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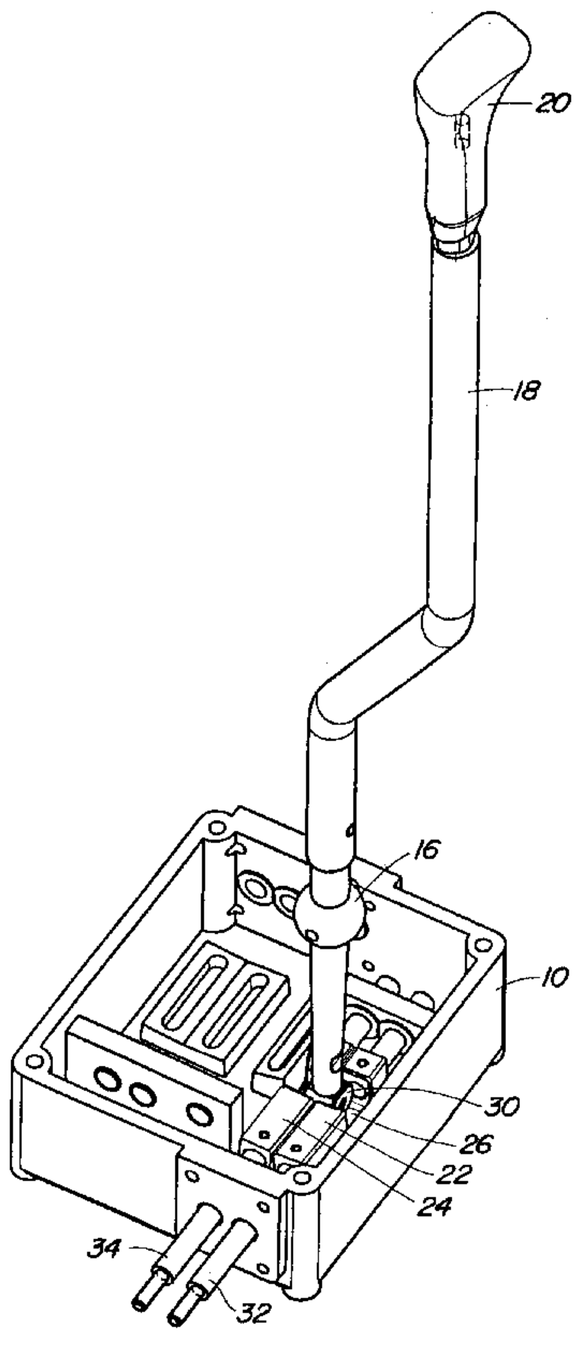
(54) **MECANISME SELECTEUR DE BOITE DE VITESSE DE VEHICULE**

(54) **SHIFT MECHANISM FOR A VEHICLE GEARBOX**



(57) A shift mechanism for a vehicle gearbox, in particular for a shift gearbox of an agricultural or commercial vehicle that is spaced away from the vehicle gearbox and is connected with the vehicle gearbox by shifter rods or shifter cables. The shift mechanism contains at least one shift lever supported in bearings in a housing so as to pivot and is used to shift gear ratios. The shift lever engagement region located in the interior of the housing engages transfer elements supported in bearings so as to slide parallel to each other and is forced by a reset mechanism into a neutral position. At least one shifter rod or at least one shifter cable connected to the vehicle gearbox is fastened to each transfer element. In order to exclude any risks to safety that could occur by the unintentional engagement of a gear ratio during maintenance or repair operations it is proposed that the shift lever, while in its neutral position interacts by its engagement region simultaneously with at least two transfer elements whereby a relative movement of the transfer elements with respect to each other and thereby the engagement of a gear ratio is prevented.

Abstract

A shift mechanism for a vehicle gearbox, in particular for a shift gearbox of an agricultural or commercial vehicle that is spaced away from the vehicle gearbox and is connected with the vehicle gearbox by shifter rods or shifter cables. The shift mechanism contains at least one shift lever supported in bearings in a housing so as to pivot and is used to shift gear ratios. The shift lever engagement region located in the interior of the housing engages transfer elements supported in bearings so as to slide parallel to each other and is forced by a reset mechanism into a neutral position. At least one shifter rod or at least one shifter cable connected to the vehicle gearbox is fastened to each transfer element. In order to exclude any risks to safety that could occur by the unintentional engagement of a gear ratio during maintenance or repair operations it is proposed that the shift lever, while in its neutral position interacts by its engagement region simultaneously with at least two transfer elements whereby a relative movement of the transfer elements with respect to each other and thereby the engagement of a gear ratio is prevented.

SHIFT MECHANISM FOR A VEHICLE GEARBOX

Background And Summary Of The Invention

The invention concerns a shift mechanism for a vehicle gearbox, in particular for shift gearboxes of agricultural or commercial vehicles, that is arranged at a location separated from the vehicle gearbox and that is connected to the vehicle gearbox by shifter rods or shifter cables. The shift mechanism contains at least one shift lever that is supported on bearings, free to pivot, in a housing and is used for the shifting of the gear ratios. The shift lever engagement region is located in the interior of the housing and engages transfer elements supported in bearings free to slide parallel to each other. The shift lever is forced into a neutral position by a reset mechanism. At least one shifter rod or at least one shifter cable is fastened to each transfer element. The vehicle gearbox may be a gear ratio shift gearbox as well as a group shift gearbox, as used, for example, in agricultural tractors, so that gear ratios or groups can be shifted by means of the shift mechanism.

In such a shift mechanism known from EP-C-0 696 698, the shift lever occupies a self-centering neutral position in the region of its selector channel which lies in the shift channel for the third and fourth gear ratio, extending transverse to the selector channel. The shift lever can be pivoted from its neutral position within the aforementioned shift channel, whereby a transfer element associated with the third and fourth gear ratio is shifted. The transfer element transmits the pivoting movements of the shift lever over a shifter cable to a shift gearbox, in order to engage the third or the fourth gear ratio.

The known shift mechanism does not fulfill all the desires for safety, since during repair or maintenance operations a person could move a shifter rod or shifter cable by manipulation or inadvertent operation and carry along the associated transfer element and engage a gear ratio of the shift gearbox. If the engine were running, the vehicle could hereby start to move unexpectedly and endanger the person.

The problem underlying the invention is seen as that of defining a shift mechanism of the aforementioned type through which the noted safety risks are avoided. In particular it should not be possible to engage a gear ratio of the shift gearbox as long as the shift lever is in its self-centering neutral position.

The shift mechanism according to the invention has the result that when the shift lever is in the neutral position, the transfer elements and shifter rods or the shifter cables are locked, making it impossible to engage a gear ratio or a group unintentionally by manipulation of the shifter rods. Only when the shift lever is moved out of its neutral position is the locking released, so that a gear ratio or a group can be engaged.

The peculiarity of the invention lies in the fact that the shift lever is biased to the neutral position such that after disengaging a gear or a group, the shift lever will move to the neutral position without any action on the part of the operator. Hereby the free end of the shift lever engages simultaneously at least two transfer elements, whereby these are coupled together and cannot be shifted independently of one another. If a compression or tension force is applied inadvertently or on purpose to a shifter rod during repair or maintenance operations, then this force is transmitted simultaneously to the other shifter rod by the coupling. A simultaneous shifting of two shifter rods, however, is not possible, if, for example, a locking mechanism is provided in the gearbox, that prevents the simultaneous engagement of two gear ratios or groups. In the presence of a shift mechanism according to the invention, a person that leaves the operator's platform when the engine is running cannot engage a gear ratio or group by manipulation or inadvertent operation of the shifter rods or shifter cables and thereby endanger himself.

To great advantage, the engagement region of the shift lever is located at the end of the shift lever. The end of the shift lever engages in recesses or transfer gates of the transfer elements, in order to be able to move the transfer elements for the engagement of gear ratios. Preferably the free end of the shift lever is provided with a sliding bearing, that is configured with edges and that makes possible a reliable engagement between the shift lever and the transfer elements.

In particular, for shifting three or four different gear ratios or groups it is advantageous to employ a shift mechanism in which two transfer elements located alongside each other or one above the other are guided so as to slide in the housing. By sliding each of the two transfer elements back and forth, a selection can be made in each case between two gear ratios.

The transfer elements are preferably located close and alongside each other so

that their recesses or transfer gates are also close alongside each other. When the shift lever is located in its self-centering neutral position, the engagement region of the shift lever simultaneously engages transfer gates of adjoining transfer elements and locks the latter against each other.

According to a preferred further development of the invention, the shift lever is guided in a shift gate that guides the shift lever in predetermined paths and limits the pivoting motion. The shift gate is configured in such a way that the shift lever cannot be pivoted out of its neutral position in the longitudinal direction in order to move the transfer elements that are engaged with it. When the shift lever is in its neutral position, the result thereby is a locking that prevents a simultaneous movement of the transfer elements, so that the engagement of a gear ratio of the gearbox is impossible.

For the shifting of three or four gear ratios or groups, the shift lever is preferably guided in a shift gate that is essentially H-shaped, which contains two shift channels at the sides and a central selector channel that connects the shift channels. The neutral position of the shift lever occupies a position in the selector channel that does not lie at an intersection with a shift channel. The neutral position is preferably in a central region between the two shift channels.

If three forward gear ratios and one reverse gear ratio are to be shifted with the shift lever, it is advantageous that the shift channel in which the reverse gear ratio position lies is not directed in a straight line, but is provided with two legs originating from the selector channel that are offset from one another. By this measure a straight-line motion of the shift lever without interruption between a forward gear ratio and a reverse gear ratio position or vice versa is avoided, which would result in an abrupt reversal of the direction of operation. This angled configuration of the shift channel forces the shift lever to pause in the selector channel and prevent the shift lever from being moved inadvertently beyond the selector channel where the opposite direction of operation is engaged.

Preferably the shift lever is supported in bearings by a ball joint in the housing and can be pivoted in at least two directions.

The configuration of the reset mechanism, by means of which the shift lever is forced into its neutral position, can be arranged in the usual manner. A preferred embodiment of the invention proposes for this, however, that a concentric

compression spring be arranged axially on the shift lever that is supported at one end on the housing or a component connected to the housing (housing cover) and supported at the other end on the shift lever.

Brief Description of the Drawings

The drawing shows embodiments of the invention on the basis of which the invention as well as further advantages and advantageous further developments and embodiments of the invention shall be explained and described in greater detail in the following.

Fig. 1 shows a perspective view of a shift mechanism according to the invention without housing cover.

Fig. 2 shows a partial perspective section of the shift mechanism according to the invention of figure 1.

Figs. 3a and 3b each show a shift scheme for a shift mechanism according to figures 1 and 2.

Figs. 4a through 4d show schematic views of four different shift positions of an alternative shift mechanism according to the invention.

Detailed Description of the Preferred Emobiment

Figures 1 and 2 show a first actuating mechanism according to the invention for controlling the change of gear ratios of a gearbox. The actuating mechanism contains an integrated mechanism for protection against unintentional actuation of the gearbox. The actuating mechanism is provided with a housing 10 that can be closed by a housing cover 12. The housing cover 12 carries a cone-shaped hollow tower 14 in whose upper end a ball joint 16 is located on which a shift lever 18 is supported in bearings so as to be able to pivot. The end of the shift lever 18 protruding from the housing 10 is bent in two places and ends in a knob 20 by means of which an operator can pivot the shift lever 18.

In the bottom region of the housing 10, two transfer elements 22, 24, which can also be designated as quadrants lying close alongside each other, are supported in bearings so as to be able to move in a longitudinal direction. The transfer elements 22, 24 are each provided with a transverse groove 26, 28 that opens upward and in which

a sliding bearing 30 is guided. The sliding bearing is formed at the lower end of the shift lever 18 disposed in the interior of the housing 10. By pivoting the shift lever 18 in the transverse direction, the sliding bearing 30 can be shifted within the transverse grooves 26, 28 from one transfer element 22, 24 to the other. In the central position of the shift lever 18 as shown, the sliding bearing 30 is located in the region of action of both transfer elements 22, 24. It can be moved out of this central position by pivoting the shift lever in the transverse direction in such a way that it is only in the region of action of either the right or the left transfer element 22, 24.

Each of the two transfer elements 22, 24 is connected, by way of a shifter rod 32, 34, to a shift gearbox, not shown. If the shift lever 18 is not located in its self-centering neutral position as shown, but entirely in the region of action of one of the two transfer elements 22, 24, then the shift lever 18 can be pivoted in the longitudinal direction. Thereby the transfer element 22, 24 whose transverse groove 26, 28 engages the sliding bearing 30, is shifted in the longitudinal direction. This movement is transmitted to the shift gearbox, so that a corresponding gear ratio is engaged.

The shift gearbox may contain a locking device that does not permit the simultaneous transmission of the shifting of both transfer elements 22, 24, since this would lead to contradictory gear tooth engagements within the shift gearbox. Such a gearbox locking device has the result that a shifting of the transfer elements 22, 24 is not possible when the shift lever 18 is located in its neutral position shown, since then the sliding bearing 30 lies in the region of action of both transfer elements 22, 24, and prevents a shifting of the two transfer elements 22, 24 relative to each other. From this neutral position the shift lever 18 can be pivoted only in the transverse direction but not in the longitudinal direction. Since the transfer elements 22, 24 are locked against each other in the neutral position of the shift lever 18, they cannot be shifted even by tension or compression forces that may be applied to the shifter rod 32, 34. This has the result that an operator that applied tension or compression forces to the shifter rods 32, 34 during maintenance or repair operations, cannot move these, so that the accidental engagement of a gear ratio is impossible.

Figure 3a reveals the scheme of an H-shaped shift gate that is used in the usual manner as a guide for the shift lever 18. The shift lever 18 can be moved within the shift gate in order to engage a first, second, third and fourth gear ratio. The gear

ratio positions are indicated by the numbers 1, 2, 3 and 4. The positions for the first and the second gear ratio are connected to each other by a straight-line first shift channel 40 and the positions for the third and fourth gear ratio are connected to each other by a straight-line second shift channel 42. Both shift channels extend parallel to each other. The first and the second shift channel 40, 42 are connected to each other by a selector channel 44 extending transversely. The neutral position N of the shift lever 18 is located at a central position of the selector channel 44.

Figure 3b shows a shift gate that is an alternative to that of figure 3a, that contains gear ratio positions for a first, second and third gear ratio 1,2,3 as well as for a reverse gear ratio R. A first shift channel 46 is configured as a straight-line channel and connects the positions of the second and third forward gear ratio 2, 3. The shift channel 48 for the first forward gear ratio 1 and the shift channel 50 for the reverse gear ratio R are not aligned with each other, but end in the selector channel 52 that extends transversely in its central region in which the self-centering neutral position N of the shift lever 18 is located. With this configuration of the shift gate, it is not possible to move the shift lever 18 without interruption in a straight-line movement from the first forward gear ratio 1 into the reverse gear ratio R or vice versa. Thereby the danger is largely prevented that the operator unintentionally performs a reversal of the direction of operation of the vehicle.

The shift lever 18 is forced into its neutral position by a reset mechanism shown in figure 2, as long as it is located in the selector channel. The reset mechanism consists essentially of a cone-shaped helical spring 54 that is arranged concentric to the shaft of the shift lever 18. The lower end of the helical spring 54 is supported on the upper end of the tower 14 and the upper end of the helical spring 54 is supported on a step or shoulder 56 of the shift lever 18. The helical spring 54 is configured as a compression spring and forces the shift lever 18 into its vertical, central, neutral position.

With reference to figures 4a through 4d, the method of operation of an alternative embodiment of a shift mechanism according to the invention is described below. Within a housing 60 of the shift mechanism, three transfer elements 62, 64, 66 are supported in bearings so as to be able to slide and are configured essentially as cylindrical rods and are shown in cross section. In their central section, the transfer

elements 62, 64, 66 are each provided with a transverse groove open upward (see dashed centerlines). A shift lever 68 that is free to pivot carries at its lower end a sheet metal shift plate 70, whose lower edge is configured as a curved contour that interacts and engages with the transfer elements 62, 64, 66.

According to figure 4a the shift lever 68 is pivoted to the left. Thereby a section of the curve contour engages the transverse groove of a first transfer element 62. The second and the third transfer elements 64, 66, however, are not in the engagement region of the sheet metal shift plate 70. By moving the shift lever 68 in the longitudinal direction the first transfer element 62 can be moved. Thereby it operates over a shifter rod, not shown in any detail, or a shifter cable on the gearbox, not shown, so that a corresponding gear ratio of the gearbox is engaged. According to figure 4a the second and the third transfer element 64, 66 are not affected by the longitudinal movement of the shift lever 68 and remain in their original axial positions.

According to figures 4c and 4d the shift lever 68 is located in a first or a second position pivoted to the right. Corresponding to figure 4a here, too, there is only one transfer element (according to figure 4c the central transfer element 64 and according to figure 4d the right transfer element 66) in the engagement region of the sheet metal shift plate 70, while in each case the other two transfer elements (62, 66 or 62, 64) are free. By longitudinal movement of the shift lever 68 other gear ratios of the gearbox can thereby be engaged.

According to figure 4b the shift lever 68 occupies its central neutral position. In this position sections of the sheet metal shift plate 70 engage the transverse grooves of all three transfer elements 62, 64, 66. Since the shifter rods are locked through the shift gearbox and/or a shift gate against each other in such a way that no more than one transfer element can be moved in the longitudinal direction, the shifter rods 62, 64, 66 are blocked at the shift lever position shown in figure 4b and cannot be moved. Therefore it is also impossible to engage a gear ratio of the shift gearbox (unintentionally) by the application of tension or compression forces to the transfer elements or the shifter rods, so that the desired safety conditions are met.

Although the invention has been described in terms of only two embodiments, anyone skilled in the art will perceive many varied alternatives, modifications and variations in the light of the above description as well as the drawing all of which fall

under the present invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A shift mechanism for vehicle gearboxes where the shift mechanism is spatially separated from the vehicle gearbox and is connected with the vehicle gearbox by shifter elements, the shift mechanism comprising a housing, a shift lever supported by the housing on bearings, free to pivot, for the shifting of gear ratios, the shift lever having an engagement region located in the interior of the housing in engagement with transfer elements supported in bearings so as to slide parallel to each other, the transfer elements being fastened to at least one shifter element, a reset mechanism biasing the shift lever into a neutral position in which the engagement region of the shift lever simultaneously engages at least two transfer elements.

2. The shift mechanism according to claim 1 wherein the engagement region of the shift lever is located at the end of the shift lever.

3. The shift mechanism according to claim 1 wherein the engagement region of the shift lever can be moved by actuation of the shift lever in recesses of the transfer elements.

4. The shift mechanism according to claim 1 having two transfer elements that lie adjacent each other and that are guided in the housing.

5. The shift mechanism according to claim 1 wherein the transfer elements lie close alongside each other and each are connected to a shifter element that can be influenced by the engagement region of the shift lever.

6. The shift mechanism according to claim 1 wherein the shift lever is guided in a shift gate which limits the pivoting movement of the shift lever in such a way that when the shift lever is in its neutral position, a sliding movement of the transfer elements is impossible.

7. The shift mechanism according to claim 1 wherein the shift lever is guided in an essentially H-shaped shift gate that contains two shift channels at the sides and a selector channel connecting the shift channels and extending therebetween and wherein the neutral position (N) occupies a position in the selector channel that does not lie at an intersection with one of the shift channels.

8. The shift mechanism according to claim 7 wherein at least one shift channel does not connect two shift positions in a straight line, but is provided with two legs extending from the selector channel that are offset from each other.

9. The shift mechanism according claim 1 wherein the shift lever is supported in bearings through a ball joint in the housing and can be pivoted in at least two directions.

10. The shift mechanism according to claim 1 further comprising a concentric compression spring that is arranged axially on the shift lever and that is supported at one end on the housing and at the other end on the shift lever and that forces the shift lever into its neutral position as the reset mechanism.

FIG. 1

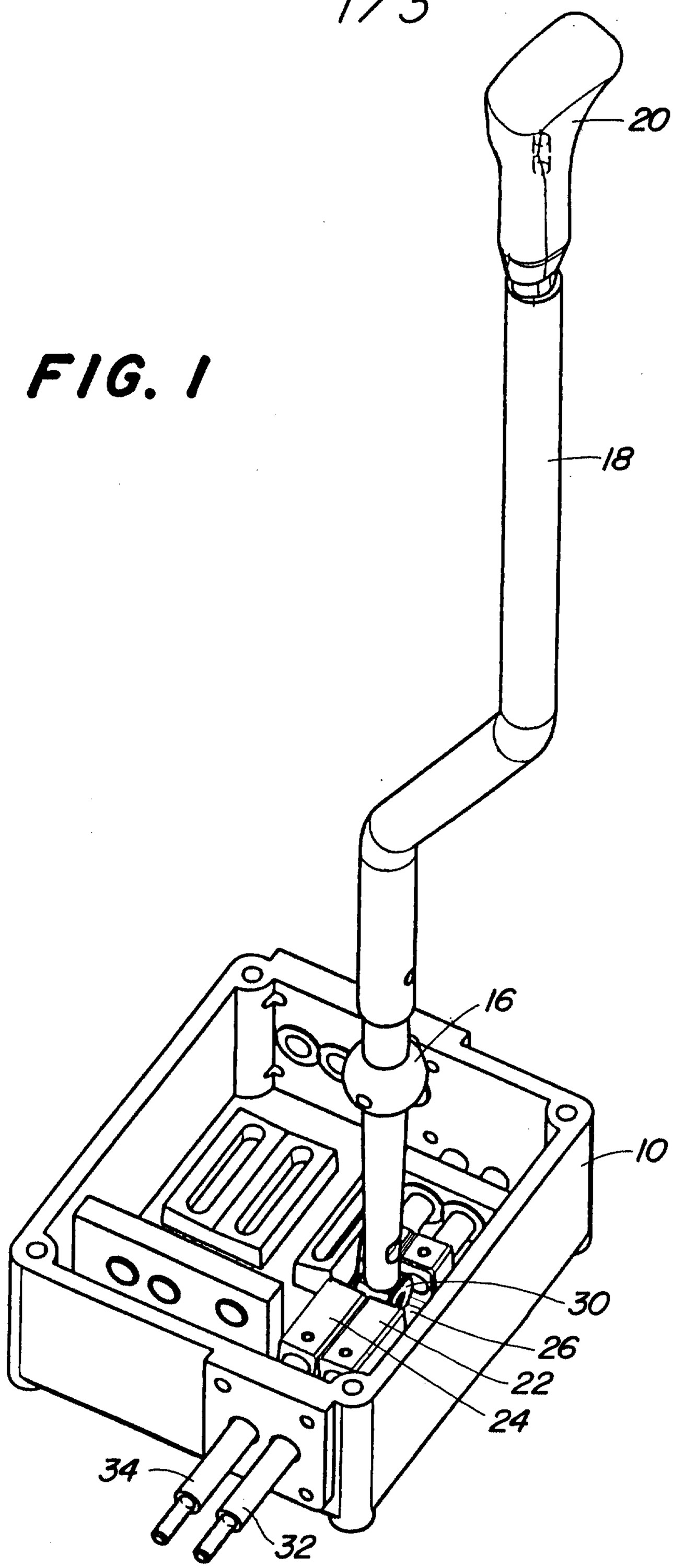
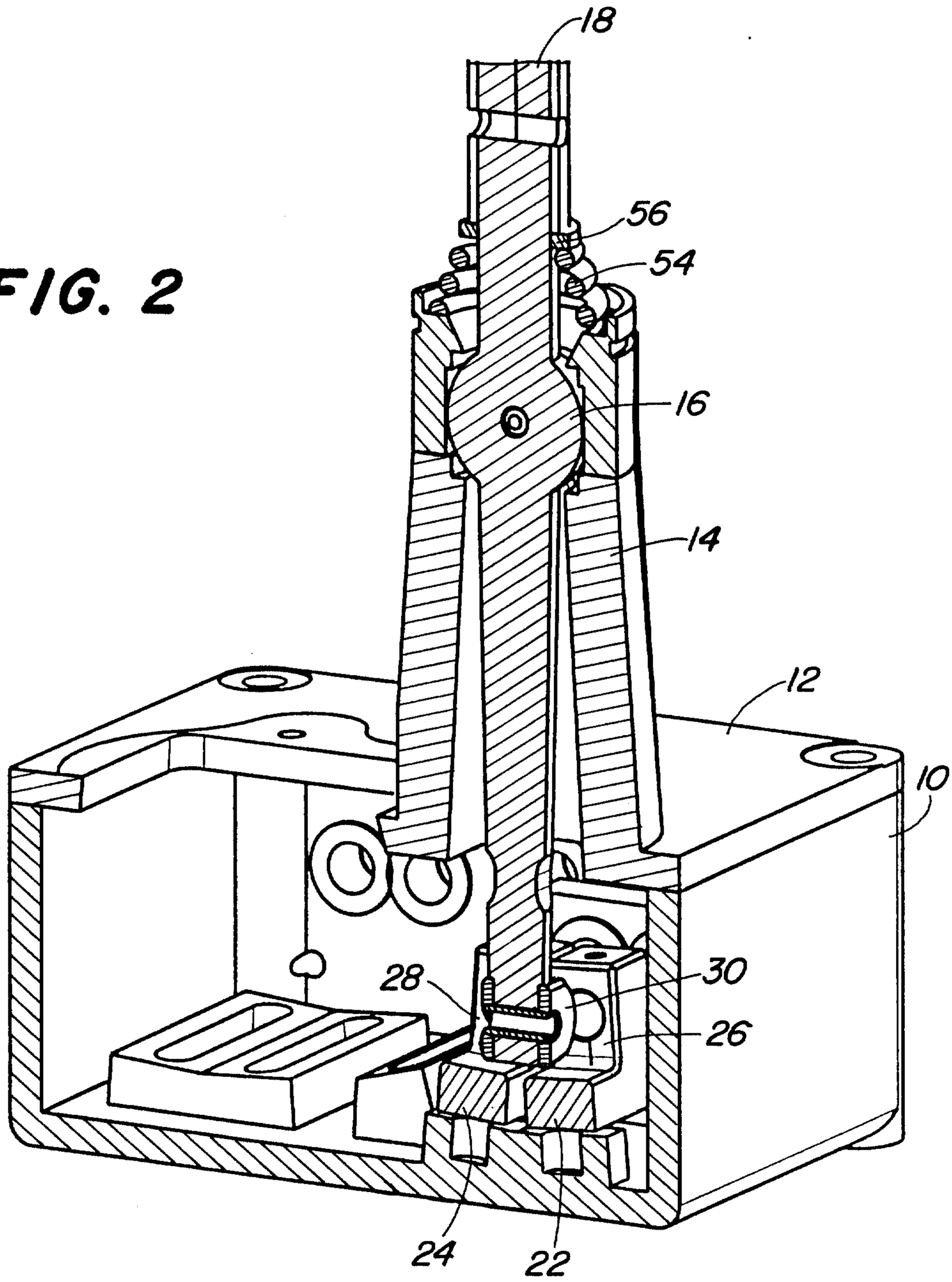


FIG. 2



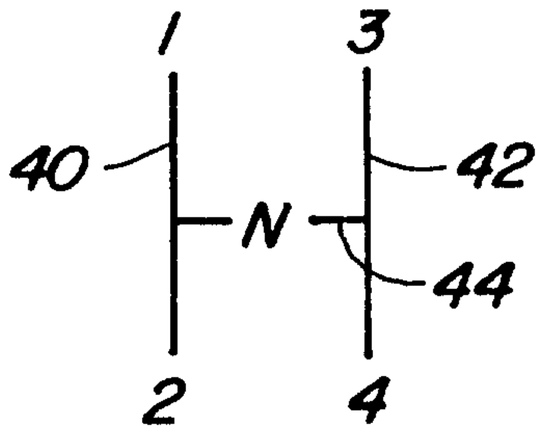


FIG. 3a

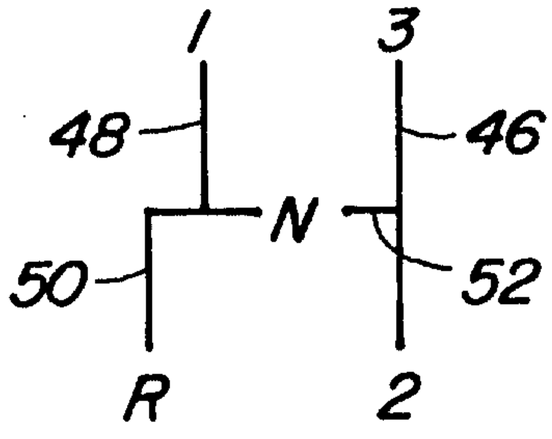


FIG. 3b

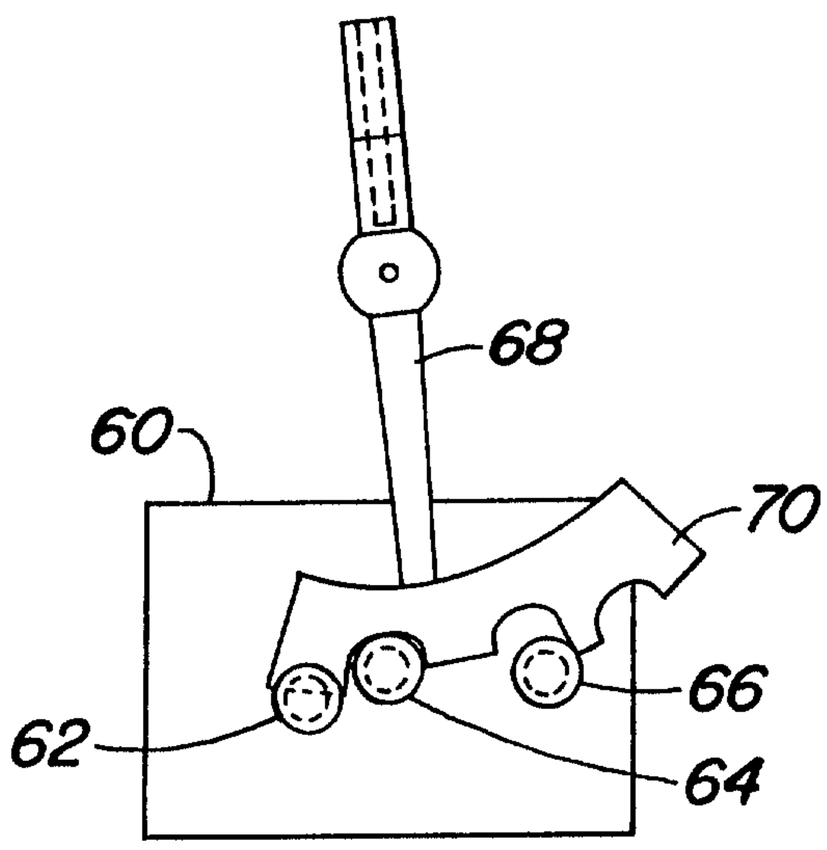


FIG. 4a

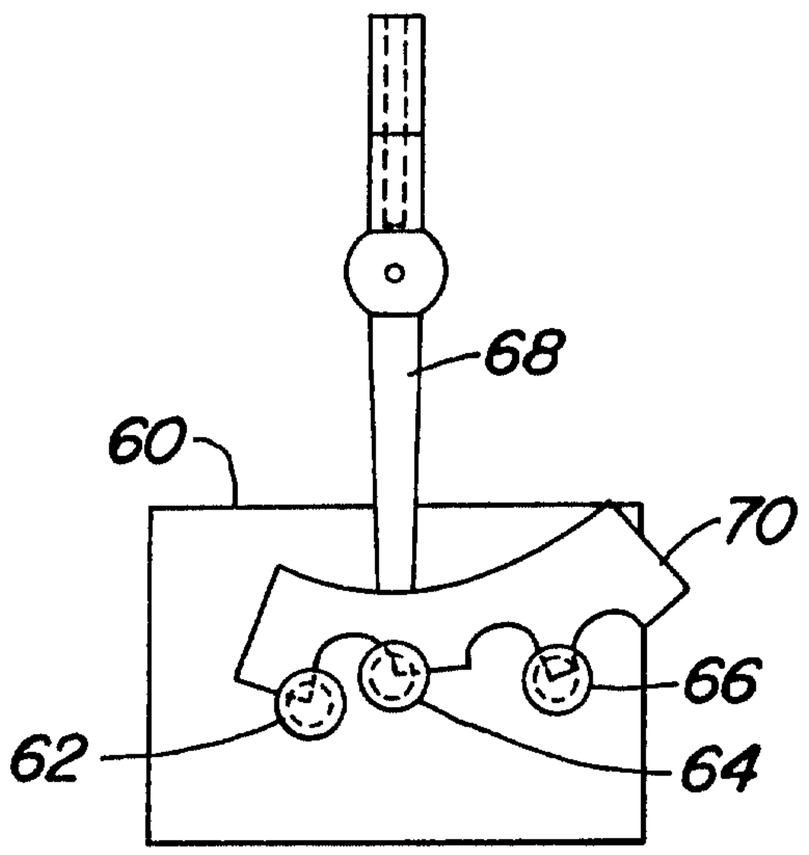


FIG. 4b

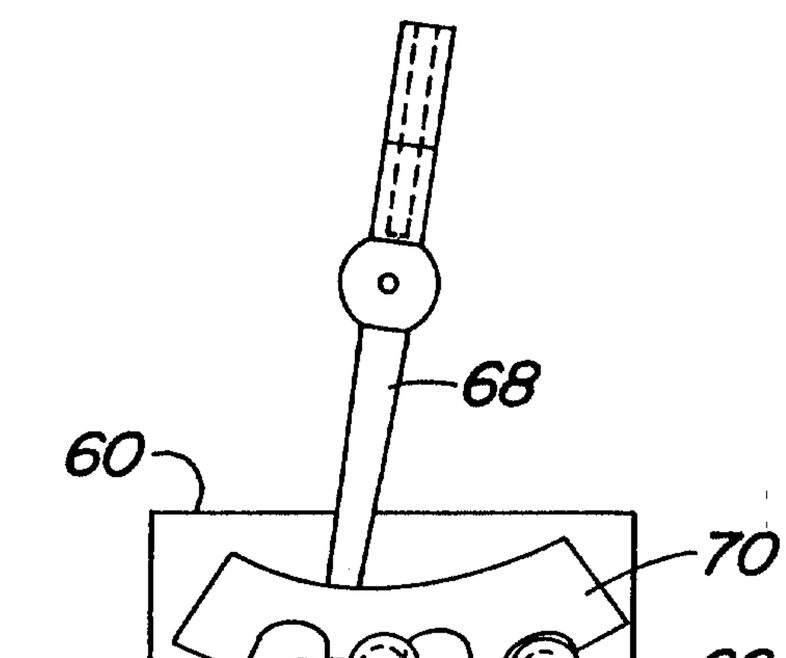


FIG. 4c

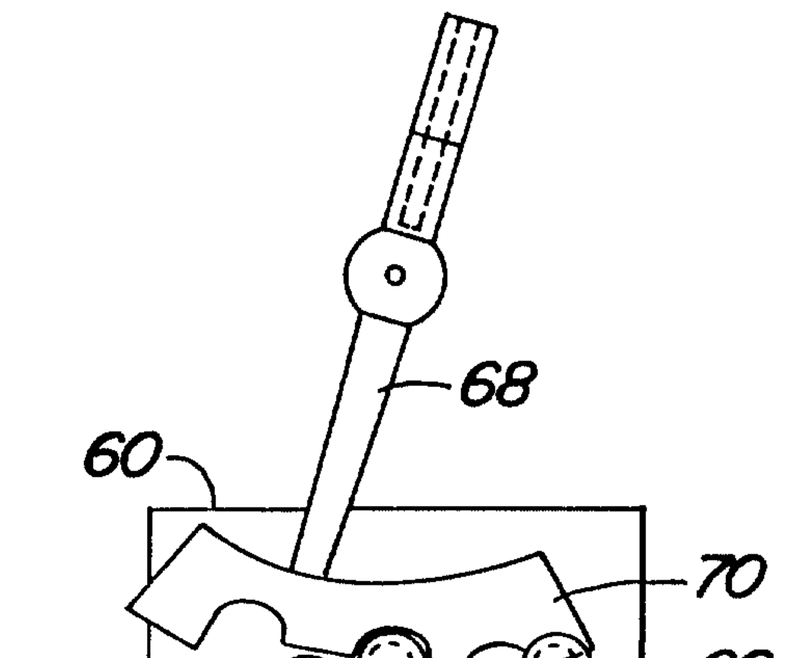
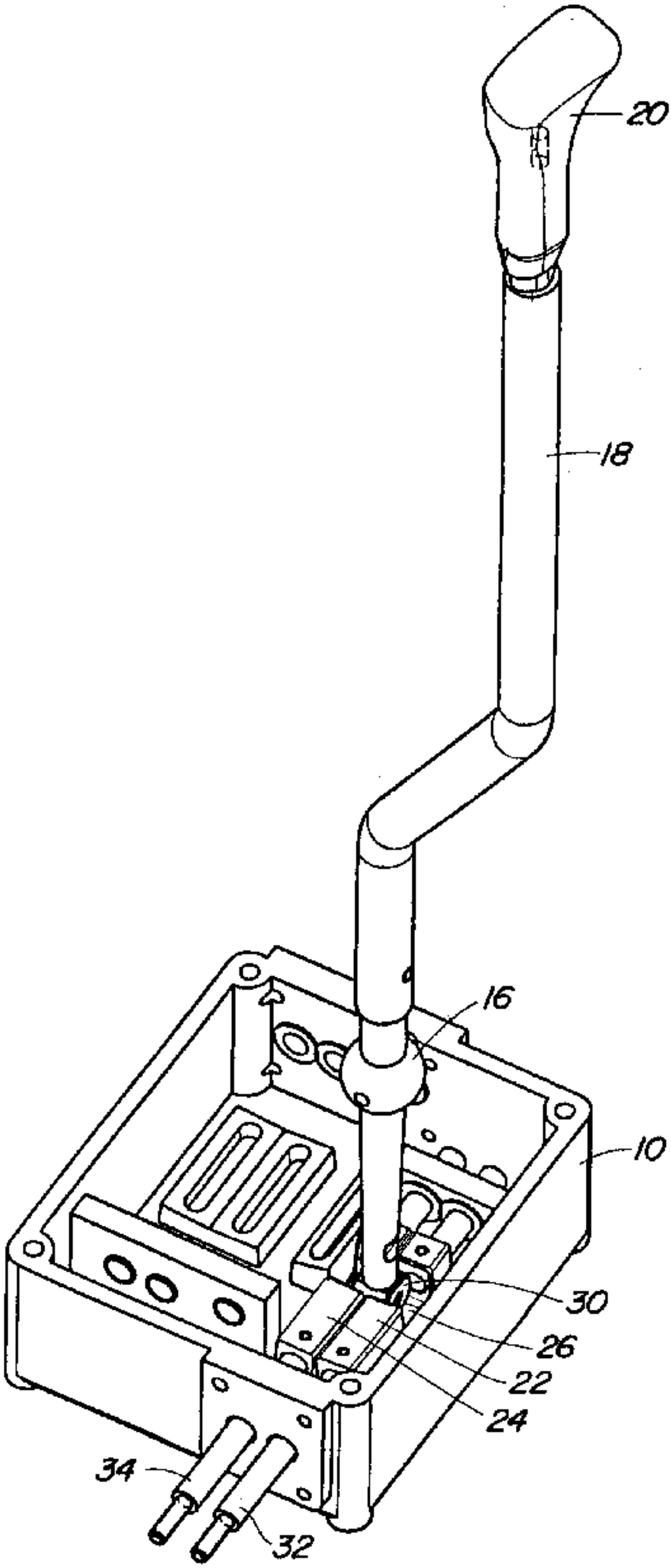


FIG. 4d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