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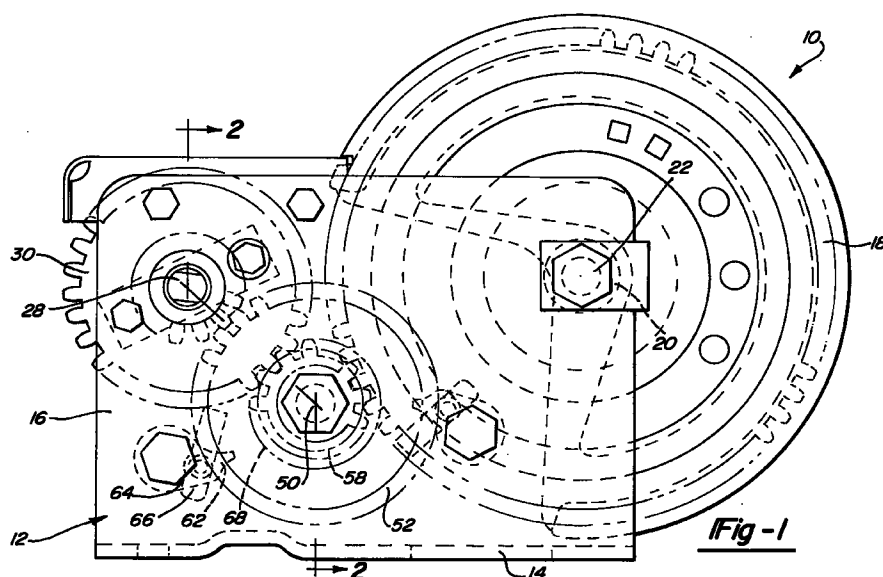
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(54) Multi-speed winch with constant mesh gearing system

(57) A constant mesh gearing system for a multi-speed winch (10) which allows shifting of gear ratios for varying operating properties. The gearing system incorporates at least two different sized crank gears (32,34) coaxially mounted to a crankshaft (28). Each of the crank gears (32,34) are in constant mesh engagement with drive gears (54,56) mounted to a drive shaft (50). The other end of the drive shaft (50) includes a ratchet gear (58) drivably engaging the winch drum (18). A ratchet pawl (62) with a standoff link (66) locks the ratchet gear (58) against rotation in one direction. Upon cranking the standoff forces the pawl (62) away from the

ratchet gear (58) for noiseless cranking of the winch (10). The crankshaft (28) of the winch (10) is longitudinally shiftable to selectively engage either of the crank gears (32,34). The shaft (28) includes detents (44) engageable by a spring-biased ball bearing (46) to prevent inadvertent longitudinal movement of the crankshaft (28). The crankshaft (28) also includes a drive tooth (40) selectively engageable with the crank gears (32,34). Upon longitudinal shifting of the crankshaft (28), different gear ratios may be selected for operation of the winch (10).



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Description

Background Of The Invention

I. Field of the Invention

This invention relates to winches for winding a cable, strap or rope to pull such as watercraft and, in particular, to a winch with a gearing system to change gear ratios for operation which does not require shifting between different gears providing constant meshing of the gears for improved durability.

II. Description of the Prior Art

Manual winches are popular mechanisms for pulling vehicles such as watercraft onto their trailers or other storage facilities. The typical winch incorporates a crank with a crank gear mounted to the crankshaft and in engagement with the drum upon which the line is wrapped. Rotation of the crank and crank gear causes the drum to rotate collecting the line on the drum. The crank effort is dictated by the gear ratio between the crank gear and the drum gear. Typically the consumer must purchase the winch which incorporates the gear ratio required for a particular application.

While clutch and transmission mechanisms have developed means of changing gear ratios, such complex mechanisms are not suitable for relatively inexpensive and simple winch assemblies. In such transmissions, the gear ratios are kept in constant mesh with a drive shaft moving between the gear sets. However, these transmissions are heavily dependent upon hydraulics to shift between gear ratios. In view of the simple nature of a manual winch, extraordinary mechanisms to shift between gear ratios would complicate these winches.

Summary Of The Present Invention

The present invention overcomes the disadvantages of the prior known winches by providing a constant mesh gearing system which allows shifting between gear ratios by longitudinally moving the crankshaft for operation in accordance with performance requirements.

The winch of the present invention includes a winch housing to which the components are mounted including a winch drum upon which a winch line is wrapped. The winch drum includes a gear for rotatably driving the drum on a drum shaft mounted to the housing. Also mounted to the housing in parallel alignment with the drum shaft is a crankshaft and a driveshaft. The winch cranks are attached to the crankshaft for rotation of the crankshaft to rotatably drive one of at least two different crank gears mounted coaxial with the crankshaft. The crankshaft includes a fixed gear tooth which can be shifted between the crank gears to selectively drive a single crank gear Detent means on the crankshaft pre-

vents inadvertent shifting of the crankshaft between crank gears. The crank gears are in constant mesh with drive gears forming the different gear ratios. The drive gears are mounted to the drive shaft which also includes a ratchet gear in constant mesh with the winch gear such that rotation of the drive gears rotates the ratchet gear and winch gear.

Longitudinal shifting of the crankshaft will cause the fixed gear tooth to engage the hub of one of the crank gears depending upon the desired gear ratio. Once engaged with the hub, rotation of the crank will cause the selected crank gear and its meshed drive gear to rotate in accordance with the gear ratio. Rotation of the drive gear in turn rotates the drive shaft, ratchet gear and winch gear for rotation of the winch drum. Thus, despite changing gear ratios the crank and drive gears remain in constant mesh with only a specific set of gears being chosen by shifting the crankshaft. In order to provide noiseless operation of the ratchet system which locks the winch against reverse rotation, a stand-off is mounted to the ratchet pawl which holds the ratchet pawl away from the ratchet gear eliminating the well-known ratchet noise of typical winches.

Other objects, features, and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawing.

Brief Description Of The Drawing

The present invention will be more fully understood by reference to the following detailed description of a preferred embodiment of the present invention when read in conjunction with the accompanying drawing, in which like reference characters refer to like parts throughout the views and in which:

FIGURE 1 is a side elevational view of a winch with a constant gearing system embodying the present invention;

FIGURE 2 is a cross-sectional view of the winch taken along lines 2-2 of Fig. 1;

FIGURE 3A and 3B are cross-sectional views of the gear hubs with the crankshaft tooth drive; and

FIGURE 4 is a cross-sectional view of winch housing, winch drum and drum bearing of the winch.

Detailed Description Of A Preferred Embodiment Of The Present Invention

Referring first to Figure 1, there is shown a winch 10 embodying the present invention. The winch 10 is adapted to rotatably retract a flexible line such as a rope or cable for pulling heavy objects. In a typical application, the winch 10 is used to pull a watercraft onto its trailer or other storage structure. Through the use of gear ratios, little effort is needed to pull a heavy object. However, the prior known winches had a fixed gear ratio built into the winch which could not be changed. The

present invention allows the gear ratio to be changed for multi-speed operation.

The winch 10 of the present invention includes a housing 12 to which the components of the winch 10 are mounted and which facilitates attachment of the winch 10 to a support structure. The housing 12 preferably comprises a metal frame 14 having opposing side walls 16. Rotatably mounted to side walls 16 of the housing 12 is a winch drum 18 upon which a tow line (not shown) is rotatably wrapped. As best shown in Figure 4, the winch drum 18 is secured to a drum bearing 20 rotatably mounted to a winch shaft 22 secured at opposite ends to the housing 12. Mounted to the drum 18 for rotation therewith is a winch gear 24.

Manual operation of the winch 10 is conducted through at least one crank 26 connected to a crankshaft 28 rotatably mounted to the side walls 16 of the housing 12 to extend through the housing 12. The crankshaft 28 is longitudinally movable to shift between gear ratios in accordance with the present invention. Coaxially mounted on the crankshaft 28 is at least two crank gears 30 corresponding to the gear ratios of the winch 10. For clarity of understanding, the present invention will be described in connection with a first crank gear 32 and a second crank gear 34 selectively drivable by the crankshaft 28. However, additional crank gears may be employed to provide a wider range of gear ratios. Each of the crank gears 32 and 34 include a hub slot 36 and 38 adapted to selectively receive a crank tooth 40 fixedly formed on the crank shaft 28 (Figs. 3A and 3B) in order to rotatably drive the respective crank gear 30 upon rotation of the crankshaft 28.

The crankshaft 28 also includes detent means 42 preferably formed in an opposite end of the crankshaft 28. The detent means 42 includes a pair of detents 44 formed on the crankshaft 28 corresponding to the spacing and number of crank gears 30. The detents 44 selectively receive ball bearings 46 biased against the crankshaft 28 by springs 48. The force of the springs 48 can be overcome to move the crankshaft 28 longitudinally but the bearings 46 prevent inadvertent movement of the crankshaft 28 during operation thereby ensuring that the crank tooth 40 will be engaged with the corresponding crank gear 30.

Rotatably mounted to the housing 12 parallel to the drum shaft 22 and the crankshaft 28 is a drive shaft 50. Fixedly mounted to the drive shaft 50 for simultaneous rotation are drive gears 52 corresponding to the number of crank gears 30. In accordance with the preferred embodiment, a first drive gear 54 mounted to the drive shaft 50 is in driving engagement with the first crank gear 32 and a second drive gear 56 is in driving engagement with the second crank gear 34. The size of the drive gears 54 and 56 is dictated by the size of the crank gears 32 and 34 to ensure meshing engagement between the gears. Accordingly, rotational drive is transferred from the crankshaft 28 and crank gears 30 to the drive gears 52 and drive shaft 50.

Also mounted to the drive shaft 50 for rotation therewith is a ratchet gear 58 and a ratchet wheel 60. The ratchet gear 58 drivingly engages the drum gear 24 to transfer rotation to the drum 18. The ratchet wheel 60 is engaged by a ratchet pawl 62 to prevent unwinding of the winch 10 until desired. The pawl 62 is pivotably mounted to a bracket 64 to repeatedly engage the teeth of the ratchet wheel 60 facilitating rotation in a first direction but preventing rotation in the opposite direction. Associated with the ratchet pawl 62 is a standoff 66 which allows "noiseless" operation of the winch 10. In the conventional winch 10, the chatter or clicking of the pawl is widely recognized. This results from the pawl falling between the teeth of the ratchet wheel 60. During normal cranking, the standoff 66 holds the pawl 62 away from the ratchet wheel 60. As cranking begins, the standoff 66 engages a circular outer surface 68 of the ratchet wheel 60 to pivot the pawl 62 outwardly away from the ratchet wheel 60.

Operation of the present invention allows selection between different gear ratios of the winch 10 by simply shifting the crankshaft 28. In accordance with the application, the user can shift the crankshaft between the low gear ratio associated with crank gear 32 and the high gear ratio associated with crank gear 34. When low gear is desired, the crank tooth 40 is engaged with the hub 36 of the first crank gear 32. When high gear is desired, the crankshaft 28 is moved longitudinally overcoming the detent means 42 to engage the crank tooth 40 with the hub 38 of the second crank gear 34. With either crank gear 30 engaged, rotation of the crank 26 will transfer rotation from the crank gears 30 to the drive gears 52 which transfers rotation to the ratchet gear 58 and drum gear 24 to wind the line onto the drum 18. During cranking, the standoff 66 maintains the pawl 62 away from the ratchet wheel 60. When cranking stops, the standoff pivots outwardly allowing the pawl 62 to engage ratchet wheel 60 preventing further rotation of the winch drum 18. Thus, the present invention allows convenient shifting between gear ratios while maintaining the gears in constant mesh eliminating stripping and other damage to the gears.

The foregoing detailed description has been given for clearness of understanding only and no unnecessary limitations should be understood therefrom as some modifications will be obvious to those skilled in the art without departing from the scope and spirit of the appended claims.

Claims

1. A multi-speed winch receiving a line, said winch comprising:

- a housing;
- a winch drum rotatably supported within said housing for receiving the line;
- a crankshaft rotatably supported within said housing and receiving crank means for rotating

said crankshaft, said crankshaft longitudinally movable to axially displace a key means on said crankshaft;

at least two rotatable members mounted to said crankshaft for selective rotation therewith upon engagement by said key means of said crankshaft; and

drive means in rotatable connection with said winch drum and said at least two rotatable members for transmitting rotation of said at least two rotatable members to said winch drum.

2. The winch as defined in claim 1 and further comprising detent means preventing inadvertent longitudinal movement of said crankshaft without preventing rotation of said crankshaft, said detent means including at least two detents formed on said crankshaft corresponding to said at least two rotatable members, said at least two detents engaged by spring-biased bearing means to prevent inadvertent longitudinal movement of said crankshaft.
3. The winch as defined in claim 2 wherein said drive means includes a drive shaft rotatably supported within said housing and at least two drive members mounted to said drive shaft, said at least two drive members drivably connected to said at least two rotatable members such that rotation of said at least two rotatable members transmits rotation to said at least two drive members and said drive means.
4. The winch as defined in claim 3 wherein said at least two rotatable members include key slots selectively engageable by said key means upon axial displacement of crankshaft to rotatably drive one of said at least two rotatable members.
5. The winch as defined in claim 4 wherein said at least two rotatable members includes a first crank gear and a second crank gear having a greater diameter than said first crank gear and wherein said at least two drive members includes a first drive gear in constant mesh with said first crank gear and a second drive gear in constant mesh with said second crank gear to selectively provide different gear ratios for operation of the winch.
6. The winch as defined in claim 5 wherein said drive means includes ratchet means for selectively preventing rotation of said drive shaft and winch drum in a first direction.
7. A multi-speed winch receiving a line, said winch comprising:

a housing;

a winch drum rotatably supported within said housing for receiving the line;

a crankshaft rotatably supported within said housing and having a crank for rotating said crankshaft, said crankshaft longitudinally movable to axially displace a key means on said crankshaft;

first and second rotatable members mounted to said crankshaft for selective rotation therewith upon engagement by said key means of said crankshaft, said key means axially displaceable with said crankshaft to engage one of said first and second rotatable members for rotation with said crankshaft; and

drive means in rotatable connection with said winch drum and said rotatable members of transmitting rotation of said crankshaft and said engaged rotatable member to said winch drum.

8. The winch as defined in claim 7 and further comprising detent means preventing inadvertent longitudinal movement of said crankshaft without preventing rotation, said detent means including two detents formed on said crankshaft corresponding to said first and second rotatable members, at least one of said detents engaged by a spring-biased bearing means to prevent inadvertent longitudinal movement of said crankshaft.
9. The winch as defined in claim 8 wherein said drive means includes a drive shaft rotatably supported within said housing and first and second drive gears in constant mesh with said first and second rotatable members respectively such that rotation of said rotatable members transmits rotation to said drive members of said drive means.
10. The winch as defined in claim 9 wherein said second rotatable member has a greater diameter than said first rotatable member to selectively provide different gear ratios for operation of the winch upon axial displacement of said key means.
11. The winch as defined in claim 10 wherein said first and second rotatable members include key slots selectively engageable by said key means upon axial displacement of said crankshaft to rotatably drive one of said first and second rotatable members.
12. A multi-speed winch receiving a line, said winch comprising:
 - a housing;
 - a winch drum rotatably supported within said housing for receiving the line;
 - a crankshaft rotatably supported within said housing and having a crank for rotating said crankshaft, said crankshaft longitudinally mov-

able to axially displace a key means on said crankshaft;

first and second rotatable members mounted to said crankshaft for selective rotation therewith upon engagement by said key means of said crankshaft, said rotatable members having key slots for selective engagement by said key means upon axial displacement of said crankshaft to engage one of said first and second rotatable members for rotation with said crankshaft; and

drive means in rotatable connection with said winch drum and having rotatable first and second drive members connected to said first and second rotatable members respectively said first rotatable member transmitting rotation to said first drive member of said drive means and said second rotatable member transmitting rotation to said second drive member of said drive means such that said drive means transmits rotation to said winch drum whereby said first rotatable member and drive member and said second rotatable member and drive member have different rotational ratios for different speeds of operation of said winch.

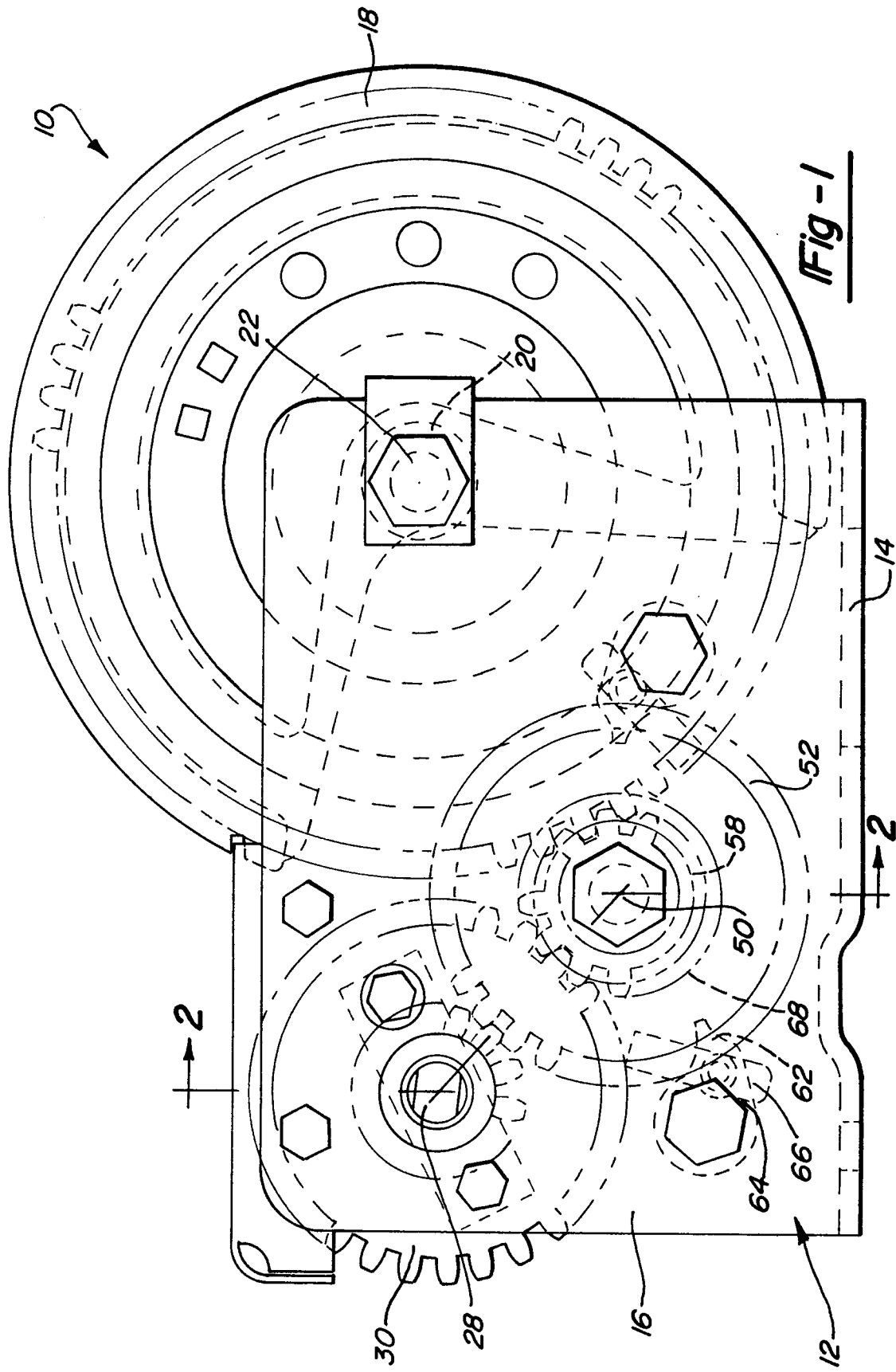
13. The winch as defined in claim 12 and further comprising detent means preventing inadvertent longitudinal movement of said crankshaft without preventing rotation, said detent means including two detents formed on said crankshaft corresponding to said first and second rotatable members, at least one of said detents engaged by a spring-biased bearing means to prevent inadvertent longitudinal movement of said crankshaft.

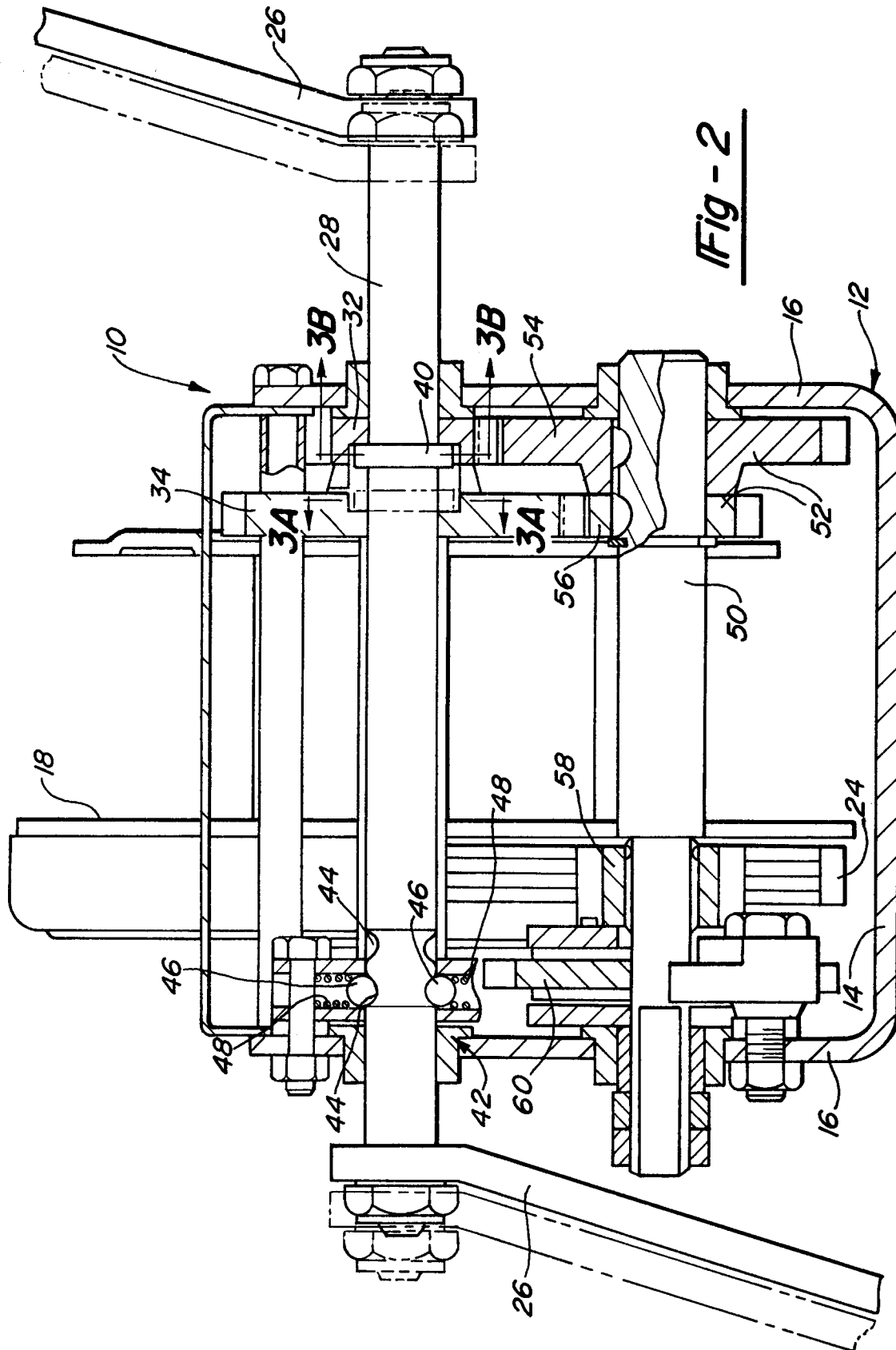
14. The winch as defined in claim 13 wherein said second rotatable member has a greater diameter than said first rotatable member to selectively provide different gear ratios for operation of the winch upon axial displacement of said key means.

15. The winch as defined in claim 14 wherein said first and second rotatable members include key slots selectively engageable by said key means upon axial displacement of said crankshaft to rotatably drive one of said first and second rotatable members.

16. The winch as defined in claim 15 wherein said drive means includes a drive shaft rotatably supported within said housing, said first and second drive members mounted to said drive shaft.

17. The winch as defined in claim 16 and further comprising ratchet means mounted to said drive shaft, said ratchet means selectively preventing rotation of said winch drum and drive shaft in a first direction.





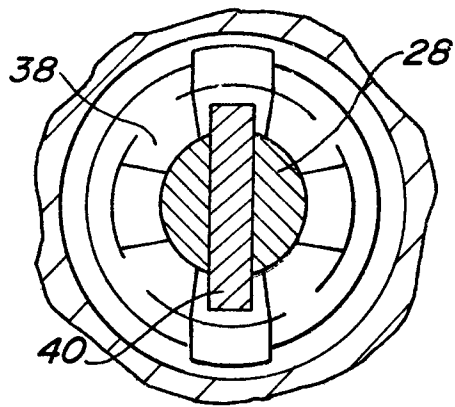


Fig - 3A

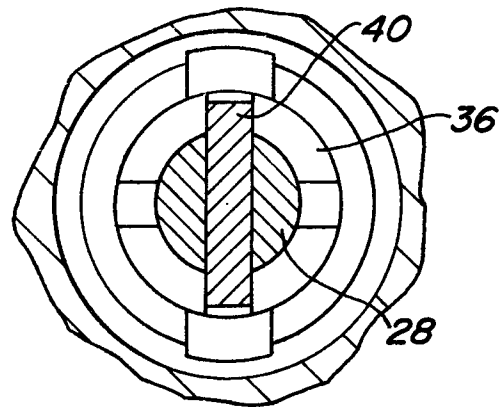


Fig - 3B

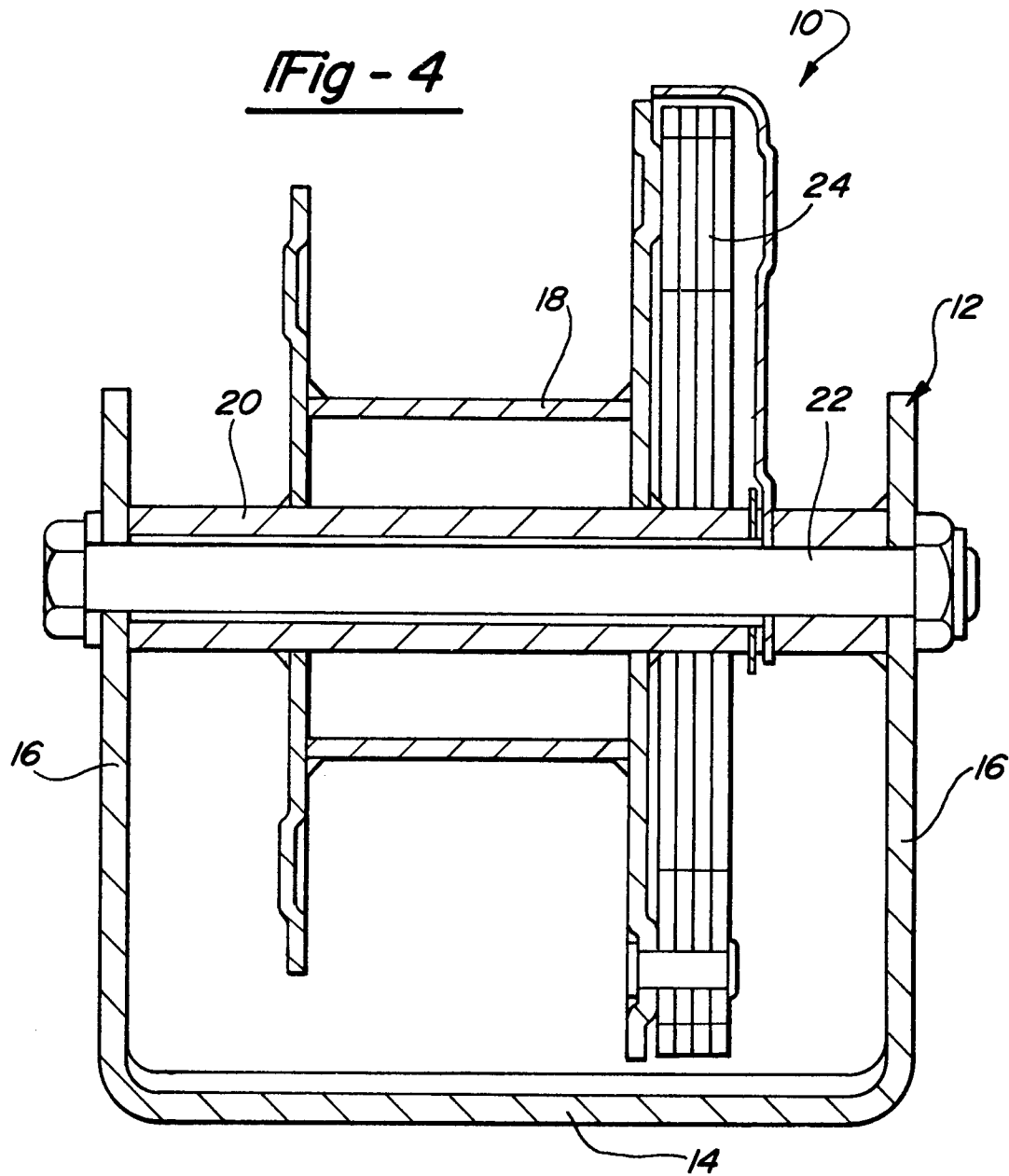


Fig - 4