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SOLENOIDS

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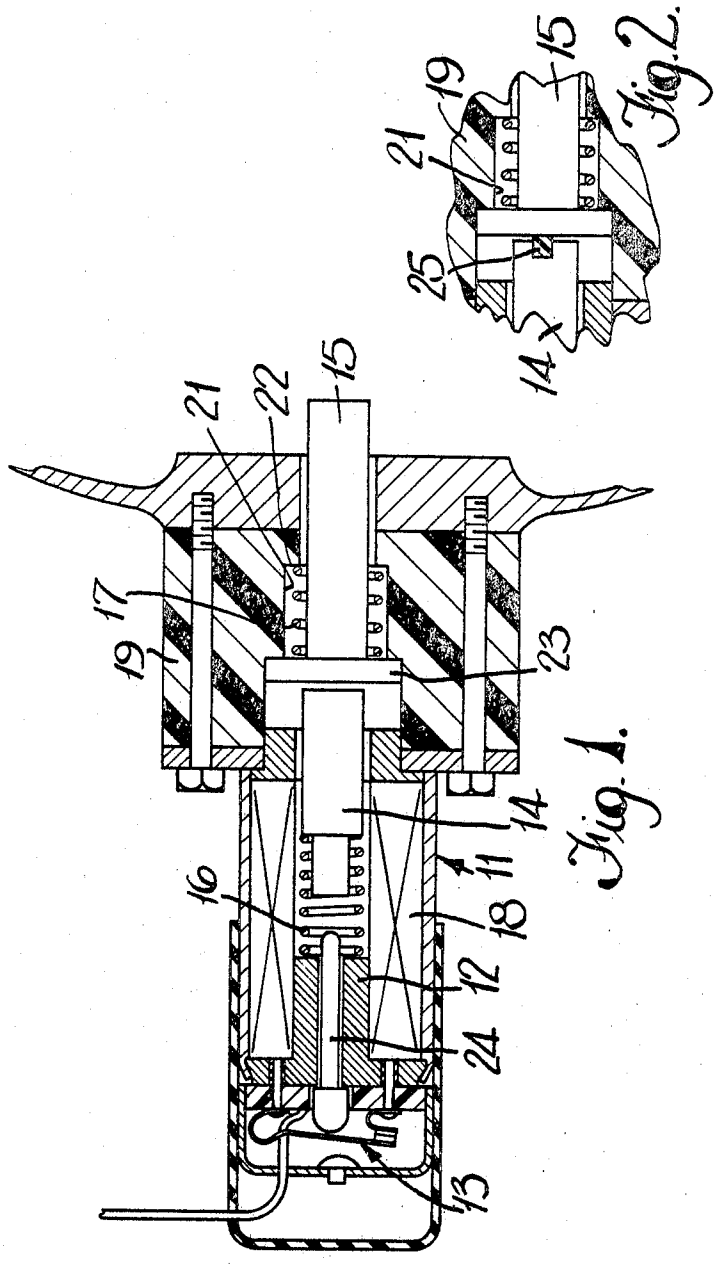

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SOLENOIDS

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ABSTRACT OF THE DISCLOSURE

In a solenoid of the kind comprising a casing, an armature axially movable within the casing, and pull in and hold in windings within the casing, the armature is in two parts. The first inner part of the armature is urged outwardly of the casing by a first spring, and the second outer part of the armature is co-axial with the first part, and is urged inwardly of the casing by a second spring. The first spring is stronger than the second spring, and the arrangement is such that when the windings are not energised the first part engages the second part under the action of the first spring. and the second part is thereby moved outwardly against the action of the second spring.

This invention relates to solenoids of the kind comprising a casing, an armature axially movable within the casing, and pull in and hold in windings within the casing.

According to the invention, in a solenoid of the kind specified the armature is in two parts, a first, inner part which is urged outwardly of the casing by a first spring and a second, outer part coaxial with the first part and urged inwardly of the casing by a second spring, said first spring being stronger than said second spring and the arrangement being such that when said windings are not energised said first part engages said second part under the action of said first spring, and said second part is moved outwardly against the action of said second spring.

In the accompanying drawings FIGURE 1 is a sectional view of a solenoid according to one example of the invention, and FIGURE 2 is a fragmentary sectional view of a modification of the solenoid shown in FIGURE 1.

Referring to the drawings, the solenoid includes a hollow cylindrical casing **11**, one end of which is closed by an end core **12** having secured thereto the body of a normally closed switch **13**. Slidable axially within the casing **11** is a steel first part **14** of an armature which is urged outwardly of the casing **11** by a first spring **16** acting between the part **14** of the armature and the closed end of the casing. Housed within the casing **11** is a pair of coils **18** constituting respectively the hold in and pull in windings of the solenoid, the pull in winding being connected in use to a D.C. supply through the switch **13**.

At its end remote from the switch **13** the casing **11** includes a bearing block **19** formed from non-magnetic material, having extending therethrough a stepped bore **21**. Slidable axially in the bore **21** of the bearing block **19** is a steel second part **15** of the armature, coaxial with the part **14** of the armature. The part **15** of the armature projects from the bearing block **19** at its end remote from the main part of the casing **11** and is urged towards the part **14** of the armature by a second spring **17** acting between the annular shoulder **22** of the stepped bore **21** in the bearing block **19** and a flange **23** on the part **15** of the armature. The spring **16** is stronger than the spring **17** so that when the windings **18** are not energised the spring **16** urges the part **14** of the armature outwardly into abutment with the part **15** of the armature which is moved against the action of the spring **17**.

When it is desired to operate the solenoid, the pull in winding and the hold in winding are energised simultaneously and the part **14** of the armature is drawn into the casing **11** against the action of the spring **16**, the part **15** of the armature being moved with the part **14** by the action of the spring **17**.

When the part **14** of the armature has moved a predetermined distance towards the switch **13** closing said one end of the casing **11**, the part **14** of the armature engages a plunger **24** associated with the switch **13** and further movement of the part **14** of the armature towards the switch **13** opens the switch **13** to de-energise the pull in winding, the part **14** of the armature being maintained in its inner position by the hold in winding which remains energised.

It is important when a road vehicle is being driven, with its internal combustion operating at a high speed, that the driver does not select a lower gear which would cause the engine to operate at an even higher speed resulting in damage to the engine of the vehicle.

In one application of the invention the solenoid is used to control a latch mechanism associated with a road vehicle gearbox.

The hold in and pull in windings **18** of the solenoid are energised through a switch which is sensitive to engine speed and which is closed only when the engine speed is below a predetermined level and the part **15** of the armature constitutes a latch mechanism in the gearbox of the vehicle which is operable to prevent the selection of a lower gear.

When the vehicle is being driven with its engine operating above said predetermined speed the speed sensitive switch is open and the armature **14, 15** is in its outer position so that the latch mechanism in the gearbox is locked so preventing the driver of the vehicle selecting a lower gear. However, when the engine falls to a speed below the predetermined speed the speed sensitive switch will close and the hold in and pull in windings **18** will be energised and the armature **14, 15** will be moved to its inner position to free gearbox to allow the selection of a lower gear.

Should the driver of the vehicle apply pressure to the gear selector lever to select a lower gear as the engine speed falls, then the part **15** will be subject to pressure and will become trapped against subsequent inward movement. Thus, when the speed sensitive switch closes the pull in and hole in windings **18** will be energised and the part **14** of the armature will be moved inwardly and will open the switch **13** to de-energise the pull in winding. However, the part **15** of the armature will not move inwardly under the action of the spring **17** to free the gearbox until the pressure on the gear selector lever is released.

It will be appreciated that if the armature were of one part construction, then if the pull in and hold in windings **18** were energised while the armature was trapped against inward movement, then the pull in winding would remain energised and would probably be burnt out.

The bearing block **19** is formed from non-magnetic material in order to reduce the magnetic attraction between the parts **14, 15** of the armature in use.

In the modification shown in FIGURE 2 a non-magnetic spacer **25** is secured to either the part **14** or the part **15** of the armature, and serves to maintain a predetermined air gap between the parts **14, 15**, again to reduce the magnetic attraction between the two parts.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. A solenoid of the kind specified wherein the armature is in two parts, a first, inner part which is urged outwardly of the casing by a first spring and a second, outer part coaxial with the first part and urged inwardly of the casing by a second spring, said first spring being stronger than said second spring and the arrangement

being such that when said windings are not energised said first part engages said second part under the action of said first spring, and said second part is moved outwardly against the action of said second spring.

2. A solenoid as claimed in claim 1 wherein both parts of the armature are formed from ferrous material and means are provided for reducing the magnetic attraction between said parts in use.

3. A solenoid as claimed in claim 2 wherein said means includes a non-magnetic spacer secured to one of said parts and engageable with the other of said part to maintain a predetermined air gap between the parts, when the parts are moved towards one another.

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