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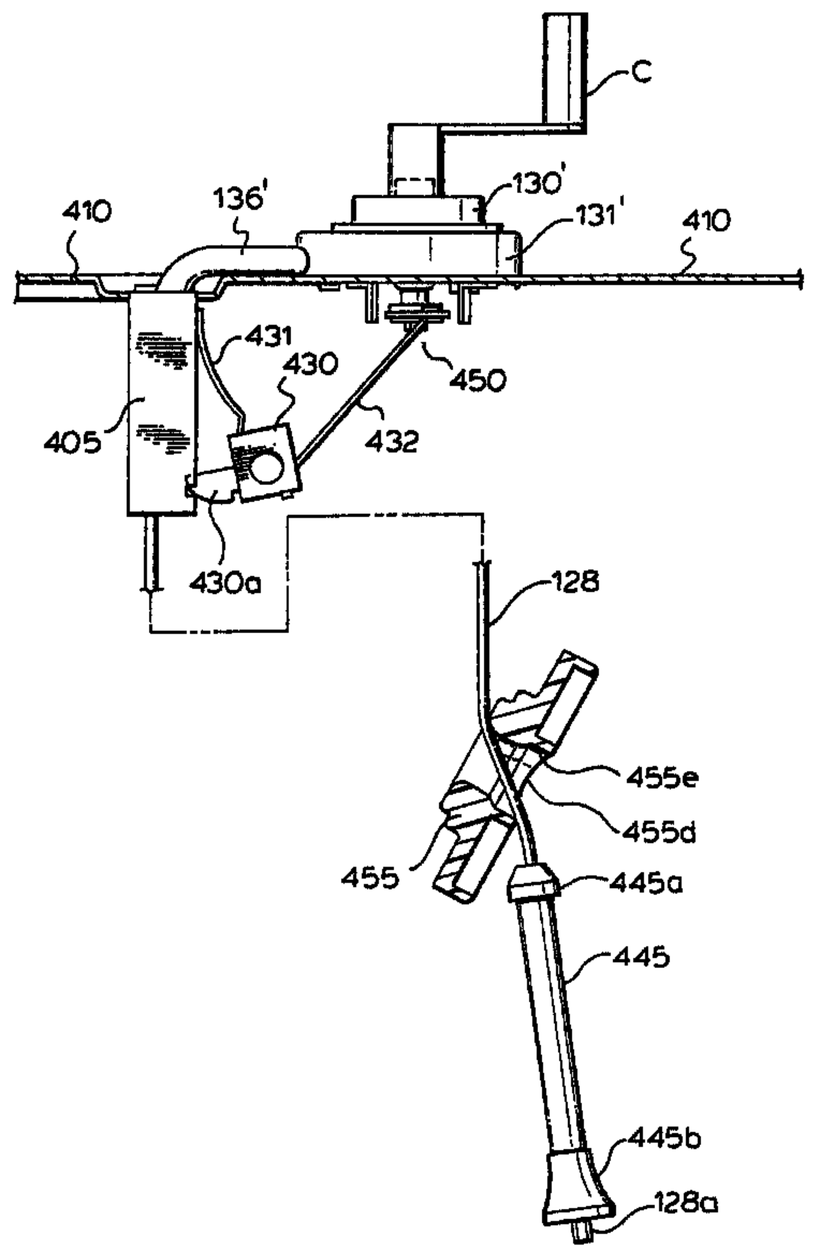
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(54) Titre : LOQUET DE SECURITE POUR PORTE-PNEU ET AMELIORATIONS CONNEXES
(54) Title: SAFETY LATCH FOR A TIRE CARRIER AND IMPROVEMENTS THEREFOR



(57) Abrégé/Abstract:
A winch assembly is provided including a single mounting bracket for mounting the winch assembly directly to a frame (for example beams) of a vehicle having a front and rear. The mounting bracket has a winch mounting area provided therewith, and a tire carrier and cooperative flexible member outlet area spaced from the winch mounting area towards the front of the vehicle. The mounting bracket is adapted to bolt directly to the frame members (for example beams) of a vehicle. The mounting bracket for the winch therefore obviates the need to provide welded or fastened reinforcing plates with the vehicle proximate the locations wherein the winch assembly is to be mounted.

ABSTRACT

A winch assembly is provided including a single mounting bracket for mounting the winch assembly directly to a frame (for example beams) of a vehicle having a front and rear. The mounting bracket has a winch mounting area provided therewith, and a tire carrier and cooperative flexible member outlet area spaced from the winch mounting area towards the front of the vehicle. The mounting bracket is adapted to bolt directly to the frame members (for example beams) of a vehicle. The mounting bracket for the winch therefore obviates the need to provide welded or fastened reinforcing plates with the vehicle proximate the locations wherein the winch assembly is to be mounted.

TITLE OF INVENTION

SAFETY LATCH FOR A TIRE CARRIER AND IMPROVEMENTS THEREFOR

FIELD OF INVENTION

This invention relates to safety devices which maintain a load in a retained position. More specifically this invention finds application for tires which are stored under a vehicle, having been raised to that position by a tire winch, which includes letting out and reeling in a resilient flexible member such as a cable to move the tire from a lowered position to a stored position. A safety device is therefor provided, which ensures the tire remains in the stored position should the resilient member break. This application also relates to embodiments of a rotary actuator which in a preferred embodiment is embodied with the winch

BACKGROUND OF THE INVENTION

A great number of devices exists which raise and lower a load, and specifically a spare tire from a stored position underneath a vehicle to a lowered position for access by an individual. Conventionally the tire carrier may be pinned to the frame by nut and bolt or the like to retain the tire in a raised position, should a resilient member break.

U.S. Patent 3,856,167 to Kabushiki Kaisha, describes an improved holding device for a spare tire which includes a tire carrier portion suspended from a chain so that a tire is retained in a stored position and is locked in position. The release of the lock is actuated by the rotation of the shaft 9 which causes the disengagement of the lever from the groove of the wheel support member. Therefore rotation of the operating shaft in the appropriate direction is what is required to raise and lower the spare wheel. Further the assembly of the aforementioned device is quite heavy and cumbersome in operation as best seen in Figures 3, 4, 9 and 10 thereof. The '167 patent, provides a pawl or spring

steel spring 19 which prevents the rotation of the ratchet wheel, as seen in Figure 2, 6 (a, b), and 7, wherein member 19 forcibly engages the peripheral edge of the ratchet wheel 5 and prevents the rotation of the wheel in the direction which causes release of the chain.

It would therefore be advantageous in one aspect of the invention to provided a positive locking of the wheel in position which is less complicated and in one embodiment is not dependent upon the rotation of the shaft, and the mechanical reliability of all of the interrelated components, which are required for such a mechanism to work. It would also be advantageous to simplify the '167 structure considerably so as to provide a simple device which upon rotation of the winch handle releases the locking device in a positive manner.

Nowhere within the prior art is there found a latch which is released upon rotation of the cranking device using a member which releases the latch upon rotation of the cranking mechanism in a much simplified manner than presently known devices.

U.S. Patent 4,884,785 to Deuer Manufacturing describes a securing mechanism for a spare tire which is normally disengaged from the carrier of the tire when the tire is in the raised position. Should the cable break locking pins are urged to engage the tire carrier and hold it in a raised position so the tire is not lost. This mechanism includes locking pins which are urged outwardly by springs. Should salt spray over a number of years degrade the quality of response of these pins, it is possible that the device may fail just when it is most needed.

Heretofore it has been known to provide separate mounting plates for winch and tire carrier assemblies spaced from one another for mounting (for example welding) to separate reinforcing members of the vehicle. As best as is known, nowhere is there provided a single mounting

member for a winch and tire carrier assembly supplied with the winch assembly which obviates the need to provide the aforementioned reinforcing members with the vehicle proximate the mounting location , thus providing both functions with the mounting member of the winch and tire carrier assembly.

It is known to provide a carrier for a tire in a tire winch assembly at the free end of the flexible member with the other end being engaged with a winch reel. Many manufacturers provide winches in various models of their trucks and vans which vehicles have varying tire sizes. It would therefore be beneficial to provide a carrier which is adaptable to receive several sizes of tires therewith for use with a winch assembly.

It is a further object of this invention to provided a safety device for a load carrier which is engaged at all times when the carrier is in the raised position.

It is a further object this invention to provide a safety device for a load carrier which is easy to use and is reliable.

It is a further object of this invention to provide a mounting member for the winch assembly with the winch assembly which fastens in place directly to the supporting members of the vehicle.

It is yet another object of the invention to provide a mounting member for a winch assembly supplied with the winch assembly which obviates the need to provide mounting members within the vehicle, thus providing both functions with the mounting member of the winch assembly.

It is a further object of an improvement to the invention to provide a rotary actuator which controls an operating device for a remote mechanism and which operation of the actuator device moves

the operating mechanism. Preferably the actuator is embodied with a winch mechanism as an add on component thereof or as an integral part thereof

It is yet another object of the invention to provide a carrier which is adaptable to receive several sizes of tires therewith for use with a winch assembly.

Further and other objects of this invention will become apparent to a man skilled in the art when considering the following summary of the invention and the more detailed description of the preferred embodiments illustrated herein.

SUMMARY OF THE INVENTION

This invention provides a safety mechanism for a winch assembly when storing a load, such as a tire under a vehicle or a boat on a trailer, in a raised or stored position. The invention finds particular application to a spare tire, but those skilled in the art will appreciate the broader benefits of such a structure when used with a winch assembly for other uses such as a boat winch for a trailer or any analogous use wherein it is desirable to secure a load in the raised or stored position.

According to one aspect of the invention there is provided a safety device for a winch assembly, preferably for a spare tire storage assembly, the assembly including a winch affixed by mounting means proximate a stored position for a load, for example the preferred spare tire, the winch by the operation of handle means lets out and takes up a length of a member (preferably a cable) affixed at one end to the winch and preferably to a reel thereof, which letting out and taking up of the member moves the load, for example the preferred spare tire, installed on a hub, from a locked stored position, preferably under a vehicle, to an unlocked accessible position remote and preferably below the stored

position, the safety device comprising a carrier and preferably a tire carrier for carrying the load, for example the preferred spare tire installed on the hub, the carrier including a first portion and a second portion, the first portion for supporting the load, the preferred tire installed on a hub, and the second portion being integral with the first portion and affixed with the other end of the member remote the winch, the second portion of the carrier including a detent portion, (preferably a shoulder), the safety device having engaging means for said handle means, the engaging means for said handle means being affixed with the mounting means proximate the winch and having a preferably hollow portion, the preferably hollow portion of the engaging means having lever means associated therewith, the lever means being movably affixed with respect to the mounting means, the safety device having resiliently biased latching means movably affixed with respect to the mounting means, the lever means being interconnected with the latching means and being moveable from a first position when the handle means does not engage the engaging means to a second position whereat the handle means engages the engaging means, the latching means having detent means disposed therewith and moveable with the latching means by the lever means from a third position whereat the load, for example the preferred spare tire, is in the locked position, and the detent means of the latching means engages the detent means of the second portion of the carrier to latch the carrier in the stored position and preclude the loss of the load should the member break, to a fourth position whereat the load, for example the preferred spare tire installed on a hub, is unlatched and free to move by the letting out or taking up of the member by the operation of the winch to and from the accessible position.

According to another aspect of the invention there is provided a safety device for a spare tire storage assembly, the assembly including a winch affixed by a mounting bracket adjacent a stored position for the spare tire under a vehicle, the winch by the operation of a separate handle lets out and takes up a length of a cable affixed at one end to the winch and preferably to a reel thereof, which letting out and taking up of the cable moves the spare tire, installed on a hub, from a locked stored position under a vehicle, to an unlocked accessible position below the stored position, the safety device comprising a tire carrier for carrying the spare tire installed on the hub, the carrier including a first portion for insertion within an opening in the hub and abutting the bottom of the hub, and a second shank portion having two ends and being affixed to the first portion proximate one end and having an expanded head proximate the other end, the first portion for supporting the spare tire installed on a hub, and the second shank portion being integral with the first portion and being affixed to the other end of the cable remote the winch proximate the head of the second shank portion, the head of the second shank portion of the carrier including a shoulder adjacent the shank portion, the safety device having a preferably hollow portion for engaging said handle, the preferably hollow portion being affixed with a mounting bracket proximate the winch, the preferably hollow portion having a lever associated therewith, preferably the lever including a cam surface for engaging the handle, the lever being movably affixed with respect to a mounting bracket, the safety device having a resiliently biased pawl movably affixed with respect to a mounting bracket, the lever being interconnected with the pawl and the lever being moveable from a first position when the handle does not engage the lever and preferably the

cam surface thereof to a second position whereat the handle means engages the lever and moves the lever to the second position, the pawl having at least one finger and preferably two disposed therewith and moveable with the pawl by the lever from a third position whereat the spare tire is in the locked position, and the at least one finger of the pawl engages under the shoulder of the head of the second shank portion of the tire carrier to latch the tire carrier in the stored position and preclude the loss of the tire should the cable break, to a fourth position whereat the spare tire installed on a hub is unlatched and free to move by the letting out or taking up of the cable to and from the accessible position by the operation of the winch.

According to yet another aspect of the invention there is provided a safety device for a winch assembly, preferably for a spare tire storage assembly, the assembly including a winch having a housing and affixed by mounting means near a stored position for a load, for example the preferred spare tire, the winch by the operation of handle means lets out and takes up a length of a member (preferably a cable) affixed at one end to the winch and preferably to a reel thereof, which letting out and taking up of the member moves the load, for example the preferred spare tire, installed on a hub, from a locked stored position, preferably under a vehicle, to an unlocked accessible position remote and preferably below the stored position, the safety device comprising in use a carrier and preferably a tire carrier for carrying the load, for example the preferred spare tire installed on the hub, the carrier including a first portion and a second portion, the first portion for supporting the load, the preferred tire installed on a hub, and the second portion being disposed with the first portion in use and engaged in use with the other end of the member remote the winch, the second portion of the carrier

including a detent portion, (preferably a shoulder), the safety device being moveable and preferably rotatable by rotation of said handle means when said winch is rotated and including an actuating member preferably for converting rotary motion to substantially linear motion, the actuating member in one embodiment being disposed within the winch housing and in another embodiment being engageable with said winch preferably proximate one side thereof remote said handle means in use, preferably a disk shaped member, the actuating member having disposed therewith control means, preferably disposed proximate a first side thereof, and preferably at least one spiral path, the control means of the actuating member for engagement in use with operating means of said safety device, the operating means having detent means associated with the control means of said actuating member in use and for controlling the motion of said operating means when the winch is rotated (preferably said operating means being a rod having two ends, the first end for engagement with the control means of said actuating member and preferably with the spiral path thereof, and the second end for operating the safety device and in one embodiment the rod operating lever means associated with the safety device), the operating means (and the preferred rod) being movably affixed with respect to the assembly, the safety device having preferably resiliently biased latching means movably affixed with respect to the assembly, the operating means (and in one embodiment the lever means) being interconnected with the latching means and being moveable by the actuating member and the control means thereof, in engagement with said detent means of said operating means, from a first position when the winch is not operated and the load is in the stored position, to a second position when the winch is operated and the load is being moved from the stored

position, the latching means having detent means disposed therewith and moveable with the latching means by the operating means (and in one embodiment the lever means) from a third position whereat the load, for example the preferred spare tire, is in the locked position when the winch is not operated, and the detent means of the latching means engages the detent means of the second portion of the carrier to latch the carrier in the stored position and preclude the loss of the load should the member break, to a fourth position whereat the load, for example the preferred spare tire installed on a hub, is unlatched and free to move by the letting out or taking up of the member by the operation of the winch to and from the accessible position.

According to another aspect of the invention there is provided a safety device for a spare tire storage assembly, the assembly including a winch affixed by a mounting bracket adjacent a stored position for the spare tire under a vehicle, the winch by the operation of a separate handle lets out and takes up a length of a cable affixed at one end to the winch and preferably to a reel thereof, which letting out and taking up of the cable moves the spare tire, installed on a hub, from a locked stored position under a vehicle, to an unlocked accessible position below the stored position, the safety device comprising in use a tire carrier for carrying the spare tire installed on the hub, the carrier including a first portion for insertion within an opening in the hub and preferably abutting the bottom of the hub, and a second shank portion having two ends and being engaged with the first portion proximate one end and having an expanded head proximate the other end, the first portion for supporting the spare tire installed on a hub, and the second shank portion being engaged with the first portion and being engaged with the other end of the cable remote the winch proximate the head of

the second shank portion, the head of the second shank portion of the carrier including a shoulder adjacent the shank portion, the safety device being moveable and preferably rotatable by rotation of said handle when said winch is rotated and including an actuating member preferably for converting rotary motion to substantially linear motion, the actuating member in one embodiment being disposed within the winch housing and in another embodiment being engageable with said winch preferably proximate one side thereof remote said handle in use, preferably a disk shaped member, the actuating member having disposed therewith at least one preferably spiral link control path having a first and second end, preferably the first end of the link control path being disposed proximate the centre of the actuating member and the second end of the link control path being disposed proximate the perimeter of the actuating member, preferably the link control path being disposed proximate a first side of the actuating member remote said handle in use, the link control path of the actuating member for engagement in use with an operating link of said safety device to move said operating link and operate said safety device, the operating link (preferably said operating link being a rod) having two ends, one end thereof associated with the link control path of said actuating member in use and for controlling the motion of said operating link when the winch is rotated and the second end for operating the safety device (and in one embodiment the rod operating lever means associated with the safety device), the operating link being movably affixed with respect to the assembly, the safety device having a resiliently biased pawl movably affixed with respect to a mounting bracket, the operating link being interconnected with the pawl and being moveable from a first position when the handle does not rotate the winch whereat the end of the

operating link engaging the link control path of the actuating member is proximate the first end of the link control path, to a second position whereat the handle rotates the winch and the end of the operating link engaging the link control path of the actuating member is proximate the second end of the link control path, the pawl having at least one finger, and preferably two disposed therewith, and moveable with the pawl by the motion of the operating link from a third position whereat the spare tire is in the locked position, and the at least one finger of the pawl engages under the shoulder of the head of the second shank portion of the tire carrier to latch the tire carrier in the stored position and preclude the loss of the tire should the cable break, to a fourth position whereat the spare tire installed on a hub is unlatched and free to move by the letting out or taking up of the cable to and from the accessible position by the operation of the winch.

In a preferred embodiment the detent means and the preferred at least one finger of the latching means and the preferred pawl has disposed therewith cam surfaces to engage the second portion of the carrier when the load is moved from the accessible position to the stored position to ensure proper positioning of the detent or finger of the latch with respect to the detent of the second portion of the carrier when the load is moved to the stored position.

According to yet another aspect of the invention there is provided an actuating member and preferably a disk shaped member, for converting rotary motion to substantially linear motion, preferably in one embodiment being disposed within a winch housing and preferably in another embodiment being engageable with said winch, the actuating member having disposed therewith control means, preferably disposed proximate a first side thereof, and preferably at least one spiral

path, the control means of the actuating member for engagement in use with operating means of at least a two operating position device, the operating means having detent means associated with the control means of said actuating member in use and for controlling the motion of said operating means when the actuating member is rotated (preferably said operating means being a rod having two ends, the first end for engagement with the control means of said actuating member and preferably with the spiral path thereof, and the second end for operating the at least two operating position device, and in one embodiment the rod operating lever means associated with the device), the operating means (and the preferred rod) being movably affixed with respect to the at least two operating position device, the at least two operating position device having actuated means movably affixed with respect to the assembly, the operating means (and in one embodiment the lever means) being interconnected with the actuated means and being moveable by the actuating member and the control means thereof, in engagement with said detent means of said operating means, from a first position when the actuating means is not operated, to a second position when the actuating means is operated.

According to yet another aspect of the invention there is provided an actuating member for converting rotary motion to substantially linear motion, preferably the actuating member in one embodiment being disposed within a winch housing and in another embodiment being engageable with said winch, the actuating member preferably a disk shaped member having disposed therewith at least one link control path (preferably spiral) having a first and second end, preferably the first end of the link control path being disposed proximate the centre of the actuating member and the second end of the link

control path being disposed proximate the perimeter of the actuating member, preferably the link control path being disposed proximate a first side of the actuating member, the link control path of the actuating member for engagement in use with an operating link of said an at least two operating position device to move said operating link and operate said at least two operating position device, the operating link (preferably said operating link being a rod) having two ends, one end thereof associated with the link control path of said actuating member in use and for controlling the motion of said operating link when the actuating member is rotated and the second end for operating the at least two operating position device (and in one embodiment the rod operating lever means associated with the at least two operating position device), the operating link being movably affixed with respect to the assembly, the at least two operating position device having actuated means movably affixed with respect to the assembly, the operating link being interconnected with the actuated means and being moveable from a first position whereat the end of the operating link engaging the link control path of the actuating member is proximate the first end of the link control path, to a second position whereat the actuating member rotates and the end of the operating link engaging the link control path of the actuating member is proximate the second end of the link control path, thus moving the at least two operating position device to and from its operating positions.

According to yet another aspect of the invention the aforementioned safety devices and specifically the winch therefore may further comprise an annular raised portion on the housing of the winch for engaging and locking with a supplementary housing containing a torque limiting device operable with said winch.

According to yet another aspect of the invention the aforementioned actuators, safety devices and specifically the winch therefore may further comprise an actuator comprising a disk shaped member of thermoplastic material with an opening provided therewith for the fastening of the actuator in position in use and having substantially arcuate spiral paths provided therewith to control the motion of a rod end, the paths being defined between two substantially spiral shaped raised portions which include a centre broad portion and flexible tapered flange portions proximate the ends of the raised portions, and a raised ring about the perimeter of said member, the raised portions therefore control the rod end there between as the actuator is rotated.

According to yet another aspect of the invention there is provided a clip on torque limiting unit comprising a first housing containing a torque limiting unit and having a portion which fastens in use with the side of a second housing containing a winch, said second housing having portions which act as clips to fasten with the portion of the first housing of the torque limiting unit, the first housing and the torque limiting unit thereof being aligned in use so as to engage the end of a drive means of the winch of the second housing when the first housing is clipped in position when the portion of the first housing is fastened with the clips of the second housing.

According to yet another aspect of the invention there is provided a clip on torque limiting unit comprising a torque limiting member which is for joining to a winch housing as a supplementary member contained in a first housing and utilizing one side of the winch housing acting as a backing plate for the first housing to retain the torque limiting member in use, the torque limiting member including first and

second torque limiting plates having means disposed upon contacting surfaces and a spring means to ensure the engagement of the means disposed upon the contacting surfaces of the first and second plates, one of the plates also including a nut portion for engagement with a handle in use, the other plate including means for engaging a drive mechanism of a winch in use, wherein the torque limiting plates at a predetermined torque slip with respect to one another and thus provide overload protection for any winch to which the torque limiting unit may be attached.

According to yet another aspect of the invention there is provided a torque limiting unit for inclusion with a winch assembly, the torque limiting unit including first and second torque limiting plates having means disposed upon contacting surfaces and a spring means to ensure the engagement of the means disposed upon the contacting surfaces of the first and second plates, one of the plates also including a nut portion for engagement with a handle in use, the other plate including means for engaging a drive mechanism of a winch in use, wherein the torque limiting plates, at a predetermined torque, slip with respect to one another and thus provide overload protection for any winch to which the torque limiting unit may be attached or installed.

According to yet another aspect of the invention there is provided a torque limiting device for a winch comprising a portion on the housing of the winch for engaging and locking with a supplementary housing containing torque limiting components operable with said winch, the supplementary housing and the winch housing containing the torque limiting components therebetween when assembled.

According to yet another aspect of the invention there is provided a safety device for a winch assembly, the assembly including a

winch having a housing containing a winch reel, the winch being affixed by mounting means near a stored position for a load, the winch reel by the operation of handle means and an accessible drive shaft lets out and takes up a length of a member affixed at one end to the winch reel, wherein letting out and taking up of the member moves the load from a locked stored position to an unlocked accessible position remote the stored position, a carrier for carrying the load, the carrier including a first portion and a second portion, the first portion for supporting the load, and the second portion being disposed with the first portion in use and engaged in use with the other end of the member remote the winch, the second portion of the carrier including a first detent means, the safety device being moveable by rotation of said handle means when said winch reel is rotated, the safety device comprising an actuating member rotatable by rotation of said handle when said winch reel is rotated, the actuating member being engaged with the drive shaft of said winch reel and having disposed therewith a control for an operating means, the control for the operating means of the actuating member for engagement in use with the operating means of said safety device, the operating means having detent means associated with the control of the operating means of said rotatable actuating member in use and for controlling the motion of said operating means when the winch reel is rotated, the safety device having latching means movably affixed with respect to the assembly, the operating means being interconnected with the latching means and being moveable by the rotatable actuating member and the control for the operating means thereof in engagement with said detent means of said operating means, from a first position when the winch reel is not operated and the load is in the stored position, to a second position when the winch reel is operated and the

load is being moved from the stored position, the latching means having second detent means disposed therewith and moveable with the latching means by the operating means from a third position whereat the load is in the locked position when the winch is not operated, and the second detent means of the latching means engages the first detent means of the second portion of the carrier to latch the carrier in the stored position and preclude the loss of the load should the member break, to a fourth position whereat the load is unlatched and free to move by the letting out or taking up of the member by the operation of the winch to and from the accessible position.

According to yet another aspect of the invention there is provided a rotatable actuating member for converting rotary motion to a latching/unlatching motion, the rotatable actuating member comprising a control, the control for engagement in use with an operating means of at least a two operating position device, the rotatable actuating member being, engaged with and being rotatable with a drive of the at least a two operating position device, the operating means having detent means associated with the control of said actuating member in use and for effecting the motion of said operating means when the rotatable actuating member is rotated, the operating means being movably affixed with respect to the at least two operating position device, the at least two operating position device having actuated means movably affixed with respect thereto, the operating means being interconnected with the actuated means and being moveable by the rotatable actuating member and the control in engagement with said detent means of said operating means, from a first position when the actuated means is not moved, to a second position when the actuated means is moved.

According to yet another aspect of the invention there is provided a safety device for a winch assembly, the assembly including a winch having a housing containing a winch reel, the winch being affixed by mounting means near a stored position for a load, the winch reel by the operation of a handle and an accessible drive shaft lets out and takes up a length of a member affixed at one end to the winch reel, wherein letting out and taking up of the member moves the load from a locked stored position to an unlocked accessible position remote the stored position, a carrier for carrying the load, the carrier including a first portion and a second portion, the first portion for supporting the load, and the second portion being disposed with the first portion in use and engaged in use with the other end of the member remote the winch, the second portion of the carrier including a first detent, the safety device being moveable by rotation of said handle when said winch reel is rotated, the safety device comprising an actuating member rotatable by rotation of said handle when said winch reel is rotated, the actuating member being engaged with the drive shaft of said winch reel and having disposed therewith a control, the control of the actuating member for engagement in use with an operator of said safety device, the operator having a detent associated with the control of said rotatable actuating member in use and for controlling the motion of said operator when the winch reel is rotated, the safety device having a latching movably affixed with respect to the assembly, the operator being interconnected with the latch and being moveable by the rotatable actuating member and the control thereof in engagement with said detent of said operator, from a first position when the winch reel is not operated and the load is in the stored position, to a second position when the winch reel is operated and the load is being moved from the stored position, the latch

having a second detent disposed therewith and moveable with the latch by the operator from a third position whereat the load is in the locked position when the winch is not operated, and the second detent of the latch engages the first detent of the second portion of the carrier to latch the carrier in the stored position and preclude the loss of the load should the member break, to a fourth position whereat the load is unlatched and free to move by the letting out or taking up of the member by the operation of the winch to and from the accessible position.

According to yet another aspect of the invention there is provided a rotatable actuating member for converting rotary motion to a latching/unlatching motion, the rotatable actuating member comprising a control, the control for engagement in use with an operator of at least a two operating position device, the rotatable actuating member being, engaged with and being rotatable with a drive of the at least a two operating position device, the operator having a detent associated with the control of said actuating member in use and for effecting the motion of said operator when the rotatable actuating member is rotated, the operator being movably affixed with respect to the at least two operating position device, the at least two operating position device having a latch movably affixed with respect thereto, the operator being interconnected with the latch and being moveable by the rotatable actuating member and the control in engagement with said detent of said operator, from a first position when the latch is not moved, to a second position when the latch is moved.

According to yet another aspect of the invention there is provided a winch assembly comprising a winch for letting out and taking up a flexible member and for moving a load from a stored

position to an accessible position, a mounting bracket having a top and a bottom and having affixed thereto a latch tube extending away from the bottom of the mounting bracket and for guiding the flexible member and the load to and from the stored position, said latch tube having affixed therewith a biased latch moveable away from and toward said latch tube, said latch having a first detent provided therewith, the winch assembly having a carrier for carrying the load and engaged with the flexible member, the carrier having disposed therewith a second detent, wherein when said load is moved to the stored position the first detent of the latch provided with the latch tube is positioned with respect to the second detent of the carrier to prevent loss of the load, thus ensuring that should the flexible member break that the latch will retain the load proximate the stored position.

According to yet another aspect of the invention there is provided a carrier for a tire comprising a tube having a first and second end and having an opening extending from the first end to the second end, the tube having an enlarged head disposed proximate said first end of the tube and having a flared flanged end disposed proximate the second end of the tube, the enlarged end of the tube including a detent for engagement with a latch of a winch assembly in use, the carrier having a wheel retaining portion providing a base upon which the tire will rest in use (and preferably adapted to carry multiple sizes of tires) , said base including an opening extending there through through which said tube is inserted from the first end to the second end, said opening of said wheel retainer being large enough to receive the first end of the tube but will not allow the second end to pass, preferably the bottom of said wheel retainer being substantially hollow and having disposed within the hollow reinforcing ribs to rigidify the wheel retainer, the tube

in use having a flexible member extending there through with a retaining nut provided proximate the end of the flexible member in use and disposed adjacent the opening of the second end of the tube to prevent pulling the flexible member through the tube in use, wherein said carrier is adapted to retain a spare tire in a winch assembly and to readily release the spare tire from the carrier for user access, (for example in the separation of the tube and carrier during release of the tire).

According to yet another aspect of the invention there is provided a winch assembly comprising a single mounting bracket for mounting the winch assembly directly to a frame (for example beams) of a vehicle having a front and rear, the mounting bracket having a winch mounting area provided therewith, a tire carrier and cooperative flexible member outlet area spaced from the winch mounting area towards the front of the vehicle, the mounting bracket being adapted to bolt directly to the frame members (for example beams) of a vehicle, wherein the mounting bracket for the winch obviates the need to provide welded or fastened reinforcing plates with the vehicle proximate the locations wherein the winch assembly is to be mounted.

According to yet another aspect of the invention there is provided for use in a winch assembly affixed to a vehicle via a mounting bracket, a winch housing comprising the operating parts of the winch in use, the mounting bracket providing a closure for the winch housing and the winch components , the mounting bracket having disposed therewith a plurality of openings, said winch housing having provided therewith clip portions which are sufficiently flexible to compress or tense when inserted within the openings of the mounting bracket to thereby retain the winch housing and therefore the winch in a predetermined location with the winch assembly.

According to yet another aspect of the invention there is provided a winch assembly comprising a mounting bracket for mounting the winch assembly to a vehicle, a winch housing containing the operating parts of the winch in use, the mounting bracket providing a closure for the winch housing and the winch components , the mounting bracket having disposed therewith a plurality of openings, said winch housing having provided therewith clip portions which are sufficiently flexible to compress or tense when inserted within the openings of the mounting bracket to thereby retain the winch housing and therefore the winch in a predetermined location with the winch assembly.

According to yet another aspect of the invention there is provided a mounting member for use in mounting a tire winch and compatible tire carrier under a vehicle, the mounting member comprising a single mounting plate adapted to carry the tire winch proximate a first predetermined location and the tire carrier proximate a second predetermined location, wherein the winch and as result of the operation of the winch a tire is accessible to a user, the mounting plate being adapted to be bolted directly to the frame members (for example the beams) of the under carriage of the vehicle and thereat supporting and positioning the winch and the tire carrier, wherein said single mounting plate obviates the need to provide reinforcing plates with the vehicle proximate the location wherein the winch and tire carrier would be mounted.

According to yet another aspect of the invention there is provided a rotatable actuating mechanism for converting rotary motion to a latching unlatching motion, the rotatable actuating mechanism comprising a first member and a second member, the second member

including a first detent, the first detent for engagement in use with an operator of at least a two operating position device such as a tire winch assembly, the operator having a second detent provided therewith and in communication with the first detent of the second member, the at least two operating position device having a resiliently biased latch movably affixed with respect thereto and biased to a latched position, the operator also being interconnected with the latch and being movable by the rotatable actuating member and the first detent of the second member from a first latched position wherein the latch is latched to a second unlatched position wherein the latch is unlatched , the first and second members having frictionally engaging faces engaging one another, wherein when the actuating mechanism is rotated the first member rotates, wherein rotation of the first member therefore due to friction rotates the second member up to a predetermined limit established by the movement of the operator and the first detent of the second member engaging a first stop provided adjacent the actuating mechanism, whereat above said predetermined limit said first member will slip in relation to said second member thus continuing the motion of the first member but limiting the motion of the second member allowing for , in the case of a winch assembly the paying out of a flexible member following the release of the latch, wherein rotation of the first member in a second direction opposite the first direction therefore rotates the second member up to a predetermined limit established by a second stop provided adjacent the actuating mechanism whereat at said predetermined limit said first member will slip in relation to said second member thus continuing the motion of the first member allowing for example in the case of a winch assembly the taking up of a flexible member on the winch until the latch is latched, but limiting the motion

of the second member, the second member being limited in the first direction by the first stop and being limited in the second direction by the second stop wherein the first member will continue to rotate in both directions during the operation of the winch .

According to yet another aspect of the invention there is provided a safety device for a winch assembly, preferably for a spare tire storage assembly, the assembly including a winch having a housing and affixed by mounting means near a stored position for a load, for example the preferred spare tire, the winch by the operation of handle means lets out and takes up a length of a member (preferably a cable) affixed at one end to the winch and preferably to a reel thereof, which letting out and taking up of the member moves the load, for example the preferred spare tire, installed on a hub, from a locked stored position, preferably under a vehicle, to an unlocked accessible position remote and preferably below the stored position, the safety device comprising in use a carrier and preferably a tire carrier for carrying the load, for example the preferred spare tire installed on the hub, the carrier including a first portion and a second portion, the first portion for supporting the load, the preferred tire installed on a hub, and the second portion being disposed with the first portion in use and engaged in use with the other end of the member remote the winch, the second portion of the carrier including a detent portion, (preferably a shoulder), the safety device being moveable and preferably rotatable by rotation of said handle means when said winch is rotated and including an actuating member preferably for converting rotary motion to substantially linear motion, the rotatable actuating mechanism comprising a first member and a second member, the second member including a first detent, the first detent for engagement in use with an operator of the winch assembly,

the operator having a second detent provided therewith and in communication with the first detent of the second member, the at least two operating position device having a resiliently biased latch movably affixed with respect thereto and biased to a latched position, the operator also being interconnected with the latch and being movable by the rotatable actuating member and the first detent of the second member from a first latched position wherein the latch is latched to a second unlatched position wherein the latch is unlatched , the first and second members having frictionally engaging faces engaging one another, wherein when the actuating mechanism is rotated the first member rotates, wherein rotation of the first member therefore due to friction rotates the second member up to a predetermined limit established by the movement of the operator and the first detent of the second member engaging a first stop provided adjacent the actuating mechanism, whereat above said predetermined limit said first member will slip in relation to said second member thus continuing the motion of the first member but limiting the motion of the second member allowing for the paying out of a flexible member following the release of the latch, wherein rotation of the first member in a second direction opposite the first direction therefore rotates the second member up to a predetermined limit established by a second stop provided adjacent the actuating mechanism whereat at said predetermined limit said first member will slip in relation to said second member thus continuing the motion of the first member allowing for the taking up of a flexible member on the winch until the latch is latched, but limiting the motion of the second member, the second member being limited in the first direction by the first stop and being limited in the second direction by the second stop wherein the first member will continue to rotate in both

directions during the operation of the winch .

According to another aspect of the invention there is provided a safety device for a spare tire storage assembly, the assembly including a winch affixed by a mounting bracket adjacent a stored position for the spare tire under a vehicle, the winch by the operation of a separate handle lets out and takes up a length of a cable affixed at one end to the winch and preferably to a reel thereof, which letting out and taking up of the cable moves the spare tire, installed on a hub, from a locked stored position under a vehicle, to an unlocked accessible position below the stored position, the safety device comprising in use a tire carrier for carrying the spare tire installed on the hub, the carrier including a first portion for insertion within an opening in the hub and preferably abutting the bottom of the hub, and a second shank portion having two ends and being engaged with the first portion proximate one end and having an expanded head proximate the other end, the first portion for supporting the spare tire installed on a hub, and the second shank portion being engaged with the first portion and being engaged with the other end of the cable remote the winch proximate the head of the second shank portion, the head of the second shank portion of the carrier including a shoulder adjacent the shank portion, the safety device being rotatable by rotation of said handle when said winch is rotated and including an actuating member for converting rotary motion to substantially linear motion, the actuating member being engageable with said winch proximate one side thereof remote said handle in use, , the rotatable actuating mechanism comprising a first member and a second member, the second member including a first detent, the first detent for engagement in use with an operator of the tire winch assembly, the operator having a second detent provided

therewith and in communication with the first detent of the second member, the winch having a resiliently biased latch movably affixed with respect thereto and biased to a latched position, the operator also being interconnected with the latch and being movable by the rotatable actuating member and the first detent of the second member from a first latched position wherein the latch is latched to a second unlatched position wherein the latch is unlatched , the first and second members having frictionally engaging faces engaging one another, wherein when the actuating mechanism is rotated the first member rotates, wherein rotation of the first member therefore due to friction rotates the second member up to a predetermined limit established by the movement of the operator and the first detent of the second member engaging a first stop provided adjacent the actuating mechanism, whereat above said predetermined limit said first member will slip in relation to said second member thus continuing the motion of the first member but limiting the motion of the second member allowing for the paying out of a flexible member following the release of the latch, wherein rotation of the first member in a second direction opposite the first direction therefore rotates the second member up to a predetermined limit established by a second stop provided adjacent the actuating mechanism whereat at said predetermined limit said first member will slip in relation to said second member thus continuing the motion of the first member allowing the taking up of a flexible member on the winch until the latch is latched, but limiting the motion of the second member, the second member being limited in the first direction by the first stop and being limited in the second direction by the second stop wherein the first member will continue to rotate in both directions during the operation of the winch .

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be illustrated with respect to the following drawings illustrating embodiments of the invention in which:

Figure 1 is a side plan view of a vehicle upon which the invention is installed.

Figure 2 is a side plan view of the winch assembly of Figure 1 illustrating the latching mechanism thereof for securing a tire in a stored position under a vehicle and illustrated in a preferred embodiment of the invention.

Figure 3 is a view similar to that of Figure 2 illustrating the action for unlatching the securing mechanism of the winch assembly when a crank is inserted for operation of the winch illustrated in a preferred embodiment of the invention.

Figure 4 is a close up view of the latching portion 49 illustrate in perspective and top plan view winch 20 illustrated in a preferred embodiment of the invention.

Figures 5 and 6 are perspective and side views respectively of the reduction gears of the winch illustrated in a preferred embodiment of the invention.

Figures 7 and 8 are schematic illustrations of improvements of the invention installed and illustrated in two preferred embodiments of the invention.

Figure 9 is a close-up side plan view of the embodiment illustrated in Figure 7 and illustrated in a preferred embodiment of the invention.

Figure 10 is a perspective view of the embodiment illustrated in Figure 9.

Figures 11 is an exploded perspective view of the embodiment illustrated in Figure 9, and 10.

Figures 12 and 13 are schematic views of the latching of the carrier illustrated in a preferred embodiment of the invention.

Figure 14 is an exploded perspective view of an improvement to the torque limiter of the assembly illustrated in a preferred embodiment of the invention.

Figure 15 is a cut-away view of the integrated assembly of the invention of Figure 14 illustrated in a preferred embodiment of the invention.

Figure 16 is a partially cut-away side plan view of a winch including a unique actuator contained within the housing of the winch and illustrated in a preferred embodiment of the invention.

Figures 16A and 16B illustrate the operation of the winch of Figure 16.

Figure 17 is a schematic perspective view of the assembly of Figure 8 illustrated in a preferred embodiment of the invention.

Figures 18 through 20 illustrate schematically the actuator 300 of the previous illustrations and the operation thereof illustrated in a preferred embodiment of the invention.

Figure 21 is a perspective view of a winch assembly illustrated in a preferred embodiment of the invention.

Figures 22A and 22B are schematic views of a spare tire retained on a tire carrier and illustrated in a preferred embodiment of the invention.

Figure 23 is a bottom perspective view of the winch assembly of Figure 21 illustrated in a preferred embodiment of the invention.

Figure 24 is a close-up perspective view of the components making up the rotary actuator 450 of Figure 23 and illustrated in a preferred embodiment of the invention.

Figures 25, 26, 27, 27A, and 28 are side views of the winch assembly of Figure 21 and 23 illustrating the paying out and taking up of a tire carrier and illustrated in a preferred embodiment of the invention.

Figure 29 is a perspective view of an alternative embodiment of the invention.

Figure 30 is a schematic view of the installation of the winch of Figure 17 or winch assemblies similar thereto with a mini van.

Figure 31 is a schematic view of the installation of the winch assembly of Figure 21 proximate the rear of a mini van and illustrated in a preferred embodiment of the invention.

Figure 32 is an illustration of the under cartridge of the van V1 of Figure 30 illustrating the components necessary for the correct amounting thereof.

Figure 33 is a schematic view of the installation of the winch assembly of Figures 21 and 31 in a van V2 and illustrated in a preferred embodiment of the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

Referring now to Figure 1 there is illustrated a vehicle V having a winch assembly 20 mounted therewith. Separate from the winch assembly is a torque limiter 30 which may also be integral with the winch. The tire T is conveniently stored under the vehicle V until such time as a user access the tire by lower the tire using the crank handle 5 at the end 6 and inserting it to access the torque limiting device 30 attached to the winch 20. The tire T may then be moved in a direction D2 to lower the tire to the ground. Handle 5 is inserted in a direction D1 in the sleeve 40A wherein a latching mechanism generally referred to as 40 is disposed. The end of the handle 6 engages the cam

surface 42a of the lever 40 which is connected to the rod 43 at the end 41. The rod 43 is connected to a latching mechanism 45 at the end 44 thereof. Therefore the latching mechanism 45 rotates in response to the movement of the lever 40 to disengage the shoulder 51 of the head of the shank portion 50 so that the tire carrier portion and the tire may be lowered to the ground.

The assembly includes a mounted plate 29 to which a hollow cylinder 40a is attached, by attaching portions 40b to the bracket 29. When the end 6 of the crank 5 therefore is inserted in the cylinder 40a end 6 abuts the lever cam portion 42a which lever 40 is pivoted at pivot 42, the use of which will be described hereinafter. Therefore the end 6 of the crank 5 is inserted through to the hollow shaft portion 35 which receives the end 6 of the crank handle 5. The torque limiter 30 therefore includes two outer housing portions 35a and 36a. The half 35a includes the hollow shaft portion 35 which half 35a connects to the half 36a which connects to the shaft 36 which continues on to the winch portion 20.

The shaft 36 then continues on to a typical winch including a reel 25. The winch 20 includes a housing 21 mounted to the mounting bracket 15 which winch 20 includes gear reduction portion 70 and 60 as best seen in Figures 5 and 6 which are used for speed reduction purposes. The use of these gears will be described hereinafter. A resilient cable 28 is wound on to and off of the reel 25 by the rotation of the crank 5 in the required direction. Any winch structure would suffice and the details of the winch are not provided for this reason. The important portions of the invention are the lever portion 40 and the related latching portion 45 which are actuated by the insertion of the end 6 of the crank arm 5 through the cylinder 40a.

Disposed below the mounting plate 29 is a extension portion 17. The shank portion 50a and the head 50 having shoulders 51 adjacent the shank portion 50a are contained within this frame portion 17 when the tire is retained in its stored position. The latching portion 45 therefore engages the shoulder portions 51 of the tire carrier 50 which retains the tire in the stored position should the cable 28 break. Further the latch mechanism assists carrying the load of the tire in the normal stored position.

The tire T is attached to a rim T1 at flanges T2 as is typically known in the art. The tire is retained in the stored position by the latch 45 being secured to the shoulder 51 of the head affixed to the shank 50a and having a flange 53 extending underneath the rim T1. This flange 53 raises and lowers the tire T from the stored position to the accessible position as the cable 28 is wound out or wound in. A spring biased device 54 which abuts the flange 54a is provided to retain the correct tension in the unit. This is well known in the art.

When the crank 5 is inserted toward the winch 20 the end 6 of the crank arm passes through the sleeve 40a and abuts the lever 40 at the cam surface 42a thereof to cause such lever 40 to rotate at its pivot 42 and causes the rod 43 attached to the crank or lever 40 at the end 41 to move in a direction compatible to D1 and link with the latch mechanism 45 at point 44. Therefore as the rod 43 moves in the direction D1 it causes the latch mechanism 45 pivoted at 46 via cam portion 47 to pivot in a direction D3 as best seen Figure 3. Therefore the locking fingers 49 are removed from recess 17A of the frame portion 17 disengaging the finger portions 49 from underneath the shoulder 51 of the head portion 50 of the tire carrier 52.

The rotation of the latch in direction D3 allows the release

or latching of the shoulder portion 51 of the tire carrier 52. The tire is shown in the accessible position about to be cranked up to its stored position and latched when handle 5 is removed from the cylindrical portion 40a to release the detent portion 42a and thereby allow the latch portion to return to its locked position under the shoulder 51 of the carrier 52 wherein the fingers 49 lock under the shoulder 51 on the abutting arcuate surface 44 thereof wherein the tire is therefore in the latched position.

Referring now to Figures 2 and 3 it can be readily seen that the torque limiting device 30 is contained separately from the winch assembly 20. Therefore the torque limiting device 30 includes two halves 36a and 35a which contain the torque limiting plates 30a and 30B which engage at all times and are held in constant engagement by the belleville spring 31. Therefore the spring 31 and the plates 30a and 30b are contained between the two portion 36a and 35a The shaft 35 is affixed for example by welding to portion 35a. The portion 35a and the torque plates 30a and 30b are also pressed against the other halve of the housing 36a. The portions 37 are used for connecting the two plates 35a and 36a loosely together. Therefore when the shaft 5 at end 6 is inserted within the hollow of the shaft 35 and turned the housing portion 36a and the shaft 36 which engages the winch 20 are also rotated. The torque limiting plates 30a and 30b include a multiplicity of teeth, which at a predetermined torque, the plates slip with respect to one another and thus provide overload protection for the winch 20. The torque limiting device 30 is a supplement to any winch and it may provide an add on package for a winch which has no torque overload protection by merely inserting this package 30 on a convenient shaft in between the housing 20 and the handle.

Referring now to figures 5 and 6 there are illustrated ring gear portions 60 stamped from a metal disk wherein the recess 65 including the teeth 65a are produced by stamping the ring gear 60 so as to raise a portion thereof out of the plane P1 of the ring gear 60. Similarly the planetary gear portion 70 includes teeth 75 which are formed by raising the teeth 75 out of the plane P2 of the planetary gear 70. In doing so a pocket is provided behind the section having the teeth 75 thereon. This therefore provides a simple method of forming a ring gear and a planetary gear which is easy to manufacture. The ring and planetary gear inter fit as best shown in Figure 6 wherein the teeth 75 which extends laterally away from the plain P2 of the ring gear 70 are inserted within the opening 65b of the ring gear 60 so that the teeth 65 of the ring gear engage the teeth 75 of the planetary gear. Within the winch 20 there is an offset which is inserted within the opening 63 of the ring gear 60 so that the planetary gear may wobble about the opening 73 therein and thus provide gear reduction which is known as taumel gear reduction. Therefore within the winch 20 there is provided taumel gear reductions portions including a ring gear 60 and an planetary gear 70 which are manufactured by a stamping process from flat circular plates and have teeth on the ring gear and teeth on the planetary gear which inter engage having been formed by metal stamping techniques. Generally there is one less tooth formed with the planetary gear than the ring gear to effect the taumel principle.

Referring to Figures 7 and 8 there is illustrated two embodiments of improvements to the invention. The embodiments illustrate winches 120 and 220, installed adjacent the bottom V1 and V2 of vehicles VA and VB, for moving a tire TA and TB from a stored position to an accessible position. Specifically Figure 8 illustrates a winch

220 installed at a distance from the tire TB separated therefrom by an cable access tube 228A. Further the winch 220 is disposed horizontally whereas winch 120 is disposed vertically. Handle 206 is provided in Figure 8 to rotate the winch 220.

Referring now to Figures 9, 10 and 11 there is illustrated the winch 120 of Figure 7, the winch components being contained between the housing 121 and the backing plate 115 similar to the unit described in relation to Figures 2 and 3. Nut 135a is provided for access by the handle H at end 106a thereof. The winch 120 is attached to the bottom V1 of vehicle VA at 129 by exemplary mounting holes 115b so that the portions illustrated extend through the bottom 129 toward the tire TA. Alternatively the flange 115a may be welded to the bottom 129 of the vehicle. In this manner the cable 128 may be lowered and raised securely to and from the stored and accessible positions. The tire carrier 150 is provided at one end of the cable and operates in a similar manner to the assembly of Figures 2 and 3 with the exceptions as will be described as follows.

The backing plate 115 is formed from a single stamping which includes mounting portions 115b and 115a and flanges 115c and 115d. The portion 115c has a passage similar to that illustrated in Figure 2 to provide for the passage of cable 128. The winch 120 and the components thereof are housed within the cover 121 and the backing plate 115. On the other side of the backing plate is provided the actuator 300 fixed in position by hexagonal threaded fastener 300a. As best seen in Figures 18 through 20 there is provided on the side of the actuator nearest bracket 115 substantially spiral shaped control paths 301 and 302 within which end 181 of serpentine rod 180 is disposed. When the winch 120 is operated by the handle H, the actuator 300 is

also rotated. The handle H2 is operated and is connected by arm H1 to end H3 wherein is disposed at opening 106a to engage end 135a of spindle 135a. When the winch 120 is operated in a clockwise direction thereby paying out the cable 128, the actuator 300 will rotate in a counter clockwise direction (when viewed in relation to Figure 10)moving the rod end 181 towards the perimeter of the actuator which causes the lever arm 141a of lever 140 near the other end 182 of rod 180 to move about pivot 140a fixed to flange 115d of bracket 115. The leg 141 of lever 140 is fixed at 143b to rod 143 which in turn engages with openings 148a to locking member 148 which works substantially the same as item 48 of Figure 2 with the exception that item 148 moves in a more linear fashion than item 48 of Figure 2. A torsion spring 148b is provided to bias member 148 within windows 115f of flange 115c to the locked position. Therefore when the carrier is in the position shown in Figure 13 as the winch 120 is rotated the actuator is also rotated to move end 181 of rod 180 in the manner described above so as to remove the forks 149 sufficiently away from the carrier shoulder 151 to allow the cable 128 to be payed out and the tire to be moved to the accessible position. When the winch 120 is rotated back to the stored position, after a tire change and presumably with a repaired tire thereon, the rod end 181 will be moved along paths 301 and 302 towards the centre nut 300a returning the forked portions 149 to the latched position. As the carrier 155 returns to the latched position the head 150 abuts the tapered surface 149a of forks 149 at cam surface 150a thereby forcing the forks 149 away from the head 150 as best seen in Figure 12 until the forks are free to return under the shoulders 151 of head 150 as best seen in Figure 13, being biased to do so by torsion spring 148b.

As best seen in Figures 14, 15 and 16 cable 128 is anchored in

slot 160a of circular plate 160 which plate forms one half of the winch reel R defined with the other reel plate 161. As shown the cable will therefore wind on the reel R in a clockwise direction (when observed from the housing end 121 of Figure 14) in this embodiment only, and accumulates one layer above another on surface 160b when the winch is operated. A housing 121 is provided at one end of the winch components which is mounted via opening 121e (via fasteners not shown)to the bracket 115 also providing the other closing end of the winch 120. A spindle 135 therefore extends through the opening 121b of housing 121 and an opening 117 in the mounting plate 115 as best seen in Figure 15. A nut end 135a is therefore provided for access by the handle H or for engagement with a separate clip on torque limiter as best seen in Figures 14 and 15. The spindle 135 therefore passes through an opening 173 of gear plate 170 which has gears 175 provided therewith, having nine teeth. A tail portion 170a is provided with gear plate 170 to prevent the free rotation thereof in operation as best seen in Figure 16A. The spindle 135 therefore engages gear plate 170 proximate opening 173 at eccentric portion 135b of spindle 135, the opening 173 being slightly larger than the eccentric portion 135b. The eccentric portion therefore wobbles within the opening 173 or gear plate 170 in use.

As best seen in Figure 15 the spindle portion 135d therefore passes thereafter through, the opening 160d of reel plate 160, the opening 161b of reel plate 161, the opening 117 of bracket 115, and finally through the opening 300x of the disk shaped actuator 300 whereat a hexagonal threaded fastener 300a engages opening 135e, as best seen in Figure 15, thereby fastening and retaining all of the winch components.

The reel plate 160 is constructed similarly to the structure

illustrated in Figure 5 and has a ring gear 165 formed on the side thereof nearest the gear plate 170, as best seen in relation to Figure 16A, which has ten engaging teeth to engage the nine teeth 175 of gear plate 170. This difference of one tooth in the number of teeth between the gears 165 and 175 causes a speed reduction but increased torque in the operation of the winch which speed reduction principle is known and described in many winch assemblies in the prior art. Therefore as the handle H is operated in a clockwise direction (when observed in Figure 14) , the spindle 135 will also rotate in a clockwise direction; the eccentric portion 135b operating within the opening 173 of gear plate 170 with the nine teeth 175 engaging the ring gear teeth 165, numbered ten, of reel plate 160 thereby driving the reel R in a direction so as to take-up cable.

The cable 128 is anchored in opening 160a of reel plate 160 via fastener 128a in a conventional manner. Therefore as the winch is operated the cable will be taken up in the clockwise direction and payed out in the counterclockwise direction. Of course this may be reversed in design. As best seen in relation to Figures 11 and 16B there is provided as a part of the bottom 160b of reel R, a resiliently biased arm 162 provided as a anti-back driving feature for the winch 120. The arm 162 includes an arcuate side 162a which abuts in use the first coil of cable 128 and is retained in position by the first coil at position X, until the cable is payed out to the position Y in Figure 16B, whereat the arm 162 being resiliently biased outward by torsion spring 162d upon further rotation of the winch engages the detent 121h of the housing 121 at 162b thereby preventing the further rotation of the reel R and the risk of the winch back driving and taking up cable with the further rotation of the winch 120 thereby damaging the cable. The arm 162 includes a torsion spring 162d having two ends. The first end 162f extends along the arm in a

long groove cut in the arm to ensure the proper biasing and motion of the arm, and the second end 162e extend towards the reel plate 160 and is anchored in an opening in reel plate 160(not shown). A pin extends through opening 162h to anchor the arm 162 to reel plate 161 at opening 161d. Generally an arm such as arm 162 is taught in the art in United States Patent 2,053,976 issued September of 1936.

Referring now to Figures 14 and 15 there is illustrated the same winch structure of Figures 9 through 13 with the addition that a torque limiting unit 130 is provided which fastens to the side of housing 121 by annular ring 121a which includes portions 121x which act as clips to fasten over flange 137a of torque limiter housing 137. The housing and the contents thereof when aligned so as to engages the end 135a of spindle 135 as shown therefore clips in position when the flange 137a is pressed over clips 121x causing the clips to flex downwardly until they pass the flange and clip thereof to retain the housing 137 in position. The clips are formed with the annular ring 121a of housing 121 with separations defined between the portions 121x and the ring 121a to allow the independent flexing of the clips.

The torque limiter 130 is similar in design to that illustrated in Figures 1 through 6 with the exception that its is joined to the winch housing as a supplementary member utilizing one side of the winch housing 121 to act as a backing plate for housing 137 to retain the torque limiter components. A spring therefore is provided to ensure the engagement of the teeth 132, 133 disposed upon adjacent surfaces of gears 130a and 130b as best seen in Figure 15. Member 130a also includes a nut portion 130e for engagement with the handle H in use. Member 130b includes a spindle engaging portion 133a to engage portion 135a of the spindle 135 and hence drive the winch 120 in the manner described

previously. Therefore if the handle H accesses the nut 130 formed with the gear 130 via portion H3 thereof, H3 engages the seal H5 of the assembly (which is recommended as a barrier to dirt and moisture but is optional) and nut portion 130e of the torque limiter extending through opening 137b of the housing 137. As the handle H is rotated the nut 130e will cause the gear 130a to rotate which because of the engagement of teeth 132 and 133 will cause the gear 130b to rotate which will in turn cause spindle end 135a to rotate as engaged by portion 133a of gear 130b. The teeth 132 and 133 remain in engagement as biased by belleville spring 131 which under normal operating conditions ensure the engagement of teeth 132 and 133. The torque limiting plates 130a and 130b include the multiplicity of teeth 132 and 133, and at a predetermined torque, the plates slip with respect to one another and thus provide overload protection for the winch 120. The torque limiting device 130 is a supplement to any winch and it may provide an add on package for a winch which has no torque overload protection by merely inserting this package 130 on the winch housing thereof as illustrated in Figure 15 and described above. The balance of the winch assembly 120 and the operation thereof remains as described above.

Referring now to Figure 16 there is illustrated a winch assembly as previously described with the exception that the actuator 300 replaces the reel plate 161 in defining reel R2 with reelplate 160. Otherwise the operation thereof is identical to previous descriptions of the assembly. However the embodiment of Figure 16 presents a more compact package. Further the torque limiting features illustrated and described in relation to Figure 15 may be incorporated therewith.

Referring now to Figure 17 there is illustrated the winch assembly 220 as illustrated in relation to Figure 8 which separates the

components previously described in order to provide a package which may be oriented horizontally. Therefore two mounting plates 215 and 216 are provided. The winch 220 being fastened in use to plate 215 at the bottom of the vehicle and including all of the features previously described including the actuator 300 for engagement with rod end 281 of rod 280. A tube 228a is provided to smoothly carry the cable 228 from the winch 220 to the tire carrier in a manner consistent with the previous descriptions. The rod 280 operates in a manner consistent with the operation of rod 180 described and illustrated above. The latch bracket 216 is mounted under the vehicle via opening 216e, and carries a latch 248 engageable in openings 216d disposed with downwardly extending bracket 216c in a manner as previously described. The rod end 282 rides in slots 248a in latch 248 which as previously described is resiliently biased to the latched position of the carrier by the torsion spring 248b. The rod 280 is guided by portion 215f and an equivalent portion on member 216(not shown) to ensure rod 280 travels in a substantially linear path to provide linear motion of latch 248 when engaging and disengaging the carrier head 150. Otherwise the operation of the winch 220 and rod 280 in relation to actuator 300 are consistent with the description in relation to Figures 9 through 15 above.

Referring now to Figure 16A there is illustrate the wobbling effect of plate 170 and the gears 175 thereof with respect to the ring gear 165 of reel plate 160 as driven by eccentric 135b of spindle 135. The plate 170 includes a tail portion 170a which is retained in area 121g of the space defined in housing 121 so as to prevent movement of the plate 170 beyond the bounds set by 121g. The motion of the eccentric will cause the gear 175 to drive the reel plate 160 at a speed reduction as is known and described above.

Referring now to Figure 18 through 20 and Figures 14, 15 and 16 there is illustrated the actuator 300 being molded from nylon or plastic with the opening 300x provided therewith for the fastening of the actuator in position as described previously. Substantially arcuate paths 301 and 302 are provided therewith to control the motion of rod end 181 (or 281) when the winch 120 (or 220) is operated. The paths 301 and 302 are defined between two substantially spiral shaped raised portions 305 which include a centre broad portion 315 and flexible flange portions 310 and 320 at the ends of the raised portions 305. Also provide to retain the rod end in use is a raised ring 308. The raised portions 305 therefore control the rod end 181 therebetween as the actuator 300 is rotated. For example when the tire is in the stored position and the latch 148 latches the carrier head 150, it may be desired to lower the tire for access. The rod end therefore begins at the position as shown in Figure 18 proximate the centre of the actuator 300. If the actuator were rotated in a direction D1 the rod will remain in its position of Figure 18 and the flexible flanges 320 will flex outwardly away from the rod end 181 to allow it to pass in one direction only. However when the actuator 300 is rotated in the direction D2 it will be forced to move along the substantially spiral path 301 for one quarter of a turn, not being able to pass the flexible flange ends 320 of the actuator, until the rod end reaches a position near the perimeter of actuator 300. The rod end then travels in paths 303 and 304 bounded by the raised portions 305 and the raised collar 308, passing the flexible flanges 310 in one direction only. The continued rotation of the actuator retains the rod end 181 in the control paths 303 and 304. In moving the rod end 181 from near the centre of the actuator 300 to near the perimeter of the actuator 300, the rod 180 therefore has been moved an equivalent linear

amount to the radius of the actuator so as to disengage the latch 148 form the carrier head shoulder 151 as previously described and to allow the lowering of the carrier and the tire to the accessible position. Therefore continued rotation of the winch will not change the position of the rod end 181 until such time as the tire is returned to the stored position and the actuator is rotated in direction D1 whereat the rod end 181 will not be able to pass the flexible flange 310 and will be forced to return along arcuate path 301 or 302 to near the centre of the actuator 300 whereat the rod end 181 will pass the flexible flanges 320 continually until the tire is raised and latched as described previously in relation to Figures 12 and 13.

All of the components of the winch assemblies previously described may be manufactured from resilient materials such as nylon or other thermoplastic materials in order to reduce the weight of the assembly. However this is not essential. In doing so weight savings may be realized. Further the embodiments of the invention considerably reduce the number of components of the assembly and hence reduce the weight and increase the reliability thereof. For example a winch assembly of Figure 8 may be reduced from previously known structures from 43 parts in total to 28 parts, a 34% savings, at a weight reduction from 4.75 pounds to 3.5 pounds, a 26% savings in weight.

Referring now to Figure 21 and 23, there is illustrated a winch assembly 400 which is manufactured to be installed under a van as seen in Figure 31. The winch assembly therefore includes a single mounting plate 410 which has reinforcing portions provided therewith. A land reinforcing portion 419 is provided proximate the latching tube 405 which has two substantially square tang portions 405a extending up through an opening 405b. The tang portions 405a are therefore welded in position

with the land reinforcing portion 419. Extending toward the perimeter of the mounting bracket 410 are rib portions 418, 417 and 415 substantially as shown. The side edges of the mounting bracket 410 are reinforced at 420 and 421 to provide a rigid mounting bracket for mounting beneath the van V2 of Figure 31. A winch assembly containing the components substantially as previously described in any of the previous embodiments of winches, is therefore mounted on the bracket 410. The winch assembly 130' therefore includes a housing 131' preferably made from glass fibre reinforced nylon which includes downwardly extending flexible tang portions 131a' which have outwardly extending tooth like detent portions as best seen in Figure 25 which press against the openings 410a and the mounting bracket 410 and therefore retain the housing 131' in position either by compression or tension. A crank portion 135' enables the access via handle portion C to the operation of the winch. The winch 130' carries a cable which is wound on a reel substantially as previously described. The cable 128 therefore extends down through a guide tube 136' through the latching tube 405 and down to the end opposite the reel of the winch 130' wherein a nut 128 is provided for engaging a tire carrier base 455 which engages with a separate tube portion 445 having an enlarged head at 445a as previously described in relation to Figure 2 and Figures 3 and 4.

The embodiment of Figure 21 through 28 includes another form of an actuator 450 which converts the rotary motion of the handle C into a linear motion to move the rod 432 from a position as shown in Figure 23 to a position as shown in Figure 26. The actuator 450 is mounted on the end of the drive shaft 135' best seen in Figure 25 which is tapped at the end thereof which allows the screw 453 and the washer 452 to mount the separate plate portions 451 and 453 to the shaft 135'.

The actuator 450 therefore includes a generally round plate 453 made from metal and a substantially round plate 451 made from a plastic material such as nylon, acatel or the like which includes an arm portion 451c included therewith a recess 451b for receiving the end of the wire 432. The other end of the wire portion 432 engages the latch assembly 430 as best seen in Figure 26 and moves said latch assembly 430 and the forks 430a outwardly away from the head 445a of the tube 445 so that as the handle C is moved in a direction D1 as seen in Figure 25, the latch will not encumber the movement of the cable 128 or the tire carrier 455. The latch tube 405 includes openings (not shown) through which the forks 430a extend. It is suggested that the ends of the forks 430a proximate the tips 430b be angled outwardly towards the sides of the torque tube to increase the locking action of the latch. The latch assembly 430 is therefore mounted to the latch tube 405 which is mounted to the mounting plate 410. The cable tube 136' extends down into the latching tube 405 and the cable thereafter extends down to the end of the tire carrier proximate the nut 128a. The latch 430 is operated by the wire 432 as the winch is rotated so that unknown to the operator the safety mechanism provided with latch 430 and the latch tube 405 in conjunction with the tire carrier portions 445a and 445 will move away from the head 445a of the carrier therefore allowing the user to crank the spare tire down to the ground without knowing that a safety mechanism exists as previously described. The safety mechanism will ensure that should the cable break that the tire will not fall, wherein the head 445a and specifically the shoulder thereof will engage the latch portion 430a and 430b and prevent losing the tire T1.

The actuator portion 450 therefore will rotate with the winch 130' until such time as the arm portion 451c engages the stop

portion S2 substantially as shown in Figure 26 wherein the metal plate 453 will continue to rotate along with the winch allowing the tire carrier 455 to be moved downwardly toward the ground whereas the plastic portion 451 and specifically the face thereof 451a will slip in relation to face 450a and allow the continued motion of the winch to pay out the cable 128 and the carrier 445 down to the ground in the direction shown in Figure 26 and the clutch plates will slip in relation to one another to allow for this action to occur. The latch therefore will stay in the position substantially shown in Figure 26 until such time as the winch is cranked in the opposite direction after the tire is removed as shown in Figure 27 wherein as described in relation to Figure 27a the actuator will adopt the position initially as shown in Figure 27 wherein the arm portion 451c will engage stop S1 and the plate 453 will continue to rotate and the plate 451 will slip in relation to plate 453 and the latch 430 will be positioned substantially as shown in Figure 27 until such time as the head portion as previously described and now illustrated in Figure 27 with relation to this embodiment will engage the incline surface of the latch portion 430a proximate the portion 430b causing the latch 430 to move backwardly in a direction D2 as the handle C is cranked in the direction D3 and allowing the fork portions 430b to rest below the head 445a of the carrier portion 445. This action works substantially as previously described. The major differences with this assembly is the single mounting bracket and the clutch plate actuator which converts the rotary motion of the winch to the linear motion to disengage the latch.

Referring now to Figure 23, Figure 27 and Figure 28, there is also illustrated a unique tire carrier which is made up of two parts. The first part is a tube portion 445 having two ends and having located near

the first end an extended head 445a and near the other end a tapered portion 445b. The tube includes an opening extending through the center thereof to receive the cable 128 which is anchored in position at the bottom of the tube as shown. The base portion 455 includes an opening 455d extending there through and including a tapered wall 455e to receive the taper of the enlarged portion 445b of the tube so that the first end 445a will readily pass through opening 455d but the second end 445b will not. This two part construction of the tire carrier is convenient as the two portions 445 and 455 separate when removing a tire from the carrier so that the tire easily comes off the carrier when moving the tire to the ground and alternatively when the carrier is assembled to carry the tire as the two portions 445 and 455 come together to form a unique carrier. The base portion 455 includes on the bottom 455a thereof alternating rib 455b and openings 455c to reduce the amount of plastic required used to form the base and yet still form a strong base. The two portions therefore come together to form a unique tire carrier which as best seen in relation to Figure 21A and 21B and which also provides for the various widths of tires to be stored on the tire carrier.

Referring now to Figure 29 and Figure 10 there is illustrated a similar embodiment to that of Figure 10 with the exception that the structure of Figure 29 includes the actuator of Figure 21 and not the actuator 300 of Figure 10. In mounting bracket 410' therefore is provided for a winch assembly 120' having a crank portion which is accessible at 135a'. The mounting bracket 410' is reinforced at the perimeter thereof via portions 420' and 421' and proximate the mounting holes 411' at reinforcing rib 422'. The latching tube 148' is provided with a latch 149' which works substantially the same as that described in relation to Figure 10. The two part carrier assembly

including portions 445 and 455 is provided with this assembly. A rod portion 432 extends down from the actuator portion 450 substantially as previously described in relation to Figures 21 and 23 which engage the end of a cam shaped sector 460 which engages the spring portion 431 which activates the latch portion 149'. The embodiment of Figure 29 is meant to be installed within a pick-up truck environment whereas the embodiment of Figure 21 is designed to be installed in a mini van.

Referring now to Figure 30 and 32, there is illustrated the installation of the winch assembly of Figure 17 in a van V1 so that the mounting bracket 215 is located proximate the wheel well for the tire at the rear driver side of the vehicle. The bracket 216 is mounted substantially as shown near the center of the vehicle so that the tire T3 may be raised and lowered near the bumper R1 at the rear of the vehicle V1. As seen in Figure 32 therefore, a reinforcing member P1 is therefore provided for mounting of the tire carrier bracket 216 substantially as shown which member P1 is tack welded to the beam portions B2 and B1. The bracket P1 therefore will accept the tire carrier bracket 216 which also includes a latching tube portion 216c substantially seen in Figure 17. In providing this installation as shown the winch bracket 215 may also require a reinforcing bracket P2 installed adjacent the wheel well of the van at that location so that the winch 130 may be operated. When accessing the winch therefore, a user will be located near the rear left of the vehicle in the direction of traffic T as seen in Figure 30 and there is a greater safety risk for the user at that location. The vehicle V1 therefore includes a corrugated floor pan F1 which includes beam portions B1 and B2 which are generally hat shaped sections. Further, the reinforcing portion P1 is generally a hat shaped section as well and the bracket 215 may be alternatively welded to the side rail of the wheel well wherein a

further reinforcing bracket may or may not be present.

Referring now to Figure 31 and 33 there is illustrated the installation of the winch assembly of Figure 21 within a vehicle V2 near the rear thereof. The mounting bracket 410 therefore is mounted via mounting openings 411 and 412 to beams B1 and B2 which are substantially the same position for the vehicle V1 as vehicle V2 proximate the rear R2 of vehicle V2. The reinforcing portions 417, 415, 418, 419, 420 and 421 are provided with a single mounting bracket 410 for the winch 130' and the winch housing 131' mounted proximate the rear of the vehicle V2 where it is mounted to the beams B1 and B2 without the need of reinforcing plates or welding thus eliminating costly, manufacturing labour and materials. Further in such an installation , the winch handle C therefore is disposed closer to the center of the vehicle V2 so that the individual using the winch is not as endangered in the line of traffic as with the case of Figure 30. The hat section bracket P1 of Figure 32 is therefore eliminated in Figure 33 as is the need for welding to the cross beams. The winch assembly now is substantially in line with the center line of the vehicle via a 5 volt mounting system with the tire carrier disposed more to the front and the crank and winch assembly disposed more to the rear of the vehicle. Therefore the embodiment of Figure 21 is much simplified, much more compact and ergonomically engineered than is the installation of Figure 17.

The winch assembly of Figures 21 (and also figure 29) therefore includes a one piece plastic housing which readily clips into position within the openings of the mounting bracket 410 via openings 410a. A shaft extends therefore through the winch from the crank portion 135' which extends from proximate one end of the winch as best seen in Figure 21 to the actuator 450 which releases a latch 430 for a

safety latch system embodied with a latching tube 405 which extended downwardly from the same mounting bracket 410 to which the winch 130' as assembled. The winch components may be made from plastic, nylon, delrin or any other strong resilient acceptable material.

As many changes can be made to the invention without departing from the scope of the invention, it is intended that all material contained herein by interpreted as illustrative of the invention and not in a limiting sense.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE AS FOLLOWS:

1. A winch assembly comprising:

a winch; and

a carrier for a tire including a tube having a first and second end and having an opening extending from the first end to the second end, the tube having an enlarged head disposed proximate said first end of the tube and having a flared flanged end disposed proximate the second end of the tube, the enlarged end of the tube including a detent for engagement with a latch of said winch, the carrier having a wheel retaining portion providing a base upon which the tire will rest in use, said base including an opening extending there through, through which said tube is inserted from the first end to the second end, said opening of said wheel retainer being large enough to receive the first end of the tube but will not allow the second end to pass, the tube in use having a flexible member extending there through with a retaining nut provided proximate the end of the flexible member in use and disposed adjacent the opening of the second end of the tube to prevent pulling the flexible member through the tube in use, wherein said carrier is adapted to retain a spare tire in said winch assembly and to readily release the spare tire from the carrier for user access.

2. The winch assembly of claim 2 wherein the tube and base are adapted to carry multiple sizes of tires.

3. The winch assembly of claim 2 wherein the bottom of said wheel retainer is substantially hollow and has disposed within the hollow reinforcing ribs to rigidify the wheel retainer.

4. A winch assembly comprising:

a winch coupled to a bracket for letting out and taking up a flexible member and for moving a tire from a stored position to an accessible position;

a carrier having a first member and a second member, each of said first and second members having an aperture extending therethrough, said flexible member extending through each of said apertures, wherein said first and second members are captured between said winch and a stop coupled to the distal end of said flexible member, wherein said first and second members are separable from one another and moveable along the length of the flexible member, wherein said first member includes a first end disposable through said aperture of said second member, said second member being rotatable to allow said second member to pass through an aperture of said tire, wherein said first member is selectively engageable with said bracket to retain said tire in said stored position and wherein said first member is disengagable from said bracket to allow said tire to be moved to said accessible position.

5. The winch assembly of claim 4 further including a latch coupled to one of said bracket and said first member wherein said latch selectively couples said first member and said bracket when said tire is in said stored position.

6. The winch assembly of claim 5 wherein said second member is in a first orientation relative to said tire to retain said tire in said stored position and wherein said second member is in a second orientation relative to said tire when being passed through said aperture in said tire.

7. The winch assembly of claim 6 wherein said first orientation of said second member is substantially orthogonal to said second orientation of said second member.

8. The winch assembly of claim 5 wherein said latch engages the other of said bracket and said first member upon being axially moved proximate said winch.

9. The winch assembly of claim 4 wherein said stop engages said second end of said first member, and wherein said second end of said first member engages said second member and wherein said second member engages said tire when said tire is in said stored position.

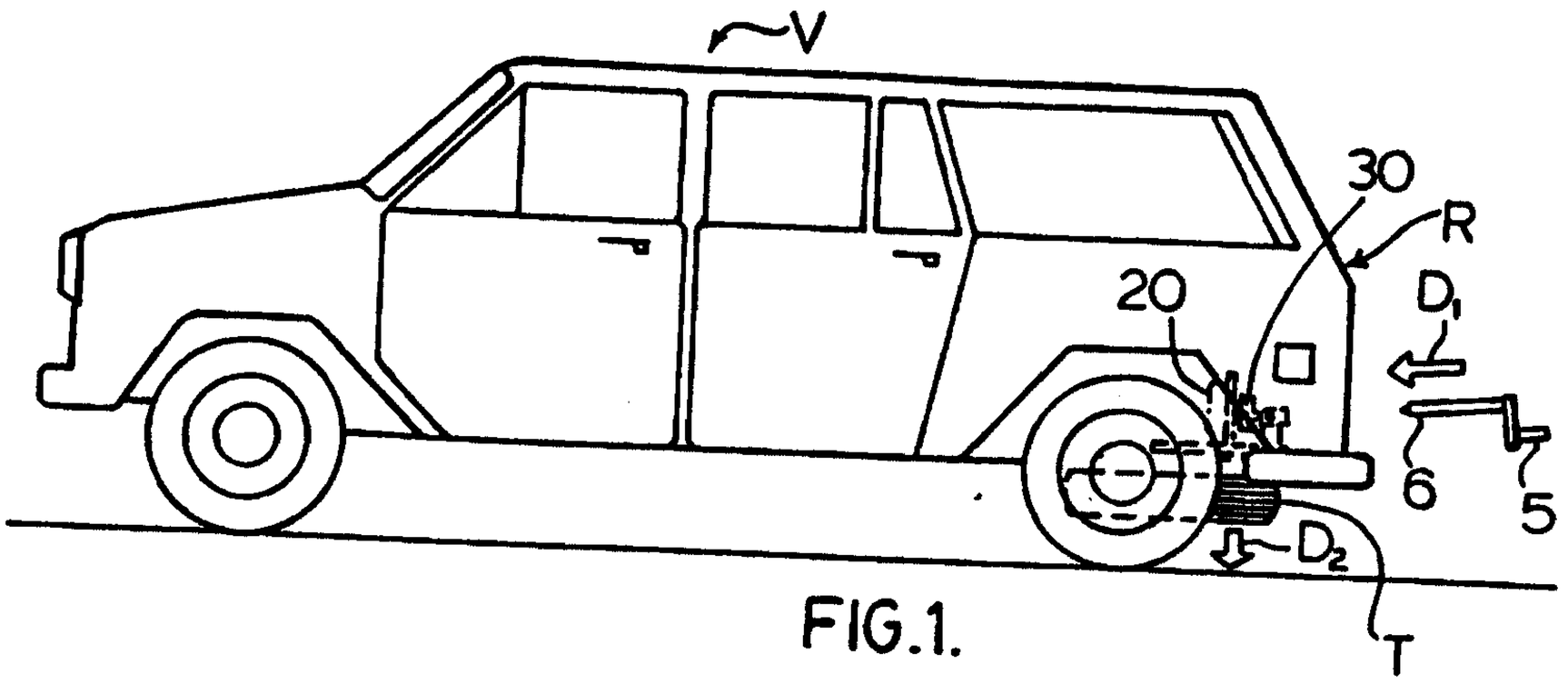

V
30
R
20
D1
6
5
D2
T

FIG.1.

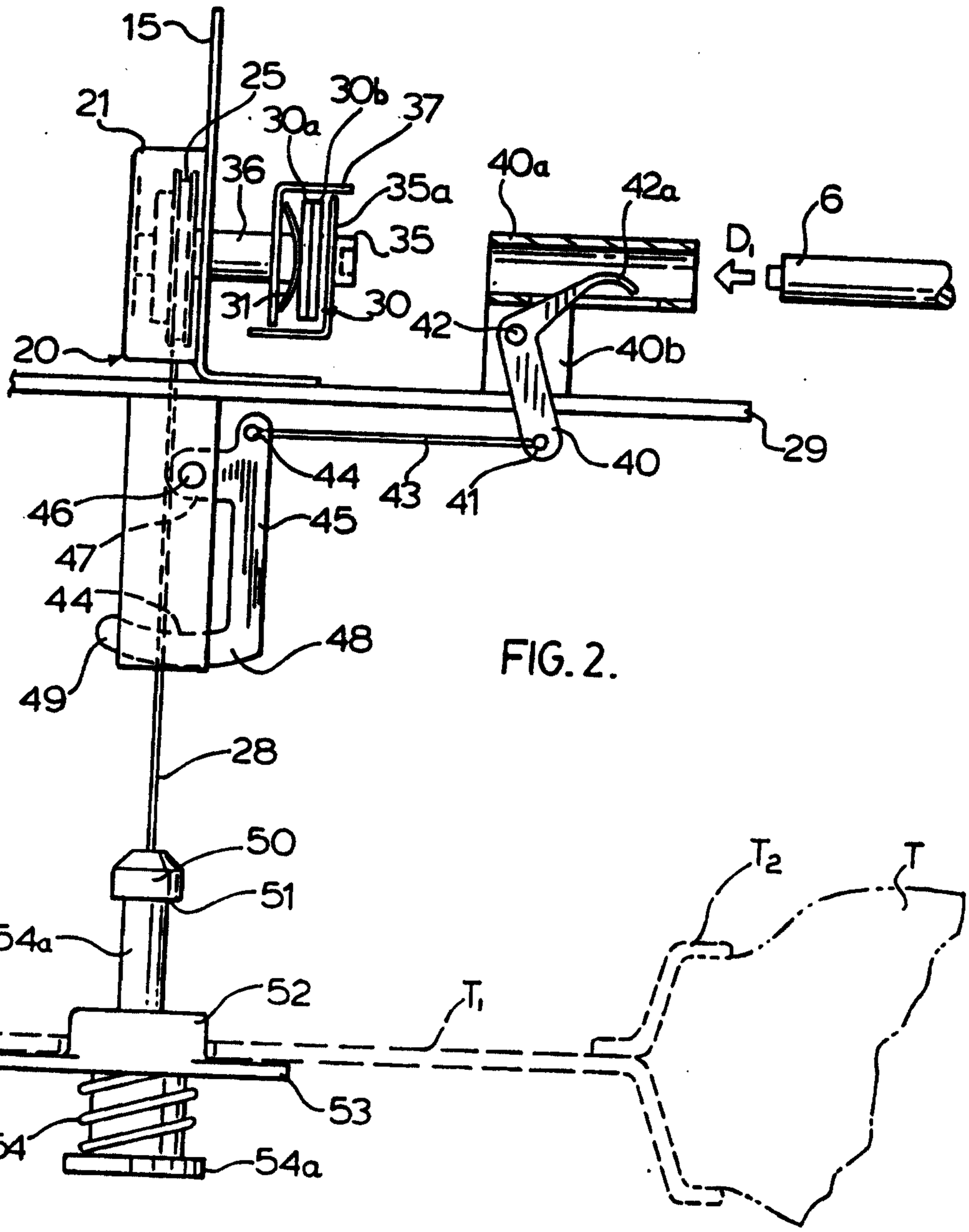

15
25
30b
37
21
30a
36
35a
40a
42a
6
35
D1
31
30
42
20
40b
29
44
43
41
40
46
45
47
44
48
49
28
50
51
54a
52
T1
T2
T
53
54
54a

FIG. 2.

FIG.3.

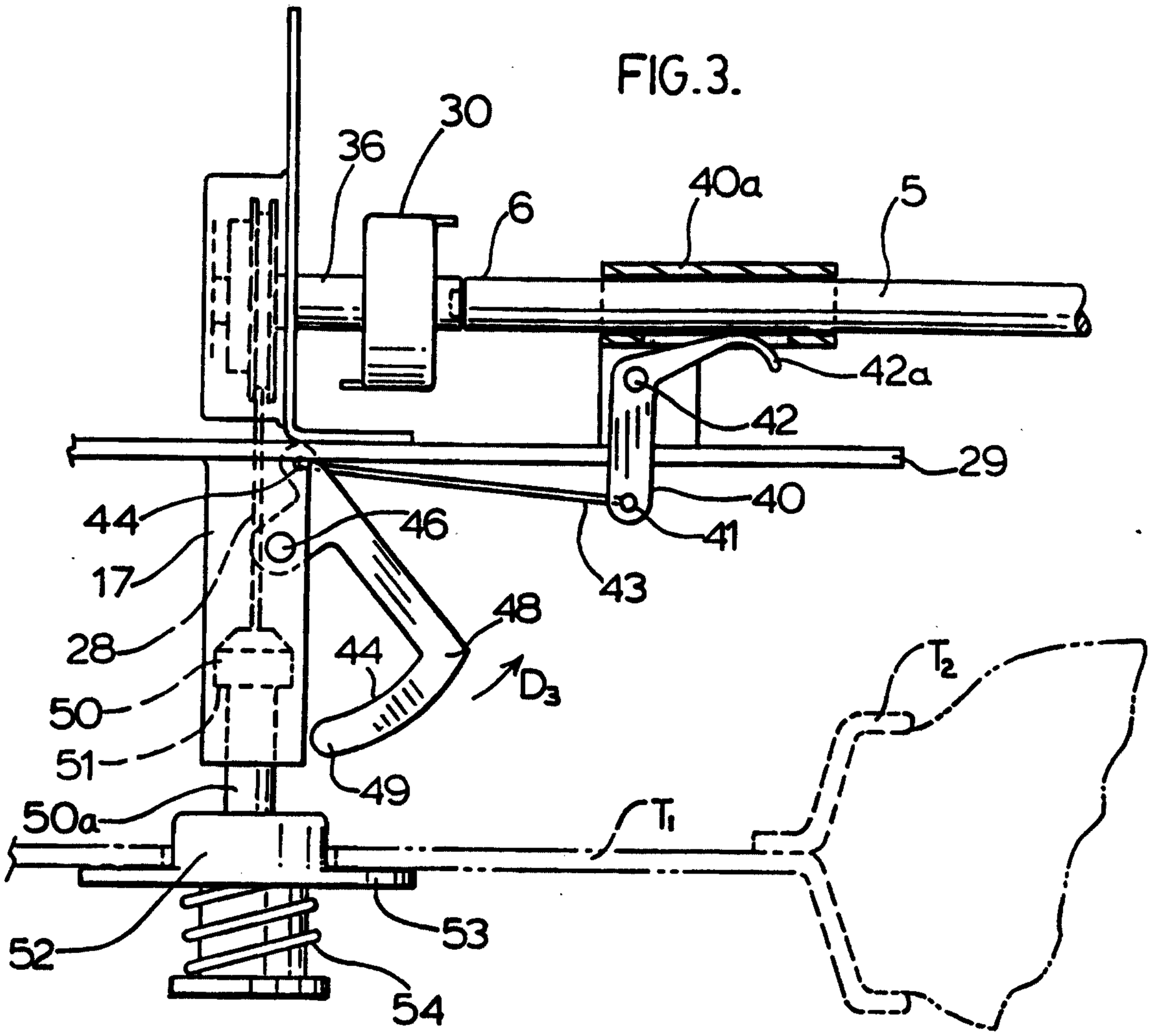
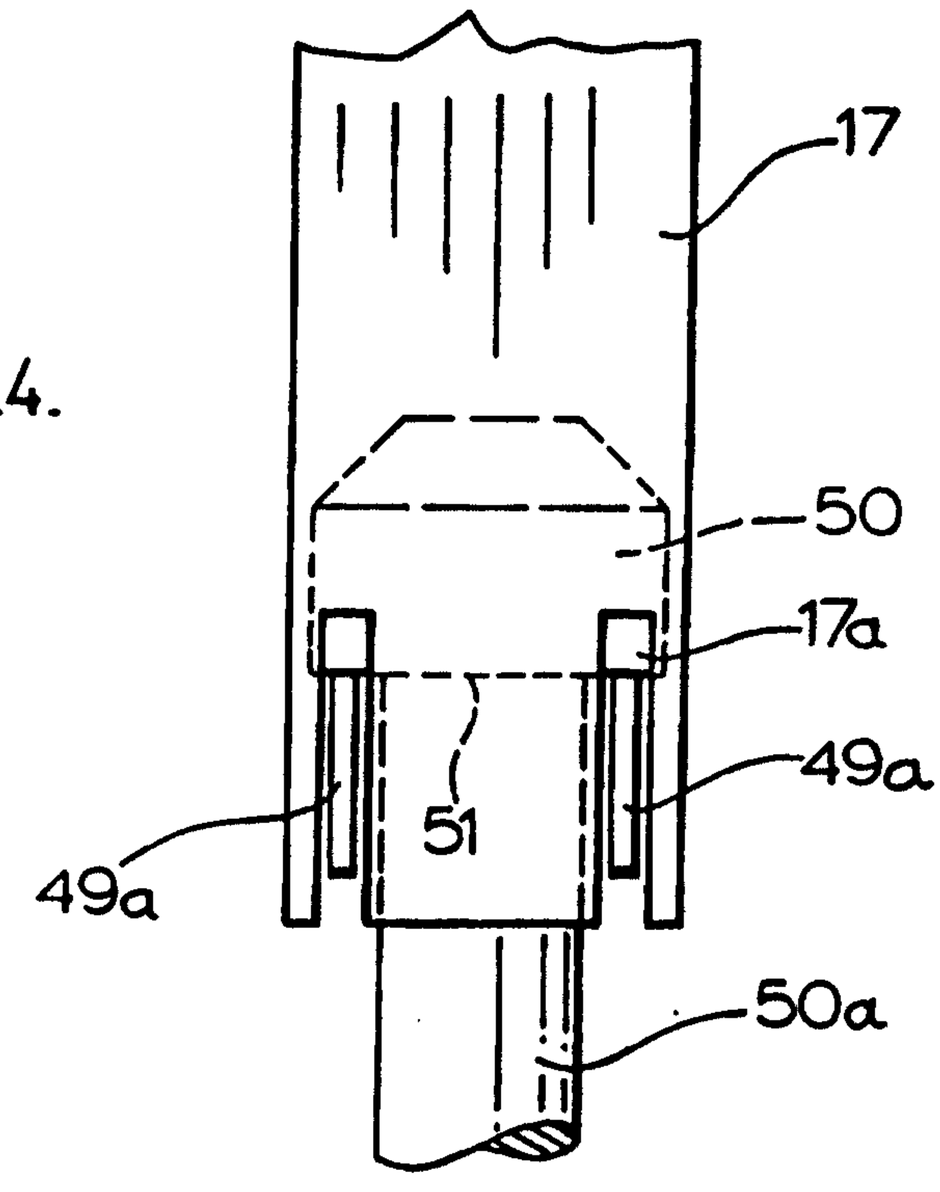

30
36
6
40a
5
42a
42
29
40
41
44
46
17
43
48
28
44
D_3
50
51
49
50a
T_1
T_2
52
53
54

FIG.4.


17
50
17a
49a
51
49a
50a

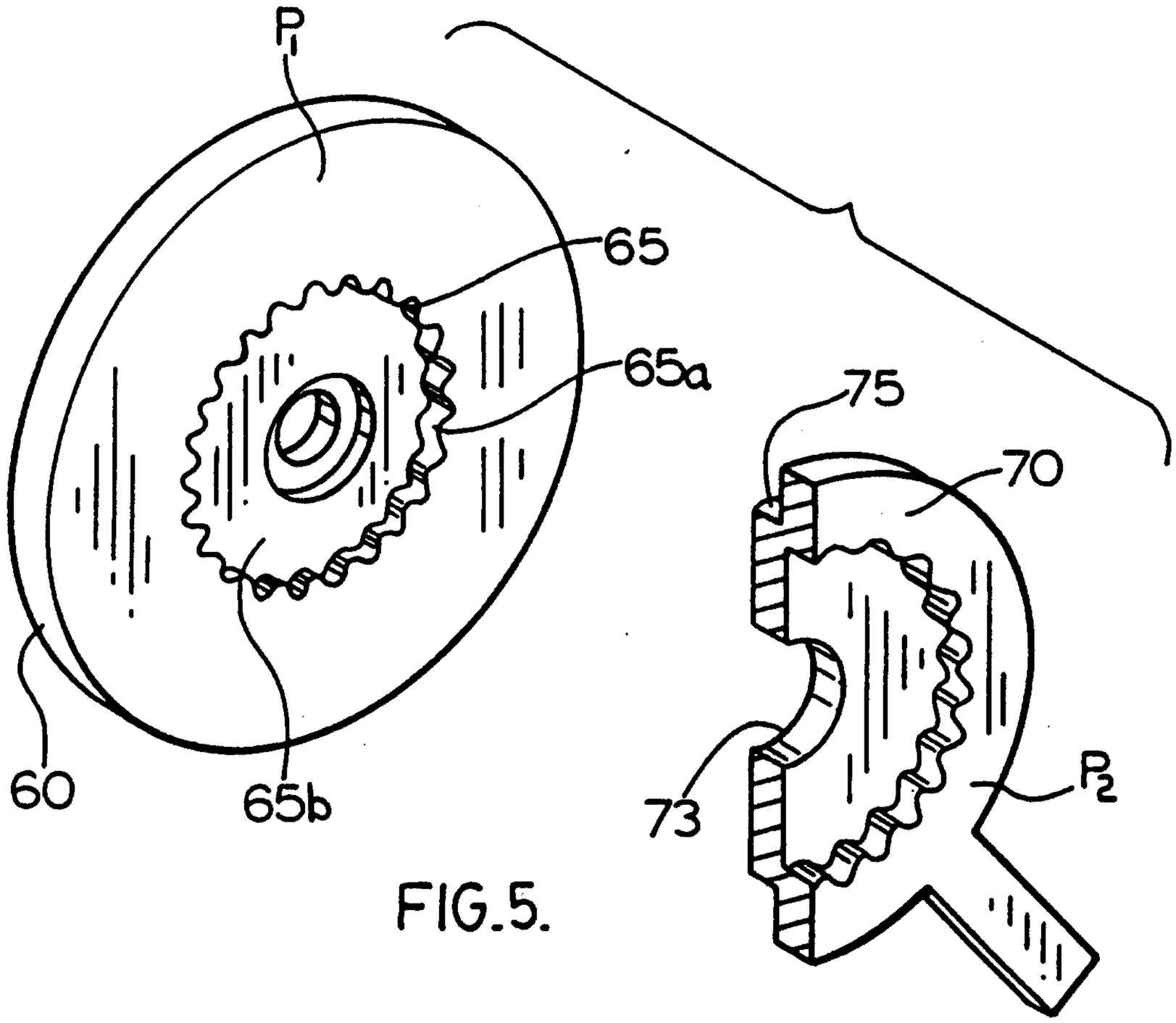


FIG.5.

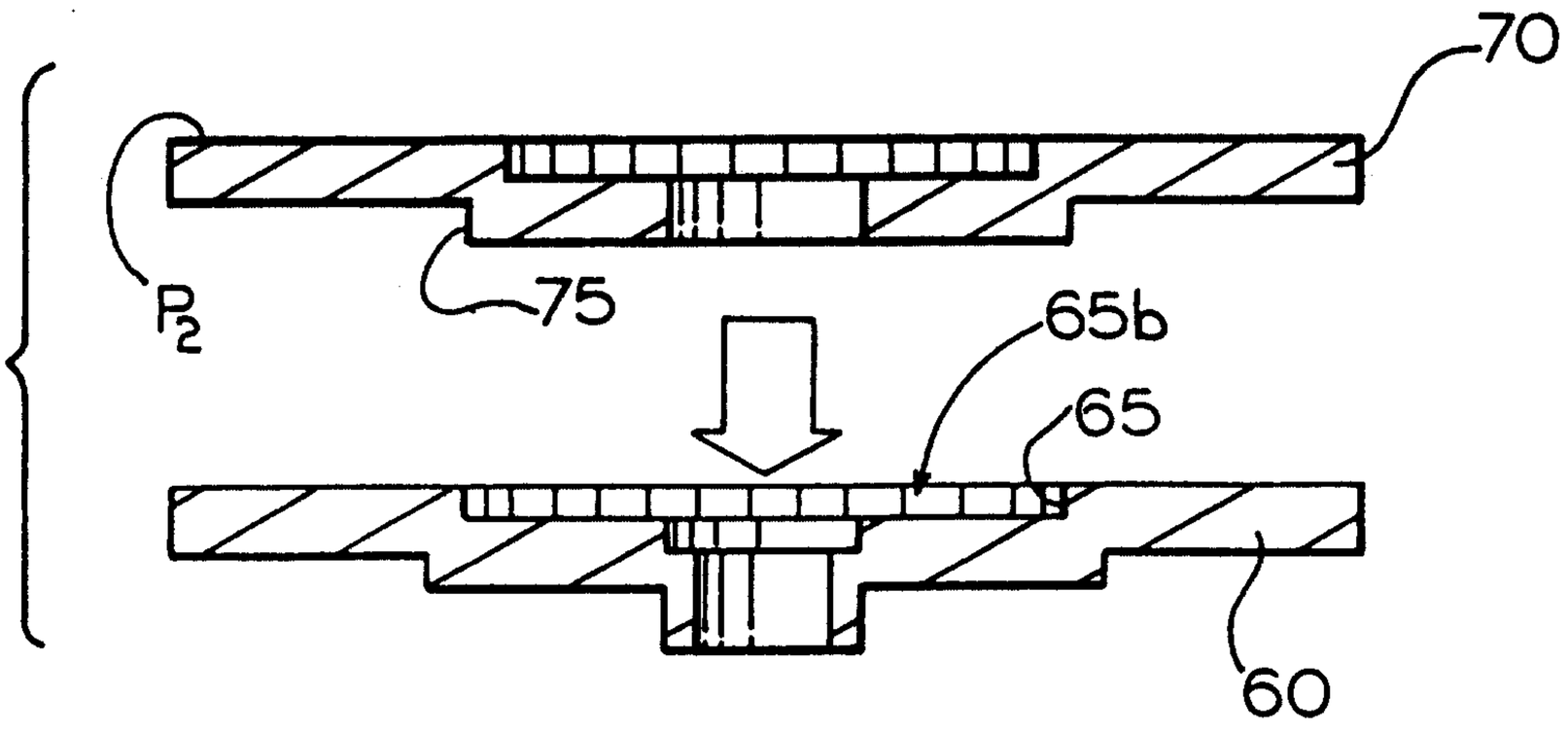


FIG.6.

FIG.7.

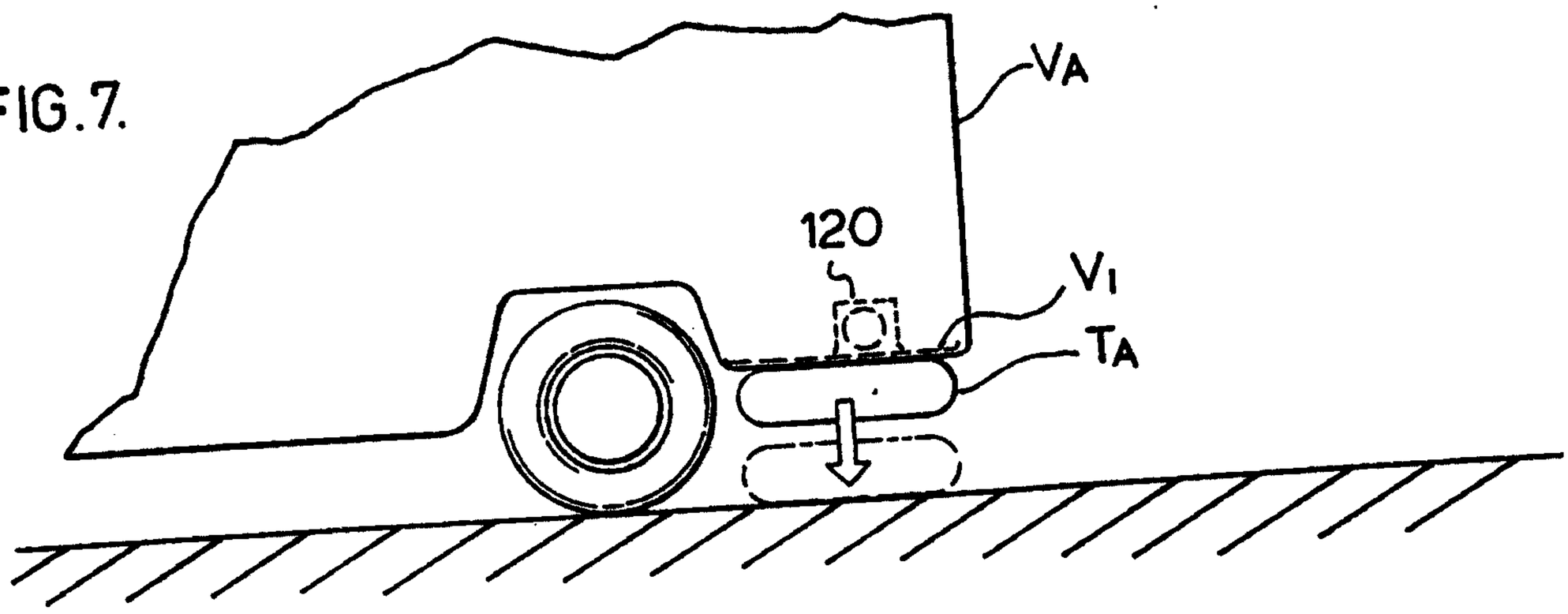


FIG.8.

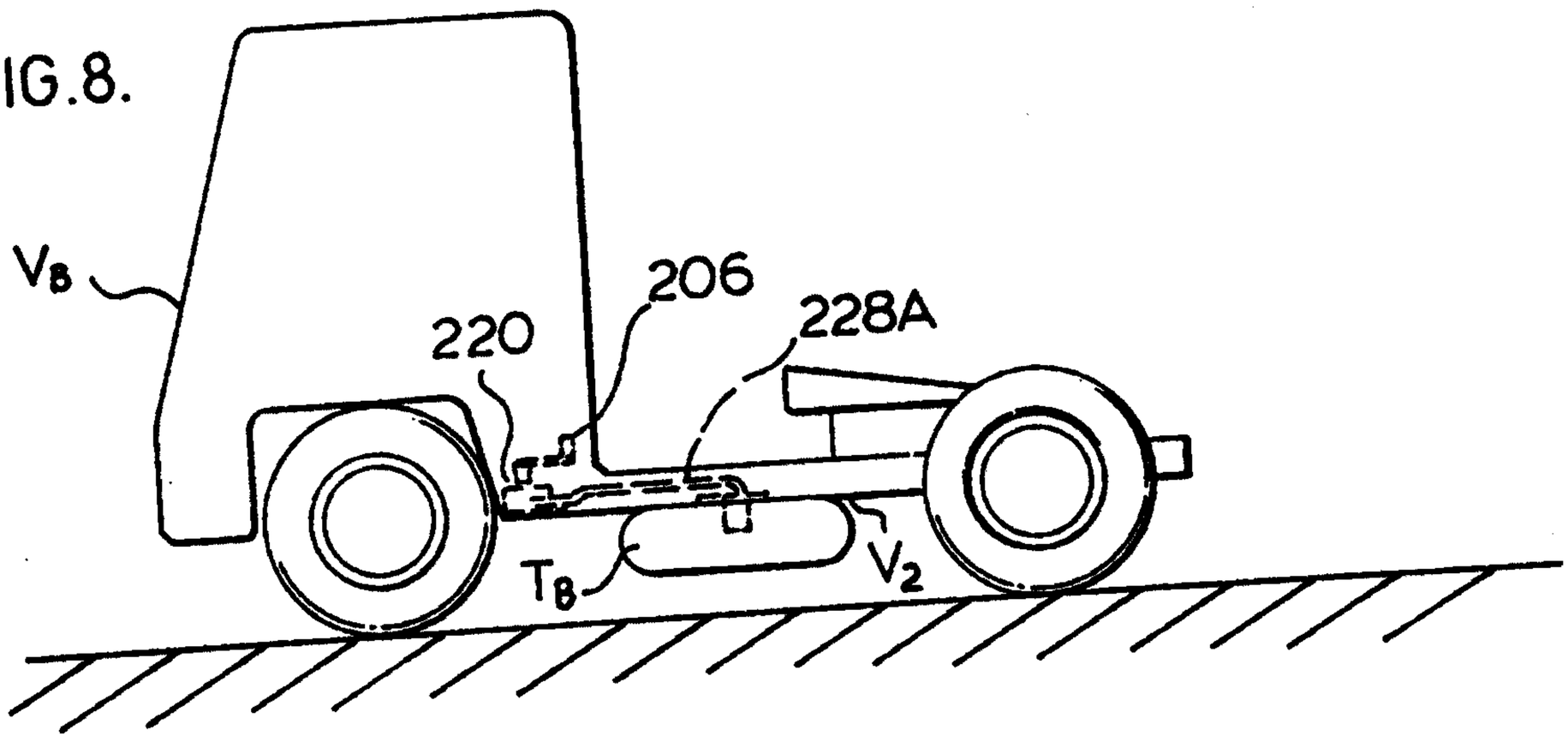


FIG.9.

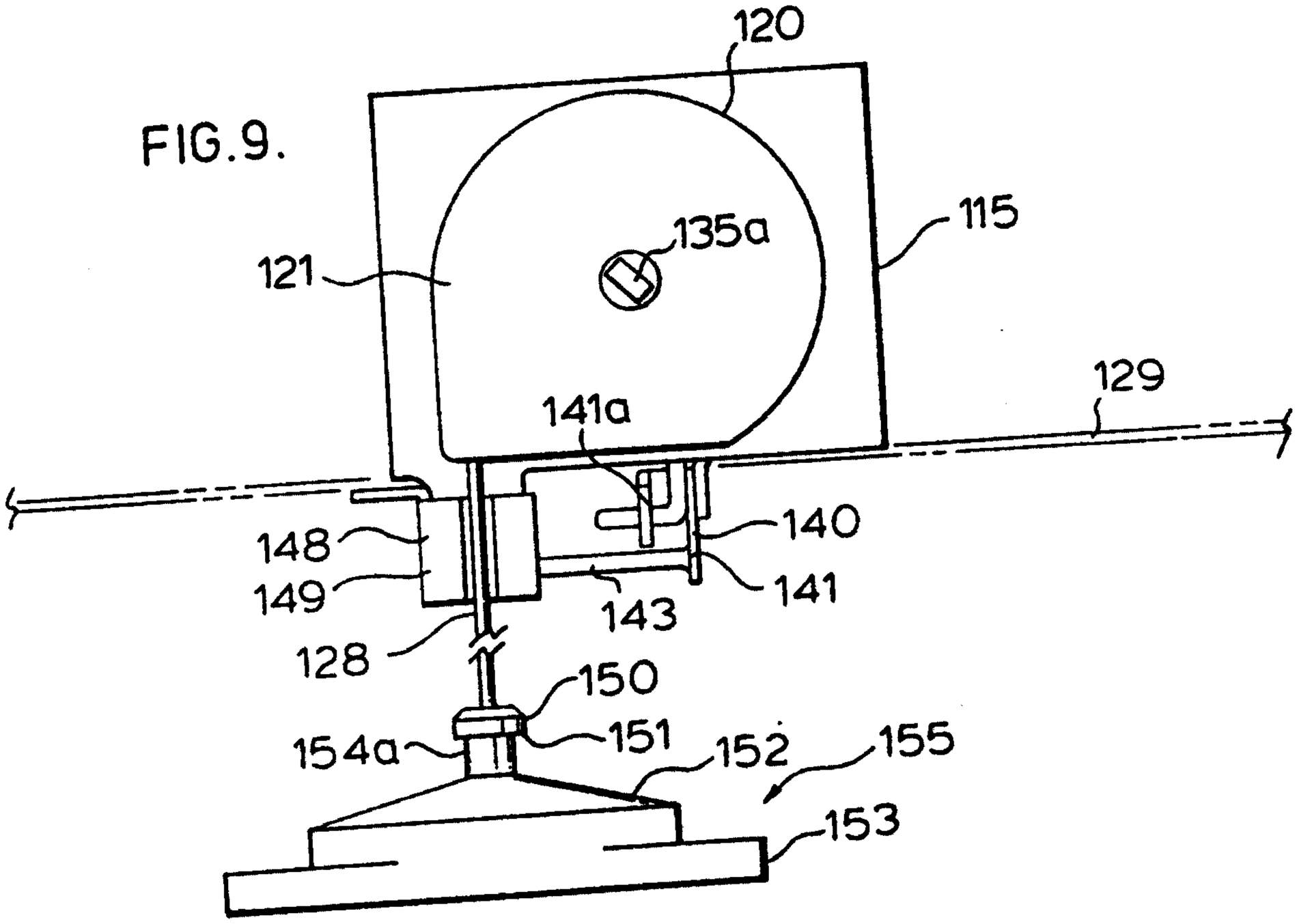


FIG.10.

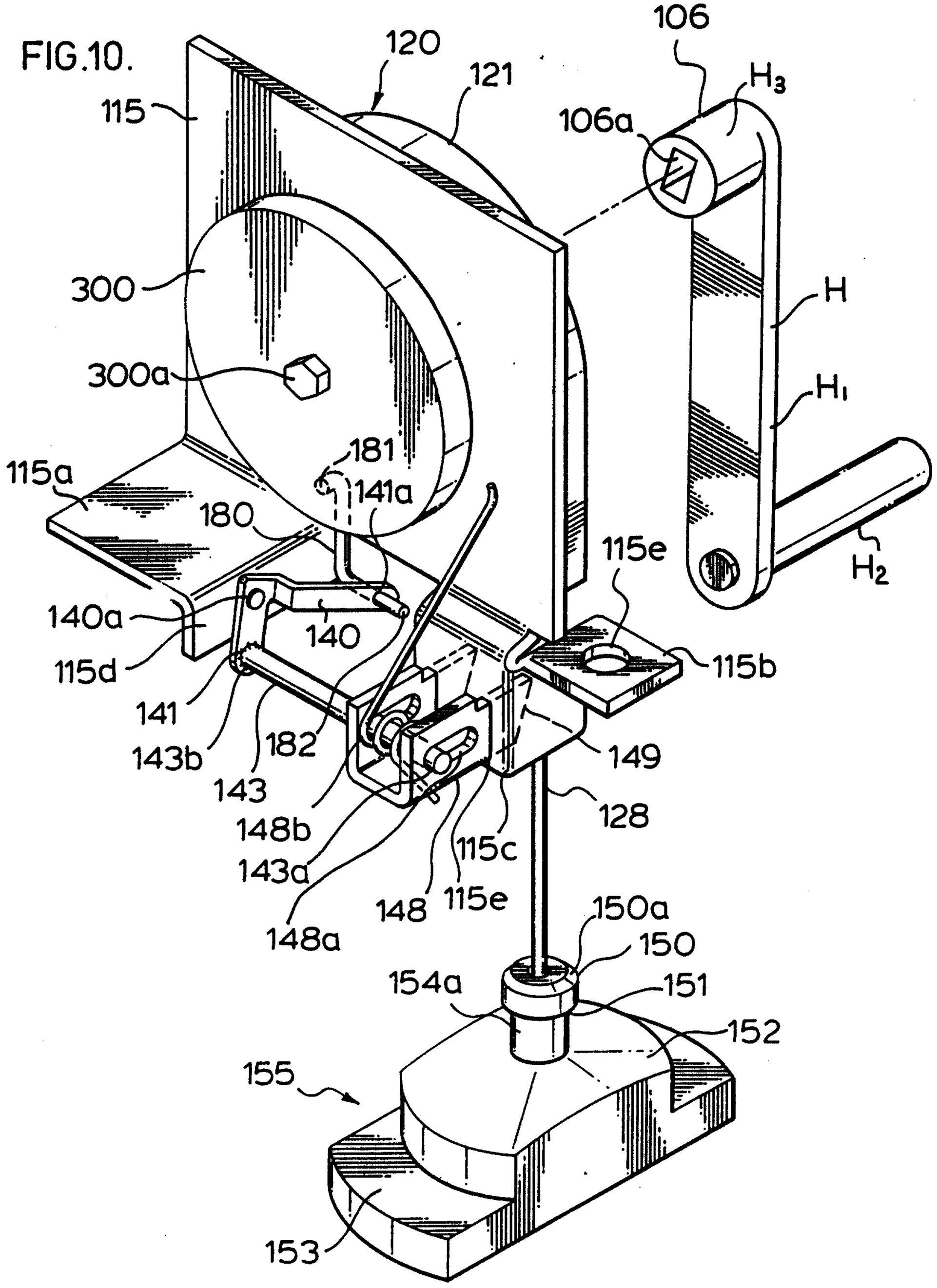

106
120
121
115
H3
106a
300
H
300a
H1
181
115a
141a
180
115e
H2
140a
140
115d
115b
141
143b
182
149
143
128
148b
115c
143a
148
115e
150a
148a
150
154a
151
152
155
153

FIG.11.

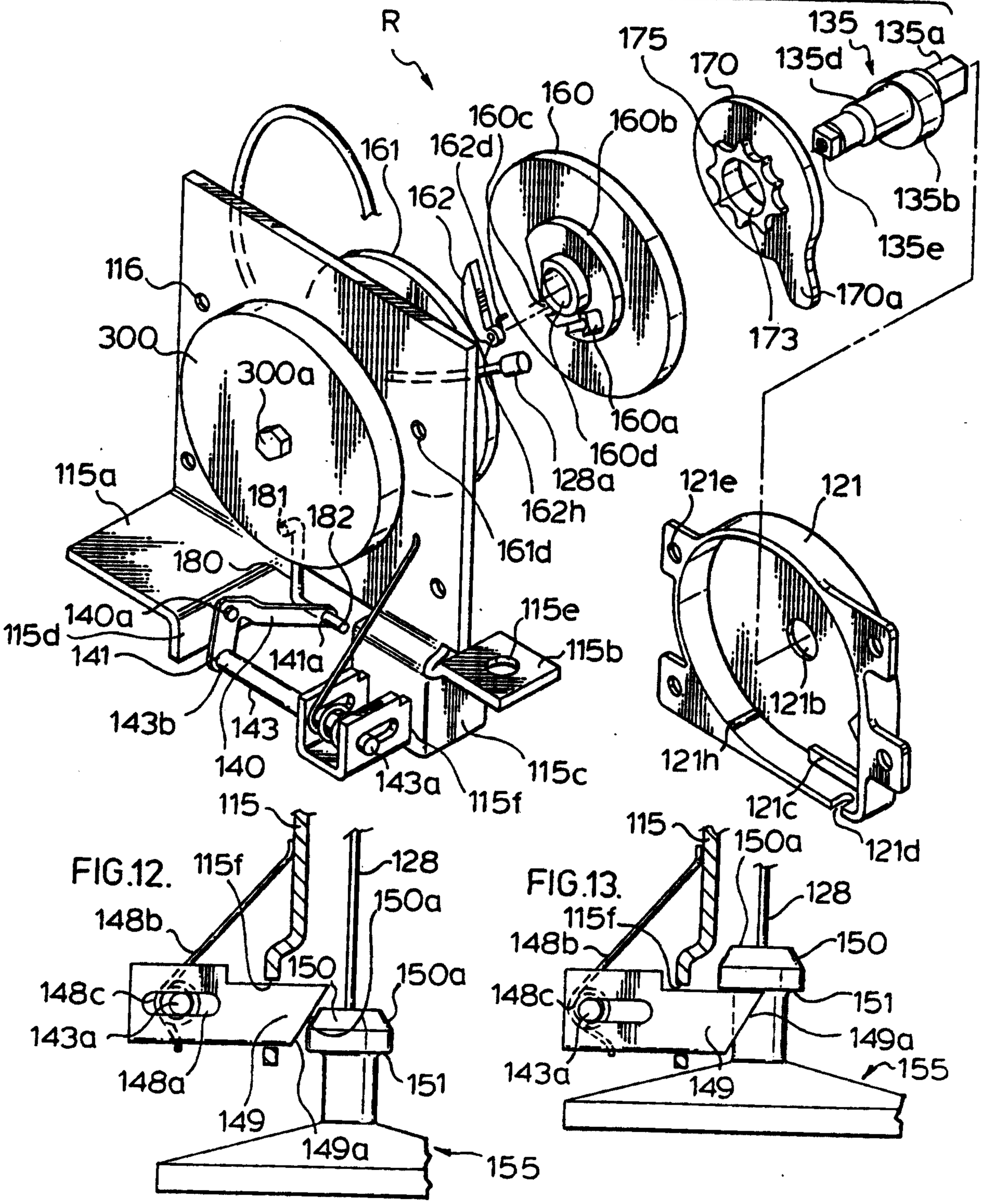


FIG.12.

FIG.13.

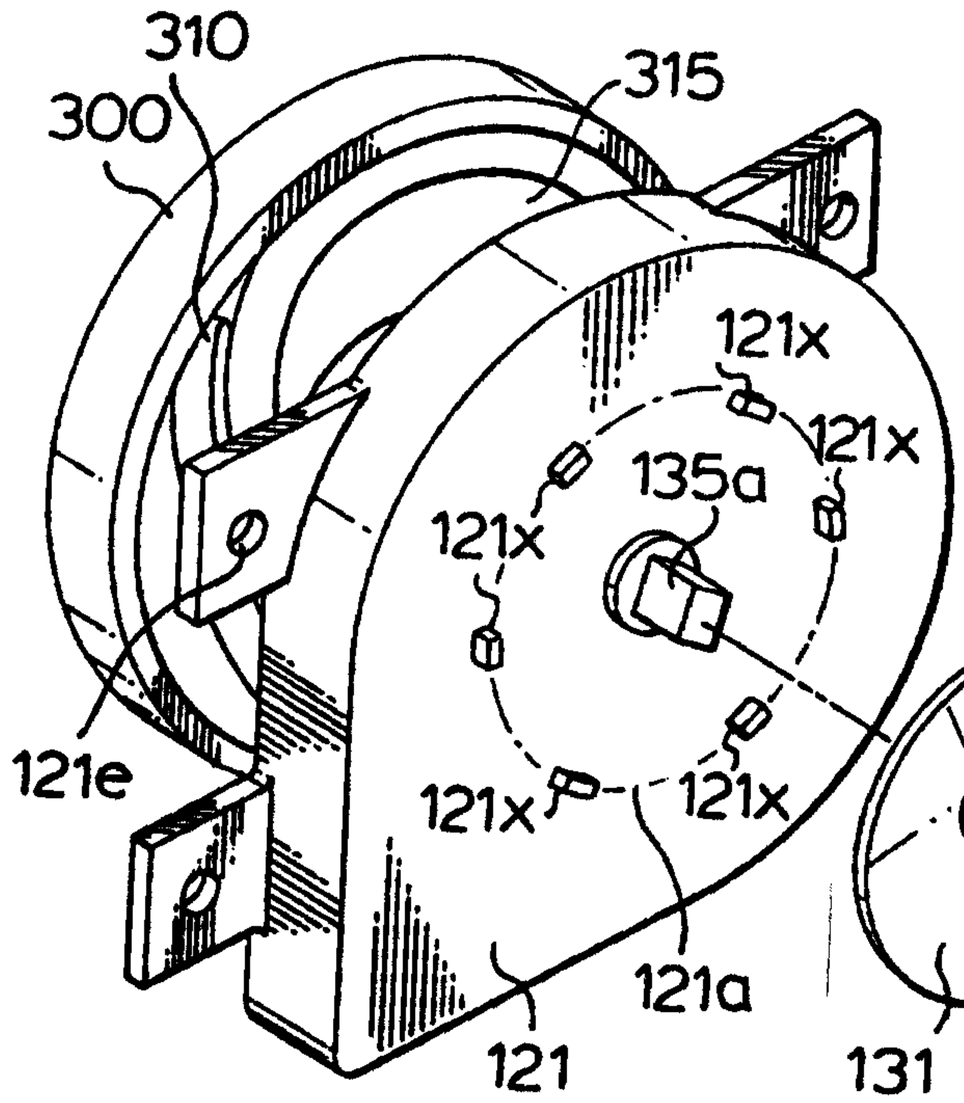
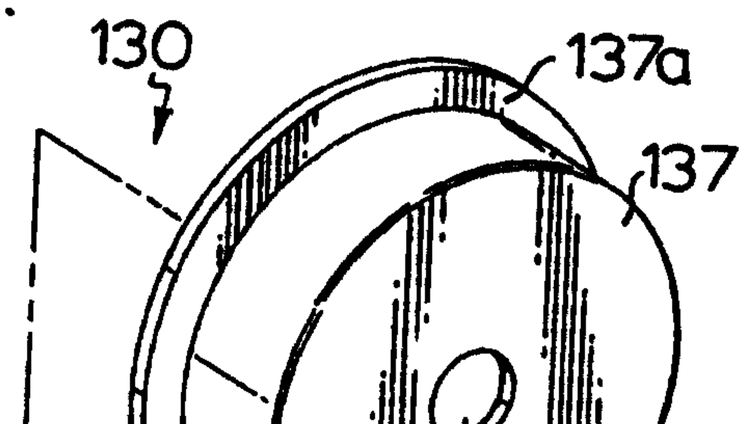

310
300
315
121x
121x
135a
121x
121x
121x
121x
121e
121a
121
131

FIG.14.


130
137a
137
137b

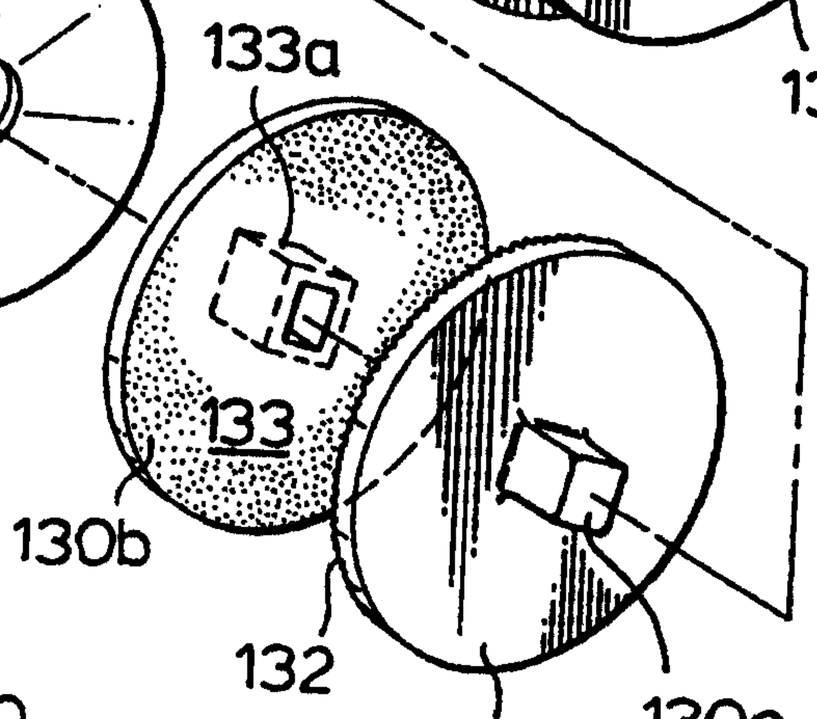
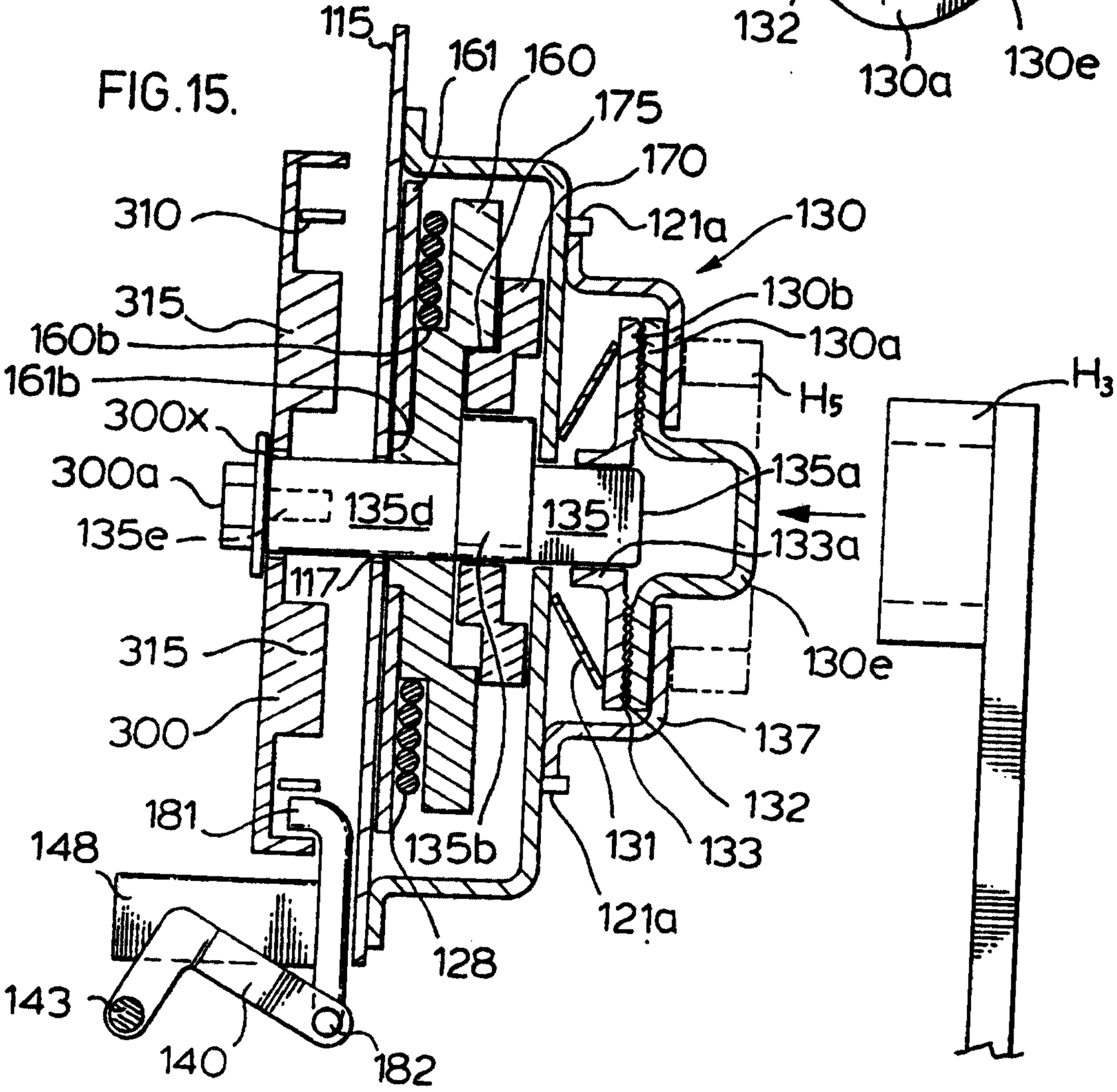

133a
133
130b
132
130a
130e

FIG.15.


115
161
160
175
170
310
121a
130
315
130b
160b
130a
161b
H5
H3
300x
300a
135d
135
135a
135e
133a
117
130e
315
137
300
132
181
135b
131
133
148
121a
128
143
140
182

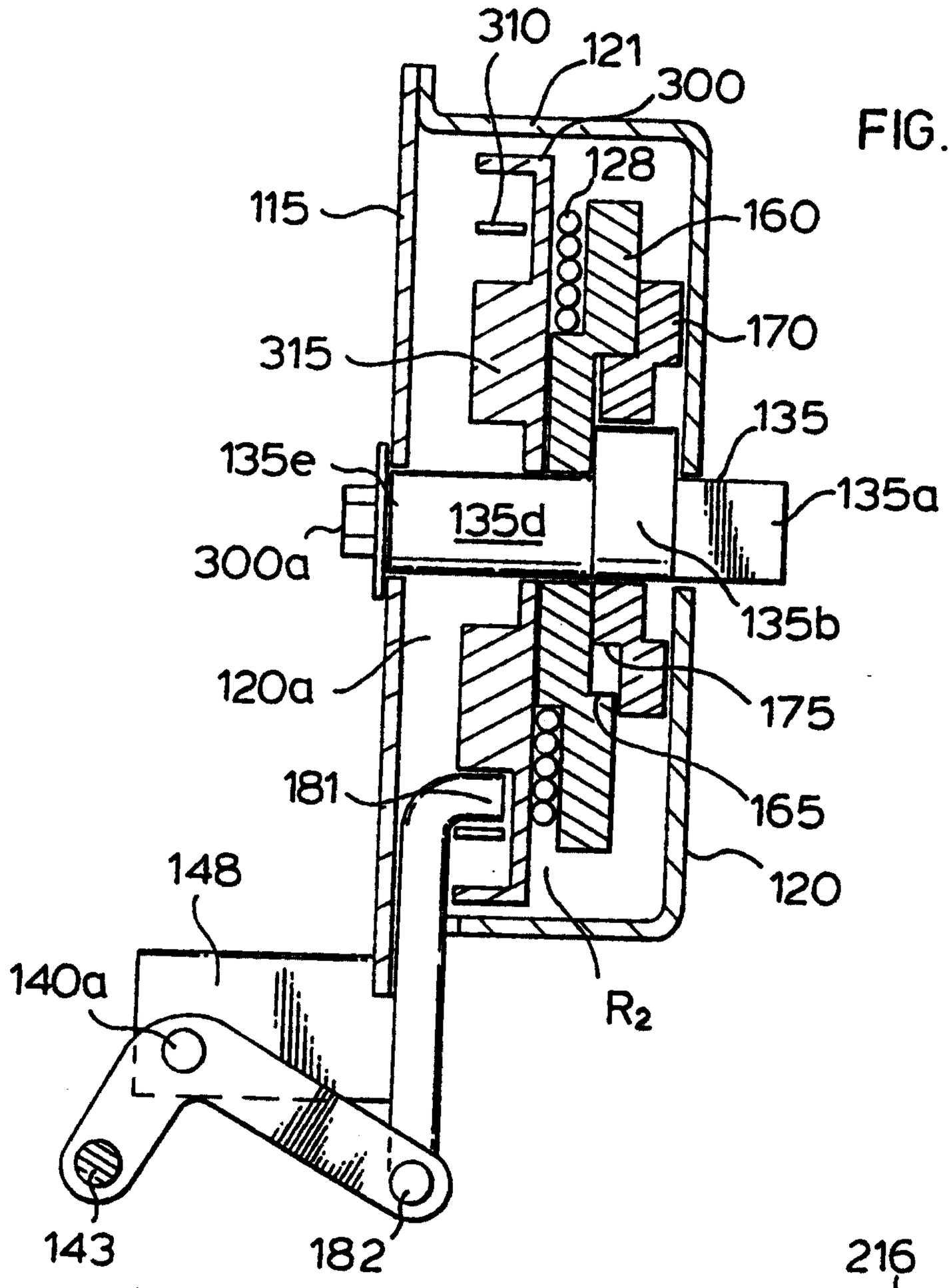

310
121
300
128
115
160
315
170
135
135e
135a
135d
300a
135b
120a
175
181
165
148
120
140a
R_2
143
182

FIG.16.

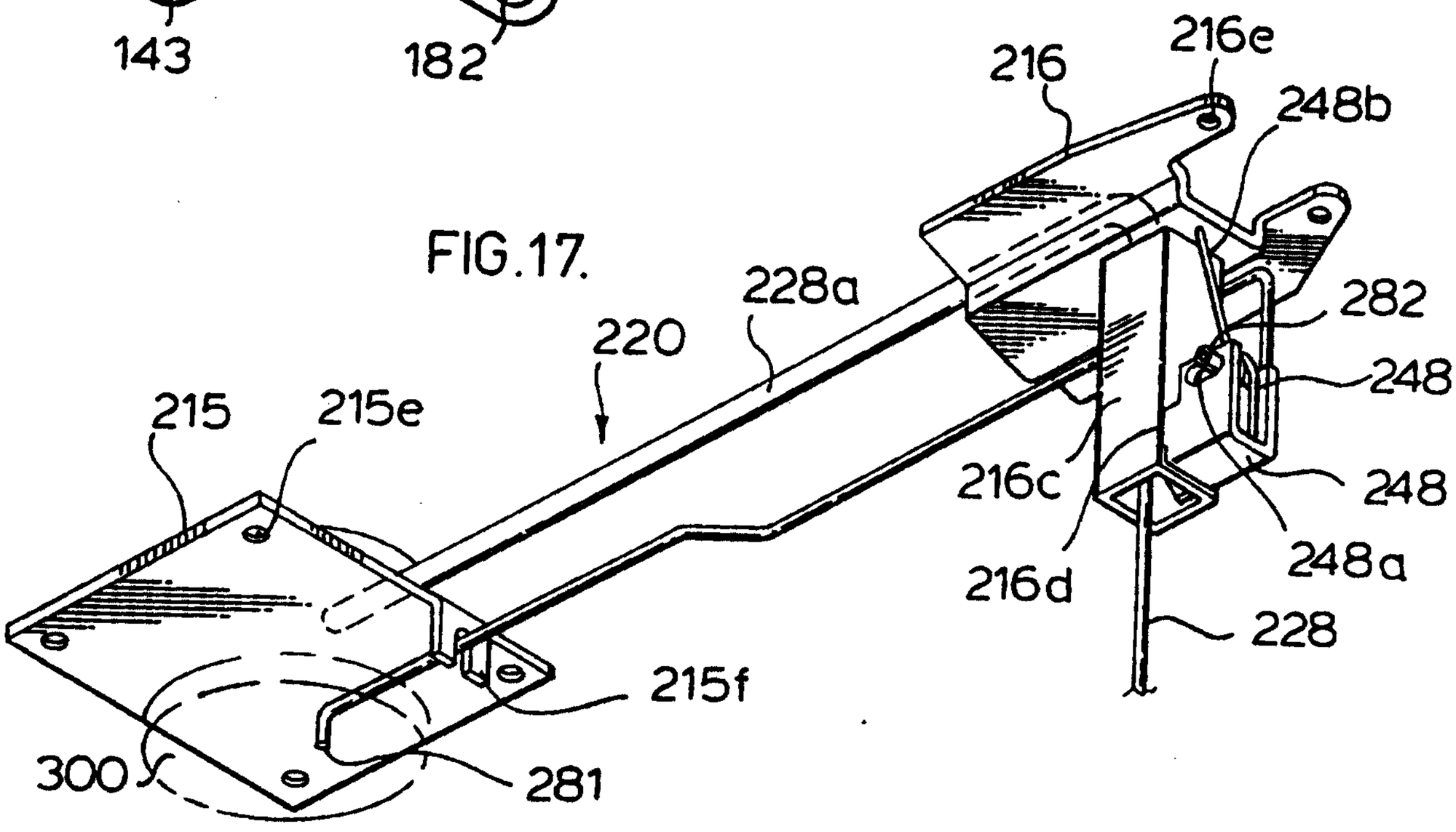

216
216e
248b
228a
220
282
215
215e
248b
216c
248
248a
216d
228
215f
300
281

FIG.17.

FIG.16A.

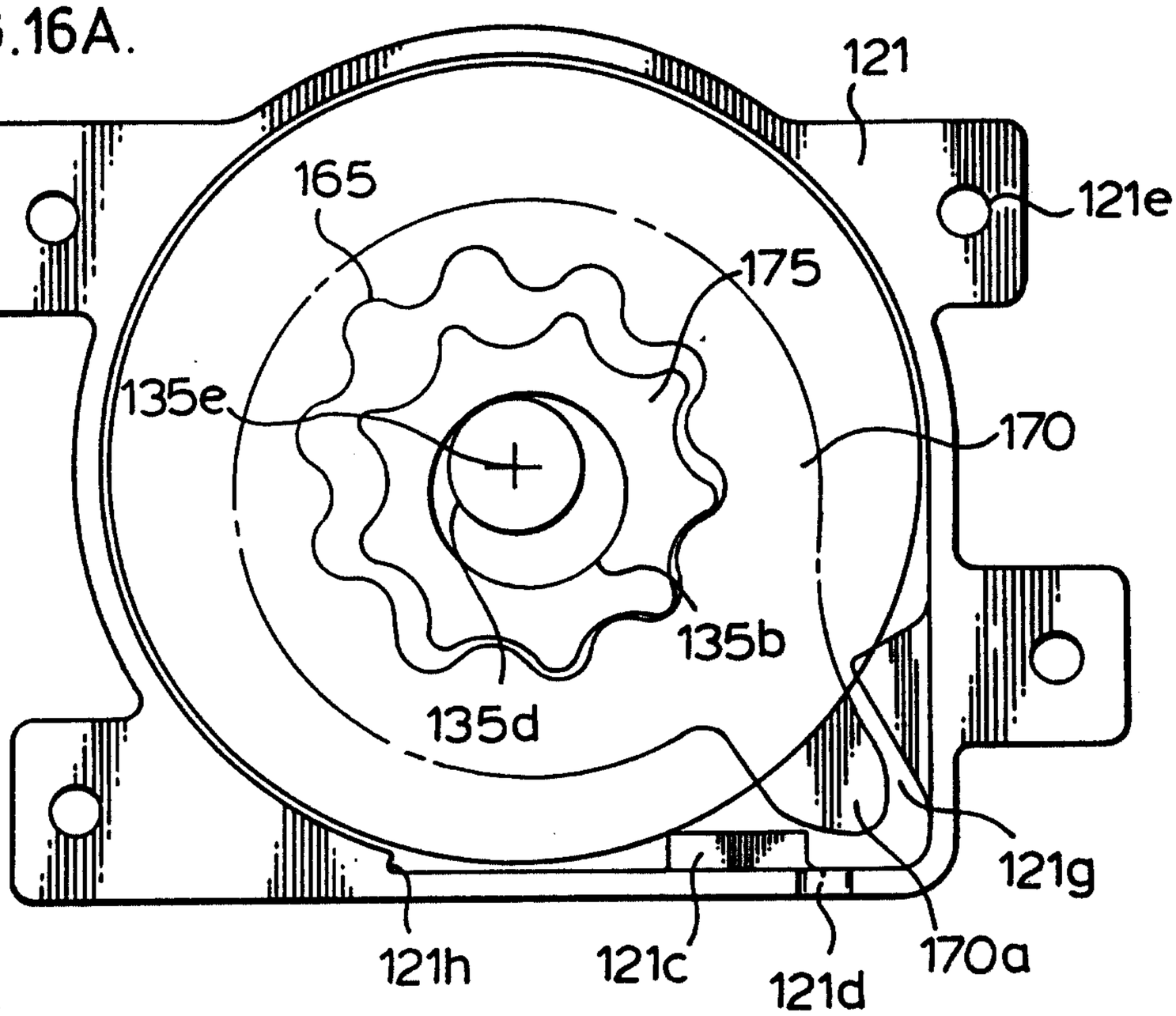


FIG.16B.

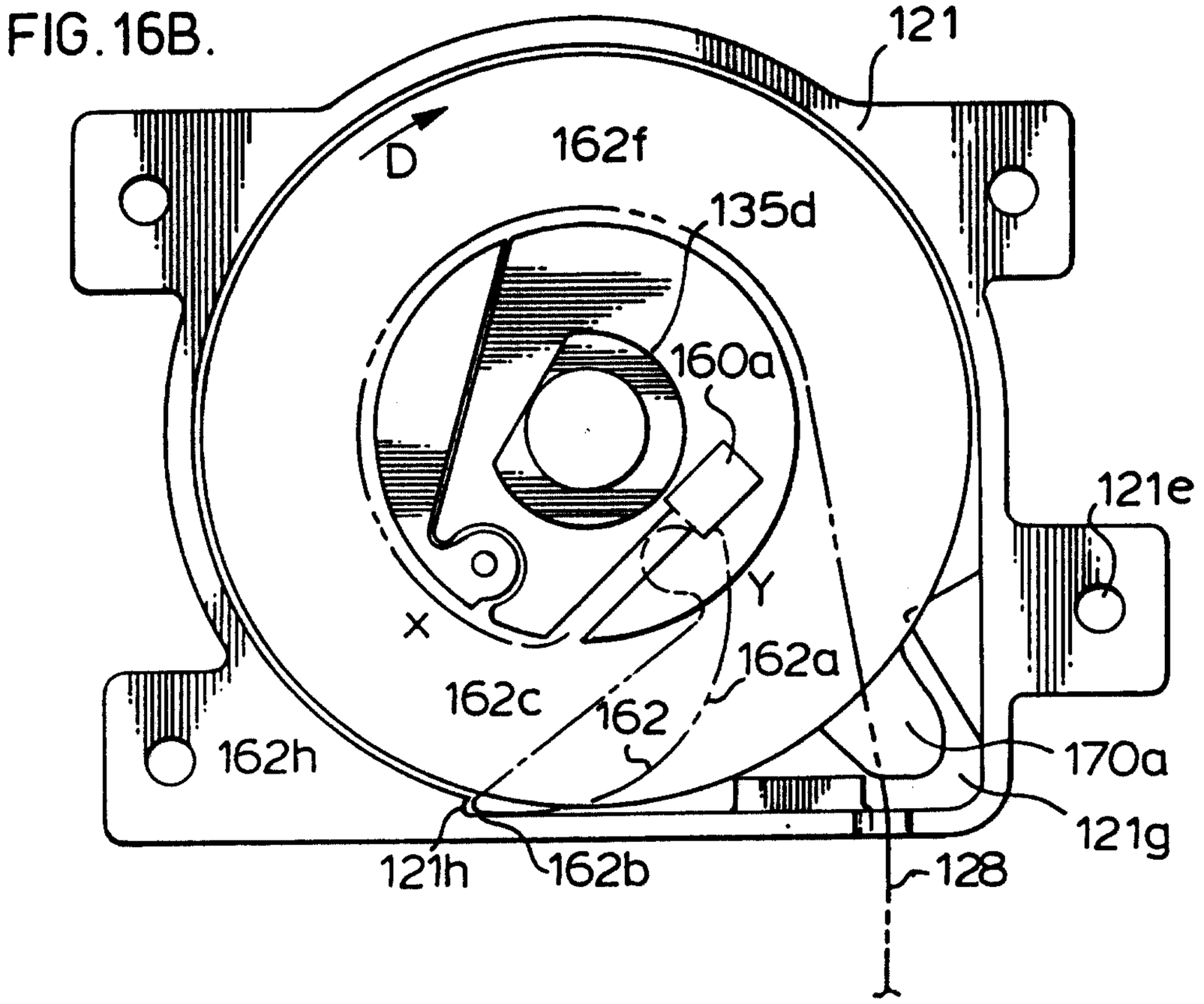


FIG.18.

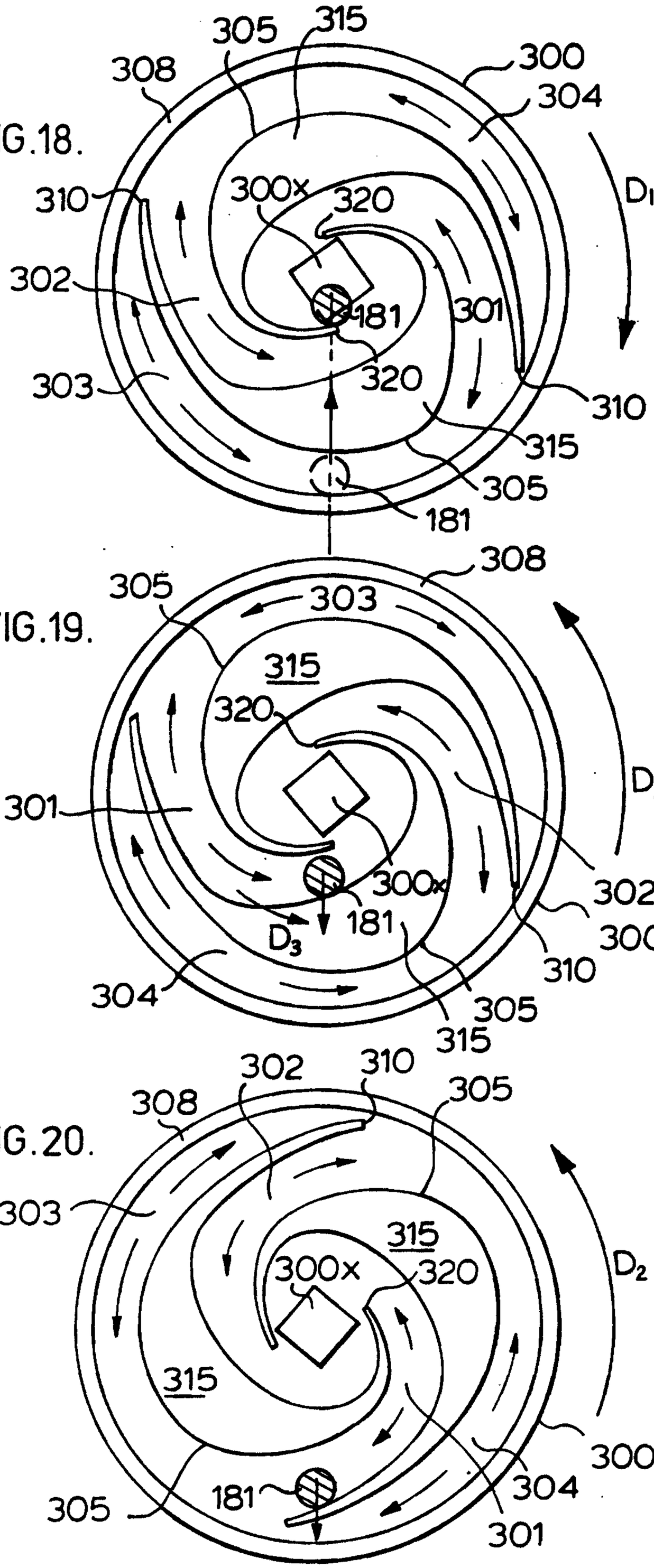


FIG.19.

FIG.20.

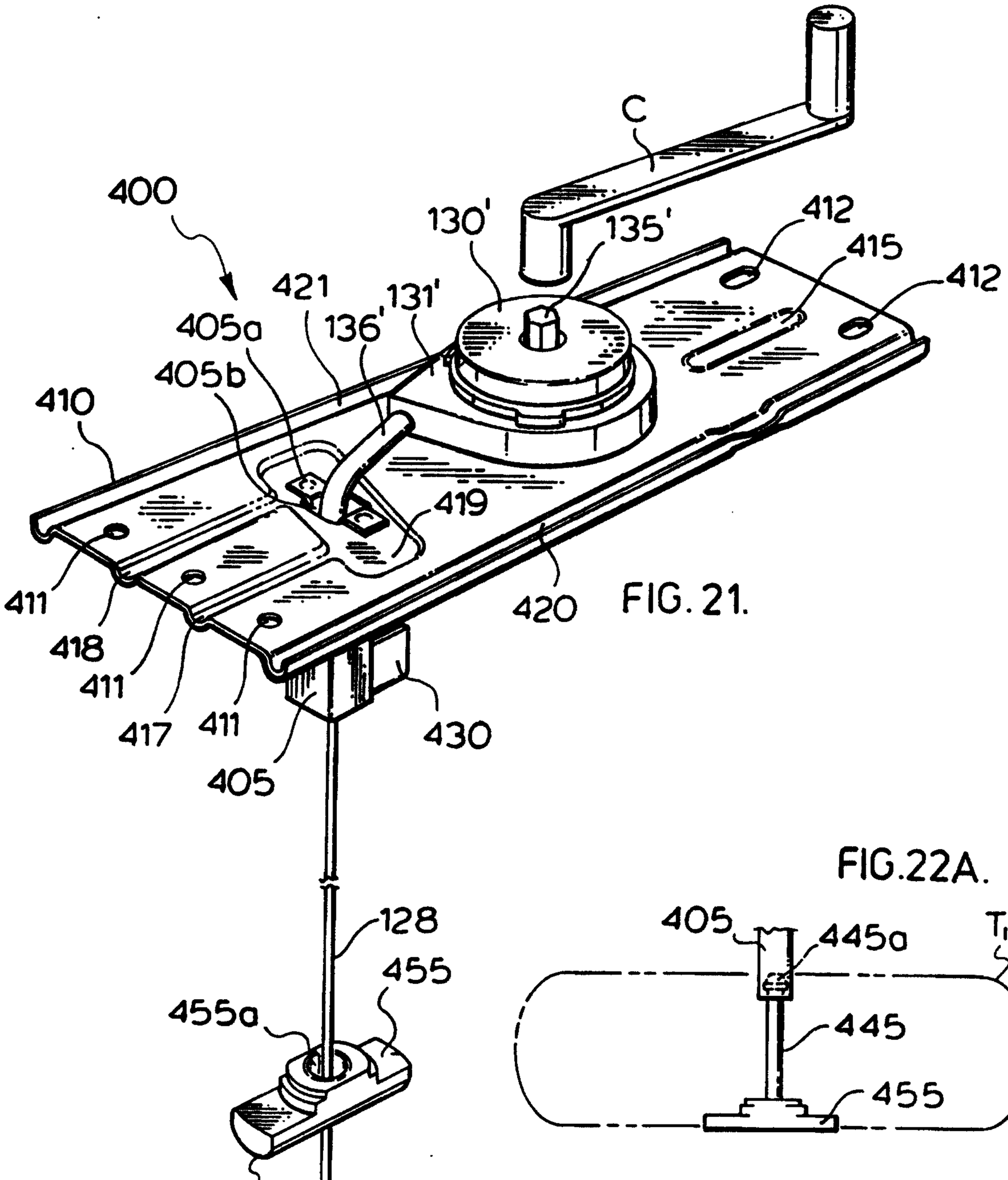
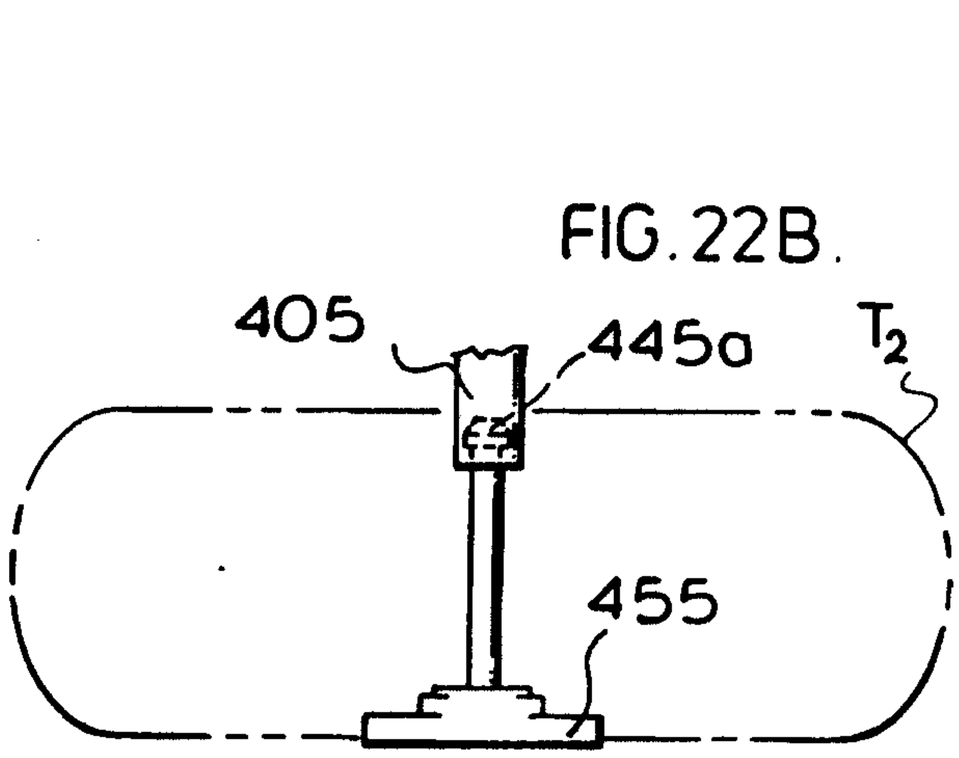


FIG. 21.

FIG. 22A.

FIG. 22B.



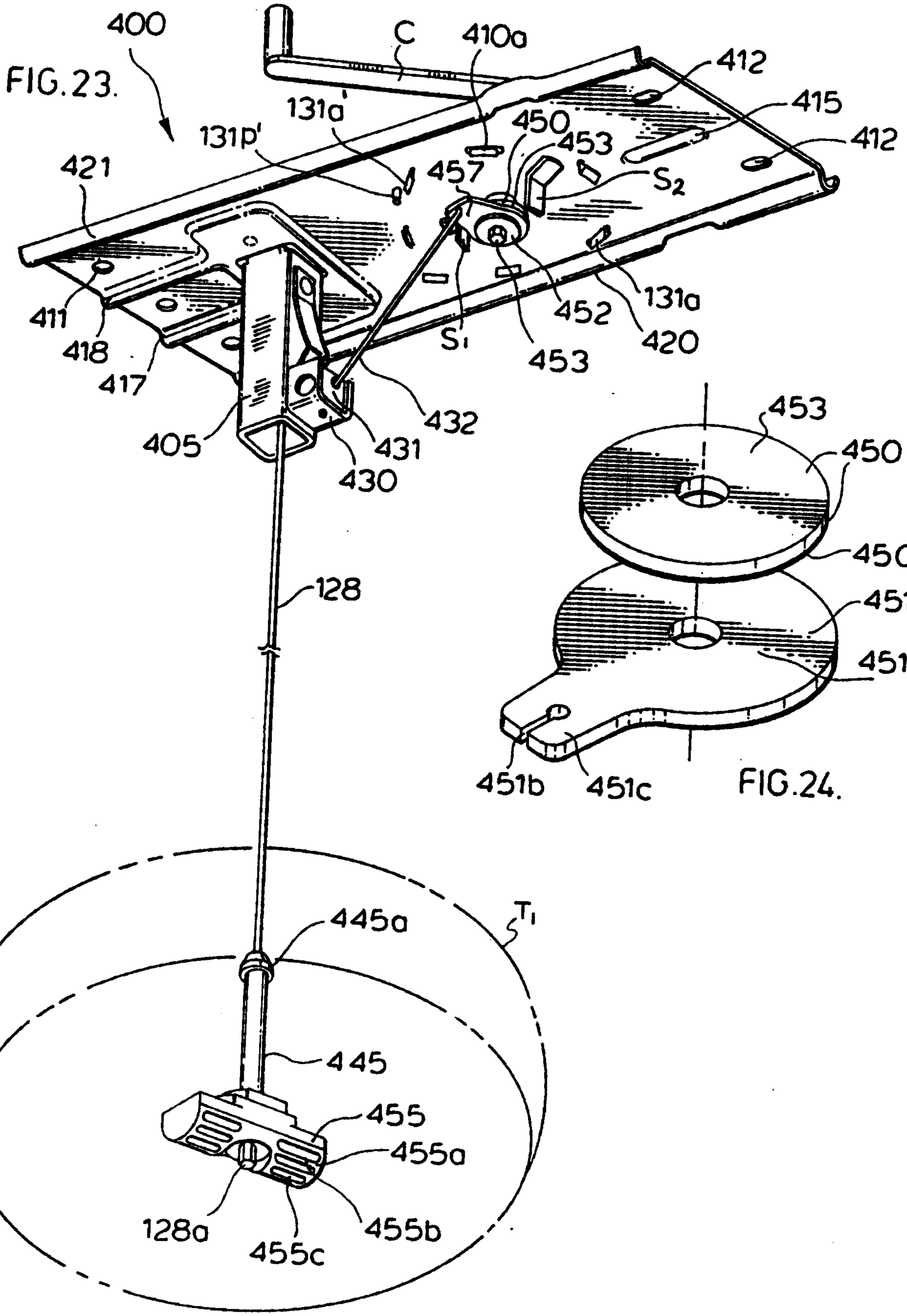

400
C
410a
412
415
131a'
450
453
131p'
457
S_2
421
411
418
417
405
431
432
S_1
452
453
420
131a
430
128
445a
T_1
445
455
455a
455b
455c
128a

FIG.23.

453
450
450a
451
451a
451b
451c

FIG.24.

FIG.25.

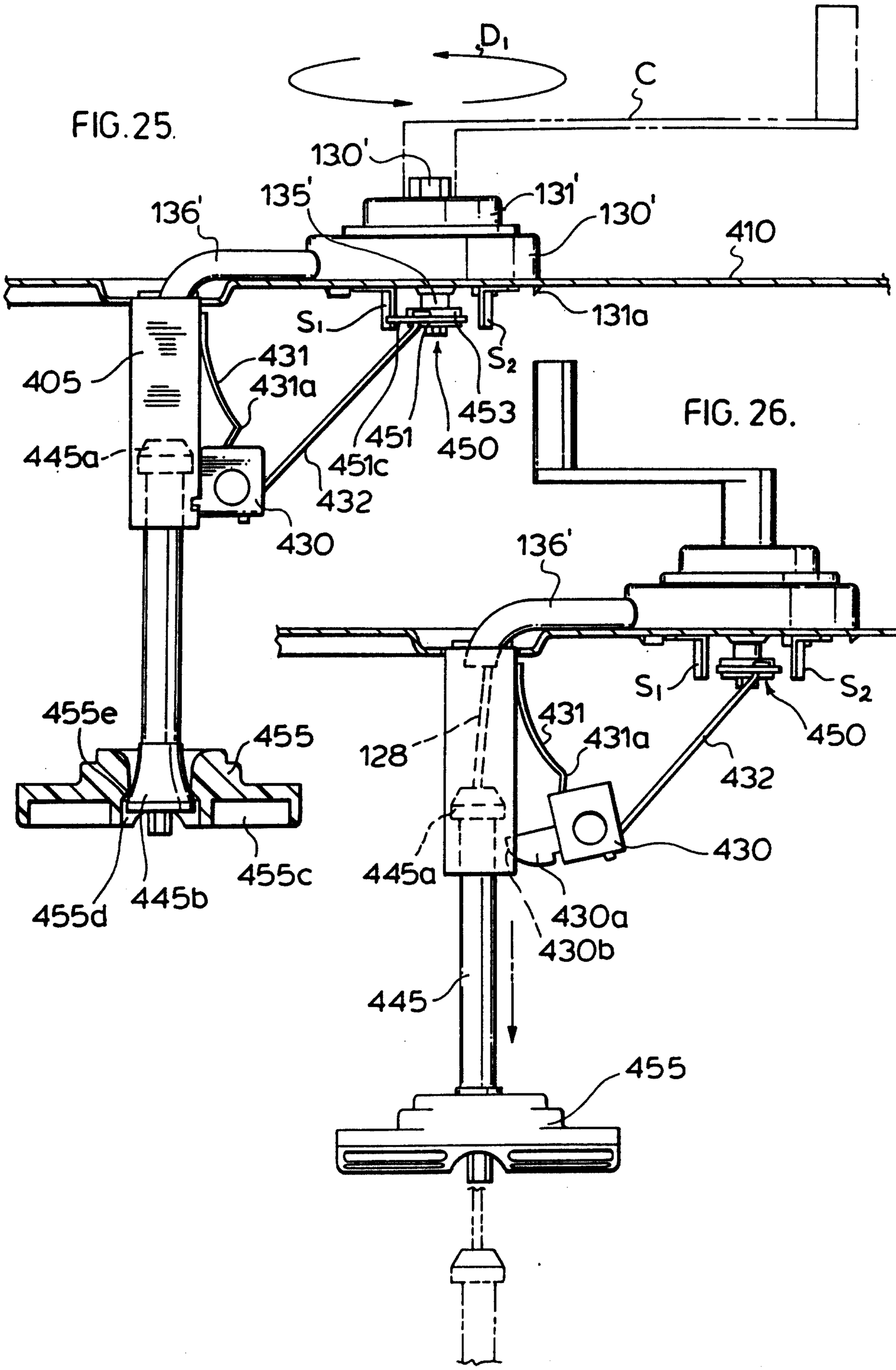

D1
C
130'
135'
131'
130'
136'
410
131a
S1
S2
431
431a
405
445a
453
451
450
451c
432
430
455e
455
128
455c
455d
445b
445
455

FIG. 26.

FIG. 27.

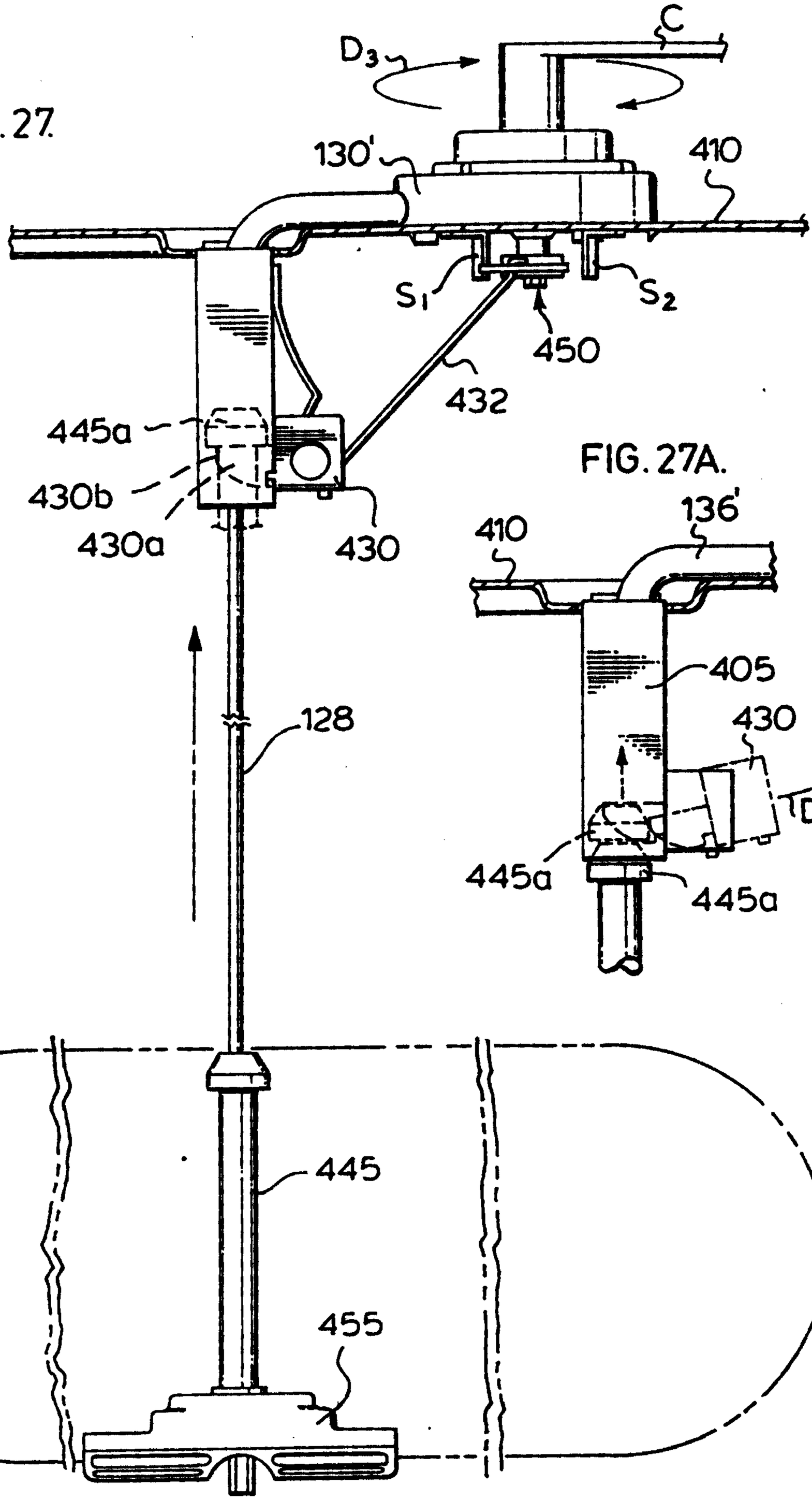


FIG. 27A.

FIG.28.

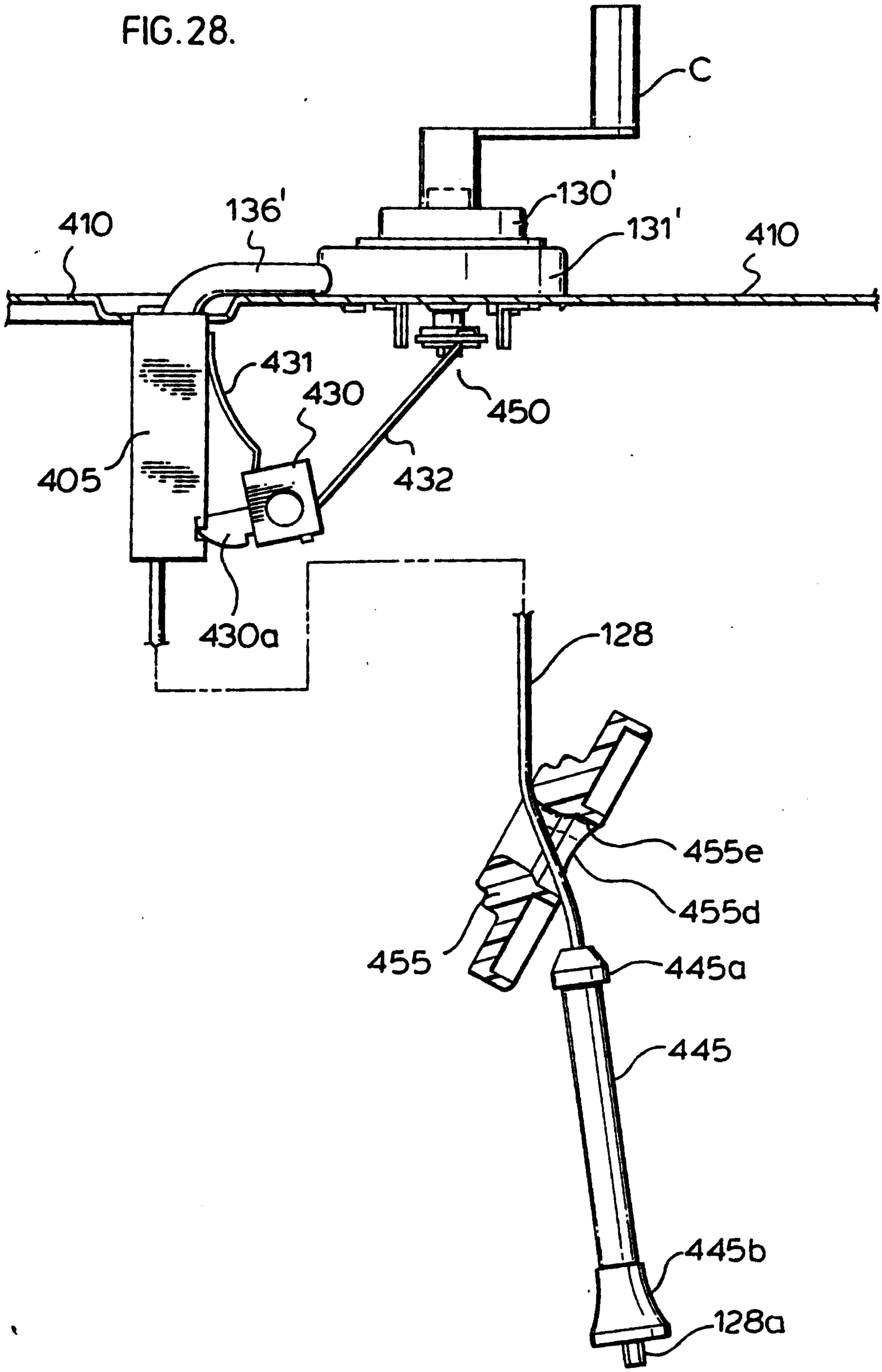

C
130'
131'
136'
410
410
431
430
450
405
432
430a
128
455e
455d
455
445a
445
445b
128a

FIG.29.

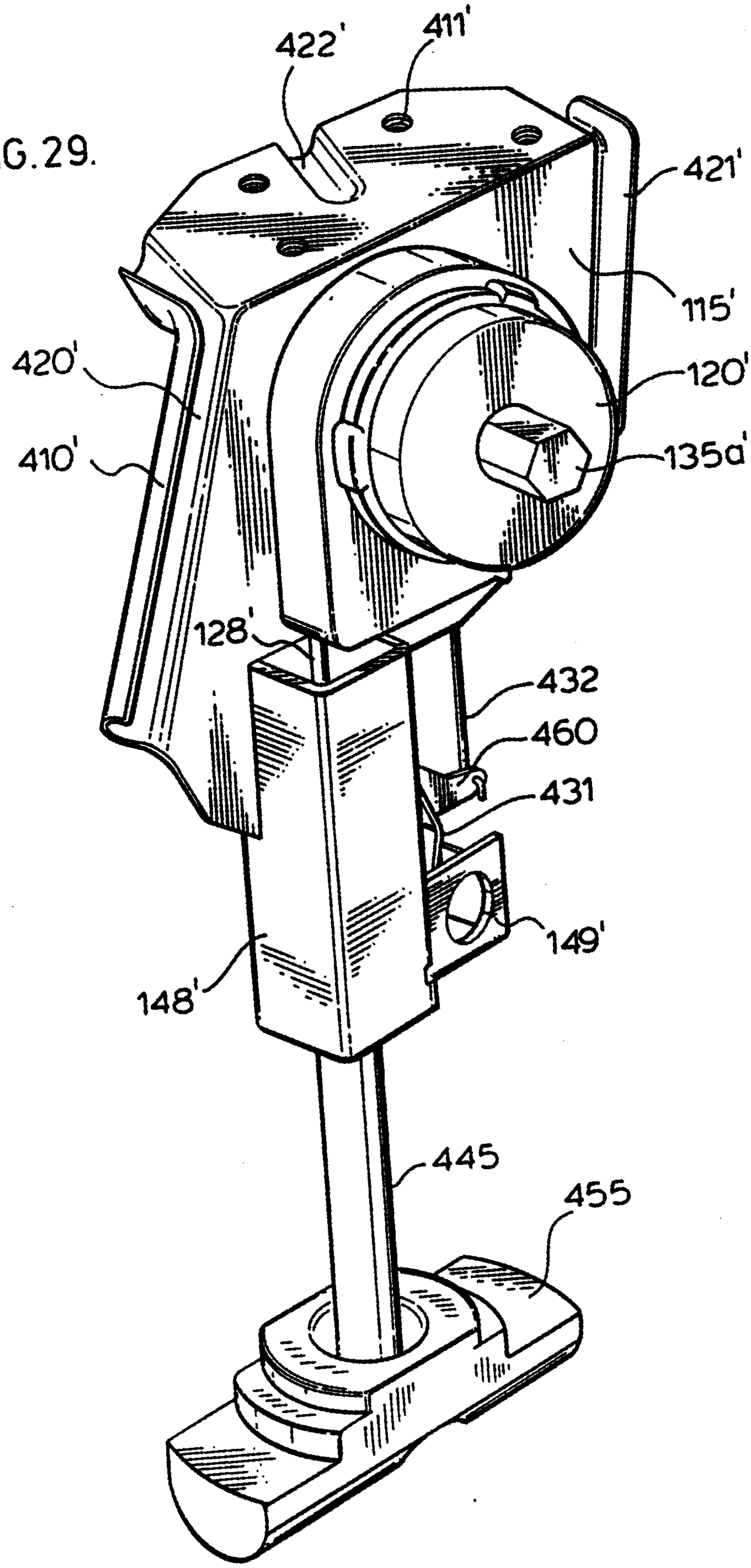


FIG. 30.

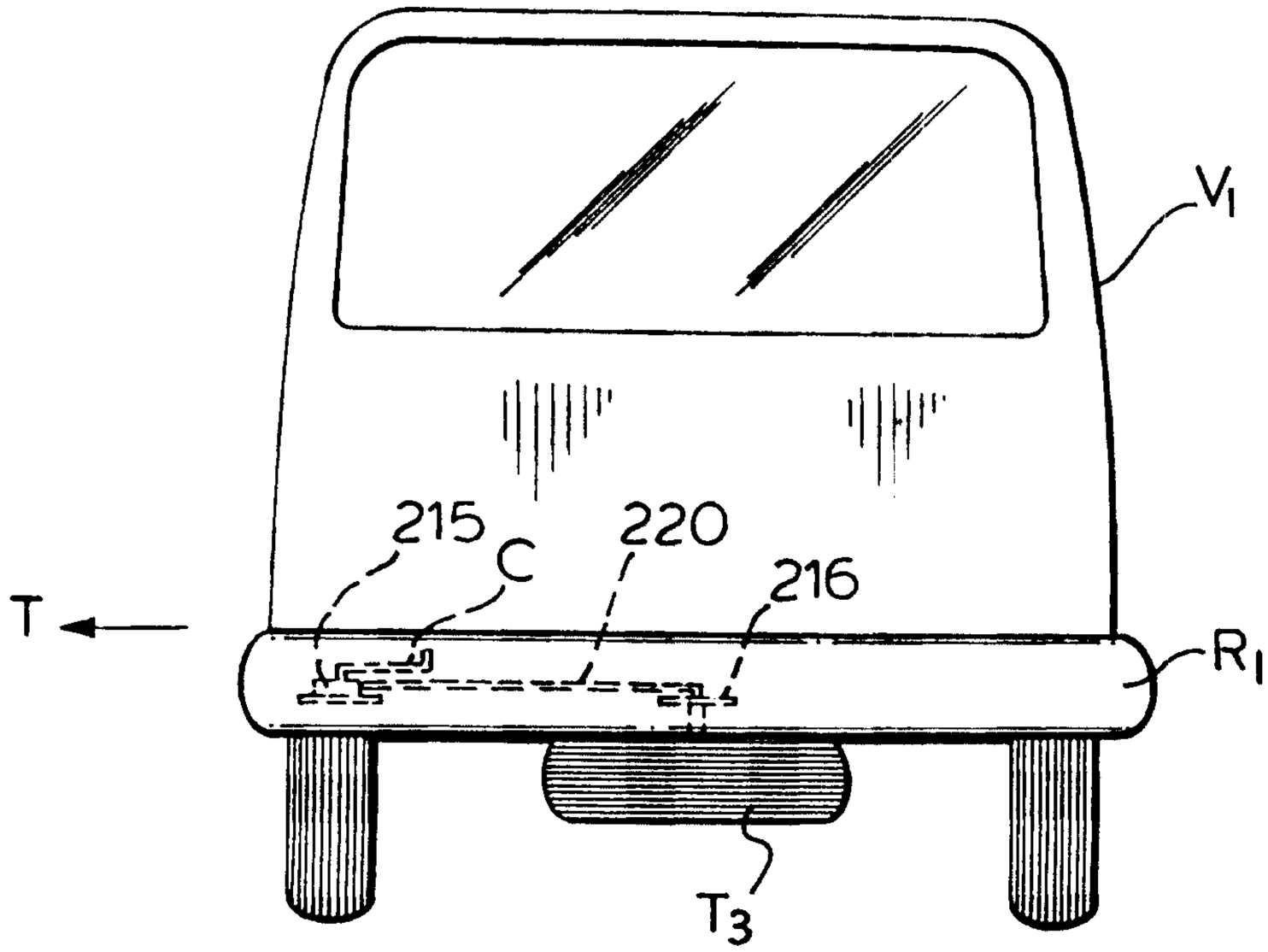


FIG. 31.

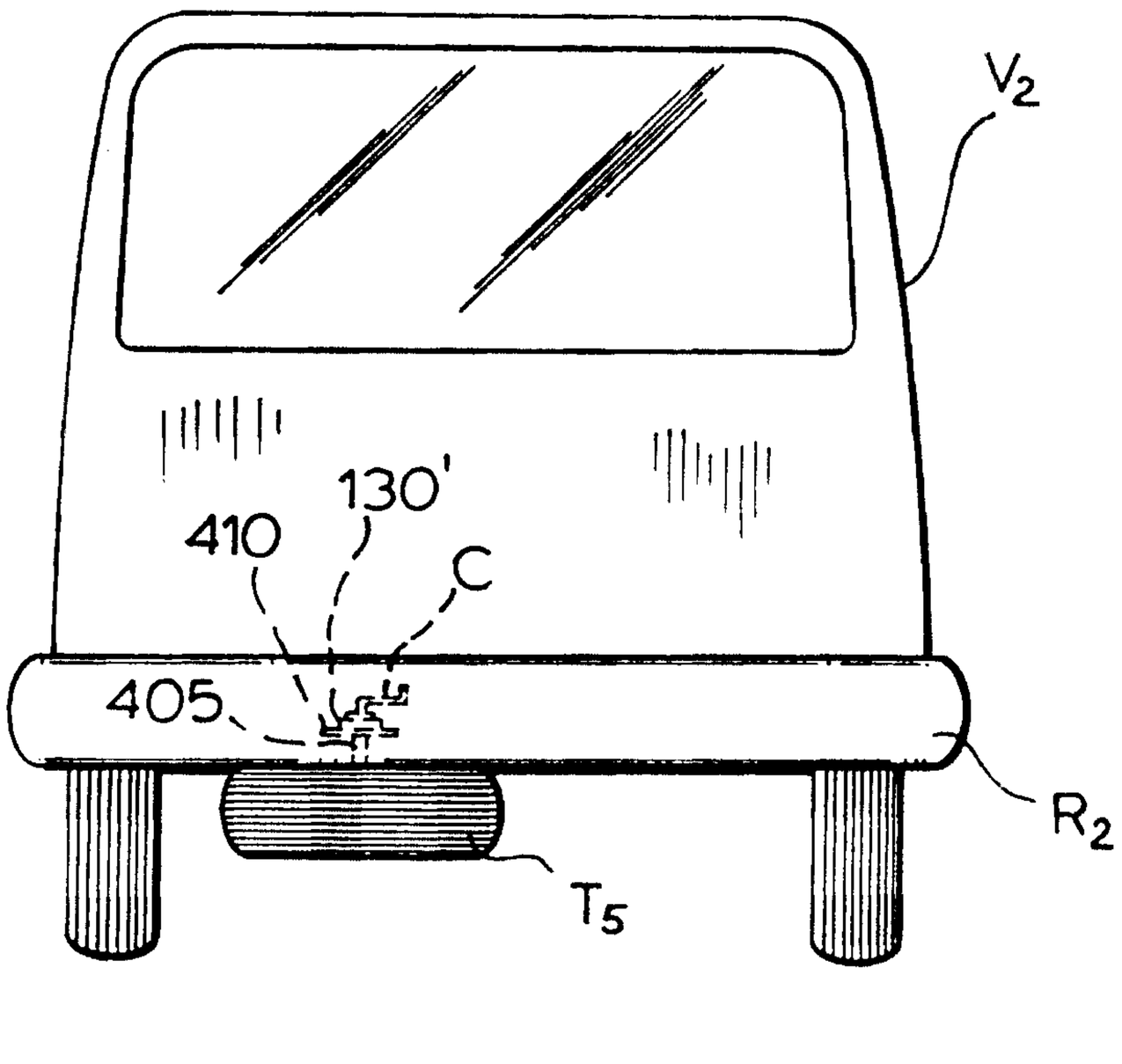


FIG. 32.

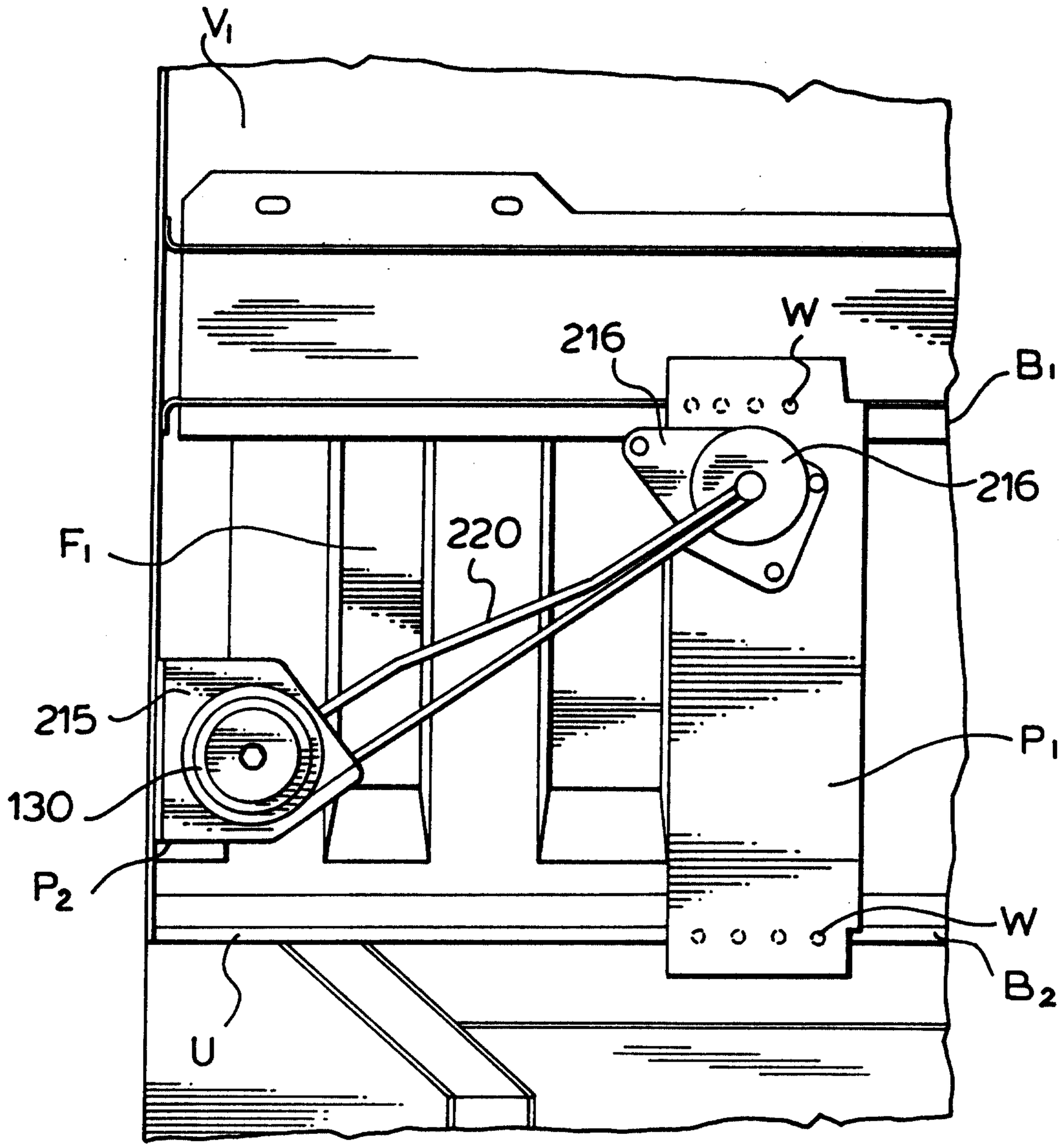
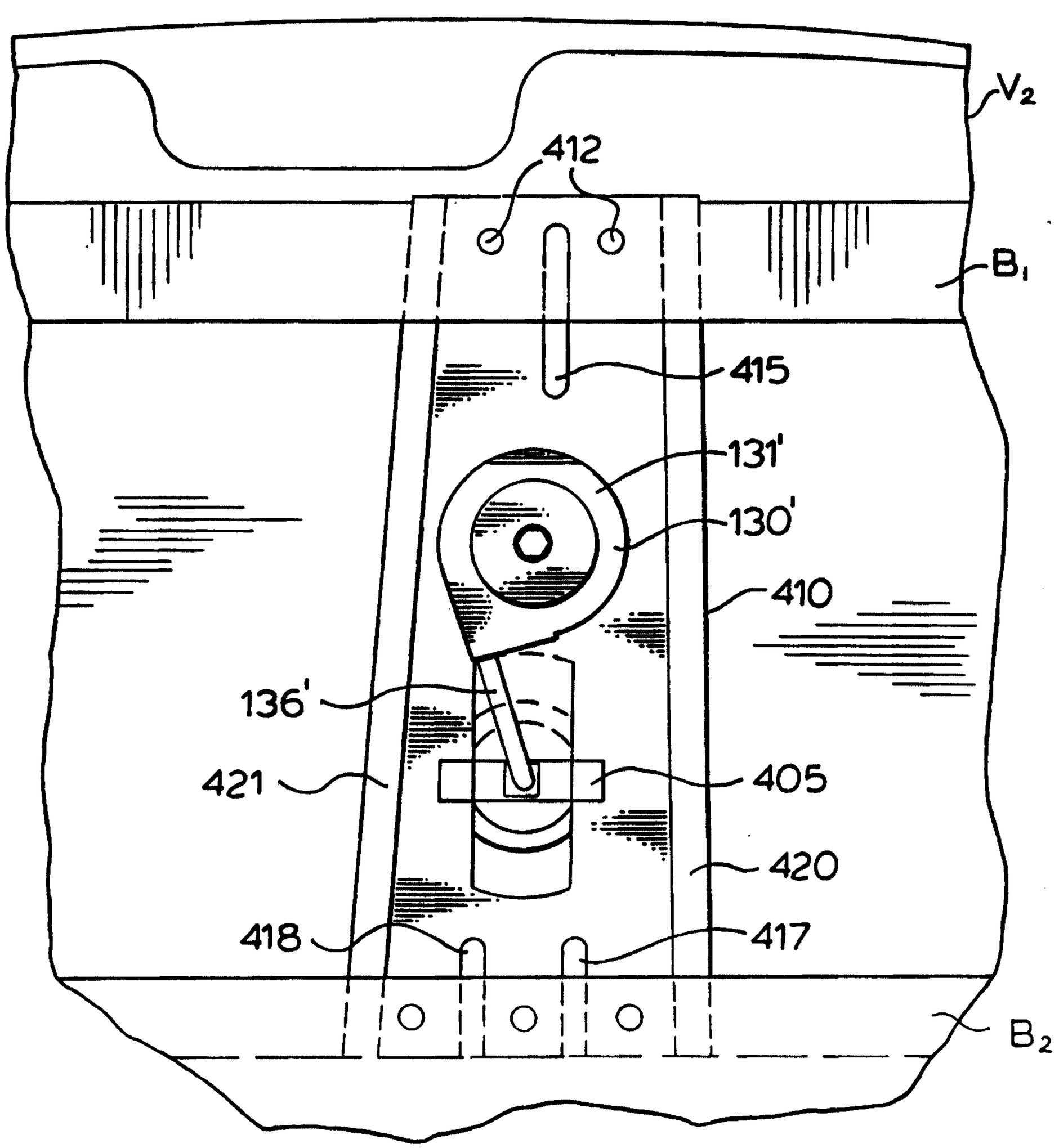
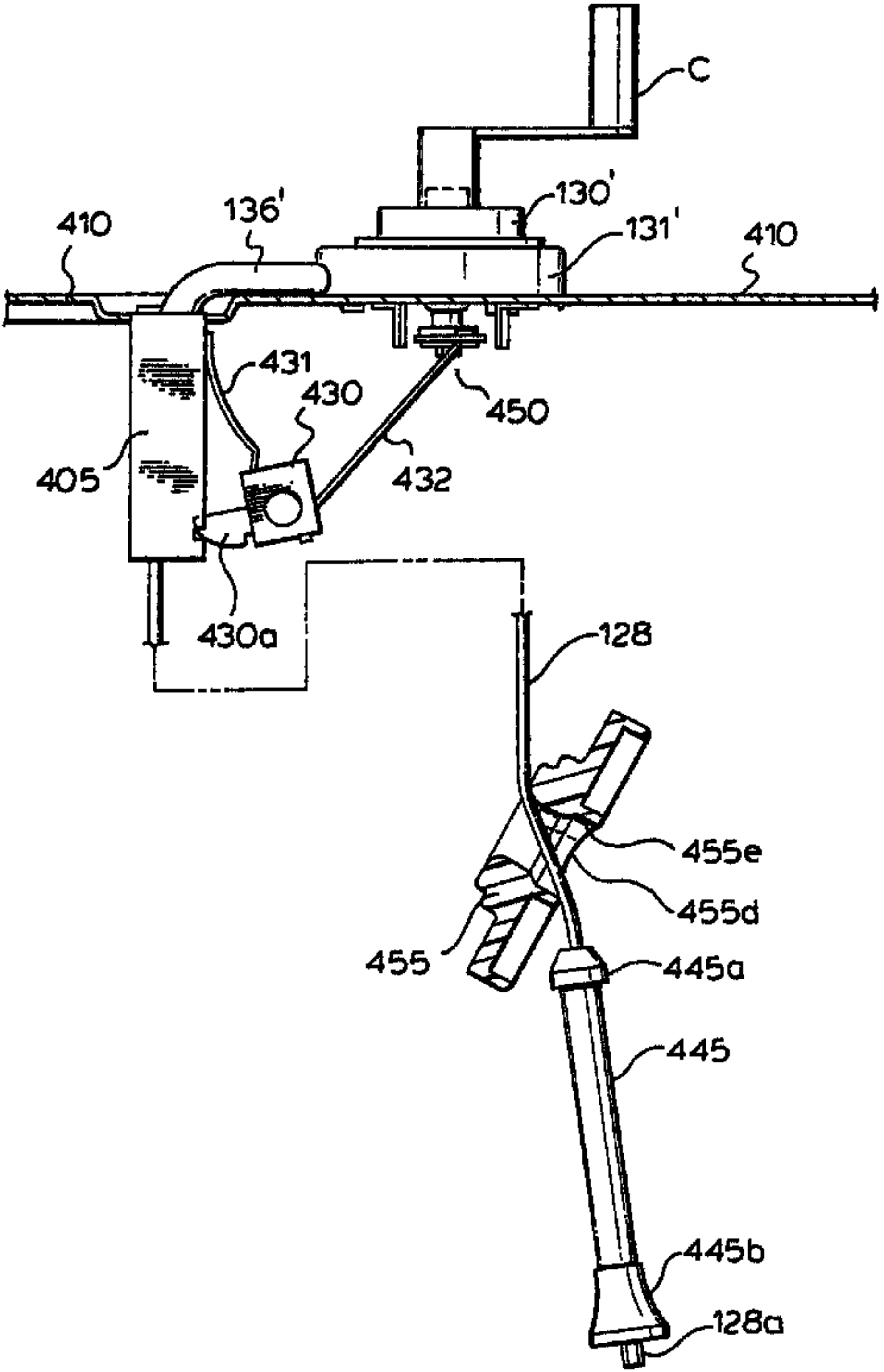


FIG. 33.




C
130'
136'
131'
410
410
431
430
450
405
432
430a
128
455e
455d
455
445a
445
445b
128a