May 25, 1965 A. L. BOMBERGER 3,184,991

STEERING CONTROL

Filed Dec. 23, 1960 2 Sheets-Sheet 1

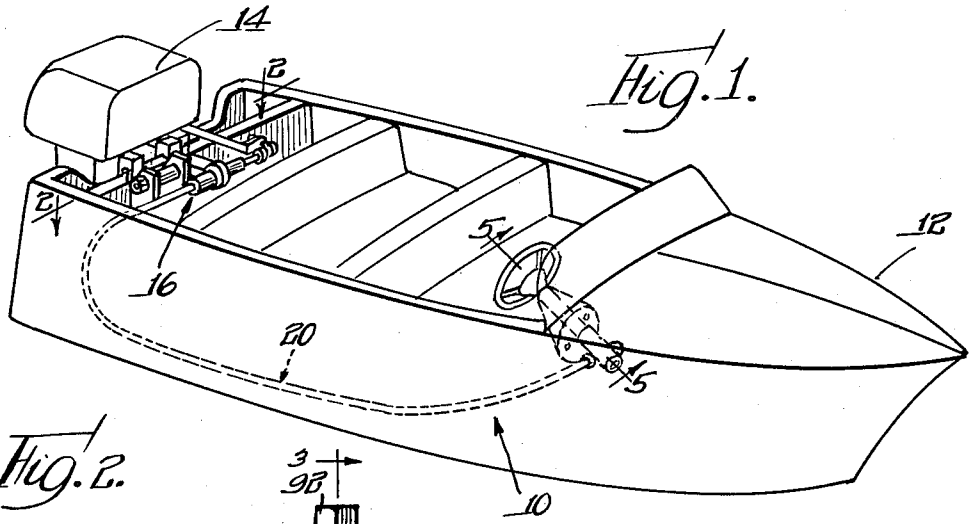


Fig. 1.

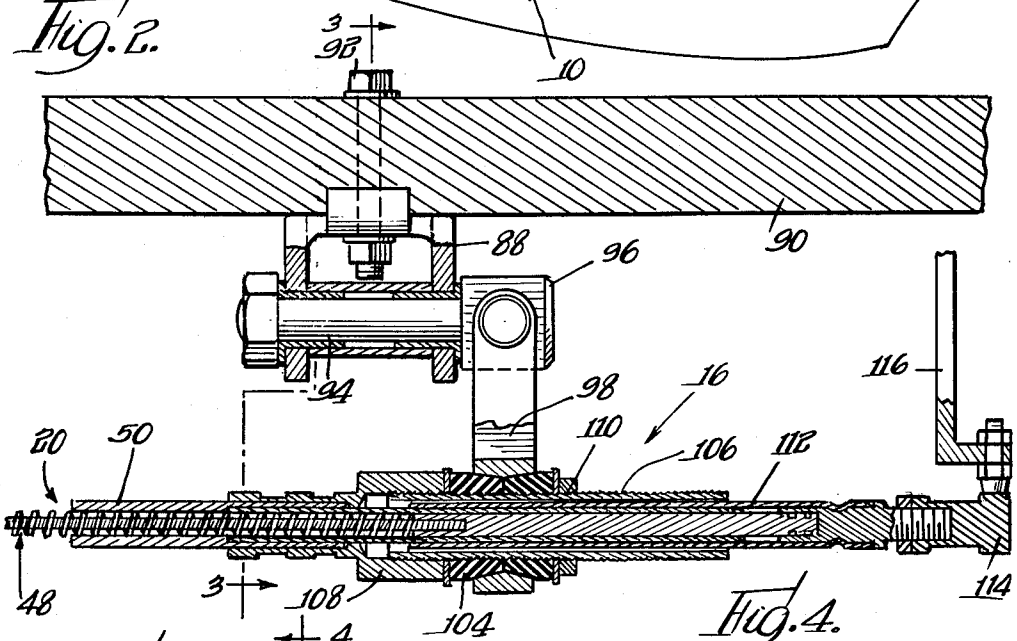


Fig. 2.

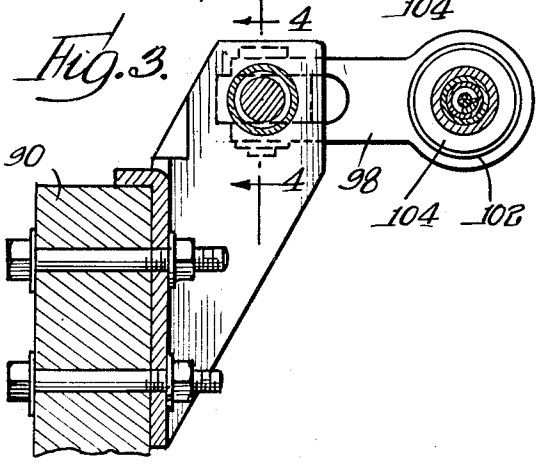


Fig. 3.

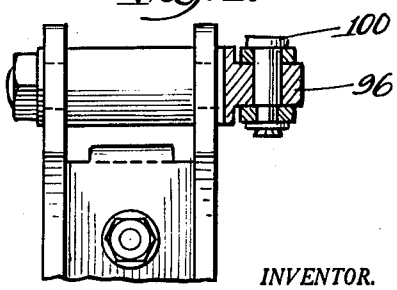


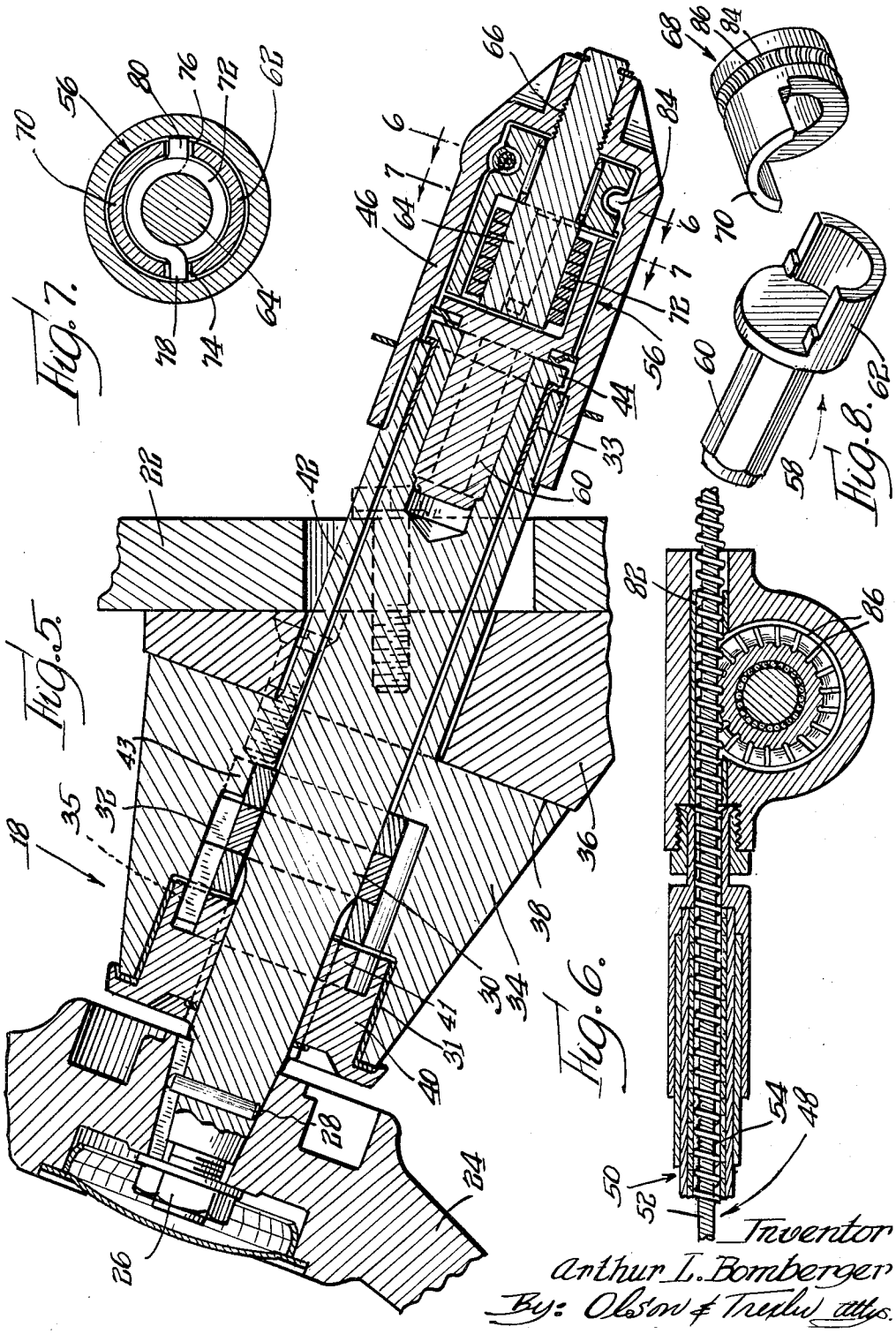
Fig. 4.

INVENTOR.
Arthur L. Bomberger
BY:
Olson & Treyler
attys.

May 25, 1965 A. L. BOMBERGER 3,184,991

STEERING CONTROL

Filed Dec. 23, 1960 2 Sheets-Sheet 2



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1

3,184,991

STEERING CONTROL

Arthur L. Bomberger, Philadelphia, Pa., assignor to Teleflex Incorporated, North Wales, Pa., a corporation of Delaware

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The present invention relates to a novel apparatus for turning or controlling a member and more particularly to a novel apparatus which is especially suitable for use as a marine steering control.

An important object of the present invention is to provide a novel marine steering control apparatus which is efficient and reliable in operation and which may be easily installed.

Another object of the present invention is to provide a novel control apparatus for turning or shifting a member easily in response to actuation by an operator and which is adapted effectively to lock the member in the desired turned or adjusted position in the absence of an actuating force applied to the apparatus by the operator.

Still another important object of the present invention is to provide a novel marine steering control apparatus utilizing a push-pull elongated element having teeth means spaced therealong and a cooperable driving gear element engageable with said teeth means and constructed so as to materially increase the reliability of the apparatus and the loads which may be transmitted between the gear element and the push-pull element.

Other objects and advantages of the present invention will become apparent from the following description and the accompanying drawings wherein:

FIG. 1 is a perspective view showing a boat having a steering apparatus incorporating features of the present invention installed therein;

FIG. 2 is an enlarged fragmentary sectional view taken generally along line 2—2 in FIG. 1;

FIG. 3 is a fragmentary sectional view taken along line 3—3 in FIG. 2;

FIG. 4 is a fragmentary sectional view taken along line 4—4 in FIG. 3;

FIG. 5 is an enlarged fragmentary sectional view taken along line 5—5 in FIG. 1;

FIG. 6 is a fragmentary sectional view taken along line 6—6 in FIG. 5;

FIG. 7 is a sectional view taken along line 7—7 in FIG. 5; and

FIG. 8 is an exploded perspective view showing complementary elements of clutch means included in the apparatus of the present invention.

Referring now more specifically to the drawings wherein like parts are designated by the same numerals throughout the various figures, a control apparatus 10 incorporating features of the present invention is shown installed in a boat 12 in FIG. 1. With the structure shown for the purpose of illustrating the present invention, the apparatus is adapted to turn an outboard motor 14 but it is to be understood that the apparatus may be adapted for turning or controlling various other members. In general, the apparatus 10 comprises a unit 16 adapted to be mounted adajacent to and connected to the member to be turned or controlled, a unit 18 adapted to be mounted as a remote location and a control cable and conduit assembly 20 extending between and connected to the units 16 and 18. In the embodiment shown, the unit 18 is secured to a dashboard 22 of the boat 12.

The unit 18 comprises a steering wheel 24 which is fixed by means of a nut 26 and a pin 28 or any other suitable means to an outer end portion of a shaft 30. The shaft 30 is rotatably supported by suitable bearing means 31 and 33 mounted within a housing member 34 which in turn is fixed to a bracket 36 mounted on the dashboard 22.

2

The shaft 30 is preferably inclined upwardly from the dashboard and this is accomplished by providing the bracket 36 with a suitably inclined surface 38 against which the housing 34 is mounted. It will be appreciated that the unit 18 may be adapted for installation on dashboards of different boats having various angles of inclination by substituting bracket members 36 having differently inclined surfaces 38. A housing cap 40 with stop lug is fixed to the shaft 30 for limiting angular and axial movement thereof. Travel rings 32 with axially and radially protruding lugs 35 are disposed between shaft 30 and housing 34. These rings provide a predetermined limited amount of rotation of shaft 30 when they are collected by the stop lug 41 within housing cap 40 which moves them via their lugs 35 from one side of the stop lug 43 in housing 34 to the opposite side of said lug.

As shown in FIG. 5, a lower end portion of the shaft 30 extends through aligned openings in the bracket 36 and dashboard 22 and the housing 34 is provided with a tubular extension 42 which also extends through these openings and surrounds the lower end portion of the shaft. A radially extending flange 44 is provided at the lower end of the shaft 30 for cooperation with the lower end of the housing extension 42 for limiting upward axial movement of the shaft. A complementary housing member 46 is secured to and extends from the lower end of the housing extension 42 for enclosing means to be described below which serves to connect the unit 18 with the cable and conduit assembly 20.

As indicated in FIGS. 2 and 6, the cable and conduit assembly 20 comprises an inner axially shiftable flexible cable 48 and an outer guide conduit 50. The cable 48 comprises a central flexible core 52 which may be formed from one or more wires or other suitable elements. Teeth 54 are disposed in axially spaced relationship along and project radially from the core 52. which teeth are preferably formed by wrapping a wire helically with spaced apart coils around the core 52. The guide conduit 50 is preferably flexible and may be of various known constructions. Reference is made to a co-pending application Serial No. 771,984, filed November 5, 1958, now Patent No. 3,063,303, for a preferred construction for the guide conduit 50.

The above mentioned means within the housing member 46 for connecting the unit 18 with the cable 48 comprises a drive-brake structure 56 constructed in accordance with a feature of the present invention. The drive-brake structure is adapted to drivingly connect the shaft 30 with the cable 48 when an operator turns the wheel 24 to rotate the shaft and lockingly to connect the cable 48 to the fixed housing member 46 when the motor 14 applies a force tending to shift the cable axially. In other words, the structure is such that an operator may readily shift the cable axially in opposite directions merely by turning the steering wheel in opposite directions. However, if the operator relaxes his grip on the wheel or leaves the wheel unattended, the cable 48 and thus the motor 14 will be effectively locked in the position in which they have been manipulated by the operator.

The drive-brake structure 56 which is shown in whole and in part in FIGS. 5–8 comprises a first member 58 having an axially extending shank 60 which fits into the shaft 30 and turns with same. The member 58 also includes an elongated generally semi-cylindrical flange 62 extending axially along one side of the housing member 46. The flange 62 partially surrounds and is radially spaced from an end portion of a fixed shaft 64 which is secured to an end 66 of the housing member 46. A combined gear and driven member 68 is rotatably disposed on the fixed shaft 64. This member includes an axially extending generally semi-cylindrical flange 70 which is

essentially identical to but disposed oppositely from the flange 62.

A helical spring 72 is coiled closely around the shaft 64 between the flanges 62 and 70. As shown in FIG. 7 the flanges 62 and 70 are formed so that their longitudinally extending edges are spaced apart to provide slots 74 and 76 therebetween. Opposite ends of the spring 72 are respectively turned outwardly in opposite directions to provide lugs 78 and 80 extending into the slots 74 and 76. The arrangement and formation of the coil spring 72 is such that when the shaft 30 is rotated so as to turn the flange 62 and force it against the lug 78, there is a tendency to unwind the coiled spring whereby the internal diameter of the spring tends to increase for enabling the spring to rotate freely around the fixed shaft 64. Continued movement of the flange 62 in the above mentioned direction advances the lug 78 against the adjacent margin of the flange 70 so that the member 68 is driven. When an operator turns the wheel 24 and shaft 30 in an opposite direction, a similar action takes place but, of course, the flange 62 is urged against the lug 80 which in turn engages and drives the flange 70 and the gear 68 in said opposite direction.

As distinguished from the function described in the preceding paragraph, it is to be noted that whenever there is a force applied to the combined driven and gear member 68 by the cable 48 which tends to rotate the member, the flange 70 will be urged or rotated into engagement with one or the other of the lugs 78 and 80. The arrangement is such that regardless of which of the lugs the flange 70 is forced against, there will be a tendency to twist or coil the spring more tightly around the shaft 64. This action causes the spring to be locked with respect to the shaft 64, which shaft is fixed against rotation with respect to the housing member 46 and thus the boat dashboard 22. Since the spring is unable to rotate around the shaft 64, the combined driven and gear member 68 will also be locked or braked against rotation.

As shown best in FIG. 6, the housing member 46 includes a transversely extending guide passageway 82 for receiving and supporting an end portion of the cable 48 in meshing relationship with the member 68. The cable 48 is, in effect, an elongated flexible rack of circular cross-section having a predetermined pitch diameter. The member 68 is provided with a peripheral groove 84 for receiving the cable or flexible rack, which groove is defined by circumferentially spaced and generally radially extending teeth 86 formed for meshing with the helical tooth elements 54 of the cable. In accordance with a feature of the present invention, the depth of the groove 84 is greater than the radius of the cable or flexible rack element 48 and the teeth 86 are formed so that they extend along opposite sides of the cable and engage the tooth elements 54 at opposite sides of the cable and not only inwardly of a plane containing the pitch diameter of the cable but also outwardly of the plane. In other words, the teeth 86 are provided with involute extensions projecting and engaging the cable teeth beyond the pitch diameter of the gear member 68. It has been found that this specific structure distributes the load transmitted between the cable and the wheel or gear over a greater number of gear teeth and cable teeth. Furthermore, it is believed that the rolling action of the gear involute teeth against the cable helices or teeth 54 at points beyond the pitch diameter of the gear tends to keep the cable properly in engagement or mesh with the gear teeth. In any event, it has been found that the structure provides greatly increased cycle life for a given load as compared with an apparatus wherein the gear teeth do not extend outwardly of the pitch diameter of the gear. A substantial increase is also obtained in the maximum dynamic load which may be transmitted between the cable and the wheel or gear.

The unit 16 comprises a bracket 88 adapted to be fixed to the transom 90 of the boat by suitable bolt means 92 in the manner shown. In certain installations the bracket alternatively may be secured to a side portion of the boat. A shaft 94 is supported for pivotal movement about a horizontal axis by the bracket 88. The shaft 94 is provided with an enlarged end portion 96 having its opposite sides flattened as shown best in FIG. 4. The end portion 96 is embraced by a bifurcated end portion of an arm 98 which is connected to the end portion 96 for pivotal movement about an axis perpendicular to the axis of the shaft 94 by a pin 100.

The arm 98 is provided with an enlarged centrally apertured outer end portion 102 in which is disposed a tubular bushing 104 formed of rubber or other suitable resilient material. A sleeve 106 extends through the bushing. A fitting 108 has one end portion crimped or otherwise suitably secured to an end of the guide conduit 50. An opposite end portion of the fitting 108 is threaded onto an end of the sleeve 106 and abuts one end of the resilient bushing 104. A nut member 110 is threaded onto the sleeve 106 and abuts the opposite end of the bushing 104. The nut member 110 is tightened against the end of the bushing so that the bushing is clamped between the nut member and the fitting 108 with sufficient force to cause axial collapsing of the resilient bushing which forces the bushing into tight gripping engagement with the sleeve 106. A rod 112 is slidably disposed within the sleeve 106. One end of the rod 112 is crimped to or otherwise fixed to an end of the cable 48 and an opposite end of the rod is connected by means of a suitable fitting 114 to a steering lever 116 of the motor 14.

It will be appreciated that when the steering wheel 24 is turned, the cable 48 will be actuated so as axially to shift the rod 112 which in turn pivots or swings the lever 116 to turn the motor. During such swinging movement of the lever 116, the arm 98 which supports the sleeve 106 pivots around the axis of the pin 100 and, if necessary, the shaft 94 may pivot slightly around its axis so that the sleeve 106 is always positioned properly with respect to the lever 116. Furthermore, the pivotal and adjustable support provided by the shaft 94 and the arm 98 for the sleeve 106 greatly facilitates initial installation of the apparatus since it eliminates any need for mounting and aligning the support with great precision relative to the motor turning lever.

While the preferred embodiment of the present invention has been shown and described herein, it is obvious that many structural details may be changed without departing from the spirit and scope of the appended claims.

The invention is claimed as follows:

1. A marine steering control comprising a rotatable steering shaft, a rotatable toothed member disposed adjacent said shaft, fixed means rotatably supporting said shaft and said member, a toothed element meshing with said toothed member and connectable with a member to be turned, and means between said shaft and said toothed member and located between parts of said fixed means for drivingly connecting said shaft to said toothed member when said shaft is rotated in either direction in response to torque applied thereto, and brake means for locking said toothed member with respect to said fixed means upon any tendency of said toothed member to rotate in response to torque applied thereto by said toothed element.

2. A control, as defined in claim 1, wherein said shaft and said toothed member are disposed for rotation about a common axis, and said connectting means includes a first projection extending in the direction of said axis from said rotatable shaft at one side of said axis, a second projection extending in the direction of said axis from said toothed member along an opposite side of said axis, one of said parts being a member secured to said fixed means and extending between said projections, and a coiled spring wound closely around said member and including opposite end portions projecting generally radially out-

wardly in opposite directions and between said projections for engagement with said projections.

3. A control, as defined in claim 2, wherein said toothed element comprises an elongated flexible rack extending from said toothed member substantially to said element to be controlled.

4. A marine steering control comprising a rotatable steering shaft disposed at a location remote from an element to be controlled, a rotatable gear disposed adjacent said shaft, fixed means supporting said shaft and said gear, a flexible rack having a generally circular transverse cross-section of predetermined diameter and meshing with said gear and extending from said gear substantially to said element to be controlled, a guide member disposed adjacent said element to be controlled, a connecting member slidable in said guide member and connected to said rack for connectting the rack to said element to be controlled, means mounting said guide member for adjustment around a pair of generally right angularly disposed axes for enabling the guide member to be positioned properly with respect to said element to be controlled, and means between said steering shaft and said gear and located between parts of said fixed means for drivingly connecting said shaft to said gear when the shaft is rotated in either direction in response to torque applied thereto, and brake means for locking said gear with respect to said fixed means upon any tendency of said gear to rotate in response to torque applied thereto by said flexible rack.

5. A steering control, as defined in claim 4, wherein said fixed means comprises a housing structure mountable to a fixed portion of a boat, said steering shaft having an outer end portion extending outwardly of said housing means for connection to means for turning the shaft such as a steering wheel, said gear being aligned with and spaced axially from an inner end of said steering shaft, said housing means including a portion extending past the inner end of said shaft and around said gear, and said connecting means including a first hollow generally semi-cylindrical flange fixed with respect to and extending from said inner end of said shaft, a second hollow generally semi-cylindrical flange fixed with respect to and extending from said gear toward said inner end of the shaft and oppositely disposed from said first mentioned flange, one of said parts being a shaft threadably secured to said housing means and extending between said flanges, and a spring element coiled snugly around said shaft and including opposite end portions extending laterally outwardly in opposite directions between said first and second flanges.

6. A control, as defined in claim 4, wherein said gear comprises annular groove means defined by circumferentially spaced teeth for receiving and engaging said flexible rack, said groove means having a depth greater than a radius of said rack for promoting greater engagement between the gear and the rack.

7. A control of the type described comprising a rotatable member adapted to be turned for actuating the control, a gear member adjacent said rotatable member and operatively connectible with an element to be controlled, an elongated rack having a circular transverse cross section of predetermined radius and including axially spaced circumferentially extending toothed elements, said gear member having an annular groove defined by circumferentially spaced toothed elements for receiving and meshing with said rack, said groove having a depth greater than said radius of said rack and having a generally U-shaped transverse cross section with an arcuate

lower portion having a radius similar to said predetermined radius of the rack, said toothed elements of said gear member extending substantially the full depth of said groove for promoting more extensive engagement between said toothed elements of said gear member and said toothed elements of said rack, fixed means rotatably supporting said rotatable member and said gear member, and means between said members and located between parts of said fixed means for drivingly connecting said rotatable member to said gear member when said rotatable member is turned in either direction in response to torque applied thereto, and brake means for locking said gear member with respect to said fixed means upon a tendency of said gear member to rotate in response to force applied thereto by said element to be controlled.

8. A control of the type described comprising a first rotatable member adapted to be turned for actuating the control, a second rotatable member adjacent said first member and axially aligned and spaced therefrom, said second rotatable member being operatively connectible with an element to be controlled, fixed means rotatably supporting said members, means between said members and located between parts of said fixed means for drivingly connecting said first member to said second member when said first member is turned in either direction in response to torque applied thereto, one of said parts being a nonrotatable shaft extending between and axially aligned with said first and second rotatable members, a first element fixed with respect to said first rotatable member and extending along one side of said shaft, a second element fixed with respect to said second rotatable member and extending along and opposite of said shaft, said elements having marginal edges spaced from each other for defining first and second slots therebetween and a spring element coiled snugly around said shaft and including opposite end portions projecting laterally outwardly in opposite directions and respectively into said first and second slots for locking said second member with respect to said fixed means upon a tendency of said second member to rotate in response to torque applied thereto by said member to be controlled.

References Cited by the Examiner

UNITED STATES PATENTS

823,971	6/06	Remondy	192—8
1,076,460	10/13	Simmons	74—49 XR
1,491,490	4/24	Newton	74—424.6
1,495,426	5/24	Myers.	
1,609,300	12/26	Nicholson	192—8
1,791,644	2/31	Sneed	74—501 XR
2,347,010	4/44	Ward et al.	74—501 XR
2,496,785	2/50	Finneburgh	74—501 XR
2,665,904	1/54	Lehmann	74—501 XR
2,890,593	6/59	Brouse	74—507 XR
2,901,910	9/59	Wandell et al.	74—501 XR
2,947,278	8/60	Magill et al.	192—8 XR
2,957,352	10/60	Pierce	192—098
2,961,986	11/60	Rockhill	74—498 X
3,021,722	2/62	Bratz et al.	74—502 X
3,039,420	6/62	Bevis et al.	115—18
3,063,303	11/62	Cadwallader	74—501
3,063,305	11/62	Ensinger	74—501 X

FOREIGN PATENTS

437,194	10/35	Great Britain.
357,300	11/61	Switzerland.

BROUGHTON G. DURHAM, *Primary Examiner.*