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(54) Bicycle shifter

(57) A bicycle shifter (10) for pulling and releasing a control cable (11) connected to a gear change mechanism that includes a housing (18) mountable to a handlebar (12), a takeup member (22), a control member (20), a holding mechanism (24) and a release mechanism. The takeup member (22) is movable for pulling the control cable (11) in a cable-release direction and releasing the control cable (11) in a cable-release direction. The control member (20) is movable in a shift direction from a rest position for a first shift movement to permit motion of the takeup member (22) in the cable-release direction. The first shift movement corresponds to a single gear change. The control member (20) is moveable in the shift direction from the rest position for a second shift movement to move the takeup member (22) in the cable-pull direction. The second shift movement corresponds to a plurality of gear changes. The second shift movement is greater than the first shift movement. The control member (20) is biased toward the rest position. The holding mechanism (24) retains the takeup member (22) in a selected gear position. The drive mechanism (26) is operable for releasing the holding mechanism (24) from the takeup member (22) and for moving the takeup member (22) in response to actuation of the control member (20).

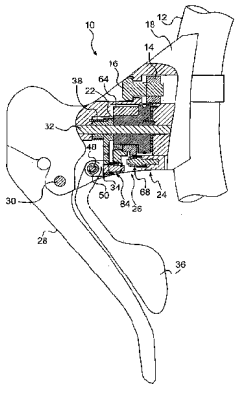

FIG. 1

EP 1 698 550 A1

Description

Background of the Invention

[0001] The present invention relates to bicycle shifters, and more particularly, to a bicycle shifter having a single control lever movable in one direction for pulling and releasing a control cable.

[0002] Conventional bicycle shifters have been designed to include separate control levers, one for pulling, another for releasing the control cable. Disadvantages of a two-lever shifter include added weight and the discomfort of repeatedly maneuvering the hand and fingers between the two levers. Bicycle shifters have also been designed to include a single lever operable in two directions, one to pull, the other to release the control cable. Although acceptable for some applications, discomfort and loss of control may result when shifting, as the rider maneuvers his hand and fingers to alternate sides of such a lever.

Summary of the Invention

[0003] The present invention provides a bicycle shifter having a single control member movable in a first direction to both pull and release a control cable connected to a gear change mechanism. The bicycle shifter includes a housing mountable to a handlebar of the bicycle, the housing enclosing a takeup member movable to pull and release the control cable in cable-pull and cable-release directions. Typically, the takeup member is biased in the cable-release direction by tension in the control cable, but may also be biased by a takeup member return spring, or the like. A holding mechanism retains the takeup member in a selected gear position, while a drive mechanism is operable to disengage the holding member in response to actuation of the control member, allowing the takeup member to move. To shift gears, the rider moves the control member in the same shift direction for a first shift movement to move the takeup member in the cable-release direction, or for a second shift movement, to move the takeup member in the cable-pull direction. Each first shift movement corresponds to a single gear change while the second shift movement corresponds to one or more gear changes. Further, the second shift movement of the control member is greater than the first shift movement. The control member is biased toward a rest position.

[0004] In one embodiment of the present invention, the takeup member is rotatable about an axis to wind and unwind the control cable thereon in the cable-pull and cable-release directions. The control member is preferably a control lever rotatably mounted to a shaft located in the housing. The shifter further includes a ratchet wheel having preferably a plurality of unevenly spaced teeth about it periphery, the ratchet wheel being rotatable with the takeup member, while the holding mechanism includes a holding pawl engageable with the ratchet wheel teeth to retain the takeup member in a selected gear position. The holding pawl has a body and a nose extending from the body, the nose biased to engage the teeth of the ratchet wheel.

[0005] The drive mechanism includes a drive pawl rotatably mounted to the control lever, while the shifter includes a declutching element for disengaging the drive pawl from the ratchet wheel. The drive pawl has a body, a nose extending from the body, and a tail. The nose of the drive pawl is biased by a spring to engage the ratchet wheel teeth, and is engageable with the nose of the holding pawl to release the holding pawl from the ratchet wheel teeth. The tail of the drive pawl is engageable with the declutching element, preferably a declutching wall of the housing, to rotate the drive pawl and disengage the nose of the drive pawl from the ratchet wheel teeth.

[0006] Before actuation, the control lever is in a rest position, the tail of the drive pawl rests against the declutching pawl, the nose of the driver pawl is disengaged from the ratchet wheel teeth. Further, the nose of the holding pawl is engaged with a corresponding first tooth of the ratchet wheel to retain the takeup member in a selected gear position.

[0007] To perform a cable-release operation, the control lever is actuated in the shift direction, rotating the control lever about its shaft, and causing the drive pawl to pivot about its own axis to move the nose of the drive pawl toward the ratchet wheel teeth. As the control lever is further rotated, the drive pawl engages the holding pawl nose to release it from engagement with the first tooth on the ratchet wheel. In altemative embodiments, intermediate elements may transmit motion between the drive pawl and holding pawl. Once disengaged, the takeup member and ratchet wheel are free to rotate in the cable-release direction until the drive pawl nose engages the same first tooth of the ratchet wheel. The engagement of the drive pawl nose with the just-released first tooth of the ratchet wheel, provides both audible and tactile feedback to the rider, signaling when to stop moving the control lever in the shift direction and releasing the lever to effect a cable-release operation. As the control lever is released, now rotating toward its rest position, the tail of the drive pawl bears against the declutching wall, rotating the drive pawl to disengage the drive pawl nose from the ratchet wheel teeth. When the drive pawl nose disengages from the first tooth of the ratchet wheel, the takeup member and ratchet wheel rotate in the cable-release direction, under the tensile force of the control cable, until the nose of the holding pawl engages the adjoining second tooth, resulting in a gear shift by one gear increment in the cable-release direction. At the end of the cable-release operation, the drive pawl returns to its rest position against the declutching wall, to position the control lever in its rest position.

[0008] To perform a cable-pull operation, instead of releasing the control lever upon disengagement of the holding pawl from the ratchet wheel during a cable-release operation, the lever is further rotated in the shift direction. Further rotation of the control lever causing the drive pawl to drive the takeup member and the ratchet wheel in the cable-pull direction, while the holding pawl free-clutches, the holding pawl nose freely sliding along the teeth of the ratchet wheel. The rider may rotate the control lever in the shift direction until the holding pawl nose engages a ratchet wheel tooth corresponding to a single, or multiple, gear shift increments in the cable-pull direction. Once a desired gear position is reached, the control lever is released and it rotates toward its rest position, now causing the drive pawl nose to free-clutch over the ratchet wheel teeth, while the holding pawl retains the takeup member in the selected gear position.

[0009] These and other features and advantages of the invention will be more fully understood from the following description of various embodiments of the invention, taken together with the accompanying drawings.

Brief Description of the Drawings

[0010] In the drawings:

FIG. 1 is a partial cross-sectional view of a bicycle shifter according to one embodiment of the present invention;

FIG. 2 is an enlarged partial cross-sectional view of the bicycle shifter to FIG. 1;

FIGS. 3a-3f are cross-sectional views of a holding mechanism and a drive mechanism at different stages of a cable-release operation; and

FIGS. 4a-4h are cross-sectional views of the holding mechanism and the drive mechanism at different stages of a cable-pull operation.

Detailed Description

[0011] FIGS. 1-4 illustrate a bicycle shifter 10 according to one embodiment of the present invention. The bicycle shifter 10 pulls or releases a control cable 11 connected to gear change mechanism (not shown) to shift between various gear positions. The gear change mechanism may be a derailleur, or other external or internal gear change devices. The bicycle shifter 10 is mounted to a handlebar 12 by a clamp 14 and a bolt 16. The bicycle shifter 10 shown is a road shifter for use on a road bike. However, similar shifters may be adapted for use on other types of bicycles, including mountain bikes. In this embodiment, the bicycle shifter 10 generally includes a housing 18, a control member 20, a takeup member 22, a holding mechanism 24 and a drive mechanism 26. In this embodiment, the shifter 10 is integrated with a brake lever 28. The brake lever 28 pivots about a pivot brake 30, pulling a brake cable (not shown) to slow the bicycle. Alternatively, the brake lever 28 may be formed separately from the shifter 10.

[0012] In this embodiment, the housing 18 is mounted to the handlebar 12 and a mounting shaft 32 extends through the housing 18. The control member 20, in this embodiment a control lever 20, includes a first portion 34 and a second portion 36, the first portion 34 rotatably mounted to the shaft 32. The control lever 20 is biased toward a rest position by a preloaded control lever return spring 38. A first leg 40 of the control lever return spring 38 is received in an opening 42 in the housing 18, and a second leg 44 of the control lever return spring 38 is received in an opening 46 in the control lever 20. The second portion 36 of control lever 20, in addition to rotating about shaft 32 along with first portion 34, also rotates about a perpendicular lever shaft 48 mounted to the first portion 34 of the control lever 20. The second portion 36 of the control lever 20 is biased by a preloaded return spring 50 mounted coaxially with the lever shaft 48. A first leg of the return spring 50 is received in an opening in the second portion 36 of the control lever 20, and a second leg of the return spring 50 is supported by the first portion 34 of the control lever 20. In this embodiment, the control lever 20 includes two portions 34, 36 to allow the second portion 36 of the control lever 20 to move with the brake lever 28 when the brake lever 28 is actuated. In other embodiments, the control lever 20 may be formed as one piece.

[0013] The takeup member 22, in this embodiment a spool, is rotatably mounted on the shaft 32. The takeup member 22 includes a groove 52 along its periphery, for receiving the control cable 11. The takeup member 22 is biased in the cable-release direction by tension in the control cable 11 and, preferably, by a takeup member return spring 54. The takeup member return spring 54 is disposed between the takeup member 22 and the housing 18. The return spring 54 includes a first leg 56 received in an opening 58 in the takeup member 22, and a second leg 60 received in an opening 62 in the housing 18.

[0014] The shifter 10 includes a ratchet wheel 64 having preferably a plurality of unevenly spaced teeth 66 about its periphery, while the holding mechanism 24 includes a holding pawl 68 engageable with the teeth 66 to prevent unwinding of the takeup member 22. The ratchet wheel 64 is rotatably mounted to the shaft 32 and rotates with the takeup member 22. The ratchet wheel teeth 66 correspond to gear positions of the gear change mechanism. Alternatively, the ratchet

wheel 64 and the takeup member 22 may be formed as one piece. The holding pawl 68 is rotatable about a holding pawl pivot 70 fixed to the housing 18, and is axially positioned by a retaining ring 72. The holding pawl 68 includes a body 74, and a nose 76 extending from the body 74. The holding pawl nose 76 is biased to engage the ratchet wheel teeth 66 by a preloaded holding pawl spring 78, coaxially mounted to the holding pawl pivot 70. A first leg 80 of the holding pawl spring 78 is received in an opening in the housing 18, and a second leg 86 is supported by the holding pawl 68.

[0015] The drive mechanism 26 includes a drive pawl 84 rotatably mounted about a drive pawl pivot 90 fixed to the control lever 20. The drive pawl 84 is axially positioned by a retaining ring 92. The drive pawl 84 includes a body 94, a nose 96 extending from the body 94, and a tail 98. A drive pawl spring 100 biases the drive pawl nose 96 toward the ratchet wheel teeth 66. The tail 98 of the drive pawl 84 rests against a declutching element 88, in this embodiment, a declutching wall 88 of the housing 18, when the control lever 20 is in its rest position.

[0016] To shift the gear change mechanism, the control lever 20 is rotated in the shift direction for a first shift movement to release the control cable 11, and in the same direction for a second shift movement to pull the control cable 11, the second shift movement being greater than the first shift movement. Looking to FIGS. 3a-3f, a cable-release operation is described. Before the control lever 20 is actuated, the tail 98 of the drive pawl 84 rests against the declutching wall 88, positioning the control lever 20 in its rest position (FIG. 3a). Further, the takeup member 22 and the ratchet wheel 64 are retained in a selected gear position by the holding pawl 68, shown engaging a corresponding first tooth 102.

[0017] Looking to FIG. 3b, as the control lever 20 is actuated by the rider, the lever 20 rotates about the shaft 32, moving the drive pawl 84 away from the declutching wall 88, and pivoting the drive pawl nose 96 toward the ratchet wheel teeth 66. Looking to FIG. 3c, as the lever 20 is further rotated, the drive pawl nose 96 engages the holding pawl nose 76, causing the holding pawl 68 to release the first tooth 102 of the ratchet wheel 64. Once released, the ratchet wheel 64 rotates about the shaft 32 in the cable-release direction, until the first tooth 102 engages the drive pawl nose 96. This action provides both audible and tactile feedback to the rider, signaling the rider to release the control lever 20, if a cable-release operation is desired.

[0018] Looking to FIG. 3d, as the control lever 20 is released, allowing it to pivot towards its rest position, the ratchet wheel 64 rotates in the cable-release direction. Further, the holding pawl nose 76 moves toward engagement with a recess 104 associated with an adjoining second tooth 106 of the ratchet wheel 64, and the drive pawl tail 98 moves toward engagement with the declutching wall 88. As the control lever 20 rotates further toward its rest position, the drive pawl nose 96 pivots further away from the ratchet wheel teeth 66, due to the torque created as the drive pawl tail 98 bears against the declutching wall 88 (FIG. 3e). When the drive pawl 84 disengages from the ratchet wheel teeth 66, the ratchet wheel 64 rotates in the cable-release direction under the force of the control cable 11 and the takeup member return spring 54, until the holding pawl nose 76 engages the second adjoining ratchet wheel tooth 106, resulting in a gear shift, by one gear increment, in the cable-release direction. At the end of the cable-release operation, the drive pawl 84 moves back to its rest position against the declutching wall 88 (FIG. 3f), positioning the control lever 20 in its rest position.

[0019] Looking to FIGS. 4a-4h, a cable-pull operation is described. Before the control lever 20 is actuated, the drive pawl tail 98 rests against the declutching wall 88, positioning the control lever 20 is in its rest position (FIG. 4a). So positioned, the ratchet wheel 64 is retained in a selected gear position with the holding pawl 68 engaging the first ratchet wheel tooth 102. As the control lever 20 is actuated by the rider in the shift direction, the drive pawl 84 moves away from the declutching wall 88, positioning the drive pawl nose 96 toward the ratchet wheel teeth 66 (FIG. 4b).

[0020] Looking to FIG. 4c, as the control lever 20 is further rotated, the drive pawl nose 96 engages the holding pawl nose 76, driving the holding pawl nose 76 out of engagement with the first ratchet wheel tooth 102. Once released, the ratchet wheel 64 rotates in the cable-release direction until the first tooth 102 engages the drive pawl nose 96. As the control lever 20 is further rotated in the shift direction, the drive pawl 84 drives the ratchet wheel 64 in cable-pull direction, as the holding pawl 68 free-clutches, the holding pawl nose 76 freely sliding along the ratchet wheel teeth 66 (FIG. 4d).

[0021] Looking to FIG. 4e, as the control lever 20 is further rotated, the drive pawl 84 further rotates the ratchet wheel 64 in the cable-pull direction until the holding pawl 68 engages a next third tooth 110 on the ratchet wheel 64, resulting in a single gear shift in the cable-pull direction. The rider, of course, is not limited to single gear shift increments in the cable-pull direction. The rider may readily shift multiple gear increments in the cable-pull direction by simply continuing to move the control lever in the shift direction, until the desired gear position is reached. Audible and tactile feedback is provided to the rider as each gear shift increment is passed.

[0022] Looking to FIG. 4f, after the desired gear position is reached, the rider releases the control lever 20 causing the control lever 20 and the drive pawl 84 to rotate toward their rest positions under the force of the control lever return spring 38. As the control lever 20 further rotates toward its rest position, the drive pawl tail 98 bears against the declutching wall 88, creating a torque that rotates the drive pawl 84 away from the ratchet wheel teeth 66 (FIG. 4g). Looking to FIG. 4h, the drive pawl 84 is in its rest position against the declutching wall 88, with the drive pawl nose 96 disengaged from the ratchet wheel 64.

[0023] While this invention has been described by reference one or more preferred embodiments, it should be understood that numerous changes could be made within the spirit and scope of the inventive concepts described. Accordingly,

it is intended that the invention not be limited to the disclosed embodiments, but that it have the full scope permitted by the language of the following claims.

Claims

1. A bicycle shifter for pulling and releasing a control cable connected to a gear change mechanism, the bicycle shifter comprising:

   a housing mountable to a handlebar;
   a takeup member movable for pulling the control cable in a cable-pull direction and releasing the control cable in a cable-release direction, the takeup member biased in the cable-release direction;
   a control member movable in a shift direction from a rest position for a first shift movement to permit motion of the takeup member in the cable-release direction, the first shift movement corresponding to a single gear change, the control member movable in the shift direction from the rest position for a second shift movement to move the takeup member in the cable-pull direction, the second shift movement corresponding to a plurality of gear changes, the second shift movement of the control member being greater than the first shift movement, the control member biased toward the rest position;
   a holding mechanism for retaining the takeup member in a selected gear position; and
   a drive mechanism operable for releasing the holding mechanism from the takeup member and for moving the takeup member in response to actuation of the control member.

2. The bicycle shifter according to claim 1, wherein the takeup member is rotatable about an axis for winding and unwinding to the control cable thereon.

3. The bicycle shifter according to claim 1 or 2, further comprising a ratchet wheel rotatable with the takeup member and having a plurality of teeth, the holding mechanism including a holding pawl biased to engage the ratchet wheel teeth to retain the takeup member in a selected gear position.

4. The bicycle shifter according to claim 3, wherein the holding pawl is rotatably mounted to the housing.

5. The bicycle shifter according to claim 3 or 4, wherein the holding pawl is biased to engage the ratchet wheel by a spring.

6. The bicycle shifter according to one of claims 3 to 5, wherein the drive mechanism includes a drive pawl rotatably mounted to the control member and biased to engage the ratchet wheel teeth, the drive pawl operable for releasing the holding pawl from the ratchet wheel teeth and for rotating the takeup member in response to actuation of the control member.

7. The bicycle shifter according to claim 6, further comprising a declutching element for disengaging the drive pawl from the ratchet wheel.

8. The bicycle shifter according to claim 7, wherein the declutching element is a declutching wall of the housing.

9. The bicycle shifter according to one of claims 6 to 8, wherein the drive pawl is biased by a spring.

10. The bicycle shifter according to claim 7 or 8, wherein the drive pawl includes a body pivotably attached to the control member, a nose engageable with the ratchet wheel teeth, and a tail engageable with the declutching element; and the holding pawl includes a body pivotably attached to the housing and a nose engageable with the ratchet wheel teeth.

11. The bicycle shifter according to claim 10, wherein after the first shift movement, the tail of the drive pawl abuts against the declutching element to disengage the nose of the drive pawl from the ratchet wheel teeth.

12. The bicycle shifter according to claim 10 or 11, wherein the tail of the drive pawl abuts against the declutching element during motion of the control lever toward its rest position.

13. The bicycle shifter according to one of claims 10 to 12, wherein the drive pawl is operable such that the drive pawl nose disengages the holding pawl nose from the ratchet wheel teeth to permit rotation of the takeup element in

response to actuation of the control member.

14. The bicycle shifter according to claim 2 and one of the preceeding claims, wherein the control member is a pivotable control lever biased toward the rest position by a return spring.

15. A bicycle shifter for pulling and releasing a control cable connected to a gear change mechanism, the bicycle shifter comprising:

a housing mountable to a handlebar;
a takeup member movable for pulling the control cable in a cable-pull direction and releasing the control cable in a cable-release direction, the takeup member biased in the cable-release direction;
a ratchet wheel rotatable with the takeup member and having a plurality of unevenly spaced teeth;
a control member movable in a shift direction from a rest position for a first shift movement to permit motion of the takeup member in the cable-release direction, the first shift movement corresponding to a single gear change, the control member movable in the shift direction from the rest position for a second shift movement to move the takeup member in the cable-pull direction, the second shift movement corresponding to at least one gear change, the second shift movement of the control member being greater than the first shift movement, the control member biased toward the rest position;
a holding mechanism including a holding pawl biased to engage the ratchet wheel to retain the takeup element in a selected gear position; and
a drive mechanism including a drive pawl operable for engaging and releasing the holding pawl from the takeup member, and for moving the takeup member in response to actuation the control member.

16. The bicycle shifter according to claim 15, wherein the takeup member is rotatable about an axis for winding and unwinding to the control cable thereon.

17. The bicycle shifter according to claim 15, wherein the holding pawl is rotatably mounted to the housing.

18. The bicycle shifter according to claim 15 or 17, wherein the holding pawl is biased to engage the ratchet wheel by a spring.

19. The bicycle shifter according to claims 15 to 18, wherein the drive pawl is rotatably mounted to the control member and biased to engage the ratchet wheel teeth.

20. The bicycle shifter according to claim 19, further comprising a declutching element for disengaging the drive pawl from the ratchet wheel.

21. The bicycle shifter according to claim 20, wherein the declutching element is a declutching wall of the housing.

22. The bicycle shifter according to claims 19 to 21, wherein the drive pawl is biased by a spring.

23. The bicycle shifter according to claim 20 or 21, wherein the drive pawl includes a body pivotably attached to the control member, a nose engageable with the ratchet wheel teeth, and a tail engageable with the declutching element; and the holding pawl includes a body pivotably attached to the housing and a nose engageable with the ratchet wheel teeth.

24. The bicycle shifter according to claim 23, wherein after the first shift movement, the tail of the drive pawl abuts against the declutching element to disengage the nose of the drive pawl from the ratchet wheel teeth.

25. The bicycle shifter according to claim 23 or 24, wherein the tail of the drive pawl abuts against the declutching element during motion of the control lever toward its rest position.

26. The bicycle shifter according to claims 23 to 25, wherein the drive pawl is operable such that the drive pawl nose disengages the holding pawl nose from the ratchet wheel teeth to permit rotation of the takeup element in response to actuation of the control member.

27. The bicycle shifter according to claim 16 and one of the preceding claims, wherein the control member is a pivotable control lever biased toward the rest position by a return spring.

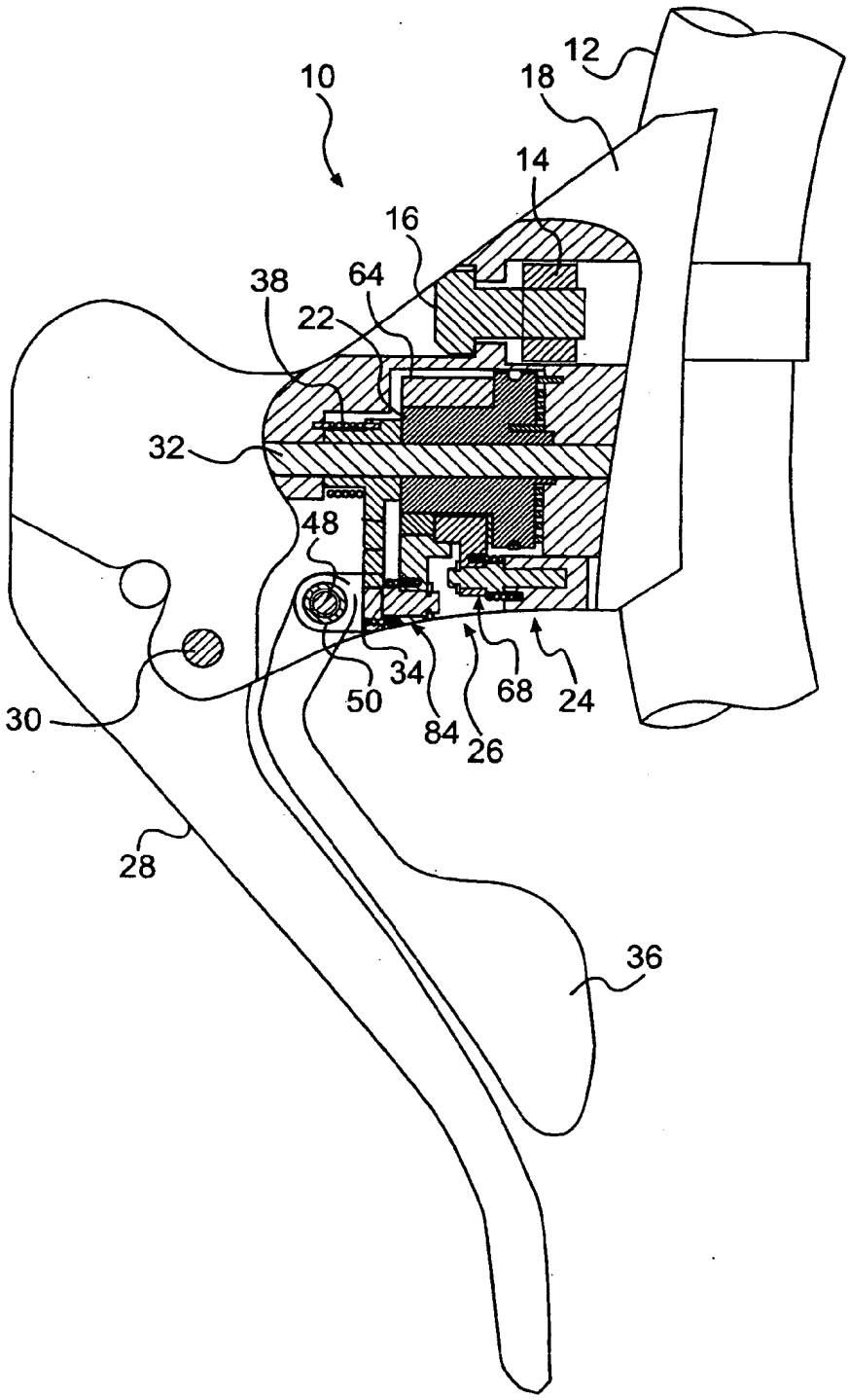

FIG. 1

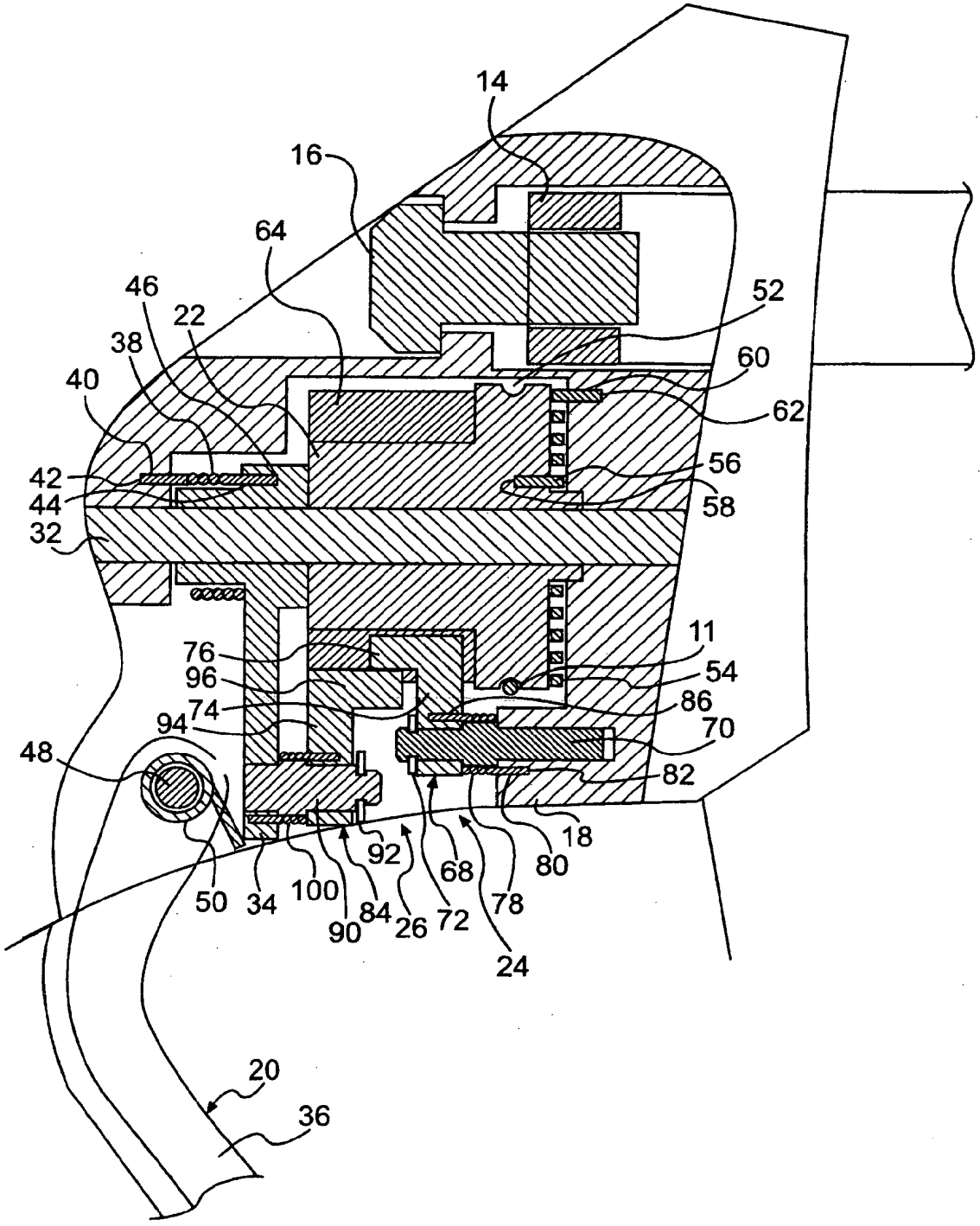
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FIG. 2

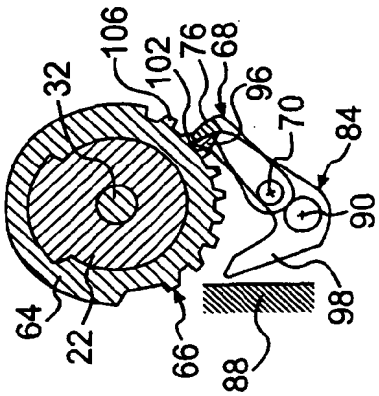

FIG. 3c

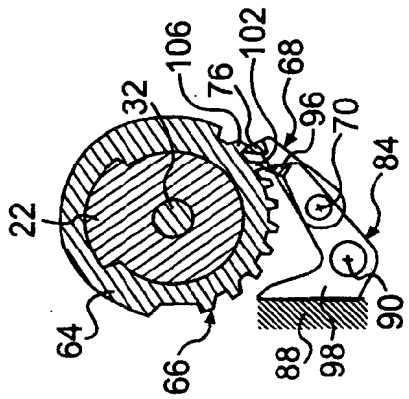

FIG. 3f

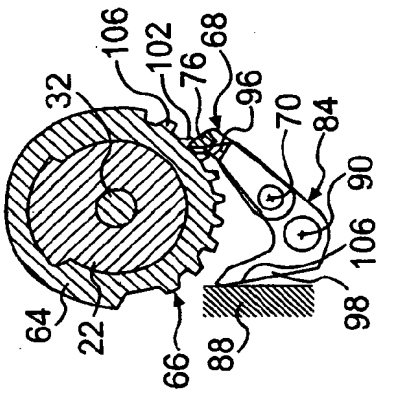

FIG. 3b

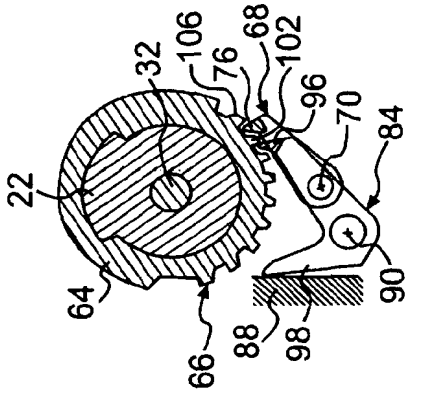

FIG. 3e

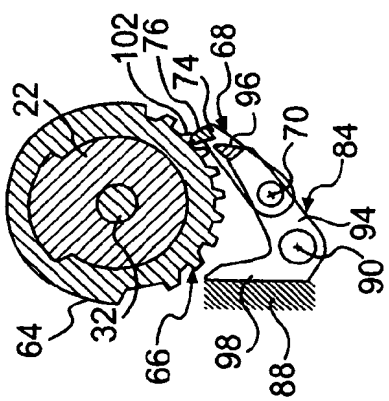

FIG. 3a

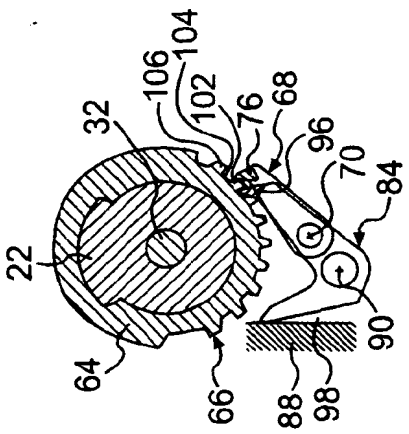

FIG. 3d

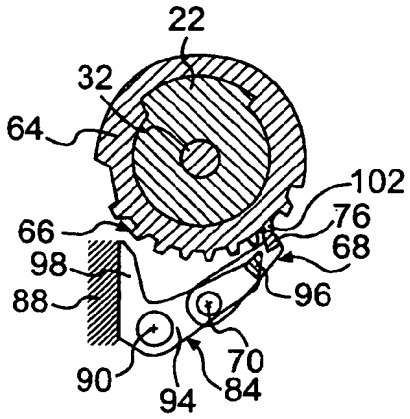

FIG. 4a

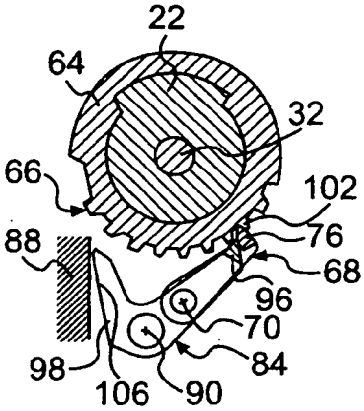

FIG. 4b

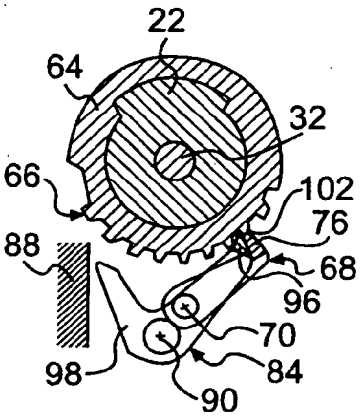

FIG. 4c

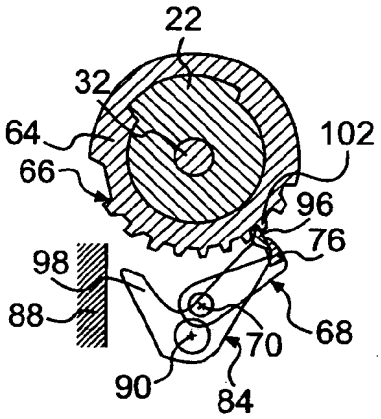

FIG. 4d

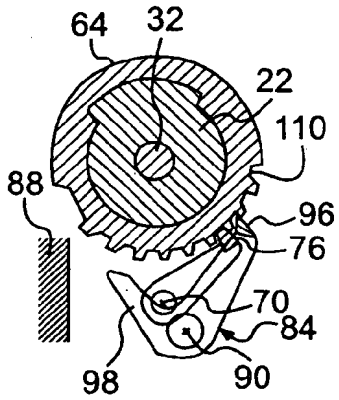

FIG. 4e

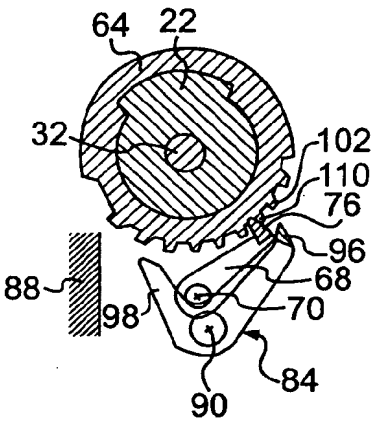

FIG. 4f

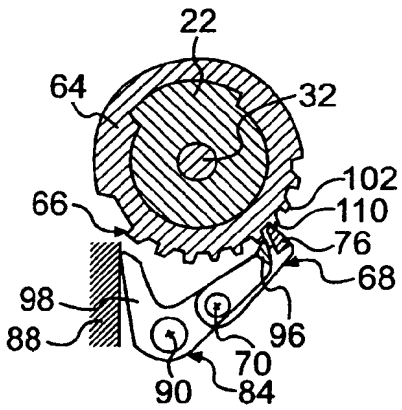

FIG. 4g

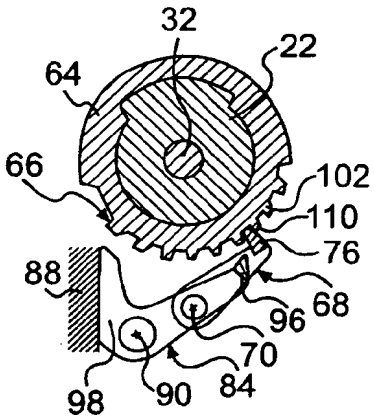

FIG. 4h

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