April 7, 1953 M. E. HARTZ 2,633,923

PROPELLER SLIP CLUTCH

Filed June 28, 1950

Fig. 1

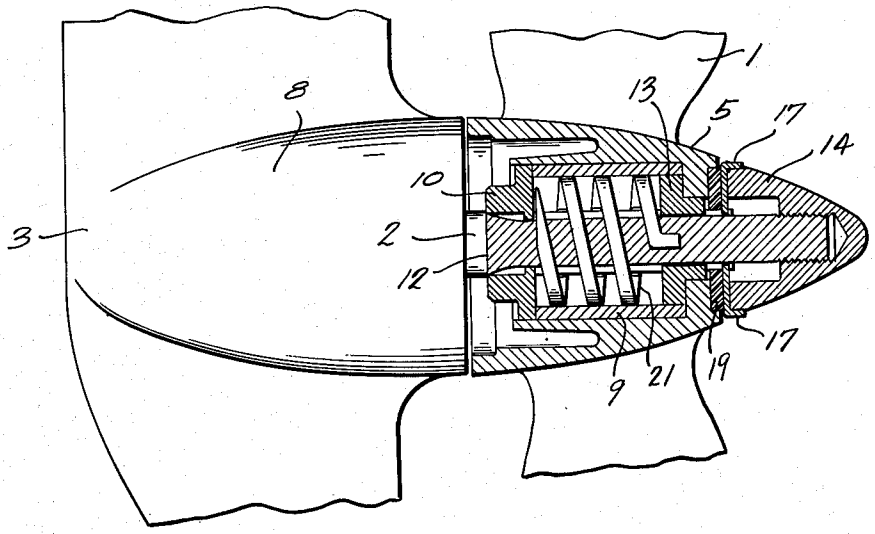


Fig. 2

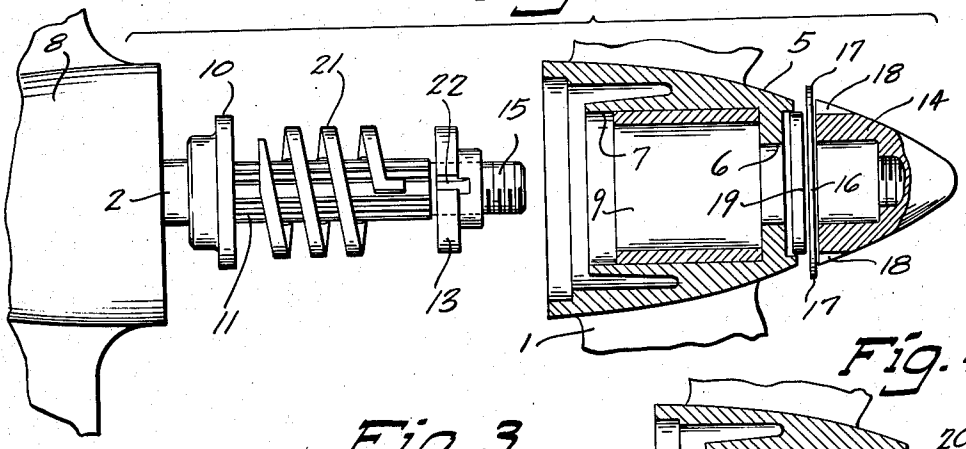


Fig. 3

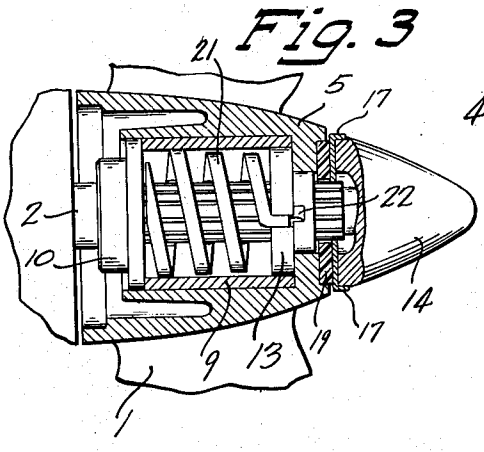
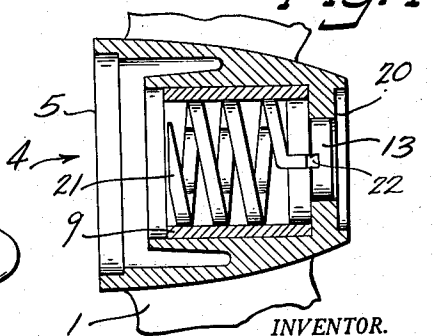


Fig. 4



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PROPELLER SLIP CLUTCH

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1 Claim. (Cl. 170—135.75)

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This invention relates to outboard motor propellers and particularly to protective overload clutches employed therewith to ensure the propeller against damage.

The invention provides a clutch within the propeller hub comprising a helical spring-clutch element carried by the propeller shaft in radial frictional engagement with the hub and disposed so that the engagement is uniformly relaxed upon overload when the propeller strikes an underwater object.

A principal object of the invention is to protect the propeller against damage with greater assurance of such protection and without slippage under maximum loads.

A more particular object is to provide in an outboard motor unit for the accurately controlled or predetermined protection of the unit.

Another object is to eliminate all adjustment before or after assembly of the propeller on the propeller shaft.

A further object is to provide at least partially for the frictional disengagement of the clutch immediately upon overloading so that the propeller is rotatably released of the propeller shaft to prevent damage thereto.

Another object is to provide for the predetermined maximum frictional torque engagement of the propeller irrespective of the load conditions and torque output of the motor.

These and other objects and advantages will be more fully set forth in the following description of a preferred embodiment of the invention illustrated in the accompanying drawings.

In the drawings:

Figure 1 is a side elevation of the lower end propeller unit of an outboard motor with a portion of the propeller hub broken away and axially sectioned in a vertical plane;

Fig. 2 is a view similar to Fig. 1 showing the propeller hub and slip clutch disassembled from the propeller shaft;

Fig. 3 is a view similar to Fig. 1 showing the clutch partially disengaged as upon overload; and

Fig. 4 is a sectional view of the propeller hub unit as prepared for assembly on the propeller shaft.

In the drawing the propeller 1 is mounted on the shaft 2 rearwardly of the lower underwater gear case 3 of an outboard motor or the like. Shaft 2 is journally carried by gear case 3 and is driven through gears, not shown, housed within gear case 3. The clutch unit 4, to which the present invention is directed, is contained within the hub 5 of the propeller and rotatably connects shaft 2 and propeller 1 under all conditions of

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normal operation of the motor to drive the propeller, as will be described.

Hub 5 of propeller 1 is provided with a stepped central, axial bore of reduced size as at 6 toward the rear of the hub and of relatively larger dimensions as at 7 extending the greater length and opening forwardly of the hub. The outer dimensions of hub 5 are streamlined with the corresponding enlarged torpedo section 8 of gear case 3. The bushing 9 preferably of hardened steel is cast or tightly held in larger bore 7 of hub 5 and is of shorter length and disposed therein so as to allow a small forward portion of bore 7 to remain exposed.

The circular plate 10 is provided with a splined, central hole to fit the complementary splined section 11 of shaft 2, and is seated forwardly on shaft 2 near the rear end of gear case 3 and against the narrow shoulder 12 formed in shaft 2. The outer diameter of plate 10 is slightly less than that of bore 7 of the propeller hub 5 to fit within the forward end of the bore ahead of bushing 9 with the forward end of the bushing disposed to contact the rear face of plate 10 and thereby limit the forward position of the propeller relative to shaft 2 and gear case 3.

The retainer collar 13 is provided with a splined, central hole for mounting on the splined section 11 of shaft 2 and so as to be rotatably secured therewith. Collar 13 is stepped to fit partly within bushing 9 and extend into the smaller bore 6 of hub 5 and disposed to support the rear end of hub 5 on shaft 2. Nominal clearances are provided between hub 5 and plate 10 and collar 13 to allow free rotation of propeller 1 thereon and with respect to propeller shaft 2.

The tapered nut 14 fitting the threaded end 15 of shaft 2 secures propeller 1 on the shaft, as described above. The washer 16 provided with a hole fitting splines 11 of shaft 2 is disposed on shaft 2 ahead of nut 14. Tabs 17 of washer 16 when bent rearwardly into corresponding notches 18 in the periphery of nut 14 serve to secure nut 14 against rotation with respect to shaft 2 to prevent loss of the nut and the propeller in operation. The bearing washer 19 is disposed between washer 16 and the rear, recessed face 20 of hub 5 to assure relative rotation of hub 5 and washer 16 without damage or interference.

Clutch unit 4 comprises the bushing 9 and collar 13, described above, and the helical spring-clutch element 21 disposed around shaft 2 within bushing 9.

The forward end of spring 21 is free within bushing 9 and the rear end is suitably bent to fit in the peripheral notch 22 in collar 13 so as to be

rotatably secured therewith. The inner diameter of spring 21 is larger than shaft 2 to provide ample clearance for the clutch action, as will be described.

The outer diameter of spring 21 is larger than the inner diameter of bushing 9 to provide the necessary frictional engagement and drive between shaft 2 and propeller 1.

The outer face of spring 21 is preferably flat to provide a maximum frictional area of contact with bushing 9.

The spring 21 winds in a direction from its fixed end held in notch 22, opposite to the direction of rotation so that rotation of collar 13 tends to pull the spring inwardly from clutch contact with bushing 9. The resilience of the spring and its resistance to inward wind provides the necessary clutch engagement normally existing between it and bushing 9, to drive the propeller 1.

In the assembly of clutch unit 4, collar 13 and spring 21 are first inserted within bushing 9. Plate 10 may be installed immediately on shaft 2, and propeller 1 with the spring-clutch unit 4 is then mounted on plate 10 and shaft 2 and secured thereon by nut 14, as described.

According to the invention, the spring-clutch member 21 provides for the accurately predetermined limited transmission of torque from shaft 2 to propeller 1 and is disposed in hub 5 of the propeller so as to be assembled and disassembled therewith as a unit. The limited torque transmission provided by spring 21 affords an initial overload protection of the propeller against damage which is determined by the resilience of the spring and generally irrespective of the frictional engagement of the clutch parts.

The initial frictional engagement between spring 21 and bushing 9 is thus readily calculated and predetermined according to the preloading of spring 21 during assembly of the clutch unit.

A feature of the invention resides in the combination of the clutch elements with the propeller which includes hub 5, bushing 9, collar 13 and spring 21, as shown in Fig. 4. By reason of the preloaded condition of spring 21 the propeller and clutch unit 4 is handled and assembled on shaft 2 as a unit with "built-in" overload protection.

The operation of the clutch upon overload is effected when the torque transmitted from collar 13 through spring 21 to the propeller exceeds the torsional capacity of the spring. When the propeller is subject to overload spring 21 winds on shaft 2 beginning with the end connected to collar 13 and is radially contracted and progressively withdrawn from contact with bushing 9, as shown in Fig. 3, until the portion of spring 21 remaining in frictional engagement with bushing 9 is reduced so as to be ineffectual and readily subject to the slippage necessary to prevent damage to the propeller.

Bushing 9 engaging plate 10 prevents axial loading of the clutch unit 4 either by the propeller thrust or by tightening nut 14. The clutch unit 4 forms an integral part of propeller 1 and is not readily disassembled. Furthermore, as will be noted, clutch unit 4 is not capable of adjustment upon shaft 2 as in securing propeller 1 with nut 14 on the shaft so that the overload

capacity of the unit, as may be predetermined, cannot be altered.

The load capacity of the clutch unit 4 is easily tested as on a jig, not shown, so that each propeller 1 before delivery may be so tested and the adequate protection of the propeller against damage assured or guaranteed.

Various embodiments of the invention may be employed within the scope of the following claim.

I claim:

In an outboard motor, a propeller shaft having a threaded end and an annular shoulder facing said end and spaced therefrom, splines formed in said shaft between said shoulder and said threaded end portion, a circular plate member disposed on said shaft against said shoulder, an internally splined circular collar fitting the splines of said shaft so as to be rotatably secured thereon, a propeller including a hub having a central, stepped axial bore rotatably supported at opposite ends on said plate and said collar, a hub mounted on the threaded end of said shaft, a tab washer fitting said splines and disposed between said propeller hub and said nut to secure the latter on the threaded end of said shaft, a friction washer disposed between said tab washer and the corresponding end of said propeller hub, a bushing tightly disposed within the larger portion of the stepped bore of said propeller hub, one end of said bushing being disposed in contact with said plate and limiting the forward position of the propeller upon said shaft, and a spring-clutch element disposed within said bushing in frictional engagement with the inner surface thereof and extending in a helix about said shaft between said plate and said collar, the end of said spring adjacent said plate being free and the opposite end of said spring being engaged within a corresponding notch formed in the periphery of said collar whereby the rotation of said shaft is transmitted from said collar to the spring, said spring being disposed within said bushing under predetermined torsional stress to maintain a minimum radial frictional engagement with said bushing and driving connection with said propeller, and said spring being wound in a rotational direction from said fixed end whereby said spring upon overload is contracted around said shaft and withdrawn from frictional engagement with said bushing to allow slippage between said spring and said bushing and protect said propeller against damage.

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