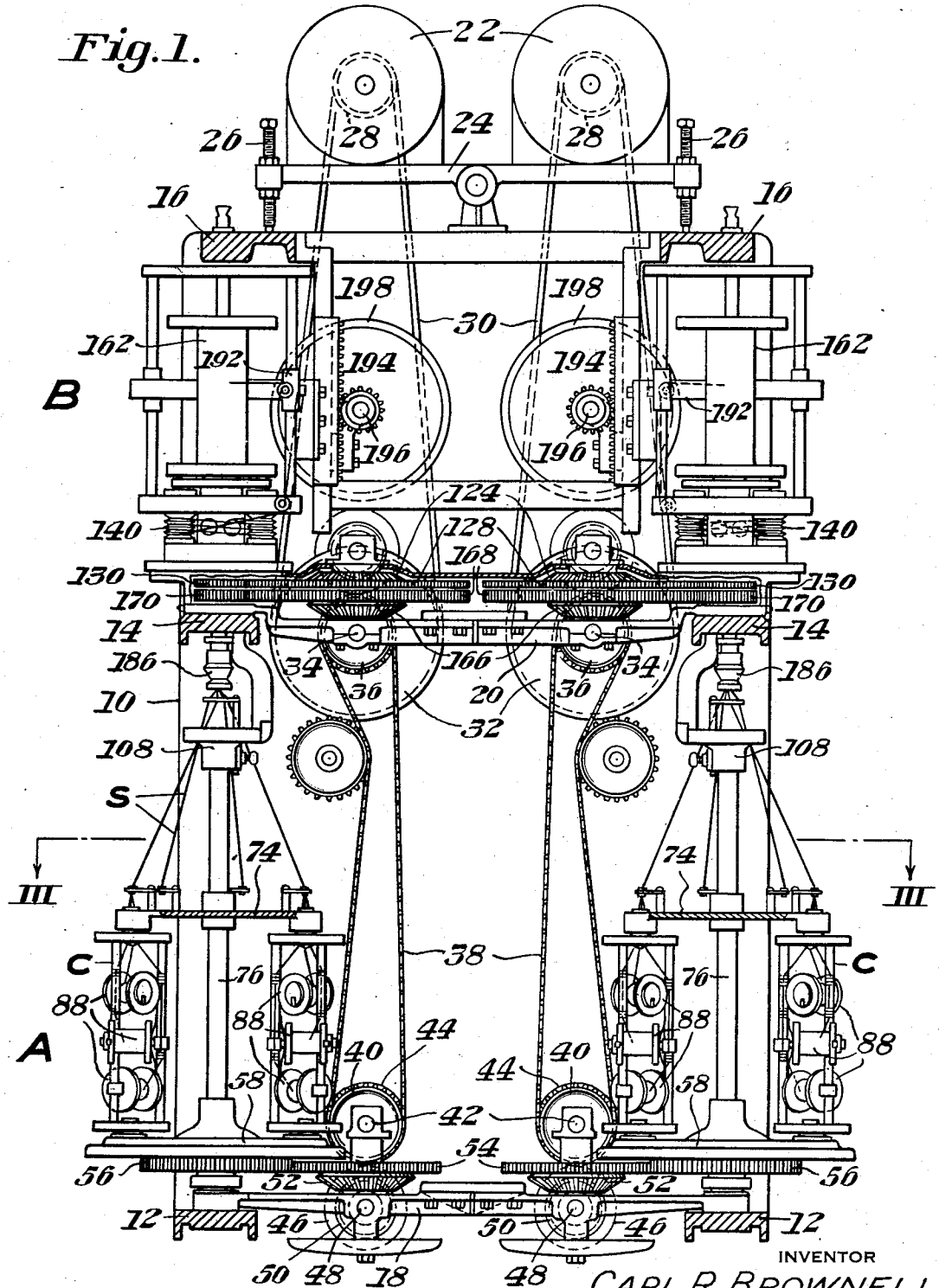
Feb. 29, 1944. C. R. BROWNELL 2,342,999

LAYER FOR MAKING WIRE CORD

Filed Nov. 16, 1942 5 Sheets-Sheet 1

Fig. 1.




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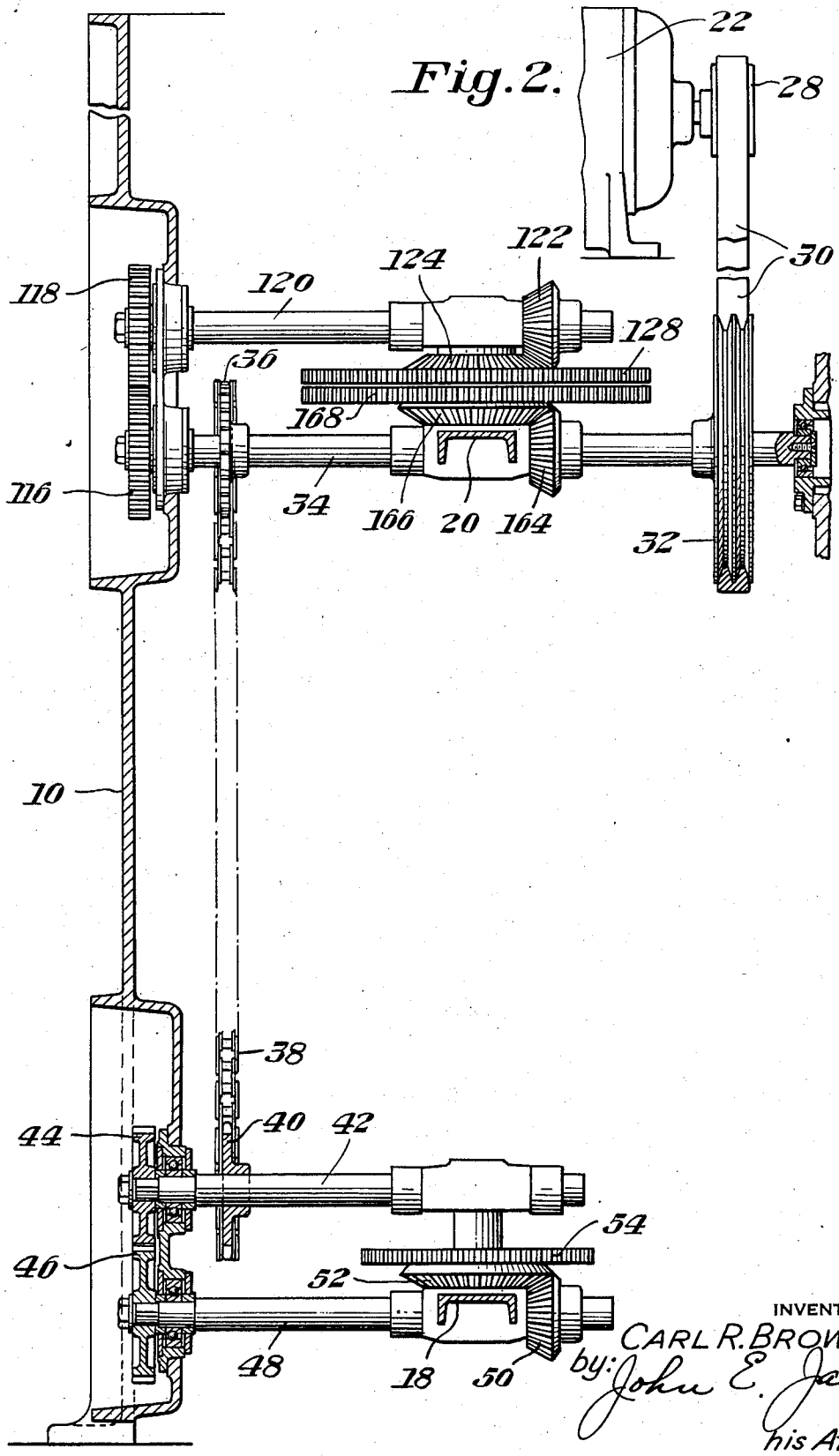
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Feb. 29, 1944. C. R. BROWNELL 2,342,999

LAYER FOR MAKING WIRE CORD

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Fig. 2.



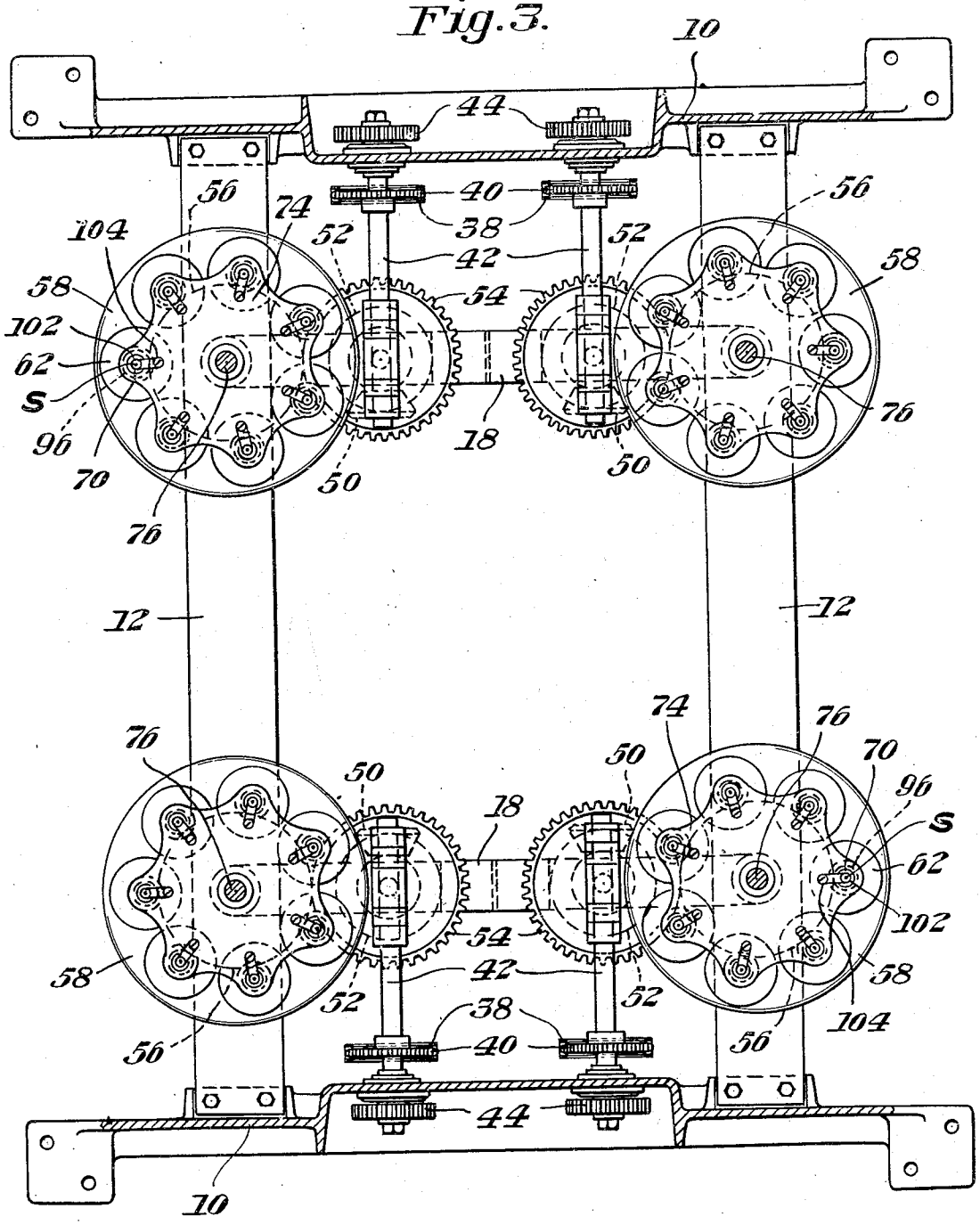

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LAYER FOR MAKING WIRE CORD

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Fig. 3.




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LAYER FOR MAKING WIRE CORD

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Fig. 4.

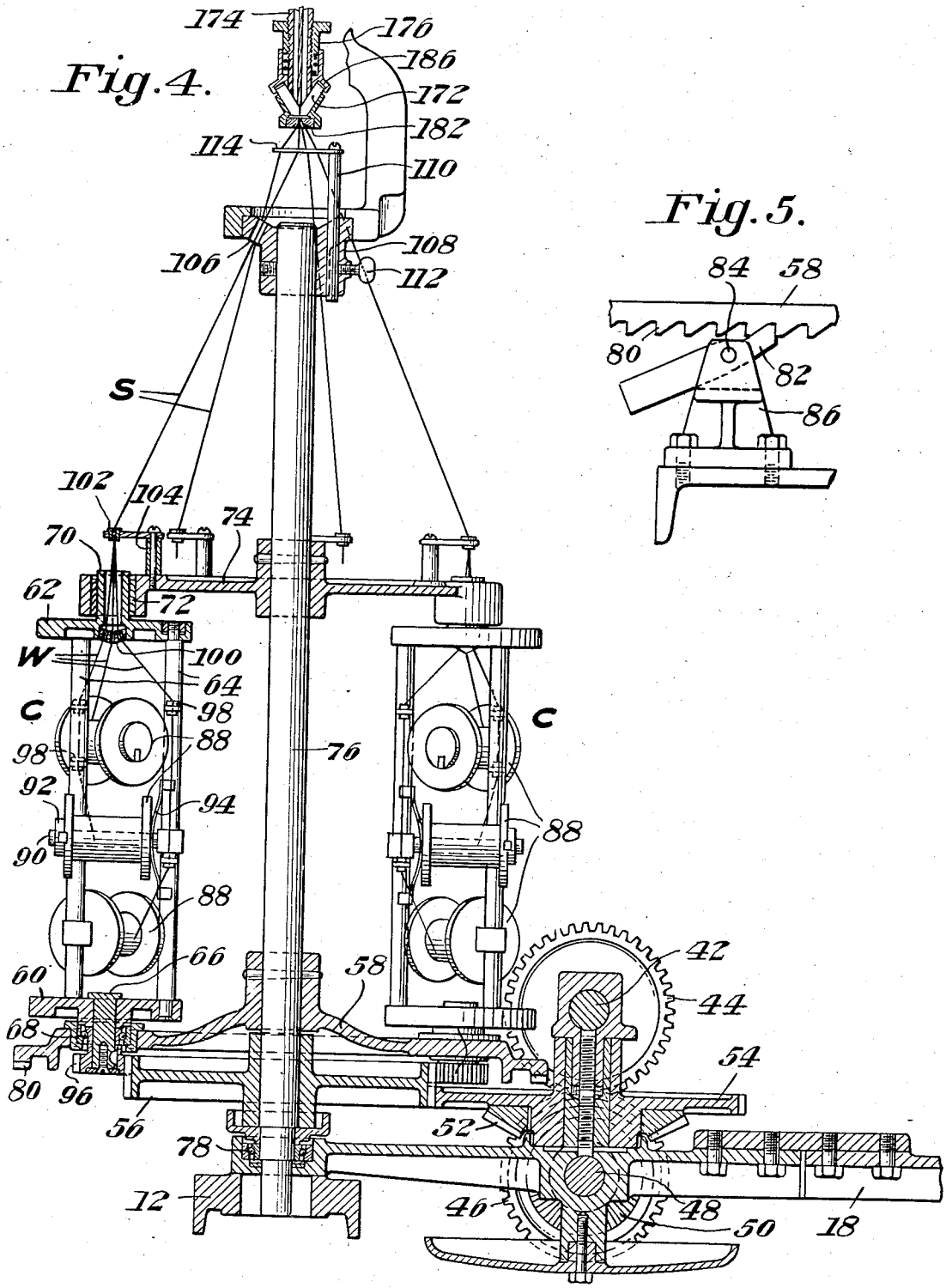



Fig. 5.




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LAYER FOR MAKING WIRE CORD

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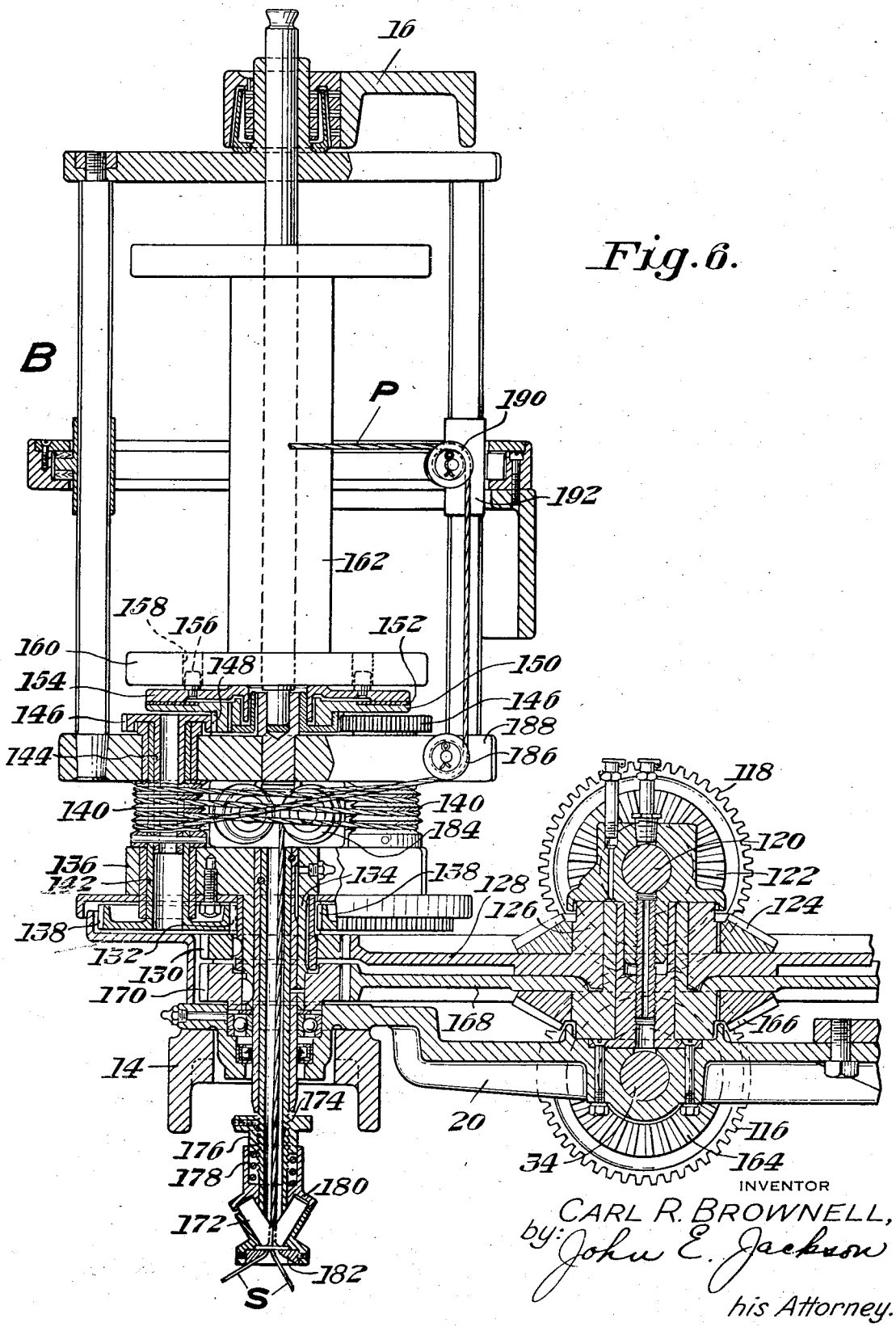



Fig. 6.

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Patented Feb. 29, 1944 2,342,999

# UNITED STATES PATENT OFFICE

2,342,999

## LAYER FOR MAKING WIRE CORD

Carl R. Brownell, Worcester, Mass.

Application November 16, 1942, Serial No. 465,759

10 Claims. (Cl. 57—60)

The present invention relates to improvements in mechanism for forming fine wires into strands which in turn are twisted together to form a cord. More specifically, the invention aims to provide improved features of design and arrangement particularly well suited to the twisting together of fine metallic wires into relatively small diameter strands, which strands are in turn twisted together to form a cord adapted to be incorporated in the carcass of an automobile tire or in a body of material to be used for belting. The invention aims to provide detailed features of structure, design, and arrangement which will permit of certain variations in the twist characteristics of both the elemental strands and the final cord without disturbing the main operating parts of the machine. A further feature relates to the provision of an improved creel supporting turntable adapted to be held in a stationary position while the machine is in operation, including means to permit the operator to quickly and easily shift any given creel to a readily accessible position to facilitate the installing of full wire supply bobbins to the creel or the removal of empty bobbins when their supply becomes depleted.

The invention will be fully apparent from the following detailed disclosure when read in connection with the accompanying drawings, and will be defined with particularity in accordance with the requirements of the patent statutes in the appended claims.

In the drawings:

Figure 1 is a sectional elevation of a machine exemplifying the present invention.

Figure 2 is a skeleton detail illustrating the main drive elements shown in Figure 1 and omitting the creel and flier structures respectively so as to show more clearly the change speed driving connections constituting an important component of the claimed invention.

Figure 3 is a horizontal section on line III—III of Figure 1.

Figure 4 is an enlarged detail illustrating the creel section of the machine.

Figure 5 is a fragmentary detail of parts shown in Figure 4.

Figure 6 is an enlarged vertical longitudinal section illustrating the upper flier section of the machine and its driving connection with a main drive shaft and an upper speed change countershaft connected thereto.

Referring in detail to the drawings, the machine embodying the present invention is a gang machine employing a plurality of identical bottom creel sections A and related upper flier sections B. Since these sections are all duplicates, it will obviously be necessary to describe only one of each in detail. It is to be noted that in a gang machine of this sort there is a problem involved in the loading and removing of the supply bobbins, and special means are provided to facilitate such loading or unloading.

The machine comprises duplicate upright end frames such as shown at 10. These are connected at the bottom by beam-like frame members 12, at the central portion by intermediate frame members 14, and at the top by top frame members 16. The bottom frame members 12 are bridged by a transverse member 18. The intermediate members 14 are bridged by a transverse member 20. The members described constitute the main supporting structure for a plurality of creel sections A and flier sections B in a manner which will be readily understood, from examination of the drawings.

A main drive motor 22 is supported on a base 24 whose position may be adjusted by a screw 26 carrying suitable lock nuts. The motor shaft carries a pulley 28 which is connected by a belt 30 to a drive pulley 32 secured to a main drive shaft 34 journalled in suitable bearings carried by the frame structure.

The main drive shaft 34 carries a sprocket wheel 36 which is connected by chain 38 to a sprocket wheel 40 secured to a bottom countershaft 42 journaled in suitable bearings carried by the end frames 10. A change gear 44 is detachably secured to one end of the bottom countershaft 42. Change gear 44 meshes with a similar change gear 46 which is detachably secured to one end of a bottom speed change shaft 48 journalled in suitable bearings carried by the end frames 10. The shaft 48 carries a bevel drive pinion 50 which meshes with a bevel gear 52 rotatable on a vertical axis and supported by a suitable bearing as shown. The bevel gear 52 has secured thereto a spur gear 54 which meshes with and drives a creel drive gear 56.

A plurality of duplicate creels C are rotatably supported by a turntable 58. In the embodiment of the invention illustrated, each turntable 58 supports seven creels of identical construction as shown. It is understood, however, that a greater or less number may be used, depending upon the characteristics of the cord to be formed. For the purpose of illustration I have chosen to show a creel arrangement for producing what is known to those skilled in the art as 7 x 3 cord, which means that the ultimate cord produced consti-

tutes seven strands S each composed of three wire elements W twisted together. While three elemental wires are used in the description, it will be understood that either more or less can be employed if desired by making obvious modifications in the creel arrangement. Since the creels are all of identical construction, a detailed description of one will suffice for all.

Each creel includes a bottom disk 60 and a top disk 62, the same being connected by upright spacer rods 64. Each bottom disk 60 carries a trunnion stud 66 which is mounted in a ball bearing 68 carried by the bottom member 58 of the turntable. Each top disk 62 carries a hollow trunnion 70 journalled in a suitable bearing 72 formed in the top member 74 of the turntable. The turntable members 58 and 74 are pinned or otherwise secured to a vertical shaft 76 which is rotatably supported in a bearing 78 carried by the bottom frame member 12. The turntable is provided on its under surface with an annular series of ratchet teeth 80 which are adapted to coact with the toothed end of a pawl 82 which is pivoted at 84 to a suitable fixed bracket 86. Normally the fixed bracket 86 prevents rotation of the turntable. However, the operator can at will move the pawl 82 so as to disconnect the impositive locking engagement between it and teeth 80 so as to permit any given one of the seven creels to be turned to a position where easy access can be had thereto. This arrangement greatly facilitates the loading and unloading of bobbins 88 which are carried by respective bearing studs 90 secured to the upright rods of the creel. In the embodiment of the invention shown there are three bobbins 88 carried by each creel and the rods 64 are spaced 120° apart, as viewed in plan. Therefore the axes of rotation of the three bobbins 88 will be disposed on 120° centers. Each bobbin is free to rotate on its respective bearing stud and is normally restrained from endwise movement by a quickly detachable collar 92. A suitable tension brake 94 serves to control the rate of payoff of elemental strand wire W.

The turntable mounting for the creels described is of particular advantage in a gang-type machine such as illustrated, since obviously where several creels are circularly arranged, many of them would normally be inaccessible for the purpose of replenishing the wire supply bobbins. With the described arrangement, the operator can easily and quickly release the impositive lock provided by the pawl 82 and rotate the turntable so as to bring any of the many creels into an accessible loading or unloading position at the front of the gang machine. This avoids the dangerous prior practice of operators' inserting their hands and arms between the units, some of which may be rotating. Thus this phase of the invention contributes materially to the safety of the operators.

Each creel trunnion stud 66 has keyed or otherwise secured thereto a pinion 96 which meshes with the main creel drive gear 56. As thus arranged, it is apparent that power transmitted from the main shaft 34 will rotate all the creels carried by the turntable in the same direction.

In the manufacture of cord suitable for use in automobile carcasses or in belting, I may, for example, use steel strand wire W of approximately .0059 inch diameter. The three elemental strand wires W from the three bobbins of each creel are led through suitable guide eyes 98 supported by the creel structure and then through a wire guide 100 located in the region of the upper axis of rotation of the creel. The three elemental strand wires then pass through the hollow trunnion 70 and through a strand closing die 102 carried by a support 104 secured to the upper member 74 of the turntable. As the respective creels rotate, the three elemental wires W fed from the three bobbins are twisted into the form of a three-wire strand S. The seven strands thus formed pass through the seven apertures 106 of the strand guide member 108 which is adjustably secured near the upper extremity of the vertical shaft 76. The strand guide 108 is provided with an aperture to receive a rod 110 which may be adjusted to different elevations by manipulation of a clamp screw 112 so as to vary the relative position between the strand guide 108 and a strand spacer plate 114 having the seven openings through which the respective seven strands from the seven creels are led. Usually six of the strands will be circularly spaced equal distances apart and the seventh strand will be located at the center of the circle defined by the other six.

A flier is provided for twisting together the seven strands delivered by each creel. Thus a cord is produced from each group of the seven strands. This flier is preferably driven from the same main shaft which drives the creels and in accordance with one aspect of the invention, change gearing is incorporated in the train of driving connections between the main drive and the flier and also between take-up drums to be presently described, and the flier. Such an arrangement is considered very advantageous since it provides a relatively simple means whereby adjustments may be made in a given machine so as to adapt the same to produce a variety of cords having differing twist or lay characteristics. In other words, provision is made so that by changing the ratio of the gears 44 and 46 and also changing the ratio of the gear drive between the main shaft 34 and the flier drive to be presently described, coordinated variations may be made in the twist imparted to the elemental wires W of the strands S and in the lay of the final cord product P. To these ends the main shaft 34 is provided with a quickly detachable change gear 116 which is adapted to be meshed with a quickly detachable change gear 118 mounted on the end of a top speed change counter shaft 120 mounted in suitable bearings carried by the end frames 10. Said top speed change shaft 120 has keyed or otherwise secured thereto a bevel drive pinion 122 which meshes with a bevel gear 124 mounted to rotate about a vertical axis. The bevel gear 124 is keyed or otherwise secured to the hub 126 of a spur gear 128 which meshes with and drives a take-up gear 130. The gear 130 is mounted to rotate about the axis of rotation of the flier B and is so arranged that it can move relatively to the flier. This take-up gear 130 is keyed to the hub of a hub gear 132 freely mounted on a hub extension 134 of the flier base plate 136. The gear 132 meshes with two identical gears 138 which are secured to grooved take-up drums 140, each gear 138 having an upwardly extending sleeve portion 142 to which each respective take-up drum 140 is pinned. Fitted within each sleeve extension 142 there is a shaft extension 144 of a respective spool drive gear 146. The spool drive gears in turn mesh with a gear 148 secured to a disk member 150 carrying a facing of friction material 152 for coaction with a flier spool disk 154. The disk 154 carries a plurality of dowels 156 which make a detachable connection with apertures 158 formed in the flange 160 of a take-

up spool 162 which is adapted to accumulate the cord P formed by the twisting together of the several strands S.

Rotary motion is transmitted to the flier from the main shaft 34 through a bevel pinion 164 secured thereto which meshes with the bevel gear 166, keyed or otherwise secured to the hub of a flier-drive gear 168 which meshes with and drives a flier gear 170 which is keyed or otherwise secured to the hub extension 134 of the flier. By reason of the fact that the creel section and the flier section are driven from a common main shaft through a countershaft which is in turn connected through the change gearing described respectively with the creel drive and the flier and take-up drives, it is apparent that the speed ratios of the parts can be adjusted so as to produce a variety of cords having differing predetermined characteristics with respect to the twist imparted to the elemental strand wires W and the lay imparted to the strands S in the cord P finally produced.

The machine described, for example, is constructed to make what is known to those skilled in the art as regular lay cord, which means a cord having elemental strand wires W and strands S all of opposite lay. That is to say, if the wires W are twisted in a left-hand lay, the strands S of the cord will be of right-hand lay; or alternatively, if the strand wires W are twisted to right-hand lay the strands S of the cord will be twisted in a left-hand lay.

The machine illustrated and described is adapted to be driven at appropriate speeds to produce 7 x 3 wire cords having either 2½, 3 or 3½ twists per inch to the cord. When a cord having three twists per inch is being made, the flier B will be caused to revolve at about 730 R. P. M. and each creel A in the lower section of the machine will revolve at about 830 R. P. M. In order to vary the number of twists per inch of the strands S in the finished cord product P, the gear ratios of the change gears 44—46 and 116—118 will be varied. For example, in order to make cord having 2½ twists per inch, the ratio of the number of teeth in the gears 116 and 118 will be in the the proportion of 46 to 53. By changing this ratio to 57 to 64, the cord lay of the strands S can be changed to three twists per inch. Or to secure a cord in which the strands S have a lay of 3½ twists per inch, this ratio can be changed to 47 to 42 by the utilization of change gears having appropriate numbers of teeth and pitch diameters. In a similar manner, variation in the number of twists per inch imparted to the elemental wires W can be effected by making appropriate changes in the ratios of the change gears 44 and 46 through which the several creels are driven. Since the creels and the flier receive their drive from the same main shaft 34, it will be manifest that the desired coordination between the twist imparted to the elemental wires W and lay imparted to the strands S can be secured at the will of the operator. The angle of the lay imparted to the strands in the final cord product, it will be appreciated, is dependent somewhat upon the relationship between the rotary speed of the flier and the rate at which the final cord product is advanced by the take-up. The cord feed or longitudinal advance or take-up is determined by the size and rate of rotation of the take-up drums 140.

The finished cord product is accumulated on a take-up spool 162. A frictional driving connection is provided between the take-up spool and the gear 148 so as to permit a certain amount of relative slip necessitated by the fact that the rotative speed of the spool must change as the diameter of the convolutions accumulating thereon increase.

A plurality of strands S converge from the strand spacer plate 114 toward the axis of rotation of the flier, and then pass into engagement with compressor dies 172 mounted in oppositely inclined guide apertures formed in the lower extremity of the hollow flier stud 174. This stud is provided with a threaded portion to which is adjustably secured a nut 176 which bears against a spring 178, the opposite end of which coacts with a head 180 which serves to yieldingly press the compressor dies 172 into operative relationship with the strands S coming from the several creels. These strands are directed to the compressor dies by a suitable guide collet 182 secured to the lower extremity of the flier stud 174. As the flier rotates on its vertical axis, the six outer strands S in the example given will be twisted around the center longitudinal strand so as to produce cord of the desired lay characteristics. The thus twisted cord is passed around a grooved guide sheave 184 from whence it is trained around the several grooves of the take-up drums 140. The cord then passes around a guide pulley 186 secured to the mid-plate 188 of the flier. From this guide pulley 186 the cord passes over a grooved guide sheave 190 carried by a traverse head 192 which is adapted to be moved up and down by traversing mechanism indicated generally at 194 of known construction and forming no part of the present invention. Suffice it to say that this traversing mechanism is adapted to be operated by a pinion driven in a conventional manner from a shaft 196 carrying a pin wheel 198. While not limited thereto, the traverse mechanism used may be such as that shown in prior Brownell patents, Nos. 624,184 or 689,786. Or any other suitable known type of mechanism may be employed which is capable of causing the completed cord to be uniformly distributed as it is being wound on the take-up spool 162.

Although in the foregoing detailed disclosure I have quite specifically described an exact combination of coacting instrumentalities which an actual reduction to practice has shown to be highly desirable, it is not to be construed that I am limited thereto since various modifications and substitutions of mechanical equivalents may be resorted to by those skilled in the art without departure from the invention as defined in the appended claims.

I claim:

1. A machine of the class described, comprising in combination a lower section including a plurality of rotary creels for twisting wires into strands, an upper section including a flier for twisting the strands into a cord, said flier carrying take-up drums for pulling the strands from the lower section, a common power drive for the creels and flier and respective speed change means interposed between the power drive and said creels and flier for varying the respective rotative speeds of all of said rotary creels as a group, said upper section, and said take-up drums whereby the respective twist of the strands and the lay of the cord can be varied at will to produce a variety of cords differing as to strand twist and cord lay characteristics.

2. A machine of the character described, comprising in combination a plurality of rotary creels

for twisting wires into strands, a rotary flier for twisting strands received from the creels into a cord, take-up drums mounted on the flier effective to withdraw a plurality of strands from the creel section, the flier carrying a spool for receiving the cord produced by twisting together the strands drawn off from the creels, a common power drive for said creels, said flier and said take-up drums and speed change mechanisms interposed between the common power drive and said creels and said flier so as to permit of selective variation of the relative rotating speeds of all of said creels as a group and flier, whereby the respective twists of the elemental strands produced by the creels and the lay of the strands of the ultimate cord twisted together by the flier can be varied at the will of the operator so as to produce a variety of cord products differing as to strand twist and cord lay characteristics.

3. A machine of the character described, comprising in combination a lower normally stationary turntable carrying a plurality of rotatably mounted creels each rotatably supporting a plurality of wire supply bobbins, a driving element common to the several creels for rotating them in uniformity so as to twist the wire led off from said bobbins into a plurality of respective strands, a fixed element having a plurality of guide openings therein through which the strands from the several creels converge, a rotatably mounted flier carrying compressor dies and take-up drums and a spool for accumulating the cord produced, a power drive common to said creels and said flier, and respective motion-transmitting connections between the power drive, said common creel driving element and said flier including change gearing, whereby the degree of twist imparted to the wires constituting said strands by said creels can be selectively varied as a group at will by the operator, and likewise the lay of the strands imparted by rotation of the flier can also be selectively varied by the operator.

4. A machine of the class described, comprising in combination a normally stationary rotatably mounted turntable, means for releasably holding the turntable in any one of a plurality of desired positions, a plurality of creels each rotatably supported by said turntable, each creel carrying a plurality of wire supply bobbins, a driving element common to all of said creels for rotating them in unison, a respective strand closing die aligned with the axis of rotation of each creel and through which the wires from the bobbins are adapted to pass, a strand guide having a plurality of apertures through which the strands from the several creels converge, a flier having take-up drums for pulling the strands through said guide, said flier carrying a rotating spool for accumulating the cord product resulting from the twisting together of said strands, a power drive, respective transmission devices operably connected therewith and with the several creels, the flier, and the take-up drums, said transmission devices including change gearing whereby variations in the relative speeds of rotation of all of the creels as a group and the flier can be effected so as to produce a variety of cords differing as to twist characteristics of the wires forming the component strands and as to the lay of the strands in the finished cord.

5. A machine of the class described, comprising in combination a power-driven main shaft, a lower countershaft driven thereby, a lower speed change shaft connected to said countershaft by change gearing, a plurality of creels all operatively connected with and driven from said lower speed change shaft, each creel carrying a plurality of bobbins of strand wire, a flier carrying take-up drums and a take-up spool, an upper speed change shaft connected by change gearing with said main shaft and respective means driven by the main shaft and the upper speed change shaft for driving said flier and said take-up drums, a friction plate having a driving connection with said take-up drums, and means for transmitting motion from the friction plate to said take up spool.

6. A machine of the class described, comprising in combination a power-driven main shaft, a lower countershaft driven thereby, a lower speed change shaft connected to said countershaft by change gearing, a plurality of creels all operatively connected with and driven from said lower speed change shaft, each creel carrying a plurality of bobbins of strand wire, a flier carrying take-up drums and a take-up spool, an upper speed change shaft connected by change gearing with said main shaft and respective means driven by the main shaft and the upper speed change shaft for driving said flier and said take-up drums, a friction plate having a driving connection with said take-up drums, a disk driven by said friction plate, and dowels in said disk detachably engaging holes in the take-up spool.

7. A machine of the class described, comprising a fixed frame member, a normally stationary turntable rotatably mounted on said frame member, a plurality of spaced creels, each rotatably supported by the turntable and each carrying a plurality of strand wire supply bobbins, and means impositively locking the turntable against rotary movement yet adapted to permit selected creels to be brought at will to a position to facilitate the mounting or dismounting of said supply bobbins.

8. A machine of the class described, comprising a turntable rotatable about an upright axis, a plurality of creels rotatably supported by the turntable and each carrying a plurality of strand wire supply bobbins and turntable locking means comprising an annular series of teeth on the turntable and a pivoted pawl normally engaging the teeth so as to prevent rotation of the turntable but adapted to be rocked so as to facilitate turning the table to bring the creels into positions to facilitate loading or unloading wire supply bobbins at a location to suit the operator's convenience.

9. A machine of the class described, comprising a main shaft, a lower countershaft driven thereby, a lower speed change shaft, respective change gears detachably secured to said lower shafts, a creel gear driven from said main shaft, a plurality of creels all driven by said creel gear, said creels each carrying a plurality of bobbins for supplying strand wire, a turntable rotatably supporting said creels, a flier and bearings for rotatably supporting it in axial alignment with the axis of rotation of said turntable, respective means for guiding strand wire from the bobbins of the several creels to the axial region of the flier, the flier having an axial stud journalled in said bearings, said stud having an axial passageway therein, means for guiding the strands from the creels to said axial passageway, take-up drums rotatably supported by the flier, each drum having a lower and an upper gear rotating therewith, a sleeve gear journaled on the hub of the flier and meshing with the lower of said take-up drum gears, a drive plate rotatable relative to

the flier and carrying a gear which meshes with the upper take-up drum gear, a spool drive disk rotatable relative to drive said plate, a take-up spool operatively connected with said drive disk, a hub gear secured to the flier, a drive gear meshing with said hub gear and carrying a bevel pinion, a bevel gear secured to the top speed change countershaft and meshing with said bevel pinion, respective upper change gears detachably secured to said main shaft and said top change speed shaft, another bevel gear secured to the main shaft and meshing with a bevel gear secured to the flier drive gear, and a driven gear secured to the flier and meshing with said flier drive gear.

10. A machine of the class described, comprising in combination, a main shaft, a lower countershaft driven thereby, a lower speed change shaft connected to said countershaft by respective change gears detachably secured to said lower shafts, a plurality of creels all driven by a common gear which is driven by said main shaft through said lower countershaft and lower speed change shaft, said creels each carrying a plurality of bobbins of strand wire, a normally stationary turntable supporting said creels for rotation about respective vertical axes, the axis of rotation of each creel being located an equal distance from the axis of rotation of said turntable, a flier rotatable on a vertical axis aligned with the axis of rotation of said turntable, respective means for guiding strand wire from the bobbins of the several creels to the axial region of said flier, the flier having a vertically disposed trunnion stud formed with an axial passageway therein, means for guiding the strands from the creels to said axial passageway, yielding compressor dies supported by said trunnion stud, grooved take-up drums rotatably supported by the flier, each having lower and upper gears rotating therewith, a sleeve gear journalled on the hub of the flier and meshing with the lower of said take-up drum gears, a friction plate rotatable relative to the flier and carrying a gear which meshes with the upper take-up drum gears, a spool drive disk rotatable relative to said friction plate and journalled thereon, a cord take-up spool having a detachable connection with said drive disk, a drive gear meshing with said hub gear and carrying a bevel pinion meshing with a bevel gear secured to a top speed change countershaft, respective upper change gears detachably secured to said main shaft and said top change speed shaft, another bevel gear secured to the main shaft meshing with a similar bevel gear secured to a flier drive gear which in turn meshes with a flier gear secured to and moving with the flier, and bearings rotatably supporting the flier.

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