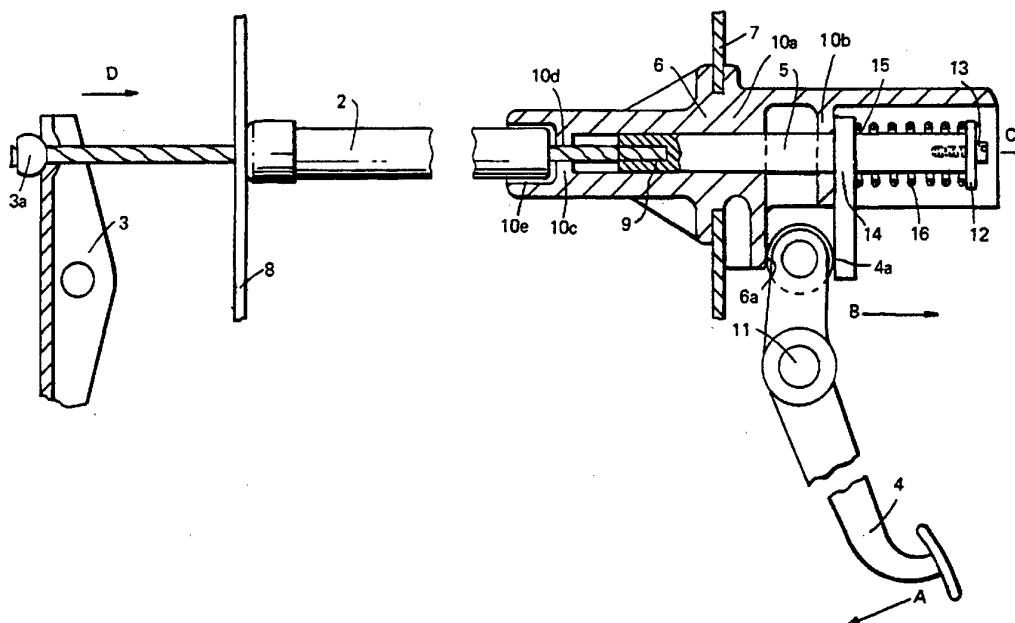


INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ : F16D 13/75	A1	(11) International Publication Number: WO 94/18469 (43) International Publication Date: 18 August 1994 (18.08.94)
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(54) Title: CONTROL CABLES



(57) Abstract

An adjusting mechanism for a clutch control cable (1, 2) includes a rod (5) which passes through a tiltable, apertured plate (14) which is operable by a clutch pedal (4) which has a captive roller (4a) engaging the plate (14). The pedal is depressed to disengage the clutch and tilts the plate (14) which engages the rod (5) and pulls the cable core (1). A helical compression spring (16) acts between the plate (14) and a washer (12) to adjust the rest position of the rod and then bring the assembly into proper adjustment. The rest position of the rod can be defined by a sliding stop (figures 2 to 5) which can operate electrical contacts (figure 10). Two springs can be used, for adjustment and for biasing the apertured plate (figures 8 and 9). The adjuster may be in-line (figures 12 to 14).

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CONTROL CABLES

5 This invention relates to control cables of the kind comprising an inner core cable and an outer conduit. Such cables are sometimes called Bowden-type cables.

10 Cable operated controls are utilised in a number of control systems within the automotive and other industries. For example, a clutch mechanism in a vehicle with manual transmission is often connected by means of a Bowden-type control cable to the clutch pedal mounted on the bulkhead separating the engine compartment from the passenger compartment of the vehicle.

15 With a clutch actuated by means of a clutch control cable a problem arises in that the effective cable length has to be reset from time to time due to tolerances in the system, cable wear and elongation, and wear of the friction lining of the clutch.

20 Previously such control systems had to be manually adjusted to achieve the desired reset position. This had the disadvantage that adjusting the system required the vehicle to be taken off the road and the services of a mechanic obtained. The adjustment tended to be made irregularly allowing the system quickly to fall out of optimal adjustment. Determining the initial adjustment of the system during manufacture also led to increased cost and assembly time.

30 Various mechanisms have been proposed to provide for self-adjustment. These can be classified in two groups: (1) core cable adjusters and (2) conduit adjusters. Both have the same objective: to maintain the control cable at its optimal effective length. However, all the mechanisms have disadvantages associated with them, including cost, unreliability,

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installation requirements, incremental adjustment and susceptibility to environmental conditions and corrosion. The components may need hardening or similar treatment and tend not to be smooth or quiet in operation.

The earlier self-adjusting control cables had a self-adjusting device in the form of an automatically releasing clamp of the ratchet and pawl type. This mechanism allowed the core and/or the conduit to move relative to an anchorage point under the influence on the cable of a tensioning spring allowing the cable to adjust itself when in its rest position.

More recent market requirements are for a self-adjusting device to be provided as part of the control cable itself. These devices may take the form of an automatically releasing clamp of either the wedged ball type or the wedged jaw type: see, for example, US 4378713, WO 85/03113, WO 86/05849 and EP 0443935. In these devices, a clamp which is mechanically linked to the core of the cable becomes displaced on depression of a control pedal. This axial movement causes the clamp to close on the conduit.

The present invention sets out to improve on the known systems.

The present invention provides control cable assemblies comprising a cable having an inner core cable received within an outer conduit, an operating member movable between a first, rest position and a second position, coupling means acting between the operating member and the core cable, the coupling means coupling the operating member to the core cable for movement thereof relative to the outer conduit upon movement of the operating member between its first and second positions and uncoupling the operating member from the core cable in the first

position, and self-adjustment means acting on the core cable in the first position of the operating member to determine the position of the core cable relative to the rest position of the operating member in order to maintain a correctly adjusted condition of the cable assembly. Such assemblies are referred to herein as being "of the type described".

When these cable assemblies are used to operate a motor vehicle clutch, the first and second positions of the operating member correspond respectively to the engaged and disengaged conditions of the clutch

In these assemblies, the adjustment of the core cable takes place in the rest position of the operating member and, when used to operate a vehicle clutch, between each engagement and disengagement of the clutch.

It will be noted that the assemblies require no means for holding the core cable in the second position. When used for clutch control, the assemblies are maintained in that position by the operator maintaining the disengaged condition of the clutch.

According to a first aspect of the invention, the coupling means of an assembly of the type described comprises an elongate element, for example a rod, attached to the core cable, and an element having an aperture through which the elongate element extends, the apertured element being movable between a tilted coupling position, in which it engages the elongate element, and an uncoupling, perpendicular or more nearly perpendicular position, in which the elongate element is free to move relative to the apertured element, the coupling and uncoupling positions of the apertured element corresponding respectively to the second and the first positions of the operating

member.

5 The operating member, usually a pedal, may act directly on the apertured element. This need not be the case however and the invention can provide a mechanism in which the apertured element is acted upon remotely by the operating member, for example through a further cable. An adjusting device can thereby be provided which is located "in-line" in a control cable comprising first and second cable runs.

10 The invention therefore also provides a control cable assembly comprising first and second cable runs each having an inner core cable received within an outer conduit, coupling means acting between the two cable runs, the coupling means uncoupling the core
15 cables of the cable runs from each other in a first position of the core cable of the second cable run and coupling the core cables to each other in a second position of the second core cable, and self-adjustment means acting on the first core cable in the first
20 position of the second core cable to determine the position of the core cables relative to each other in order to maintain a correctly adjusted condition of the cable assembly, the coupling means comprising an elongate element attached to the first core cable and
25 an element having an aperture through which the elongate element extends, the apertured element being movable between a tilted coupling position, in which it engages the elongate element, and an uncoupling, perpendicular or more nearly perpendicular position,
30 in which the elongate element is free to move relative to the apertured element, the coupling and uncoupling positions of the apertured element corresponding respectively to the second and the first positions of the second core cable.

35 Preferably, the axes of the first and second runs

are offset in the mechanism, the axis of one run extending through the aperture of the apertured element and the axis of the other conveniently being parallel to axis of the first run and intersecting the apertured element at a location to supply the tilting force to the apertured element.

In the above control cable assembly the self-adjustment means acts on the first cable run. It is therefore desirable that the position of the outer conduit of at least one cable run, preferably the second cable run, in a body of the assembly is adjustable. This can be achieved by having a peripheral groove in the outer surface of the conduit and a series of corresponding grooves in the assembly body, a locking member being locatable in the groove in the conduit and a selected one of the series of grooves to adjust the cable position. The groove may alternatively be in the body and the series of grooves in the conduit.

Advantageously, when the operating member acts directly on the apertured element, it acts with a camming action, in which there is preferably rolling contact between the two parts, for example through a captive roller mounted on the pedal. Other types of direct action are also possible, for example a pin and slot linkage.

An arrangement of this kind has the advantage of providing a particularly direct action of the operating member on the apertured element. The coupling means and the self-adjustment means can be conveniently contained in a housing or bracket which also acts as an anchorage for one end of the outer conduit.

The apertured element is preferably biased towards its first position by resilient biasing means,

conveniently a helical compression spring extending around the elongate element.

5 The apertured element is conveniently in the form of a plate forming a driveplate for the elongate element. If desired, the driveplate may be compound with two or more plates in face-to-face contact.

10 The self-adjustment means may comprise a resilient biasing means which acts on the core cable, either directly or indirectly, for example by acting on the elongate element when one is provided. The biasing force of the resilient biasing means is selected so as to be sufficient to bring the core cable into a position relative to the operating member which corresponds to the correctly adjusted condition
15 of the assembly, whilst not being sufficient to bring about any operational movement of the core cable, such as movement bringing about partial disengagement of the clutch of a vehicle in which the assembly is installed.

20 Conveniently, the biasing means for the apertured element and the biasing means of the self-adjustment means are combined in a single biasing means which acts to bias the apertured element into abutment with a fixed part of the assembly in the uncoupling
25 position of the apertured element. The combined biasing means may be a helical compression spring which extends around the elongate element and acts between the apertured element and an end stop on the elongate element.

30 When separate resilient biasing means are provided, the self-adjustment biasing means conveniently comprises a helical compression spring which extends around the elongate element and acts between an end stop thereon and an abutment on a fixed
35 part of the assembly. In another arrangement, the

5 biasing means acts between the end of the elongate element adjacent the core cable and an abutment on a fixed part of the assembly. Such a biasing means can comprise a helical compression spring extending around an end portion of the core cable adjacent the elongate element and acting between the end of the elongate element and an abutment on a fixed part of the assembly.

10 According to a second aspect of the invention, the self-adjustment means of an assembly of the type described comprises a restraining means which acts to reduce or prevent free movement of the core cable in the first position of the operating member after the operating member has returned to its first position at
15 the completion of an operating cycle of the cable assembly. The restraining means thereby keeps the control cable in a correctly adjusted condition and eliminates any slack which would otherwise develop in the control assembly during use.

20 The restraining means may comprise frictional means acting on the core cable or a part movable therewith, for example the elongate element mentioned above in the context of the first aspect of the invention. The frictional restraining force is
25 selected or adjusted so that, in use of the assembly, it is overcome by any force restoring the operating member to its first position (for example the re-engagement force of a vehicle clutch, provided by its own diaphragm or other spring) but is sufficient to
30 prevent free movement of the core cable in the rest position of the operating member.

35 The frictional means advantageously comprises an interference bearing in which the core cable, or part movable therewith, is a sliding fit. This produces a stepless adjustment. The interference fit can be

enhanced by resilient biasing means, a preferred form of which is one or more leaf or bow springs acting between the two parts. In other embodiments, serrations or ramped surfaces can be provided.

5 It is however preferred that relative movement between the restraining means and a fixed part of the assembly should take place during each operating cycle of the control assembly.

10 Thus, the restraining means may comprise first and second abutments on a fixed part of the assembly and a stop member which is movable relative to the core cable, for example by being slidably mounted on an elongate element of the kind mentioned above when one is present, the stop member engaging the first
15 abutment in the first position of the operating member, in order to define its rest position, and the second abutment during an end portion of the movement of the operating member to its second position. The
20 movement of the stop member between the first and second abutments is thus less than the movement of the core cable between the first and second positions of the operating member.

 Preferably, the stop member takes the form of an interference bearing as mentioned above.

25 Provision for limited movement between the first and second abutments reduces the possibility of the stop member sticking on the elongate element during operation of the assembly.

30 The movement of the stop member is preferably less than the stroke of the operating member between its first and second positions, thereby providing for self-adjustment of the assembly.

35 The present invention can then provide a particularly effective and simple self-adjustment means which is particularly suited to vehicle clutch

applications of the control cable assemblies..

5 One or both abutments are conveniently annular and the elongate element extends through them. The annular abutment(s) can provide support for the elongate element or there may otherwise be a clearance between the abutment(s) and the elongate element. At least one abutment may be provided by a captive washer through which the elongate element extends.

10 According to a third aspect of the invention, there is provided a control cable assembly comprising a cable having an inner core cable received within an outer conduit, an operating member movable between a first rest position and a second position, and electrical sensing means for signalling the position
15 of the operating member in its operational cycle between its first and second positions.

Preferably the electrical sensing means includes electrical contact means between which an electrical circuit can be completed by an element movable in response to movement of the core cable, at least
20 during part of the operational cycle. The movable contact element is conveniently provided on an elongate element as mentioned above, when one is present.

25 The control cable assembly is preferably one according to the second aspect of the invention and the contact element is conveniently provided by a stop member as mentioned above, when allowed movement with the core cable. One or more electrical contacts are
30 positioned to contact the stop member, which comprises conducting material where it contacts the contacts. An electrical circuit between the contacts is thus completed. The stop member may simply complete a circuit or circuits between stationary contacts, or
35 can itself form part of a circuit which may also

include the elongate element on which the stop member is mounted. Further contacts can be provided for completion of one or more further circuits at other positions of the stop member.

5 When used with a vehicle clutch, this arrangement can be used to provide various signalling possibilities: a signal produced during an initial stage of clutch disengagement can signal to a vehicle engine management system that fuel supply should be
10 cut off until the re-engagement takes place; a signal produced later in disengagement of the clutch can be used to signal that the clutch is disengaged and that starting of the vehicle engine is no longer to be inhibited.

15 It should be particularly noted that since the position of the stop member is defined by the first abutment mentioned above, the position of the stop member relative to the contacts will be the same regardless of the state of wear of the cable or the
20 device which it operates. The electrical contact means can therefore provide an accurate indication of vehicle clutch disengagement which is independent of cable and clutch wear.

25 By a combination of its second and third aspects, the invention can provide an effective and simple combined self-adjustment and signalling means.

30 The control cable assemblies according to the invention preferably include an abutment means defining the rest position of the operating member. This has the advantage of eliminating the need for adjustment of the operating member rest position during vehicle assembly. When the coupling means comprises an apertured element referred to above, the
35 abutment means assists in ensuring that the apertured element is in its uncoupling position in the rest

position of the operating member. The apertured element is thus returned to its uncoupling (perpendicular or nearly so) position and the assembly is thus "open centred".

5 The control cable assemblies of the invention may include a housing of plastics material which can be fitted, for example, to a motor vehicle by, for example, being a snap-fit in an aperture in a bulkhead or other part of the vehicle. Other ways of fitting
10 include insertion into a keyhole aperture or securement by a bolt holding the housing to the vehicle bulkhead or other part. The housing provides a convenient means for supporting any electrical contacts as mentioned above and/or for providing
15 support and guidance for the elongate element when one is present. The various abutments mentioned above may also be provided on the housing.

 Embodiments of the invention will now be described by way of example with reference to the
20 drawings, in which:

 Figure 1 is part-sectional somewhat schematic view of self-adjusting operating mechanism for a motor vehicle clutch,

25 Figure 2 is a view corresponding to part of Figure 1 of a first modified operating mechanism, at rest,

 Figure 3 shows the operating mechanism of Figure 2 during operation,

30 Figure 4 shows the operating mechanism of Figure 2 at rest after some wear in the clutch system has taken place,

 Figure 5 corresponds to Figure 2 and shows a second modified adjusting mechanism,

35 Figure 5a is a section on the line V - V of Figure 5,

Figure 6 shows part of the adjusting mechanism of Figure 2 incorporating a third modification,

Figure 6a shows a part of the adjusting mechanism of Figure 6 removed from the mechanism,

5 Figure 7 corresponds to Figure 6 but shows a fourth modification,

Figure 8 is a view corresponding to part of Figure 1 and shows a fifth modification,

10 Figure 9 corresponds to Figure 8 and shows a sixth modification,

Figure 10 corresponds to Figure 2 and shows a seventh modification,

Figure 11 corresponds to Figure 2 and shows a eighth modification,

15 Figure 12 shows somewhat schematically an in-line cable adjusting mechanism,

Figure 13 corresponds to Figure 12 but shows a modified in-line adjusting mechanism, and

20 Figure 14 shows a detail of Figure 13, viewed in the direction of the arrows E-E on Figure 14.

Referring first to Figure 1, there is shown a Bowden-type cable comprising a core cable 1 and a flexible conduit 2. The core cable 1, which is of a fixed length, extends between a clutch actuating lever 3, to which it is secured by a terminal nipple 3a, and an application rod 5 of the operating mechanism. In this embodiment, the rod 5 is of circular section and has a smooth surface finish. Any other section could however be used. The surface could be roughened. The rod 5 is slidable in a mounting bracket 6 which passes through an opening in a bulkhead 7 of the vehicle engine compartment. The mounting bracket 6 can be a plastics moulding and can be conveniently fitted to the bulkhead 7 by being received in a keyhole slot in the bulkhead. In other embodiments, the bracket can be

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snap-fit or can be bolted in place.

5 A clutch operating pedal 4 of the vehicle is mounted on the bulkhead 7 for pivotal movement about a pivot 11. The flexible conduit 2 of the control cable is anchored at its respective ends to the mounting bracket 6, which is in turn anchored to the bulkhead 7, and a further anchorage 8 constituted by, for example, a bracket on the housing of the vehicle clutch. These anchorages provide fixed mechanical
10 earth points for the conduit 2.

The end of the core cable 1 adjacent the clutch pedal 4 is secured within a narrow bore 9 extending into the forward end of the application rod 5. The application rod 5 is supported by and slidable within a
15 tubular portion 10a of the mounting bracket 6 and further supported by a portion 10b of the bracket. An outer end portion 10c of the bracket 6 has a passage 10d, through which the core cable 1 extends and also provides a seating 10e for the adjacent end of the
20 flexible conduit 2. In other embodiments, the core cable is attached to the application rod by means such as crimping, soldering and welding.

The rearward end of the application rod 5 is fitted with a washer 12 which is attached to the rod 5
25 by a screw 13. A driveplate 14 has a central aperture 15 which corresponds to the cross-section of the application rod 5 and is therefore circular in this embodiment. The application rod 5 extends through the aperture 15 so that the driveplate 14 is fitted to
30 the application rod between the supporting portion 10b of the bracket 6 and the washer 12.

A helical compression spring 16 extends around the rearward portion of the application rod 5 and is seated at its respective ends on the driveplate 14 and
35 the washer 12. A captive roller 4a forming a cam is

rotatably mounted at the upper end of the clutch pedal 4 and acts on the driveplate 14. An abutment 6a on the bracket 6 acts as a stop to define the rest position of the pedal 4. In this embodiment, the floor of the vehicle provides a stop at the opposite end of the stroke of the pedal. When the clutch pedal 4 is pivoted clockwise (as seen in Figure 1) the captive roller 4a moves the driveplate 14 against the bias of the spring 16 from the position shown in Figure 1, in which it is generally perpendicular to the longitudinal axis of the application rod 5, to a position in which it is rotated in an anti-clockwise direction (as seen in Figure 1) against the force of the spring 16. In this position, the application rod 5 becomes wedged in the driveplate aperture 15 and the driveplate 14 grips the application rod 5. Further movement of the clutch pedal 4 in a clockwise direction produces a rearward movement of the application rod 5 against the bias of the spring 16. This rearward movement of the application rod 5 in turn draws the core cable 1 further into the mounting bracket 6 and produces a clockwise (as seen in Figure 1) pivoting movement of the clutch actuating lever 3 which in turn leads to disengagement of the clutch.

The clutch operating mechanism shown in Figure 1 operates as follows. To disengage the clutch, the pedal 4 is depressed (arrow A in Figure 1). This leads to a clockwise movement about the pivot 11 of the upper part 4 of the clutch pedal (arrow B), an anti-clockwise pivoting movement of the driveplate 14 and a consequential rearward movement of the application rod 5 (arrow C). The rearward movement of the application rod 5 results in the core cable 1 being pulled through the flexible conduit 2 and the end of the actuating lever 3 to which the core cable 1

is attached pivoting in a clockwise direction (arrow D) to release the clutch of the vehicle.

Re-engagement of the clutch is a reversal of the above process. The pedal 4 is released under control of the foot, the diaphragm or other spring in the clutch draws the core cable 1 back through the conduit 2, the driveplate 14 is returned by the spring 16 to its perpendicular position and the application rod 5 is freed from engagement with the driveplate. In the resulting condition, the spring 16 acting on the washer 12 can move the application rod 5 through the driveplate aperture, and so take up any slack in the core cable 1, or allow movement of the application rod 5 in the opposite direction under the influence of the clutch spring if the effective length of the core is to be increased. A correctly adjusted position of the rod 5 relative to the driveplate 14 is thus established.

Figure 2 of the drawings shows a first modification of the clutch actuating mechanism of Figure 1. Parts of the mechanism of Figure 2 corresponding to those of Figure 1 are shown by the same reference numerals increased by "100". In this modification, the mounting bracket 106 is formed at its rearward end (the right hand end as seen in Figure 2) with a further support portion 110c which has a supporting aperture for the application rod 105 and which also extends rearwardly to form a support for a washer 112 which is captively mounted in the bracket 106 and has an aperture through which the application rod 105 can slide. Between the support portion 110c of the bracket and the captive washer 112, the application rod 105 passes through an interference bearing 120, through which the rod 105 is slidable but which fits sufficiently tightly on the rod for the

bearing to slide with the rod when not restrained from doing so by another part of the mechanism. The light spring 116 of the mechanism acts between the driveplate 114 and an abutment provided by the support portion 110c of the bracket 106 to ensure uncoupling of the driveplate.

Together with Figures 3 and 4, Figure 2 shows the operation of the first modified clutch actuating mechanism. Figure 2 shows the mechanism at rest with the vehicle clutch engaged. When the clutch pedal 104 is depressed (arrow A) to disengage the clutch, the captive roller 104a at the upper end of the pedal pivots (arrow B) and bears against the driveplate 114. This moves the driveplate from its perpendicular into its slanted position against the bias of the spring 116. The driveplate 114 is now in wedging engagement with the application rod 105. Further movement of the upper part 104 of the pedal produces a rearward movement (arrow C) of the application rod 105 and an accompanying rearward movement of the interference bearing 120, until the point in the rearward stroke of the application rod is reached in which the interference bearing 120 contacts the captive washer 112. Further rearward movement of the application rod results in relative movement between the rod and the interference bearing taking place, until the disengaged position of the clutch is attained. This is the condition of the mechanism shown in Figure 3.

When the pedal is released to re-engage the clutch, the diaphragm or other spring in the clutch acts on the core cable to draw the application rod 105 through the bracket 106. Initial movement of the rod results in the interference bearing 120 moving from right to left (as seen in Figure 3). Further re-engaging movement of the clutch results in the

application rod 105 moving further through the interference bearing 120 until the condition shown in Figure 4 is achieved. Figure 4 shows the mechanism having returned to rest but when some wear in the clutch lining and/or the cable has taken place. In this position, the interference bearing 120 has retained the application rod 105 in the position in which the slack in the cable or wear in the friction linings has been taken up by the rod adopting a new rest position in which it is displaced towards the right or left (as seen in Figure 4) relative to the position shown in Figure 2, in dependence upon the direction in which self-adjustment is necessary.

It is important to note that, in this position, the interference bearing 120 retains the application rod 105 in its adjusted position in the rest position of the pedal 104, without imposing any pre-load on the clutch mechanism. Since the effect of a pre-load is to tend to cause partial disengagement of the clutch, and therefore unnecessary wear of its lining material, this is an important advantageous feature of the adjusting mechanism of this embodiment.

Figures 5 and 5a of the drawings shows a second modified adjusting mechanism, the parts of which corresponding to the mechanism of Figure 1 are shown by reference numerals increased by "200". This mechanism corresponds closely to that shown in Figures 2 to 4 with the exception that the interference bearing 220 is located between respective side walls 206 at the rearward end of the bracket 206. The rearward limit position of the interference bearing 220 is defined by a portion 212 of the bracket, the captive washer being omitted.

Figures 6 and 6a show a third modification with reference numerals increased by "400". Here the

interference bearing 420 carries a pair of bow springs 420a, 420b which fit around the bearing 420 and produce radially inwardly directed forces on the rearward part of the application rod 405. These forces act to reinforce the interference fit between the bearing 420 and the rod 405. More than two bow springs can be used, if desired. The rest position of the actuating mechanism is therefore defined as before by the interference bearing 420.

Figure 7 shows a fourth modification with reference numerals increased by "500". Here the engagement between the interference bearing 520 and the application rod 505 is by way of mating serrations 522a, 522b on the bearing and the rod respectively, the serrations being inclined so as to allow stepwise movement of the bearing 520 along the rod 505 from left to right as seen in Figure 7. The rest position of the mechanism is again defined by the bearing 520.

Figures 8 and 9 show further modifications of the mechanism shown in Figure 1 and use reference numerals increased by "600" and "700" respectively.

In Figure 8, a first spring 616 acts between a portion 610b of the mounting bracket 606 and the washer 612; a second spring 620 acts between the driveplate 614 and the bracket portion 610b. The spring 616 defines the rest position of the application rod 605 to compensate for clutch wear and cable stretch; the spring 620 biases the driveplate 614 towards its perpendicular position.

In Figure 9, a first spring 716 acts between the support portion 710d of the mounting bracket 706 and the forward end of the application rod 705. A second spring 724 acts between the driveplate 714 and a portion 710b of the bracket 706. The first and second springs 716, 724 have the same functions as the

first and second springs 616, 620 in Figure 8.

5 In the embodiments of Figures 8 and 9, the downward movement of the pedal 604, 704 can be limited by the vehicle floor or by the bracket portions 610b, 710b limiting rearward movement of the driveplates 614, 714.

10 It should be noted that the brackets 606, 706 of the mechanisms shown in Figures 8 and 9 are secured in the respective vehicles by bolts 630, 730 which pass through bulkhead portions 607', 707' lying above the brackets 606, 706. The brackets are further located by engagement of circular bosses 632, 732 in
15 respective apertures in the bulkhead portions 607', 707'. By way of modification, the bosses 632, 732 could be oval.

Figure 10 shows schematically a modification of the modified embodiment shown in Figures 5 and 5a, in which the movement of the interference bearing 220 relative to the application rod 205 causes a
20 conducting element 224 on the bearing 220 to complete an electrical circuit between fixed contacts 226a, 226b and therefore allows signalling to take place to, for example, an engine management system or a starting-inhibition device. In further modifications,
25 a single contact or three or more contacts are provided to provide for further signalling possibilities. The switch can also be applied to the mechanism shown in Figures 6 and 6a with one or both bow springs 420a, 420b completing the electrical
30 circuit.

Figure 11 shows a modification of the mechanism of that shown in Figures 2 to 4, in which the upper end of the clutch pedal is attached to the driveplate 114 through a pivotal linkage 130 formed by a pin 132
35 on the driveplate sliding in a slot 134.

If desired, the driveplates shown in the embodiments described above can be replaced by compound driveplates comprising first and second apertured plates in face-to-face contact. This distributes the drive load and produces enhanced engagement. This is shown for the embodiment of Figure 10, which has a double driveplate consisting of plates 214a, 214b.

Figure 12 shows an adjusting mechanism which can be located "in-line" with respective cable runs extending to the clutch mechanism and the clutch pedal. Parts corresponding to those shown in Figure 1 are represented by reference numerals increased by "800".

The mechanism has a body 806 which is moulded from plastics material in two half-bodies. A first cable comprising a core cable 801 and a flexible conduit 802 extends from a clutch mechanism and terminates with a rod 805 secured to the core cable 801. The rod 805 is received in an apertured driveplate 814 on which a helical compression spring 816 acts. The driveplate 814 is also attached to a second cable which extends to the clutch pedal. The core 830 of the further cable is attached to the driveplate 814. The conduit 832 is received in the body 806. The abutment 812 is fixed to the body 806 and functions as the support portion 110c in the embodiment of Figure 2.

The mechanism shown in Figure 12 operates exactly as the mechanism of Figure 1 except that the driveplate 814 is moved to its tilted position by movement to the right (as shown in Figure 12) of the core 830 of the second cable. The spring 812 acts as an auto-adjuster for the first cable and returns the drive-plate 814 to its "open-centre" perpendicular

position.

Figures 13 and 14 show a modification of the mechanism of Figure 12. Corresponding parts are indicated by reference numerals which are increased by "900" compared with Figure 1.

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The mechanism of Figures 13 and 14 allows for adjustment of the conduit 932 of the second cable in the body 906. This is achieved by a series of annular grooves 934 which extend around the conduit 932 and can receive a clip 938 which is located in a selected one of the grooves 934 and in a groove 936 in the outer surface of the conduit 932. In this way the position of the second cable in the body 906 can be adjusted to suit the mechanism to different vehicles. A cable assembly including the mechanism can thereby be "universal" in application. In this modification a further resilient biasing means in the form of a helical compression spring 940 acts on the driveplate 914 as a light pretensioning spring.

It will be understood that the cable assemblies described and claimed in this specification are not limited to clutch-control applications. The assemblies are equally applicable to other automotive applications, including parking brake and throttle control and to non-automotive applications.

CLAIMS

1. A control cable assembly comprising a cable having an inner core cable received within an outer conduit, an operating member movable between a first, rest position and a second position, coupling means acting between the operating member and the core cable, the coupling means coupling the operating member to the core cable for movement thereof relative to the outer conduit upon movement of the operating member between its first and second positions and uncoupling the operating member from the core cable in the first position, and self-adjustment means acting on the core cable in the first position of the operating member to determine the position of the core cable relative to the rest position of the operating member in order to maintain a correctly adjusted condition of the cable assembly.

2. An assembly according to claim 1, in which the coupling means comprises an elongate element attached to the core cable and an element having an aperture through which the elongate element extends, the apertured element being movable between a tilted coupling position, in which it engages the elongate element, and an uncoupling, perpendicular or more nearly perpendicular position, in which the elongate element is free to move relative to the apertured element, the coupling and uncoupling positions of the apertured element corresponding respectively to the second and the first positions of the operating member.

3. An assembly according to claim 2, in which the operating member acts directly on the apertured element.

4. An assembly according to claim 3, in which the operating member acts on the apertured element

with a camming action.

5. An assembly according to claim 4, in which the camming action involves rolling contact between the operating member and the apertured element.

5 6. An assembly according to claim 4 or 5, in which the operating member includes a captive roller which acts on the apertured element.

10 7. An assembly according to any of claims 2 to 6, in which the apertured element is biased towards its first position by resilient biasing means.

8. An assembly according to claim 7, in which the resilient biasing means comprises a helical compression spring extending around the elongate element.

15 9. An assembly according to any of claims 2 to 8, in which the apertured element is in the form of a plate forming a driveplate for the elongate element.

20 10. An assembly according to claim 9, in which the driveplate is compound and comprises two or more plates in face-to-face contact.

11. An assembly according to any of claims 2 to 10, in which the self-adjustment means comprises resilient biasing means acting directly or indirectly on the core cable.

25 12. An assembly according to claim 11, in which the biasing means for the apertured element and the biasing means of the self-adjustment means are combined in a single biasing means which acts to bias the apertured element into abutment with a fixed part of the assembly in the uncoupling position of the apertured element.

30 13. An assembly according to claim 12, in which the combined biasing means comprises a helical compression spring which extends around the elongate element and acts between the apertured element and an
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end stop on the elongate element.

14. An assembly according to claim 11, in which the biasing means for the apertured element and the biasing means of the self-adjustment means are separate.

15. An assembly according to claim 14, in which the self-adjustment biasing means comprises a helical compression spring which extends around the elongate element and acts between an end stop thereon and an abutment on a fixed part of the assembly.

16. An assembly according to claim 14, in which the self-adjustment biasing means acts between the end of the elongate element adjacent the core cable and an abutment on a fixed part of the assembly.

17. An assembly according to claim 16, in which the self-adjustment biasing means comprises a helical compression spring extending around an end portion of the core cable adjacent the elongate element and acting between the end of the elongate element and an abutment on a fixed part of the assembly.

18. An assembly according to claim 1, in which the self-adjustment means comprises restraining means which acts to reduce or prevent free movement of the core cable in the first position of the operating member after the operating member has returned to its first position at the completion of an operating cycle of the cable assembly.

19. An assembly according to claim 18, in which the restraining means comprises frictional means acting on the core cable or a part movable therewith.

20. An assembly according to claim 19, in which the frictional means comprises an interference bearing in which the core cable, or part movable therewith, is a sliding fit.

21. An assembly according to claim 20, in which

the interference fit is enhanced by resilient biasing means.

5 22. An assembly according to any of claims 18 to 21, in which the restraining means comprises first and second abutments on a fixed part of the assembly and a stop member which is movable relative to the core cable, the stop member engaging the first abutment in the first position of the operating member, in order to define its rest position, and the second abutment 10 during an end portion of the movement of the operating member to its second position.

 23. An assembly according to claim 22, in which the stop member is slidably mounted on the elongate element.

15 24. An assembly according to claim 22 or 23, in which the stop member comprises an interference bearing.

 25. An assembly according to any of claims 22 to 24, in which at least one of the abutments is annular and extends around the elongate element to support it. 20

 26. A control cable assembly comprising a cable having an inner core cable received within an outer conduit, an operating member movable between a first rest position and a second position, and electrical 25 sensing means for signalling the position of the operating member in its movement between its first and second positions.

 27. An assembly according to claim 26, in which the electrical sensing means includes electrical contact means between which an electrical circuit can be completed by an element movable in response to movement of the core cable, at least during part of the operational cycle. 30

 28. An assembly according to any of claims 22 to 25, including electrical sensing means for signalling 35

the position of the operating member in its movement between its first and second positions, the electrical sensing means comprising the stop member and one or more electrical contacts positions to contact the stop member, which is electrically conducting, at when it contacts the electrical contacts.

29. An assembly according to any of claims 2 to 28, including abutment means defining the rest position of the operating member.

30. An assembly according to any preceding claim, including a housing having means for being mounted in a motor vehicle.

31. An assembly according to claim 30, in which the housing is of plastics material.

32. An assembly according to claim 30 or 31, in which the mounting means are receivable in an aperture in a bulkhead or other part of a motor vehicle.

33. A control cable assembly comprising first and second cable runs each having an inner core cable received within an outer conduit, coupling means acting between the two cable runs, the coupling means uncoupling the core cables of the cable runs from each other in a first position of the core cable of the second cable run and coupling the core cables to each other in a second position of the second core cable, and self-adjustment means acting on the first core cable in the first position of the second core cable to determine the position of the core cables relative to each other in order to maintain a correctly adjusted condition of the cable assembly, the coupling means comprising an elongate element attached to the first core cable and an element having an aperture through which the elongate element extends, the apertured element being movable between a tilted coupling position, in which it engages the elongate

5 element, and an uncoupling, perpendicular or more nearly perpendicular position, in which the elongate element is free to move relative to the apertured element, the coupling and uncoupling positions of the apertured element corresponding respectively to the second and the first positions of the second core cable.

10 34. An assembly according to claim 33, in which the respective axes of the cable runs are offset one from the other.

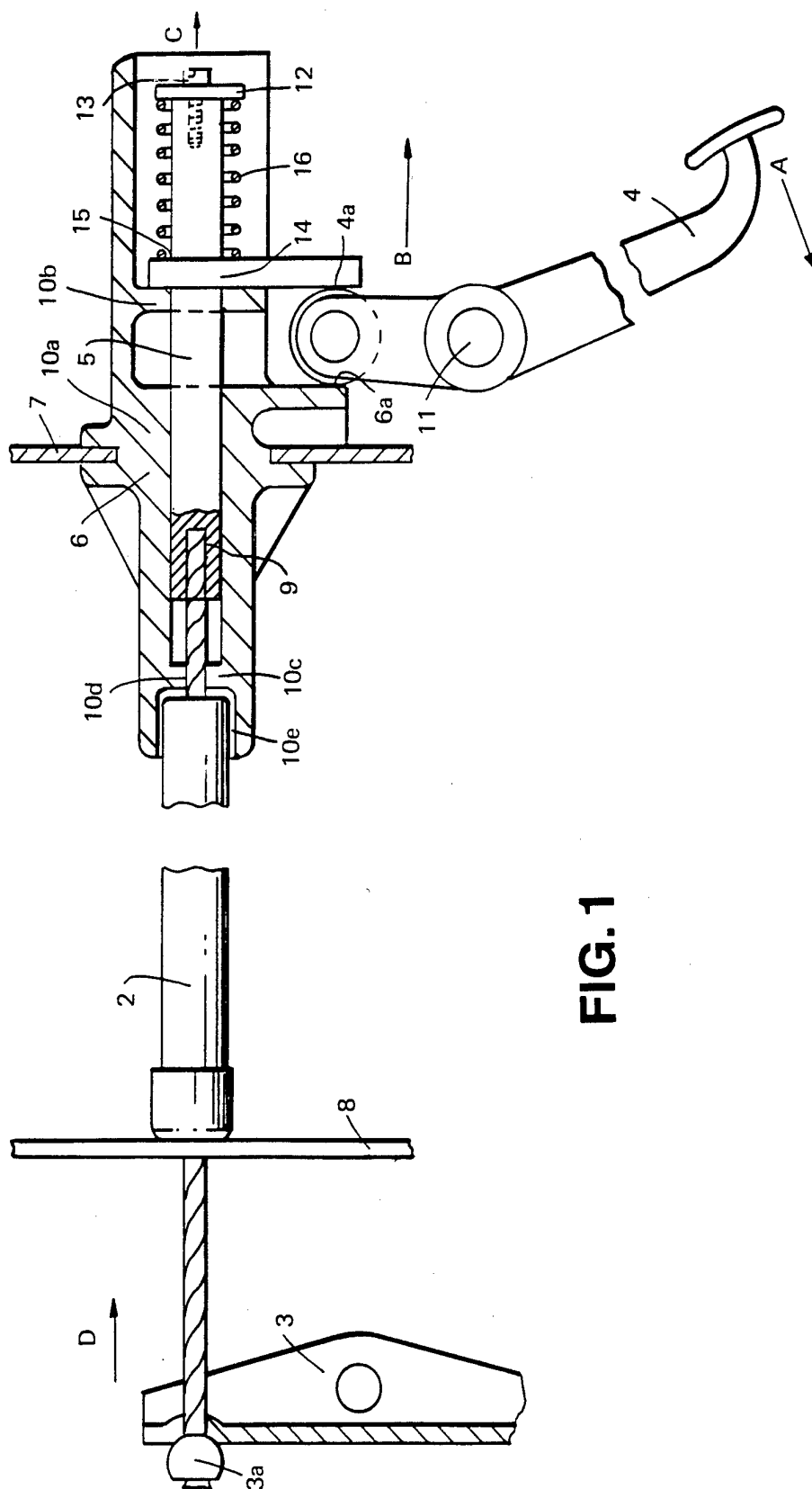
35. An assembly according to claim 34, in which the axes are parallel to each other.

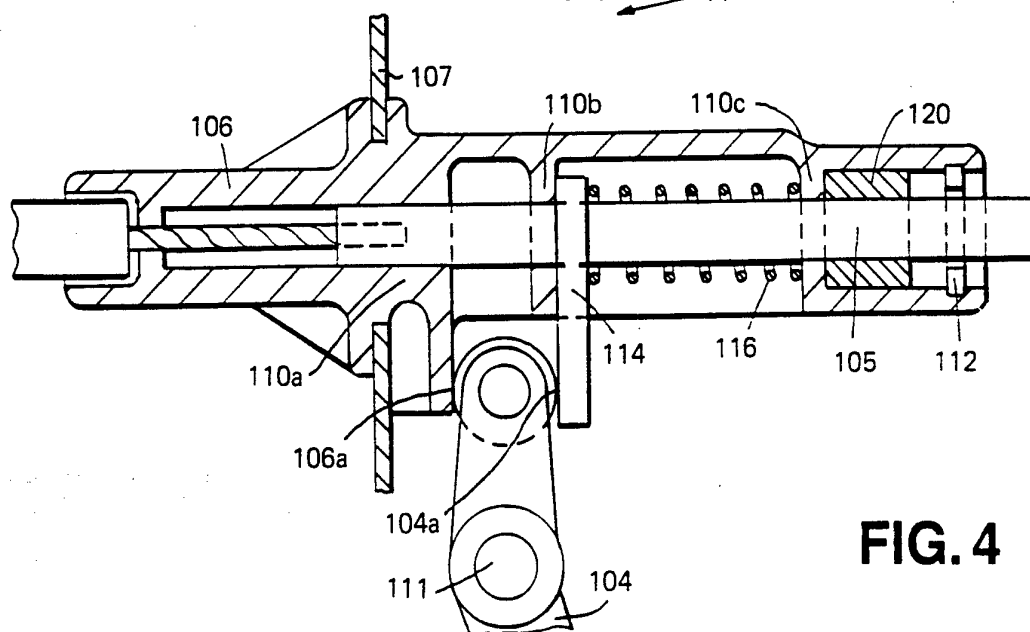
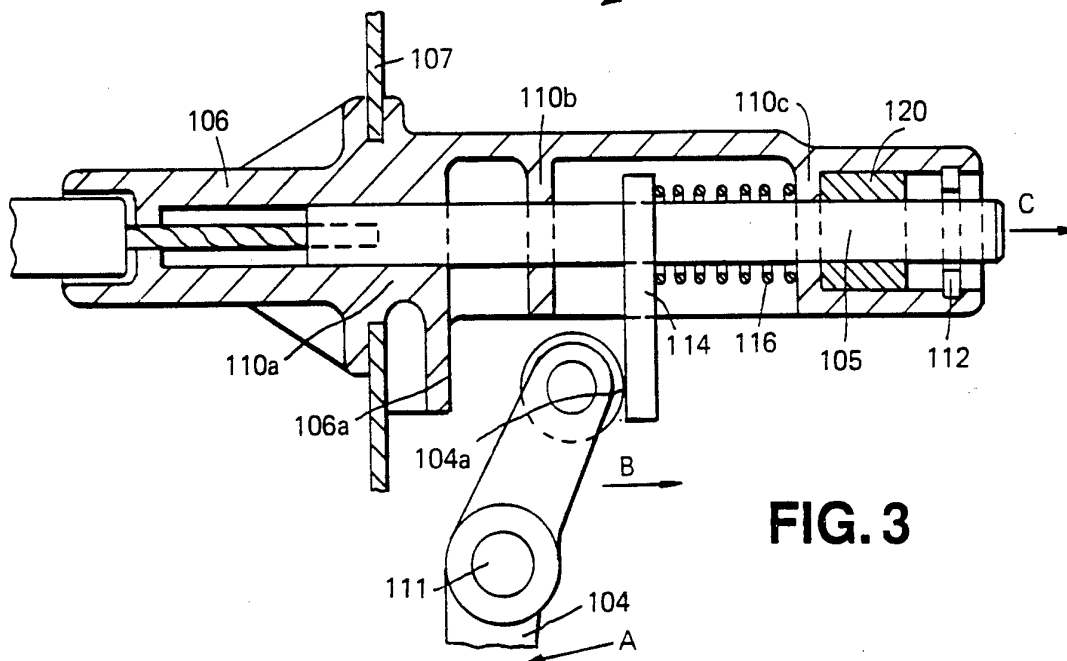
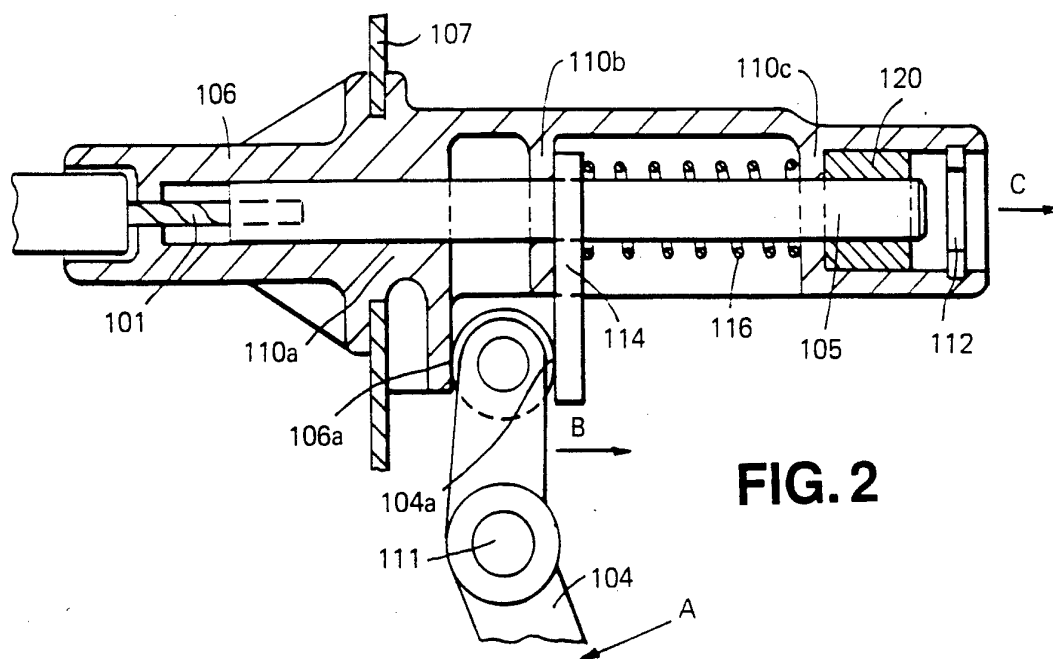
15 36. An assembly according to any of claims 33 to 35, including a housing forming an in-line adjuster in a cable comprising the two cable runs.

37. An assembly according to claim 36, including means for adjusting the position in the housing of the outer conduit of at least one of the cable runs in the housing.

20 38. An assembly according to claim 37, in which the cable-position adjusting means comprise an annular groove in the conduit of the cable run or the housing and series of annular grooves in the housing or the conduit, respectively, and a locking member for location in the groove and a selected one of the series of grooves, to hold the cable run at a selected adjusted position relative to the housing.

25 39. An assembly according to any of claims 33 to 38, in which the self-adjustment means comprises resilient biasing means acting on the first core cable.





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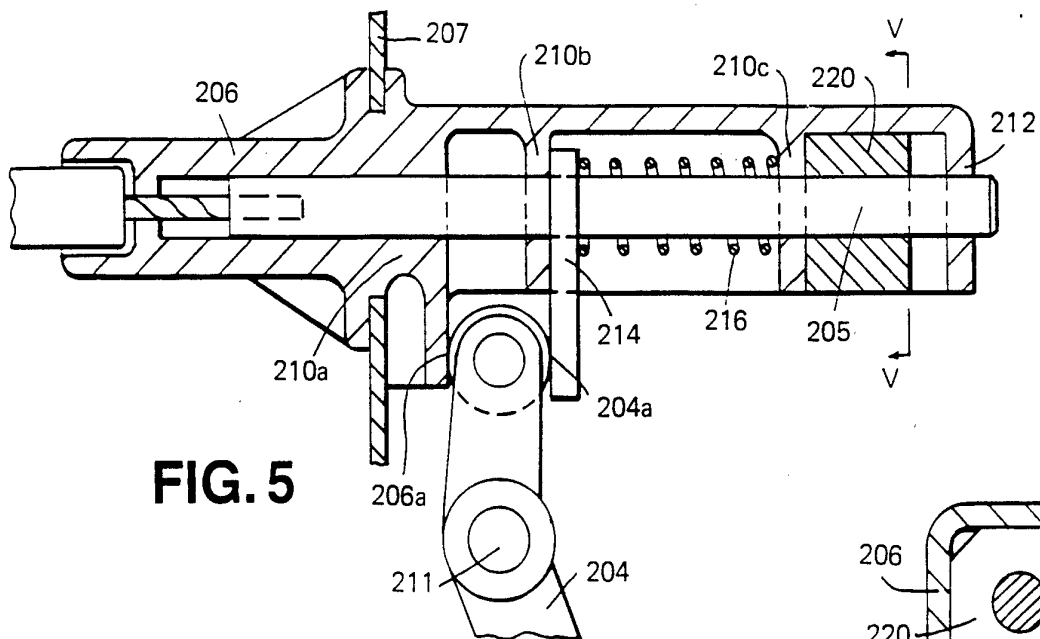


FIG. 5

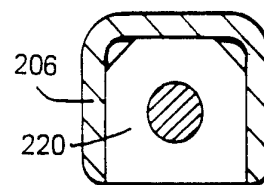


FIG. 5a

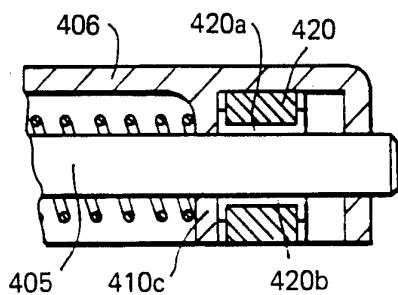


FIG. 6

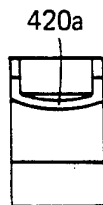


FIG. 6a

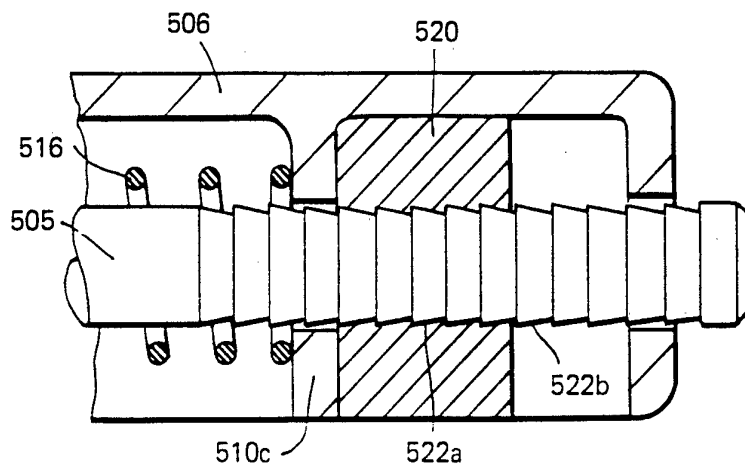


FIG. 7

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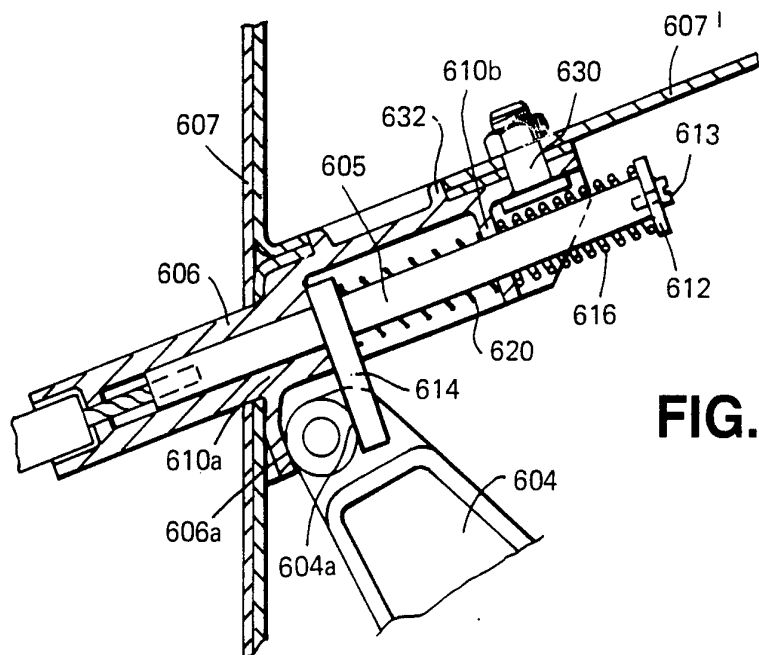


FIG. 8

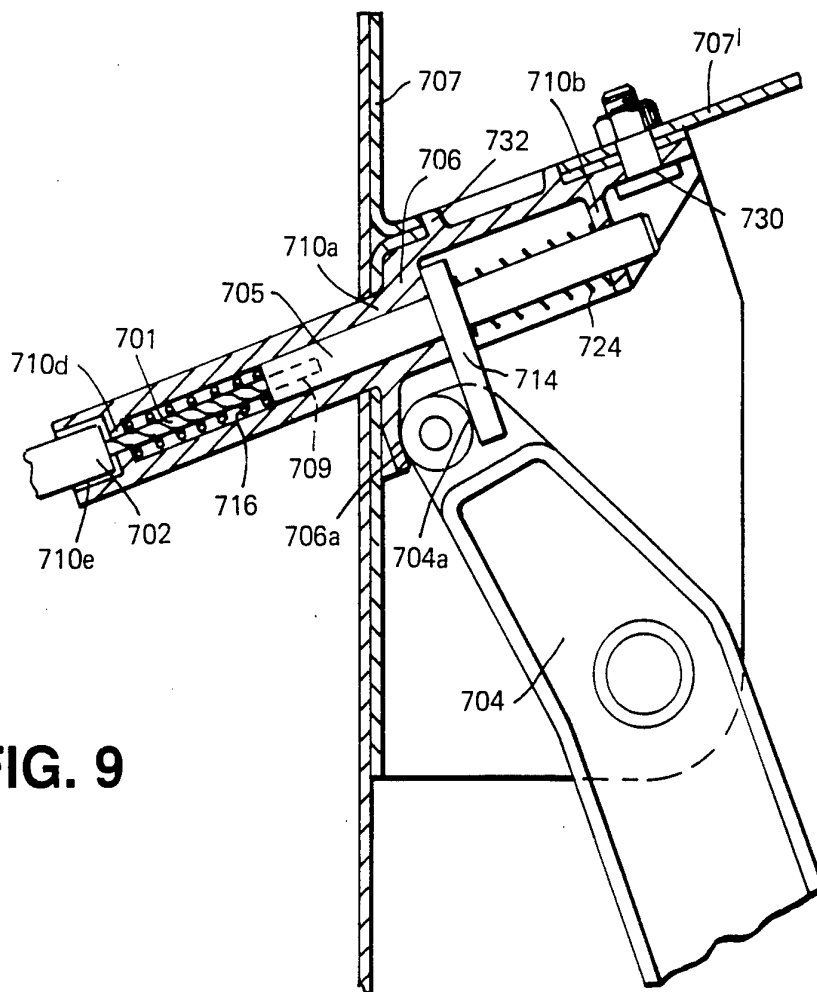


FIG. 9

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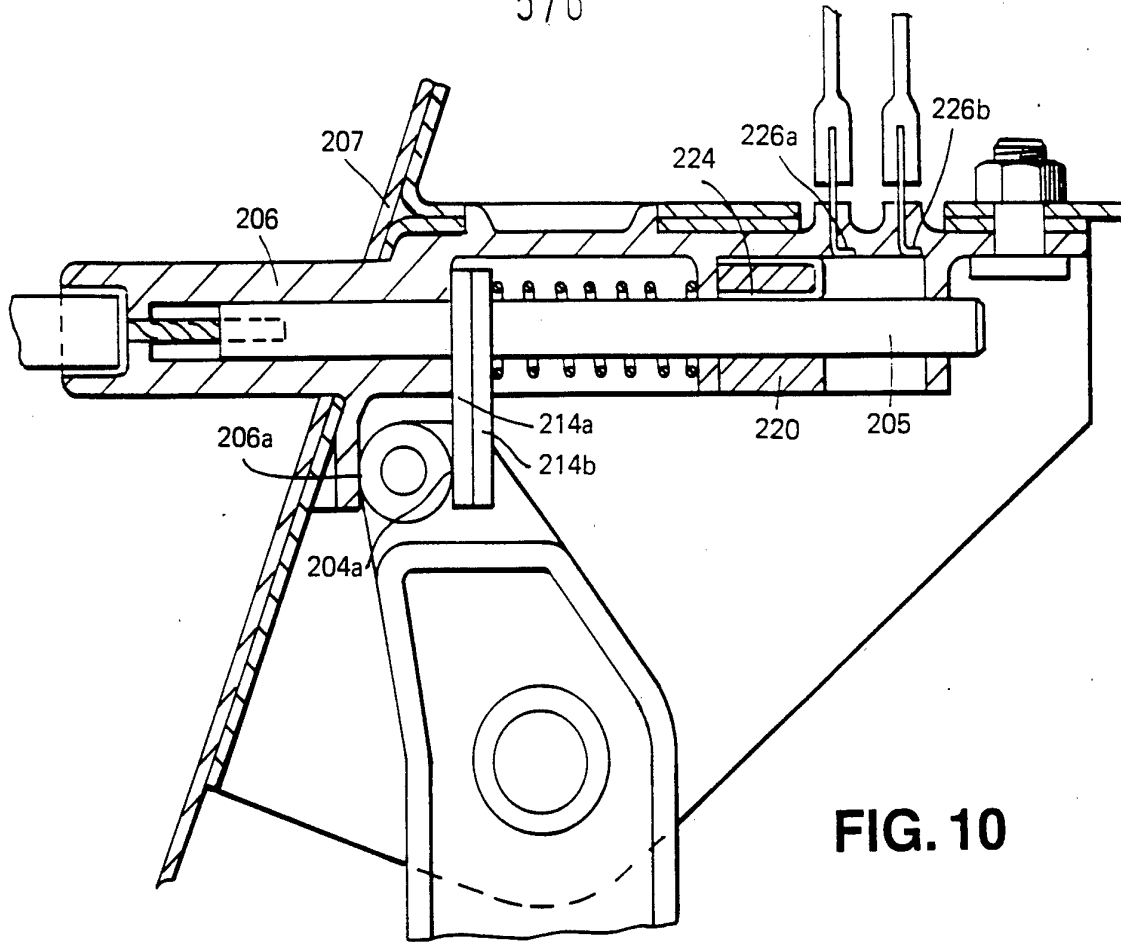


FIG. 10

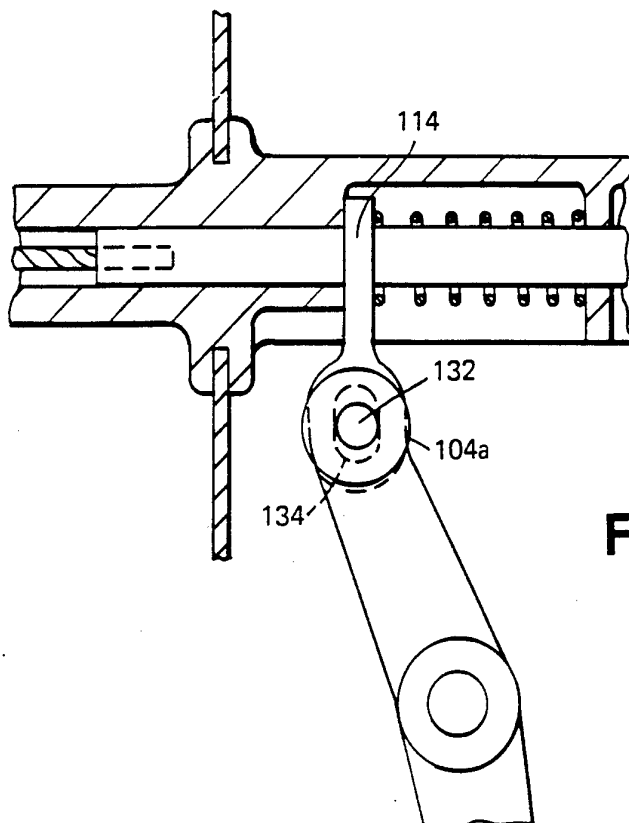


FIG. 11

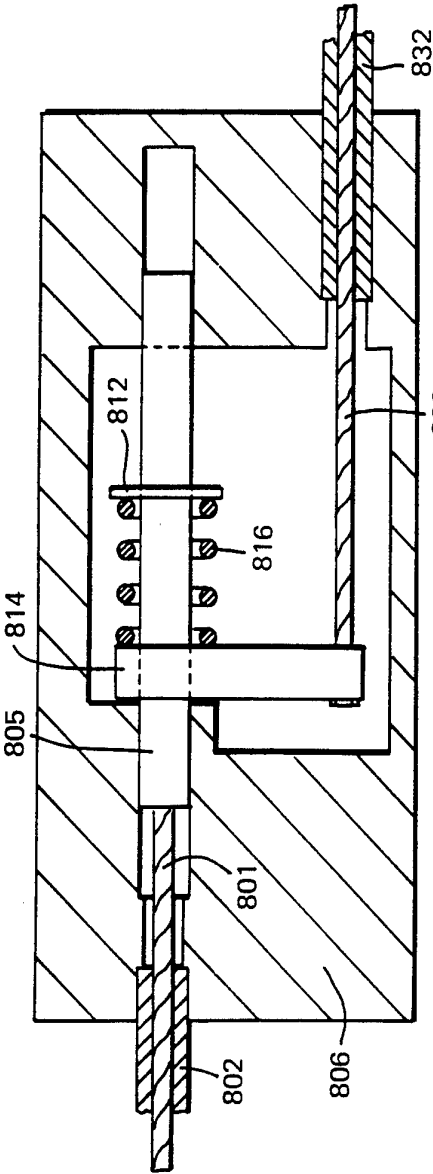


FIG. 12

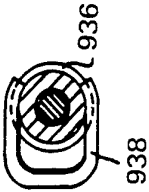


FIG. 14

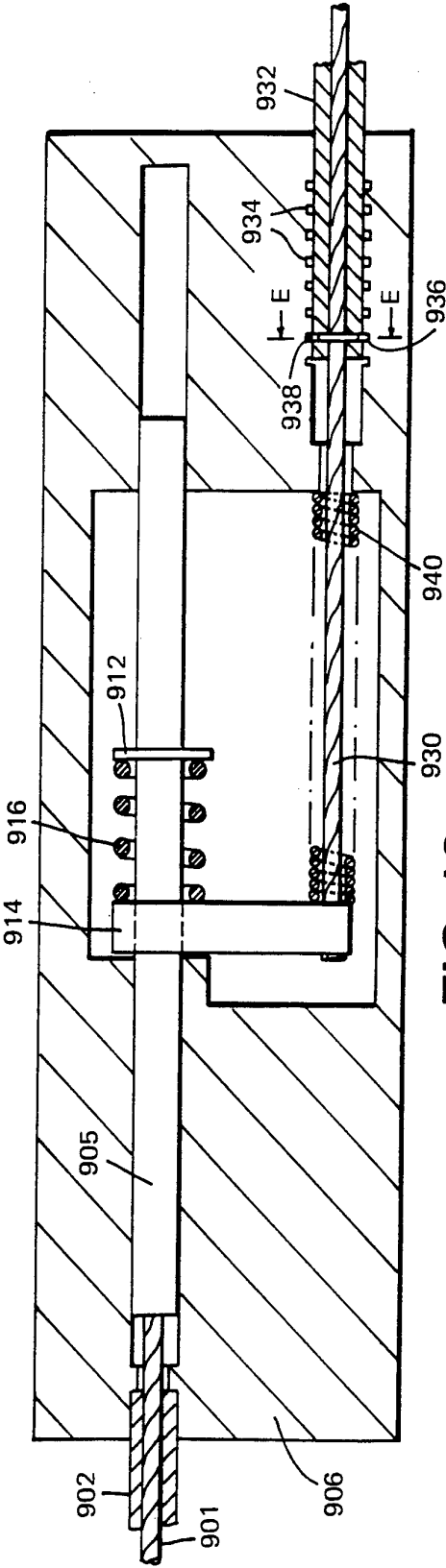


FIG. 13

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 94/00250

A. CLASSIFICATION OF SUBJECT MATTER

IPC 5 F16D13/75

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 5 F16C F16D B60T

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE,A,21 60 278 (V.W.) 7 June 1973	1-3,7-9, 11-13, 30,32
A	see the whole document	4-6
X	GB,A,2 187 528 (NIPPON CABLE SYSTEM) 9 September 1987	1,30,32
A	see the whole document	2-6
X	US,A,4 378 713 (HASKELL ET AL.) 5 April 1983	1
	cited in the application see the whole document	

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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

13 April 1994

Date of mailing of the international search report

27. 04. 94

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BEGUIN, C

INTERNATIONAL SEARCH REPORT

Inter nal Application No

PCT/GB 94/00250

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	BE,A,664 398 (BORG-WARNER) 16 September 1965 see the whole document ---	33-39
A	EP,A,0 389 273 (BABCOCK INDUSTRIES) 26 September 1990 -----	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 94/00250

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US-A-4378713	05-04-83	JP-A- 57031017	19-02-82
BE-A-664398	16-09-65	NONE	
EP-A-0389273	26-09-90	US-A- 4958536	25-09-90