

[54] RATCHET CONTROL MECHANISM

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[51] Int. Cl. **G05g 9/00**
[58] Field of Search **74/473 R, 475, 476, 477, 142, 74/143; 192/48.92**

[56] **References Cited**

UNITED STATES PATENTS

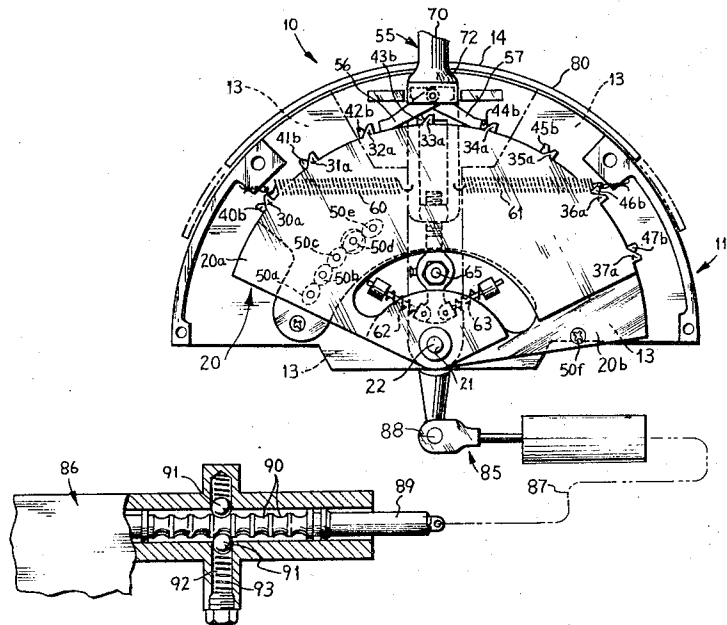
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[57] **ABSTRACT**

A ratchet control mechanism in which a series of ratchet teeth are formed on the arcuate wall of a plate. The ratchet plate is mounted for rotary movement about an axis thereof. A handle with a pawl is mounted for movement about a pivot point spaced from the axis of the ratchet plate. The handle is spring loaded for return to its central position after each actuation thereof. The pawl engages, respectively and successively, the ratchet teeth to rotate the ratchet plate in one direction in a step-by-step incremental rotary movement in response to the actuation of the handle in one direction from the central position thereof and to rotate the ratchet plate in another direction in a step-by-step incremental rotary movement in response to the actuation of the handle in another direction from the central position thereof.

13 Claims, 11 Drawing Figures



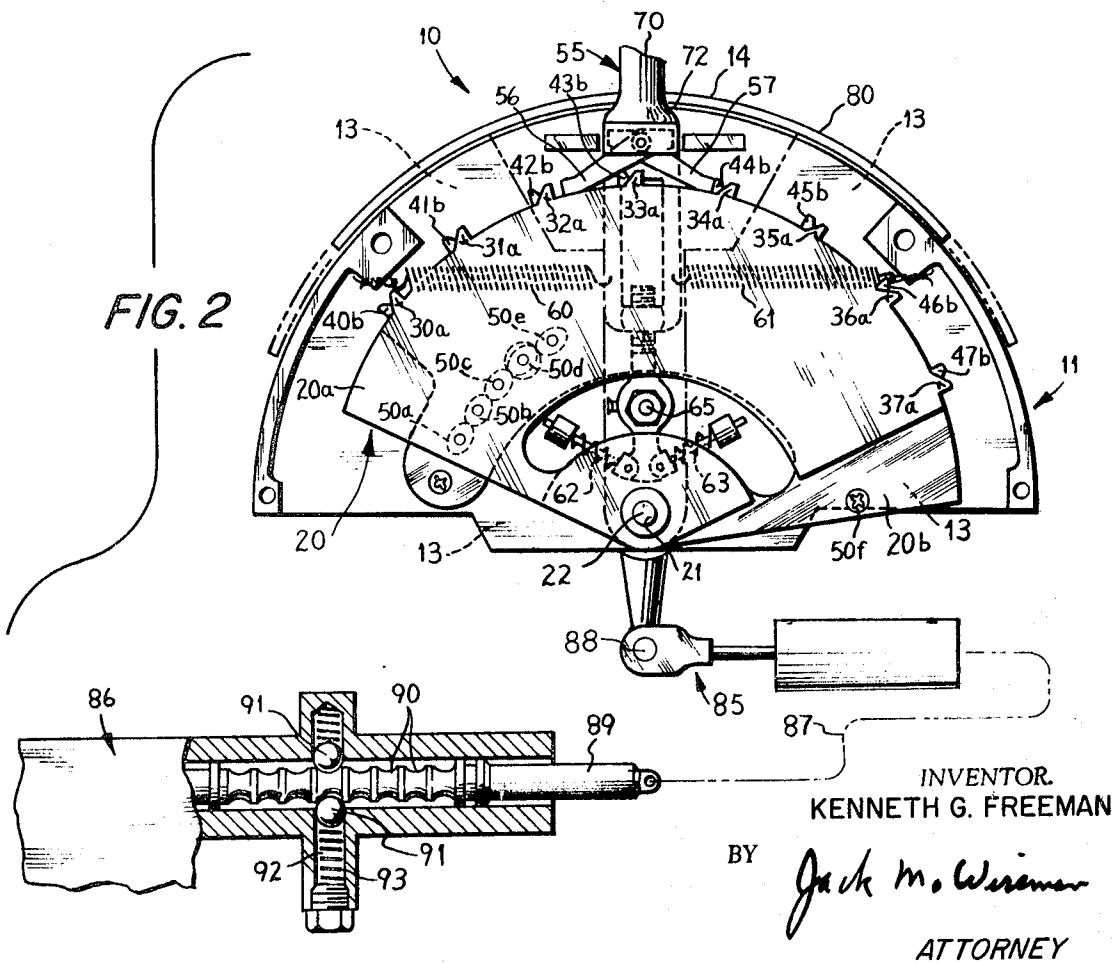
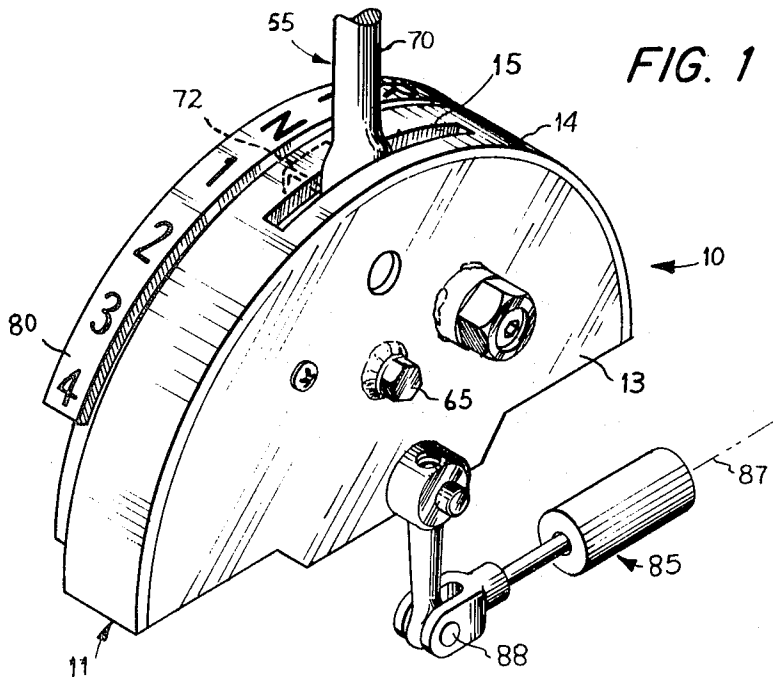


FIG. 3

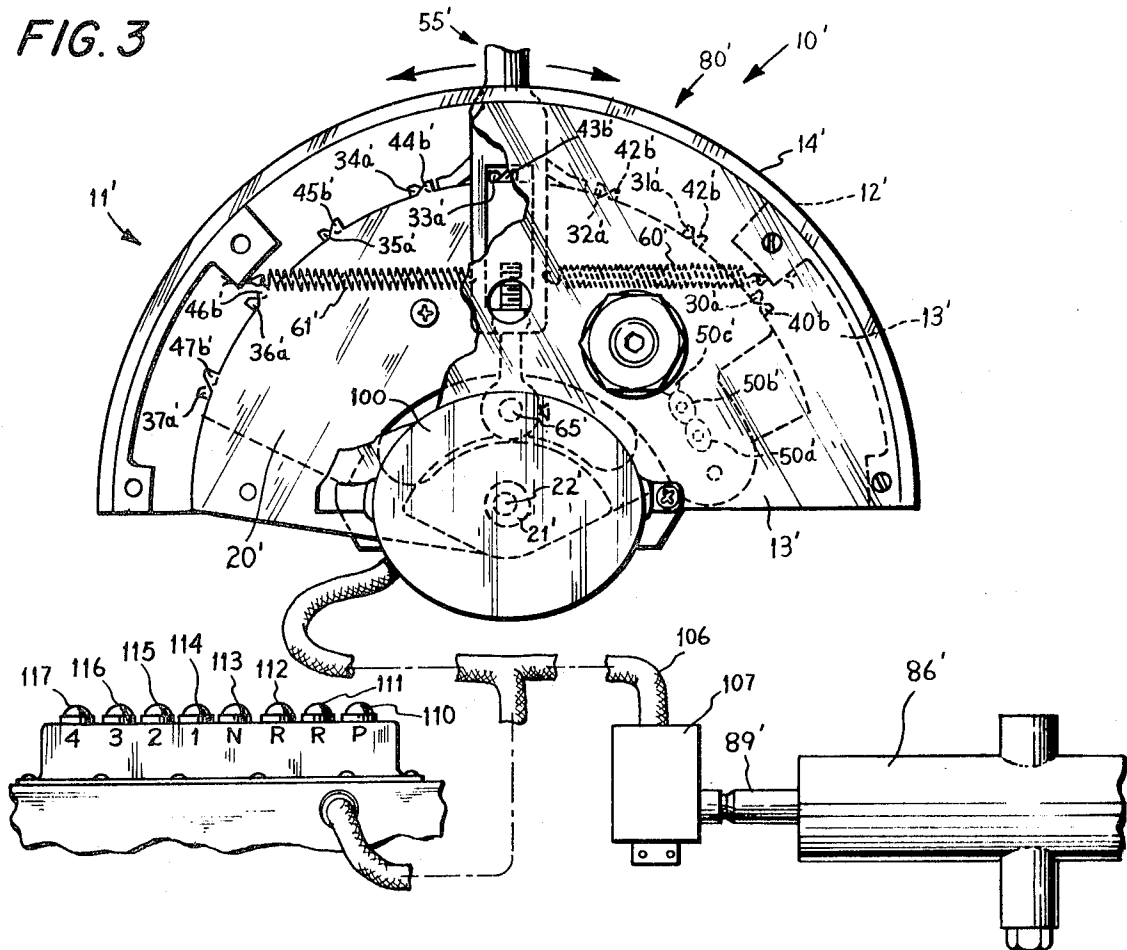
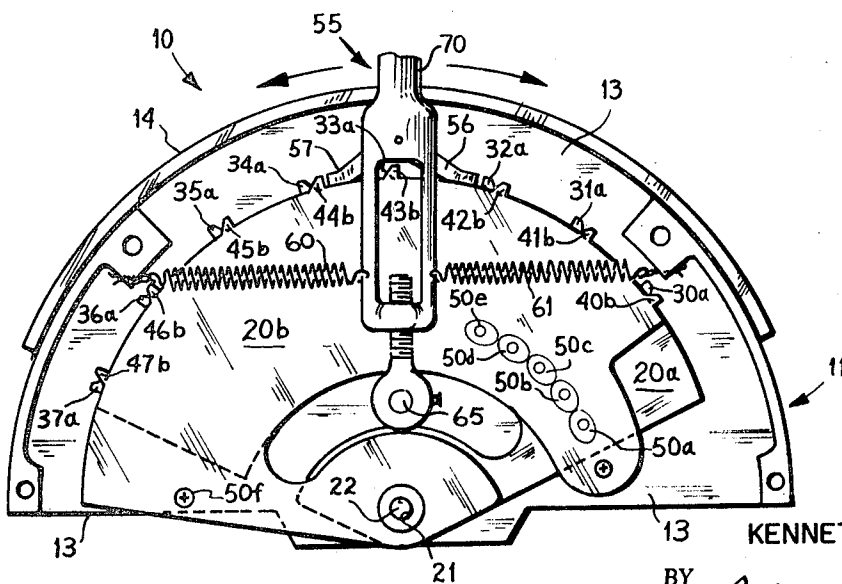


FIG. 4

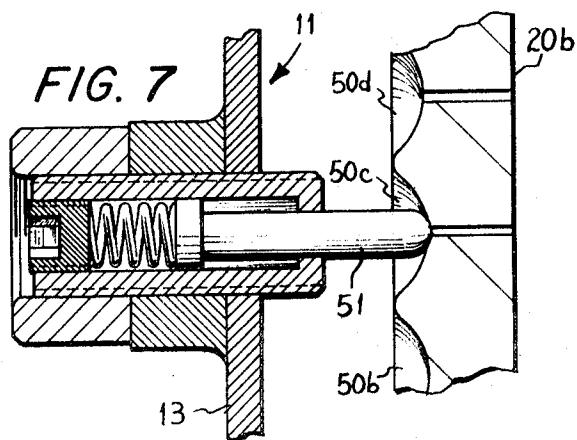
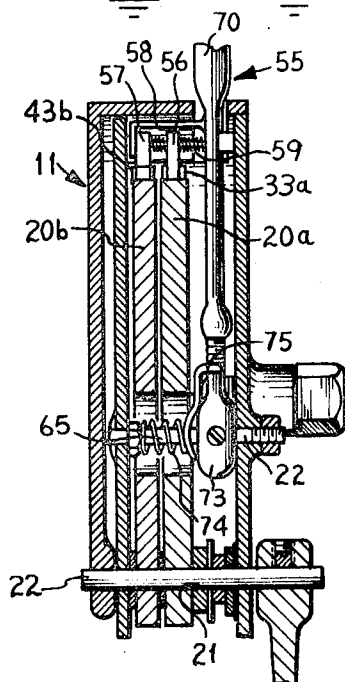
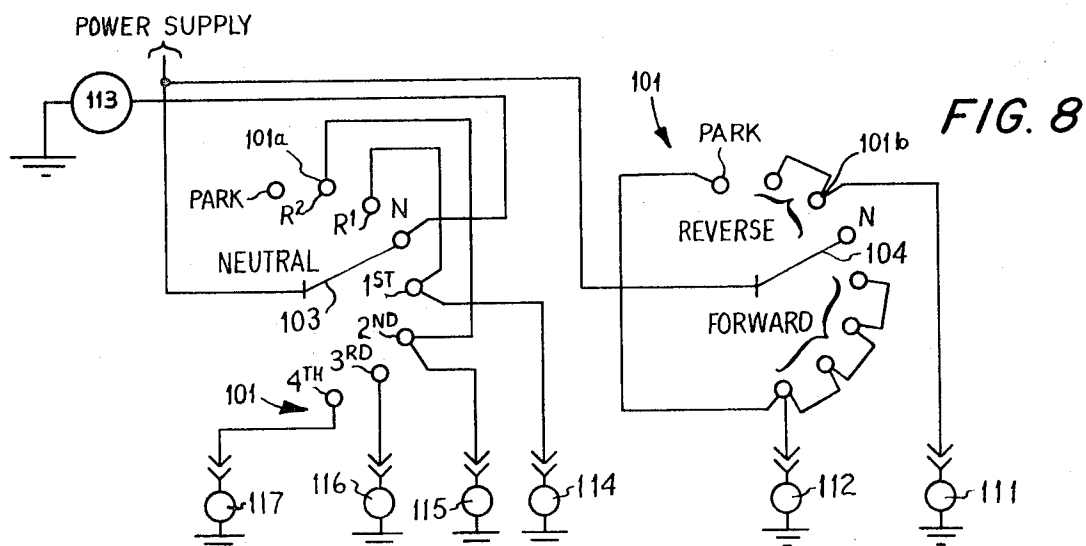
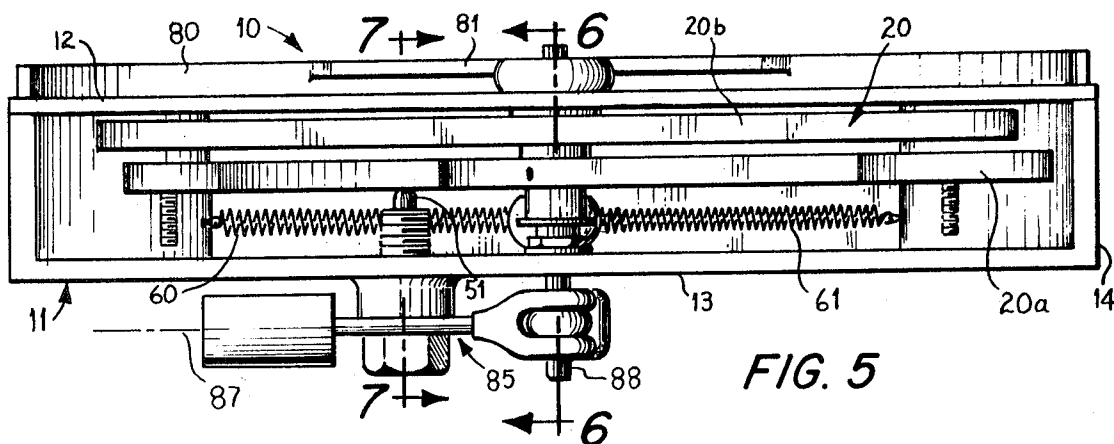


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FIG. 9

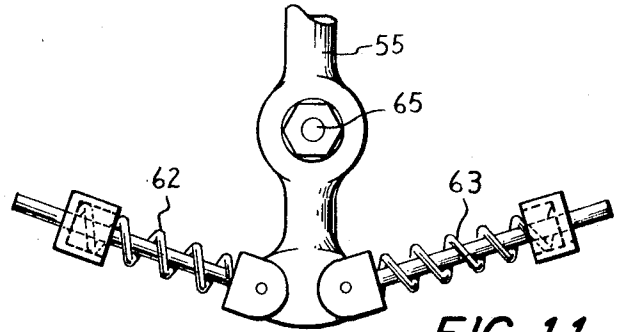
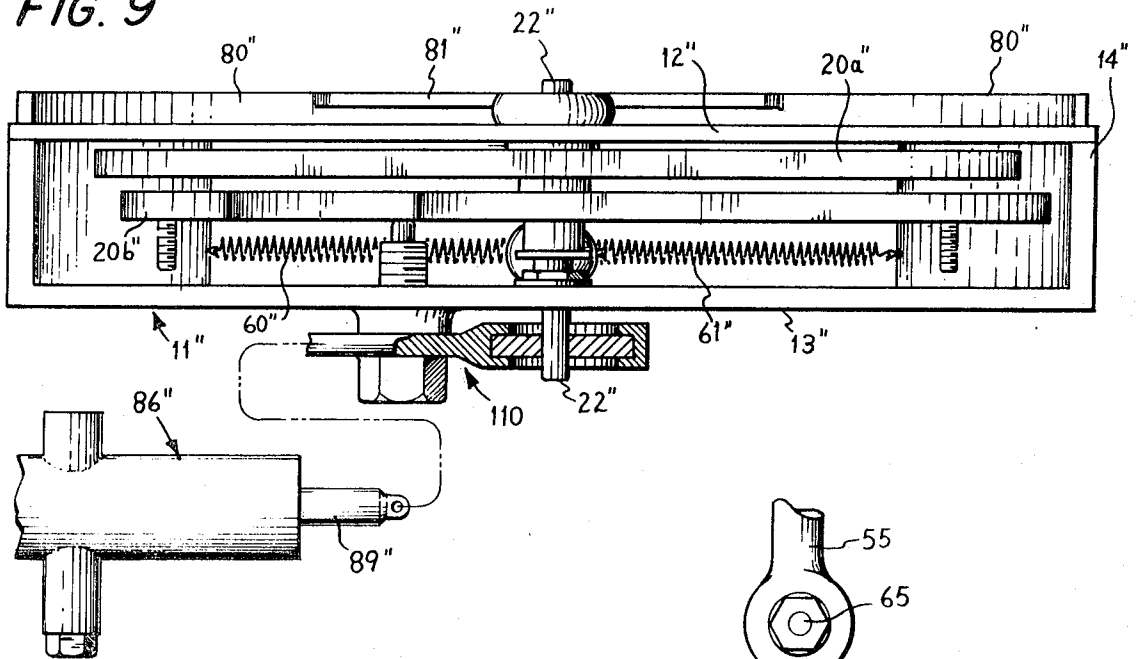
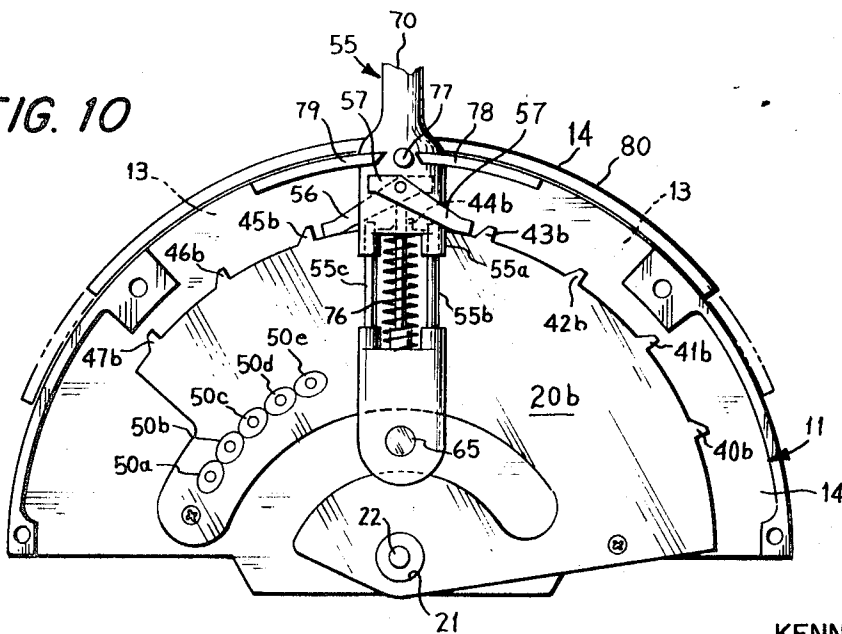


FIG. 11

FIG. 10



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RATCHET CONTROL MECHANISM

BACKGROUND OF THE INVENTION

The present invention relates in general to a ratchet control mechanism and more particularly to a ratchet control mechanism for use in an automatic transmission in which the selection of gears is made by a shift handle through a step-by-step movement.

In the patent to Fitzpatrick U.S. Pat. No. 3,490,291, and the patent to Davis et al. U.S. Pat. No. 3,520,208, a shift handle is employed in an automatic transmission system to impart a step-by-step movement to a ratchet plate through a pawl for the selection of gear ratios. However, the shift handle as to be raised to clear the pawl against the urgency of a spring. Also a detent trigger on the shift handle is actuated and a detent bar with a cross bar is employed in cooperation with a camming surface for the movement of the ratchet plate through the shift handle.

Other patents disclosing automatic transmission with shift control are as follows: Adahan U.S. Pat. No. 3,515,012 Hulten U.S. Pat. No. 3,449,980 Irgens U.S. Pat. No. 3,276,285 Hurst, Jr., et al. U.S. Pat. No. Re. 26,884 Letwin et al. U.S. Pat. No. 3,465,612

SUMMARY OF THE INVENTION

A ratchet control mechanism in which a ratchet plate is mounted for rotary movement about an axis spaced from a pivot point for the pivotal movement of a handle formed with a pawl, and in which the pawl engages, respectively, a series of ratchet teeth for moving the ratchet plate in opposite directions.

By virtue of spacing the pivot point of the handle from the axis of rotation of the ratchet plate, the ratchet plate can be rotated in either direction in a step-by-step incremental movement without raising the handle to clear the pawls. Thus, the need for a detent trigger, detent bar, cross bar and camming surfaces has been obviated. In this manner, an improved, simplified arrangement has been achieved which is sturdier by reducing the number of moving parts subject to wear and tear. Of course, the present arrangement is more economical by lessening the number of parts to be produced and assembled.

A feature of the present invention is the natural operation of the shift lever, which always returns to a central position after each operation thereof. Further, the ratchet plate is separated from the handle and pawls in that vibration loads are not transmitted back to the ratchet control mechanism. By moving the pawls in a center detent position, the pawls are disengaged from the ratchet teeth so that handle vibration loads or shocks cannot be imparted to the transmission. This is particularly desirable when electrical selections are made.

Most gear selectors had used the "maze" or "gated" positioning which required an operator to observe the gear selection for locating the handle for shifting. The ratchet shift, one gear movement of the present invention, either up or down, from any ratchet position, along with the handle returning to the same position, obviates these problems. Accidental downshift from 4th to 1st gear or into reverse is eliminated. In the event downshift at high speed is required, it can be accomplished with facility, whereas with a down shift inhibitor, down shift at high speed cannot be accomplished.

The present invention also provides "natural instinct" movement of pushing a lever forward for the forward vehicle movement and for pulling a lever to the rear for the reverse or downshift movement.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the ratchet control mechanism of the present invention.

FIG. 2 is a side elevation view of the ratchet control mechanism shown in FIG. 1 with a cover plate removed and illustrated in conjunction with a flexible cable connected to an automatic transmission system.

FIG. 3 is a side elevation view of a modification of the ratchet control mechanism shown in FIG. 1 illustrated in conjunction with a lamp display and electrical cables for controlling an automatic transmission system.

FIG. 4 is a side elevation view of the ratchet control mechanism shown in FIG. 1 with an opposite cover plate removed.

FIG. 5 is a bottom view of the ratchet control mechanism shown in FIG. 1.

FIG. 6 is a vertical sectional view taken along line 6-6 of FIG. 5.

FIG. 7 is an enlarged vertical sectional view taken along line 7-7 of FIG. 5.

FIG. 8 is a schematic diagram of the electrical circuit for the light emitting devices and the electrical gear selection of the automatic transmission system for the ratchet control mechanism shown in FIG. 3.

FIG. 9 is a bottom view of a further modification of the ratchet control mechanism shown in FIG. 1 illustrated in conjunction with a bell-crank arrangement for mechanically controlling an automatic transmission system.

FIG. 10 is a side elevation view similar to FIG. 2 with a front portion of the ratchet plate removed for clarity.

FIG. 11 is a fragmentary, enlarged elevation view of the shaft of the shift handle yield with spring attached thereto for returning the shift handle to its central location.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Illustrated in FIG. 1 is the ratchet control mechanism 10 of the present invention which comprises a substantially semi-cylindrical housing 11 with confronting parallel plates 12 and 13 of semi-cylindrical configuration and an arcuate cover plate 14 fixed to the parallel plates 12 and 13 along the curved peripheral walls thereof. A centrally located slot 15 is formed in the arcuate cover plate 14.

Mounted within the housing 11 is a ratchet plate 20 of substantially a semi-cylindrical configuration that is disposed in parallel relation with and between the plates 12 and 13. The ratchet plate 20 may be a unitary structure or may be separated plates secured together to move in unison. For purposes of convenience, the ratchet plate 20 will be described as separate plates 20a and 20b bolted together to rotate in unison. The plates 20a and 20b are in substance mirror images of one another.

Mounted between or beside the plates 20a and 20b is an operating handle 55 with a pivot point 65 spaced from but parallel to the pivot point 22 of the plates 20a and 20b. The operating handle 55 protrudes through the housing 11 at the slot 15, detenting in the center of the slot 15. The handle is returned to and held at the center of slot 15 through the urgency of springs 60 and 61 and springs 62 and 63. Springs 62 and 63 are compression springs below the handle pivot 65 as illustrated in FIGS. 2 and 11. The tension springs 60 and 61 are above the pivot point 65 as illustrated in FIGS. 2 and 4.

The ratchet plate 20 includes an axial opening 21 which receives a suitable axial shaft 22. The axial shaft 22 is supported by the parallel plates 12 and 13 of the housing 11 and it, in turn, supports the ratchet plate 20 for rotation thereabout. Along the peripheral wall of the ratchet plate 20a are formed a plurality of ratchet teeth 30a-37a (FIG. 2) that are disposed in the same plane at successive equal angular distances apart. The pawl engaging walls thereof are facing the forward or upshift pawl to be hereinafter described. Along the peripheral wall of the ratchet plate 20b are formed a plurality of ratchet teeth 40b-47b that are disposed in the same plane at successive equal angular distances apart. The pawl engaging walls thereof are facing the backward or downshift pawl to be hereinafter described.

Also formed in the ratchet plate 20 are a plurality of detent openings 50a-80e disposed angular distances apart. These detent openings (FIG. 2) are so formed that the crowns meet and peak so as to give no resting place for the detent plunger forc-

ing the plunger to travel to either detent opening resting in the valley. The valleys are so drilled completely through plates 20a and 20b so as to force any foreign particles on through these openings. Mounted on the housing 11 to be received by the detent opening aligned therewith is a suitable spring loaded detent 51 (FIG. 7). When the ratchet plate 20 is rotated about the axial shaft 21, a predetermined angular distance, the detent 51 enters one of the detent openings 50a-50 aligned therewith to retain the ratchet plate 20 in its selected angular position.

For rotating the ratchet plate 20 in selected, predetermined, incremental angular distances in a step-by-step movement, a shift handle 55 is provided. Fixed to or integrally formed with the shift handle 55 are oppositely directed pawls 56 and 57. The pawl 56 is forward or upshift pawl and the pawl 57 is a backward or downshift pawl. The shift handle 55 is received by the slot 15 of the cover plate 14 and the pawl 56 is disposed in the plane for engaging the pawl engaging walls of the ratchet teeth 30a-37a, respectively and successively. In a similar manner, the pawl 57 is disposed in the plane for engaging the pawl engaging walls of the ratchet teeth 40b-47b, respectively and successively. A pair of oppositely directed return springs 60 and 61 have their outboard ends anchored to the housing 11 and have their inboard ends attached to the shift handle 55 for returning the shift handle 55 to a neutral or central position within the slot 15 when the shift handle 55 is released by an operator.

According to the present invention, the proximal end of the shift handle 55 is supported for pivotal movement by the pivot pin or pivot shaft 65 that is spaced from the axial shaft 22 for the ratchet plate 20 and is aligned radially therewith. The pivot pin 65 is supported by the housing 11. It is to be observed that the radial distance between the path of arcuate travel of the teeth of the ratchet plate 20 and the axis of the ratchet plate 20 is greater than the radial distance between the path of arcuate travel of the pawls of the shift handle 55 and the pivot point of the shift handle 55. By virtue of the foregoing arrangement, actuation of the shift handle 55 about the pivot pin 65 from the central or neutral position thereof will either move the pawl 56 into engagement with one of the ratchet teeth 30a-37a or will move the pawl 57 into engagement with one of the ratchet teeth 40b-47b dependent on the direction of pivotal movement of the shift handle 55 from its neutral or central position. The return of the shift handle 55 about the pivot pin 65 under the urgency of the springs 60 and 61 to its neutral position will not be impeded by any of the ratchet teeth. This is accomplished without the requirement of a detent trigger, detent bar or the lifting of the shift handle 55 in the radial direction.

Thus, the pivotal movement of the shift handle 55 in the upshift or forward direction about the pivot pin 65 will cause the pawl 56 to engage one of the ratchet teeth 30a-37a to rotate the ratchet plate 20 about the pivot shaft 22 an incremental, preselected angular distance in the upshift or forward direction. At the completion of the stroke, the shift handle 55 returns to its neutral position under the urgency of the springs 60-63, while the detents 50a-50e hold the ratchet plate 20 in its selected advanced position. Likewise, the pivotal movement of the shift handle 55 in the downshift or backward direction about the pivot pin 65 will cause the pawl 57 to engage one of the teeth 40b-47b to rotate the ratchet plate 20 about the pivot shaft 22 in an incremental, preselected angular distance in the downshift or backward direction. At the completion of the stroke, the shift handle 55 returns to its neutral position under the urgency of the springs 60-63, while the detents 50a-50e hold the ratchet plate 20 in its selected advanced position.

The angular distance moved by the ratchet plate for each complete stroke of the shift handle 55 is determined by the distance travelled by the shift handle 55 in the slot 15 during each stroke and the angular distance between successive ratchet teeth of the same set of ratchet teeth. Accordingly, the ratchet plate 20 is rotated in a step-by-step movement in

either direction at a preselected, incremental angular distance for each stroke of the shift handle 55.

More specifically, the shift handle 55 comprises a shaft 70 with a convenient knob, not shown, at the distal end thereof. An angle member 72 (FIG. 1) on the shaft 70 has a flat horizontal section that extends across the slot 15. The pawls 56 and 57 (FIG. 2) are secured by nuts and bolts on the flat horizontal section. Mounted on the handle 55 are the two opposing pawls 56 and 57 with a common pivot point. The pawls are independently spring urged downward by a spring 59 (FIG. 6) but limited in downward travel to a set position above the ratchet teeth 40b-47b, 30b-37b by a stop 58. When the handle 55 is in neutral or center detent position, the pawls 56 and 57 are disengaged from the ratchet teeth. The proximal end of a threaded extension for the shaft 70 has a collar 73 (FIGS. 4 and 6) that surrounds the pivot pin 65. A spring 74 is disposed between the housing 11 and the collar 73 around the pivot pin 65 to give the shaft 72 some play in the actuation thereof. Suitable means on the shaft 72 provide the arrangement for connecting the springs 60 and 61 to the shaft 70. Detenting of the handle 55 (FIGS. 2 and 6) in the center of the slot 15 is accomplished by a spring 74 urging the handle 55 through a lever 75. Stronger or additional detenting is gained by a spring 76 (FIG. 10) urging the handle 55 upward allowing roller 77 to seat in detent between plates 78 and 79. Rods 55c and 55b are anchored in the handle 55 but slip in their respective sockets 55a in the handle 55. Rods 55c and 55b limit the travel of the handle 55 to the extend needed to unseat the roller 77 from the detent plates 78 and 79 by seating in their respective sockets.

In the exemplary embodiment, the ratchet control mechanism 10 is employed to control an automatic transmission system for selecting the gears thereof. Toward this end, an arcuate plate 80 (FIG. 1) with a gear shift legend thereon is disposed adjacent the cover plate 14 and the slot 15. A radial arm 81 (FIG. 5) supports the legend plate 80 for pivotal movement about the pivot shaft 22. A pin enters the axial shaft 22, which enters the housing 11 to interconnect the ratchet plate 20 with the arm 81, and moves in unison with the ratchet plate 20. Thus, the rotary movement of the ratchet plate 20 imparts a like rotary movement to the arm 81.

A transmission control cable assembly 85 (FIG. 2) operatively connects the ratchet plate 20 to the automatic transmission 86. This assembly includes a push-pull cable 87 which is connected at one end by a pin 88 to the ratchet plate 20 and which is operatively connected at the other end to an axially shiftable selector valve 89. This valve is a part of a conventional hydraulic control in the transmission. The selector valve has spaced annular grooves 90 which accommodates balls 91 of ball detents 92 in the transmission. The balls are pressed into engagement with the grooves 90 by coil springs 93 so that the valve will be detented and thereby retained in any adjusted position. When the ratchet plate 20 is rotated a preselected, incremental angular distance, the cable 87 will be actuated to move the selector valve 89 for a distance equal to one groove, thereby changing the gear selection of the automatic transmission to reflect the selected gear shift position for the transmission. It is apparent that a mechanical arrangement employing bell cranks and linkage can be employed equally as well.

The selection of gears in an automatic transmission can also be accomplished electrically (FIGS. 3 and 8). For this purpose, an electrical housing 100 is mounted on the housing 11'. It is to be noted that the ratchet control mechanism includes similar parts and operates in a similar manner. Hence, like parts have been identified with the same reference numeral with a prime suffix. A stepping switch 101 with sets of contacts 101a and 101b and associated wiper arms 103 and 104 are mounted within the housing 100. The wiper arms 103 and 104 are supported for rotation about the axis of the axial shaft 22'. A pin through the axial shaft 22' interconnects the contact arms 103 and 104 with the ratchet plate 20 so that the rotation of the ratchet plate 20' imparts rotation to the wiper arms 103 and 104. The wiper arms 103 and 104 will move in unison with

the ratchet plate 20'. When the ratchet plate 20' is rotated in a step-by-step incremental movement, the wiper arms 103 and 104 step from associated contact to associated contact in a step-by-step fashion to select electrically through an electrical cable 106 connected to a suitable solenoid 107 the gears of the automatic transmission 86'. Suitable connections are made to the contacts 101a and 101b to illuminate respectively light emitting diodes 110-117 (FIGS. 3 and 6) to show the gear selection in use.

The selection of gears in an automatic transmission can also be accomplished mechanically (FIG. 9) through a bell-crank arrangement 110. The bell-crank is connected at one end to the ratchet plate 20'' and is actuated in response to the step-by-step movement thereof to operate the automatic transmission 86'' for selecting the gears thereof in a well-known manner. The ratchet control mechanism is similar in components and operation as above described. Thus, like parts have been identified with the same reference numeral with a double prime suffix.

I claim:

1. A ratchet control mechanism comprising:

- a. a ratchet plate with an arcuate wall forming a surface equi-distant from an axis of rotation;
- b. ratchet teeth on said arcuate wall spaced angular distances apart;
- c. means for mounting said ratchet plate for rotation about the axis thereof;
- d. a handle disposed in the vicinity of said ratchet plate;
- e. a pawl on said handle for engaging each of said ratchet teeth respectively; and
- f. means for mounting said handle for pivotal movement about a pivot point spaced from the axis of rotation of said ratchet plate, said axis of rotation for said ratchet plate and said pivot point for said handle being aligned radially, the radial distance between said pivot point for said handle and the arcuate path of pivotal movement of said pawl being less than the radial distance between said axis of rotation of said ratchet plate and the arcuate path of rotation of said ratchet teeth,

said handle normally occupying a neutral position and comprising yieldable means connected to said handle for urging said handle toward its neutral position.

2. A ratchet control mechanism as claimed in claim 1 wherein the movement of said handle from its neutral position rotates said ratchet plate to advance said ratchet plate a preselected, incremental angular distance and comprising detent means for retaining said ratchet plate in the advanced position while said handle returns to its neutral position under the urgency of said yieldable means.

3. A ratchet control mechanism comprising:

- a. a ratchet plate with an arcuate wall forming a surface equi-distant from an axis of rotation;
- b. a first plurality of ratchet teeth on said arcuate wall spaced angular distances apart in a first plane;
- c. a second plurality of ratchet teeth on said arcuate wall spaced angular distances apart in a second plane;
- d. means for mounting said ratchet plate for rotation about the axis thereof;
- e. a handle disposed in the vicinity of said ratchet plate;
- f. a first pawl on said handle disposed in said first plane for engaging each of said first ratchet teeth respectively;
- g. a second pawl on said handle disposed in said second plane for engaging each of said second ratchet teeth respectively; and
- h. means for mounting said handle for pivotal movement about a pivot point spaced from the axis of rotation of said ratchet plate,

said first and second pawls being oppositely directed.

4. A ratchet control mechanism as claimed in claim 3 wherein said axis of rotation for said ratchet plate and said pivot point for said handle are aligned radially and wherein the radial distance between the pivot point for said handle and the respective arcuate paths of pivotal movement of said front and

second pawls is less than the radial distance between said axis of rotation of said ratchet plate and the respective arcuate paths of rotation of said first and second ratchet teeth.

5. A ratchet control mechanism as claimed in claim 4 wherein successive ratchet teeth of said first ratchet teeth and successive ratchet of said second ratchet teeth are spaced apart equal angular distances.

6. A ratchet control mechanism as claimed in claim 4 wherein said handle normally occupies a neutral position and comprising yieldable means connected to said handle for urging said handle toward its neutral position.

7. A ratchet control mechanism as claimed in claim 6 wherein the movement of said handle from its neutral position in one direction moves said one pawl into engagement with one of said first ratchet teeth for advancing said ratchet plate in one direction a preselected incremental angular distance for a step-by-step movement of said ratchet plate and wherein the movement of said handle from its neutral position in another direction moves said second pawl into engagement with one of said second ratchet teeth for advancing said ratchet plate in another direction a preselected incremental angular distance for a step-by-step movement of said ratchet plate, and comprising detent means for retaining said ratchet plate in the advanced position while said handle returns to its neutral position under the urgency of said yieldable means.

8. A transmission control for an automatic transmission system having gears for providing a plurality of different gear selections comprising:

- a. means connected to said transmission for selectively operating said transmission in the selection of gears;
- b. a ratchet plate connected to said means for actuating said means for selectively operating said transmission in the selection of gears, said ratchet plate being formed with an arcuate wall forming a surface equi-distant from an axis of rotation;
- c. a first plurality of ratchet teeth on said arcuate wall spaced angular distances apart in a first plane;
- d. a second plurality of ratchet teeth on said arcuate wall spaced angular distances apart in a second plane;
- e. means for mounting said ratchet plate for rotation about the axis thereof;
- f. a shift handle disposed in the vicinity of said ratchet plate;
- g. a first pawl on said shift handle disposed in said first plane for engaging each of said first teeth respectively and successively;
- h. a second pawl on said shift handle disposed in said second plane for engaging each of said second teeth respectively and successively, and
- i. means for mounting said shift handle for pivotal movement about a pivot point spaced from the axis of rotation of said ratchet plate.

9. A transmission control as claimed in claim 8 wherein said first and second pawls are oppositely directed.

10. A transmission control as claimed in claim 9 wherein said axis of rotation for said ratchet plate and said pivot point for said shift handle are aligned radially, and wherein the radial distance between the pivot point for said shift handle and the respective arcuate paths of pivotal movement of said first and second pawls is less than the radial distance between said axis of rotation of said ratchet plate and the respective arcuate paths of rotation of said first and second ratchet teeth.

11. A transmission control as claimed in claim 10 wherein successive ratchet teeth of said first ratchet teeth and successive ratchet teeth of said second ratchet teeth are spaced apart equal angular distances.

12. A transmission control as claimed in claim 10 wherein said shift handle normally occupies a central position and comprising yieldable means connected to said shift handle for urging said shift handle toward its central position.

13. A transmission control as claimed in claim 12 wherein the movement of said shift handle from its central position in one direction moves said one pawl into engagement with one of said first ratchet teeth for advancing said ratchet plate in

one direction a preselected, incremental angular distance for a step-by-step movement of said ratchet plate to actuate said means in a step-by-step manner for selectively operating said transmission in the selection of gears and wherein the movement of said shift handle from its central position in another direction moves said second pawl into engagement with one of said second ratchet teeth for advancing said ratchet plate in another direction a preselected, incremental angular distance

for a step-by-step movement of said ratchet plate to actuate said means in a step-by-step manner for selectively operating said transmission in the selection of gears, and comprising detent means for retaining said ratchet plate in the advanced position while said shift handle returns to its central position under the urgency of said yieldable means.

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