Nov. 13, 1962 H. R. NUSBAUM 3,063,679

REEL

Filed Dec. 29, 1958 3 Sheets-Sheet 1

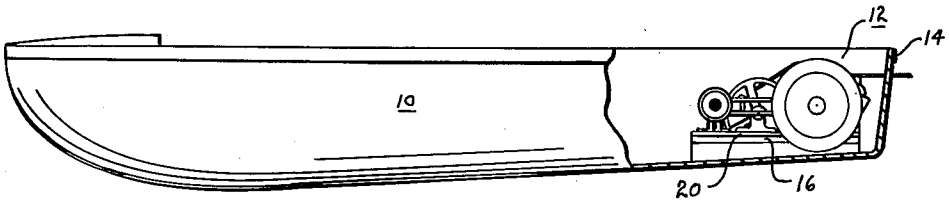


FIG. 1

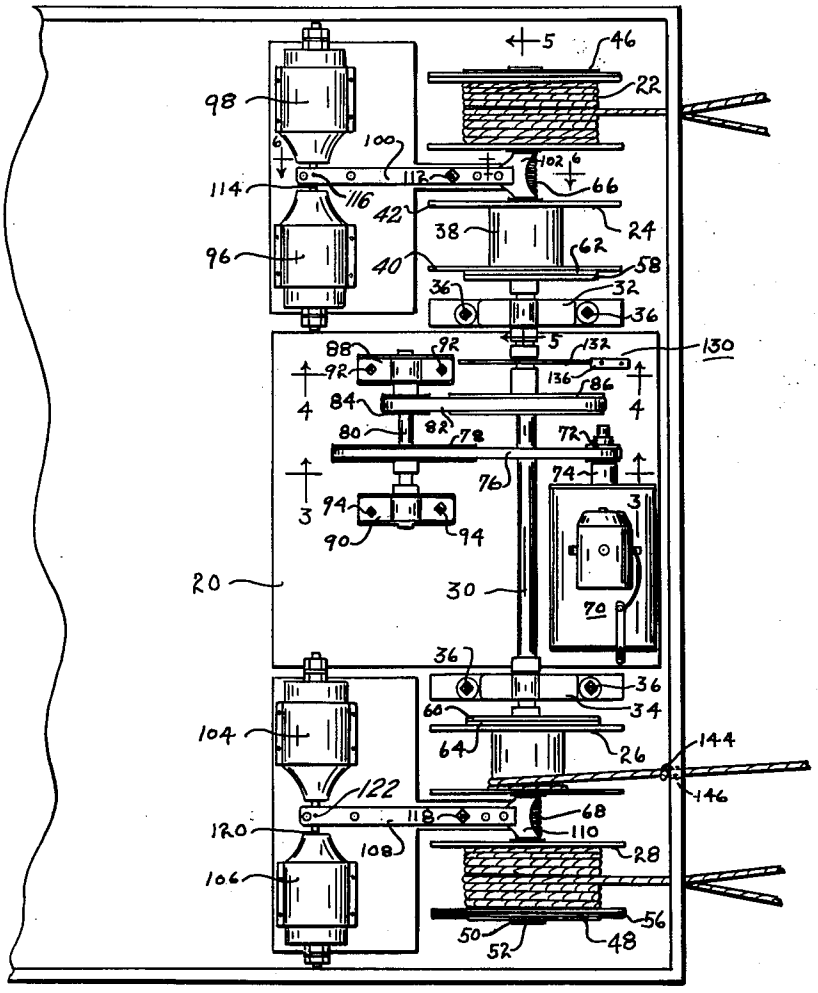


FIG. 2

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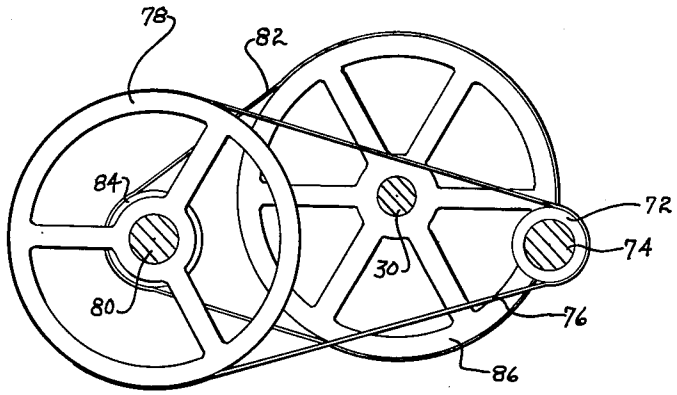


FIG. 3

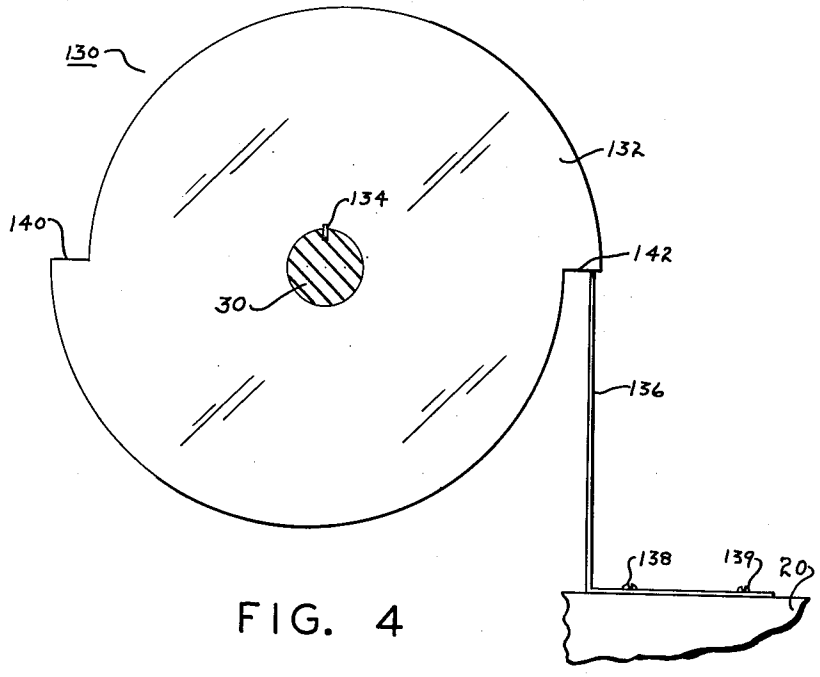


FIG. 4

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REEL

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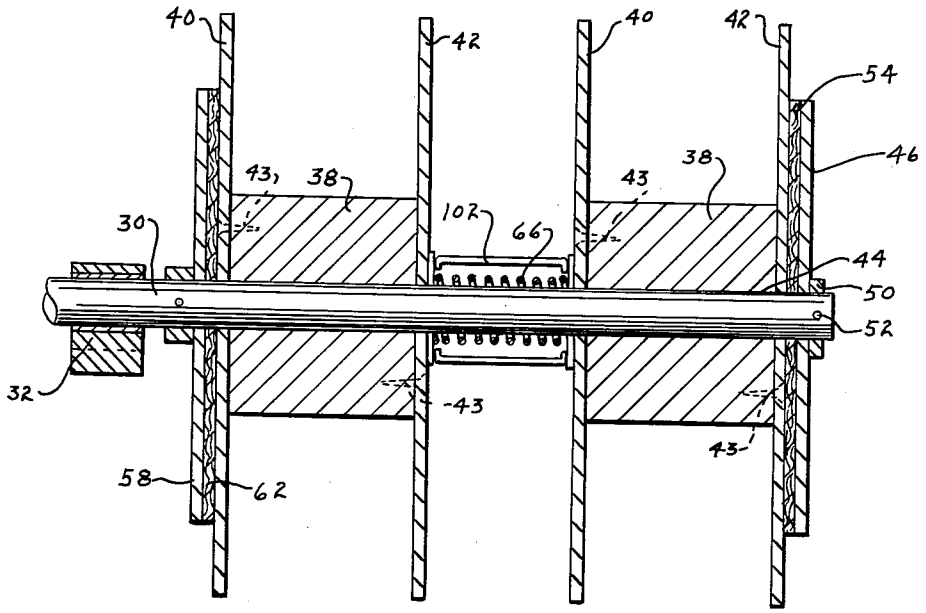


FIG. 5

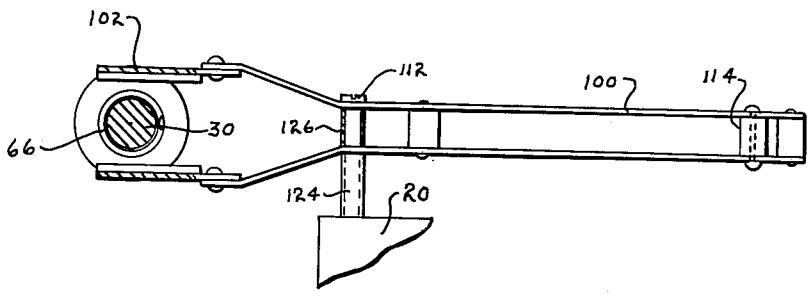


FIG. 6

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REEL

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7 Claims. (Cl. 254—185)

The present invention relates to reels for winding rope, and more particularly to a reel apparatus for winding and unwinding rope for use in water skiing and the like.

One of the principal objects of the present invention is to provide a multiple reel apparatus for handling a plurality of ski tow ropes behind a boat, in which a single mechanism is used to wind the ropes either one at a time or two or more simultaneously, and which can be controlled at a place in the boat remote from the apparatus.

Another object of the invention is to provide a power driven multiple reel apparatus for ski towing ropes, the reels of which can be operated individually or in any combination, and in which the force applied to the individual reels can be readily controlled to meet the various operating conditions.

Still another object of the invention is to provide a power driven multiple reel apparatus for ski tow ropes, having a remotely controlled variable braking action and a controlled variable rewind force.

A further object is to provide a multiple reel apparatus for water skiing ropes, which can be readily installed in conventional outboard and inboard motor boats and which can be easily operated without any special skills or training.

Another object of the invention is to provide a power driven multiple reel apparatus for use in the water skiing sport, in which one reel can be operated to rewind a tow rope and another reel simultaneously operated to unwind a tow rope.

Another object of the invention is to provide a reel of the aforesaid type which can be installed on a boat without the use of any special tools or equipment and which can thereafter be safely operated and easily serviced by unskilled operators.

Additional objects and advantages will become apparent from the following description and accompanying drawings, wherein:

FIGURE 1 is a side elevational and partial cross sectional view of an outboard motor boat, showing my reel apparatus in elevation installed therein;

FIGURE 2 is a top plan view of my reel apparatus installed in a boat, a fragmentary top plan view of the boat being shown;

FIGURE 3 is a vertical cross sectional view of my reel apparatus taken on line 3—3 of FIGURE 2;

FIGURE 4 is a vertical cross sectional view of my reel apparatus taken on line 4—4 of FIGURE 2;

FIGURE 5 is an enlarged cross sectional view of a portion of the apparatus taken on line 5—5 of FIGURE 2; and

FIGURE 6 is an enlarged cross sectional view of a portion of the apparatus taken on line 6—6 of FIGURE 2.

Referring more specifically to the drawings, numeral 10 designates an outboard motor boat, having a section thereof broken away to show the present reel apparatus 12 installed in operationg position in the rear of the boat, the outboard motor (not shown) of any conventional or well known type being mounted on the transom 14 to the rear of the boat. The particular kind of boat shown in the drawings is merely for the purpose of ilustrating the present invention which can be as satisfactorily used in conjunction with inboard motor type boats and various other types of outboard motor boats. The present apparatus is shown mounted on and secured to a platform or rear seat 16 which forms a secure anchor for the apparatus.

The operating mechanism of the reel apparatus is mounted on a base 20 which seats on and is secured to the platform or rear seat and includes in the present embodiment of the invention four spool-like reels 22, 24, 26 and 28 rotatably journalled on a main shaft 30 extending the full length of the apparatus and journalled in bearings 32 and 34. These bearings which may be of the plain, ball or roller type are secured firmly to base 20 by bolts 36. Each reel consists of a hub 38 and disc-shaped sides 40 and 42 secured rigidly to the hub by a plurality of screws 43, and an axial hole 44 for receiving shaft 30, the parts of the hub and sides defining hole 44 forming a bearing for relative rotation between the respective reel and shaft 30. Secured on opposite ends of shaft 30 for rotation therewith are clutch plates 46 and 48 held firmly on the shaft by an integral flange 50 and a pin 52 extending through the shaft and opposite sides of the flange. Plates 46 and 48 adjacent the respective reel are provided with friction layers 54 and 56, which are preferably cemented or otherwise secured to plates 46 and 48 and are adapted to grip the adjacent side of the reels as the latter are moved axially on shaft 30 into engagement with the plates. Secured on shaft 30 inwardly from reels 24 and 26 are clutch plates 58 and 60 with friction layers 62 and 64 interposed between the respective clutch plates and reels, said layers preferably being secured to the faces of the plates.

In the embodiment shown in the drawings, reels 22 and 24 are urged apart and into engagement with the respective clutch plates by a coil spring 66 mounted on shaft 30 between the two reels and reacting between the adjacent faces of the reels. A similar spring 68 is mounted on the shaft between reels 26 and 28 and urges the reels against clutch plate 58 and 60. These two springs place a slight drag on the reel to prevent back lash and accidental partial rewinding of the rope as a result of sudden release of pull on the rope during the unwinding operation. The amount of force applied by the springs is not sufficient to prevent relatively free rotation of the reels on shaft 30 when the tow rope is being pulled outwardly behind the boat.

The reels are operated to wind the tow ropes by a motor 70 positioned near the center of shaft 30 and operatively connected thereto by a pulley 72 on motor shaft 74, belt 76 on pulley 72 and a pulley 78 secured to shaft 80 and belt 82 on pulleys 84 and 86 secured to shafts 80 and 30, respectively. The series of pulleys forms a speed reduction mechanism between motor 70 and shaft 30. The motor is rigidly mounted on base 20 and shaft 80 is journallel in bearings 88 and 90 which is turn are rigidly secured to the base by bolts 92 and 94, respectively. The motor is normally operated only when one or more tow ropes are to be wound on the reel; however, only those reels are operated by the motor having at least a partially unwound and unused rope.

Under certain conditions of operation a tow rope may be pulled in from behind the boat with relatively little force, requiring only the pressure of spring 66 or 68 to maintain a non-slipping connection between the reel and its respective clutch plate for driving the reel. However, normally more force is required to maintain this non-slipping connection than is provided by the springs. This additional force is obtained by solenoids 96 and 98 acting through lever 100 and shoe 102 to apply pressure separately to reels 22 and 24, and solenoids 104 and 106 acting through lever 108 and shoe 110 to apply pressure separately to reels 26 and 28. The pressure is applied to the reels by the shoes adjacent the springs augmenting the force urging the reels against the clutch plates. Lever 100 is pivoted on a pin 112 and is connected to the plungers of solenoids 96 and 98 by a stem 114 pivotally connected to lever 100 by a pin 116, and lever 108 is pivoted on a pin 118 and connected to the plungers of solenoids

104 and 106 by a stem 120 pivotally connected to lever 108 by a pin 122. Pins 112 and 118 are seated in base 20 and the respective levers 100 and 108 are held in proper operating position by sleeves 124 and 126 and the head of each pin. When solenoid 96 is energized, shoe 102 is pressed firmly against reel 22 which is pressed in turn firmly against clutch plate 46, causing reel 22 to rotate with the plate if motor 70 is in operation. The other three reels are operated in the same manner by the respective solenoids and clutch plates. As soon as the solenoids are deenergized, shoes 102 and 110 return to their neutral position between the reels.

In order to prevent the tow ropes from rotating shaft 30 unintentionally or causing a reverse rewinding after the rope has been rapidly unwound, a ratchet mechanism 130 is included in the apparatus, consisting of a wheel or disc 132 fixedly secured to shaft 30 by a key 134 or any other suitable means and a relatively stiff resilient lever 136 mounted on base 20 by screws 138 and 139. As the motor turns the shaft to wind the tow ropes, the shaft and disc 132 are rotated in the counter-clockwise direction and lever 136 does not interfere with the operation. In the event the shaft and disc attempt to rotate in a clockwise direction, resulting for example from the force exerted by a tow rope, one or the other of steps 140 or 142 engages the upper end of lever 136 and prevents any further rotation in that direction. This ratchet mechanism is usually not a necessary feature in the present apparatus since sufficient resistance to reverse rotation of shaft 30 is provided by the speed reduction mechanism between the motor and the shaft, this mechanism in the present apparatus being pulleys 72, 78, 84 and 86 and the associated belts.

In the operation of the present multiple reel apparatus installed in a boat, such as that shown in FIGURE 1, the ski tow ropes on, for example, reels 22 and 26 are unreeled behind the boat by merely pulling the rope out until it is fully unwound or until a stop such as a knot 144 or the like engages the part of the boat transom around the hole 146 through which the rope is threaded. Each reel rotates on shaft 30 independently of the other reels during the unwinding operation, a slight drag, however, being placed on the reel by springs 66 and 68 urging the reels with relatively light force against their respective clutch plates. When it is desired to rewind one of the tow ropes, for example the one on reel 26, motor 70 is started, thus rotating shaft 30 and clutch plate 60 together with the rest of the clutch plates. Solenoid 106 is then energized pulling the left hand end of lever 108 as viewed in FIGURE 2 toward said solenoid and forcing shoe 110 firmly against reel 26 and in turn the reel against clutch plate 60 with sufficient force that reel 26 is rotated with shaft 30 in the direction to rewind the tow rope. When the rope is fully wound on the reel, solenoid 106 is deenergized, permitting the reel to stop rotating. If the solenoid is not deenergized when the rope is fully wound and the handle on the end thereof is pulled firmly against the transom, no damage is done to either the reel or rope since slippage between the reel and the clutch occurs to permit the reel to stop. Since the other three reels are operated in the same manner as reel 26, just described, a detailed description of those will not be given herein.

Frequently the resistance on the ropes after being released by the skier is sufficiently small that the respective reels will rotate with shaft 30 with pressure provided by springs 66 and 68 to wind the ropes without the additional pressure provided by the solenoids so that all four reels can be wound at the same time. If one or the other reel on either set of reels does not operate to rewind the rope when the motor is started, the respective solenoid can be energized to provide the necessary frictional contact between the reel and its clutch plate.

While in the present embodiment four reels are mounted on a shaft in sets of two each, a larger or smaller number of reels can be mounted on a single shaft and the reels can be installed and operated independently of each other, each having a separate lever and shoe connecting the solenoid with the reel. Independent spring means can also be used for each reel. Further changes, including substitution of an integral motor and gear reduction box for the motor, belts and pulleys shown, and two-way solenoids for those shown to reduce the number, and for some uses the elimination of the solenoids altogether, can be made without departing from the scope of the present invention.

I claim:

1. A multiple reel apparatus for ski tow rope, comprising a base, a rotatable shaft, bearings supporting said shaft on said base, a set of two reels mounted on each end of said shaft and adapted to rotate relative to said shaft, a clutch plate secured to said shaft for rotation therewith adjacent each reel on opposite sides of each of said sets, a coil spring around said shaft and between the reels of each of said sets urging said reels against the respective clutch plates, a shoe between the reels of each of said sets, a pivoted lever connected to each of said shoes, a pair of solenoids connected to each of said levers for urging the respective shoe into engagement with the respective reel to seat the reel firmly against its clutch plate, a motor for rotating said shaft, a speed reducing means connecting said motor with said shaft, and a ratchet means for preventing reverse rotation of said shaft.

2. A multiple reel apparatus for ski tow rope, comprising a base, a rotatable shaft, bearings supporting said shaft on said base, a set of two reels mounted on said shaft and adapted to rotate relative to said shaft, a clutch plate secured to said shaft for rotation therewith adjacent each reel on opposite sides of said set, a coil spring around said shaft and between the reels of said set urging said reels against the respective clutch plates, a shoe between the reels of said set, a pivoted lever connected to said shoe, a pair of solenoids connected to said lever for urging said shoe into engagement with said reels to seat the respective reel firmly against its clutch plate, a motor for rotating said shaft, a speed reducing means connecting said motor with said shaft, and a ratchet means for preventing reverse rotation of said shaft.

3. A multiple reel apparatus, comprising a base, a rotatable shaft, bearings supporting said shaft on said base, a set of two reels mounted on said shaft and adapted to rotate relative to said shaft, a clutch plate secured to said shaft for rotation therewith adjacent each reel on opposite sides of said set, a spring between the reels of said set urging said reels against the respective clutch plates, a shoe between the reels of said set, a lever connected to said shoe, a solenoid connected to said lever for urging said shoe into engagement with said reels to seat the respective reel firmly against its clutch plate, a motor for rotating said shaft, and a speed reducing means connecting said motor with said shaft.

4. A multiple reel apparatus, comprising a rotatable shaft, bearings supporting said shaft, a set of two reels mounted on said shaft and adapted to rotate relative to said shaft, a clutch plate secured to said shaft for rotation therewith adjacent each reel on opposite sides of said set, a spring between the reels of said set urging said reels against the respective clutch plates, means between the reels of said set, a lever connected to said means, a solenoid connected to said lever for urging said means into engagement with said reels to seat the respective reel firmly against its clutch plate, and a power means for rotating said shaft.

5. A multiple reel apparatus, comprising a rotatable shaft, bearings supporting said shaft, a set of two reels mounted on said shaft and adapted to rotate relative to said shaft, a clutch plate secured to said shaft for rotation therewith adjacent each reel on opposite sides of said set, a coil spring around said shaft and between the reels of said set urging said reels against the respective clutch plates, a power means operating in conjunc-

tion with said spring for increasing the action of said clutch plate, a motor for rotating said shaft, and a speed reducing means connecting said motor with said shaft.

6. A multiple reel apparatus, comprising a rotatable shaft, bearings supporting said shaft, a set of two reels mounted on said shaft and adapted to rotate relative to said shaft, a clutch plate secured to said shaft for rotation therewith adjacent each reel on opposite sides of said set, a spring between the reels of said set urging said reels against the respective clutch plates, a power means operating in conjunction with said spring for increasing the action of said clutch plate, and a power means for rotating said shaft.

7. A reel, comprising a base, a rotatable shaft, bearings supporting said shaft on said base, a reel mounted on said shaft and adapted to rotate relative to said shaft, a clutch plate secured to said shaft for rotation therewith adjacent said reel, a coil spring around said

shaft urging said reel against the clutch plate, a shoe, a pivoted lever connected to said shoe, a solenoid connected to said lever for urging said shoe into engagement with said reel to seat the reel firmly against the clutch plate, a motor for rotating said shaft, and a speed reducing means connecting said motor with said shaft.

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