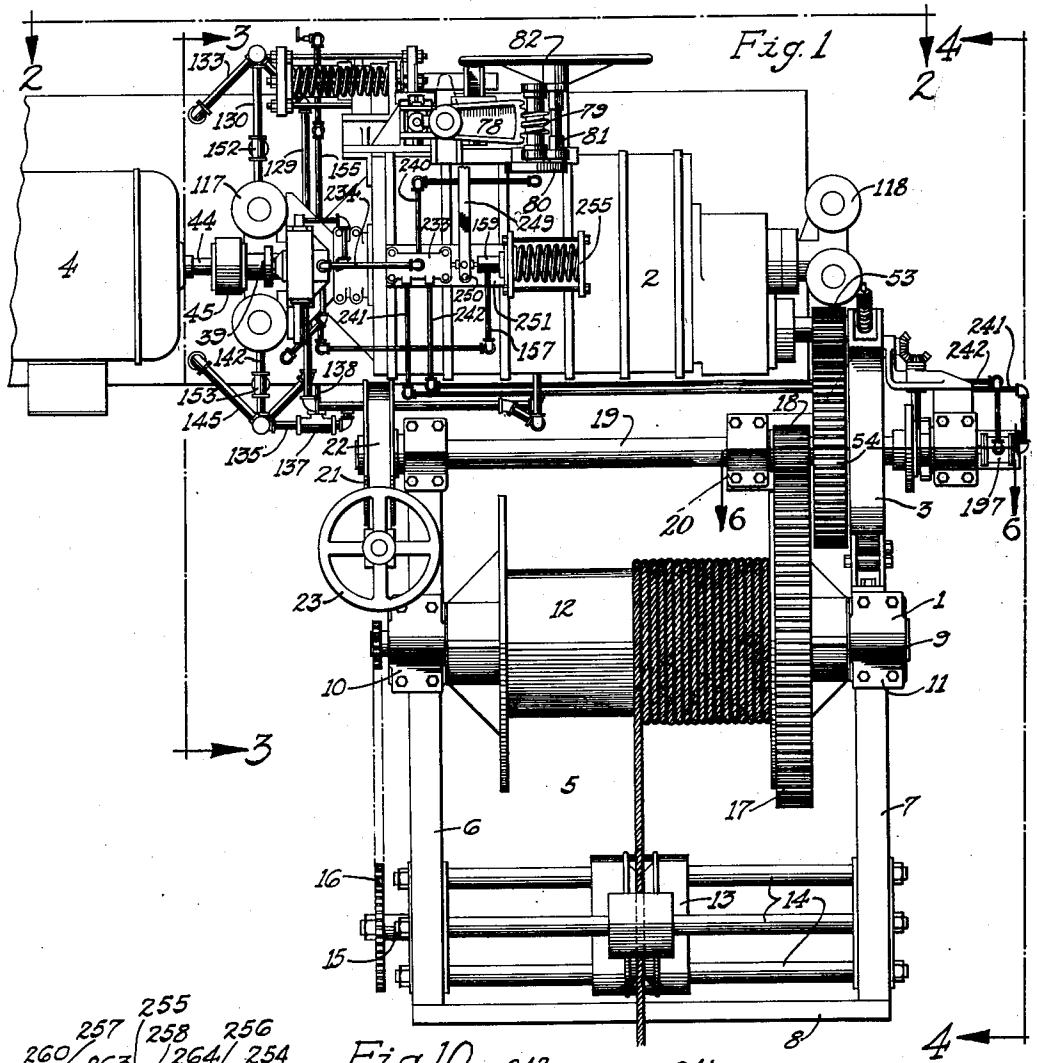
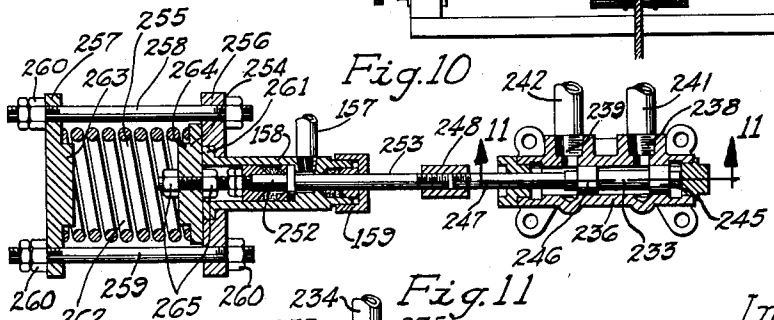
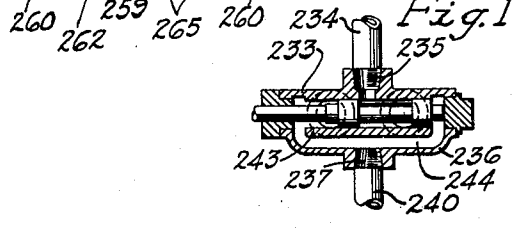
March 27, 1934. R. C. LAMOND 1,952,504

MOORING APPARATUS

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MOORING APPARATUS

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Fig. 2

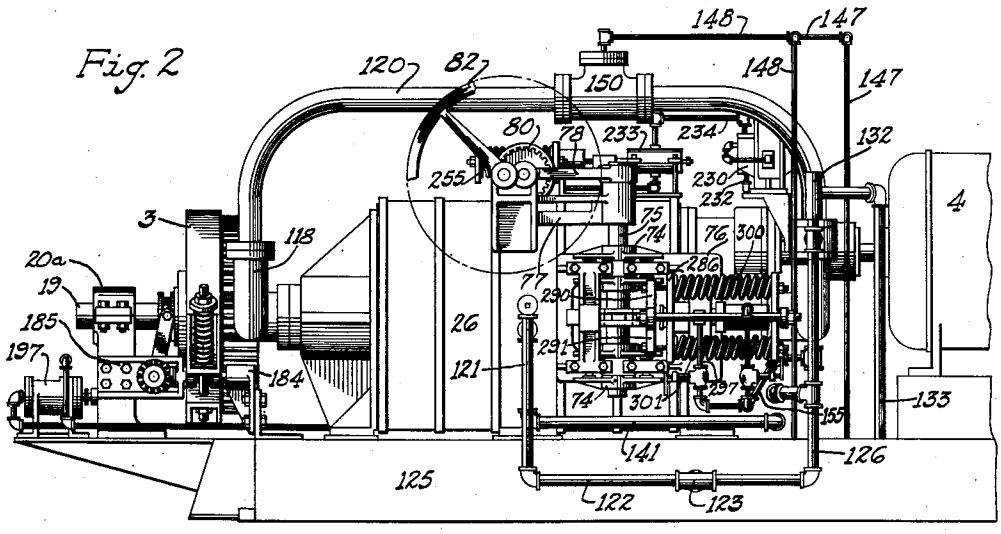
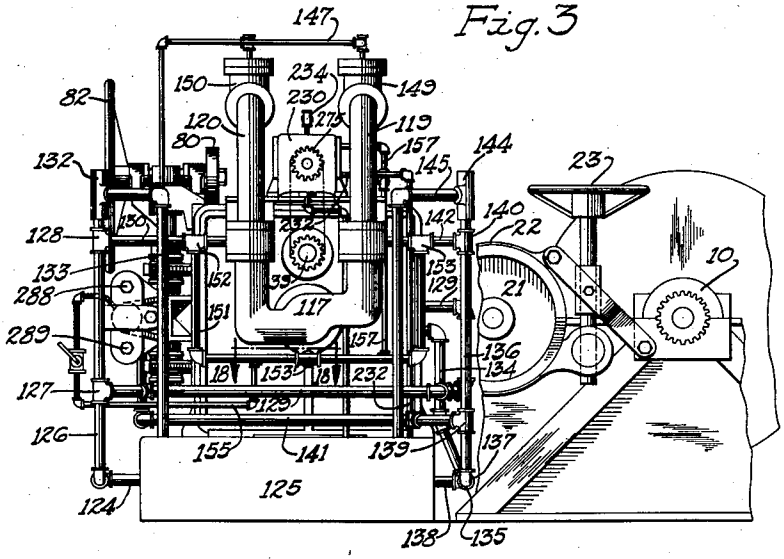


Fig. 3



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Fig. 4

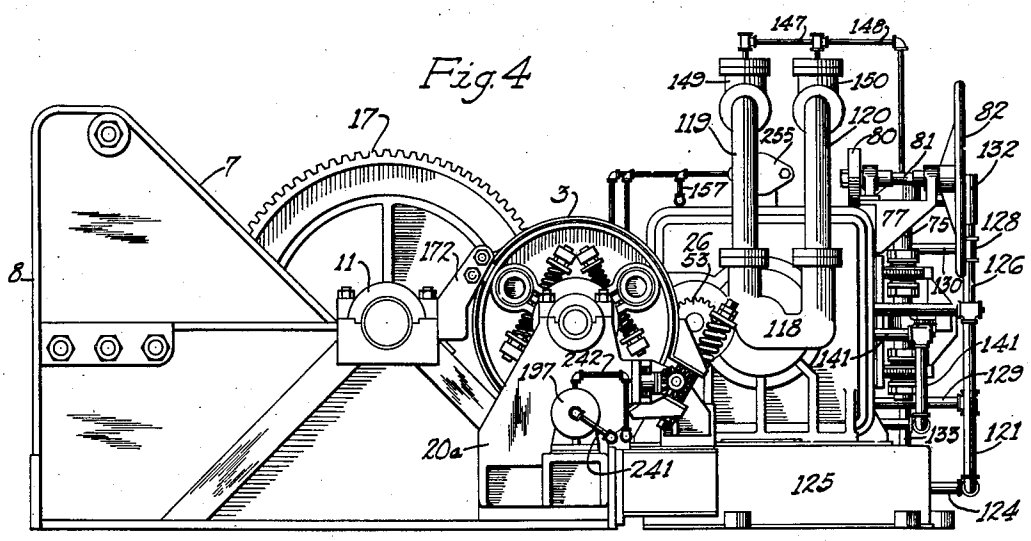


Fig. 5

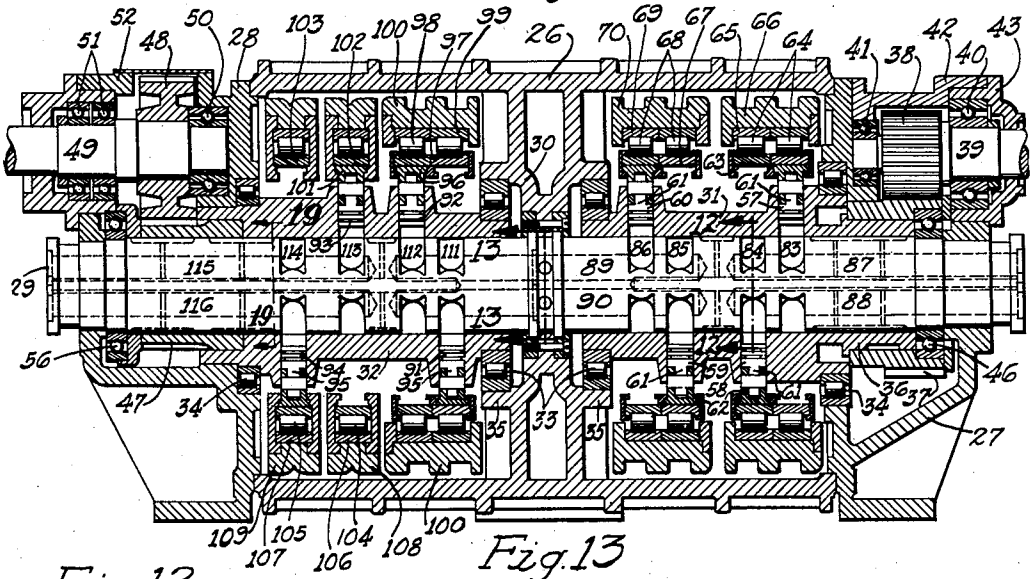
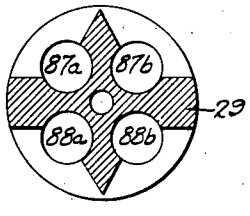
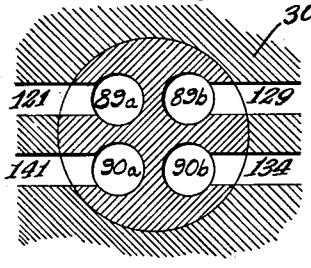


Fig. 13

Fig. 12





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Fig. 6

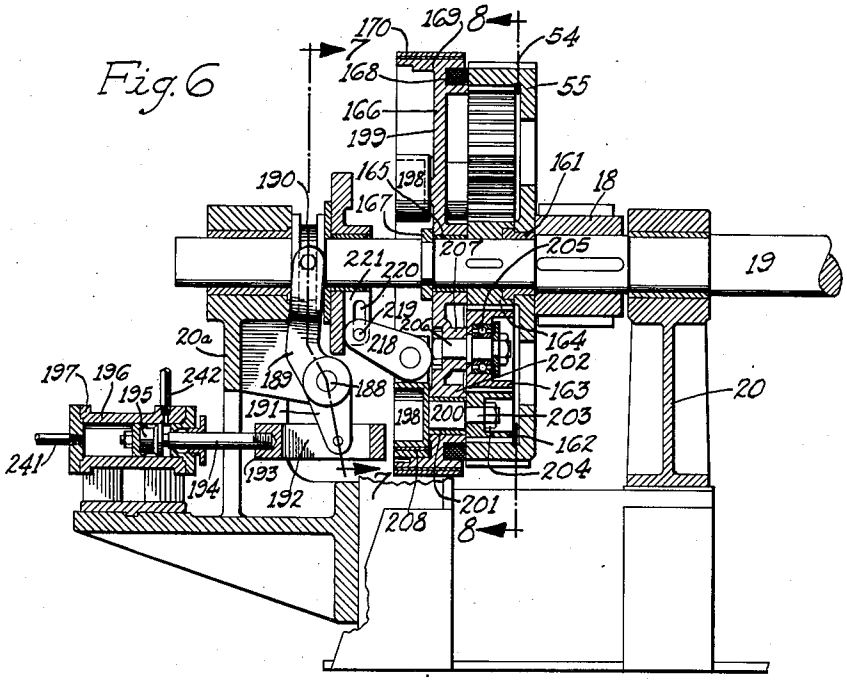


Fig. 7

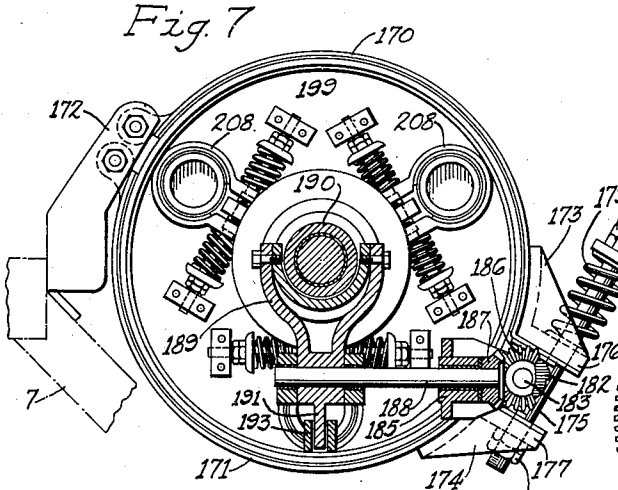


Fig. 8

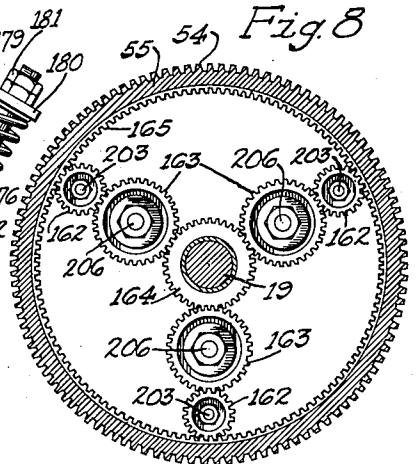
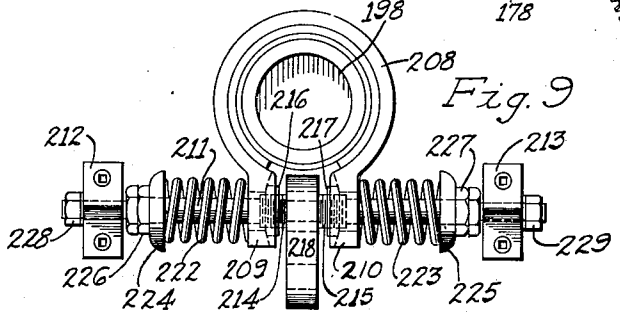


Fig. 9



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Fig. 14

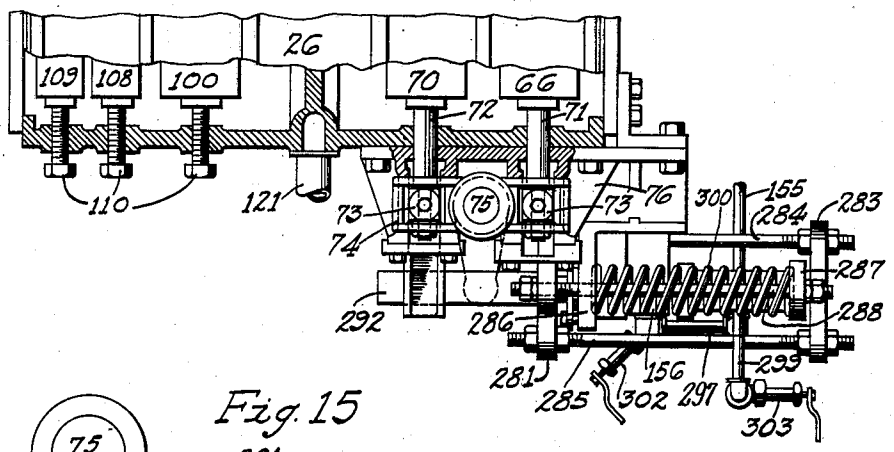


Fig. 15

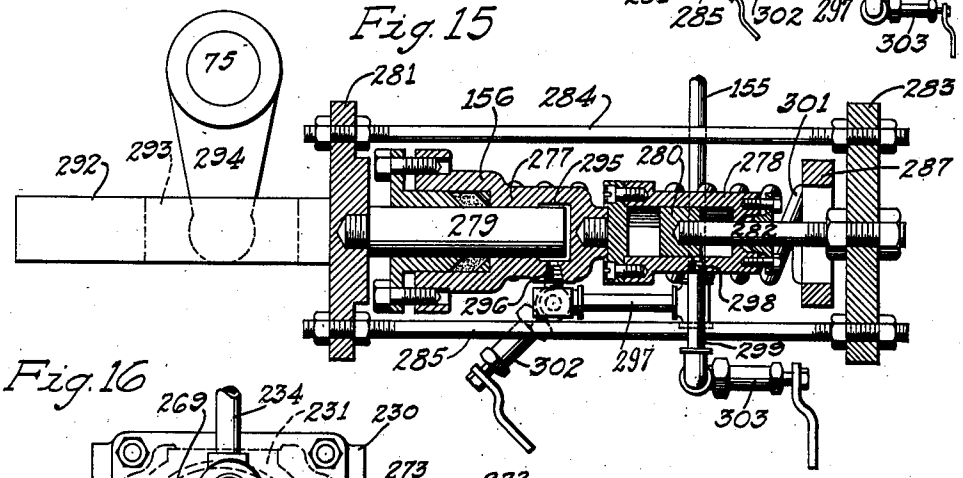


Fig. 16

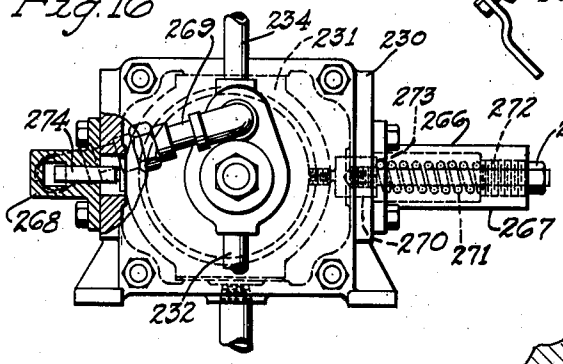


Fig. 17

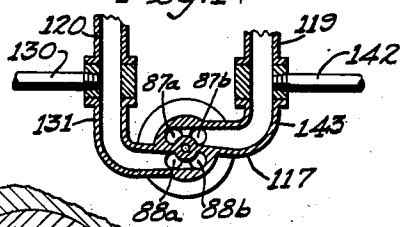


Fig. 18

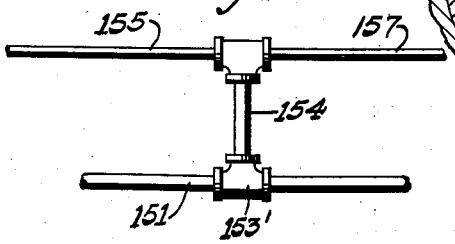
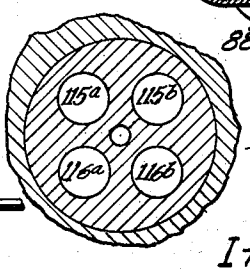


Fig. 19



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1,952,504

UNITED STATES PATENT OFFICE

1,952,504

MOORING APPARATUS

Robert C. Lamond, Philadelphia, Pa., assignor to American Engineering Company, Philadelphia, Pa., a corporation of Pennsylvania

Application October 3, 1932, Serial No. 635,975

24 Claims. (Cl. 254—172)

This invention relates to mooring apparatus and more particularly to mooring apparatus of the electrohydraulic type.

The principal object of the present invention is to provide a mooring device for aircraft, ships and the like, which is extremely flexible, whereby the object to be moored may be handled regardless of weather conditions.

Another object of this invention is to provide a mooring device which responds automatically to load conditions to regulate the speed of operation thereof.

A further object of this invention is to provide a mooring device of the electrohydraulic type having a safety device associated therewith which causes reversal of the mechanism when the operating pressure exceeds a predetermined amount.

A further object is to provide a mooring device of the stated character having a gear transmission and automatic means for effecting speed changes in said transmission.

Other and further objects of this invention will become apparent as the description thereof progresses.

Of the drawings:

Fig. 1 is a plan view of the mooring device comprising the present invention.

Fig. 2 is a side elevational view of the transmission mechanism taken on line 2—2 of Fig. 1.

Fig. 3 is an end elevational view taken substantially on line 3—3 of Fig. 1 showing the transmission mechanism and a portion of the winch associated therewith.

Fig. 4 is an elevational view taken substantially on line 4—4 of Fig. 1.

Fig. 5 is a sectional elevational view taken through the hydraulic transmission showing the various operating parts thereof.

Fig. 6 is a sectional view taken substantially on line 6—6 of Fig. 1, showing the gear transmission and mechanism for effecting speed changes.

Fig. 7 is a view taken substantially on line 7—7 of Fig. 6 showing some of the operating parts of the gear transmission.

Fig. 8 is a view taken substantially on line 8—8 of Fig. 6 showing the arrangement of the gears comprising the gear transmission.

Fig. 9 is a view showing the brake and operating means therefor associated with one of the planetary gears.

Fig. 10 is a sectional plan view of the valve mechanism and the operating means therefor provided on the top of the hydraulic transmission.

Fig. 11 is a sectional view of the valve taken substantially on line 11—11 of Fig. 10.

Fig. 12 is a sectional view of the central valve taken substantially on line 12—12 of Fig. 5.

Fig. 13 is a sectional view taken substantially on line 13—13 of Fig. 5, showing the various ports of the central valve and certain of the connections leading thereto.

Fig. 14 is a plan view partly in section of a portion of the hydraulic transmission with certain parts removed to show the means for adjusting the sliding blocks and the automatic means for causing reversal of the parts when the pressure in the system exceeds a predetermined amount.

Fig. 15 is a sectional plan view of the automatic means shown in Fig. 14.

Fig. 16 is an elevational view partly in section of the pump provided for actuating the motor associated with the planetary gear transmission.

Fig. 17 is a sectional elevational view taken substantially through one of the fittings of the hydraulic transmission.

Fig. 18 is a plan view taken substantially on line 18—18 of Fig. 3.

Fig. 19 is a sectional view taken substantially along line 19—19 of Fig. 5.

Referring to the drawings, the numeral 1 designates a mooring winch driven by a hydraulic transmission 2 through a variable speed planetary gear transmission 3. The hydraulic transmission 2 may be driven by an electric motor 4 or by any other suitable driving mechanism.

The winch 1 is of usual construction and comprises a base casting 5, side supporting frames 6 and 7, and an end frame 8. A shaft 9 suitably supported in bearings 10 and 11 provided in side frames 6 and 7, has secured thereto a winding drum 12. A cable guide block 13 slidably supported on rods 14 secured in side frames 6 and 7 properly spaces the cable on drum 12. The cable guide block 13 is operated by the usual diamond screw shaft 15 which in turn is driven by a chain and sprocket mechanism 16 from shaft 9. Secured to shaft 9 is a comparatively large gear 17 which meshes with a pinion 18 secured to a shaft 19 suitably journalled in side frame 6 and standards 20 and 20a. Shaft 19 is driven by the planetary gear transmission 3 as will appear more fully hereinafter A brake drum 21 is secured to the free end of shaft 19 and a brake band 22 adjustable by a hand wheel 23 cooperates therewith. This brake mechanism is employed in case of

emergency to prevent rotation of the winding drum 12 in either direction of movement.

Referring more particularly to Figs. 1 and 5 of the drawings, it is seen that the hydraulic transmission 2 comprises a substantially rectangular casing 26 provided with end plates 27 and 28 in which a central valve 29 is supported. The central valve 29 extends longitudinally of the casing and is also supported intermediate its ends in a transverse partition 30 integrally secured to the inner sides of said casing. The central valve is rigidly held against movement about its supports by any suitable means. Mounted for movement about the central valve 29 at opposite sides of partition 30 are cylinder bodies 31 and 32, each of which closely fitting the central valve 29.

The cylinder bodies 31 and 32 are each provided with bearings 33 and 34, the bearings 33 being supported in flanges 35, 35, of partition 30, and the bearings 34 being respectively supported in the end plates 27 and 28. The cylinder body 31 is provided with an extension 36 which has secured thereto a gear 37 which meshes with a pinion 38 keyed to a shaft 39 journalled in bearings 40 and 41 provided in a subcasing 42 mounted on end plate 27. Shaft 39 projects through end plate 43 of subcasing 42 and is connected to armature shaft 44 of motor 4 by a suitable coupling 45. A bearing 46 is provided for the outer end of gear 37.

The cylinder body 32 has also secured at the outer end thereof a gear 47 which meshes with a pinion 48 keyed to a shaft 49. Shaft 49 is mounted on bearings 50 and 51 provided in a subcasing 52 mounted on end plate 28 and the outer end of said shaft projects through the end wall of said subcasing and has secured thereto a pinion 53. Pinion 53 meshes with the outer teeth 54 of a ring gear 55 of the planetary gear transmission 3. A bearing 56 is also provided for the outer end of gear 47.

The cylinder body 31 has formed therein four radially arranged series of cylinders 57, 58, 59 and 60 in which operate pistons 61. The outer end of each piston is pivotally connected with a slipper 62. The slippers 62 of the pistons 61 of the series of cylinders 57 and 58 being slidably secured against the inner face of a ring 63 which constitutes the inner race of the roller bearing 64, the outer race 65 of which is secured within a guide block 66, adjustably mounted on the housing. The slippers 62 of the pistons 61 of the series of cylinders 59 and 60 are similarly slidably secured against the inner faces of a ring 67 which constitutes the inner race of a roller bearing 68, the outer race 69 of which is mounted in a second guide block 70 also adjustable in the housing. The blocks 66 and 70 are provided, respectively, with rods 71, 71 and 72, 72, which extend through the side of the casing 26 and are slidably mounted therein as shown more particularly in Figs. 1, 2, 3 and 14. The outer or free end of each of the rods 71 and 72 has pivotally secured thereto a crosshead 73 slidably positioned in transverse guideways at opposite ends of yokes 74. The yokes 74 are secured to a vertical shaft 75 suitably mounted in a bracket 76 secured to the outer side of the casing 26. The upper end of shaft 75 is journalled in a second bracket 77 also secured to the casing 26 and has secured thereto a segmental spiral gear 78. Spiral gear 78 meshes with a spiral gear 79 also journalled in bracket 77. The inner end of spiral gear 79 has secured thereto an internal gear 80 which meshes with a pinion secured to the inner end of a shaft 81 also journalled in bracket 77. The outer end of shaft 81 has secured thereto a hand wheel 82. From the foregoing description it is seen that any movement of hand wheel 82 will be imparted to vertical shaft 75 and yokes 74 with the result that sliding blocks 66 and 70 will be simultaneously moved in opposite directions.

When the guide blocks 66 and 70 are in the position shown in Fig. 14 the rings 63 and 67 are both concentric with cylinder body 31 so that rotation of said body by motor 4 results in no reciprocating movement of the pistons 61. Adjustment of the guide blocks 66 and 70 in either direction from this neutral position moves rings 63 and 67 into positions eccentric to the cylinder body 31, with the result that rotation of the latter effects a reciprocation of the pistons, the stroke of said pistons depending upon the degree of eccentricity of said rings.

The central valve 29 is provided with four sets of ports 83, 84, 85 and 86 which register, respectively, with the inner ends of the series of cylinders 57, 58, 59 and 60. Each of said sets of ports comprises two ports arranged at diametrically opposite sides of the valve 29, these two ports being so arranged that the pistons 61 when reciprocated in their associated cylinders, as previously described, create a suction on one of the ports and pressure on the diametrically opposite port. The correspondingly positioned ports of the sets 83 and 84 communicate with passages 87*a*, 87*b* and 88*a*, 88*b*, extending longitudinally in central valve 29 from ports 84 to the right hand terminal of valve 29. The correspondingly positioned ports of the sets 85 and 86 communicate respectively with passages 89*a*, 89*b* and 90*a*, 90*b*, which also extend longitudinally in valve 29 from the ports 85 past the central portion of said valve.

The cylinder body 32 has also formed therein four radially arranged series of cylinders 91, 92, 93 and 94 in which operate pistons 95, each having pivotally connected at the outer end thereof a slipper 96. The slippers of the pistons of the two series of cylinders 91 and 92 are slidably secured against the inner face of a ring 97 which constitutes the inner race of a roller bearing 98, the outer race 99 of which is secured within a guide block 100 adjustably mounted within the housing. The slippers 101 of the pistons 95 of the series of cylinders 93 and 94 are similarly slidably secured against the inner faces of rings 102 and 103 which respectively constitute the inner races of roller bearings 104 and 105, the outer races 106 and 107 of which are mounted respectively in guide blocks 108 and 109. These blocks may be adjusted in any suitable manner, such as by set screws 110 as shown in Fig. 14, and held thereby in adjusted position. The cylinder body 32 and the parts just described associated therewith constitutes the motor side of the transmission which is driven by the fluid delivered thereto from the pump side thereof which comprises the cylinder body 31 and the parts associated therewith previously described.

When the guide blocks 100, 108 and 109 are in the position, shown in Fig. 14 the rings 97, 102 and 103 are concentric with the cylinder body 32 so that fluid pressure applied to the inner ends of cylinders 91, 92, 93 and 94 exerts through the pistons 95 a direct radial thrust upon rings 97, 102 and 103, and there is no tendency to cause rotation of the cylinder body 32. Adjustment of the guide blocks 100, 108 and 109 in either direction from this neutral position moves the rings into positions eccentric to the cylinder body

32 with the result that fluid pressure exerted behind pistons 95 effects a rotation of the cylinder body 32 and consequently gear 47, pinions 48 and 53, and ring gear 55. The guide blocks 108 and 109 are adjusted equal amounts in the same direction while the guide block 100 is adjusted an equal amount in the opposite direction. By adjusting the guide blocks in this manner, the pressure exerted upon central valve 29 is balanced. The capacity of the cylinders provided in cylinder bodies 31 and 32 is the same and therefore, when the sliding blocks are adjusted for full stroke operation of the pistons 61 and 95, the cylinder bodies 31 and 32 will rotate at substantially the same rate of speed. However, if it is desired to rotate the cylinder body 32 at a greater speed than cylinder body 31 it is only necessary to adjust the guide blocks 100, 108 and 109 so that the stroke of the pistons 95 of the cylinder body 32 is less than that of the pistons 61 of the cylinder body 31. Variable speeds may also be obtained by adjusting the guide blocks associated with cylinder body 32 so that one or two remains in neutral position while the others are eccentric in respect to the cylinder body 32.

The central valve 29 is also provided with four sets of ports 111, 112, 113 and 114 positioned respectively to register with the inner ends of cylinders of the series 91, 92, 93 and 94. Each of these sets of ports is also provided with two ports arranged at diametrically opposite sides of valve 29. The correspondingly positioned ports of the sets 111 and 112, respectively, communicate with passages 89*a*, 89*b* and 90*a* and 90*b* extending longitudinally in valve 29 from the ports 85 and 86, as previously set forth. Correspondingly positioned ports of the sets 113 and 114 respectively, communicate with passages 115*a*, 115*b* and 116*a*, 116*b* which extend from ports 113 and 114 to the left hand extremity of central valve 29.

Referring to Figs. 1 to 4 and 17, it is seen that the passages 87*a*, 87*b* are connected through fittings 117 and 118, and pipe 119 with passages 115*a*, 115*b*, while the passages 88*a*, 88*b* are similarly connected through said fittings and a pipe 120 with passages 116*a*, 116*b*.

In order to balance the pressures in the various passages just described, and to permit fluid to be drawn into the system for makeup purposes, the following apparatus is provided. A pipe 121 is fitted into one side of casing 26 and communicates through a passage provided in the partition 30 of said casing with passage 89*a* of central valve 29. A horizontal extension 122 of pipe 121 is provided with a T coupling 123 to which is connected a short pipe 124 which extends into the makeup tank 125. A one-way valve (not shown) is provided at the inner end of pipe 124 which permits oil to be drawn into the system to replenish the oil which may leak therefrom, but which prevents the escape of oil from the system. Extension 122 is attached to a vertical pipe 126 having T couplings 127 and 128 provided thereon. A pipe 129 leads from coupling 127 and extends across one end of casing 26 and thence along the opposite side thereof, and is fitted in casing 26 and communicates with passage 89*b* of central valve 29 through a passage provided in the partition 30. A pipe 130 extending from coupling 128 of pipe 126 is fitted into the upper end of branch 131 of fitting 117. A relief valve 132 is provided at the upper end of pipe 126 and a pipe 133 extends from said relief valve to the makeup tank 125. Relief valve 132 functions to permit the discharge of oil from the system through pipe 133 should the pressure therein exceed a predetermined maximum.

A similar set of pipe connections is provided between passages 90*a* and 90*b* of central valve 29. A pipe 134 is fitted at the upper end thereof into casing 26 and communicates with passage 90*b* of central valve 29 through a passage provided in partition 30. The lower end of pipe 134 is connected to one end of a horizontal extension 135, the other end of said extension being connected to a vertical pipe 136. Extension 135 is provided with a T coupling 137 from which a short pipe 138 also extends into makeup tank 125. A one-way valve (not shown) is also attached to the inner end of pipe 138 which functions to permit fluid to be drawn into the system for makeup purposes but prevents the escape of fluid therethrough from the system. Vertical pipe 136 is also provided with a pair of T couplings 139 and 140. A pipe 141 extends from coupling 139 across the end of casing 26 and along the opposite sides thereof and communicates with passage 90*a* of central valve 29 through a passage provided in partition member 30. A pipe 142 also extends from coupling 140 and is fitted into branch 143 of fitting 117, and a relief valve 144 is also provided at the upper end of pipe 136 from which a pipe 145 extends to makeup tank 125. This relief valve, like valve 132 provided on pipe 126, functions to permit oil from the system to discharge therethrough to the makeup tank 125 in the event the pressure in the system should exceed a predetermined maximum. By providing relief valves 132 and 144 any damage to the parts due to excessive pressure conditions is avoided. A pair of small pipes 147 and 148 are connected to fittings 149 and 150 of pipes 119 and 120, respectively, through which any air present in the oil is discharged from the system. A bypass pipe 151 is connected at one end to a T coupling 152 provided in pipe 130 and at the other end to a similar coupling 153 provided on pipe 142. A T coupling 153′ is provided in the horizontal portion of pipe 151 to which a short extension 154 is attached. A pipe 155 is attached at one end to extension 154 and extends to a fluid motor 156 which is provided to actuate the sliding blocks 66, 70 of the pump to neutral position or to a position causing reversal of the discharge of the pump, in case the pressure in the system should exceed a predetermined maximum, as will fully appear hereinafter. A second pipe 157 is also attached to extension 154 and leads to cylinder 158 of the fluid motor 159, the purpose of which will also presently appear.

The planetary gear transmission 3 is so constructed that for light loads it drives shaft 19 at a comparatively high rate of speed, but when the load increases to a predetermined amount it is automatically adjusted to drive shaft 19 at a comparatively low rate of speed. Referring to Figs. 1 to 4 and 6 to 9, it is seen that the planetary gear transmission 3 comprises a ring gear 55 rotatably mounted upon a bearing 161 secured to shaft 19, planetary gears 162, idler gear 163 and a driven gear 164 keyed to shaft 19. Planetary gears 162 mesh with the internal teeth 165 of ring gear 55 and with the idler gears 163, the latter of which mesh with the driven gear 164. As shown more clearly in Fig. 6, the hub of ring gear 55 is positioned between gears 18 and 164, and a portion thereof abuts against an annular shoulder of bearing 161. Ring gear 55 is thus held against axial movement. As pointed out

before, the external teeth 54 of ring gear 55 mesh with a pinion 53 keyed to shaft 49, which shaft in turn is driven by gear 47 secured to cylinder body 32, of the hydraulic transmission just described.

Rotatably mounted on a bearing 165 secured to shaft 19 is a brake drum 166, the hub of which being disposed between and abutting against gear 164 and a collar 167 secured to shaft 19. Brake drum 166 is thus also held against axial movement. An annular bearing 168 is provided in the flange 169 of drum 166 which engages the inner end of ring gear 55 as shown in Fig. 6. During low speed operation of the transmission 3 brake drum 166 is free to move and rotates about shaft 19 with ring gear 55, but during high speed operation thereof the said brake drum is held against movement. The means for holding brake drum 166 against movement will now be described in detail.

Referring more particularly to Figs. 6 and 7, it will be observed that a pair of complementary brake bands 170 and 171 engage the outer periphery of brake drum 166. These brake bands are pivoted at one end to a bracket 172 secured to the side frame 7 of mooring winch 1, and at the other end have secured thereto brackets 173 and 174, respectively. A bolt 175 extends through apertures provided in the outwardly extending portions 176 and 177 of brackets 173 and 174, respectively, and lock nuts 178 prevent upward movement of said bolt. A coil spring 179 encircles the upper portion of bolt 175, the lower end of said spring engaging portion 176 of bracket 173 and the upper end thereof engaging a collar 180 loosely mounted on said bolt. A pair of nuts 181 are provided to adjust the tension of spring 179 and thus regulate the gripping action of bands 170 and 171. The brake bands 170 and 171 are extended to release the drum 166 for movement by a cam 182 secured to a shaft 183 journalled in suitable bearings provided in brackets 184 and 185, as shown in Fig. 2. A bevel gear 186 secured to one end of shaft 183 meshes with a bevel gear 187 secured to the outer end of a shaft 188, the latter being suitably journalled in bracket 185. The other end of shaft 188 is secured to and supports a yoke 189. The upper end of yoke 189 has pivotally secured thereto a semicircular band which engages into an annular groove provided in a block 190 slidably mounted on shaft 19. The depending arm 191 of yoke 189 extends into an elongated slot 192 of a block 193 secured to one end of a piston rod 194. A piston 195 to which the other end of rod 194 is secured operates in a cylinder 196 of a fluid motor 197. It therefore is seen that upon reciprocation of piston 195 block 193 will engage arm 191 thus rocking yoke 189 and shaft 188, the movement of the former effecting axial movement of block 190 on shaft 19 while the movement of the latter is imparted to cam 182 through bevel gears 187, 186 and shaft 183. When shaft 188 is rocked in one direction the high side of cam 182 engages the inner sides of portions 176 and 177 of brackets 173 and 174, thereby extending brake bands 170 and 171 to release the brake drum 166 for movement. When shaft 188 is rocked in the opposite direction the low side of cam 182 is presented to brackets 173 and 174 and spring 179 functions to actuate the bands 170 and 171 into gripping engagement with drum 166.

Each of the planetary gears 162 has secured thereto a brake drum 198 extending from the opposite side of web 199 of brake drum 166. The elements associated with each gear 162 and drum 198 are the same so that a description of one will suffice for all. Brake drum 198 has secured thereto a journal 200 which is fitted into a bearing 201 provided in a boss 202 of the web 199 of drum 166, and a reduced threaded portion 203. Threaded portion 203 extends through an aperture provided through the axis of gear 162 and a nut 204 engages said threaded portion to integrally secure gear 162 to drum 198. Idler gear 163 is supported upon a bearing 205 provided on a stub shaft 206 secured in a boss 207 provided in the web 199 of drum 166. A substantially U-shaped brake band 208 engages the outer periphery of drum 198 and is so adjusted by a mechanism which will presently be described that for high speeds of the transmission 3 it will release drum 198 for movement and for low speeds thereof it will grip the drum and prevent rotation thereof. It may be stated here that when the brake bands 170 and 171 grip drum 166 to prevent movement thereof the bands 208 are extended to release their drums 198 and associated planetary gears for operation and vice versa, when the bands 170 and 171 release the associated drum 166 for operation brake bands 208 grip their drums 198 to prevent movement thereof and of the associated gears 162.

The free ends 209 and 210 of each brake band 208 are provided with circular apertures through which a shaft 211 extends. Shaft 211 is suitably journalled in a pair of brackets 212 and 213 secured to the outer side of web 199 of drum 166. Right and left hand threads 214 and 215 are provided on shaft 211 intermediate the ends thereof which engage nuts 216 and 217 provided adjacent the inner sides of the free ends 209 and 210, respectively, of brake band 208. A lever 218 is secured to shaft 211 intermediate the ends of the latter, and the free end of said lever has secured thereto a laterally extending stud 219 which extends into a slot 220 provided in a radially extending web 221 of sliding block 190. It therefore is clear that upon reciprocation of block 190 shafts 211 will be rocked causing nuts 216 and 217 to move either toward or away from each other, depending upon which direction the shafts are rocked. Referring to Fig. 9, it is seen that shaft 211 is provided with a pair of coil springs 222 and 223 the inner ends of which engage the outer sides of end portions 209 and 210, respectively, of brake band 208 while the outer ends thereof engage collars 224 and 225. The tension of springs 222 and 223 is adjusted by nuts 226 and 227. Shaft 211 is held against axial movement by nuts 228 and 229 provided on the ends of said shaft adjacent the outer sides of brackets 212 and 213 respectively. When shaft 211 is so rocked as to cause nuts 216 and 217 to move toward each other springs 222 and 223 will urge the ends of brake band 208 toward each other thereby causing the latter to grip drum 198 to prevent movement thereof and of its associated gear 162.

Piston 195 of fluid motor 197 is reciprocated to cause adjustment of brake bands 170, 171 and 208 by a variable discharge pump 230 of the general type disclosed in the patent to Hele-Shaw No. 1,077,979. The specific construction of this pump forms no part of the present invention and therefore it will not be described in detail. For the present purpose, however, it may be stated that when the sliding block 231 of pump 230 is in neutral position, as shown in Fig. 16, no pumping action takes place, but when the sliding block 231 is shifted in either direction from neutral

position fluid is discharged therefrom. Pump 230 is suitably secured upon the upper side of casing 26 near one end thereof as shown in Figs. 1, 2 and 3, and fluid is supplied thereto from makeup tank 125 through a pipe 232. The discharge side of pump 230 is connected to a valve 233 by means of a pipe 234. Pipe 234 is fitted in a port 235 provided in the upper side of the casing 236 of valve 233 as shown in Figs. 1 and 11. Valve casing 236 is also provided with a port 237 in the lower side thereof and ports 238 and 239 in one side thereof. A pipe 240 has one end thereof fitted in port 237 and the other end fitted in an aperture provided in casing 26. A pair of pipes 241 and 242 are fitted at one end in ports 238 and 239, respectively, while the other ends of said pipes are fitted into the right and left hand ends of cylinder 196, respectively, of motor 197, as viewed in Fig. 1. Mounted within casing 236 and extending longitudinally thereof is a cylinder 243 in which operates valve 233. Cylinder 243 is open at both ends thereof and communicates with ports 235, 238 and 239. The ends of cylinder 243 also communicate with a passage 244 disposed beneath said cylinder which in turn communicates with port 237. Valve 233 comprises two spaced enlarged cylindrical portions 245 and 246 which fit snugly against the inner wall of cylinder 243 so that no oil may escape between them and the wall of the cylinder. When the parts are in the position shown in Figs. 10 and 11 fluid entering the cylinder 243 from pump 230 discharges through port 238 and enters the left hand end of cylinder 196 of motor 197 through pipe 241, thus moving piston 195 to the right as viewed in Fig. 6. The oil discharged from cylinder 196 by this movement of piston 195 flows through pipe 242, passage 244 and into pipe 240 which conveys it to the interior of casing 26 where it drains to makeup tank 125 through suitable outlet openings provided in the bottom of said casing.

The stem 247 of valve 233 is tapped at the outer end thereof and is secured to one end of an elongated nut 248 pivotally attached to a lever 249 pivoted at 250 to a bracket 251. The motor 159 and valve 233 are also secured to bracket 251 which in turn is secured to the top of casing 26. The piston 252 of motor 159 is secured to a rod 253 coaxial with valve stem 247. This rod is also tapped at the free end thereof and is secured to the other end of nut 248, as shown in Fig. 10. Rod 253 extends through piston 252 and the outer threaded end thereof is secured to the plunger 254 of a spring motor 255. Spring motor 255 comprises a pair of spaced end plates 256 and 257, having a pair of aligned apertures through which bolts 258 and 259 extend, the nuts 260 thereon preventing movement of said plates away from each other.

End plate 256 is provided with an enlarged grooved circular aperture which is fitted about fluid motor 159 in such a manner that the grooved portion thereof engages an annular flange 261 provided at the left hand end of motor 159, as viewed in Fig. 10. Movement of plate 256 toward plate 257 is thus prevented. A spring 262 extends between end plate 257 and plunger 254 and is held in position by the circular bosses 263 and 264 provided on the inner sides of plate 257 and plunger 254, respectively. The tension of spring 262 may be regulated by adjusting nuts 265 provided at either side of plunger 254 on rod 253. Pipe 157, as described hereinbefore, is attached to extension 154, the pressure in which being that of the system, through its connection with pipe 151. It therefore is seen that when the pressure in the system exceeds the tension of spring 262 piston 252 will be moved to the left. When this occurs valve 233 will also be moved to the left and the fluid discharging from pump 230 will flow through pipe 242 to the right hand end of cylinder 196 of motor 197, as viewed in Fig. 6, causing pistons 195 to move to the left. By this action yoke 189 will move sliding block to the right and also cause shaft 188 to rotate to the right as viewed in Fig. 6, with the result that brake bands 170 and 171 will release brake drum 166 for movement while brake bands 208 will be caused to grip their respective drums 198 to prevent rotation of planetary gears 162. Drum 166 will thus rotate with ring gear 55 and planetary gears 162, and idler gears 163 will revolve about shaft 19. Since gears 162 and 163 are held against rotation, gear 164 is rigidly connected to ring gear 55 and thus will rotate at the same rate of speed as said ring gear. Drum 12 will thus be driven at a greatly reduced rate of speed. When piston 195 moves to the left the oil displaced thereby will flow through pipe 241 and enter valve 233 through port 239. The oil then flows through passage 244 and into pipe 240 which conveys it to the interior of casing 26, and into makeup tank 125, as previously described. When piston 195 reaches either of its limiting positions, if pump 230 continued to discharge oil through these connections a comparatively great pressure would be built up therein and the parts may become damaged. It therefore is necessary to provide means for automatically restoring the sliding block 231 of pump 230 to neutral position when piston 195 has been properly adjusted in either direction. To this end an automatic control for pump 230 has been provided, as shown more particularly in Fig. 16. This control comprises a spring motor 266 provided within a casing 267 secured to one end of pump 230 and a fluid motor 268 secured to the other end of said pump and which is connected to the pressure side of pump 230 by a pipe 269. Spring motor 266 comprises a plunger 270 secured at its inner end to sliding block 231. The stem of plunger 270 extends through an enlarged opening provided in casing 267 and has provided thereon a spring 271. One end of spring 271 bears against the inner end of a tapped plug 272 secured in the end of casing 267 and the other end thereof bears against the enlarged portion 273 of plunger 270. The outer end of the stem of plunger 270 extends through plug 272 and is guided therein. A hollow extension 272' of plug 272 is provided to facilitate the securing of the latter in the casing and affords a means for adjusting the tension of spring 271. Sliding block 231 will thereby be normally urged to the left. When, however, the piston 195 of motor 197 reaches either of its limiting positions pressure builds up in pump 230. This pressure is communicated to fluid motor 268 causing the piston 274 thereof which, as shown in Fig. 16, bears against the opposite side of sliding block 231 to actuate the latter to neutral position and thus prevent further pumping action of pump 230. The parts will remain in this position until valve 233 is again shifted. This causes a reduction of the pressure in pump 230 and spring 271 will again actuate sliding block 231 to the left causing pump 230 to again discharge oil to valve 233. The piston 195 of motor 197 will then be forced in the opposite direction and when it reaches its limiting position the pressure will again build up in pump 230 which causes piston

274 to again restore the sliding block 231 to neutral position. Pump 230 is driven from shaft 39 by a chain and sprocket connection 275, as shown in Fig. 3.

Mechanism has also been provided to cause the drum 12 of the winch 1 to pay out the cable when the pressure in the system exceeds a predetermined amount. Referring more particularly to Figs. 1, 2, 14 and 15, this mechanism comprises a fluid motor 156, suitably mounted upon the bracket 76 secured to one side of casing 26 of the hydraulic transmission 2. Fluid motor 156 comprises a pair of axially aligned cylinders 277 and 278 having pistons 279 and 280, respectively, operating therein. Piston 279 is secured at its left hand end (Fig. 15) to a substantially horizontal movable bar 281, while piston 280 is secured to one end of a rod 282, the other end of said rod being rigidly secured to a horizontally disposed movable bar 283. A pair of tie rods 284 and 285 secured at the ends thereof to the opposite ends of bars 281 and 283 respectively, hold the latter in spaced relation. Adjacent to bar 281 is a substantially vertical bar 286 integrally secured to the cylinder 277 of motor 156. Adjacent to bar 283 is a second substantially vertical movable bar 287. A pair of rods 288 and 289 are respectively secured at one end to vertically extending ears 290 and 291 integral with bar 281. These rods extend through apertures provided in bar 286 and the other ends thereof are secured to vertical bar 287. A pair of coil springs 300 and 301 are provided on rods 288 and 289 respectively, one end of said springs abutting against fixed bar 286 while the other ends thereof engage the inner side of bar 287. It therefore is seen that any movement of pistons 279 and 280 to the left is opposed by springs 300 and 301. Secured to the outer side of bar 281 is a sliding member 292 suitably guided for reciprocation in bracket 76. Member 292 is provided with a longitudinal slot 293 which receives the outer end of an arm 294 secured to vertical shaft 75. Slot 293 provides a lost motion connection so as to permit adjustment of the sliding blocks 66 and 70 associated with cylinder body 31 by hand wheel 82 without disturbing motor 156. Cylinder 277 is provided with an enlarged opening 295, and a port 296 is provided therein. One end of a pipe 297 is fitted in port 296 while the other end thereof is attached to pipe 155 which, it will be remembered, is connected to extension 154, which communicates with the pressure in the system through its connection with pipe 151. Thus the fluid entering cylinder 277 through port 296 is the same as that in the system. Cylinder 278 is also provided with a port 298 in which is fitted one end of a pipe 299, the other end of said pipe being also connected to pipe 155. Pipes 297 and 299 are provided with valves 302 and 303, respectively, so that if it is desired to operate the transmission without the reversing motor 156 fluid from the system is simply shut off by means of these valves. Fig. 15 shows the position of pistons 279 and 280 and the elements associated therewith in normal position wherein it will be observed that fluid may always enter cylinder 277 while the port 298 of cylinder 278 is closed by piston 280. The device is constructed in this manner to permit pressure to build up in the system to a predetermined amount without effecting a reverse movement of sliding blocks 66 and 70. However, as this pressure exceeds this predetermined amount piston 279 will be actuated to the left against the tension of springs 300 and 301, and since piston 280 is connected to piston 279 by virtue of the connections previously described, it also will be moved to the left. When piston 280 has been moved sufficiently to uncover port 298 member 292 will have engaged arm 294 thereby rotating shaft 75 which in turn has been rocked sufficiently to move the sliding blocks 66 and 70 to neutral position through the connections described hereinbefore. If the pressure in the system becomes greater pistons 279 and 280 will now act in unison to further compress springs 300 and 301 thereby rocking shaft 75 still further with the result that sliding blocks 66 and 70 will be moved in the reverse direction from which they were adjusted by hand wheel 82, thereby causing a reversing operation of the mooring winch. When the pressure in the system falls off springs 300 and 301 will gradually restore pistons 279 and 280 to normal position, and shaft 75 will be rocked in the reverse direction causing sliding blocks 66 and 70 to assume the position occupied when adjusted by hand wheel 82. The mooring winch will then be operated to wind in the cable and continue drawing the ship into its mooring. By this construction a flexible control is provided which functions automatically to cause the winch to pay out cable when an excessive load is imposed upon the apparatus and also functions automatically to cause a renewal of the mooring operation when the pressures are reduced within the operating limits of the system. By this apparatus it is apparent that a craft may be moored safely regardless of weather conditions.

In order to bring out the structure and operation of the mooring apparatus comprising the present invention, it was necessary to describe in considerable detail the various elements thereof. A complete restatement of the operation of this device is therefore unnecessary. However, in order to co-relate the various elements of the apparatus a brief summary of the operation thereof will now be given.

Consider, for example, that the mooring device is to be employed to moor a dirigible, it is apparent that owing to the immense size and character of such craft, careful handling thereof is necessary. The sliding blocks 100, 108 and 109 (Fig. 14) associated with cylinder body 32 of the hydraulic transmission 2 are first adjusted so that the desired speed ratio between cylinder bodies 32 and 31 is obtained. The cable is then suitably attached to the dirigible and motor 4, which drives cylinder body 31, is energized. Sliding blocks 66 and 70 associated with cylinder body 31 are then adjusted by hand wheel 82, and fluid immediately begins to circulate through the various passages and central valve 29, fittings 117 and 118, and pipes 119 and 120, with the result that cylinder body 32 will be rotated at a predetermined rate of speed. The rotary movement of cylinder body 32 is transmitted to winding drum 12 of winch 1, through the planetary gear transmission 3, and the dirigible is consequently drawn toward its mooring. The planetary gear transmission 3 is normally adjusted for high speed operation so that the slack in the cable may be quickly taken up. This high speed operation is also desirable to enable mooring of the dirigible as quickly as possible during favorable conditions. Owing to the size of the dirigible it is obvious that in case a wind should arise it would render it more difficult to draw the same into its moorings. Referring to Figs. 1, and 6 to 11, the elements com-

prising the planetary gear transmission 3 and the control mechanism therefor, are shown in normal position. In this position of the parts spring motor 255 urges valve 233 (Fig. 10) to the right, causing the oil discharged from pump 230 to enter pipe 241. Pipe 241 communicates with the left hand end of cylinder 196 of fluid motor 197 (Fig. 6), thus causing the piston 195 operating therein to move to the right. This action of piston 195 rocks yoke 189 in a counterclockwise direction thereby causing sliding block 190 to move to the left. Shaft 188 which is secured to yoke 189 is also rocked to the left. Upon movement of sliding block 190 in this manner the shafts 211 for actuating brake band 208, associated with drums 198, will be rotated so as to cause nuts 216 and 217 thereon to release bands 208 and thereby permit rotation of drums 198, and consequently planetary gears 162 secured thereto for rotation. When shaft 188 is rocked to the left the bevel gear 187 secured thereto will actuate bevel gear 186 on shaft 183 so as to bring the low sides of cam 182 secured thereto, opposite the inner sides of portions 176 and 177 of brackets 173 and 174, which brackets, it will be remembered, are secured to brake bands 170 and 171 associated with drum 166. Spring 179 will then urge brake bands 170 and 171 into gripping engagement with drum 166. When the parts are in this position rotation of ring gear 55 by pinion 53, which in turn is driven by cylinder body 32, causes rotation of planetary gears 162. Planetary gears 162 mesh with idler gears 163 which in turn mesh with gear 164 secured to shaft 19. Since drum 166 is held against movement by brake bands 170 and 171, the planetary gears will rotate about fixed pivots, and driven gear 164 will be rotated at a comparatively high rate of speed. When the piston 195 has been moved to the right, further pumping of oil from pump 230 will cause a pressure to build up therein. This pressure is communicated to piston 274 which moves sliding block 231 of said pump to neutral position, thereby preventing further pumping action to take place. The mooring of the dirigible at this comparatively high rate of speed will continue until it encounters a resistance. Suppose a wind should arise which would tend to drive the dirigible away from its moorings it is obvious that the load on the hydraulic transmission would increase with the result that a pressure would be built up in the system. When this pressure reaches a predetermined amount piston 252 of fluid motor 158 (Fig. 10) will be moved to the left causing valve 233 to also be shifted to the left. By this action of valve 233, the pressure in pump 230 is reduced and spring 271 (Fig. 16) will urge sliding block 231 of pump 230 to the left and the pump will again discharge oil to valve 233. Since valve 233 has been shifted to the left, the oil discharged therefrom will now flow through pipe 242 and into the right hand end of cylinder 196 of motor 197 (Fig. 6) causing piston 195 to move to the left. This causes yoke 189 and shaft 188 to rock in a clockwise direction moving sliding block 190 to the right. Through the connections previously described nuts 216 and 217 operating on shafts 211 (Figs. 7 and 9) will be moved toward each other, and springs 222 and 223 will urge brake bands 208 into gripping engagement with their drums 198, thus holding planetary gears 162 against movement. The high sides of cam 182 will also engage portions 176 and 177 of brackets 173 and 174 to thereby release drum 166 for rotation. Drum 166 will now rotate with ring gear 55 carrying planetary gears 162 and idler gears 163 with it. Since these gears are now held against rotation by brake bands 208, driven gear 164 is rigidly connected with ring gear 55, and will rotate therewith. It therefore is seen that winding drum 12 will now be rotated at a greatly reduced rate of speed. When piston 195 is moved to the left further pumping of oil by pump 230 again causes a pressure to be built up therein which pressure is again communicated to piston 274 which returns sliding block 231 to neutral position thereby discontinuing further pumping action of pump 230.

Supposing now, that an extremely brisk wind should grip the dirigible tending to move it away from its moorings, it is obvious that a tremendous load would be imposed upon the apparatus. This would result in the building up of the pressure in the hydraulic system which would soon reach a danger point. In order to reduce the pressure in the system to prevent damage to the apparatus, a fluid motor 156 is provided which functions when such conditions arise to cause sliding blocks 66 and 70 associated with cylinder body 31 to be moved to neutral position or to a position opposite to that which they were originally adjusted by hand wheel 82 with the result that the discharge of the pump unit would be reversed. By reversing the discharge of the pump unit the direction of rotation of the motor unit and winding drum 12 is also reversed thereby causing the latter to pay out cable. Fluid motor 156 (Figs. 14 and 15) is provided with a pair of cylinders 277 and 278 in axial alignment. Pistons 279 and 280 operating respectively in cylinders 277 and 278 are connected for simultaneous movement, although only piston 279 is normally in communication with the pressure in the system, the port 298 of cylinder 278 being normally closed by the piston 280 operating therein. Cylinders 277 and 278 are connected to the pressure in the system through pipe 155. Springs 300 and 301 normally urge pistons 279 and 280 to the right, but when the pressure exceeds the tension of said springs piston 279 is urged to the left carrying piston 280 with it. When the pistons are moved in this manner sliding block 292 engages arm 294 secured to vertical shaft 75, thereby rocking said shaft in a clockwise direction overhauling hand wheel 82. Shaft 75 being connected to sliding blocks 66 and 70 through yokes 74, crossheads 73, and rods 71 and 72, will thereby actuate said sliding blocks toward neutral position. When pistons 279 and 280 have been moved sufficiently to cause the sliding blocks 66 and 70 to be adjusted to neutral position, piston 280 will have uncovered port 298, and the pressure in the system will now communicate with both pistons 279 and 280, and the combined effort thereof will rock shaft 75 still further causing sliding blocks 66 and 70 to move in the reverse direction from which they had been adjusted by hand wheel 82. The discharge of the pump unit will now be reversed causing the motor unit to rotate in the reverse direction with the result that winding drum 12 will also be rotated in the reverse direction and will now pay out cable, and thus permit the dirigible to move away from its moorings. When the wind subsides the load on the apparatus obviously is reduced and the pressure in the system falls off. When this occurs springs 300 and 301 will gradually return pistons 279 and 280 to normal position. This action also causes shaft 75 to be returned to the position occupied when adjusted by hand wheel 82, and sliding blocks 66 and 70 will consequently also assume their original po-

sition of adjustment. Winding drum 12 will now wind in the cable and again draw the dirigible toward its moorings.

If it is desired to begin the mooring operation at a low speed it is only necessary to shift valve 233 to the left by manipulating hand lever 248. The oil discharging from pump 230 will then flow through pipe 242 causing piston 195 of motor 197 to move to the left. This causes the planetary gear transmission 3 to be so conditioned as to drive winding drum 12 at a comparatively slow speed.

Oil is drawn into the hydraulic system for makeup purposes from makeup tank 125 by the pipe connections shown more particularly in Figs. 1 to 3. Oil is drawn into passages 89*a* and 89*b* of central valve 29 through pipes 121 and 129 which are connected to pipe 124, leading to makeup tank 125 through their connection with pipes 122 and 126, respectively. A similar set of pipes 141 and 134 connect passages 90*a* and 90*b* with makeup tank 125 through their connections with pipes 136, 135 and 138, the latter of which extending into makeup tank 125. Oil is drawn into the system through pipes 130 and 142 which enter branches 131 and 143, respectively, of fitting 117, said pipes being connected to pipes 126 and 136, respectively. By this piping arrangement the pressure of the oil flowing through the hydraulic system is also balanced.

While the form of mechanism herein described is admirably adapted to fulfill the objects primarily stated, it is to be understood, however, that it is not intended to confine the invention to the one form of embodiment herein shown, since it may be embodied in other forms, all coming within the scope of the claims which follow.

What is claimed is:

1. In a mooring device, the combination with a winch, a hydraulic transmission, variable speed gearing interposed between said hydraulic transmission and said winch, means associated with said gearing responsive to the pressure in said hydraulic transmission for effecting speed changes in said gearing, and control means responsive to pressure conditions in said transmission to effect reversal thereof when the pressure exceeds a predetermined maximum.

2. In a mooring device, the combination with a winch, a hydraulic transmission, a variable speed planetary gear transmission driven by said hydraulic transmission which in turn drives said winch, manual means for regulating the speed of said hydraulic transmission and automatic means for regulating the speed of said planetary gear transmission.

3. In a mooring device, the combination with a winch, a hydraulic transmission, a variable speed planetary gear transmission driven by said hydraulic transmission, and operatively connected to said winch, a fluid motor having a piston operating therein, means operated by said piston to change the speed ratio of said planetary gear transmission, a pump for actuating said piston, and an automatic control for pump so constructed and arranged that when said piston has been operated to either of its limiting positions said pump will be rendered inoperative.

4. In a mooring device, the combination with a winch, means for operating said winch, comprising a planetary gear transmission, said planetary gear transmission comprising a ring gear and a plurality of planetary gears and a driven gear, means associated with said planetary gears for holding the same against rotation, additional means for preventing revolving of said planetary gears, and automatic means for rendering said first mentioned means effective and ineffective and said second mentioned means ineffective and effective, respectively.

5. In a mooring device, the combination with a winch, a hydraulic transmission for driving said winch, manual means for regulating the speed of said hydraulic transmission, automatic means for effecting reversal of operation of said transmission when the pressure therein exceeds a predetermined maximum, said last mentioned means comprising a fluid motor operatively connected to the pressure in said transmission, said motor comprising a pair of spaced axially aligned ram cylinders, one of said cylinders being responsive to pressures in said system at all times and the other of said cylinders being rendered effective only when the pressure therein exceeds a predetermined maximum.

6. In a mooring device, the combination with a winch, means for driving said winch, comprising an hydraulic transmission and a planetary gear transmission, fluid pressure means for controlling the speed ratio of said planetary gear transmission, a pump for actuating said fluid means, a control for said pump for adjusting the latter to neutral position when said fluid means has been fully adjusted, said control means comprising a resilient means for placing the pump on stroke and fluid actuated means connected to the pressure side of said pump for restoring the pump to neutral position when the pressure therein reaches a predetermined amount.

7. In a mooring device, the combination with a winch, a variable speed reversible hydraulic transmission for actuating said winch, manual means for regulating the speed of said transmission, and automatic means for overhauling said manual means and reversing the operation of said transmission when the pressure therein exceeds a predetermined maximum, said automatic means comprising a fluid motor connected to the pressure in said transmission, spring means normally preventing operation of said motor, said motor being adapted to compress said spring when the pressure in the system exceeds a predetermined amount and a second fluid motor adapted to operate in conjunction with said first mentioned motor when said spring has been compressed a predetermined amount.

8. In a mooring device, the combination with a winch, means for driving said winch including a variable speed gear transmission comprising a ring gear and a plurality of planetary gears, means for holding said ring gear against rotation, additional means for holding said planetary gears against rotation, means for releasing either of said holding means to effect speed changes in said transmission, and a pressure actuated valve for controlling said last mentioned means.

9. In a mooring device, the combination with a winch, a hydraulic transmission for driving said winch, a variable speed gear transmission, automatic means for effecting speed changes in said gear transmission, said last mentioned means comprising a fluid motor having a piston operating therein, a valve controlling the operation of said piston, a pump for actuating said fluid motor and control means for said pump whereby when said piston is fully operated in either direction said pump will be rendered inoperative.

10. In a mooring device, the combination with a winch, means for operating said winch including a variable speed gear transmission, said

gear transmission comprising a ring gear, a plurality of planetary gears and a driven gear, a brake drum, means for mounting said planetary gears for rotation in said brake drum, a brake drum secured to each of said planetary gears, automatic means for releasing said planetary gears for rotation when said first mentioned brake drum is held against rotation, and to secure said planetary gears against rotation and simultaneously release said first mentioned drum for rotation, and a valve for controlling said automatic means.

11. In a mooring device, the combination with a winch, driving means for said winch including a planetary gear transmission, said planetary gear transmission comprising a ring gear, a plurality of planetary gears and a driven gear, a brake drum in which said planetary gears are mounted for rotation, a brake device associated with each of said planetary gears, means for rendering said brake devices effective and ineffective, said means including a rotatable shaft for each brake device, means provided on said shaft for rendering its associated brake device ineffective when said shaft is moved in one direction, and resilient means for rendering said brake device effective when said shaft is rotated in the opposite direction, and automatic means for actuating said shaft.

12. In a mooring device, the combination with a winch, driving means for said winch comprising a planetary gear transmission, said gear transmission comprising a ring gear, a plurality of planetary gears, and a driven gear, a brake drum, means for rotatably mounting said planetary gears in said brake drum, brake means for said drum, and a brake device associated with each of said planetary gears, means for rendering said brake devices effective and ineffective and said brake means ineffective and effective, respectively, a fluid motor for actuating said means, a pump for operating said fluid motor, and a valve for controlling the operation of said fluid motor.

13. In a mooring device, the combination with a winch, means for driving said winch including a hydraulic transmission and a planetary gear transmission, means for effecting speed changes in said planetary gear transmission including a fluid motor, a pump for actuating said fluid motor, a valve for controlling the flow of fluid from said pump to said motor, resilient means for urging said valve in one direction and means actuated by the pressure in said hydraulic transmission for urging said valve in the opposite direction and control means for said pump including a spring plunger normally conditioning said pump for operation and a fluid motor connected to the pressure side of said pump, said parts being so constructed and arranged that when said first mentioned fluid motor means has been fully operated to effect a speed change in said planetary gear transmission said second mentioned fluid motor will be actuated by the pressure of said pump to render said pump ineffective.

14. In a mooring device, the combination with a winch, means for driving said winch including a hydraulic transmission, manual means for conditioning said hydraulic transmission for operation, automatic means for rendering said transmission inoperative when adjusted to a certain position and for reversing the direction of rotation of said transmission when moved to another position, and means associated with said transmission for balancing the pressure therein and for permitting fluid to be drawn therein for makeup purposes.

15. In a mooring device, the combination with a hydraulic transmission having a pump unit and a motor unit provided within a common casing, means for adjusting said pump unit to discharge fluid to said motor unit, thereby causing operation of the latter, automatic means associated with said pump unit to render the latter inoperative when moved to one position and to cause reversal of the discharge of said pump when moved to another position, said means comprising a pair of fluid motors having pistons operating therein, resilient means, normally opposing the movement of said pistons in one direction, one of said pistons being normally connected to the pressure in said transmission and rigidly connected to the other of said pistons, said parts being so constructed and arranged that when the pressure of the fluid in the system exceeds the tension of said resilient means, the pressure communicated first to one of said pistons will operate the latter to render said pump unit ineffective and the pressure will then be communicated to both of said pistons to reverse the discharge of said pump unit.

16. In a mooring device, the combination with a winch, variable speed mechanism for driving said winch, comprising a ring gear and a plurality of planetary gears, means for holding said ring gear against rotation, additional means for holding said planetary gears against rotation, automatic means for releasing either of said holding means to effect speed changes in said mechanism including a valve, pressure means for actuating said valve in one direction whereby said means will be actuated to condition said mechanism to operate said winch at one rate of speed and resilient means for actuating said valve in another direction whereby said means will condition said mechanism to drive said winch at another rate of speed.

17. In a mooring device, the combination with a winch, variable speed mechanism for operating said winch, fluid motor means for conditioning said mechanism for operation, a valve controlling said fluid motor, resilient means normally urging said valve in one direction whereby said fluid motor will condition said mechanism for one rate of speed and fluid pressure means for actuating said valve in another direction to cause operation of said fluid motor in the reverse direction to condition said mechanism for another rate of speed.

18. In a mooring device, the combination with a winch, a variable speed mechanism for operating said winch, a fluid motor having a piston operating therein for conditioning said mechanism for operation, a valve for controlling the operation of said fluid motor, resilient means for urging said valve in one direction whereby said piston will be moved in one direction to condition said mechanism to drive said winch at a comparatively high rate of speed, and pressure means for actuating said valve in another direction whereby said piston will be operated in the reverse direction to condition said mechanism to drive said winch at a comparatively low rate of speed, connections from said valve to said fluid motor, passages provided within said valve communicating with said connections, and a discharge outlet communicating with one of said passages, said parts being so constructed and arranged that when said piston is moved in either

direction the fluid displaced thereby will be conducted to said passages in said valve and discharged therefrom through said discharge outlet.

19. In a mooring device, the combination with a winch, variable speed mechanism for operating said winch, means for conditioning said mechanism for variable speed operation including a fluid motor having a piston operating therein, a pump for operating said fluid motor, a valve controlling the operation of said motor, resilient means for urging said valve in one direction whereby said pump will actuate said motor in one direction to condition said mechanism for a given rate of speed, and pressure means for actuating said valve in another direction whereby said motor will be actuated by said pump in the reverse direction to condition said mechanism for another rate of speed, connections from said valve to said motor and means provided in said valve through which the fluid displaced by movement of said piston in either direction is discharged.

20. In a mooring device, the combination with a winch, mechanism for operating said winch including a hydraulic transmission and a variable speed gear mechanism, said hydraulic transmission comprising a motor unit and pump unit, manual means for controlling the speed of operation of said motor unit, manual means for regulating the discharge of said pump unit, and automatic means for rendering said pump unit inoperative when moved to one position and for reversing the discharge of said pump when moved to another position.

21. In a mooring device, the combination with a winch, means for operating said winch including an hydraulic transmission, said transmission comprising a pump and a motor driven by said pump, said pump and motor each having a cylinder body and one or more pistons operating therein, and means for adjusting the stroke of the pistons of said motor to vary the speed of operation of said motor.

22. In a mooring device, the combination with a winch, means for operating said winch including an hydraulic transmission, said transmission comprising a pump and a motor driven by said pump, said pump and motor each having a rotatable cylinder body, and one or more pistons operating therein, means for adjusting the stroke of the pistons of said pump to vary the speed of rotation of said motor, and additional means for adjusting the stroke of the pistons for said motor to further vary the speed of rotation of said motor.

23. In a mooring device, the combination with a driven member, driving means for said driven member including a planetary gear transmission, said planetary gear transmission comprising a ring gear, and a plurality of planetary gears, means for holding the ring gear against rotation, additional means for holding said planetary gears against rotation, means for rendering said holding means effective and ineffective, said means including a rotatable shaft for each of said holding devices, means provided on each shaft for rendering its associated holding devices ineffective when said shaft is moved in one direction, and resilient means for rendering said holding means effective when said shaft is rotated in the opposite direction, and means for actuating said shafts.

24. In a mooring device, the combination of an hydraulic transmission, manual means for conditioning said hydraulic transmission for operation, automatic means for rendering said transmission inoperative when adjusted to one position, and for reversing the direction of rotation of said transmission when moved to another position, said means comprising a plurality of fluid motors, means for connecting one of said fluid motors to the pressure in said transmission so as to respond to each change in pressure therein, and means for connecting another of said fluid motors to the pressure in said transmission so as to respond to the pressure therein only when it exceeds a predetermined value.

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