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## (54) Improvements in surgical and/or examination tables.

(57) A hydraulic operating system and controls therefor are disclosed in the environment of a surgical and/or examination table (1) for operating a plurality of cylinder/piston units or rams (14-18) in a coordinated arrangement including a multi-port valve device (60) connected to the units for selecting and controlling pressurization thereof. A rotary piston, hydraulic pump (130) is arranged to supply fluid pressure to the valve device (60) as a unidirectional, non-reversible flow thereby presenting efficient and safe operation to the environment in which it is used. For use with a surgical/examination table (1), a hydraulic foot operated system is disclosed which provides pressure and controls the elevation of the table (1) and which raises and lowers the base (2) for the table (1) while minimizing the prospects of undue rocking when the base (2) is brought to rest upon the floor of use. To add to the efficiency of the table (1), a novel pivotal arrangement is disclosed for an accessory rail system (250-255) which cooperates with the pivotal connections (258-260) for the table top sections (5-7) of the table (1) to provide a continuous unbroken rail surface for the efficient use and movement of medical accessories.

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# IMPROVEMENTS IN SURGICAL AND/OR EXAMINATION TABLES

## CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of application Serial No. 07/260,945 filed October 21, 1988.

## Background of the Invention

This invention relates generally to surgical and/or examination tables and, more particularly to new and significant improvements in such tables by the incorporation of novel subsystems adapted to provide overall improvement and efficiency thereto.

The prior art disclosures of operating tables, accessories therefor, and subsystems utilized to perform specific functions of the table are rather extensive. For the most part, the apparatus disclosed in prior art patents are complicated, highly inefficient, expensive to use as well as to manufacture, and require mechanical mechanisms or hydraulic systems which are not fail-safe with respect to inadvertent mishandling or failure of one or more parts of the mechanism. Some of the apparatus of the prior art require external power sources which render the apparatus inappropriate during power outage or in the field, such as for use with a M.A.S.H. organization.

In the prior art, U.S. Patent No. 4,061,324 discloses a pneumatic system for producing and controlling articulation of a relatively simple patient support table having a main patient support and a headrest. For the manipulation of the single support table, the pneumatic system comprises main valves and air motors arranged in complicated fashion to produce the desired results. While the system is tolerant for small air leakages, it is not conditioned for major leakage and failure for parts of the system.

In U. S. Patent No. 3,241,828 a more conventional operating table is disclosed comprising a plurality of table sections all of which are individually position controlled. However, the complete power and control system therefor for effecting all of the disclosed range of movements of the various table sections are very extensive and complicated. The power and control systems therefor combine complex mechanical and hydraulic subsystems and the utilization of an electric motor as a primary source of power. It is well known that the use of electricity in operating table systems can be dangerous in view of the prospects that sparks and overheating are hazardous when working on a patient during a surgical procedure. In any event, the disclosed operating table system is not a stand-alone system, that is, outside power sources are required.

Another rather elaborate control system for a patient supporting table having three or more table sections is disclosed in U. S. Patent No. 3,977,664. In this disclosure, five slidable spool valve members and associated valve blocks are disclosed in order to accomplish the table section articulation. To compound the complexity and cost, many check valves and lock valves are associated with the hydraulic lines to provide control to these articulations.

U. S. Patent No. 3,896,704 describes an operating table comprising five independently and hydraulically controlled table sections by means of a single valve operating unit. The valve operating unit utilizes a rotatable valve element for selectively operating the desired working cylinder and which is actually movable to effect one or the other of the direction of movement of the piston in the working cylinder. Speed setting is obtained by the positioning of the valve element axially for uncovering the size of passageways in the valve unit. While this valve operating unit is relatively simple, it is highly inefficient both as to the selection of the working cylinder and the setting of the speed of operation thereof. Inadvertent movement of the valve element by the control handle therefor by personnel utilizing the surgical table can affect not only the table section being utilized, but also the speed of movement of its articulation.

Another disclosure of a single, central valve unit is disclosed in Patent No. 4,012,031. The valve unit utilizes pilot operated check valves in the main valve block and thereby operates inefficiently since the reversing of direction of movement of the working cylinders operated thereby is sluggish in response to the manual manipulation of the control handle for the unit.

Other surgical tables which utilize electrical circuitry are disclosed in U. S. Patent Nos. 3,635,461, 4,101,120 and 4,168,099. As previously stated, the use of electrical circuits in the environment of an operating room has the drawback that electrical contacts must be thoroughly enclosed due to the danger of explosion, such precaution being rather expensive. In addition, their use does not safely eliminate the dangers of explosion, but merely to reduce it.

For use with certain accessories, conventional operating tables utilize various methods and de-

vices for permitting the placement of an accessory in the vicinity of the operating table. For this purpose, the operating table disclosed in U. S. Patent No. 3,065,344 utilizes side rails individually mounted on the specific table sections which make up the complete operating table. In the disclosed arrangement, however, the side rails of one table section are not integrated with the side rails of another table section, thereby leaving relatively large spaces between the adjacent ends of the rails when the table sections are arranged in a common plane. This arrangement prohibits the rails from allowing an accessory to be slid thereon from one table section to another without the requirement that the accessory be detached from the rails of one section and reattached to the rails of another section.

While most operating tables utilize a base having some arrangement for permitting the movement of the operating table such as a plurality of caster wheels, there is no provision for preventing the uneven application of hydraulic pressure to each of the caster wheels which prevents uneven or rocking movement of the base which, in turn, may seriously affect the positioning of the patient on the table.

In U. S. Patent No. 4,225,125, a frame is devised to support four caster wheels and a single hydraulic unit needs to be utilized to effect the simultaneous vertical downward movement of the caster wheels. In this arrangement, there is no assurance that all of the caster wheels will be driven evenly into contact with the floor or ground.

With the above-described disadvantages and drawbacks of the conventional examination tables in mind, the primary object of the present invention is to improve surgical operating and/or examination tables by incorporating integrated subsystems which in themselves are improvements over counterpart subsystems of the prior art, and thereby effect a highly efficient table which is easy to operate and maintain and relatively inexpensive to fabricate.

Another object of the invention is to improve a surgical table by incorporating novel subsystems, and to arrange the same in a compact and simple configuration.

Another object of the present invention is to improve a surgical table by the utilization of a fluid control system having a valve control apparatus which is easy to manipulate and provides proper pressure at all times to the working cylinders of the table sections for the operating table.

Still another object of the invention is incorporation of a hydraulic system having provision for stopping and locking the fluid controlled movable devices in the event of leakage or failure of parts.

Another object of the present invention is to improve a control device for a hydraulic system used to drive a plurality of cylinder/piston units by the utilization of a valve device which provides positive pressure at all times during operation of the units.

Another object of the present invention is to improve a hydraulic pump for use with a double acting cylinder/piston unit which is arranged to provide positive unidirectional pressure continuously during operation.

Another object of the present invention is to improve a surgical operating table by utilizing a novel rotary piston pump which is adapted to provide positive and unidirectional pressure to the operating cylinders for the table sections incorporated in the surgical table.

Another object of the present invention is to improve a surgical table by the use of rails on the sides of the table sections therefor wherein the rails are arranged so that when the table sections are oriented in a common plane, the rails provide a continuous and unbroken surface for the movement of accessories utilized with the table.

Still another object of the present invention is to improve surgical operating tables with the use of a novel arrangement of driving means for forcing caster wheels downwardly into contact with the ground upon which the table is supported which will ensure that the table will not rock unevenly during the resultant movement of the wheels.

In order to obviate the disadvantages and drawbacks pointed out in the foregoing, the present invention was devised with novel design features which are not only improvements to specific subsystems of a surgical table, but also are integrated in such a way as to produce a table having the capability for performing to the highest degree of efficiency without sacrificing simplicity or ease of operation.

The above described objects and other objects which will be made apparent hereinafter, are achieved by a significantly improved, hydraulically operated surgical and/or examination table having novel and simplified subsystems integrally related into a modular, highly efficient system for the utilization by medical technicians. The surgical/examination table includes a simplified control system for selectively articulating the cylinder/piston units for each of the table sections. This control system includes a novel valve apparatus comprising a rotatable valve element which provides a single hand control for all table functions. Fluid under pressure is directed to the valve apparatus from a novel rotary piston pump which is formed with passageways and check valves arranged to provide unidirectional constant pressure fluid to the valve apparatus. The valve apparatus and rotary pump work in conjunction with integral

check valves associated with the cylinders for the cylinder/piston units thereby assuring more responsive and accurate actuation of the table sections. Each of the table sections is provided with rails on both sides with each of the rails being pivotally mounted with a novel pivot arrangement, whereby for any positioning of a table section relative to another, full extent of its pivotal range is achieved without obstruction. The present invention also contemplates the use of a control arrangement for pressurizing the cylinder/piston units associated with caster wheels utilized to permit the movement of the table on the floor of an operating room. The control arrangement is devised to release the pressurization of the units whereby in the event a patient shifts weight on the table, the event will occur without unevenly rocking the table and causing discomfort to a patient supported thereon, thereby improving the overall efficiency of the table.

The invention will be better understood from the following detailed description when read in conjunction with the accompanying drawings, wherein:

## Brief Description of the Drawings

Figure 1 is a perspective view of a surgicall and/or examination table in which the present invention is utilized;

Figures 2 and 2a are plan and elevational views of the table top;

Figure 3 is a schematic view of the hydraulic system for the articulation of table sections;

Figures 4, 5, 6 and 7 are cross-sectional views of the table taken along lines 4-4, 5-5, 6-6 and 7-7 in Figure 1;

Figure 8 is a partial elevational view, of one end of a frame section for the table of Figure 1 showing the selector control device utilized with the invention;

Figure 9 is a cross-sectional view of the selector control valve taken along lines 9-9 in Figure 8;

Figure 10 is a cross-sectional view of the selector valve of Figure 9 taken along lines 10-10 in Figure 9;

Figure 11 is a schematic illustration of the hydraulic system for the selector valve and the cylinder/piston units controlled thereby;

Figure 12 is an elevational view of the dial used with the control valve of Figure 9;

Figure 13 is a cross-sectional view of the rotary piston pump taken along lines 13-13 of Figure 8 utilized in the present invention;

Figures 14, 15, and 16 are cross-sectional views of the pump of Figure 13 taken along lines 14-14, 15-15 and 16-16, respectively;

Figure 17 is a schematic illustration of the hudraulic system for the elevation of the table top in the present invention and the caster wheel control therefor;

Figure 18 is an elevational fragmentary view of one end of the table base showing the control foot pedals and pump used therewith;

Figure 19 is a plan view of the end of the table base shown in Figure 18;

Figure 20 is a partial fragmentary view of one corner of the base showing a caster wheel and associated structure;

Figure 21 is a plan view of the corner of the base shown in Figure 20; and

Figure 22 is a partial view of a pivotal connection between side rails for the table sections used in the table of the present invention.

## Description of a Preferred Embodiment

Referring now to the drawings in greater detail, a preferred embodiment of the surgical and/or examination table is shown in Figure 1. The table 1 includes a generally rectangular mobile base 2 on which a telescoping pedestal 3 is mounted. A patient supporting table 4 is connected to the uppermost end of the pedestal by an arrangement which permits longitudinal and lateral pivoting movement of the table relative to the base. The tabletop 4 is made up of a back section 5, a seat section 6, and a leg section 7. While not shown since it does not form a part of the invention, a head table section may be detachably applied to the outer end of the shoulder section 5.

As in conventional surgical tables, the table sections 5, 6 and 7, which make up the table top 4, are movable relative to each other so that portions of a patient's body can be held in different positions depending upon the operation or examination to be performed. Therefore, as seen in Figures 1, 2, and 2a the back section 5 is pivotally fastened by means of clevis pivot joints 8 on both sides thereof to the adjacent end of the seat section 6. Similarly, the leg section 7 is pivotally fastened by means of a clevis pivot 9 on both sides thereof secured to the adjacent edge of the seat section 6.

While the patient support sections 5, 6 and 7 (comprising table top 4) have been respectively indicated as the back, seat and leg sections for each and conventionality of designation, it will be appreciated that such sections may support other portions of a patient's anatomy. The table top 4 is supported on the pedestal 3 by a frame 10 having a cover 11 surrounding the same for enclosing some of the mechanisms supported on the frame. The frame is pivotally secured to the top member

12 of the pedestal to be movable therewith during extension and contraction of the pedestal to lower and raise the table to its various working positions. Further description of this pivotal support will be described below.

The pivotally interconnected table sections 5, 6 and 7 are selectively articulated about the respective interconnecting pivots 8 and 9 by a subsystem involving the actuation of hydraulic double-acting cylinder/piston rams or units 14, 15 and 16, respectively, secured on the frame 10. In addition, as part of the subsystem, the entire table top 4 may be laterally tilted along an axis parallel to its longitudinal axis by the actuation of a hydraulic cylinder/piston ram or unit 17, and rotated about a transverse axis for Trendelenburg and reverse Trendelenburg motion by a cylinder/piston ram or unit 18. The double-acting units 17, 18 are also secured on the frame 10.

As shown in Figures 3-7, the frame 10 for supporting the table top 4 comprises frame members 20, 21 suitably connected in parallel spaced relationship, as shown in Figure 5, by interconnecting struts (not shown). The top end of the upper pedestal section 12 is closed off by a plate 22 secured thereto. Depending downwardly from the plate 22 is a plate 23 formed with a central opening 24 through which a horizontally oriented pivot shaft 25 is supported for rotation arranged to support a pivotal yoke 26. Short stub shafts 27 extend outwardly from each of the arms 28 of the yoke 26 and are positioned in axial alignment. The pivot shafts 27 project through suitable openings formed in the frame members 20, 21 and are locked from axial displacement by suitable nuts fastened to cooperating threads formed on the ends of the shafts.

Lateral tilting of the frame 10 is thereby effected by the pivotal rotation of the pivotal yoke 26 about the axis of the pivot shaft 25. This lateral tilting motion of the frame 10 is transmitted to the table 1 to produce tilting thereof by means of pivotal connections to the underside of the seat section 6 of the table top. As shown in Figures 4 and 5, ears 29 depend from the lower surface of the seat section 6 on both sides thereof, the ears being pivotally connected to the frame members 20, 21 by suitable pivots 30.

Rocking movement of the pivotal yoke 26 is provided by the cylinder/piston unit 17 having its cylinder connected to a depending arm 31 fixed to the pedestal section 12 and its piston rod pivotally connected to a depending arm 32 integral with the yoke arm 28. Upon fluid actuation of the unit 17 to produce movement of the piston thereon in either direction produces corresponding pivotal movement of the yoke 26 about the axis defined by the pivot shaft 25. In this manner, actuation of the unit 17 produces tilting movement in either direction of the frame 10 thereby producing correspondingly tilting of the table 1 about an axis parallel to its longitudinal axis.

The table 1 is also capable of pivoting motion about a transverse axis commonly known as the Trendelenburg movement, and is accomplished about an axis defined by the stub shafts 27. As previously stated, the main frame 10 is pivotally supported on the shafts 27. Such rotation in either direction to effect Trendelenburg and reverse Trendelenburg motions is effected by the cylinder/piston unit 18 which has its cylinder rotatively anchored to the frame member 21 and its piston rod 33 pivotally connected to a rocker arm 34 non-rotatively secured to an adjacent end of the shaft 27. Upon actuation of the unit 18 in either direction, the fixed rocker arm 34 will induce pivoting motion to the table 1 in either direction about the shaft 27 by way of the intermediary structure in the form of the main frame 10.

As is shown in Figures 3 and 4, articulation in either direction of the back section 5 is produced by the cylinder/piston unit 14 having its cylinder pivotally connected to the frame member 20 and its piston rod 35 pivotally connected to a link 36 non-rotatively mounted on a shaft 36a. Shaft 36a has its ends pivotally mounted in frame members 20 and 21. A pair of link assemblies 37-38 is provided. One end of link 37 of each pair is pivotally attached to one end of link 38 of the same pair. The free ends of links 37 are fixed to shaft 36a. The free ends of links 38 and pivotally connected to brackets 38a on the underside of back section 5. Actuation of the unit 14 in either direction produces corresponding rotation of the link 36 and articulation of link assemblies 37-38 thereby imparting rotation of the section 5 about the pivot 8.

As shown in Figures 3 and 6, articulation of the leg section 7 relative to the seat section 6 is induced by the piston/cylinder unit 16 and a rack and pinion device. The unit 16 is rigidly connected to the undersurface of the seat section 6 and has its piston rod 40 terminating in a gear rack 41 arranged to drive a first pinion gear 42 and a second pinion gear 43 in mesh therewith. The pinion gear 43 is fixed to a shaft 43a pivotally mounted in the housing 39 for the unit 16, a pair of link assemblies 44-45 is non-rotatively affixed to either end of shaft 43a. The free end of each link assembly is pivotally attached to one end of link 46. The free ends of links 46 are pivotally attached to brackets 46a on the underside of leg section 7. As a result, actuation of the unit 16 in either direction produces rotating movement of the section 7 about the pivot 9 in either the up or the down direction.

As in conventional surgical tables, the table 1

is also capable of flex and reflex articulation, that is, rotation of both of the table sections, back section 5 and seat section 6 relative to the pivots 8. In order to accomplish this motion, the cylinder/piston unit 15 is arranged to impart pivotal motion in either direction about pivots 30. Pursuant to achieving this movement, the lower surface of the seat section 6 has a rocker arm 51 secured thereto. The rocker arm 51 is pivotally connected to the piston rod 52 for the unit 15 which has its cylinder pivotally connected to the frame member 21. The actuation of the cylinder/piston unit 15 in either direction, produces corresponding pivotal movement of the seat section 6 and the head section 5 about pivot pin 8.

Selective actuation and control of the cylinder/piston units 14, 15, 16, 17 and 18 is under full and complete control by a subsystem including a selector valve device 60 mounted at one end of the main frame 10 adjacent the head section of the table 1 in easy reach for manipulation by the anesthetist or any other person in charge of the use of the table. The valve device 60 includes a valve block 61 having a cylindrical chamber 62 formed therein and a rotatable valve member 63 mounted within the chamber 62 being rotatable in either direction relative to the block 61. As shown in Figure 9, the valve member 63 is formed with a circumferential groove 64 which is in continuous communication with a passageway 65 formed in the block 61 and terminating in an input port 66 for the introduction of fluid under pressure to the valve device 60. A pair of 0-rings 67 are retained in suitable grooves formed in the block 61 on either side of the groove 64 for isolating the same against leakage.

The circumferential groove 64 is in continuous communication with a passageway 68 extending along the length of the valve member 63 spaced from and parallel to the longitudinal axis thereof. This passageway is connected to a passageway 69 projecting radially within the member 63 and adapted to be selectively positioned upon rotation of the valve member 63 in communication with one of a plurality of radiating passageways 70, 71, 72, 73, 74, 75, 76, 77, 78 and 79. Each of the passageways terminate respectively in output ports 80, 81, 82, 83, 84, 85, 86, 87, 88, and 89 circumferentially arranged around the valve block 61 in a common plane. As shown in Figure 10, the passageways 70-79 are radially oriented relative to the longitudinal axis of the valve block 61 and valve member 63. There are ten such passageways and each is 36° oriented relative to the adjacent passageways.

Each of the five working cylinder/piston units 14, 15, 16, 17 and 18 have two valve ports associated therewith, the valve ports being adjacent one another in this relationship. For example, the valve ports 80, 81 are connected by tubing 90, 91 to either side of the piston for the unit 18. Similarly, tubing 92, 93 connect the valve ports 82, 83, respectively to both sides of the piston for the unit 16. The tilt unit 17 is connected by tubing 94, 95 to the ports 84, 85, the back or shoulder unit 14 is connected by tubing 96, 97 to the valve ports 86, 87, and the flex unit 15 is connected by tubing 98, 99 to the valve ports 88, 89.

The valve element 63 is also formed with radial passageways 101, 102 which together with the passageway 69 lie in a common plane. The radial angular relationship between the passageways 101 and 102 is 72° thereby being adapted to connect to two of the passageways 70-79 with the passageway 69 therebetween, as shown in Figure 10. Both passageways 101, 102 are in communication with the passageway 103 formed axially of the valve member 63 which is in communication with a vent port 104 connected by tubing 105 to a fluid reservoir, which will be described hereinafter.

Each of the cylinder/piston units 15, 16, 17, 14, and 18 has associated therewith pairs of pilot operated check valves 106, 107, 108, 109 and 110, respectively within the structure of the cylinder associated therewith. The check valves are oppositely acting and each must be pressurized to open, thereby providing the arrangement wherein the respective piston is adapted for action in either direction by pressure introduced on either side of the pistons and allowing the other side of the piston not being pressurized to vent back into the valve device 60, as will be described below.

The operative end shaft for the valve member 63 projects exteriorly of the cover 11 for the main frame 10 terminating in a manually operable knob 115 to which is secured a dial 116 having imprinted thereon the various table top articulations for the table for which the valve device 60 is capable of controlling. As shown in Figure 12, the dial 116 is imprinted with the various actions of articulation which the operator is able to set and achieve by virtue of cylinder/piston units 14, 15, 16, 17 and 18.

As previously indicated, each of the cylinder/piston units 14, 15, 16, 17 and 18 are associated with adjacent valve output ports: 80, 81 for the unit 18, 82, 83 for the unit 16, 84, 85 for the unit 17, 86, 87 for the unit 14, and 88, 89 for the unit 15. For example, the Trendelenburg motion producing unit 18 is connected to the adjacent valve ports 80, 81 and as shown in Figure 12, the legends "R. Tren" and "Tren" are indicative of this connection and are utilized to effect action of the piston for the unit 18 in either direction, respectively. The parts of the valve shown in Figure 9 are arranged for actuating the Trendelenburg unit 18. In this arrangement, the pressure passageway 69 provides fluid to the outlet port 80 and therefore to

the left side of the piston for the unit 18 by way of the conduit 90. This pressure is allowed to act upon the piston for its movement to the right by means of the pair of check valves 110, one of which being pressurized to open and permit the pressurization of the cylinder on that side of the piston. Venting of the portion of the cylinder to the right of the piston is vented through the tubing 91 by way of the other check valve of the pair 110 by virtue of its being pressurized by conduit 90. The vented fluid through the tubing 91 is returned to the valve 60 by way of the passageways 71, 101, and 103 to the vent port 104 and eventually by way of the tubing 105 to a fluid reservoir 120.

It will be noted that the passageway 102 is also connected to the vent tubing 105 and by way of the tubing 99 to the unit 15. However, since the piston for the unit 15 is not being actuated, neither of the oppositely acting pilot operated check valves 106 is pressurized to open. In order to reverse the actuation of the Trendelenburg unit 18, that is, moving the piston to the left by pressurizing the back side of the same, the knob 115 is manipulated to the left 36° to bring the pressure passageway 69 into communication with the passageway 71. This action provides pressure to the output port 81 for pressurizing the back side of the piston for the unit 18 by way of the tubing 91. Since the other of the check valves 110 associated with the cylinder chamber to the left of the piston is now pressurized to open, the pressure effective upon the back side of the piston drives the same to the left allowing the left chamber to vent, and thereby effect reverse Trendelenburg motion to the table top 4.

This action is permissible since the portion of the cylinder 18 to the left of the piston therein is vented by virtue of the pressure within conduit 91 to open the other of the check valves 110 to permit the venting of fluid through the tubing 90 and into the passageway 70, through the passageway 102 and into the vent line 105 and back to the reservoir 120. This rotation of the knob 115 also moves the passageway 101 into communication with the passageway 77 and the valve output port 82 to connect the conduit 92 to the portion of the cylinder to the left of the piston in the unit 16. Since neither of the check valves of the pair 107 is pressurized, no flow of fluid is produced in the tubing 92.

Each of the other cylinder piston units 17, 14 and 15 is actuated in either direction upon continued rotation of the knob 15 to the left as viewed in Figures 11 and 12 similarly to the operation discussed above relative to the units 18 and 16. Each of these actuations require the placement of the pressure passageway 69 in communication with the corresponding passageway 72, 73, 74, 75, 76, 77, 78, and 79. The rotation of the valve element 62 to effect this placement of the pressure passageway 69 places one of the vent passageways 101 and 102 into communication with the other side of the respective piston to permit the venting of that side of the piston for that particular unit back into the reservoir 120. This rotation of the valve member 62 also places the other of the vent passageways 101 and 102 into communication with an adjacent piston cylinder unit.

The knob 115 and the dial 116 are held in their selected position by the operator by a detent mechanism comprising a spring biased ball 121 retained within an opening 122 formed in the valve block 61 and urged inwardly axially by a spring. The ball 121 cooperates with a series of recesses 123 formed in the outer circumferential surface of the valve member 63 and arranged so that there is one recess for each of the ten positions indicated on the dial 116 as indicative of the ten actions of articulations available from the cylinder/piston units. As the knob 115 is rotated 36° from one operating position to another, the ball 121 is forced into the appropriate recess 123 to hold the knob and dial releasably in that operating orientation.

Fluid under pressure is continuously supplied to the input valve port 66 from a subsystem including a unidirectional constant pressure rotary piston pump 130 by way tubing 131. The pump 130 includes a pump housing 132 having a parallelepiped configuration and formed with an inner cylindrical chamber 133 into which is mounted for rotation therein a pump shaft 134 surrounded by ball bearing races 135 which serve to maintain the radial position of the pump shaft. Suitable lock rings 136, 137 maintain axial orientation of the shaft.

The inner end of the pump shaft 134 supports a cam roller 138 rotatably mounted on a pin 139 which is eccentrically retained by the shaft 134 by any suitable means such as screw threads. The cam roller 138 is adapted to be eccentrically rotated within a chamber 140 arranged coaxial with the chamber 133 but of slightly reduced diameter relative thereto.

The pump housing is formed with four radiating cylindrical chambers or cylinders 141, 142, 143 and 144 arranged in a common plane normal to the axis of the shaft 134 and angularly spaced 90° from each other, as shown in Figure 16. Slidable within the chambers in both directions are pistons 145, 146, 147 and 148, respectively. During rotation of the cam roller 138 the same engages each of the adjacent ends of the pistons 145, 146, 147 and 148 in succession against the bias of a spring 148, only one of which is shown relative to the piston 145. The springs 148 urge the respective pistons inwardly to be driven outwardly in its turn by the rotating roller 138.

As each piston is driven outwardly by the cam roller 138 against the bias of the spring 148, fluid pressure is built up within the outer space of each of the chambers 141, 142, 143 and 144. Fluid under pressure produced by the outward actuation of a piston is transmitted to passageways 150, 151, 152 and 153 associated with the cylinders 141, 142, 143 and 144, respectively. The passageways 150, 151, 152 and 153 are in communication with enlarged passageways 154, 155, 156 and 157, respectively, which, in turn, are connected with a common passageway 160 connected to an output port.

The common passageway 160 connects all of the passageways 154, 155, 156 and 157 to carry fluid under pressure produced by the interactions of the four pistons to an output port 161 which is in fluid communication by the tubing 131 to the input port 76 of the valve device 60. In operation, continuous rotation of the pump shaft 134 produces an eccentric rotation of the cam roller 138 for driving the pistons 145 to 148 outwardly to produce pressure in the common passageway 160. During continuous rotation of the cam roller, the pressure within the common passageway 160 will be continuous, and unidirectional pressure thereby ensuring unidirectional pressure to the input port 66 for the selector valve device 60.

After each piston reaches the extent of its pumping action as illustrated by the piston 145 within the cylinder 141 as shown in Figure 16, the spring 148 serves to maintain the piston against the cam roller 138 as it moves out of drive engagement with the piston 145. As the piston 145 moves downwardly, fluid is drawn into the upper portion of the cylinder 141 by way of a passageway 163, and a chamber 164, both formed in the pump housing 132 from the reservoir 120. A common passageway 165 is formed circumferentially around the housing 132 and connects all of the other cylinders equivalent to cylinder 164 which are associated with cylinders 142, 143 and 144. In order to maintain simplicity of description only one such passageway 163 and chamber 164 has been described, and it will be apparent that these formations are duplicates associated with the other pistons for the pump 130.

In each of the chambers 164 is positioned a check valve in the form of a ball 166 arranged to close off the chamber 164 from the interconnecting passageway 165 by action of a spring 167 which normally forces the ball to close off the communication. The interconnecting passageway 165 is connected to an input port 168 for the pump 130, the port being connected by a tubing 169 to the output side of the reservoir 120.

In operation, as each of the pistons 145, 146, 147 and 148 is moved radially inwardly by spring 148, respectively, in following the cam roller 138, the reduced pressure in the fluid on the opposite end of the respective piston permits the fluid in the reservoir 120 to overcome the effect of the closing of the check valve comprising the ball 166 and spring 167 in order to allow fluid to enter the chamber 167 from the common passageway and fill up the cylinder on that side of the respective piston. As the respective piston is driven in the reverse direction, pressure is built up on the end thereof remote from the roller 138 in order to provide fluid under pressure, as aforesaid, in the passageway 150 to 157 and consequently bringing fluid under pressure to the input port 166 for the valve device 60.

As shown in Figure 13, the pump shaft 134 terminates outwardly in a crank arm 172 and a handle 173 for permitting the pumping action of the pump 130 by an operator. Rotation of the crank arm 172 by means of the handle 173 produces the eccentric rotation of the cam roller 138 thereby producing fluid pressure and flow relative to the output port 161. This fluid flow is unidirectional, as indicated by the arrow, regardless of which direction the crank arm 172 is rotated. In operation of the table 1, the pump 130 is utilized to produce the desired articulation and the direction thereof after the knob 115 and dial 116 have been rotated to the appropriate setting. Rotation of the handle 173 then provides the actual movement of the table top sections. If the handle 173 is rotated at a slow speed the articulation motion will be slow and conversely, if the handle 173 is rotated relatively fast, the articulation motion will be correspondingly speeded up.

The pump 130 has been devised with a safety feature which inhibits reverse articulation in the event that an operator or a person inadvertently moves the handle 173 in a direction opposite to that which was initially started. For example, if the handle 173 was rotated in a clockwise direction, as shown in Figure 3, in order to initiate a particular articulation, in the event the handle was inadvertently moved in a counter-clockwise direction, the direction of movement of articulation will continue and not attempt an articulation in the reverse direction. Regardless of which direction the handle 173 is rotated and regardless of when a change in rotation has been intervened, the direction of articulation of the table top sections will continue as initially programmed as determined by the setting of the dial 116.

Another operative feature which is inherent in the pump 130 because of its capability to produce unidirectional, pressure regardless of which direction the pump shaft 134 is turned and because of its design, is the ability to permit the continuation of this pressure for articulation of the table sections

even for repeated, short relative movement of the handle 173. In the event the handle cannot be fully rotated in one direction to effect articulation due to the presence of equipment or personnel blocking such full rotation, the handle may be operated in short up and down strokes on one side of its full range of rotation.

As previously stated, the table 1 is adapted for vertical movement either ascending or descending relative to the base 2 by means of the telescoping pedestal 3. As shown in Figure 6, the pedestal comprises four square tubular sections 12, 180, 181 and 182, the latter three completely encircled by the pedestal section 12 when in fully contracted condition. Within the base 2 and the pedestal 3 is an elevating control subsystem including a cylinder/piston unit 185 having its cylinder 186 connected to the base 2 and a piston rod 187 extending upwardly toward the main frame 10.

The upper end of the piston rod 187 supports a pulley 188 for rotation relative thereto and has a chain 189 entrained therearound. One end of the chain is secured to the inner wall of the lowermost section 182 and the other end to a depending element 190 secured to the inner surface of the plate 22 which closes off the upper end of the pedestal section 12 With this arrangement, when the pulley 188 is driven upwardly upon actuation of the unit 185, it will drive the lower end of the chain 189 which is connected to the element 190 upwardly carrying therewith the element 190 and consequently the section 12. In this manner, the table 1 is elevated to the extent that the unit 185 is actuated. With the upper movement of the section 12 thus imparted, the lower sections 180 and 181 will likewise be extended upwardly. When the unit 185 is actuated in the reverse direction, the pulley 188 will descend thereby producing descending action of the table by the resultant contraction of the pedestal sections.

Actuation of the unit 185 is provided by a hydraulic, foot actuated pump 194 suitably mounted in the base 2 and operable by a lever 195 to which foot pedal 196 is attached. The lever and foot pedal extend outwardly of the base in easy proximity to the operator who would be manipulating the valve device 60 and pump 130. As shown in Figure 18, the lever 195 is pivoted about a pivot pin 197 secured to the interior of the base 2 and a crank arm 198 secured thereto. The arm extends from the pivot 197 and supports a wheel 199 on one side arranged to ride upon one end of piston rod 200 for a piston 201 slidably received within the cylinder 202 for the pump 194. Repeated depressing of the pedal 196 causes the wheel 199 to drive the piston 201 repeatedly and thereby produce pressure in the unit 185 to cause lifting of the pulley 188 and, consequently, cause elevation of the table 1.

The cylinder head for the pump 194 is hydraulically connected by a tubing 203, (see Figure 17) to a T connection 204, one end of which is connected by a tubing 205 to the cylinder 186 and the other end by a conduit 206 to a dump valve 207. The dump valve 207 includes a plunger 208 which when actuated inwardly serves to relieve the fluid pressure within the cylinder 186. This inward movement of the plunger 208 is achieved by movable contact with an actuating contacting member 209 secured to the outer end of the crank arm 198 opposite the position of the roller 199. To lower the table 1, the operator need only to raise the pedal 196 upwardly, say by the movement of his foot, to produce rotation of the crank arm 198 in a clockwise direction. This operation forces the actuator 209 upwardly against the plunger 208 to drive the same inwardly and effect the release of the fluid pressure within the cylinder 186 and thereby effect the downward movement of the table 1. A flow control device 210 connected in the tubing serves to control the pressure build up and release of pressure in the cylinder 186 to ensure patient comfort during descent of the table.

The fact that the tubular sections 12, 180, 181 and 182 are of square cross section is advantageous in preventing the telescoping pedestal 3 from twisting. No keys or the like are required as in pedestals made up of cylindrical sections, which keys require constant adjustment.

The base 2 is provided with a floor contacting foot member 215 at corners thereof and a caster wheel adjacent each of the foot members. As shown in Figure 20, the floor contacting foot member 215 is adjustably secured to the undersurface of the base 2 and is normally arranged to rest upon the floor or ground associated with the area to which the table 1 is to be employed. Adjacent each of the foot members 215 is a caster wheel 216 and its actuating structure, only one of which will be described in detail since all four caster wheels and actuating structures are of the same construction.

As illustrated in Figures 20 and 21, a caster wheel 216 is shown rotatably arranged on a lever member 217 pivotally mounted on the base 2 by a pivot pin 218 secured to the base. The end of the pivotal member 217 opposite the pivot pin 218 is operatively associated with a piston rod 219 of a hydraulic piston/cylinder unit 220 mounted on the base 2. Upon pressurization of hydraulic fluid within the cylinder 220, the rod 219 is moved downwardly to drive the lever member 217 from the dotted position to the full line position which action forces the caster wheel 216 downwardly into engagement with the floor and to raise the adjacent end of the base. This action places this corner of the base 2 upon the caster wheel 216 since the foot 215 will

be relieved of its previous floor engaging contact. Releasing of the pressure within the cylinder 218 will result in the upward movement of the caster wheel 216 to its position as shown in dotted line and the lowering of the base 2 so that the foot 215 contacts the floor and serves to support the base 2 and consequently the table 1.

Fluid flow to the caster wheel actuating cylinder 220 is provided by a lever 221 having a foot pedal 222 mounted at one end for its actuation by the operator, the pedal 222 being mounted adjacent the foot pedal 196 for the elevator pump 194. The foot pedal 222 serves to actuate a pump 223 hydraulically connected to the caster wheel actuating cylinder/piston unit 220 mounted at one corner of the base 2 and to cylinder/piston units 224, 225 and 226 located one for each of the other three corners of the base. The pump 223 is similar to the pump 194, as shown in Figure 19 and includes all of the related structure thereto as illustrated in Figure 18, that is, upon repeated depressing of the pedal 222, the pump 223 is arranged to produce pressure within its cylinder and to transmit this pressure to the four caster wheel hydraulic units 220, 224, 225, 226. Associated with the pump 223 is a dump valve 227 and actuating mechanism therefor similar to that for the pump 194.

As shown in Figure 17, the output of the pump 223 is connected by tubing 223a to the units 220 and 224 located at one end of the base 2 and by a conduit 223b to the units 225, 226 located at the other end of the base 2. Actuation of the pump 223 serves to provide fluid under pressure for pressurizing front units 220, 224 and the rear units 225, 226 in unison in order to drive the caster wheels associated therewith downwardly relative to the respective corners of the base 2 and thereby lifting the associated foot members 215 from the floor and place the base and consequently the table 1 upon the four caster wheels associated with base 2. By virtue of this arrangement, the table may be moved longitudinally and lateral from place to place as desired.

In order to return the base 2 to the support of the foot members 215, the foot pedal 222 is lifted by the operator foot to cause the dump valve to cause the release of the fluid pressure within the units 220, 224, 225 and 226 thereby effecting the downward movement of the base 2, under gravity, until the foot members 215 contact the floor to take over and support the base 2, and consequently, the table 1. In the event that the floor is uneven, or that the release of pressure from the caster hydraulic units is unevenly distributed, there is the likelihood that the table top 4 will rock. There is also this likelihood if a patient moves at this time, or that accessories are shifted or that operators of the table lean against the same.

The hydraulic system shown in Figure 17 is devised to prevent or minimize resultant rocking if this occurs before the base 2 comes to complete and secured rest. To this end, the system includes a check valve 228 interposed between the pump 223 and each of the units 220, 224 at one end of the base 2, and a check valve 229 interposed between the pump and the units 225, 226 at the other end of the base. As shown, the check valves 228, 229 allow fluid flow under pressure to each of the four units during pumping action by the pump 223. Upon release of this pressure by the dump valve 227 in order to lower the base 2, the cylinders for the units 220, 224 expel fluid by way of the conduit 223a through a check valve 230 and into and through the dump valve 227 and reservoir for the system. Similarly, the cylinders for the units 225, 226 expel fluid by way of the conduit 223b through a check valve 231 and to the dump valve.

Assuming that only three of the foot members 215 come to rest upon the floor after actuation of the valve 227, because of an uneven floor so that the fourth hydraulic unit for the associated caster wheel remains in contact with the floor, the base 2 will remain supported by the three members 215, which condition is sufficient as a table support. However, assuming that there is a sudden shift in weight to that corner of the base with the still active caster wheel caused by a patient moving on the table, or by an operator leaning on the table, or by the movement of accessories the base could normally rock or tilt in the direction of that corner until the fourth foot member 215 has contacted the floor. This would be caused by the still active unit releasing the final pressure therein to another unit because of the sudden build up of pressure therein caused by the rocking movement. However, in the present invention, the check valves 228, 229 230 and 231 have been arranged to prevent the release of this pressure from the affected hydraulic unit regardless of which unit is still active.

In the event that two of the caster wheels should be locked from its freewheeling condition so that the table and base may be steered into a controlled path of movement, an arrangement has been devised so that two of the caster wheels 216 are locked from pivotal movement in order to allow the caster wheels at the other of the base to serve as a steering mechanism for movement of the table 1.

As shown in Figures 20 and 21, each caster wheel 216 is rotatably mounted on the lever member 217 by a bearing member 232 mounted within the lever 217 for rotation about its vertical axis. The bearing member 232 is formed with an opening 233 at diametrically opposed positions. Both of the openings 233 are adapted to receive an elongated pin 234 which when inserted therein arrests the

rotative movement of the caster wheel about the axis 231. The pin 234 is secured at one end of a cable 235 which extends the length of the base 2 and is connected to one end of a crank arm 236 located between the pedals 222 and 196 (see Figure 19). The outer end of the crank arm 236 is provided with a foot pedal 237 arranged for operation by the operator. A spring 238 associated with the pin 234 normally forces the same in either one of the two openings 233 for locking the respective caster wheel 216 in position so the same will not be able to rotate about the axis 231. In order to release the two caster wheels 216 to permit freewheeling thereof about the axis 231, the operator depresses the foot pedal 237 to rotate the crank arm 236 counter-clockwise as shown in Figure 18 which removes the pin 234 from an opening 233 for this purpose.

The table top 4 is provided with a novel arrangement of a rail system for permitting the unobstructed, smooth movement of accessories from one end of the table top 4 to the other when the table top is arranged with its table sections in a common plane so that the operator for the table 1 will not have to detach an accessory from one table section and to re-install that accessory on another table section in the event the accessory is to be moved from one section to another. As shown in Figures 2, 2a and 22, the table section 5 is provided with rails 250, 251 on both sides thereof, the table section 6 with rails 252, 253 and the table section 7 with rails 254, 255. For purposes of brevity, only the rails associated with the sections 5 and 6 will be discussed herein.

The rail 251 is formed at the end adjacent the end of the rail 253 for the table section 6 with an extension 258 of approximately one half of the thickness of the rail 251. The extension 258 cooperates with a similar extension 259 of approximately one-half of the thickness of the rail 253 and is arranged to overlap the extension 259. A pivot pin 260 extends through the extension 258, 259 and is in axial alignment with the pivotal axis of the pivot 8 for the table sections 5 and 6 thereby assuring that the pivotal connections between the rails 251, 253 will not interfere with the articulation between the sections 5 and 6.

Each of the extensions 258, 259 are secured at their extreme ends having a radius with its center coterminous with the axis of the pivot pin 260. The curved ends are arranged in overlapping relationship so that the upper merging of the curved surfaces of the extensions with the straight surfaces of the rails remains flat whereby a continuous unbroken and smooth rail surface is presented for the movement of accessories along the rail from one table section to another table section. While only one rail connection has been described, namely for the rails 251 with 253, it will be understood that the foregoing description also applies to the connections between the rails 252, 253 and the rails 254 and 255.

While there has been described and illustrated the preferred form of the invention, it will be apparent that various modifications and changes may be made therein, in addition to those specifically pointed out above, particularly in the form and the relation of the parts of each subsystem described and the subsystems themselves without departing from the spirit of the invention as set forth in the appended claims.

## Claims

1. A control system for selectively controlling fluid flow to a plurality of cylinder/piston units independently from a fluid pump to drive the pistons under pressure in either direction within their respective cylinders, comprising:
a valve block having a cylindrical valve chamber and formed with valve ports in communication with said chamber being arranged for fluid cooperation with the cylinders with adjacent ports associated with each of the cylinder/piston units, and an input port connected to the output of the pump;
a cylindrical valve member rotatably mounted in said valve chamber for movement to an operative position for each of the cylinder/piston units, said valve member being formed with passageways arranged during each of its operative positions to connect one of said adjacent ports to one side of a piston of a unit and said input port to the other side of the piston for that unit, whereby the respective piston is driven in one direction, and during another operative position, to connect the other of said adjacent ports to said other side and said input port to said one side of that piston whereby the piston is driven in another direction.

2. A control system for selectively controlling fluid flow to a plurality of cylinder/piston units independently from a fluid pump to drive the pistons under pressure in either direction within their respective cylinders, comprising:
a valve block having a cylindrical valve chamber and being formed with valve ports in communication with said chamber arranged for fluid cooperation with the cylinders and with two adjacent ports associated with each of the cylinders, one relative to each side of the piston therefor, said valve block being formed with an input valve port connected to the output of the pump; and
a cylindrical valve member rotatably mounted in said valve chamber to an operative position relative to each of the cylinder/piston units and having two radial passageways formed therein, said valve

member being arranged with one of said passageways operatively connected to one of said adjacent valve ports and the other of said passageways connected to said input port for each of said operative positions of said valve member.

3. The valve system defined in claim 1 including a detent device for releasably holding said valve element upon rotation thereof relative to said valve block.

4. The valve system defined in claim 1 including a check valve in each of the cylinder/piston units for controlling fluid flow therein.

5. The valve system defined in claim 1 including two check valves in each of the cylinder/piston units for controlling fluid flow relative to pressurization on either side of the pistons therein.

6. The valve system defined in claim 1 including a pair of check valves in each of the cylinder/piston units, one associated with each directional movement of the piston therein, and arranged to position lock the piston in the event of system failure.

7. A surgical table, or the like, having a platform formed with two or more function-articulating table sections, a cylinder/piston unit and associated linkage for articulating each section, and a fluid system having a fluid pump to drive the pistons under pressure in either direction within their respective cylinders, the surgical table including:
a valve block having a cylindrical valve chamber and formed with valve ports in communication with said chamber being arranged for fluid cooperation with the cylinders with adjacent ports associated with each of the cylinder/piston units and an input port connected to the output of the pump;
a cylindrical valve member rotatably mounted in said valve chamber for movement to an operative position for each of the cylinder/piston units, said valve member being formed with passageways arranged during each of its operative positions to connect one of said adjacent ports to one side of a piston of a unit and said input port to the other side of the piston for that unit, whereby the respective piston is driven in one direction, and to connect the other of said adjacent ports to said other side and said inport port to said one side of that piston whereby the piston is driven in another direction.

8. A surgical table, or the like, having a platform formed with two or more function-articulating table sections, a cylinder/piston unit and associated linkage for articulating each section and a fluid system having a hydraulic pump for pressurizing the cylinder on either side of the respective piston therefor, comprising:
a cylindrical valve member having radial passageways formed therein;
a valve block having a cylindrical valve chamber adapted to receive said valve element rotatably therein; and
means for selectively imparting rotation to said valve member to operative positions indicative of the articulation of the table sections, respectively;
said valve block being formed with valve ports arranged in fluid cooperation with cylinders/piston units upon rotation of valve members to said operative positions, said valve ports arranged with two adjacent ports being associated with each of the cylinder/piston units and being cooperable with said passageway in said valve member for each of said operation position thereof wherein one of said adjacent ports is connected to the positive pressure side of the respective piston and the other of said ports is connected to the negative pressure side of the piston.

9. A surgical table, or the like, having a patient supporting platform formed with two or more function-articulating table sections, and cylinder/piston units for articulating each table section, the surgical table including:
a valve block having a cylindrical valve chamber, valve ports in communication therewith and arranged for fluid cooperation with the cylinder of the units, and an input fluid port for receiving fluid under pressure;
a cylindrical valve member supported within said chamber for rotative movement to an operative position for each of the cylinder/piston units, said valve member being formed with passageways arranged during each of its operative positions to connect one of said valve ports to one side of a piston of a unit and said input port to the other side of the piston whereby the respective piston is driven in a working direction to articulate the respective table section and to connect another of said valve ports to one side of a piston in another unit, and;
a unidirectional fluid pump connected to said input port for providing pressure to said valve ports under selective control by said valve member as aforesaid for driving each piston and effecting articulation of the table sections.

10. A surgical table, or the like, having a patient supporting platform formed with two or more function-articulating table sections, and cylinder/piston units for articulating each table section, the surgical table including:
a valve block having a cylindrical valve chamber valve port in communication therewith and arranged for fluid cooperation with the cylinders of the units, and an input fluid port for receiving fluid under pressure:
a cylindrical valve member supported within said chamber for rotative movement to an operative position for each of the cylinder/piston units, said valve member being formed with a plurality of passageways and when rotated to one of its oper-

ative positions, one of the passageways being arranged to connect one of said valve ports to one side of a piston of a first unit, a second passageway to connect said input port to the other side of the piston to effect drive of the same in one of its directions of movement to articulate the respective table section, and a third passageway to connect a second of said valve ports to one side of the piston of a second of the cylinder/piston units;
a unidirectional fluid pump connected to said input port for providing pressure to said valve ports under selective control by said valve member as aforesaid for driving each piston and effecting articulation of the respective table sections.

11. The surgical table defined in claim 4 wherein said passageways are arranged for another operative position of the valve member; for said one passageway to connect a third of said valve ports to one side of a piston of a third of the cylinder/piston units, for said second passageway to connect said input port to said one side of the piston of said first unit to effect drive of the same in another of its directions of movement and to articulate the respective table section and for said third passageway to connect said second port to said other side of the piston of said first unit.

12. A patient support table for supporting a patient in various positions suitable for medical treatment and/or examination and having a base and support pedestal therefor, comprising:
a plurality of sections swingably connected together at their ends to form a continuous tabletop adapted to be supported with the top surface of said sections lying in a common plane;
means associated with each of said sections for articulating the same relative to and independently from the other sections;
elongated rail members mounted on both sides of each of said sections and arranged to be in axial alignment, respectively, when said upper surface of said sections are in said common plane, said rail members having an upper surface adapted for slidably supporting table accessories thereon; and
pivot means at the adjacent ends of said rail members pivotally connecting one rail member to the adjacent rail member during articulation of the same, said pivot means having upper surfaces contiguous to the upper surfaces of the connecting rail members thereby forming a continuous and unbroken co-planar rail surface along the sides of the table.

13. The support table as defined in claim 1 wherein said pivot means comprise overlapping end elements which together equal the dimension of a rail member taken in a direction transverse to a table section.

14. The support table as defined in claim 12 including pivot means for swingably connecting the table sections, said pivot means for said rail members and said pivot means for the table section being pivotal along a common axis.

15. The support table as defined in claim 12 wherein said pivot means for said rail members and said pivot means for the table sections include a common pivot pin.

16. A hydraulic pump for generating continuous fluid pressure to a working double-acting cylinder/piston unit, comprising:
a pump housing having four cylindrical chambers radially arranged with their respective axis normal to each other, said housing having an output port connected to the cylinder/piston unit;
a piston slidably received in each of said chambers;
a rotary drive member operatively connected with said pistons arranged for successively forcing the same radially outwardly relative to their respective chambers wherein each of said chamber becomes pressurized sequentially during continuous rotation of said drive member;
means for effecting the inward radial movement of each of said pistons after outward movement thereof;
said housing having interconnecting passageways in communication with said chambers and said output port during pressurization thereof whereby continuous inidirectional pressure is applied to the unit, said housing being formed with vent passageways for successively venting each of said ohambers during said inward movement thereof; and
check valve means associated with said passageways arranged for effecting said continuous unidirectional pressure at said output port during rotation of said drive member in either direction.

17. A surgical and/or examination table system for supporting a patient during surgical procedures and/or examination comprising:
a table having a plurality of table sections swingably connected to each other to provide various function-articulating arrangements, and including a cylinder/piston unit and linkages for independently and selectively articulating each section;
a base having an upstanding pedestal operatively connected to said table and including a hydraulic system arranged to extend or contract said pedestal and thereby vary the elevation of said table and sections therefor;
a fluid system operatively associated with said table for controlling fluid flow to said cylinder/piston units, said system including a hydraulic pump having a pump housing formed with an output port, pressure generating means arranged therein having a manually rotatable member movable in either direction of rotation to produce pressure in said housing, and passageways within said housing arranged to provide unidirectional pressure to said

output port upon rotation of said rotatable member in either direction, and

a control valve mechanism having a valve block formed with a cylindrical valve chamber and valve ports in communication with said chamber being arranged for fluid cooperation with the cylinders with adjacent ports associated with each of the cylinder/piston units, an input port connected to the output of said pump; a cylindrical valve member rotatably mounted in said valve chamber for movement to an operative position for each of the cylinder/piston units, said valve member being formed with passageways arranged during each of its operative positions to connect one of said adjacent ports to one side of a piston of a unit and said input port to the other side of the piston for that unit, whereby the respective piston is driven in one direction, and during another operative position, to connect the other of said adjacent ports to said other side and said inport port to said one side of that piston whereby the piston is driven in another direction.

18. A surgical table, or the like, having a supporting platform arrangement including a plurality of articulating table sections, and cylinder/piston units for articulating each table section, comprising:

a hydraulic pump for generating continuous fluid pressure to the cylinder/piston units, said pump including a pump housing having four cylindrical chambers radially arranged with their respective axis normal to each other, said housing having an output port, a piston slidably received in each of said chambers; a rotary drive member operatively connected with said pistons arranged for successively forcing the same radially outwardly relative to their respective chambers whrein each of said chamber becomes pressurized sequentially during continuous rotation of said drive member; means for effecting the inward radial movement of each of said pistons after outward movement thereof, said housing having interconnecting passageways in communication with said chambers and said output port during pressurization thereof whereby continuous unidirectional pressure is applied to said output port, said housing being formed with vent passageways for successively venting each of said chambers during said inward movement thereof, and check valve means associated with said passageways arranged for effecting said continuous unidirectional pressure at said output port during rotation of said drive member in either direction, and a valve mechanism for selectively connecting said output port to the cylinder/piston units for effecting articulation of the table sections.

19. A surgical and/or examination table having articulating table sections for supporting a patient comprising:

a base adapted for movement on a floor,

a pedestal mounted for vertical movement on said base and connected to the table for supporting the same,

said base including a plurality of foot members arranged with two of said members positioned at each end of the base and adapted to rest upon the floor to support the base and table in a fixed working position,

at least four caster wheels mounted in the base, one adjacent each of said foot members and adapted to be moved into and out of contact with the floor,

means associated with each of said caster wheels for imparting a driving force to said wheels into contact with the floor to effect movement of the foot members out of supporting contact with the floor, and to release said force and permit said wheels to return to their non-contacting condition, and

means associated with said means for imparting a force for controlling the release of said driving force wherein the force produced in one of said means upon application of weight at the corresponding end of said base will not be released thereby ensuring that the caster wheel associated with said means will remain in force contact with the floor.

20. A surgical and/or examination table having articulating table sections for supporting a patient comprising:

a base adapted for movement on a floor,

a pedestal mounted for vertical movement on said base and connected to the table for supporting the same,

said base including a plurality of foot members arranged with two of said members positioned at each end of the base and adapted to rest upon a floor to support the base and table in a fixed position,

at least four caster wheels mounted in the base, one adjacent each of said foot members and adapted to be moved into and out of contact with the floor,

a cylinder/piston unit associated with each of said caster wheels,

a source of fluid pressure for actuating said cylinder/piston units by the introduction of fluid pressure therein for forcing said wheels into contact with the floor thereby effecting movement of said foot members out of supporting contact with the floor,

means for releasing said fluid pressure from said units to permit said wheels to return to their non-contacting condition by gravitational force, and

means for controlling the release of said fluid pressure wherein the pressure in one of said units upon application of weight at the corresponding end of said base will not be released thereby ensuring

that the caster wheel associated with said member will remain in force contact with the floor.

21. The table defined in claim 20 wherein said control means includes a network of check valves arranged to prevent the release of pressure from said one unit.

22. A surgical and/or examination table having articulating table sections for supporting a patient comprising:

a base adapted for movement on a floor,

a pedestal mounted for vertical movement on said base and connected to the table for supporting the same,

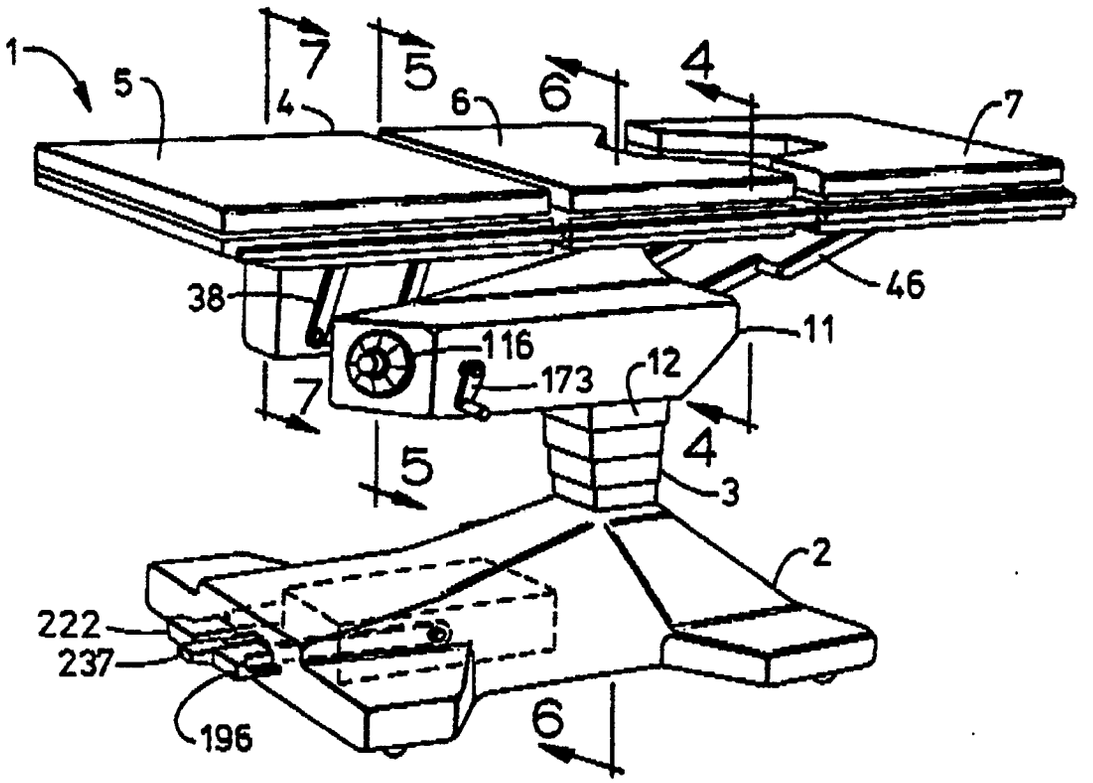
said base including a plurality of foot members arranged with two of said members positioned at each end of the base and adapted to rest upon a floor to support the base and table in a fixed position,

at least four caster wheels mounted for free-wheeling rotation mounted in the base, one adjacent each of said foot members and adapted to be moved into and out of contact with the floor,

a cylinder/piston unit associated with each of said caster wheels,

a source of fluid pressure for actuating said cylinder piston units by the introduction of fluid pressure therein for forcing said wheels into contact with the floor thereby effecting movement of said foot members out of supporting contact with the floor, and

means for selectively locking the caster wheels at one of said ends of said base against free-wheeling rotation to permit steering of the base by the other caster wheels at the other end of said base, said locking means a locking pin for arresting rotation of each caster wheel.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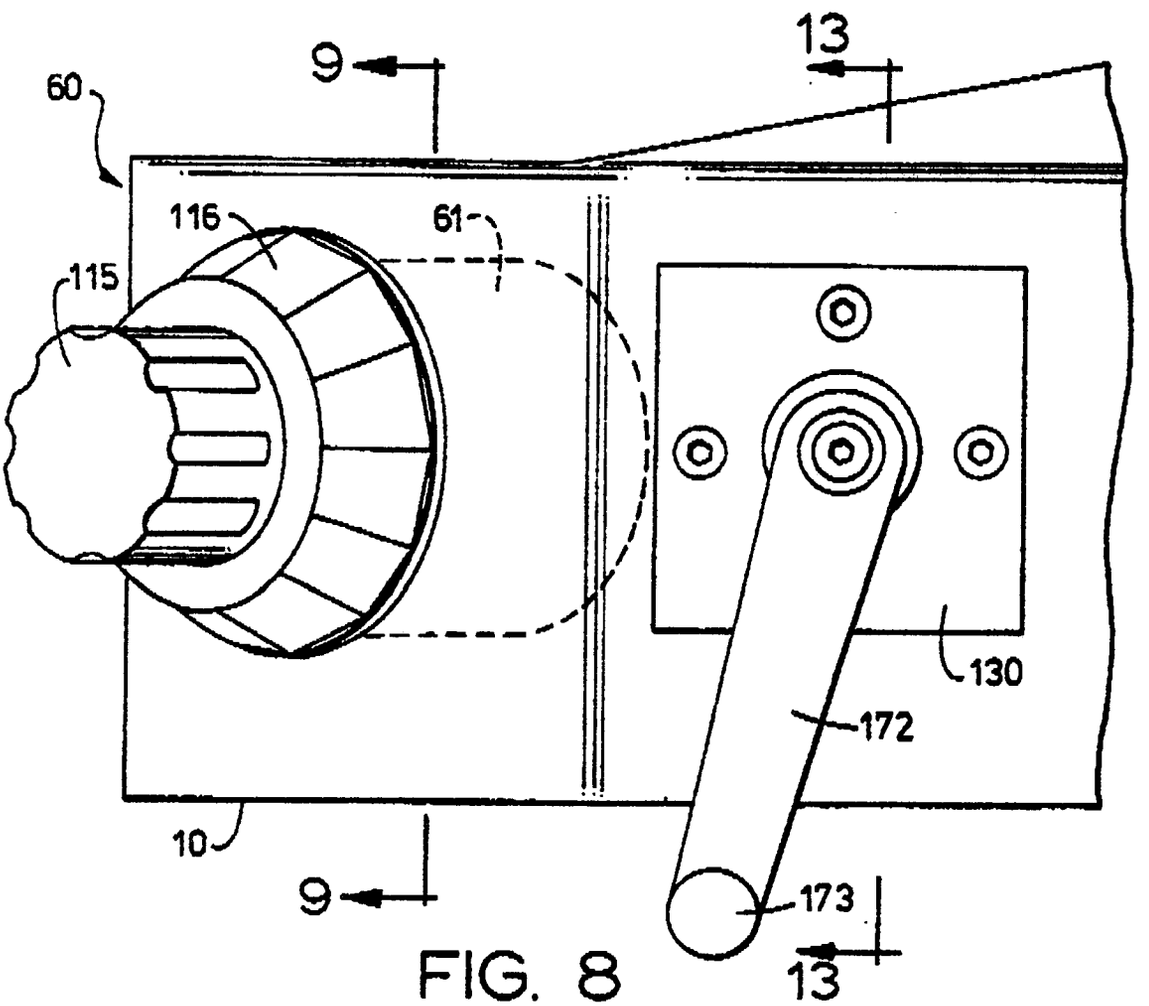
237
196
6

FIG. 1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173
13

FIG. 8

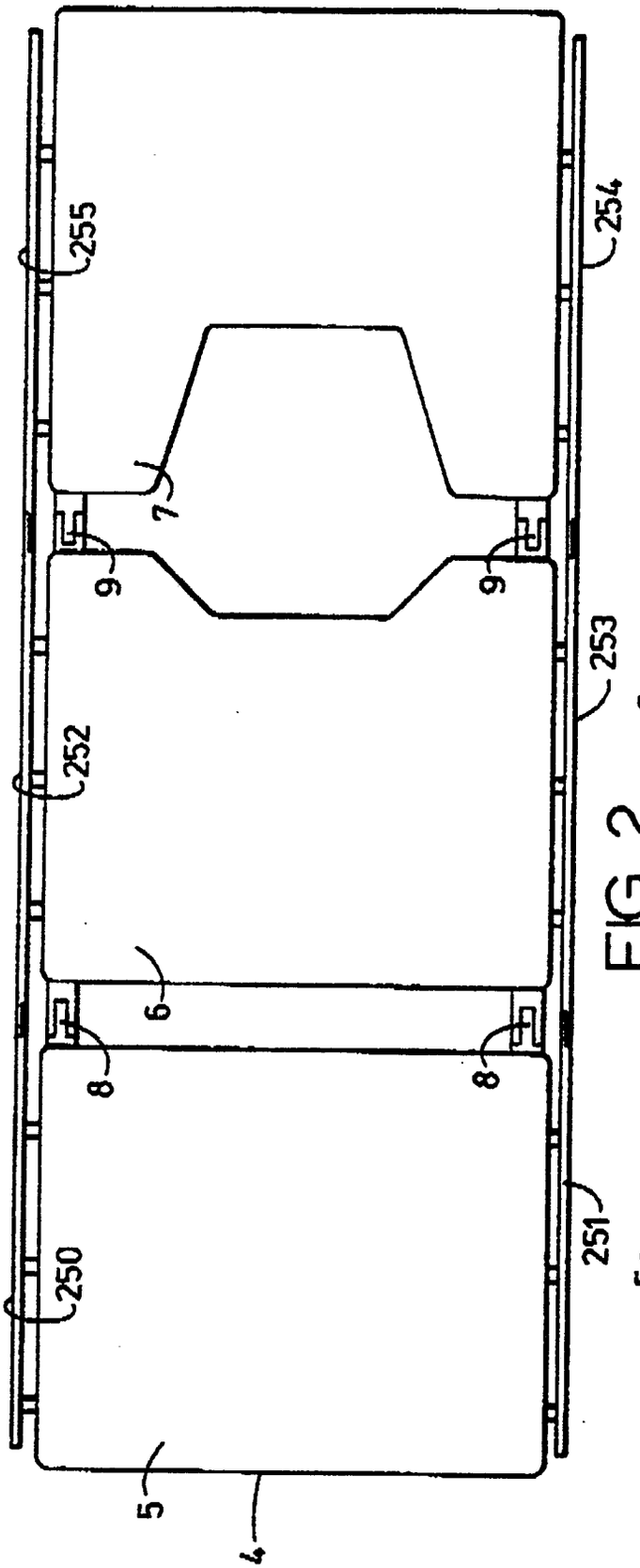



FIG. 2


FIG. 2A

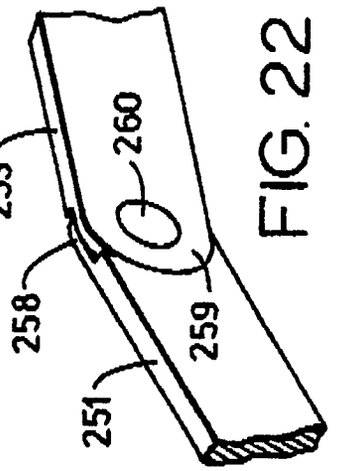
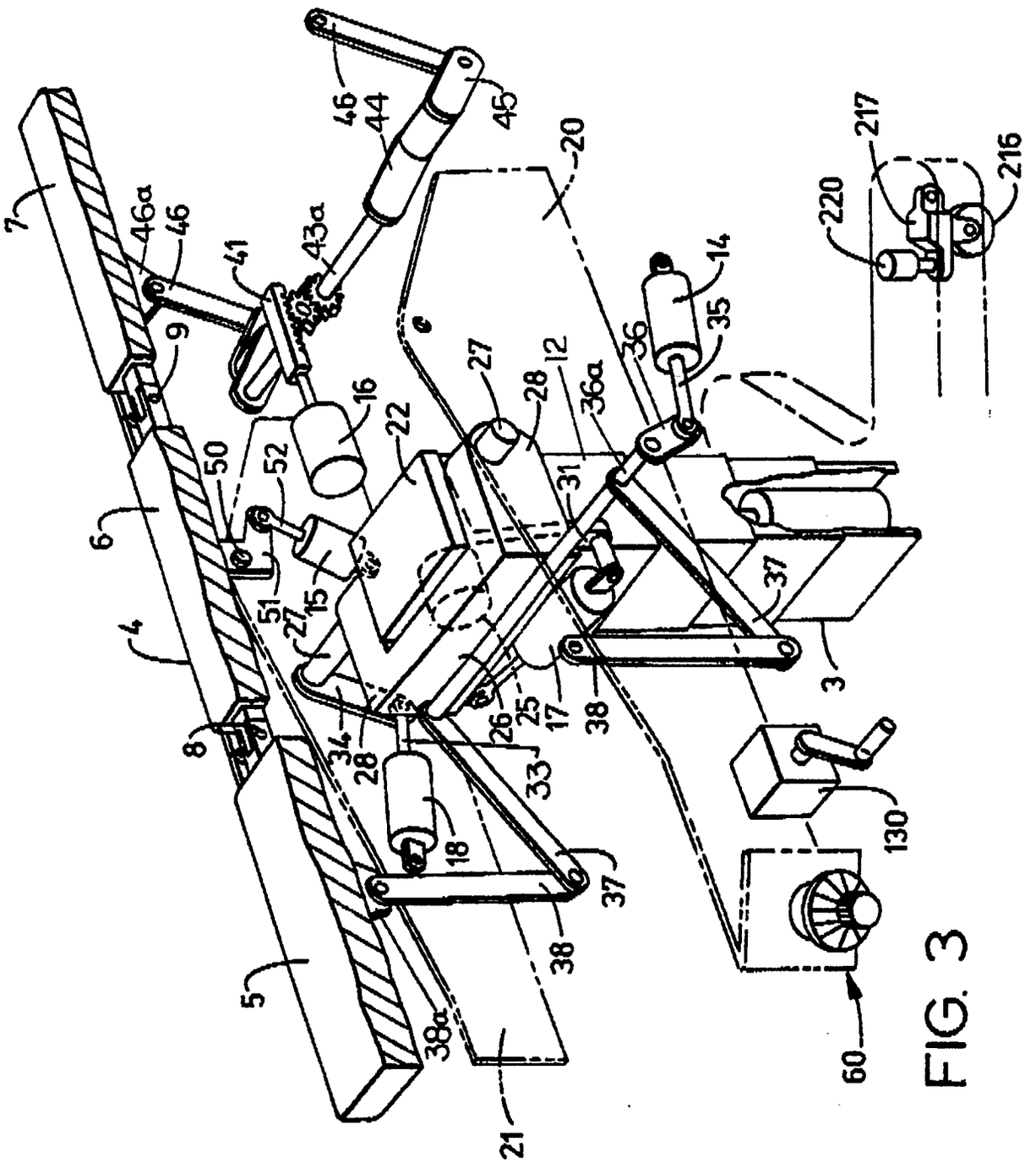



FIG. 22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15
27
4
31
37
3
8
34
28
33
26
25
17
38
18
37
38
5
38a
21
130
60

FIG. 3

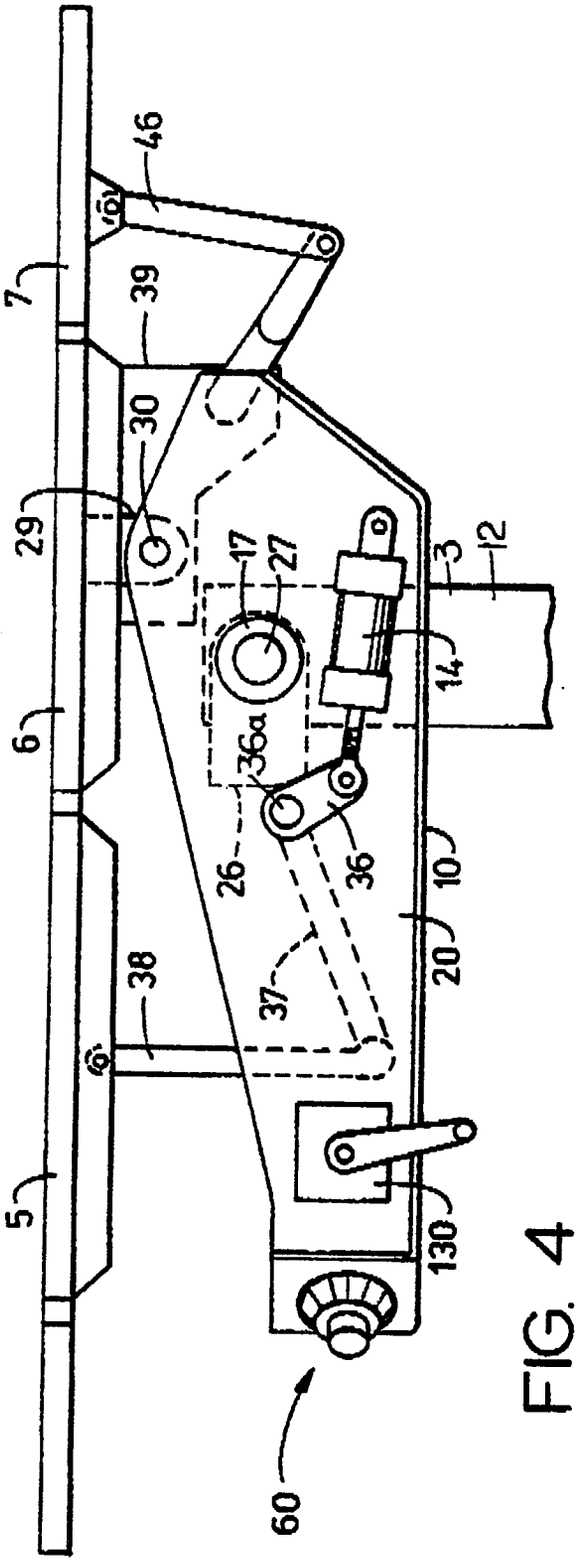

46
7
39
30
29
17
27
3
12
14
6
36a
26
36
10
20
38
37
6'
5
130
60

FIG. 4

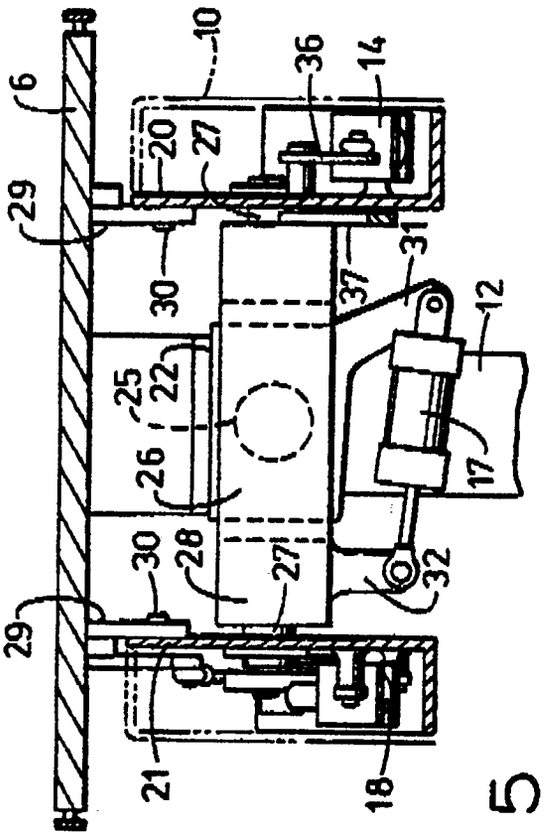

10
36
14
6
20
27
29
31
30
37
12
25
22
26
17
30
28
27
32
29
21
18

FIG. 5

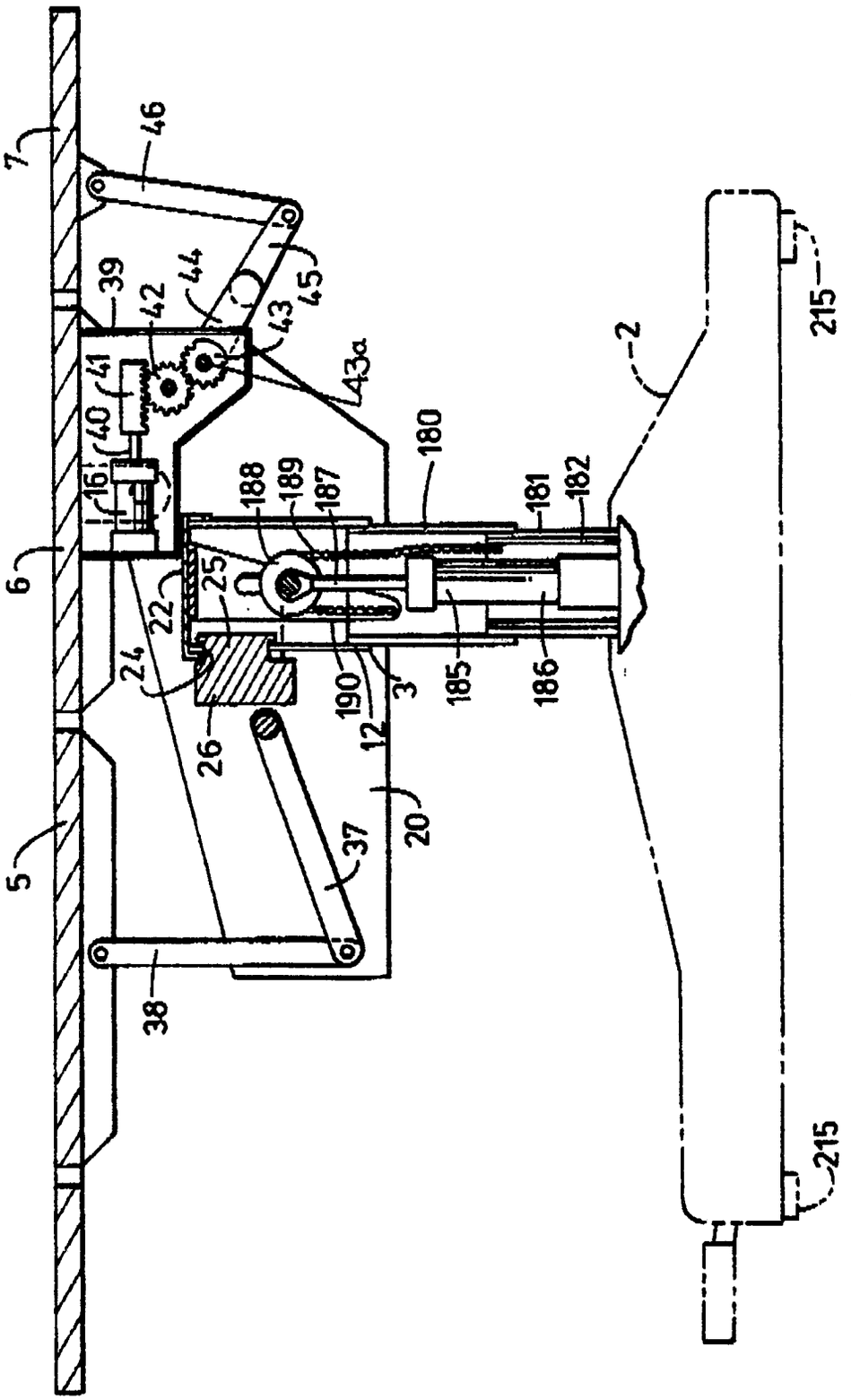

7
46
39
42
44
45
43
43a
41
40
16
6
188
189
187
180
181
182
2
215
22
25
24
26
190
12
3
185
186
20
37
5
38
215

FIG. 6

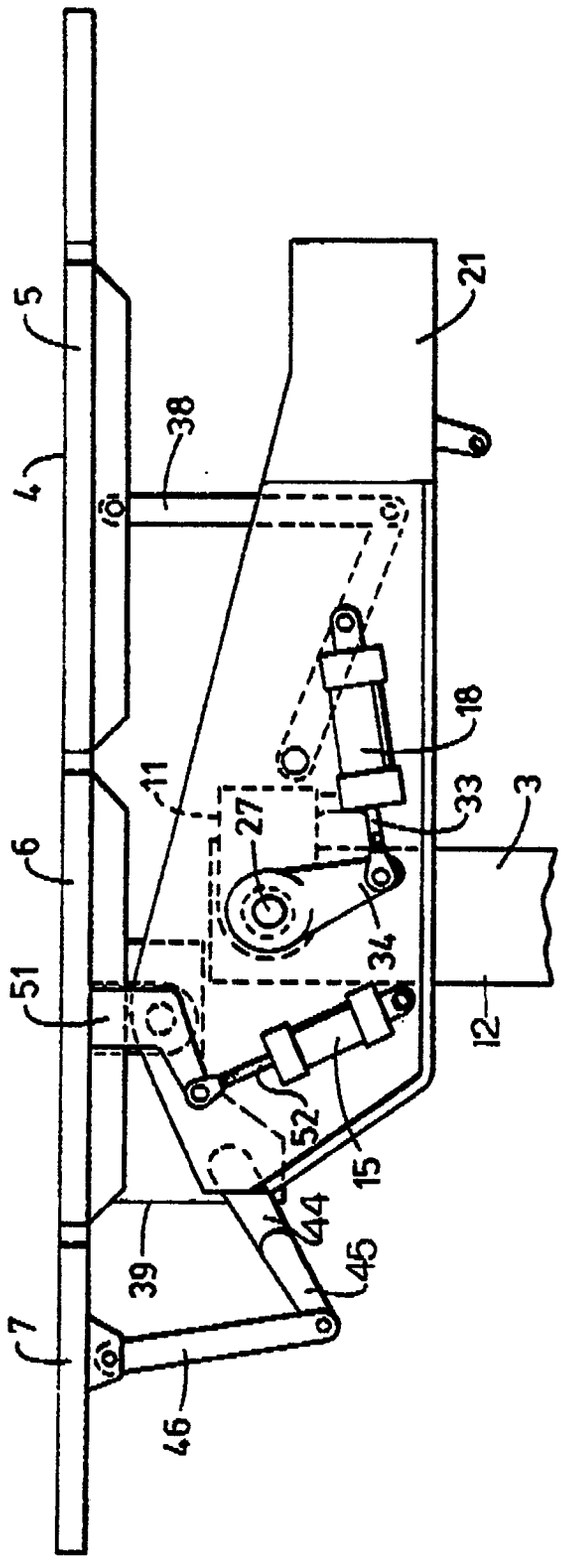
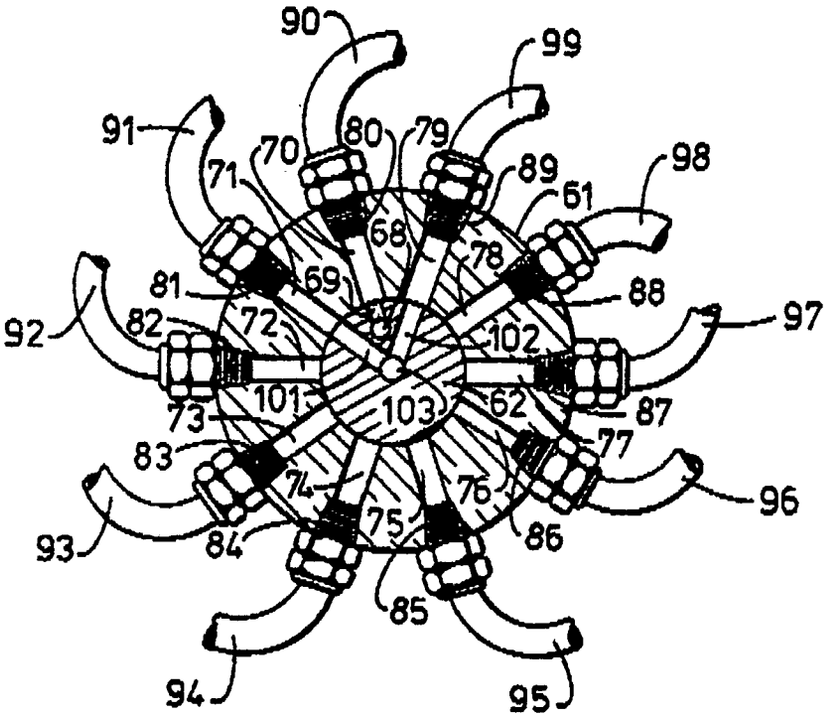



FIG. 7


90
99
91
80
79
70
71
89
98
61
68
78
81
69
88
97
92
82
72
102
73
101
103
62
87
83
77
74
76
96
93
84
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86
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94
95

FIG. 10

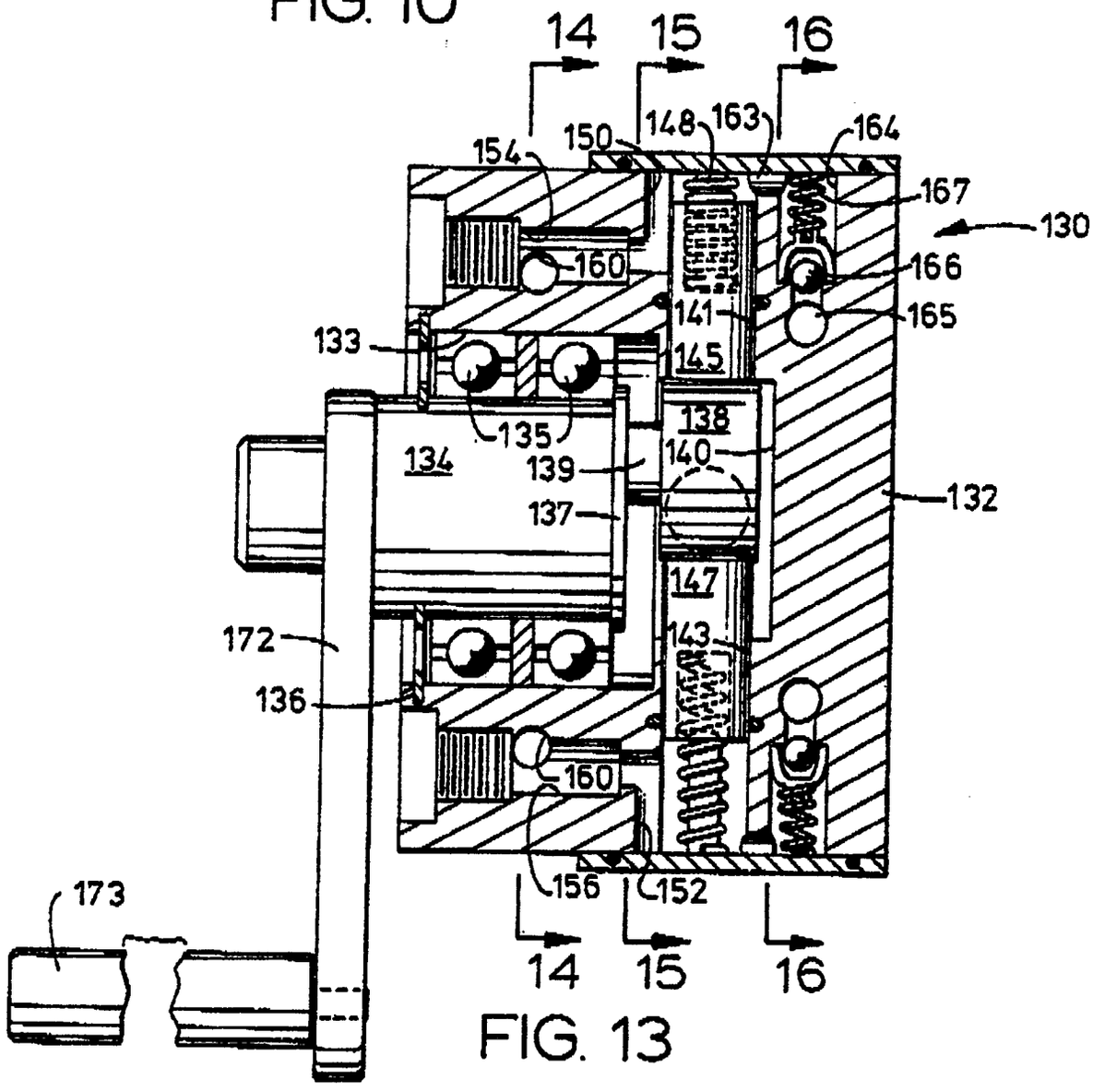

14
15
16
154
150
148
163
164
167
130
160
166
141
165
133
145
138
135
134
139
140
132
137
147
172
143
136
160
156
152
173
14
15
16

FIG. 13

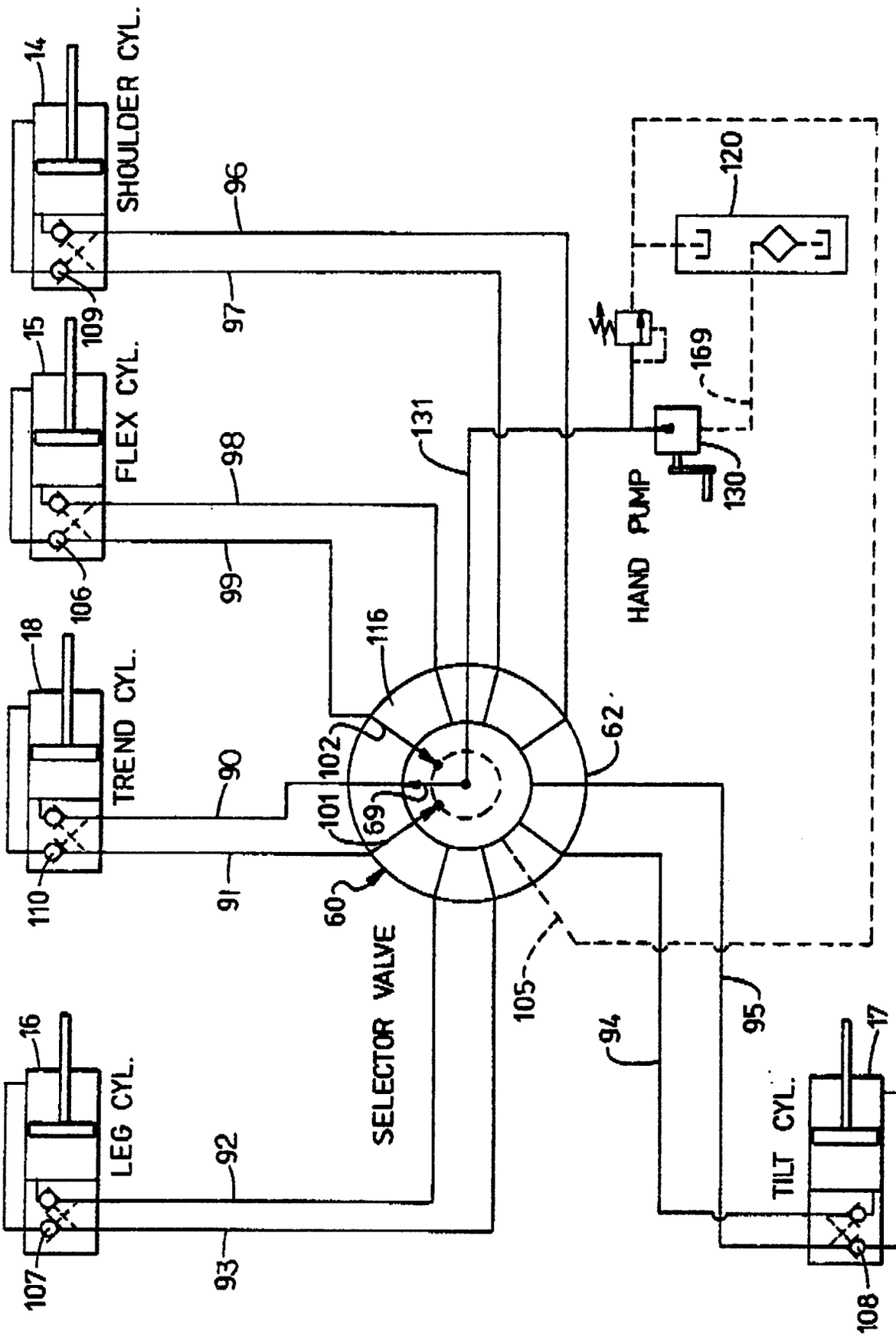

SHOULDER CYL.
FLEX CYL.
TREND CYL.
LEG CYL.
TILT CYL.
HAND PUMP
SELECTOR VALVE
14
15
16
17
18
60
62
69
90
91
92
93
94
95
96
97
98
99
101
102
105
106
107
108
109
110
116
120
130
131
169

FIG. 11

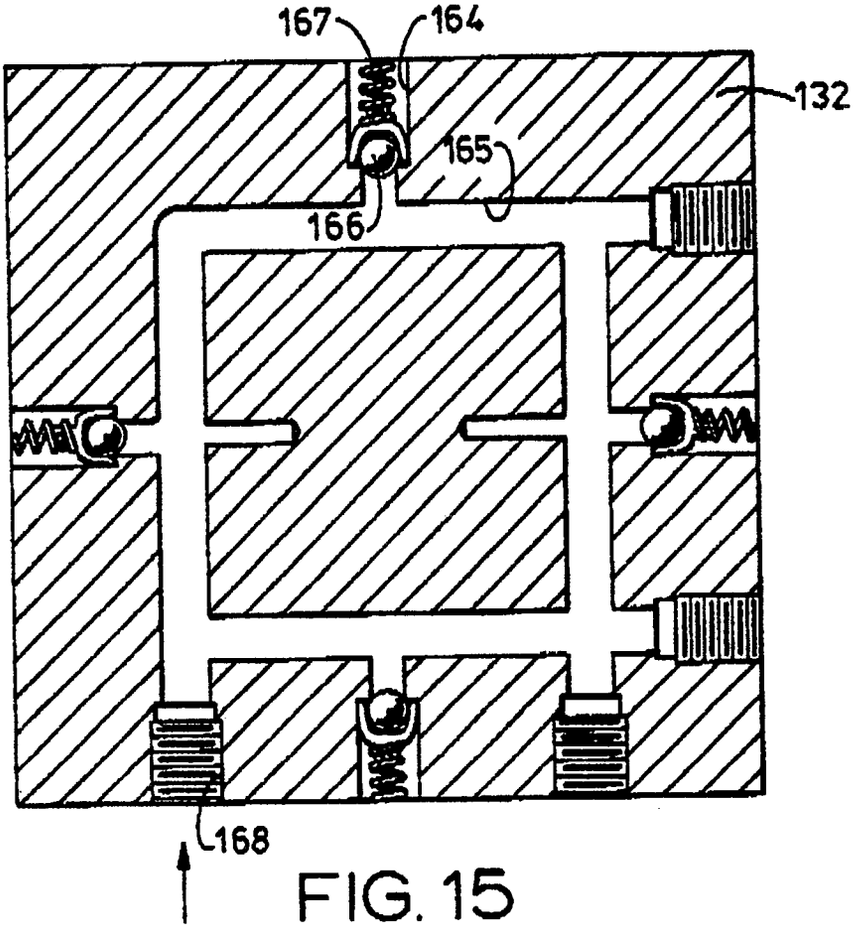

167
164
132
165
166
168

FIG. 15

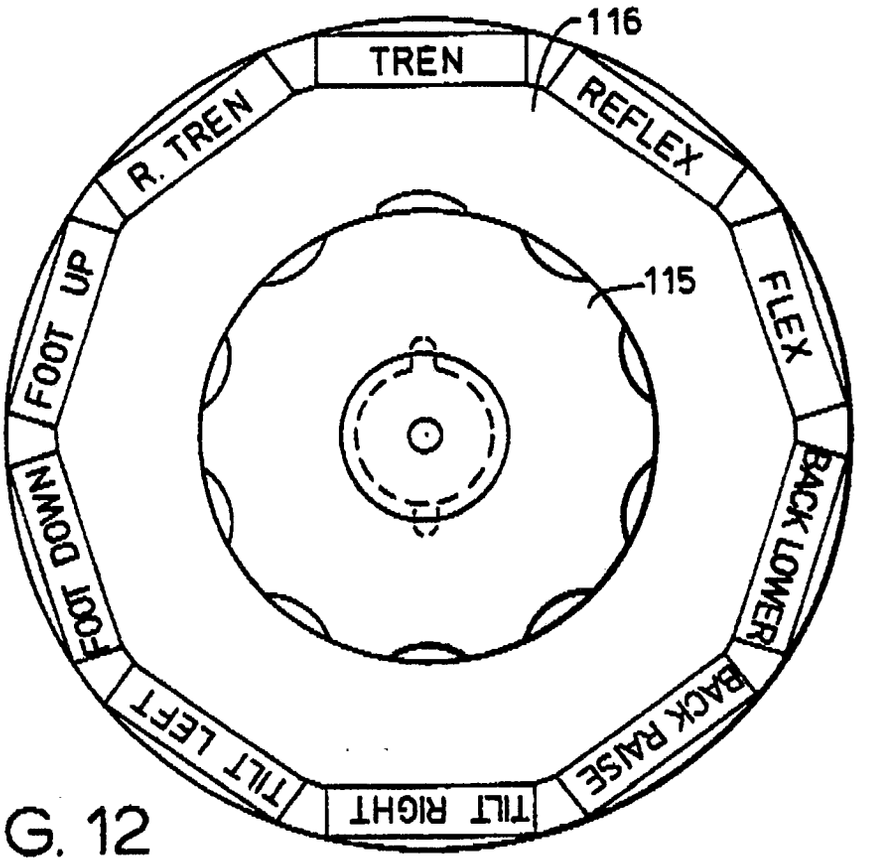

116
TREN
REFLEX
FLEX
BACK LOWER
BACK RAISE
TILT RIGHT
TILT LEFT
FOOT DOWN
FOOT UP
R. TREN
115

FIG. 12

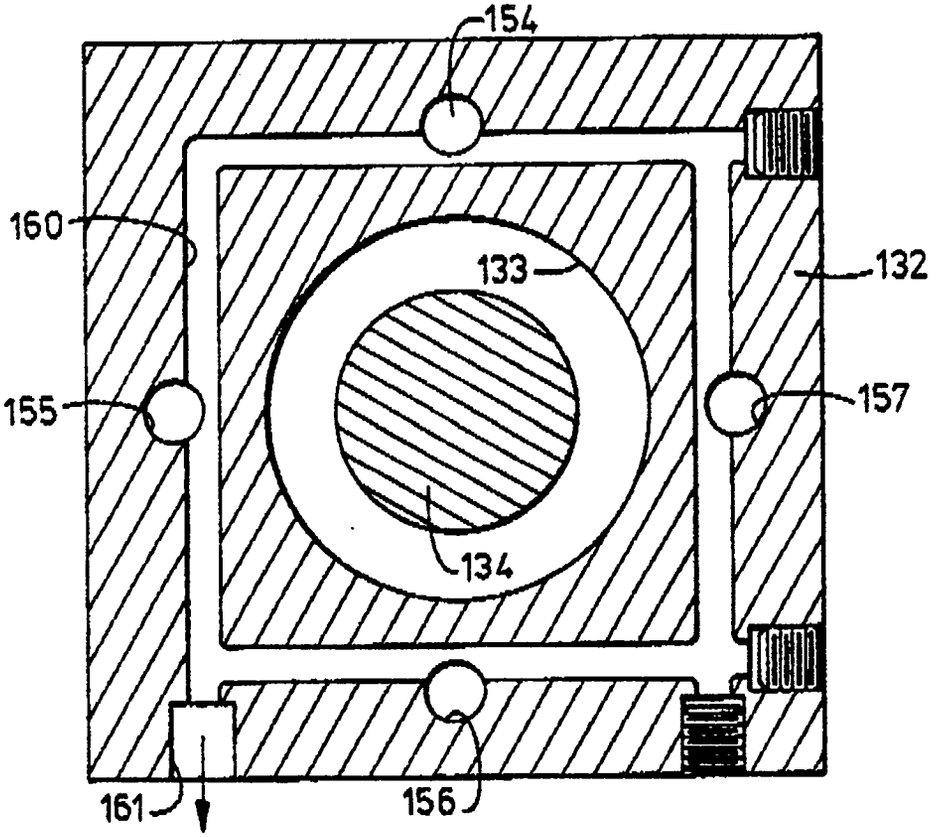

154
160
133
132
155
157
134
161
156

FIG. 14

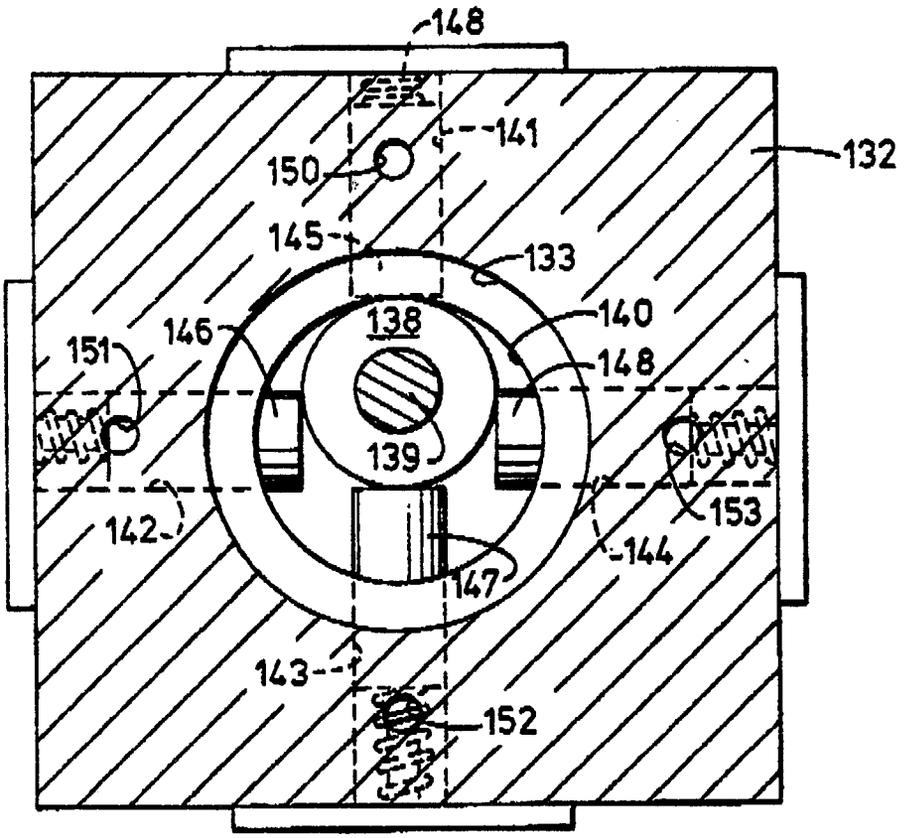

148
141
132
150
145
133
140
138
146
151
148
139
153
142
144
147
143
152

FIG. 16

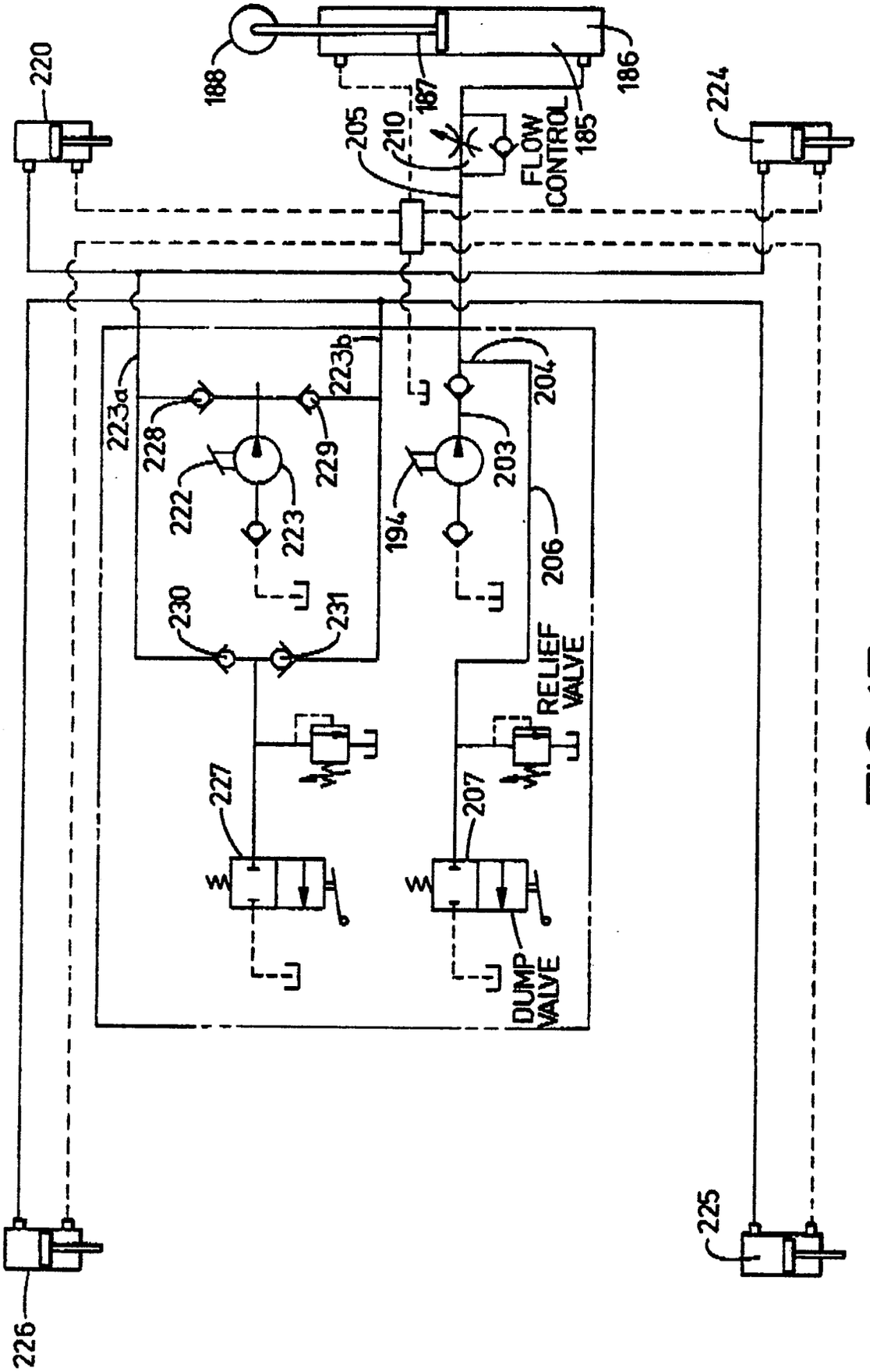

188
187
186
205
210
185
FLOW CONTROL
220
224
223a
223b
228
229
222
223
204
203
194
206
230
231
RELIEF VALVE
227
207
DUMP VALVE
225
226

FIG. 17

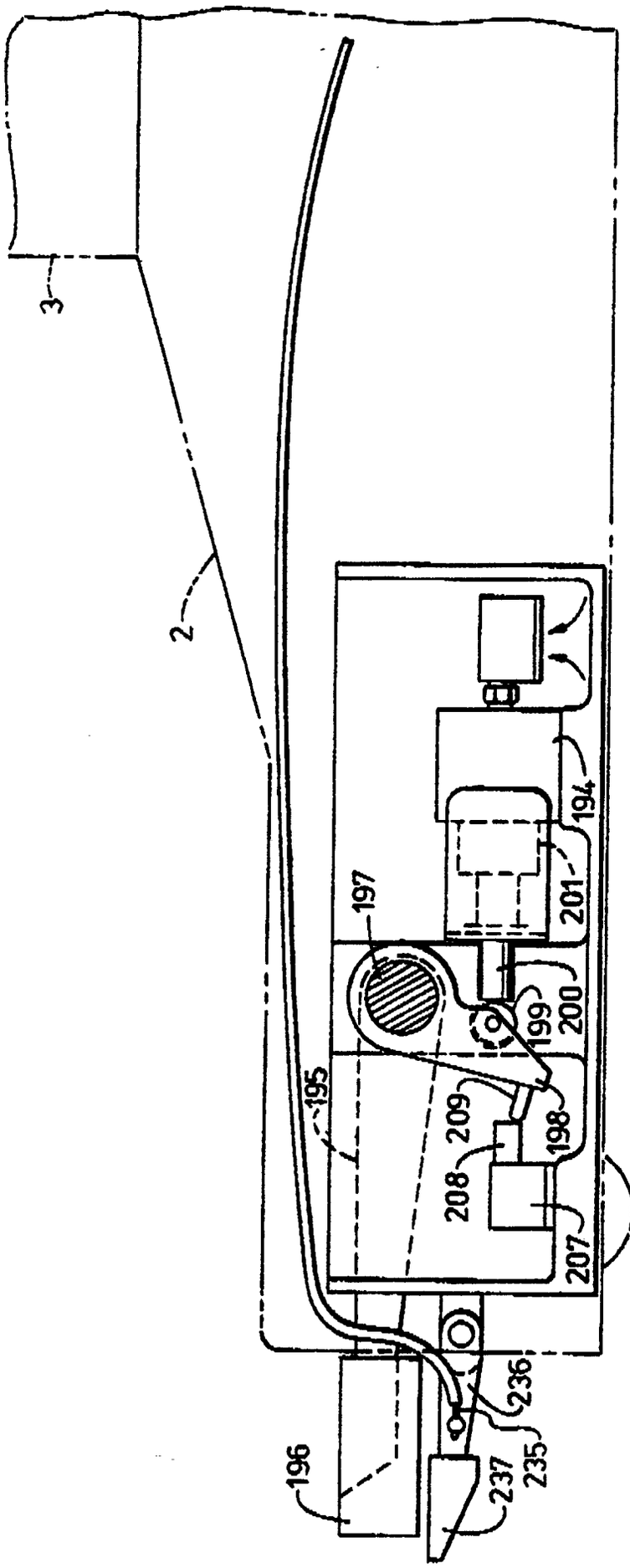
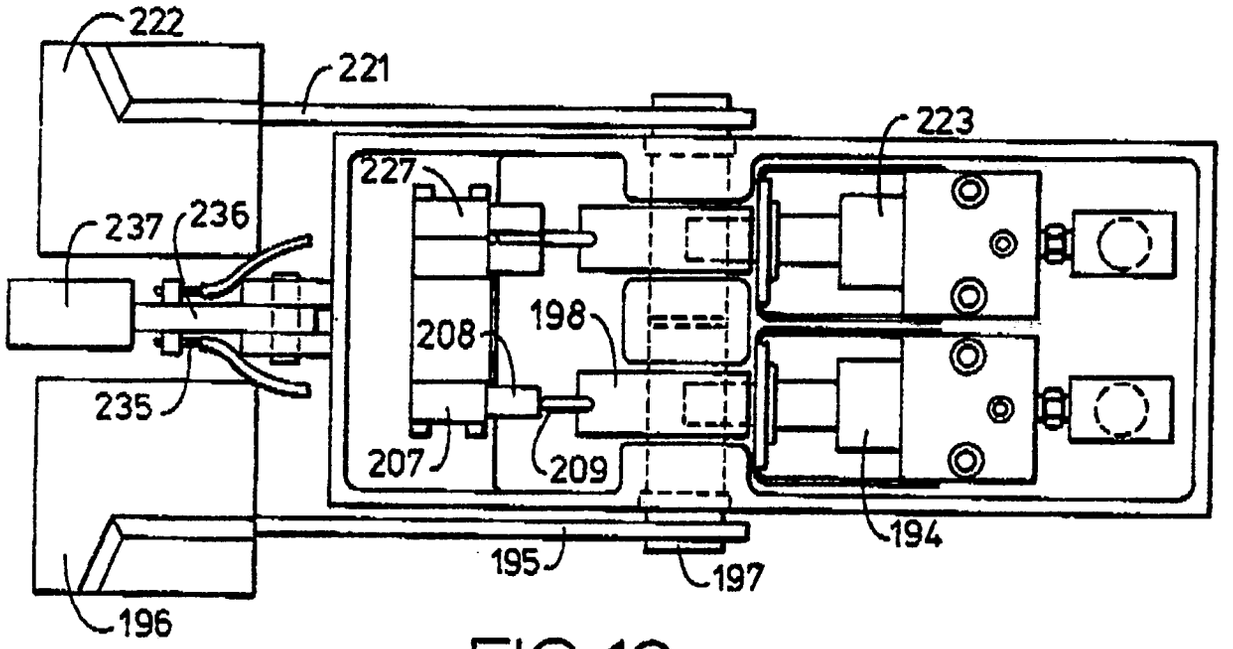



FIG. 18


222
221
223
227
237
236
208
198
235
207
209
194
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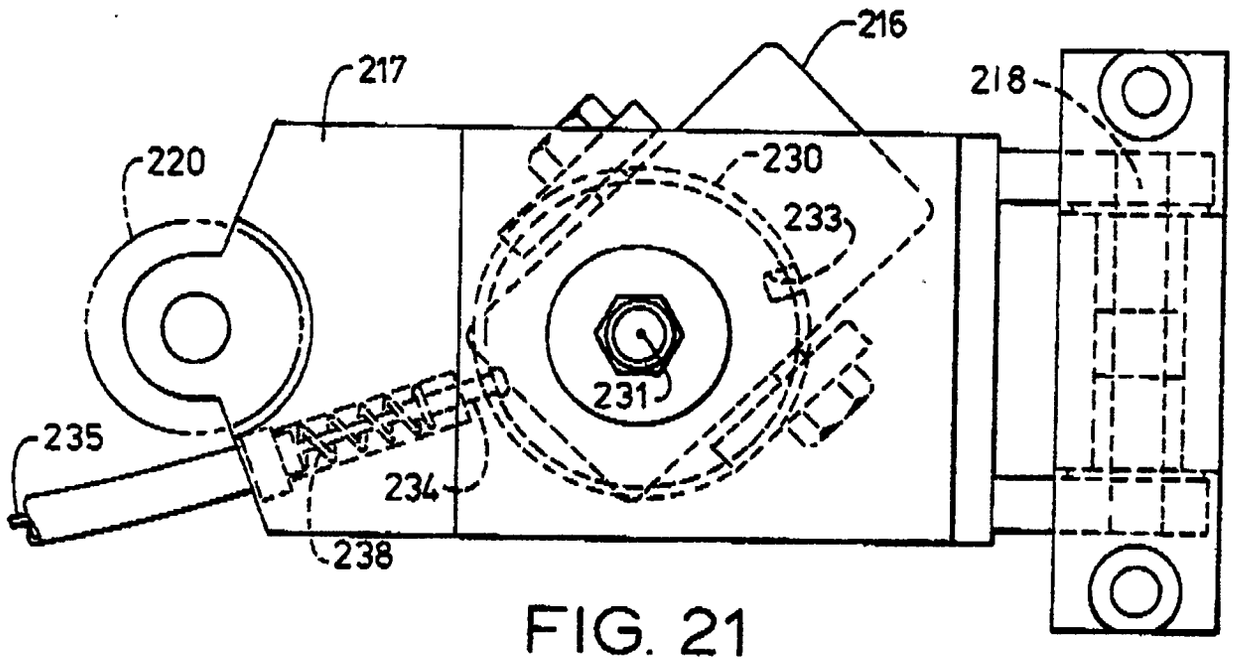
197
196

FIG. 19


216
217
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220
230
233
231
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234
238

FIG. 21

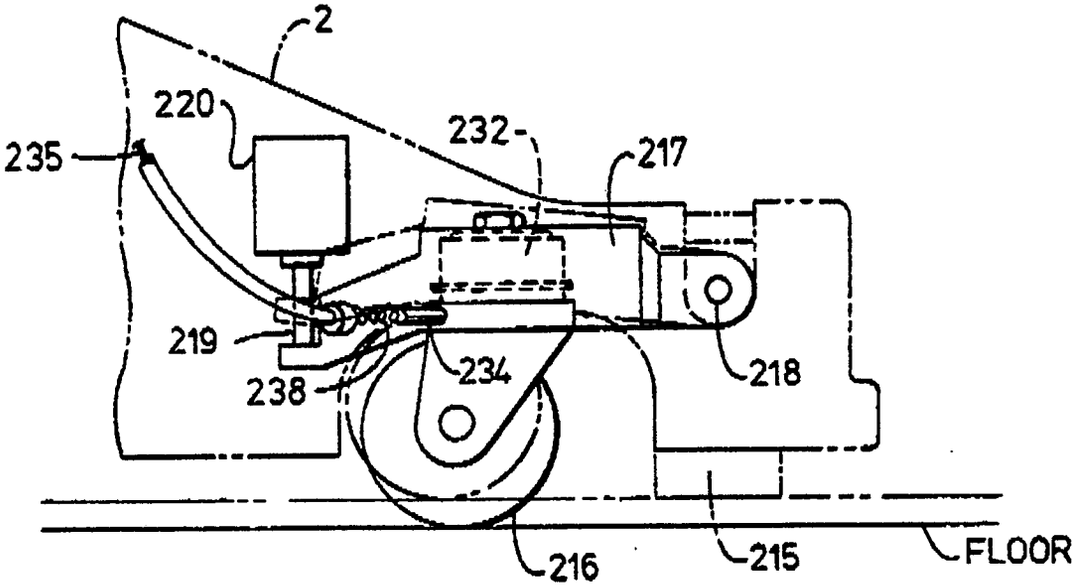
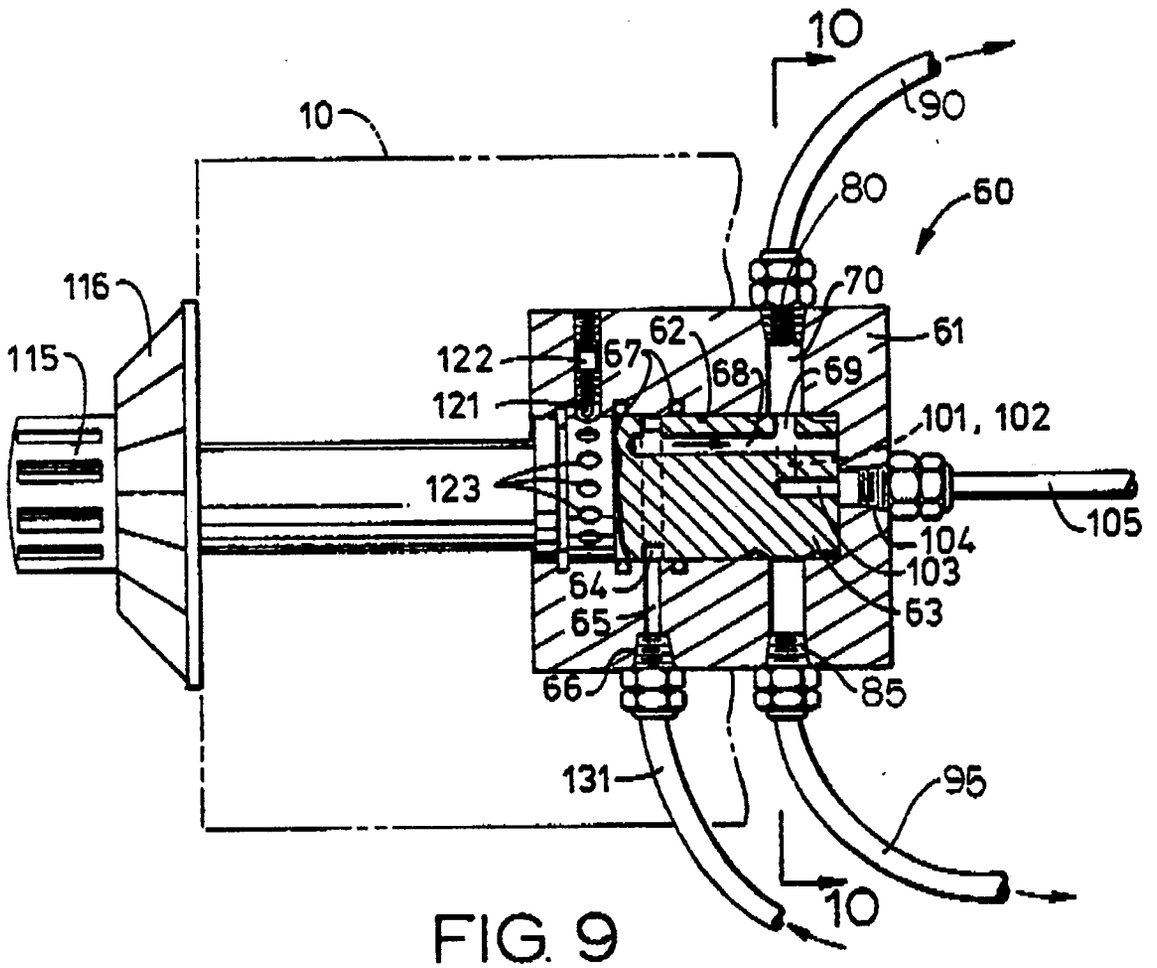

2
220
232
235
217
219
234
238
218
216
215
FLOOR

FIG. 20


10
90
10
80
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116
70
115
62
61
122
67
68
69
121
101, 102
123
105
104
103
64
63
65
66
85
131
95
10

FIG. 9