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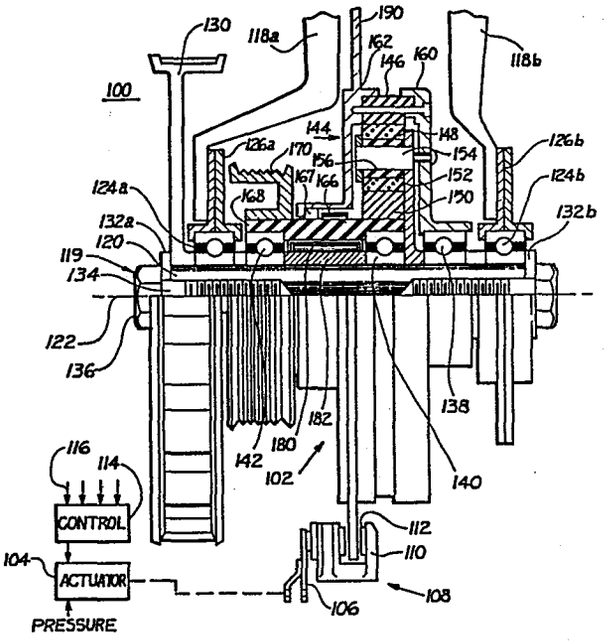
(54) Accessory drive control mechanism.

(57) An accessory drive system (10) for controlling the operation of engine driven accessories (16, 28, 30, 32, 34) comprising a crank clutch (12) operatively mounted to and rotated by the engine having an output member (22) which is decoupled from the engine in response to control signals in a first operable state and which is coupled to and rotates with the engine during a second operable state and a two speed accessory drive (14, 100) for driving the engine accessories, including an input adapted to be driven by the output member of the crank clutch during the second operable state and further including an output adapted to vary the driving engagement by the accessories with a second control signal.



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ACCESSORY DRIVE CONTROL MECHANISM

Background and Summary of the Invention

This invention relates to a clutch system for powering accessories such as an air conditioner, water pump, power steering unit, alternator, etc., of an engine. More specifically, the invention is related to a clutch system utilizing a crank clutch and an accessory drive or accessory clutch for selectively engaging and disengaging the accessories from the engine.

To reduce the horsepower drain on a vehicle engine, clutching devices have been used to control the operation of engine driven accessories. Further, during various operational intervals it is desirable to be able to drive such accessories at a slower than normal speed during low accessory demand periods and at higher predetermined speed during heavy accessory demand periods. Such a two-speed accessory drive is shown by Mason in U.S.S.N. 502,803 which is herein incorporated by reference. While the accessory drive of Mason illustrates a means for extending the useful life of these accessories as well as a way of reducing parasitic power losses because of its ability to drive the accessories at reduced speeds, these accessories are always connected to and provide a continuous source of power loss for the engine. This power loss is most notable during start and during acceleration. The present invention further improves fuel economy, improves belt life and reduces accessory generated noise. Further many transverse mounted engine vehicles are built with a crankshaft pulley positioned very close to the frame rail. It is not possible to replace the crankshaft pulley with a direct drive two speed accessory clutching device since such a device is

often more bulky than the pulley. The present invention permits the placement of such a device remote from the crankshaft with a primary belt drive from a crankshaft clutch which replaces the crankshaft pulley. A further advantage of the present invention permits complete disengagement of all of the accessories driven by the two speed accessory clutching device under the control of the crankshaft clutch.

Accordingly, the invention comprises:

first clutch means responsive to control signal input thereto, said clutch means having at least two operable states, an input member operatively mounted to and rotated by a moving member of the engine and an output member which is decoupled from said input member in response to said control signals in a first operable state and which is coupled to and rotates with the input member during a second operable state;

second two speed accessory drive means responsive to control signals input thereto for driving accessories selectively at either of two predetermined speed ratios including an input adapted to be driven by the output member of said first clutch means and an output drivingly engaged to said accessories.

Brief Description of the Drawings

In the drawings:

FIGURE 1 is a schematic diagram of the invention.

FIGURE 2 is a cross-sectional view of a two-speed accessory drive.

Detailed Description of the Drawings

Reference is made to FIGURE 1 which illustrates a schematic diagram of an accessory drive control system

10. The system comprises, in its preferred embodiment, a crank clutch 12 which is typically driven by a moving member of the engine such as a crankshaft. The system further includes a power transmission drive device 14 such as a two-speed accessory drive. As illustrated in FIGURE 1, an air pump 16 or other accessory is attached to an input member 18 of the crank clutch 12 which is directly connected to the engine crankshaft to enable the air pump to be driven by belt 20 during all periods of operation. It should be appreciated that any accessory that must be continuously operated could be connected to the input member 18 of the crank clutch 12. As an example the alternator may be driven by the input member 18. One such crank clutch 12 is illustrated in the commonly assigned U.S. Patent 4,397,380 which is expressly incorporated herein by reference. In addition the crank clutch 12 of the fail-safe type wherein its output member 22 rotates with the crankshaft in the absence of control signals input thereto and is disengaged therefrom in response to such control signals.

The crank clutch 12 comprises an output member generally designated as 22 having a belt 24 connecting it with an input 23 of the drive device 14. The drive device 14 includes an output member 24 which may include a single pulley or plurality of pulleys that is connected by belts 26a and b to a variety of engine driven accessories such as an air conditioner compressor 28, alternator 30, water pump 32 and power steering unit 34.

The crank clutch 12 and drive device 14 are preferably electro-magnetically or electrically responsive devices activated by an electronic control unit 40 of a known type in response to engine operating parameters.

With reference to FIGURE 2 there is shown a two-speed accessory drive unit 100 which is exemplary of the drive device 14 illustrated in FIGURE 1. The accessory

drive unit 100 comprises an overdrive unit or drive 102 activated by actuator 104. The actuator 104 may be a vacuum motor or electrical device capable of moving a lever 106 to activate a disk brake mechanism 108 of a known type including a caliper 110 and brake pads 112. The caliper 110 is mounted to the engine by a bracket of a known variety which is not shown. The actuator 104 may be controlled by a controller 114 (such as ECU 40) in response to various engine parameters sensed by a set of sensors 116. The lever 106 may be necessary to supply additional mechanical advantage to the disk brake 108 if a low torque actuator 104 is utilized.

The accessory drive unit 100 is adapted to be mounted to the engine by brackets 118a and b of a known variety. More specifically, the brackets 118 support a hollow shaft 120 for rotation about an axis 122. The shaft 120 is supported proximate its ends by support bearings 124a and b. The outer race of each support bearing 124 is connected to one of the brackets 118a or b by a bearing support 126 (126a, b). An input pulley 130 is mounted to and rotates the shaft 124. The input pulley 130 is attached to the shaft 124 in a known manner such as by a keyway or by splines neither of which is illustrated in FIGURE 2. The input shaft 120 is laterally fixed relative to the shaft 120 by spacers 132a and b, bolt 134 and nut 136. The bolt 134 is received within the shaft 120 and is co-axial thereto. The shaft 120 supports three ball bearings 138, 140 and 142 which, as detailed below, support various rotating members of the drive 102.

The drive unit 100 further includes a planetary gear set 144 comprising a ring gear 146, a plurality of pinion or planetary gears 148, only one of which is illustrated, and a sun gear 150. Each of the pinion or planetary gears is attached to a carrier member 152. Each of the

pinion or planetary gears 148 is mounted to the carrier 152 by a respective pin 154 and roller bearing 156. The pinion gears 148 interconnect the ring gear 146 with the sun gear 150. The planetary gear set 144 comprising the above-noted ring gear 146, planetary gears 148 and sun gear 150 is covered by a back cover 160 and front cover 162 which are attached to and rotatable with the ring gear 146. The back cover 160 is supported for rotation relative to shaft 120 by bearing 138. The front cover 162 is supported for rotation by a roller bearing 166 that is mounted concentric to the central axis 122. A bearing seal 167 may be provided adjacent the roller bearing 166. The roller bearing 166 is supported by a hub or second shaft 168. The hub or second shaft 168 may be an element separate from the sun gear 150 or an integral extension thereof. The hub 168 is supported for rotation relative to the shaft 120 and axis 122 by the bearings 140 and 142. The hub 168 is driven, as described below, by a roller clutch 180 that is supported by a sleeve 182. As illustrated in FIGURE 2, the hub 168 supports an output pulley member 170. The number of pulleys of the output pulley member 170 may vary with the application.

The drive unit 100 further includes a disk 190 preferably constructed of steel or suitable material that is mounted to and rotatable with the front cover 162 and ring gear 146. The disk 190 extends between the brake pads 112 which are supported within by the brake caliper 110.

In operation the drive unit 100 will be rotated by the action of its shaft 120 in unison with the input pulley 130. The input pulley 130 is rotated by a belt, such as belt 24 of FIGURE 1, during intervals when the crank clutch 12 is activated by a control unit such as controller 114. Under normal operating conditions, that

is, with the actuator 104 not activated, the disk 190 is free to rotate relative to the brake pads 112. In this manner the output pulley member 170 is driven through the roller clutch 180. During this mode of operation the planetary gear set 144, which is also coupled to shaft 120, freewheels and does not supply torque to the hub or second shaft 168.

When it is desired to have the drive unit 100 drive the accessories at an increased speed, the actuator 104 is activated by the controller 116 thereby causing the disk brake 108 to lock and hold the disk 190. Since the ring gear 146 is directly connected to the disk 190 by virtue of their mutual connection to the front cover 162, the act of locking the disk 190 in turn locks and prevents the ring gear 146 from rotating. With the ring gear 146 now locked in place, the planetary carrier 152, which is connected directly to the shaft 124, will overdrive the sun gear 150 at a speed faster than the speed of the concentric shaft 124 which is driven directly by the input pulley 130. Since the sun gear is mechanically connected to the hub or shaft 168, the output pulley 170 is driven at an accelerated speed. During this accelerated speed mode of operation the roller clutch 180 permits the second shaft or hub 168 to overdrive relative to the sleeve 182 and in this manner the roller clutch 180 allows the second shaft 168 (and output pulley 170) to run faster but not slower than the speed of the shaft 124 which is driven directly by the crankshaft.

Further, during intervals involving engine cranking, or during periods when the vehicle is accelerated, the crankshaft clutch 12 is deactivated thus deactivating the accessory drive unit 100 or drive 14 to disengage the accessories from the engine and to lessen the drag on the engine.

Many changes and modifications in the above-described embodiment of the invention can, of course, be carried out without departing from the scope thereof. Accordingly that scope is intended to be limited only by the scope of the appended claims.

CLAIMS:

1. An accessory drive system (10) for controlling the operation of engine driven accessories (16, 28, 30, 32, 34) comprising;

clutch means (12) responsive to first control signals input thereto, said clutch means having at least two operable states, an input member (18) operatively mounted to and rotated by a moving member of the engine and an output member (22) which is decoupled from said input member in response to said control signals in a first operable state and which is coupled to and rotates with the input member during a second operable state;

drive mechanism means (14, 100) responsive to second control signals input thereto for the engine driving accessories, including an input adapted to be driven by the output member of said clutch means during said second operable state and further including an output engaged to said accessories, said output being drivingly engaged by said second control signals.

2. The drive system (10) as defined in Claim 1 wherein said input of said drive mechanism means (14, 100) and said output member (22) of clutch means (14) are linked by a belt (24).

3. The drive system as defined in Claim 2 wherein said drive mechanism means (14, 100) includes planetary gear means (144) for driving said output member at a first gear ratio in the absence of said second control signals input to said drive mechanism means and at a second gear ratio in the presence of said second control signals.

4. The system (10) as defined in Claim 1 wherein said first control signals received by said clutch means (12) is such as to decouple said output member from said input member during engine cranking periods or during periods of vehicle acceleration.

5. The system (10) is defined in Claim 2 wherein said clutch means (12) comprises a crank clutch having its input member operatively driven by the crankshaft of

the engine.

6. The system (10) as defined in Claim 2 wherein said drive mechanism means is a two-speed accessory drive device.

7. The system (10) as defined in Claim 6 wherein said crankshaft clutch is of the type that is fail-safe whereby its output member rotates with the engine crankshaft in the absence of control signals input thereto and wherein said output member is disengaged from the engine crankshaft in response to said first control signals.

8. A method of operating at least one engine mounted accessory such as an alternator, water pump, power steering unit, etc., said accessory engageably connected to a two-speed drive, said two-speed drive mounted in driving engagement with an output member of a crankshaft clutch, mounted to the crankshaft of the engine, said two-speed drive and said crankshaft clutch responsive to control signals thereto for changing their operative state, the method comprising the steps of:

applying a first control signal to said crankshaft clutch to activate same causing an output member thereof to rotate at crankshaft speed;

applying a second control signal to said two-speed drive to cause an output member thereof to rotate at either a first or at a second speed in response to the motion of said output member of said crankshaft clutch; and

terminating said first control signal to declutch said output member of said crankshaft clutch.

9. The method as defined in Claim 7 wherein said step of terminating is performed during intervals of vehicle acceleration or during engine cranking intervals.

10. In a system comprising a crankshaft clutch selectably engageable with the crankshaft or other moving member of an engine, a two-speed accessory drive having an output member adapted to be driven at one of

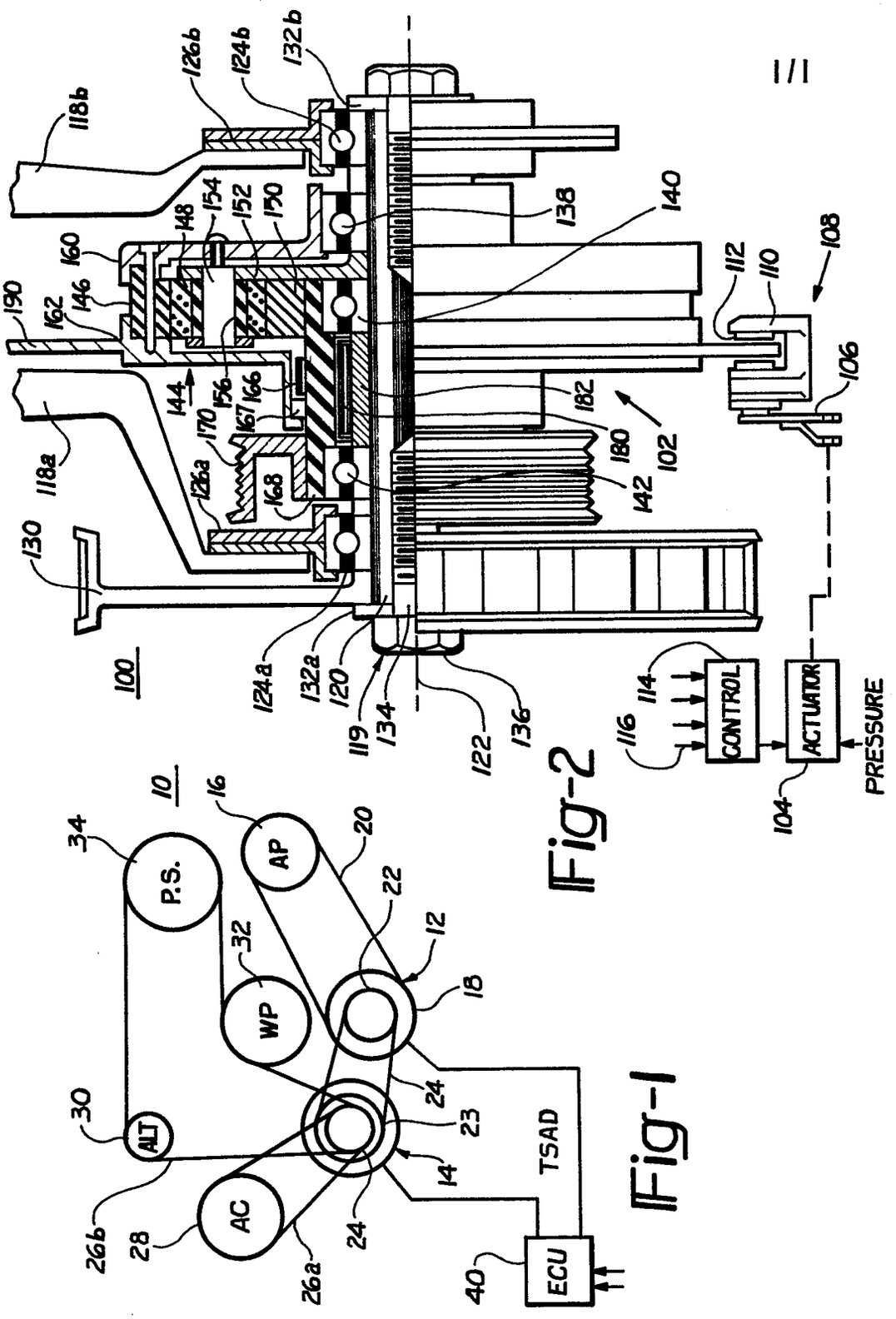
two speeds and connected to at least one engine mounted accessory; said two speed accessory drive mounted in driving engagement with an output member of said crankshaft clutch; a method of operating at least one accessory comprising the steps of:

operating the output member of said crankshaft clutch at engine speed;

applying a first signal to said two-speed drive to cause its output member to rotate at either one of said two speeds in response to the motion of the output member of said crankshaft clutch;

terminating said first signal to cause said output member of said two-speed drive to rotate at the other of said two-speeds; and

applying a second signal to said crankshaft clutch to disengage said output member thereof from said crankshaft.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26b
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Fig-1

100
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108
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118a
118b
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124a
124b
126a
126b
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132a
132b
134
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138
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162
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167
168
170
180
182
190
CONTROL
ACTUATOR
PRESSURE

Fig-2