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(54) **GEARBOX ACTUATION SYSTEM AND METHOD FOR ADJUSTING A GEARBOX ACTUATION SYSTEM**

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(58) **Field of Classification Search** 477/115; 74/473.1
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(57) **ABSTRACT**

A method for the adjustment of a gearbox actuation system of an automated gearbox of a vehicle. The gearbox includes a shift finger; a plurality of gearshift rails, each rail in the plurality of gearshift rails in a respective position; a neutral gap with a first portion formed by respective jaws for said each rail and with a second portion formed separate from the respective jaws and open to the first portion; and, a gearshift motor. The method includes the step of performing at least one reference travel with a gear in the automated gearbox engaged.
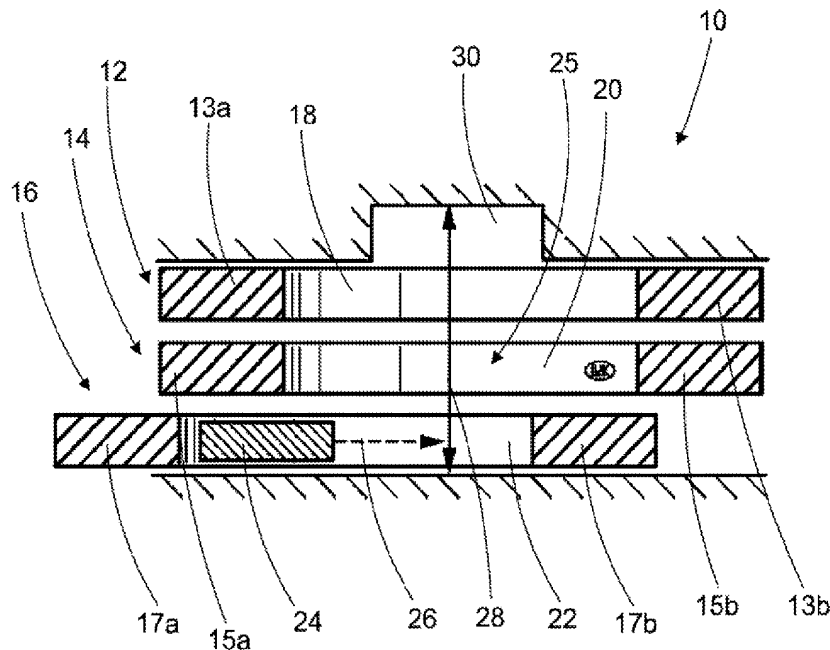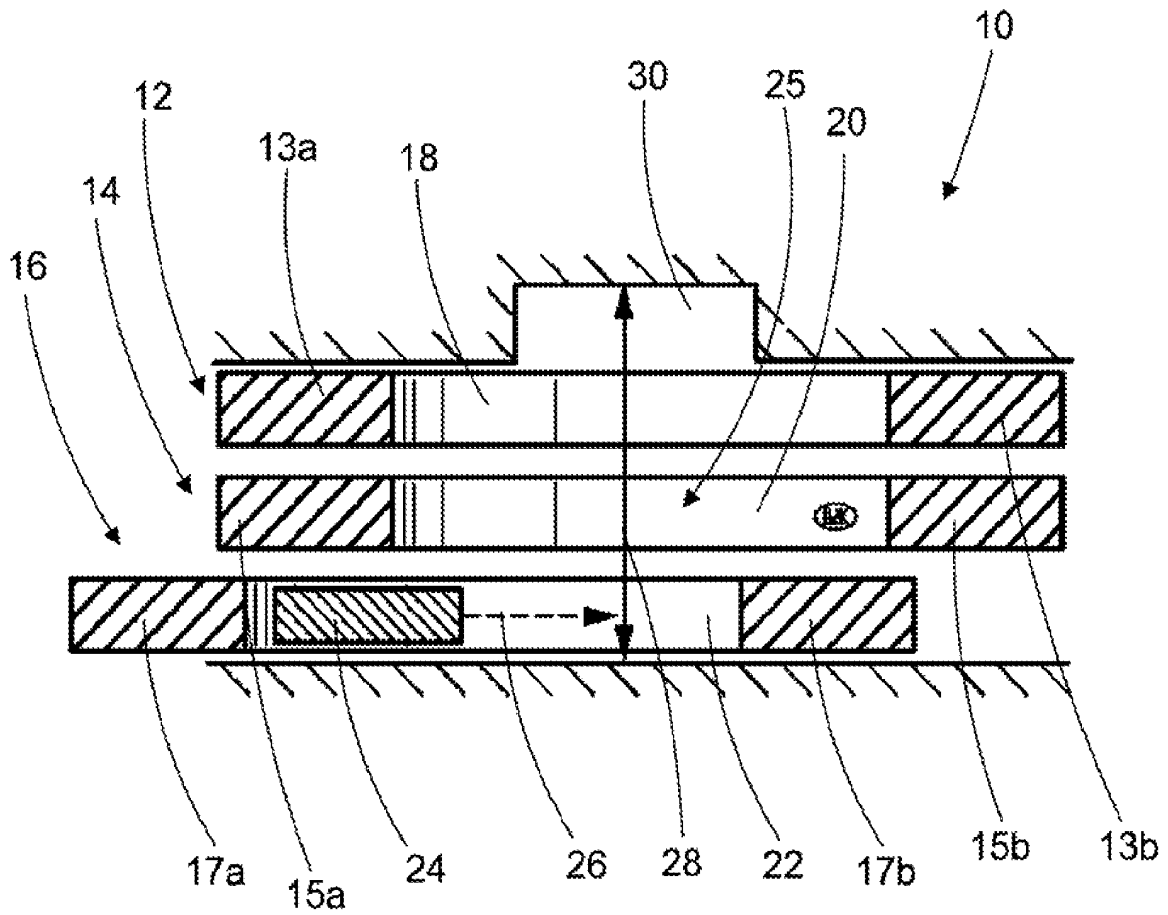
8 Claims, 1 Drawing Sheet

Fig. 1

GEARBOX ACTUATION SYSTEM AND METHOD FOR ADJUSTING A GEARBOX ACTUATION SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a divisional application of U.S. patent application Ser. No. 10/711,848, filed on Oct. 8, 2004, now U.S. Pat. No. 7,438,666, which is a continuation under 35 U.S.C. §120 and §365(c) of International Patent Application PCT/DE03/01183, filed Apr. 10, 2003, said international application claims priority from German Patent Applications 102 15 715.4, filed Apr. 10, 2002, and 102 41 068.2 filed Sep. 5, 2002, which applications are incorporated herein by reference.

BACKGROUND OF THE INVENTION

This invention relates to a gearbox actuation system and a method for adjusting a gearbox actuation system in an automated gearbox of a vehicle.

Automated gearboxes such as, for example, XSG gear systems (ASG [automated gearboxes], PSG [parallel gearboxes], etc.), are being installed in vehicles with increasing frequency. The gearbox actuation system of such gearboxes can be operated regularly or irregularly, for example, in case of a defect or a presumed defect against certain reference points. This start to the reference points is used to adjust or reference the sensor system, in particular, the incremental travel sensor system. Furthermore, this start to the reference points can be done in a "probing" fashion. This procedure is employed preferably when the exact position of the actuation system within the available movement space, as a rule, the H wiring diagram of a mechanical gearbox, is not known. The reference points are started within the neutral gap so that one must make absolutely sure that the engine is not in gear.

OBJECT OF THE INVENTION

The object of the invention is to provide a gearbox actuation system and a method for adjusting a gearbox actuation system of an alternated gearbox of a vehicle in such a way that it will not be required to disengage the current particular gear to adjust the gearbox actuation system.

This problem is solved in a methodical fashion by a process for adjusting the gearbox actuation system of an automated gearbox of a vehicle where at least one reference travel is performed with the gear engaged.

BRIEF SUMMARY OF THE INVENTION

According to the invention, it may be provided that the gearbox actuation system is so made that one starts a reference point in the neutral gap without at the same time moving the particular selector forks and gearshift rails. This means that during the reference travel in the neutral gap, the gearshift fork is not necessarily moved at the same time so that the current gear need not have to be disconnected.

The essential advantage of the invention resides in the following—with the engine in gear, and thus not noticeable as far as the driver is concerned, there can be referencing or an adjustment of the gearbox actuation system or its measurement systems.

As part of a development of the invention, the gearshift rails can form a gap with their gearshift jaws in which the shift finger can move regardless of whether the engine is in gear. If

a reference travel is now started from that situation, the shift finger can move laterally in the direction of the N-gap and at the same time can probe periodically upward and downward until a resistance can be detected. If this resistance is eliminated, then the shift finger, in other words, in this case, can move upward over the entire neutral gap width, for example, to an opposite reference point.

The selected direction can thus already be adjusted. The concluding adjustment in the gearshift direction, for example, can be performed according to a next development of the invention in a recess or the like especially provided for this purpose.

A further development of the invention can provide that the shift finger, after referencing, again returns to its position prior to the reference travel. Suitable logics should be determined in case of an unknown starting point in order to establish in which gearshift direction the initial movement is to take place.

A further development of the invention at hand can propose that the mentioned probing routine be performed regularly or irregularly in combination with the mentioned gearshift jaw geometries.

The method proposed according to the invention can be employed especially in automated gearboxes and in parallel gearboxes with the so-called active interlock actuation system.

Furthermore, the problem constituting the basis of the invention is solved by an invention-based gearshift actuation box, in particular, for implementing the proposed method, where at least one reference travel is provided for adjustment purposes.

According to a development of the invention, the gearshift jaws on the gearshift rails can be so made that the neutral gap during the reference travel is attained by the shift finger without the current gear having to be disengaged.

Preferably, the gearshift jaws of the gearshift rails that are arranged parallel to each other will form a gap in which the shift finger can be moved during the reference travel regardless of whether the engine is in gear.

According to a development of the invention, the provided gap can be supplied for the purpose of adjustment in the direction of selection. At least one recess can be considered for the purpose of adjustment in the gearshift direction.

Locking the individual gearshift rails is helpful or necessary in order to keep the last gear that was put in also engaged when the shift finger does not take care of arresting the gearshift rail.

Preferably, in the invention-based gearshift actuation system, one can provide, for example, a brushless electric motor or the like as the selection and/or gearshift motor.

BRIEF DESCRIPTION OF THE DRAWINGS

Other advantages and advantageous developments will result from the subclaims and the only FIGURE of the invention.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 shows automated gearbox 10 having three gearshift rails 12, 14 and 16, each comprising respective gearshift jaws 13a, 13b, 15a, 15b, 17a and 17b. Gearshift jaws 13a and 13b of gearshift rail 12 form opening 18, gearshift jaws 15a and 15b of gearshift rail 14 form opening 20, while gearshift jaws 17a and 17b of gearshift rail 16 form opening 22. Thus, the gearshift jaws of gearshift rails 12, 14 and 16 form gap 25, i.e., the gap formed by openings 18, 20 and 22. Shift finger 24, not

shown in any further detail, can be moved within gap 25, regardless of whether or not the engine is in gear, for example, in the direction of arrow 26 and/or first bi-directional arrow 28. In the embodiment shown in FIG. 1, specific gears are associated with each particular gearshift rail 12, 14 and 16, e.g., first and second gears may be associated with rail 12, third and fourth gears may be associated with rail 14, while fifth and reverse gears may be associated with rail 16.

When a reference travel is started, shift finger 24 can move laterally in the direction of the N-gap, or in other words the neutral gap, and at the same time can probe periodically upward and downward until a resistance becomes detectable. In one embodiment, reference travel is indicated by arrows 26 or 28. In one embodiment, the position of shift finger 24 in FIG. 1 is a starting position. In FIG. 1, lateral movement is indicated by arrow 26, while upward and downward movement is indicated by first bi-directional arrow 28. Once this resistance is eliminated, then shift finger 24 can be moved upward over the entire neutral gap width, i.e., through gap 25, and an opposite reference point can possibly be reached. The direction of selection can thus be adjusted. The concluding adjustment in the gearshift direction, for example, can be performed in recess 30 that is specially provided for this purpose. After referencing, the shift finger again returns to its position prior to the reference travel.

The patent claims submitted with the application are formulation proposals without regard to the attainment of additional patent protection. Applicant reserves the right to claim additional feature combinations that are so far disclosed only in the description and/or drawings.

References, used in the subclaims, point to the additional development of the object of the main claim by means of the features of the particular subclaim; they are not to be understood as a waiver of the attainment of an independent, objective protection for the feature combinations of the referenced subclaims.

The object of the subclaims can form separate and independent inventions with a view to the state of the art on the priority date; therefore, applicant reserves the right to make them into an object of independent claims or partial declarations.

They can furthermore also contain independent inventions that display a design independent of the objects of the preceding subclaims.

The exemplary embodiments are not to be construed as a restriction of the invention. Instead, numerous changes and modifications are possible in the context of the disclosure on hand, especially those variants, elements and combinations and/or materials that, for example, by combination or modification of individual features or elements or process steps in

conjunction with those described in the general description and embodiments as well as the claims and contained in the drawings, can be preferred by the expert with a view to the solution of the problem and that by means of features that can be combined lead to a new object or to new process steps or new process step sequences also to the extent that they relate to production, testing and working processes.

What is claimed is:

1. A method for the adjustment of a gearbox actuation system of an automated gearbox of a vehicle, wherein the gearbox includes a shift finger; a plurality of gearshift rails, each rail in the plurality of gearshift rails in a respective position; a neutral gap with a first portion formed by respective jaws for said each rail and with a second portion formed separate from the respective jaws and open to the first portion; and, a gearshift motor, comprising the step of performing at least one reference travel with a gear in the automated gearbox engaged.

2. The method according to claim 1, wherein the gearbox actuation system includes a plurality of gearshift forks and wherein the gearbox actuation system is so made that a reference point is started in the neutral gap without the particular gearshift forks and gearshift rails being moved at the same time.

3. The method according to claim 1, wherein the gearbox actuation system includes a plurality of gearshift jaws and wherein the gearshift rails form a gap with their particular gearshift jaws in which gap the shift finger is moved to start reference points.

4. The method according to claim 1, wherein the shift finger is moved laterally in the direction of the neutral gap and, at the same time, reference points are started periodically upward and downward.

5. The method according claim 1, wherein the neutral gap includes a width and wherein a direction of selection is adjusted when the shift finger is moved over the entire neutral gap width.

6. The method according to claim 1, wherein an adjustment in a gearshift direction is performed parallel to the gearshift rails by means of the second portion of the neutral gap.

7. The method according to claim 1, wherein the gearbox actuation system includes a starting position for the shift finger and wherein the shift finger is again moved back into the starting position prior to the reference travel after referencing.

8. The method according to claim 1, wherein said at least one reference travel is performed regularly or irregularly to start reference points.

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