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(71) Applicant(s)

Kongsberg TechMatic UK Limited
(Incorporated in the United Kingdom)
Tachbrook Road, LEAMINGTON SPA, Warwickshire,
CV31 3ER, United Kingdom

(72) Inventor(s)

David Anthony Harries

(74) Agent and/or Address for Service

Anthony Cundy & Co
1 Oulton Bridge, 245 Warwick Road, SOLIHULL,
West Midlands, B92 9AH, United Kingdom

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(56) Documents Cited

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US 5004086 A US 4829221 A US 4650056 A

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(54) Abstract Title

Clutch actuator arrangement and actuating system.

(57) The actuator assembly comprises a support member, an actuator mounted on the support member and a clutch operating lever pivoted on the support member, the actuator acting on the lever to pivot the lever to engage or disengage a clutch. The actuator 34 may be a hydraulic cylinder mounted on the support member 30 and receiving fluid from a pump 32 powered by a motor 31 to move the lever 21 to disengage the clutch. Solenoid valve 36 controls release of the fluid to permit lever return and clutch engagement. Alternatively the actuator may be electrically operated. The actuator assembly can be used with a clutch (11 Figure 1) for continuously variable transmission(13) and is controlled by a control unit (22) receiving signals from clutch (23) and, throttle position (24), vehicle speed (25), brake (26) and selector lever position (27) sensors.

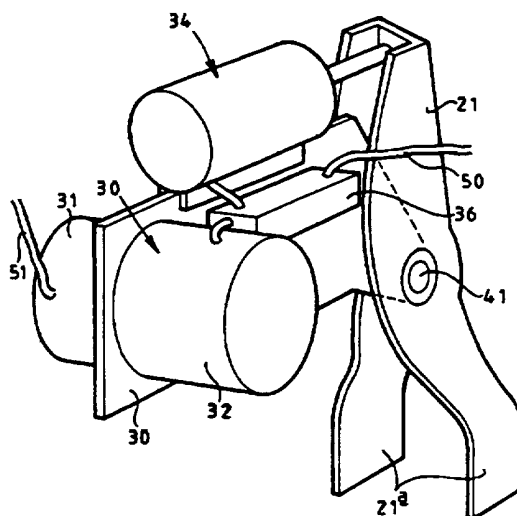
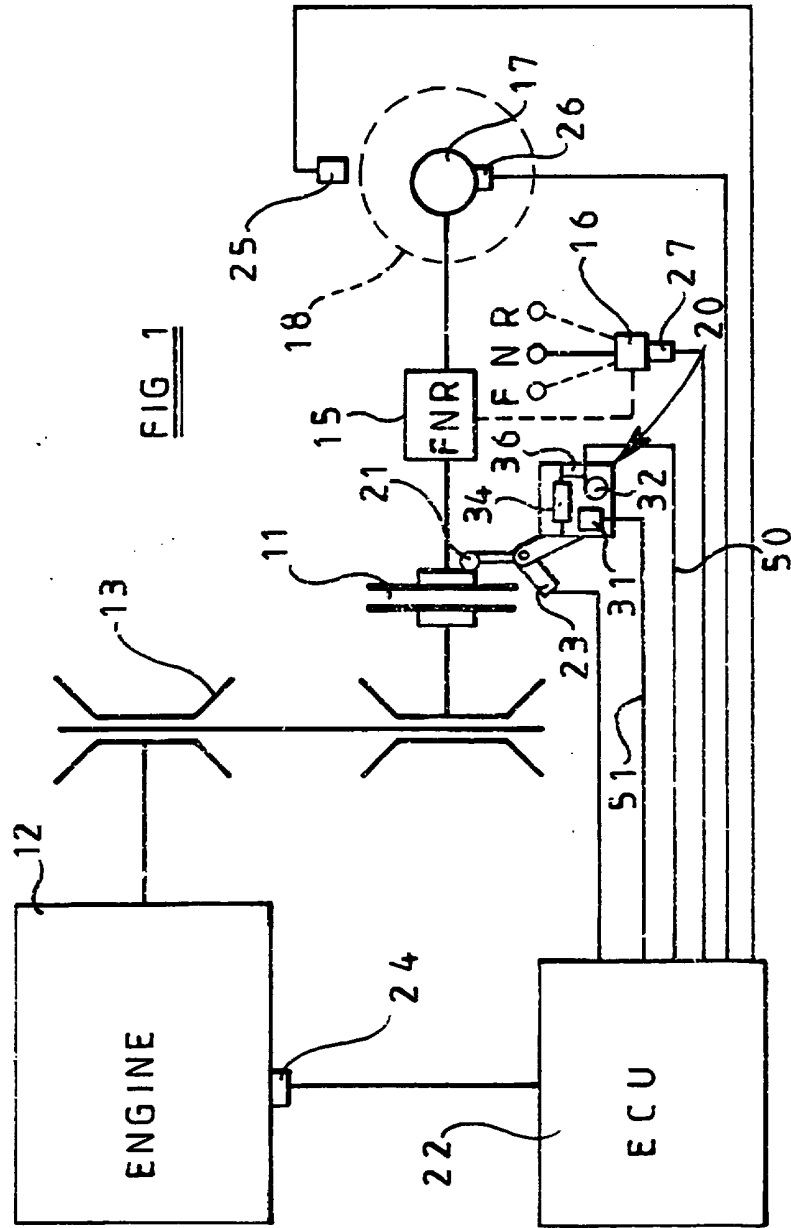
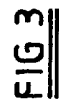
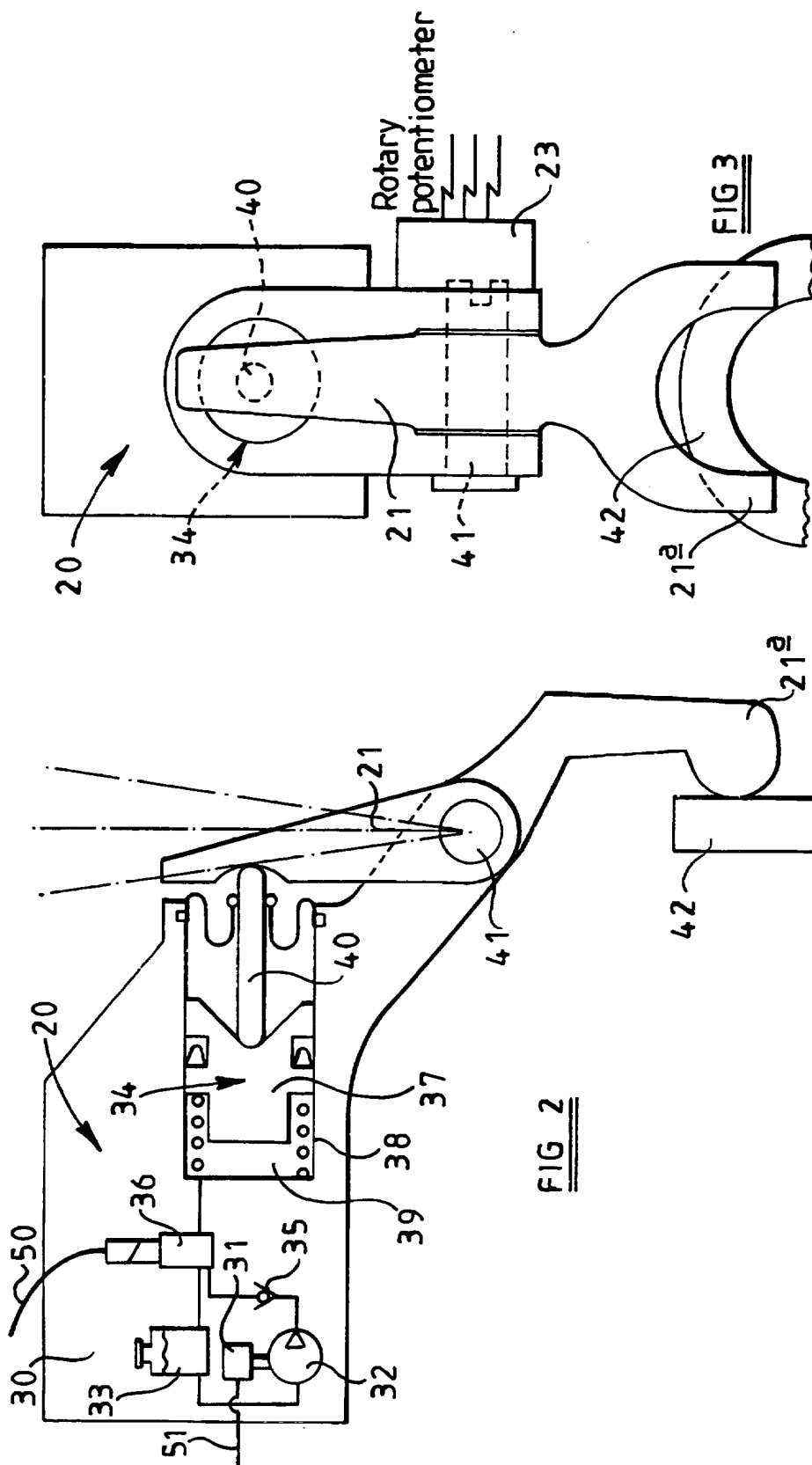


FIG 4
"Rough schematic"

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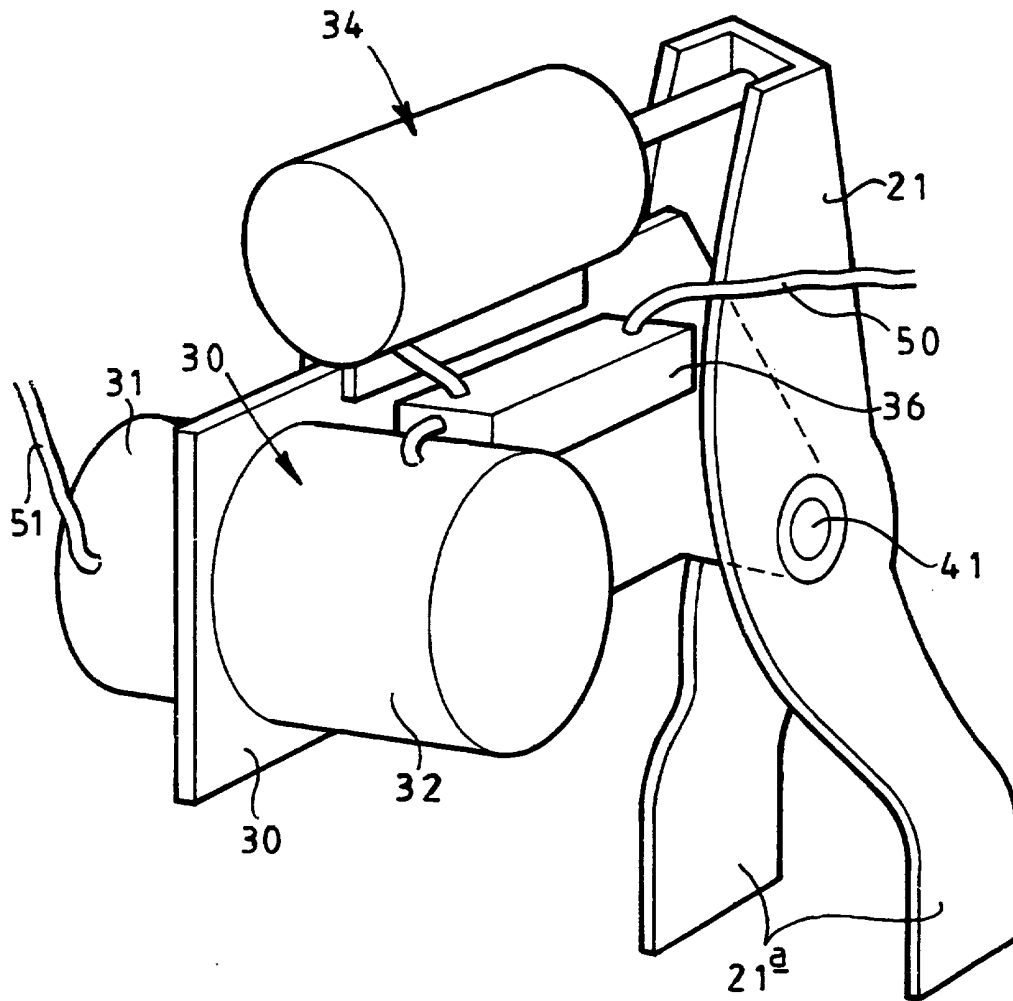
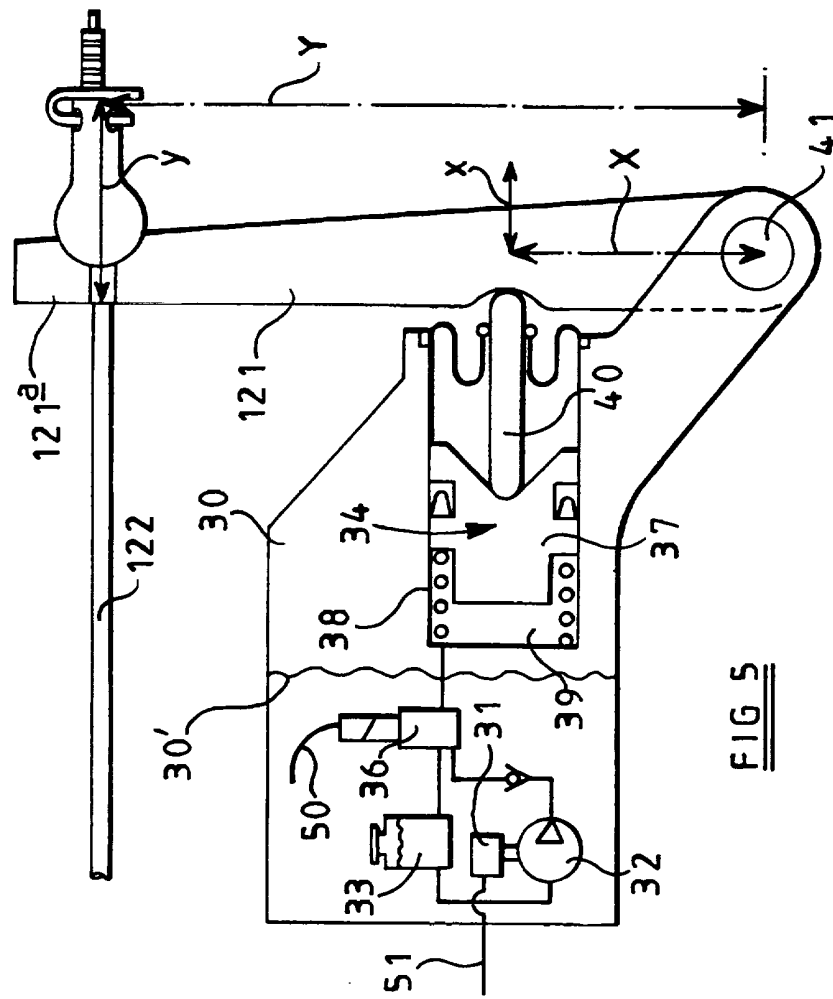
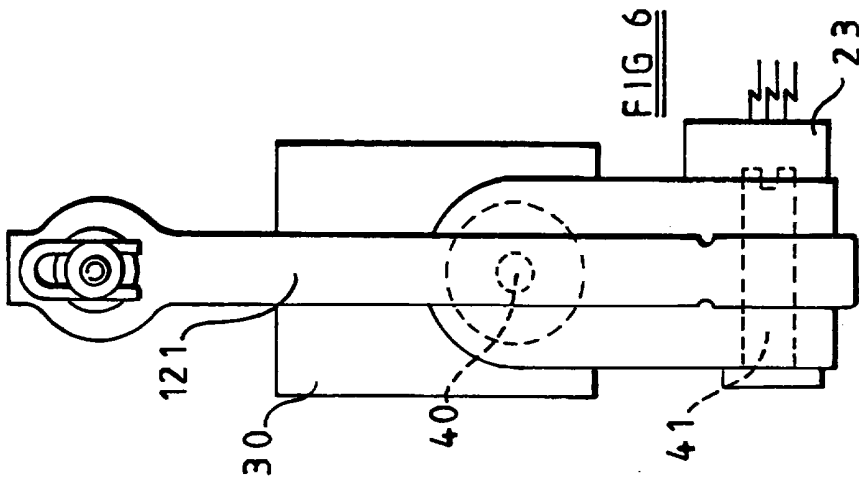


FIG 4
"Rough schematic"



CLUTCH ACTUATORS

This invention relates to clutch actuator assemblies and actuating systems which include such assemblies.

5 It is an object of the present invention to provide an improved form of clutch actuator assembly and actuating system which are both compact and efficient and which are particularly suitable for use with transmissions where clutch operation is relatively infrequent such as Continuously Variable transmissions (CVTs) where the clutch is often only required to operate on starting and stopping of the vehicle.

10 Thus according to the present invention there is provided a clutch actuator assembly comprising a support member, an actuator mounted on the support member and a clutch operating lever pivotally mounted on the support member, said actuator acting on the clutch operating lever, to pivot the lever.

15 Such an assembly is compact and efficient and requires no separate mounting of the clutch operating lever.

The lever may operate directly on clutch release mechanism (e.g. release bearing).

20 Alternatively the lever may operate the clutch via a cable or other operating link such as a hydrostatic line.

According to one embodiment of the invention the clutch actuator comprises a fluid pressure operated clutch operating cylinder. A fluid circuit for supplying fluid under pressure is preferably mounted, at least in part, on the support member. The circuit may include a fluid pressure

generating pump driven by an electric motor, the outlet from the pump being connected to the clutch operating cylinder via a control valve.

5 A small volume accumulator may also be mounted on the support member to receive pressurised fluid from the pump for onward supply to the clutch operating cylinder via the control valve.

10 According to an alternative embodiment an electrical actuator may be mounted on the support member and drivingly connected to the clutch operating lever. The electrical actuator may be in the form of an electric motor, which may, if necessary, be drivingly connected to the clutch control lever by a gear system.

15 Depending on the particular vehicle application, the lever may advantageously be pivotted on the support member adjacent one end, connected with the associated clutch adjacent the other end and operated on by the actuator intermediate the ends. Such an arrangement is particularly compact and enables a given movement of the clutch operating end of the lever to be obtained with the minimum movement of the actuator.

According to a second aspect of the present invention there is provided a vehicle clutch actuating system comprising:-

- 20 - an electrically powered clutch actuator assembly including a clutch actuator; and
- an electronic control unit which receives signals representative of predetermined vehicle operating parameters indicative of the requirement to engage and disengage an associated clutch to start
- 25 and stop the associated vehicle, the control unit processing said parameter signals and being arranged on receipt of a signal

indicative of the requirement to engage or disengage the clutch to energise the actuator to engage/disengage said clutch as required.

5 Preferably the actuating system is arranged to energise the actuator when it is desired to release the associated clutch and the clutch is engaged by internal springs in the clutch. This will therefore only require the system to energise the actuator when clutch disengagement is required.

Typically the parameter signals received by the control unit comprises one or more of the following:-

10 clutch engagement position
throttle opening/accelerator pedal position
vehicle speed
brake application
operation of associated transmission ratio selector member.

15 Such an actuating system is particularly suitable for use with CVTs since such transmissions often only require operation of the clutch on starting and stopping of the vehicle.

The actuator assembly and actuator of the first aspect of the present invention may conveniently be used in the actuating system of the second aspect of the invention.

20 The present invention will now be described, by way of example only, with reference to the accompanying drawings in which:-

Figure 1 shows a vehicle clutch actuating system in accordance with the present invention used in conjunction with a CVT;

Figures 2, 3 and 4 show in more detail a clutch actuator assembly used in the system of figure 1, and

Figures 5 and 6 show an alternative form of clutch actuator in accordance with the present invention.

5 Referring to Figure 1 this shows a vehicle clutch actuating system 10 used to operate a clutch 11 in a vehicle drive-line which includes an engine 12 connected with a CVT 13. The drive-line also includes a forward-neutral-reverse gear box 15 controlled by a selector lever 16 and a final drive 17 which delivers power to the vehicle wheels 18. Clutch 11
10 may be positioned anywhere in the drive-line, for example between engine 12 and CVT 13.

The clutch actuating system 10 comprises a clutch actuator assembly 20 (shown in greater detail in Figures 2, 3 and 4) which operates the clutch 11 via an actuating lever 21. The actuator assembly is controlled by an
15 electronic control unit 22 which receives input signals from a clutch engagement position sensor 23, throttle opening or accelerator pedal position sensor 24, a vehicle speed sensor 25, a brake application sensor 26 and a selector lever position sensor 27.

As can be seen from Figures 2 to 4 the clutch actuator assembly 20
20 comprises a support member 30 on which is mounted an electric motor 31 which drives an hydraulic pump 32 which delivers pressurised fluid from a reservoir 33 to a clutch operating cylinder 34 via a non-return valve 35 and a solenoid operated control valve 36.

Although the actuator assembly 20 is shown in Figures 2 to 4 as
25 comprising a plate-like support member 30 on which the motor, pump, control valve and lever are separately mounted, the assembly could

comprise a cast block incorporating an integral valve and pump body and integral pivot and may also carry a closure plate for an opening in a housing of clutch 11 through which lever 21 extends.

5 The clutch operating cylinder 34 comprises a piston 37 slideable in a bore 38 thus defining the working chamber 39 which may be pressurised with fluid from pump 32. Piston 37 operates a push rod 40 which in turn acts on clutch operating lever 21 which is pivoted intermediate it ends on a pivot pin 41. The end 21a of lever 21 operates on a clutch release bearing 42 associated with clutch 11. The angular position of lever 21, 10 and hence the engagement position of clutch 11, is sensed by sensor 23, as described above, which can conveniently comprise a rotary potentiometer associated with pivot pin 41.

As will be appreciated from the above, the clutch actuator assembly is particularly compact and also offers the advantage that the pivot 15 mounting of clutch actuating lever 21 forms part of the assembly and therefore requires no further separate mounting on the vehicle.

The clutch actuating system operates as follows.

With the selector lever 16 in the neutral position the clutch 11 is held disengaged by pressurisation of clutch operating cylinder 34. If the driver 20 wishes to engage forward drive he moves the selector lever 16 to the forward position and this movement is sensed by sensor 27 and communicated to control unit 22. Control unit 22 then issues a signal to solenoid operated valve 36 via line 50 to open the working chamber 39 to reservoir 33 and hence depressurise working chamber 39 by allowing the 25 pressurised fluid to leak back into reservoir 33. The vehicle can then continue to function in the forward drive direction with the CVT controlled at the appropriate ratio either by the control unit 22 or more likely by a separate control unit (not shown).

If the vehicle driver now wishes to bring the vehicle to a halt which will necessitate disengagement of clutch 11, the various sensors 24, 25 and 26 will sense this wish on the part of the vehicle driver and when the vehicle speed, indicated by sensor 25, has reached the appropriate low level, a signal will be issued from control unit 22 via line 51 to activate motor 31 and hence power pump 32 to deliver fluid pressure to the working chamber 39 of cylinder 34 via valve 36 which now connects working chamber 39 to the pump 32, having been actuated via line 50. Hence piston 37 is moved along bore 38 to pivot lever 21 about pivot pin 41 and hence disengage clutch 11.

The above described clutch disengagement procedure could be initiated by other actions of the vehicle driver, for example, by the movement of selector lever 16 from the forward to neutral or reverse to neutral drive position.

As will be appreciated, the above arrangement is particularly efficient since it only requires the pump 32 to operate when pressurisation of cylinder 34 is required and no accumulator is therefore necessary in the system. If appropriate a small capacity accumulator may be provided to enable a quicker system response to the requirement to disengage the clutch.

Figures 5 and 6 show schematically an alternative clutch actuator assembly in which operating cylinder 34 acts on a clutch operating lever 121 which is pivotted at one end on pin 41 and connected with the associated clutch at its other 121a either for direct operation on the clutch release bearing or, as shown in Figure 5, with a cable 122 which is connected with the clutch. If desired the cable 122 could be replaced by a hydrastatic link.

5 The push rod 40 of operating cylinder 34 acts on lever 121 intermediate its ends to provide a particularly compact and efficient lever arrangement in which the axial movement of x of push rod 40 required to achieve an axial movement Y of cable 122 is in the same ratio as the lever ratio X/Y which reflects the distances of the lines of action of push rod 40 and cable 122 from pivot 41. Hence a relatively large displacement y can be achieved for relatively small push rod movement x .

10 This operating cylinder 34 and lever 121 arrangement could be used separately with the support member 30 terminated at break line 30 ' and the remainder of the system mounted remote from the operating cylinder 34. Thus the clutch actuator in its most basic form would simply comprise operating cylinder 34 associated pivot 41 and connected operating lever 121 all mounted on a common support member 30 with the clutch position sensor associated with the lever pivot.

15 In accordance with an alternative embodiment the actuator may comprise an electric motor which is mounted on the support plate 30 and is drivingly connected to the clutch operating lever 21 by means of a suitable gear system. The ECU 22 provides energy to the electric motor to engage and disengage the clutch, as required.

CLAIMS

1. A clutch actuator assembly comprising a support member, an actuator mounted on the support member, and a clutch operating lever pivoted on the support member, the actuator acting on the lever to pivot the lever.
5
2. A clutch actuator assembly according to claim 1 in which the actuator is a fluid operated cylinder.
3. A clutch actuator assembly according to claim 2 in which a fluid circuit for delivering pressurised fluid to the clutch operating cylinder is mounted, at least in part, on the support member.
10
4. A clutch actuator assembly according to claim 3 in which the fluid circuit comprises an electric motor driven pump and a control valve.
5. A clutch actuator assembly according to claim 3 or 4 in which the fluid circuit includes a pressure accumulator.
6. A clutch actuator assembly according to any one of claims 3 to 5 in which the support member comprises a plate-like member upon which the components are separately mounted, the plate-like member defining a pivot for the lever.
15
7. A clutch actuator assembly according to any one of claims 3 to 5 in which the support member comprises a cast block, said cast block defining a pivot for the lever, one or more body formations being defined by the cast block for components of the fluid circuit.
20
8. A clutch actuator assembly according to claim 1 in which the

actuator is an electrical actuator.

9. A clutch actuator assembly according to claim 8 in which the actuator comprises an electric motor.

5 10. A clutch actuator assembly according to claim 9 in which the electric motor drives the clutch operating lever through a gear system.

11. A clutch actuator assembly according to any one of the preceding claims in which the lever acts directly on the clutch release mechanism.

10 12. A clutch actuator assembly according to any one of claims 1 to 10 in which the lever acts on the clutch release mechanism via a cable or other operating link such as a hydrostatic line.

13. A clutch actuator assembly according to any one of the preceding claims in which the support member forms a closure plate for an opening in a clutch housing, the lever being adapted to extend through said opening when the support member closes the opening.

15 14. A clutch actuator assembly according to any one of the preceding claims for use with a continuously variable transmission.

15. A clutch actuator assembly substantially as described herein with reference to and as shown in Figs. 1 to 4 and Figs. 5 and 6 of the accompanying drawings.

20 16. A clutch actuating system comprising a clutch actuator assembly according to any one of the preceding claims and an electronic control unit, the electric control unit controlling operation of the actuator.

17. A clutch actuating system according to claim 16 in which the electronic control unit receives signals representative of predetermined vehicle operating parameters indicative of the requirement to engage and disengage an associated clutch to start and stop the associated vehicle, the control unit processing said parameter signals and being arranged on receipt of a signal indicative of the requirement to engage or disengage the clutch, to energise the actuator to engage/disengage said clutch as required.
18. A clutch actuating system comprising;
an electrically powered actuator assembly including a clutch actuator; and
an electronic control unit which receives signals representative of predetermined vehicle operating parameters indicative of the requirement to engage and disengage an associated clutch to start and stop the associated vehicle, the control unit processing said parameter signals and being arranged on receipt of a signal indicative of the requirement to engage or disengage the clutch to energise the actuator to engage/disengage said clutch as required.
19. A clutch actuating system according to claim 17 or 18 in which the parameter signals received by the control unit include one or more of the following parameters; clutch engagement position, throttle opening/accelerator pedal position, vehicle speed, brake application and operation of associated transmission ratio selector member.



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Examiner: J. C. Barnes-Paddock
Date of search: 12 October 1999

Patents Act 1977 Search Report under Section 17

Databases searched:

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UK Cl (Ed.Q): F2L (LAX LK)

Int Cl (Ed.6): F16D 23/12, 27/00, 29/00, 48/06

Other: Online: WPI, EPODOC PAJ

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2 293 427 A (FICHTEL & SACHS) See Figures 1 and 3. Electronic control, motor and arcuate pivoted lever mounted on support. Lever acts on clutch release through master cylinder.	1,8-10 12,14 16,17
X	GB 2 241 298 A (AUTOMOTIVE) See Figure 1 page 8, para 3 Hydraulic actuator and lever on supporting housing 19.	1-3,11,14
X	US 5 307 965 (TURFCO) See Figures 2,3. Electric actuator and lever mounted on plate to operate a clutch.	1,8,11,14
X	US 5 004 086 (ZAHNRADFABRIK) See Figure 2. Pressure fluid clutch actuator and pivot mounted on support member.	1-5,11,14, 16,17
X	US 4 829 221 (VALEO) See Figure 1. Clutch operating lever driven through gearing by electric motor with controller.	1,8-11 14,16,17 19
X	US 4 650 056 (VALEO) See Figure 1. Clutch operating lever driven through gearing by electric motor.	1,8-11 14,16

X Document indicating lack of novelty or inventive step
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 P Document published on or after the declared priority date but before the filing date of this invention.
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