Oct. 19, 1954 R. F. DELP 2,691,864

WIRE ROPE MAKING MACHINE

Filed Jan. 2, 1951 4 Sheets-Sheet 1

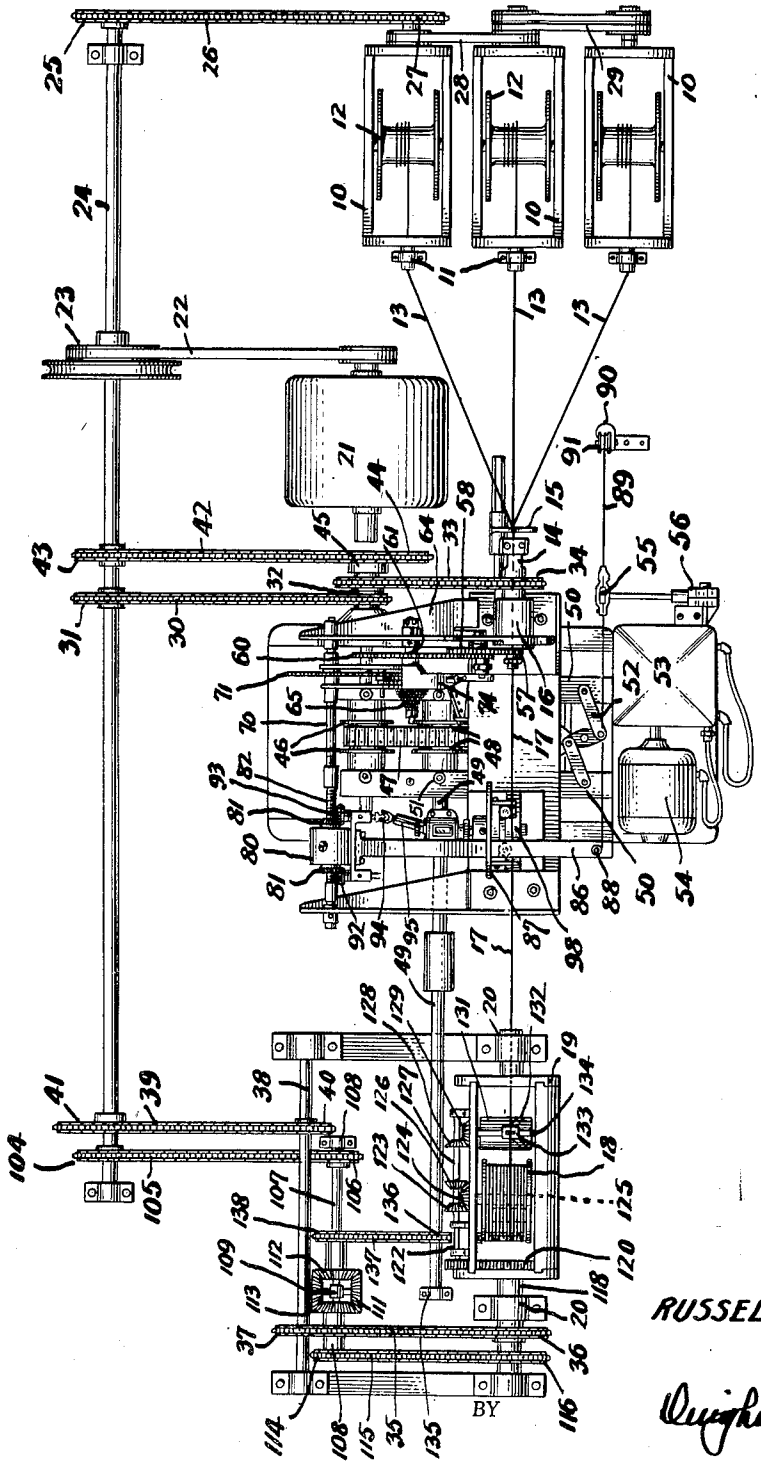


Fig. 1.

INVENTOR
RUSSELL F. DELP,

BY

ATTORNEY

Oct. 19, 1954 R. F. DELP 2,691,864

WIRE ROPE MAKING MACHINE

Filed Jan. 2, 1951 4 Sheets-Sheet 2

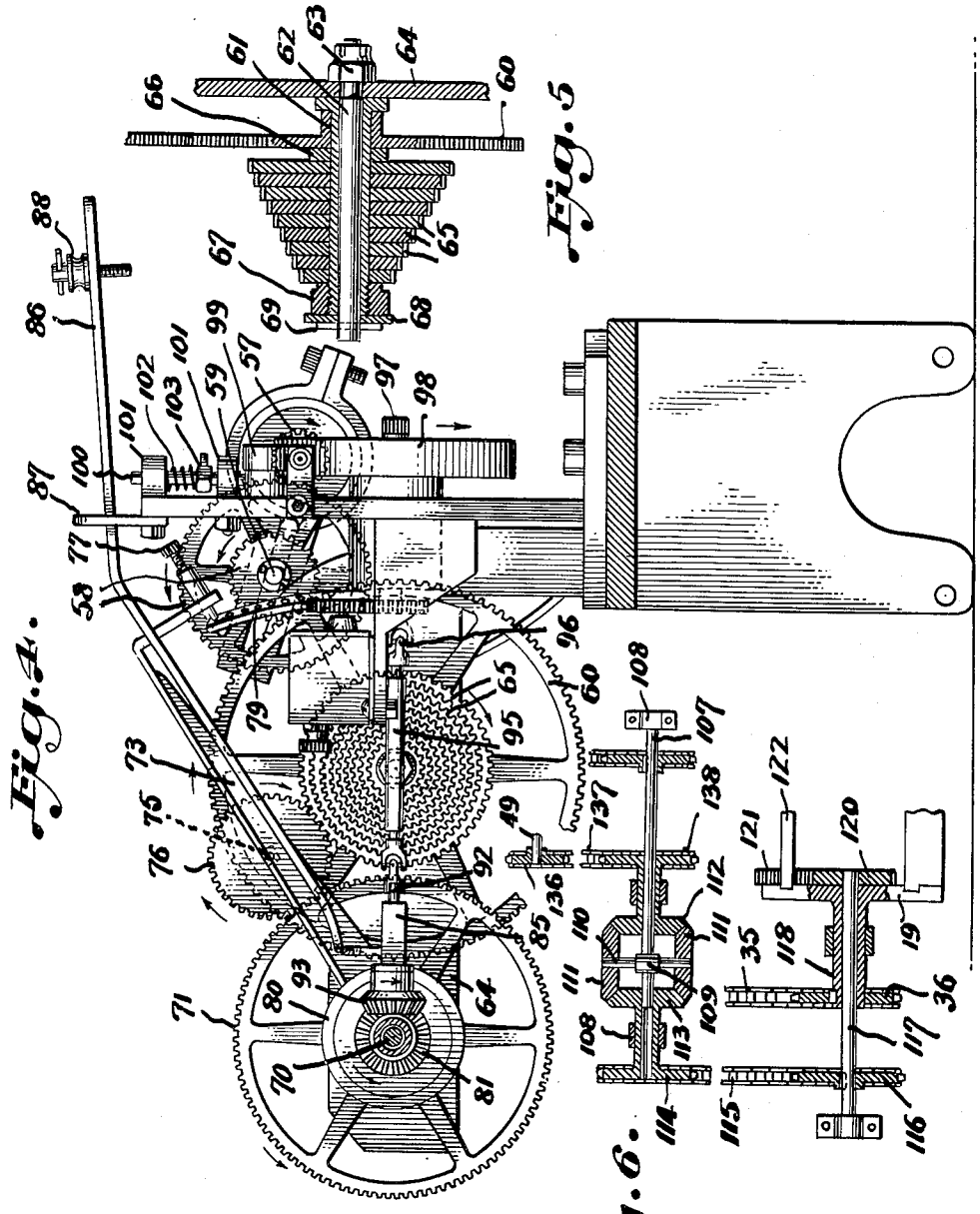


Fig. 4.

Fig. 5.

Fig. 6.

INVENTOR
RUSSELL F. DELP.

BY Dwight B. Thurston

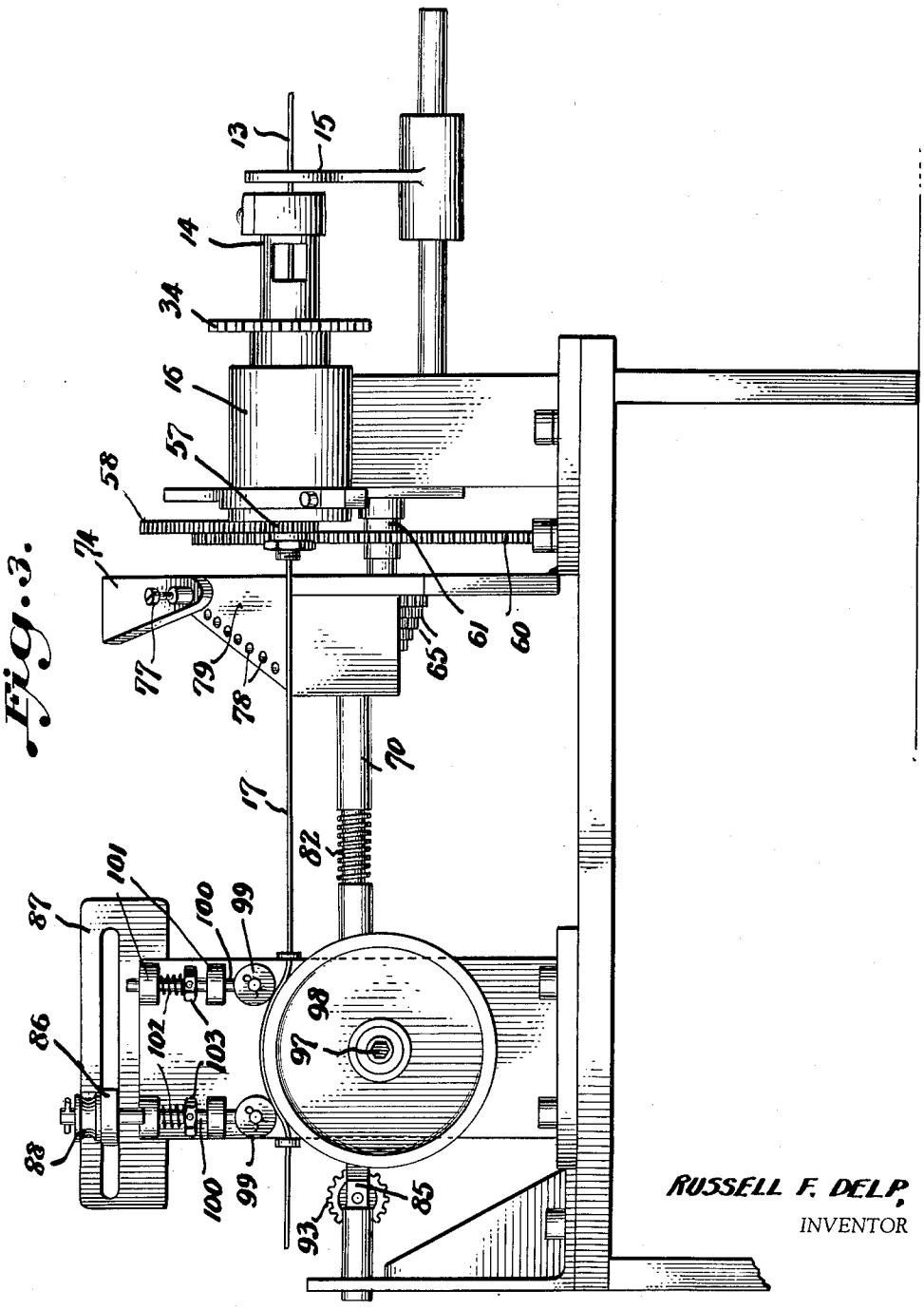
ATTORNEY

Oct. 19, 1954 R. F. DELP 2,691,864

WIRE ROPE MAKING MACHINE

Filed Jan. 2, 1951 4 Sheets-Sheet 3

Fig. 3.



RUSSELL F. DELP,
INVENTOR

BY

ATTORNEY

Oct. 19, 1954 R. F. DELP 2,691,864

WIRE ROPE MAKING MACHINE

Filed Jan. 2, 1951 4 Sheets-Sheet 4

Fig. 1.

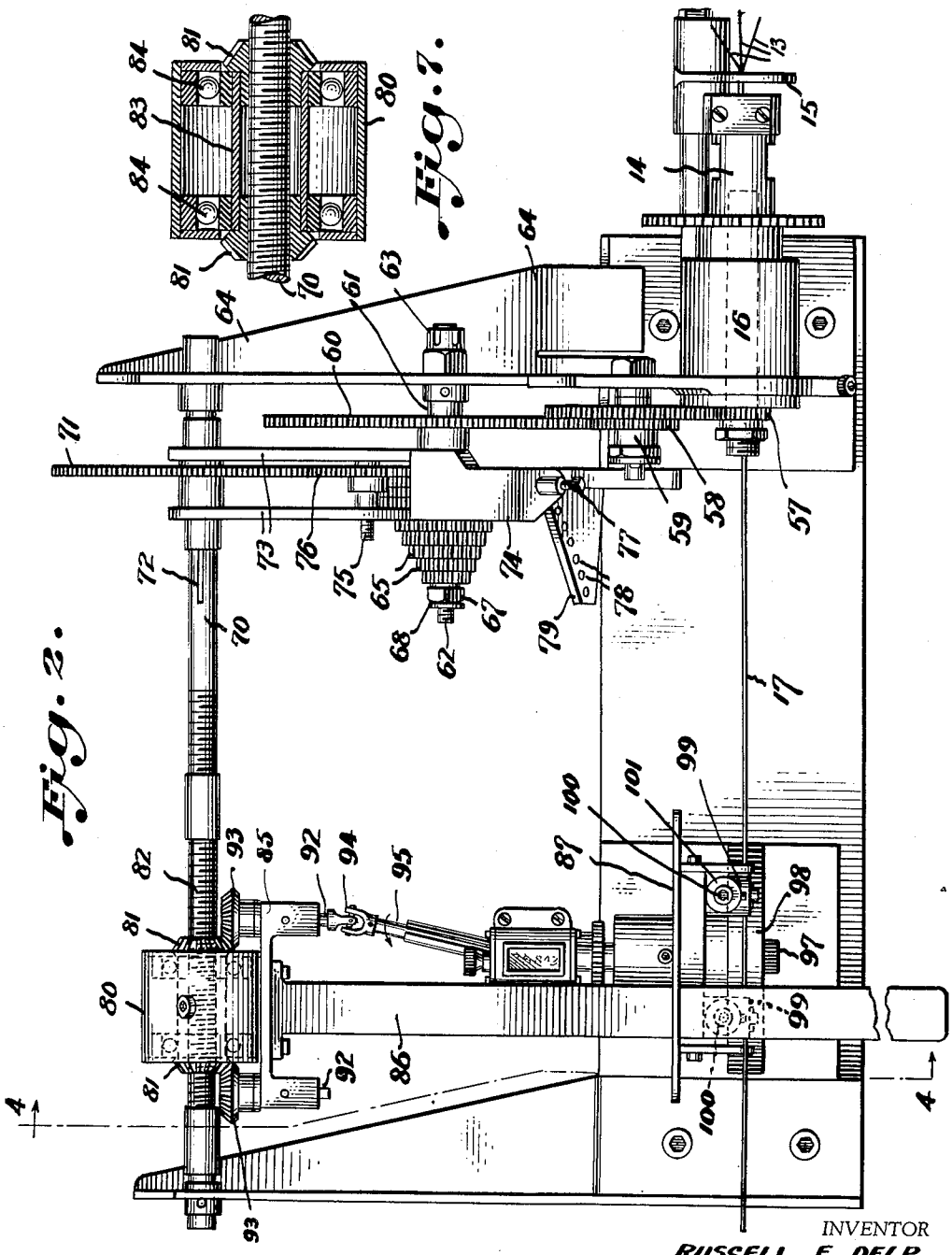


Fig. 2.

INVENTOR
RUSSELL F. DELP,

BY Dwight B. Starr

ATTORNEY

Patented Oct. 19, 1954

2,691,864

UNITED STATES PATENT OFFICE

2,691,864

WIRE ROPE MAKING MACHINE

Russell F. Delp, Northumberland, Pa.

Application January 2, 1951, Serial No. 204,033

4 Claims. (Cl. 57—66.5)

1

This is a wire rope manufacturing or stranding machine for use in the production of rope or cable in which a plurality of wires are wrapped or twisted together to provide an elongated strand, the invention being adaptable to the manufacture of strands of extremely small lateral dimension or heavy wire cable.

One of the objects of the invention is to provide a stranding machine involving new and improved means for regulating or determining the lay in the completed strand, to automatically vary the speed of the wind-up bobbin to synchronize the lay to the speed of the machine.

Another object of the invention is to provide a machine wherein the twisted strand is drawn through the machine in such manner as to be at all times visible to inspection in the formation of the strand.

A further object of the invention is to provide a machine involving the usual rotating twisting die in which the strand is formed by a pulling or draw operation, and wherein the speed of rotation of the twisting die is maintained at the same rotational speed as the wind-up bobbin unit.

A further and important object of the invention is to provide a wire rope making machine embodying a rotating twisting die for forming the wires into a strand and wherein the formed strand is drawn through the die and wound upon a wind-up drum having speed rotation equal to the speed of rotation of the die, and wherein the automatic synchronizing means is provided to equalize the speed of rotation of the wind-up bobbin with the speed of travel of the strand through the machine.

A further object of the invention is to provide a wire rope making machine embodying the use of a positively driven rotating die through which the wires are drawn and twisted into a finished cable drawn through the machine by a wind-up drum, and wherein means are provided to retard or lessen the speed of rotation of the wind-up drum due to the gradually increasing diameter thereof in the wind-up operation to automatically slow down the speed of rotation of the bobbin in order that the finished strand may be drawn through the machine at uniform speed.

A further object is to provide a wire rope making machine of that type which involves a twisting die rotating at uniform speed, and a wind-up bobbin to draw the finished strand through the die, and means interposed between the die and the wind-up bobbin whereby to automatically slow down the speed of rotation of the

2

wind-up bobbin in order that a constant and uniform speed of travel of the wires and strand through the twisting die is maintained at all times.

With the foregoing objects in view, together with others which will appear as the description proceeds, the invention consists in the novel construction, combination and arrangement of parts, all as will be described more fully hereinafter, illustrated in the drawings, and particularly pointed out in the claims.

In the drawings:

Fig. 1 is a plan view of a wire rope making machine constructed in accordance with my invention,

Fig. 2 is an enlarged plan view showing the intermediate unit, in part, of the machine,

Fig. 3 is a side elevation of the part shown in Fig. 2,

Fig. 4 is a transverse sectional view taken substantially upon line 4—4 of Fig. 2,

Fig. 5 is a detail sectional view illustrating the selective gear assembly,

Fig. 6 is a detail fragmentary sectional view of diagrammatic nature showing the flow of power from shaft 49 to flier shaft 117 of the wind-up bobbin, and

Fig. 7 is a similar view showing the mounting of the slidable head on the jack shaft.

Referring now to the drawings and particularly to Fig. 1 thereof, 10 represents a plurality of feed wire bobbin frames arranged in spaced parallel relationship, rotatably supported at their ends in suitable bearings indicated at 11 and each having rotatably supported therein and transversely thereof a wire bobbin 12. The wires 13 from each of the bobbins 12 pass through the hollow trunnion at the forward end of each of the frames 10 and are drawn in converging relationship into a conventional type of rotating twisting die 14 after first passing through a separating or dividing device indicated at 15. The die 14 is attached to the die spindle represented generally at 16, which spindle is hollow throughout its length in order that the twisted strand indicated at 17 may be drawn from the die in its finished or twisted form. The strand 17 continues in a straight line beyond the twisting die and is ultimately wound upon the wind-up bobbin 18 rotatably mounted in the wind-up bobbin frame 19 rotatably supported in bearings 20.

The mechanism for bringing about the operations thus far briefly described and the mechanism hereinafter more fully described receives

its power from the main power source 21, which may be an electric motor or any other prime mover. This motor drives belt 22 which passes over a pulley 23 affixed to main power shaft 24 of the machine, which shaft is mounted for rotation in suitable bearings as shown. Affixed to the shaft 24 is a sprocket wheel 25 over which passes chain 26 engaged over sprocket 27 carried by a trunnion of one of the wire feed bobbin frames 10. The remainder of the frames may be driven by belt or chain connections 28–29 in the manner shown clearly in Fig. 1. This power drive assures positive rotary movement of the various feed bobbin frames at uniform speed.

The die spindle 16 is driven from the main shaft 24 by a sprocket chain 30 passing over a sprocket wheel 31 affixed to the said shaft 24 and also passing over the compound idler sprocket 32, from which sprocket chain 33 passes over a suitable sprocket 34 affixed to the die spindle.

The wind-up bobbin frame 19 has been described as being rotatably supported by hollow trunnions in bearings 20, and this frame is positively driven by a sprocket chain 35 which passes over a sprocket wheel 36 affixed to one of the trunnions of the said bobbin cradle and also over a sprocket 37 affixed to a jack shaft 38 which is positively driven by a chain 39 passing over sprockets 40 and 41 secured respectively to the jack shaft 38 and the main power shaft 24. The chain drives between the main power shaft 24 and the twister die and the wind-up bobbin cradle rotate the die and cradle at the same or at uniform speeds to produce a cable of the type here under consideration, but it will be understood that these rotative speeds may be varied if occasion demands.

Arranged in conjunction with this machine is a standard fluid controlled variable speed mechanism which obtains its power from the main drive shaft 24 through the instrumentality of a drive chain 42 which passes over a sprocket 43 affixed to the shaft 24 and also over a sprocket 44 affixed to the main drive shaft 45 of the variable speed regulator. The main shaft 45 has affixed thereto the opposed cones 46 accommodating between them the belt 47 which also passes over opposed and adjustable cones 48 carried by the jack shaft 49 of the variable speed mechanism. The variable speed mechanism here shown is of standard well known construction and operation and a detail description thereof may therefore be dispensed with, it being sufficient to say that the drive shaft 45 operating through the belt 47 drives the driven shaft 49 by means of the cone members 48 engaged by the belt 47. The spaced arms 50 are mounted for oscillation as at 51 and are interconnected with one another by an equalizing linkage indicated at 52. Rocking movement of these arms 50 upon their pivots 51 is brought about by suitable fluid pressure mechanism contained within the housing 53 and the proper degree of pressure is maintained by the motor 54. Operation of this variable speed mechanism is controlled by lever 55 which governs the direction of liquid pressure by operation of valve 56 as will be understood.

Affixed to the die spindle 16 is a spur gear 57 in mesh with a compound intermediate idler 58 rotatably supported as at 59, which idler is in driving connection with gear 60 mounted upon sleeve 61 through which passes supporting shaft 62 rigidly secured at one end by the nut 63 to a strut or part of the frame of the machine indicated at 64. Also mounted upon the sleeve 61 are a plurality of gears of varied sizes indicated at 65, the innermost or largest of the said gears being separated from the main gear 60 by the spacer 66. The gears 65 are held in proper frictional and locking engagement with one another by a nut 67 threaded upon the outer end of sleeve 61 and maintained in firm gear clamping relationship by means of the washer 68 secured in place by a cotter pin 69 passing through the end of supporting shaft 62. It will be seen from this construction that the main gear 60 and the gang of gears 65 are rigidly secured together as a unit upon the sleeve 61 which in turn is rotatably supported upon the fixed shaft 62. The construction is such that the gang of gears 65 is positively driven by the spur gear 57 which is affixed to the die spindle 16.

Arranged beyond the shaft 62 and rotatably supported at its ends in suitable bearings in the frame or strut 64 is a jack shaft 70 upon which is splined a gear 71. This gear 71 rotates positively with the shaft 70 but is capable of sliding longitudinally thereon by means of a key engaged in a keyway 72 as shown in Fig. 2. The gear 71 is confined between the arms 73 of a rocker arm 74, the outer ends of which are rotatably engaged upon the shaft 70. The rocker arm 74 also rotatably supports upon the shaft 75 an idler gear 76, the said gear being in constant mesh with gear 71. It will be observed that the rocker arm is mounted in such position that the idler gear 76 may be brought into intermeshing engagement with the teeth of any one of the several gears of the gang 65, the sliding connection of the outer end of the rocker arm with the jack shaft 70 permitting this selectivity. The inner end of rocker arm 74 is provided with a threaded stud 77 to engage selectively within openings 78 in plate 79 attached to the frame of the machine. The construction is such that the drive ratio between the die spindle 16 and the jack shaft 70 may be varied as desired by moving the rocker arm 74 to engage the idler gear 76 with a gear of the gang 65 of the proper ratio, to determine the lay of the twisted strand.

Mounted upon the shaft 70 and capable of travelling longitudinally thereon is a housing represented generally at 80. This housing is of substantially cylindrical shape and has mounted in its opposite ends bevel gears 81 which are provided with threads to engage with the threads 82 on the shaft 70. A spacer sleeve 83 is arranged within the housing and is interposed between the bevel gears 81, while anti-friction means 84 are arranged within the housing to permit of the bevel gears and the spacing sleeve 83 rotating independently thereof. The housing 80 is rigidly secured to the head 85 carried by arm 86 disposed horizontally across the machine and confined within a guide or keeper plate 87 affixed to the machine frame adjacent to the path of travel of the strand 17 and transversely thereof. The end of the arm 86 has arranged thereon a roller or reel 88 to which is attached one end of a wire or cord 89, which cord is attached to valve operating lever 55 of the variable speed regulator heretofore described. The free end of the cord or wire 89 has secured thereto a weight 90, the wire or cord 89 passing over a guide roller 91.

The head 85 has rotatably mounted thereon a pair of shafts 92, each of which has secured to the outer ends thereof a bevel gear 93 in mesh with the adjacent bevel gear 81 carried by the housing 80 as heretofore described. One of the shafts 92 has secured thereto one end

of a universal coupling indicated at 94, which coupling is connected to one end of an extensible shaft indicated at 95. The opposite end of the shaft 95 is connected by a similar universal connection 96 to a spindle 97 to which is attached a regulator wheel 98. The spindle 97 is suitably mounted in proper bearings for rotation in the frame of the machine, and maintains the regulator wheel in such position that the strand 17 moving from the twister die to the wind-up bobbin passes directly over the periphery thereof, frictional contact between the strand 17 and the regulator wheel 98 being assured by rollers 99 rotatably secured to the lower ends of shafts 100 rotatably mounted in suitable bearings 101 secured to the frame. These shafts are mounted for vertical sliding movement in the bearings 101 and expansion springs 102 encircling the shafts and bearing at one end against collars 103 affixed to the shafts and against the uppermost of the bearings 101 maintain the rollers 99 in yieldable contact with the strand 17 passing over the regulator wheel 98.

From this construction it will be clear that rotative movement of the twister die will be transmitted from spur gear 57 through compound idler gear 58 to main gear 60 through the selected gear of the gang 65 to idler gear 76 to gear 71 causing the threaded shaft 70 to rotate. The speed of rotation of the shaft 70 will be determined, of course, by the gear of the gang 65 which has been selected. As the strand 17 passes from the twister die it travels over a part of the periphery of the regulator wheel 98 thus imparting rotative movement to the said wheel, which movement is transmitted to shaft 97 which is connected by telescopic shaft 95 to shaft 92 carrying bevel gear 93 in mesh with bevel gear 81 threadedly engaged with the threads 82 of the shaft 70.

The main power shaft 24 has affixed thereto a sprocket 104, over which passes a chain 105 which in turn engages a sprocket 106 affixed to a countershaft 107 suitably mounted in bearings 108 and disposed parallel to the axis of the wind-up cradle or frame 19. The shaft 107 has secured thereto a head 109 to which are secured spindles 110 upon which are idler bevel gears 111 forming a component part of a familiar differential. Mounted for rotation upon the shaft 107 are complementary driving and driven bevel gears 112 and 113 respectively, which bevel gears are in mesh with gears 111. The driven gear 113 has affixed thereto a sprocket wheel 114, over which passes a chain 115 also engaged with a sprocket wheel 116 secured to the outer end of a shaft 117 passing longitudinally through the hollow supporting trunnion 118 of one end of the wind-up frame or cradle 19. The shaft 117 extends through to the interior of the frame or cradle 19 and has a gear 120 affixed thereto. This gear is in mesh with a gear 121 affixed to one end of a shaft 122 mounted in suitable bearings longitudinally of the cradle 19. The opposite end of this shaft has attached thereto a bevel gear 123 which is in mesh with a similar gear 124 secured to one end of the bobbin supporting shaft 125. The bevel gear 124 is in mesh with a similar gear 126 affixed to the inner end of a shaft 127 mounted in suitable bearings at the side of the cradle or frame 19 and parallel to the axis thereof. The opposite end of shaft 127 has secured thereto a bevel gear 128 in mesh with a similar gear 129 affixed to one end of a cam drum 131 having a cam groove 132 therein to be engaged by a guide or traveller 133 slidably carried by a bar 134 disposed transversely within the frame and directly above the cam drum 131. It will be understood that the traveller 133 is equipped with an eye through which passes the strand 17 and that the follower 133 is given reciprocatory movement by its engagement within the groove 132 in the drum 131.

Referring back to the variable speed mechanism, it will be observed that the driven shaft 49 thereof is disposed substantially parallel with the axis of the wind-up bobbin frame, and is mounted for rotation in suitable bearings 135. This shaft has secured thereto a sprocket 136 over which passes a chain 137 in turn passing over a sprocket 138 affixed to the driving bevel gear 112.

In operation, the several mechanisms referred to derive their power from the main power source 21 through the instrumentality of the main power shaft 24. The wires 13 pass through the guide plate 15 and through the rotating twister die 14 where they are twisted into the strand 17, and this strand 17 passes over and in frictional contact with wheel 98 and from thence to the wind-up drum 18. The wind-up drum obtains its rotative power from main shaft 24 through sprocket chain 105 and the associated sprockets, shaft 107 through the differential gears 112, 111 and 113, sprocket 114, chain 115, sprocket 116, shaft 117, gear 120, gear 121, bevel gear 123 and similar gear 124 affixed to the transverse supporting shaft of the wind-up bobbin. It will be observed that the driven variable speed shaft 49 is in positive driving connection with bevel gear 112 of the differential mechanism through the instrumentality of chain 137 and sprockets 136—138. As long as the speed of rotation of the wind-up bobbin exerts a linear pull upon the strand 17 commensurate with the speed of operation of the twister die 14, the drive of the wind-up bobbin will remain as described. However, as the wind-up bobbin fills there will be a tendency of the strand 17 to increase linear speed. This increase in linear speed is detected by wheel 98, and this increased speed influence is transmitted through shaft 95 to bevel gear 93 and to bevel gear 81. This differential causes the gears 81 to move longitudinally upon shaft 82 due to their threaded connection therewith, whereupon arm 86 moves to draw the wire or cord 89 to operate lever 50 controlling the hydraulics of the variable speed regulating mechanism. This immediately varies the speed regulating device to compensate for the change of speed, whereupon the operated shaft 49 of the variable speed regulating mechanism immediately reflects this variation of speed in the differential bevel gear 112 through the instrumentality of chain 137 and sprockets 136—138. The bevel gear 112 thereupon transmits this speed variation to the cooperating gears of the differential bringing about the desired variation in the driving speed of the chain 115. As the strand continues to wind upon the bobbin and thus increases its circumference the tendency for the strand 17 to increase its linear speed continues, and the speed ratio is in the manner described automatically and progressively compensated for.

When the wind-up bobbin has become filled the machine is brought to rest and the bobbin removed to be replaced by an empty spool. The new end of the cable is attached to this spool, whereupon the wheel 98 is manually rotated to reset the automatic regulating device on the threaded shaft 82 to its initial position, where-

upon the operation above described is repeated with the same results.

I claim:

1. In a wire rope making machine, a main power source, a twisting die, means operated by said power source to rotate said die at constant speed, a rotatable bobbin frame, a wind-up bobbin in said frame, means operated by said power source to rotate said bobbin to draw a plurality of wires into a twisted strand through said die, a jack shaft, a drive connection between said die and said jack shaft, a head slidable longitudinally upon said jack shaft, means governed by the linear speed of said strand for moving said head on said jack shaft, and means interposed in said bobbin rotating means governed by the sliding movements of said head for varying the speed of said bobbin rotating means.

2. In a wire rope making machine, a main power source, a twisting die driven from said power source at a constant speed, a rotatable bobbin frame, a wind-up bobbin rotatable in said frame, means operated by said power source to rotate said bobbin to draw a plurality of wires into a twisted strand through said die, a jack shaft, a drive connection between said die and said jack shaft, a head slidable on said jack shaft, means governed by the linear speed of said strand for moving said head on said jack shaft, variable speed mechanism in said bobbin rotating means, and means governed by the sliding movements of said head on said jack shaft for operating said variable speed mechanism to maintain the lay of said strand.

3. In a wire rope making machine, a main power source, a twisting die driven from said power source at a constant speed, a rotatable bobbin frame, a wind-up bobbin rotatable in said

frame, means operated by said power source to rotate said bobbin to draw a plurality of wires into a twisted strand through said die, a jack shaft, a variable speed drive connection between said die and said jack shaft, a head slidable on said jack shaft, means governed by the linear speed of said strand for moving said head on said jack shaft, a variable speed mechanism in said bobbin rotating means, and means governed by the sliding movements of said head on said jack shaft for operating said variable speed mechanism to maintain the lay of said strand.

4. In a wire rope making machine, a main power source, a twisting die driven by said power source at a constant speed, a rotatable bobbin frame and means for driving the same from said power source, a wind-up bobbin rotatable in said frame, a variable speed mechanism interposed between said power source and said bobbin to rotate the latter to draw a plurality of wires into a twisted strand through said die, and means governed by the linear speed of said strand to operate said variable speed mechanism independently of the speed of rotation of said bobbin frame.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,171,993	Reichelt	Sept. 5, 1939
2,287,708	Reynolds et al.	June 23, 1942
2,349,882	Reichelt	May 30, 1944
2,360,783	MacCreadie	Oct. 17, 1944
2,484,178	MacCreadie	Oct. 11, 1949
2,526,247	Lewis	Oct. 17, 1950
2,546,977	Clary, Jr. et al.	Apr. 3, 1951