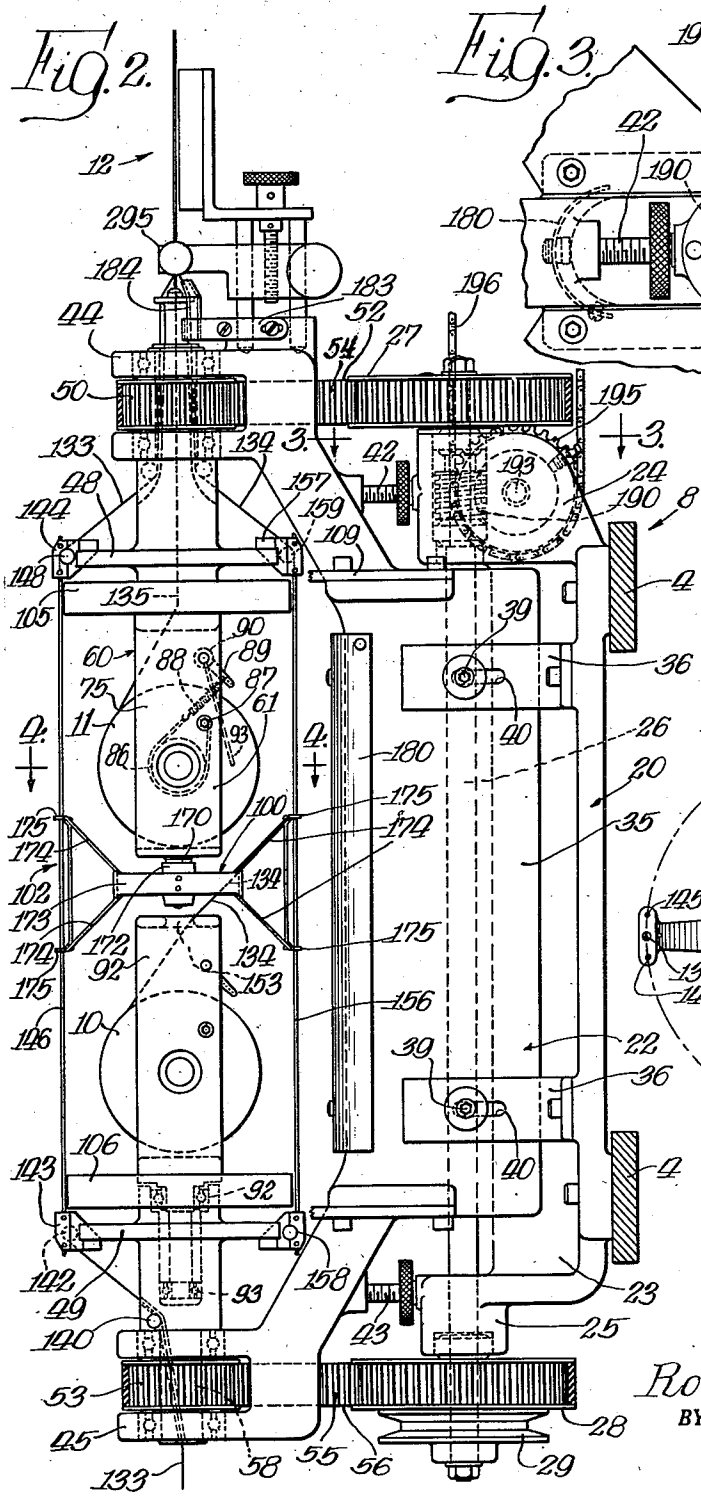


Fig. 3.

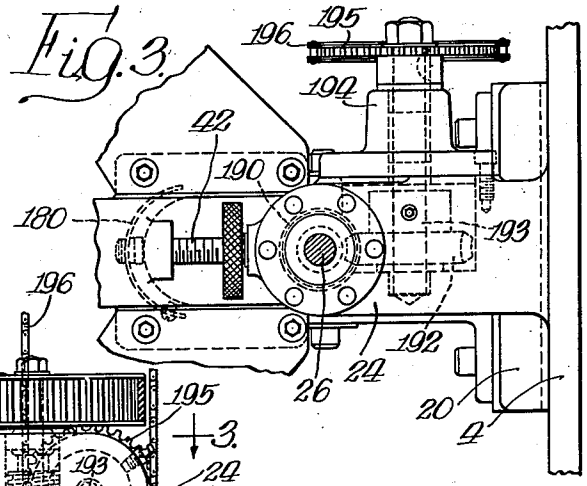
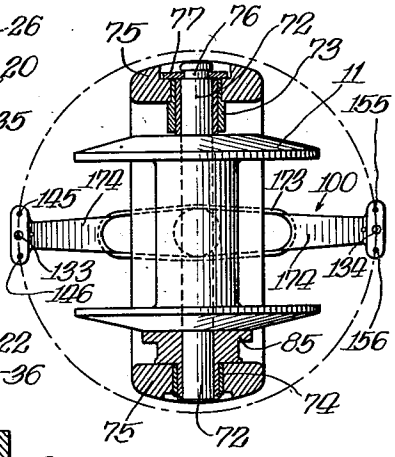


Fig. 4.



INVENTOR.
Robert C. Pierce,
BY Brown, Jackson, Boettcher & Dienner
Attys.

Sept. 11, 1951 R. C. PIERCE 2,567,347

STRANDING MACHINE

Filed July 30, 1949 6 Sheets-Sheet 3

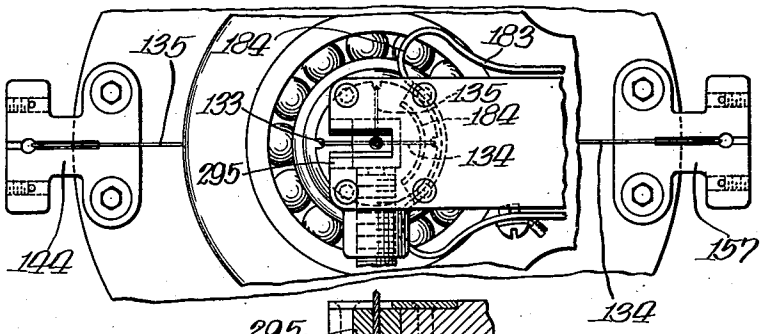


Fig. 6.

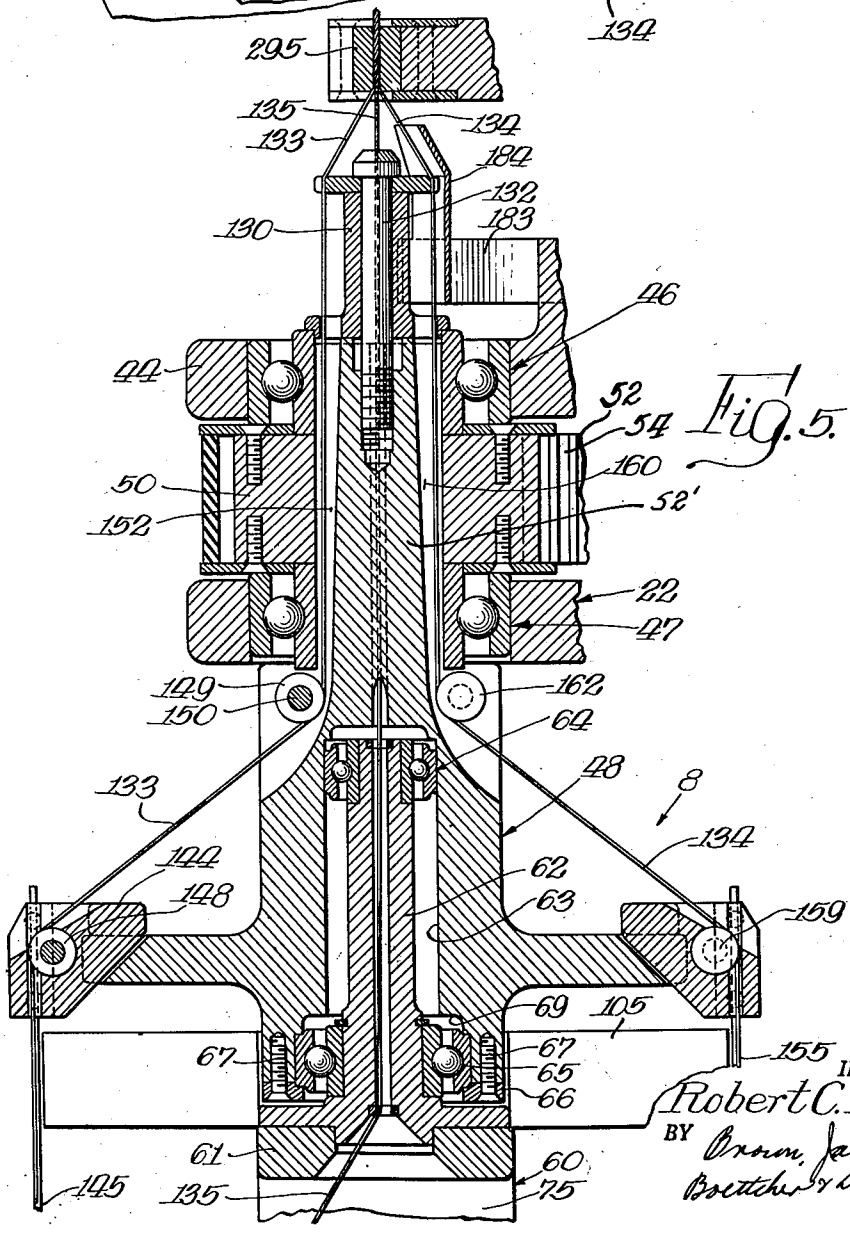


Fig. 5.

INVENTOR.
Robert C. Pierce,
BY Brown, Jackson, Boettcher & Dienner
Attys.

Sept. 11, 1951 R. C. PIERCE 2,567,347

STRANDING MACHINE

Filed July 30, 1949 6 Sheets-Sheet 4

Fig. 7.

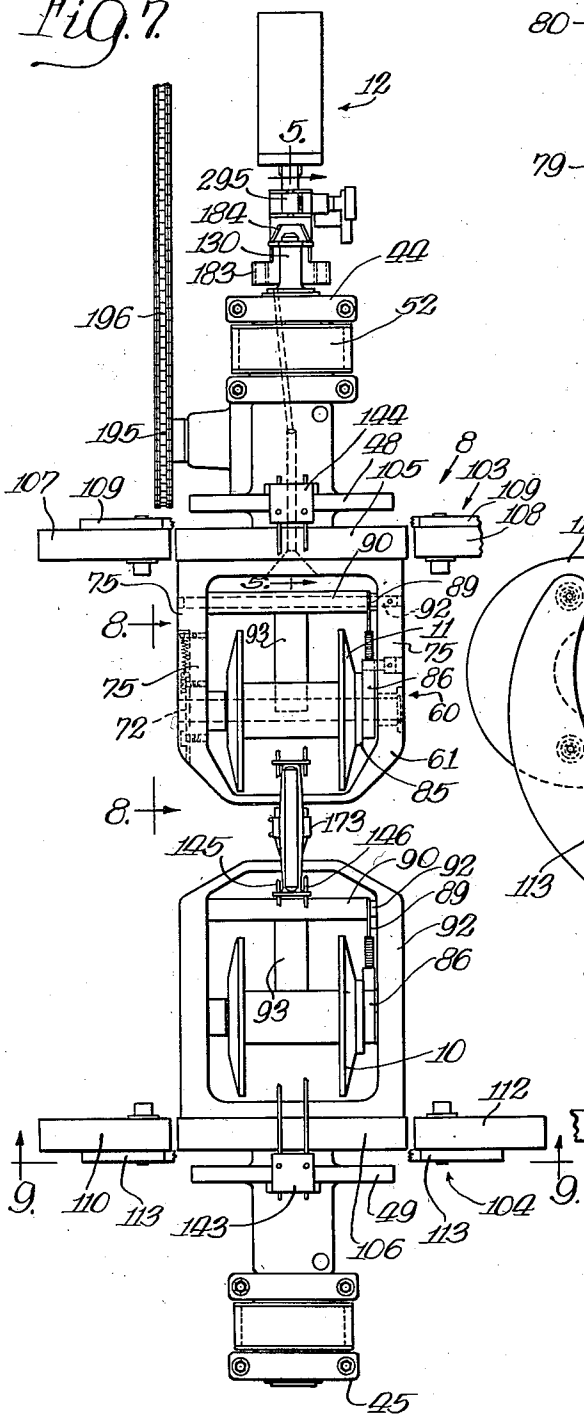


Fig. 8.

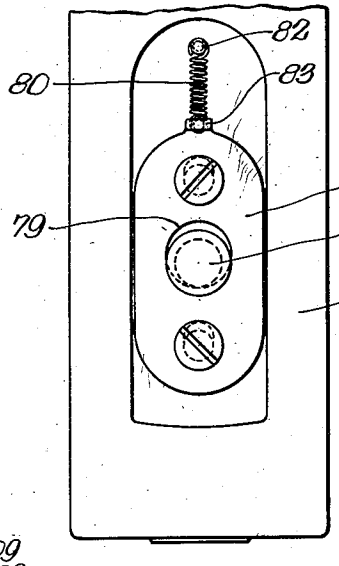
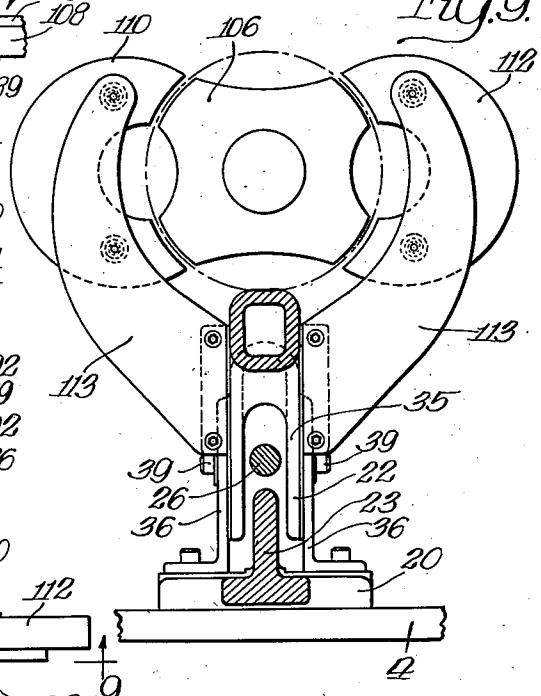


Fig. 9.

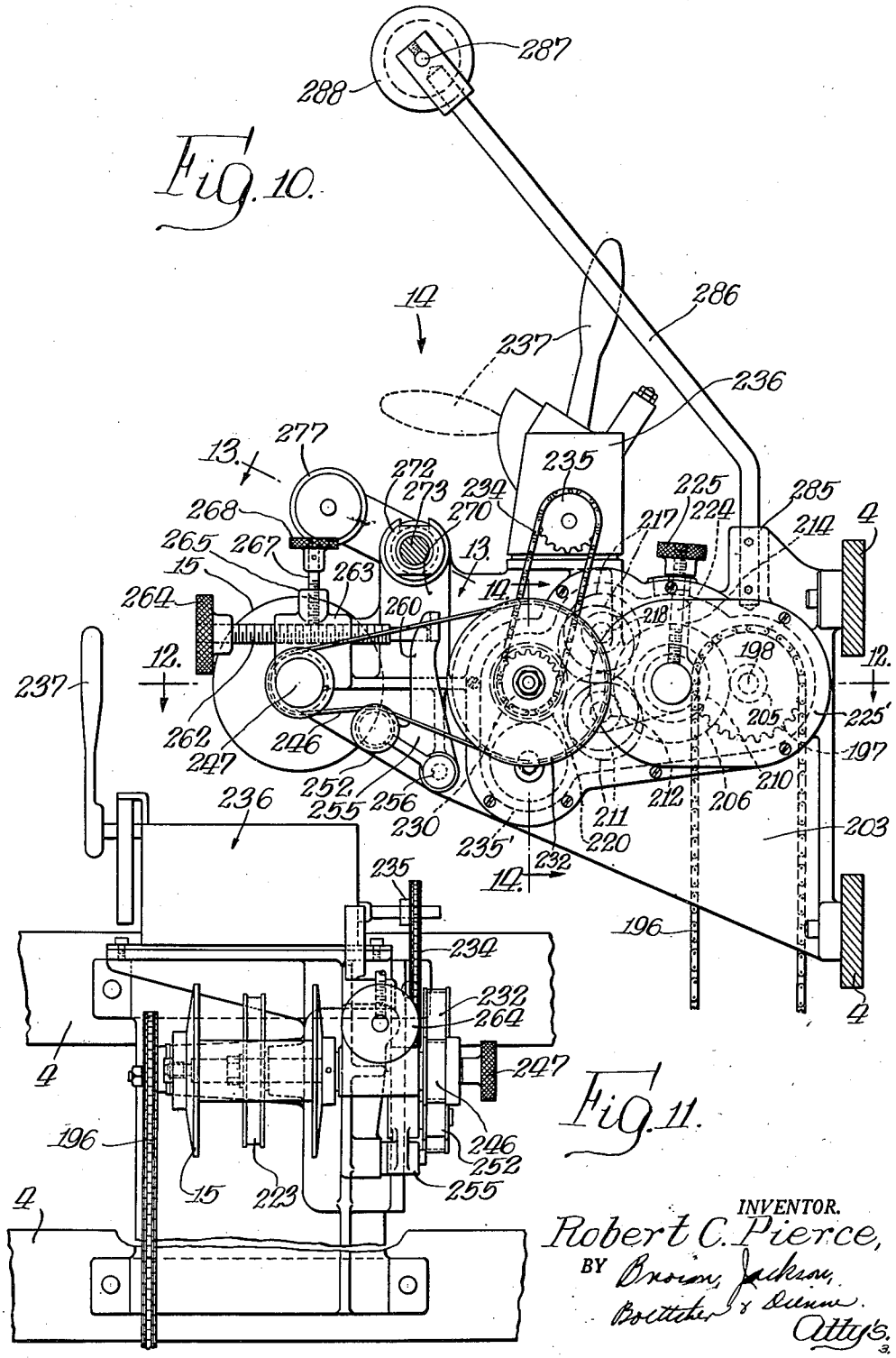


INVENTOR.
Robert C. Pierce,
BY Brown, Jackson, Boettcher & Dienner
Atty's.

Sept. 11, 1951 R. C. PIERCE 2,567,347

STRANDING MACHINE

Filed July 30, 1949 6 Sheets-Sheet 5

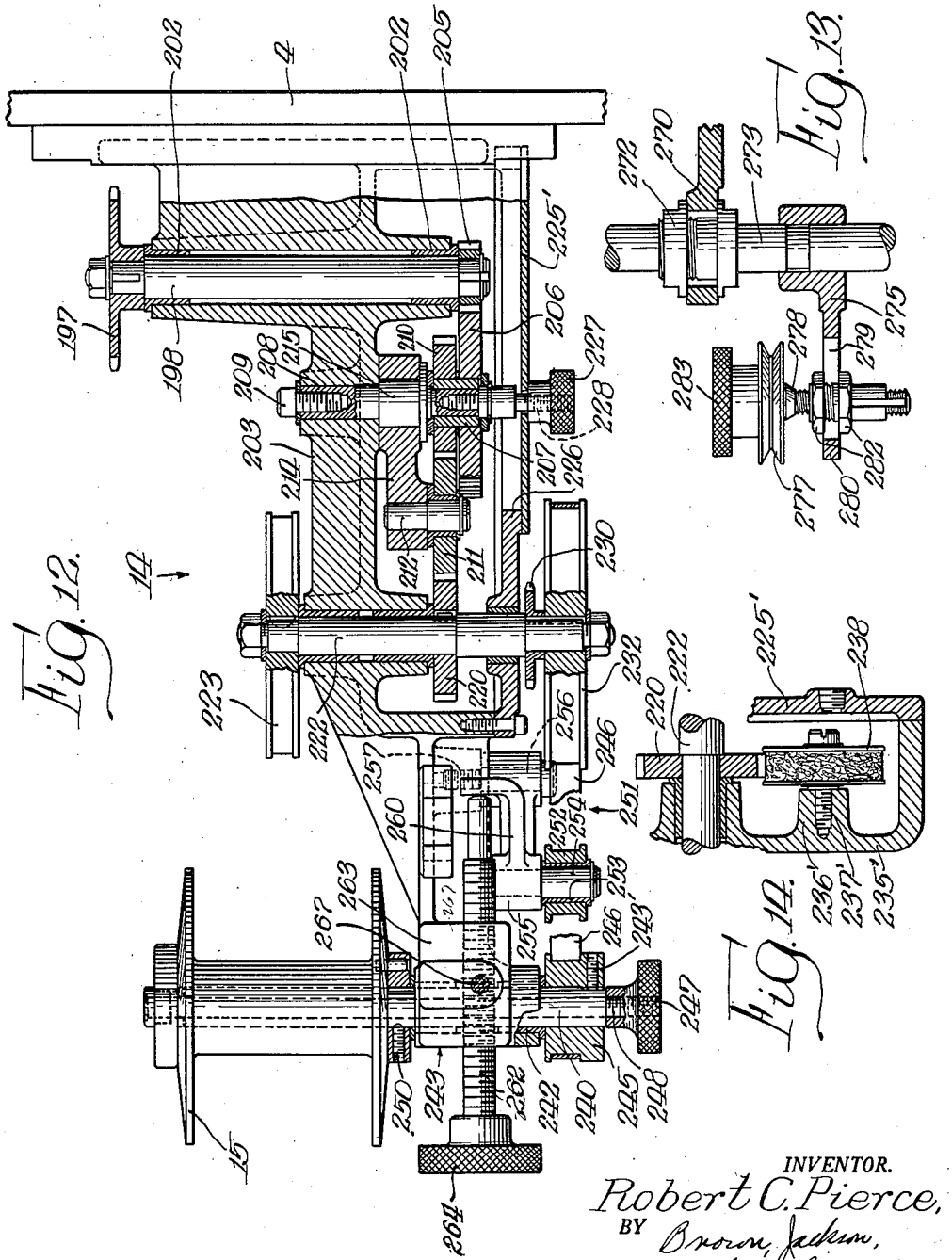


INVENTOR.
Robert C. Pierce,
BY Brown, Jackson, Boettcher & Dunn.
Atty's.

Sept. 11, 1951 R. C. PIERCE 2,567,347

STRANDING MACHINE

Filed July 30, 1949 6 Sheets-Sheet 6



INVENTOR.
Robert C. Pierce,
BY Brown, Jackson, Boettcher & Dienner
Atty's.

Patented Sept. 11, 1951 2,567,347

UNITED STATES PATENT OFFICE

2,567,347

STRANDING MACHINE

Robert C. Pierce, Niles, Mich., assignor to National-Standard Company, Niles, Mich., a corporation of Michigan

Application July 30, 1949, Serial No. 107,675

15 Claims. (Cl. 57—1)

1

My present invention relates to improvements in stranding machines, which, as is known, provide for the laying of a plurality of wires without twisting thereof to form a strand.

In the known conventional stranding machines there is usually provided a tubular rotor mounted for rotation about a horizontal axis, and in which rotor, cradles are journalled for the support of supply spools of wire to be stranded. In these known machines the cradles are arranged to be restrained against rotation with the rotor by the force of gravity so that as the wires are drawn off the supply spools mounted in the cradle, they are laid over each other by rotation of the rotor by means of a stranding head rotatable with and disposed at one end of the rotor. In order to achieve a saving in floor space, it has been proposed to depart from the aforementioned conventional form of horizontal strander by arranging the rotor with its axis extending vertically to provide what may be termed a vertical strander. In the vertical arrangement of the rotor, magnetic means may be provided for preventing rotation of the cradles as the wires are drawn off of the supply spools journalled in the cradles.

In the above referred to machines, the rotatable rotors impose limitations on the speeds at which the machines may be safely operated due to inertia characteristics of the rotor, and further, if operated at excessive speeds, the tubular rotors are subject to undue strain and, in fact, may be distorted so that the machines do not operate satisfactorily at high speeds.

In the further development of vertical stranding machines, it has been proposed to provide upper and lower rotor members driven in synchronism, and in which the opposite ends of a suitable cradle means for one or more spools of wire may be journalled.

In such construction, the aforementioned tubular rotors and the disadvantages thereof are eliminated, but such construction in turn has certain other limitations. One such limitation, is that the wires from the spools passing between the upper and lower rotors and which are being caused to travel in a substantially cylindrical path by rotation of the rotors, bow outwardly of the preferred cylindrical path resulting in non-uniformity in tension of the wires in the stranding thereof, and further subjecting the wires to breakage by the centrifugal force developed in rotation of the upper and lower rotors. A high incidence of breakage of wires is of disadvantage in that upon such breakage the wires being stranded become ensnarled with the apparatus before the machine can be brought to a stop.

2

It is an object of my present invention to provide a stranding machine in which the above several disadvantages and limitations of known constructions are avoided, and to provide a machine which may be operated at high speed in a satisfactory manner.

According to my present invention, I propose to provide a stranding machine in which a spool cradle is journalled at one end in a rotor, which permits the free and ready passage of the wire from a spool mounted to the stranding head of the machine.

A preferred feature of my invention, by virtue of the construction noted, permits of taking the wire off of a spool carried in a spool cradle so mounted without drawing the wire through the bearing in which the spool cradle is journalled.

A further feature of my invention resides in providing a stranding machine having upper and lower rotors each supporting a single spool cradle and a suitably supported tail spool in which guide means is arranged between the rotors to provide for retaining certain of the wires from the wire spools in a substantially cylindrical path in effecting the making of a strand.

The above and other objects, features and advantages of my invention will appear from the detailed description.

Now in order to acquaint those skilled in the art with the manner of constructing and utilizing a stranding machine in accordance with my present invention, I shall describe in connection with the accompanying drawings a preferred embodiment of my invention.

In the drawings:

Figure 1 is a perspective view of a stranding machine constructed in accordance with my present invention as it appears when viewed from the front and one side thereof, and in which the upper portion of a second machine is shown in juxtaposition of the machine fully illustrated showing the manner in which a plurality of the machines may be arranged, side by side, in a bank;

Figure 2 is an enlarged side elevational view of a portion of the stranding machine shown in Figure 1, illustrating primarily the upper and lower rotors, the spool cradles journalled therein, and the drive means for the rotors;

Figure 3 is a plan view of a gear box disposed adjacent the upper rotor embodying a power take-off for the driving of a take-off assembly mounted at the upper end of the stranding ma-

chine, with the view being taken substantially along the line 3—3 of Figure 2, looking in the direction indicated by the arrows;

Figure 4 is a detail horizontal sectional view taken substantially along the line 4—4 of Figure 2, looking in the direction indicated by the arrows and illustrating the manner in which a wire carrying spool is journalled in a spool cradle;

Figure 5 is an enlarged vertical sectional view of the portion of the apparatus at the upper rotor member with the view being taken substantially along the line 5—5 of Figure 7, looking in the direction indicated by the arrows;

Figure 6 is a plan view of the apparatus as shown in Figure 5;

Figure 7 is a front elevational view of the portion of the apparatus shown in Figure 2;

Figure 8 is a side elevational view of a clamping means for a spool for mounting the same in a cradle with the view being taken substantially along the line 8—8 of Figure 7 looking in the direction indicated by the arrows;

Figure 9 is a bottom view of the lower spool cradle illustrating the manner in which magnetic means is embodied for preventing rotation of the cradle in the operation of the apparatus, with the view being taken substantially along the lines 9—9 of Figure 7 looking in the direction indicated by the arrows;

Figure 10 is a side elevational view of the take-off assembly for drawing the wires to be stranded through the stranding machine and for winding the finished strand on a spool;

Figure 11 is a front elevational view of the take-off assembly shown in Figure 10;

Figure 12 is a substantially horizontal longitudinal sectional view through the take-off assembly shown in Figure 10, with the view being taken substantially along the line 12—12 of Figure 10, looking in the direction indicated by the arrows;

Figure 13 is a detail sectional view taken substantially along the line 13—13 of Figure 10, looking in the direction indicated by the arrows; and

Figure 14 is a detail sectional view taken substantially along the line 14—14 of Figure 10, looking in the direction indicated by the arrows.

Referring now particularly to Figure 1 of the drawings, the apparatus therein shown comprises a first stranding machine A, and a second stranding machine B, arranged side by side and supported upon a suitable main frame structure indicated at C. It will be understood that the stranding machines A and B may be of the same construction and in view of which the description following hereinafter will be limited to the machine shown at A.

The main frame structure C may be of any suitable form and comprises a pair of vertical channel members or posts 3 to which a plurality of horizontally extending supporting frame members 4 are secured to provide for mounting of the stranding machine A and B on the frame C.

The stranding machine A as shown in Figure 1 comprises in the main an electric motor 5, which serves as the motive power source for the stranding machine. The motor 5 is supported on a lower horizontally extending frame member 6 of the main frame supporting structure C to one side of a tail spool bracket support indicated generally at 7. Disposed above the electric motor 5 is a cradle and rotor assembly indicated generally at 8, which together with the tail spool bracket support 7 provides for the support of three spools of wire indicated generally at 9, 10 and 11, to provide, what is termed in the art, a three wire strander.

Immediately above the cradle and rotor assembly 8 there is provided a conventional form of straightening roller means indicated generally at 12 through which the strand or the laid wires drawn from the spools 9, 10 and 11 pass. The machine A further comprises a take-off assembly indicated generally at 14, which as will later appear provides for drawing of the several wires from the spools 9, 10 and 11 through the cradle and rotor assembly 8 and the straightening roller means 12. The take-off assembly 14 also provides for the support and drive of a spool 15 for the finished strand. The apparatus A further includes an electric control box indicated at 16 for controlling, starting and stopping of the machine.

It will be understood that the stranding machine B may be of the same construction as the stranding machine A so that a detail description of the machine A will suffice for purposes of disclosing the novel features of my invention present in the arangement of more than one of such machines in side by side relation.

The several portions or assemblies above referred to shall hereinafter be described in detail and at the outset I shall first describe the cradle and rotor assembly 8 which is shown in detail in Figures 2 through 9.

Cradle and rotor assembly

Referring now more particularly to Figure 2 it will be observed that the cradle and rotor assembly 8 comprises a main frame 20 which is suitably secured to a pair of the horizontal supporting bars 4 of the main frame C. The supporting frame 20 in turn provides for the support of a sub-frame 22. The main frame 20, as shown in Figures 2 and 9, has a vertically extending reinforcing rib 23 at the opposite ends of which integral boss portions 24 and 25 are provided for supporting and rotatably mounting a vertically extending drive shaft 26. The drive shaft 26 has identical upper and lower pulleys 27 and 28 keyed thereto, and a drive pulley 29 is secured adjacent the lower end of the drive shaft 26 below the pulley 28. Upon reference to Figure 1 it will be observed that an endless friction belt 30 is trained about a pulley 32 connected to the armature shaft of electric motor 5 and about pulley 29 so that the electric motor when energized is adapted to rotate the drive shaft 26.

The sub-frame 22 as best shown in Figures 2 and 9 comprises a body portion 35 of U-shape in cross-section and is mounted to extend forwardly of the main frame 20 by means of a plurality of angle brackets 36, which are each secured at one end to the main frame 20. The leg portions of the body 35 of the sub-frame straddle the vertical rib 23 of the main frame and as shown, the drive shaft 26 lies between these leg portions.

A plurality of screws 38 are arranged so that the shanks thereof extend through slots 40 formed in bracket members 36 and the screws 39 have threaded engagement in the sub-frame to provide for the rigid support of the sub-frame in juxtaposition forwardly of the main frame. Adjusting screws 42 and 43 are provided between the upper and the lower boss portions 24 and 25 of the main frame 20 and adjacent portions of the sub-frame 10 to provide for aligning the sub-frame 22 vertically and forwardly of the main frame 8 upon loosening of screws 39. The slots

40 in brackets 36 permit the adjustment of the sub-frame and when the sub-frame is properly positioned by means of screws 42 and 43 screws 39 may be drawn tight so as to support rigidly the sub-frame.

The sub-frame 22 further comprises upper and lower fork-shaped end portions 44 and 45 respectively. These two end portions are of like construction and each, as best shown in the detail section of upper end portions 44 in Figure 5, support a pair of ball bearing assemblies 46 and 47. The bearing assemblies 46 and 47 of upper fork-shaped portion 44 of the sub-frame, provide for the rotatable support of an upper rotor indicated generally at 48, and a lower rotor 49 has journalled support in like manner in the lower fork-shaped portion 45. The fork-shaped portions 44 and 45 provide for the rotatable mounting of the upper and lower rotors 48 and 49 about a substantially common vertical axis.

Referring now particularly to Figures 2 and 5 it will be observed that a pulley 50 is suitably secured to the shaft portion of the upper rotor 48 and is arranged between the pair of ball bearing assemblies 46 and 47 forwardly of and in the same horizontal plane as the upper pulley 27 on the drive shaft 26. The pulleys 27 and 50 are provided with positive drive teeth of gear form and of the same size and shape, and an endless belt 52 is trained about the pulleys. The belt 52 as shown is formed with integral cleats or gear shaped teeth 54 having positive driving engagement with the drive teeth of the pulleys 27 and 50 so as to provide for the positive drive of the upper rotor 48 by the drive shaft 26. The lower rotor 49 has a pulley 53 keyed to the shaft portion 58 thereof and between the pair of ball bearing assemblies of the lower fork-shaped portion 45 providing for the journalled support of the lower rotor 49. The pulley 53 is identical to pulley 50 and has positive drive teeth with which the cleats 55 of an endless belt 56, identical with belt 52, have positive driving engagement. The belt 56 is trained over the pulley 28 which also has positive drive teeth for engaging the teeth of the belt to provide for the positive drive of the lower rotor 49. By virtue of the above construction, the upper and lower rotors 48 and 49 are caused to be driven in synchronism.

Upon reference now to Figure 5 it will be observed that the upper rotor member 48 provides for the journalled support of one end of an upper spool cradle indicated generally at 60. The upper spool cradle 60 comprises spool carrying frame 61 and a mounting stem or shank portion 62 at the upper end thereof which is disposed within a bore 63 formed in the upper rotor 48. Suitable ball bearing assemblies 64 and 65 are disposed between the shaft portion 62 and the bore 63 of the upper rotor to provide for relative rotational movement of the upper rotor 48 with respect to the upper spool cradle 60. An annular retaining plate 66 is secured to the lower end portion of the rotor 48 as by a plurality of screws 67 which serve to retain the outer race of the ball bearing assembly 65 within the bore 69 at the lower end of the upper rotor 48. It will be observed by virtue of the construction above described that the spool cradle 60 is thus journalled at one end thereof in the upper rotor 48. The spool 11 which is adapted to support a coil wire for formation of a strand is as best shown in Figure 4, provided with end journal shaft portions 72 mounted in bushings 73 and 74 supported in the leg portions 75 of the spool carrying frame 61. The shaft 72 for supporting the spool 11 is removably mounted between the legs 75 of the spool carrying frame 61 and for this purpose may at one end be formed with an annular recess 76 with which a plate member 77, as best shown in Figure 8, is associated for retaining the shaft 72 in position between the legs 75. To this end the plate member 77 is formed with a circular opening 79 of larger diameter than the diameter of shaft 72 and in which a spring 80 is connected between the plate member and a pin 82 fastened in leg 75 normally serves to bias the plate member 77 upwardly as viewed in Figure 8 to engage the portion of the plate member 77 defining the opening 79 in the annular recess 76 in the shaft 72. The plate member 77 is formed with a laterally outwardly projecting end flange 83 which may be engaged manually to move plate member 77 downwardly and against the force of the spring 80 to align the opening 79 with the shaft 72, whereby the shaft may be withdrawn from the spool cradle and the spool 11 removed. The construction described provides for the ready and convenient removal of an empty spool for replacement with a full spool of wire.

Upon reference now to Figures 4 and 7 it will be observed that the spool 11 has a brake drum indicated at 85 secured to one of the end flanges thereof. The brake drum 85 forms one element of an automatic compensating brake for restraining rotation of the spool 11 as a factor of the diminishing diameter of the wire thereon to provide for withdrawing of the wire from the spool under uniform tension. This brake means may be of any suitable construction for the purposes noted, and may, for example, comprise, as best shown in Figure 2, a brake band 86 rigidly anchored at one end as by a pin 87 to the leg 75 of the upper spool carrier 60 adjacent brake drum 85. The other end of brake band 86 is connected by means of a spring 88 to the end of a crank arm 89, which as shown in Figure 7, is fixed to a tubular member 90 which is journalled on a shaft 92 extending transversely between the legs 75 at the upper end of the upper spool cradle 60. A sensing finger 93 has connection with the tubular member 90 and the free end of the sensing finger 93 is adapted to ride on the periphery of the coil of wire on the spool 11 for purposes of varying the spring tension of the coil spring 88 to vary the braking force of the brake member 86 on the brake drum 85. The sensing finger 93 controls the spring tension of the coil spring 88 as a factor of the diameter of the wire on the spool to provide for the uniform withdrawal of wire from the spool under uniform tension.

The cradle and rotor assembly 8 as previously noted, further comprises a lower rotor 49 in which a lower spool cradle 92 is journalled at its lower end. Ball bearing assemblies 93 and 94 identical to the ball bearing assemblies 64 and 65 of the upper spool cradle 60 are provided for rotatably supporting the lower spool cradle 92 in the lower rotor 49. It will be observed that the lower spool cradle is journalled at its lower end in the lower rotor 49, and that the upper spool cradle 60 is journalled at its upper end in the upper rotor 48. The opposed ends of the upper and lower spool cradles 60 and 92 respectively, are spaced apart from each other to provide for the disposal therebetween of a reinforcing spider indicated generally at 100 and which forms part of the wire guide means indicated generally at 102 which shall be presently described.

The above referred to lower spool cradle 92 provides for the rotatable support of the wire spool 10. The wire spool 10 is of the same construction as the wire spool 11 and an automatic brake means such as that above described is also provided therefor.

In order to prevent rotation of the upper and lower spool cradles 60 and 92 with the upper and lower rotors 48 and 49 magnetic means indicated generally at 103 in Figures 1 and 7 is provided for the upper spool cradle, and magnetic means 104 is provided for the lower spool cradle. The magnetic means 103 and 104 each comprise magnetic members 105 and 106 secured respectively, to the upper and lower spool cradles 60 and 92.

A pair of stationary permanent magnets 107 and 108 are disposed laterally of the permanent magnet 105 to either side thereof and are secured by suitable brackets 109 to the sub-frame 22. Also disposed in laterally spaced relation of the permanent magnet 106 for the lower spool cradle 92 are a pair of permanent magnets 110 and 112 which likewise are secured by means of brackets 113 to the sub-frame 22. The permanent magnet 105 for the upper spool cradle lies in the same horizontal plane as the permanent magnets 107 and 108 and are arranged so as to provide a gap between the periphery of the permanent magnet 105 and the permanent magnets 107 and 108 through which the wires being stranded are adapted to pass as will presently appear. Likewise the permanent magnet to which the lower cradle member 92 is mounted also lies in substantially the same plane as the stationary permanent magnets 110 and 112 with clearance being provided between the opposed pole faces of these magnetic members to provide a gap for passage of certain of the wires being stranded thereof in the operating of the stranding machine.

Referring again to Figure 1 it will be observed that the tail spool shaft supporting bracket means 7 comprises a reinforced angle iron 115 secured to a cross supporting member of the frame structure C which provides for the support of the tail spool 9 substantially immediately below the cradle and rotor assembly 8. The bracket 115 provides for the support at the outer end thereof of a shaft 116 upon which the spool 9 is journalled. In this arrangement of parts an automatic self compensating brake means indicated generally at 117 is also provided for effecting drawing off of the wire from the spool 9 under uniform tension. The brake means 117 comprises a brake drum 118 suitably mounted on a shaft 116 for rotation with the spool 9 and a brake band 119 has connection at one end as at 120 to a pin adjustably mounted on the bracket 117, and a spring 122 extends from the other end of the brake band to a crank arm 123 carried by the shaft 124.

The shaft 124 has a sensing finger 125 mounted thereto which is adapted to ride upon the periphery of the wire on the spool 9, and as the sensing finger moves inwardly the tension of the spring 122 is lessened so that the wire is caused to be withdrawn from the spool under uniform tension.

The above described cradle and rotor assembly 8 and tail spool mounting means thus defines a three wire strander in which the wires from the three spools 9, 10 and 11 are caused to be stranded or laid over one another through means of a conventional form of a stranding head 130 which as shown in Figure 5 is mounted by means of a bolt 132 to the upwardly projecting portion

of the shaft 52' of the upper rotor 48 above the upper forked end 44 of the sub-frame 22 with the inner end portion of the stranding head bearing against the outer end of the shaft portion 52' and the inner bearing race of the ball bearing assembly 46.

The wire drawn off the tail spool 9 is indicated by the reference numeral 133, the wire from the spool 10 of the bottom cradle 92 of the rotor and cradle assembly 8 by the reference numeral 134, and the wire from the spool 11 of the upper spool cradle 60 bears reference numeral 135. The wire 133 from the tail spool 9 is caused to be drawn through the lower end portion of the lower rotor 49 and the pulley 53, with these parts being suitably ported for the passage of the wire therethrough as illustrated in Figure 2. The wire 133 is trained over a guide wheel or pulley 140 secured to the lower rotor 49 above the lower forked end portion of the sub-frame 22, and from the guide wheel 140 extends laterally, outwardly and upwardly to a guide roller 142 carried in a bracket 143 fixed at the periphery of the lower rotor 49. A second bracket 144 of the same construction as bracket 143 is secured to the upper rotor 48 in vertically aligned position with respect to bracket 143, as shown in Figures 2 and 4, a pair of spoke members 145 and 146 are secured at their opposite ends to the brackets 143 and 144. The wire 133 extends vertically upwardly between the spokes 145 and 146 and is trained over a guide roller 148 journalled in the upper bracket 144, thence as shown in Figure 5, laterally, inwardly and upwardly to a guide roller 149 journalled in the upper rotor as upon a pin 150 and thence vertically upwardly therefrom through slot or groove 152 formed in the shaft portion 52' of the upper rotor to the stranding head 130.

The wire 134 from the lower cradle spool 10 as shown in Figure 2 passes through an opening 153 formed in the upper end of the bottom spool cradle 92, thence laterally, outwardly and upwardly through the spider 102 and thence vertically upwardly between a pair of spokes 155 and 156 which are secured at their opposite ends to brackets 157 and 158, secured, respectively, to the upper and lower rotors 48 and 49 in diametrically opposed relation, respectively, of brackets 144 and 143. The bracket 157 supports a guide roller 159 over which the wire 134 is trained, with the wire 134 then extending laterally, inwardly and vertically upwardly through a groove or slot 160 formed in the shaft portion 52' of the upper rotor and diametrically opposite the groove 152 for the wire 133. At the lowermost portion of the groove 160 a guide roller 162 is mounted for guiding the wire in its passage from the guide roller 159 about roller 162 and thence substantially vertically upwardly through the groove 160.

In the rotation of the upper and lower rotor members and by virtue of the guiding means above described, the wires 133 and 134 are caused to be rotated in a substantially cylindrical path with such wires being adapted to pass in the gaps between the stationary magnets 105 and 106 of the upper and lower rotors respectively, and the fixed permanent magnets 107, 108 and 110 and 112, respectively, therefor, to the stranding head 130 at the upper end of the upper rotor. The wire 135 from the upper cradle spool 60, as best shown in Figure 5, passes through the passageway provided therefor formed in the stem or shaft portion 62 of the upper cradle 60, then through a suitable bore formed in the shaft por-

tion 52' of the upper rotor and then through the stranding head 130. The three wires 133, 134 and 135 are thus caused to be laid over each other by the stranding head 130 at the upper end of the cradle and rotor assembly 8.

The spider 100 previously referred to provides for preventing bowing outwardly of the several spokes 145, 146 and 155, 156, extending between the upper and lower rotors by centrifugal force in the rotation of the upper and lower rotors 60 and 92, and serves to prevent wires 133 and 134 passing one between each of such pairs of spokes from bowing outwardly. These are of light weight and enable operation of the stranding machine at high speed in that they present no appreciable inertia problems. The spider 100 is preferably journalled in any suitable manner at the lower end portion of the upper spool cradle 60, and for this purpose the upper spool cradle is provided with a depending shaft portion 170 upon which the hub 172 of the spider 100 is rotatably mounted. Suitable bearings may be disposed between the shaft 170 and the hub 172 if desired to reduce friction between these parts. The hub 172 has secured to it a transversely extending supporting body member 173 to which outwardly flaring end extensions 174 project in diverging relation from each other. The extensions 174 are formed with flange members 175 through which the spokes 145 and 155 and 156 extend. The diverging end extensions 174 at each end of the body member 173 of the spider provide for the reinforcement of the intermediate portions of the spokes for a substantial distance to prevent bowing of these portions which are subjected to substantial centrifugal force in the high speed rotation of the upper and lower rotors. The journal formed between the shaft 176 of the upper spool cradle and the hub 172 of spider 100 enables the free rotation of the spider 100 with the guide spokes as a unit and conjointly with the upper and lower rotors 48 and 49 for relative rotation with respect of the upper and lower spool cradles 60 and 92.

Upon reference again to Figure 2 it will be observed that a contact plate 180 is shown secured to the sub-frame 22 between the forked end portions 44 and 45 thereof and opposite the spool and cradle assembly 8. This contact plate member serves as a control element in a suitable control circuit to effect the de-energization and braking of the electric motor upon breakage of any of the three wires 133, 134 and 135 by contact of any of these wires with the contact plate 180. Also, as best shown in Figures 5 and 6, a second contact plate 183 is secured on the sub-frame 22 to lie above the upper yoke portion 44 thereof, and includes an arcuate portion 184 closely adjacent to but in spaced relation of the stranding head 130 and which contact plate 183 if engaged by any one of the wires being stranded as upon breakage thereof at the stranding head, effects the de-energization of the electric motor 5 and the braking thereof. The electrical control system in which the contact plates 180 and 183 are embodied forms no part of the claimed subject matter of my present application. It will be noted, however, that these plates are disposed at portions of the stranding machine where breakage of wires is most likely to occur and in which event the machine is rapidly brought to a stop to prevent snarling or tangling of the wires with the stranding apparatus.

Take-off assembly

The take-off assembly 14 previously referred to provides for drawing of the several wires 133, 134, and 135 from the tail spool, and the cradle and rotor means 8 with the take-off assembly being shown most clearly in Figures 10 through 14 to which reference will be made presently. The drive for the take-off assembly is best shown in Figures 2 and 3 and includes a worm 190 fixed to the upper end of drive shaft 26 disposed within the enlarged housing at 24 of the main frame 20. The worm 190 has meshing engagement with a worm wheel 192 fixed to a shaft 193 projecting laterally outwardly through a suitable journal cap member 194 fixed to the housing 24. A drive sprocket 195 is suitably secured to the outer end of the shaft 193 and an endless chain 196 is trained over the sprocket 195 and a sprocket 197, which as best shown in Figure 12, is connected at one end to the drive shaft 198 of the take-off assembly 14. Thus upon rotation of the drive shaft 26 for the spool and cradle assembly 8 the worm and worm wheel effect rotation of the drive shaft 198 for the take-off assembly 14. In this manner the common electric motor 5 drives the upper and lower rotors of the spool and cradle assembly 8 and also the take-off assembly 14 which as will become apparent as the description proceeds, provides for drawing of the wires to be stranded from the supply spools to the finished strand spool 15 of the take-off assembly 14.

For purposes of further disclosure of the take-off assembly 14 reference may now be had to Figures 10 through 14.

The take-off assembly drive shaft 198 is journalled adjacent its opposite ends in bushings 202 mounted in the housing 203 thereof. The inner end of the drive shaft 198 carries a drive pinion 205 which is adapted to have meshing engagement with a pinion 206 mounted on a bearing sleeve 207, rotatably mounted on a gear shaft 208 which is mounted at one end by means of a screw 209 to the take-off assembly housing 203. A pinion 210 is mounted on the sleeve 207 and rotates with the gear 206. The pinion 210 has constant meshing engagement with a pinion 211 which is journalled on a pin 212 carried in a gear carrier 214 which in turn is journalled on the enlarged intermediate portion 215 of the gear shaft 208. The gear carrier 214 also supports a second gear 217 by means of a stud 218 mounted in the carrier 214 with the gear 217 being disposed above the gear 211 as shown in Figure 10. The gear 217 has constant meshing engagement with the gear 211 and the carrier 214 is movable about gear shaft 208 so that the gear 211 may be selectively engaged or disengaged with a pinion 220 keyed to a driven shaft 222 journalled in the take-off assembly housing 203 and which shaft 222 has a bull wheel 223 secured at one end thereof about which the strand from the stranding head is wound three or four turns for drawing the wire from the spools. As best shown in Figure 10, a shaft member 224 for moving the carrier 214 is threaded at one end in the portion thereof disposed about the gear shaft 215, and an adjustment nut 225 is threaded on the outer projecting end of the shaft 224. The shaft 224 projects through a slot like opening in the adjacent upper portion of the take-off assembly housing 203, and by loosening and tightening the nut 225, the gear carrier 214 may be rocked selectively to engage pinion 211 with the driven

pinion 220, or to engage the pinion 217 with the driven pinion 220. The pinions 211 and 217 thus provide a reversing means for effecting rotation of the driven shaft 220 in opposite direction and consequently of the bull wheel 223, carried thereby selectively in opposite directions, so that either a left or right hand turn may be imparted to the fabricated strand as will appear in detail hereinafter.

In the dotted line positions of the pinions 211 and 217 as shown in Figure 10 drive is imparted to the driven shaft 222 by meshing engagement of the pinion 211 with the pinions 210 and 220. The carrier 214 may be shifted by means of shaft 224 to the left from its position as shown in Figure 10 so that gear 211 is moved to its dot-dash position and the gear 217 is disposed to its dot-dash line position in meshing engagement with driven gear 220. In this position of the carrier, the pinion 211 has meshing engagement with the pinion 210 and the pinion 211 has meshing engagement with the pinion 217, and the latter in turn has meshing engagement with the driven pinion 220 so as to effect rotation of the driven shaft 222 in an opposite direction.

It will be observed that the arrangement is such that the several gears and pinions described and the reversing gear carrier 214 are enclosed within the take-off assembly housing 203, and a removable side cover plate 225' is secured to the take-off assembly housing 203 to close an opening 226 provided therein for access to the interior of the housing. The cover is secured in position by a nut 227 having threaded engagement with a reduced threaded shaft portion 223 of the gear shaft 208.

Referring again to Figure 12 it will be seen that the driven shaft 222 at the end thereof opposite the bull wheel 223 has a drive sprocket 230 and a pulley wheel 232 keyed thereto. An endless chain 234, as best seen in Figure 10, extends from the sprocket 230 to a sprocket 235 of a counting device 236 for recording the number of feet of wire being stranded by the apparatus. The counting or registering device 236 is thus driven by the driven shaft 222 carrying the bull wheel 223 which draws the wire through the stranding apparatus so that the registering device 236 gives an accurate recording of the number of feet of strand being produced. The counting device 236 per se is of known construction and includes a handle 237 for resetting the device.

The take-off assembly housing 203 below the driven gear 220 is formed with a sump portion 235' and the housing as best shown in Figure 14 is provided with an integral boss 236' which receives a screw 237' for rotatably supporting an oil distributor wheel 238 for effecting lubrication of the several gears previously described. The wheel 238 is preferably provided with a felt layer about its periphery which engages with the gear teeth of pinion 220. The felt is effective to pick up lubricating oil from the sump and the oil is transferred to the gear 220 which by its peripheral engagement with the oil distributor wheel drives the latter. The oil thus picked up by gear 220 is transferred to the several other gears described.

At the forwardly projecting end of the take-off assembly housing 203 there is mounted a shaft 240 which provides for the support of the strand take-up spool 15. The shaft 240 is journalled in a bushing 242 mounted in the end portion 243 of the take-off assembly housing 203 and this shaft has secured thereto as by a set screw 243' a drive pulley wheel 245. An endless slip belt 246 is trained over the pulleys 232 and 245 for effecting rotation of the strand spool shaft 240. A nut 247 is threaded onto the outer projecting threaded end of a rod 248 extending through the strand spool shaft 240. The rod 248 has a nut threaded at the other end thereof for engagement with the adjacent flange member which is formed with a U-shaped slot opening into the periphery thereof and providing for securing the strand spool 15 against movement axially of shaft 240. A screw 250 is provided to secure a collar having driving connection with the spool to the shaft 240. The arrangement provides for the ready assembly and disassembly of the strand spool 15 from shaft 240. It will be understood that any other desired construction of detachable mounting means for the strand spool may be used since such construction forms no part of my present invention.

Belt tensioning means indicated generally at 251 is provided for effecting adjustment of the tension or slipping characteristics of the slip belt 246 and is arranged on the take-off assembly housing 203 between the pulleys 232 and 245. The belt tensioning means 251 comprises a pulley 252 journalled on a bushing 253 at one end of a shaft 254 which is mounted in a bracket 255 pivoted on a pin 256 which is threaded as indicated at 257 in the take-off assembly housing 203. The bracket is provided with an upwardly extending leg portion 260 the free end portion of which is adapted to be engaged by an adjustment screw 262 threaded into a boss of the take-off assembly housing 203 forwardly thereof. Threaded shaft 262 may be moved axially through the boss 263 by turning of nut 264 which is fast to the forward end of the shaft to rock the bracket 255 about the shaft 256 to a selected adjusted position to provide for the desired frictional engagement of the idler pulley 252 with the endless belt 246 to adjust the tension thereof and thereby the slipping characterstics of the belt 246 in order to provide for driving of the strand take-up spool 15 through the gear means for driving the bull wheel 223. It will be observed that the boss 263 includes an upwardly extending integral projection 265 in which a set screw 267 having a nut member 268 secured thereto is threaded for engagement with the axially shiftable adjustment shaft 262 to provide for securing of the latter in a selected adjusted position for the desired tension adjustment of the slip belt 246.

Referring now to Figures 10 and 13, it will further be observed that the take-off assembly housing has an integral vertically extending bracket portion 270 having an opening at its upper end for receiving a slide bearing 272 through which the shaft 273 of a level wind mechanism is adapted to have sliding engagement. Preferably each of the stranding machines A and B as shown in Figure 1 have the take-off assemblies thereof provided with the aforedescribed bracket 270 to provide for the spaced support of the level wind shaft 273 to effect the level winding of wire on the strand take-up spools 15 of the machines upon reciprocating axial movement of shaft 273.

The shaft 273 has a plurality of brackets 275 secured thereto, one for each of the strand spools 15, with each of the brackets 275, as best shown in Figure 13, providing for the support of a guide pulley 277 for guiding a strand upon a strand spool. The guide pulley 277 is journalled on a

shaft 278 which extends through an elongated slot 279 formed in the arm 280 of the bracket 275. A pair of nuts 282 are provided for adjusting the position of the shaft 278 in the slot of the bracket so as to provide for disposal of the guide pulley in the desired direction. A nut 283 has threaded engagement with the shaft 278 for securing the pulley 277 in position.

Rearwardly of the upper end portion of the take-off assembly housing 203 there is a boss 285 which provides for the support of an upwardly and forwardly projecting rod 286 which at its outer end carries a shaft 287 upon which a guide pulley 288 is journalled. As previously related three or four turns of the strand from the straightening rollers 12 are wound about the bull wheel 223 with the strand then extending from the bull wheel to the pulley 288 and thence to pulley 277 from which it is guided upon the strand spool 15. The shaft 287 supports the pulley 288 for relative axial sliding movement thereon so that the pulley 288 is adapted to slide axially with the pulley 277 in the reciprocation thereof to and fro of the strand spools 15 as will presently appear. The finished strand is thus caused to be level wound upon the strand spools 15.

Referring now to Figure 1 it will be observed that the level wind shaft 273 is mounted in a bracket 290 to which a pair of actuating arm members 292 are pivotally secured. A suitable electric motor (not shown), but independent of the main drive motor 5 is provided and supported by the supporting structure C and a driving connection is provided between the armature shaft thereof with the arms 292 to provide for conjoint movement to and fro of the pivoted pins of the latter arms so that such movement of the arms 292 effects the reciprocatory axial movement of the level wind shaft 273. The brackets 275 carrying the guide pulleys are thus reciprocated axially to and fro of the end flanges of the strand spools 15, and such movement the guide pulleys 277 through the strand effects the axial movement of the guide pulleys 288 on the shaft 287 supported at the upwardly projecting ends of the supporting rods 286.

The above referred to straightening roller assembly 12 is of conventional construction and is mounted adjacent the upper end of the cradle and rotor assembly 8. The assembly 12 inches a conventional die 295 for closing the strand prior to its passage through the straightening rollers, and from whence the strand passes to the bull wheel of the take-off assembly.

It will be observed that with respect of the stranding machine A that the electric motor 5 provides for driving the rotors of the cradle and rotor assembly 8 and the take-off assembly 14 for effecting drawing of the wires through the stranding machine.

While I have shown and described what I consider to be a preferred embodiment of my invention it will be understood that various modifications and rearrangements may be made therein without departing from the spirit and scope of my invention.

I claim:

1. In a wire stranding machine, the combination of a pair of rotor members mounted in spaced apart relation for rotation about a common axis, a pair of spool cradle means one journalled at one end in each of said rotor members, drive means for said rotors for driving the same in synchronism, and means for preventing rotation of said spool cradle means with said rotor members.

2. In a wire stranding machine, the combination of a pair of rotor members mounted in spaced apart relation for rotation about a common vertical axis, a pair of spool cradle means between said rotor members one being journalled at one end thereof in each of said rotor members, drive means for said rotors for driving the latter in synchronism, and means for preventing rotation of such spool cradle means with said rotor members.

3. In a wire stranding machine, the combination of a pair of rotor members mounted in spaced apart relation for rotation about a common axis, a pair of spool cradle means between said rotor members each being adapted to support a spool of wire, said spool cradle means being journalled one at one end in each of said rotor members and having their lengthwise axes in alignment with the axis of rotation of said rotor members, first guide means between said rotor members for guiding the wire from one of the spools in one of said cradle means generally laterally outwardly between the opposed ends of said spool cradle means and toward one end of the machine, second guide means extending through the other of said spool cradle means for guiding the wire from the spool thereof towards said one end of the machine, drive means for said rotor members for driving the same in synchronism, and means for restraining rotation of said spool cradle means with said rotor members.

4. The machine of claim 3 characterized by said first guide means comprising a spider member extending transversely of the axis of rotation of said rotor members between the opposed ends of said pair of spool cradle means.

5. The machine of claim 4 characterized by said spider member being journalled in one of said spool cradle means.

6. In a wire stranding machine, the combination of a pair of rotor members mounted in spaced apart relation for rotation about a common vertical axis, a pair of spool cradle means between said rotor members each being adapted to support a spool of wire, said spool cradle means being journalled one at one end in each of said rotor members and having their lengthwise axes in alignment with the vertical axis of rotation of said rotor members, guide means extending between said rotor members for guiding the wire from the spool of the lowermost spool cradle means generally laterally outwardly between the opposed ends of said spool cradle means and toward the upper end of the machine, and second guide means extending through the uppermost end of the uppermost spool cradle means for guiding the wire from the spool mounted therein toward the upper end of the machine, drive means for said rotors for driving the latter in synchronism, and means for preventing rotation of said spool cradle means with said rotor members.

7. The machine of claim 6 characterized by said first guide means comprising substantially diametrically opposed spoke means extending between said rotor members, and a spider member extending transversely between the opposed ends of said spool cradle means and connected with said spoke means for restraining bowing outwardly of said spoke means by centrifugal force in the rotation of said rotor members.

8. The machine of claim 7 characterized by said spider member being journalled in the uppermost spool cradle means.

9. In a stranding machine, the combination

of upper and lower rotor members adapted to be driven in synchronism, wire guide means comprising spoke members secured at their opposite ends to said upper and lower rotor members and arranged in diametrically opposed relation with respect to each other, and a spider member extending transversely between the opposed spoke members intermediate the ends thereof.

10. In a stranding machine, the combination of a pair of spaced apart rotor members journalled for rotation about a common axis, spool cradle means journalled in said rotor members, drive means for said rotor members for driving the same in synchronism, means for said spool cradle means for restraining the same against rotation with said rotor members, and guide means extending between said rotor members comprising spoke members extending therebetween and secured at their opposite ends to said rotor members.

11. A wire guide means for a stranding machine, having synchronously driven and spaced apart rotor members rotatable about a common axis comprising, a plurality of spokes extending parallel with the axis of rotation of said rotor members and extending between and secured at their opposite ends to said rotor members.

12. The wire guide means of claim 11 characterized by a spider extending transversely of the axis of rotation of said rotor members and between said spokes.

13. A wire guide means for a stranding machine having synchronously driven and spaced apart rotor members rotatable about a common axis, comprising, two pairs of spokes extending parallel with the axis of rotation of said rotor members and extending between and secured at their opposite ends to said rotor members, one pair of said spokes being disposed in substantially diametrically opposed relation to the other of said pair of spokes, and a spider extending transversely of the axis of rotation of said rotor members between the opposed pairs of spokes intermediate the ends thereof.

14. A wire guide means for a stranding machine having synchronously driven and spaced apart rotor members rotatable about a common axis, and having spool cradle means, one journalled at each of said rotors, comprising two pairs of spokes parallel with the axis of rotation of the rotor members and disposed in diametrically opposed relation between and secured at their opposite ends to said rotor members, and a spider journalled in one of said spool cradle means and extending transversely of the axis of rotation of said rotor members, said spider member being mounted at its opposite ends to the opposed pairs of said spokes and intermediate the ends of the latter.

15. The wire guide means of claim 14 characterized by the opposite ends of said spider each having a pair of end extensions diverging away from each other.

ROBERT C. PIERCE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,416,941	Brockway	May 23, 1922
1,867,596	Roseman	July 19, 1932
1,907,530	Ferier	May 9, 1933
1,917,914	Andrew et al.	July 11, 1933
2,113,698	Larmuth	Apr. 12, 1938
2,173,762	Morton	Sept. 19, 1939
2,184,744	Jonassen	Dec. 26, 1939
2,208,306	La France et al.	July 16, 1940
2,343,535	Clarkson	Mar. 7, 1944
2,349,855	Federico	May 30, 1944
2,352,647	Linsenmeyer et al.	July 4, 1944
2,457,402	Roetting	Dec. 28, 1948
2,499,258	Pierce	Feb. 28, 1950