Nov. 1, 1966 R. D. DEWEY 3,281,872

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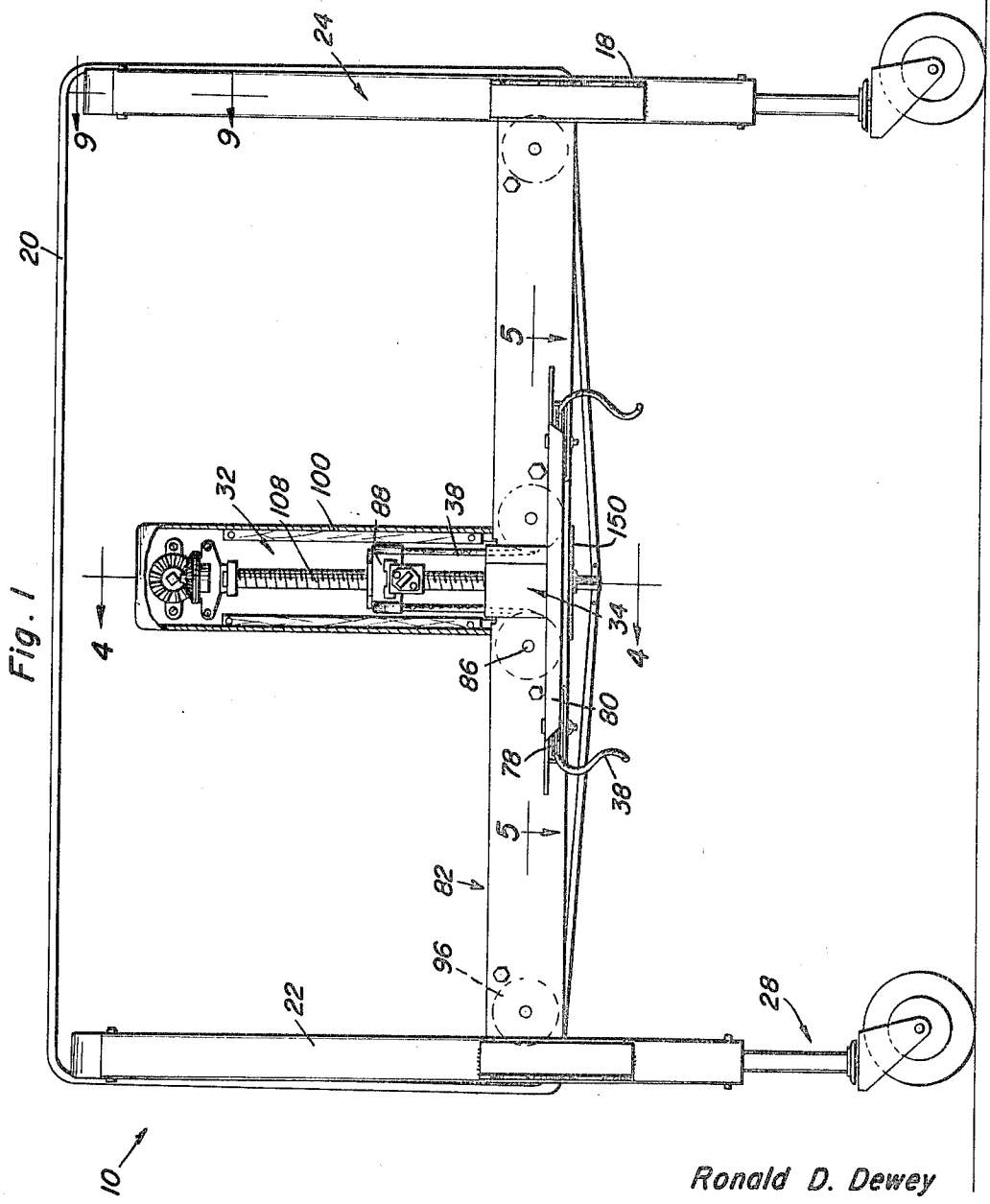


Fig. 1

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Fig. 3

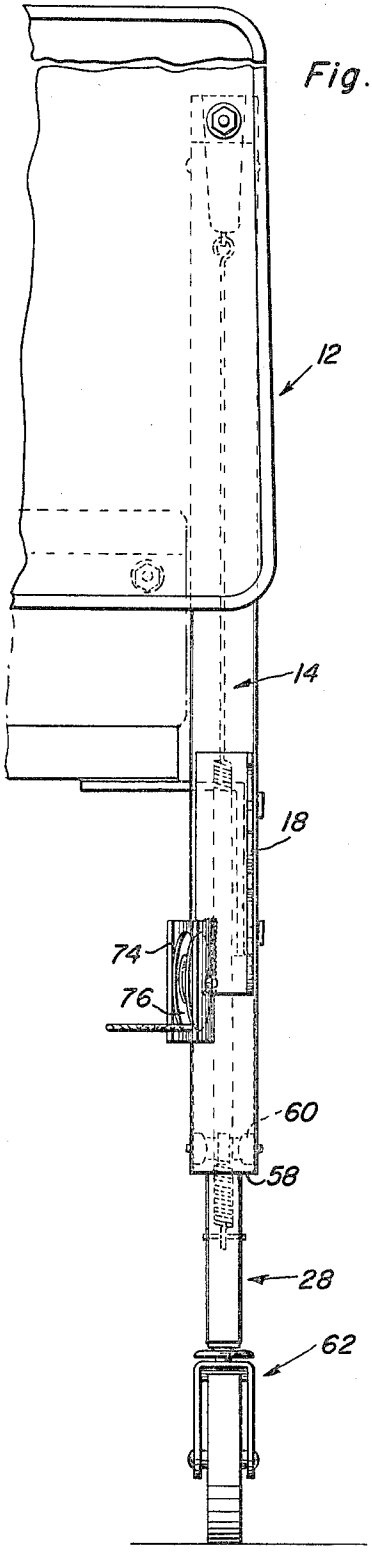
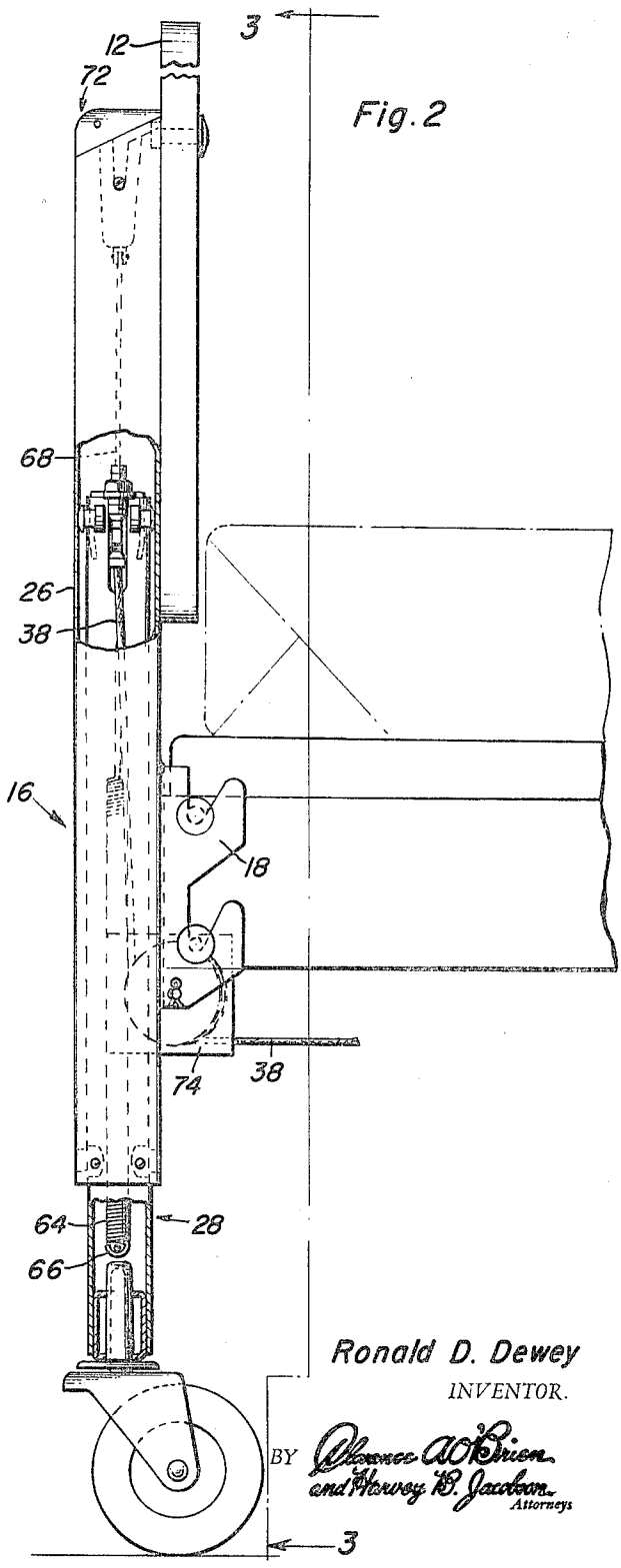


Fig. 2



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Fig. 2A

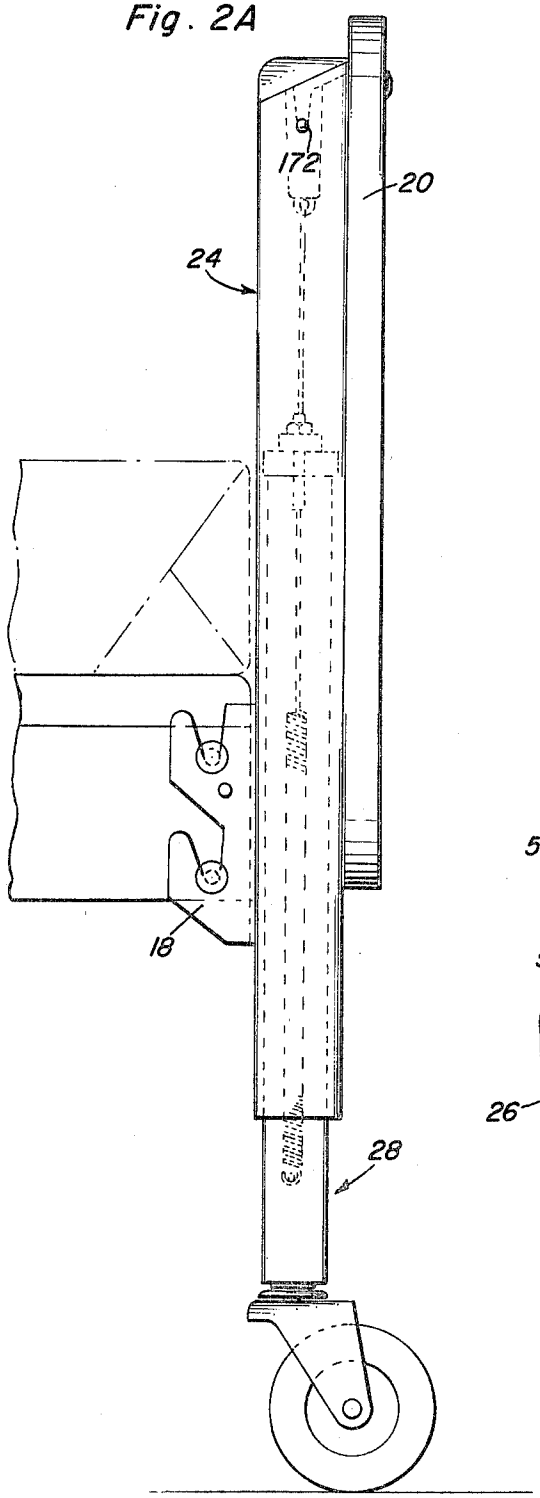


Fig. 9

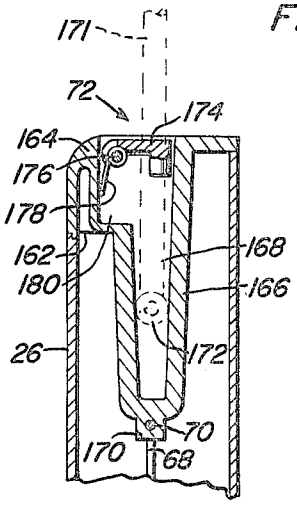
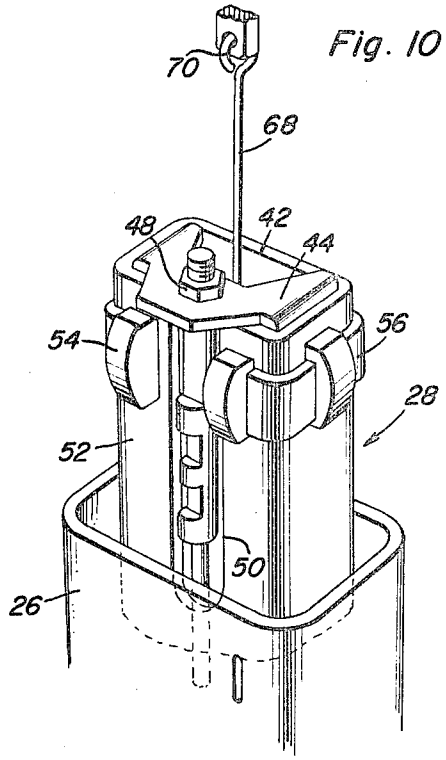


Fig. 10



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Fig. 4

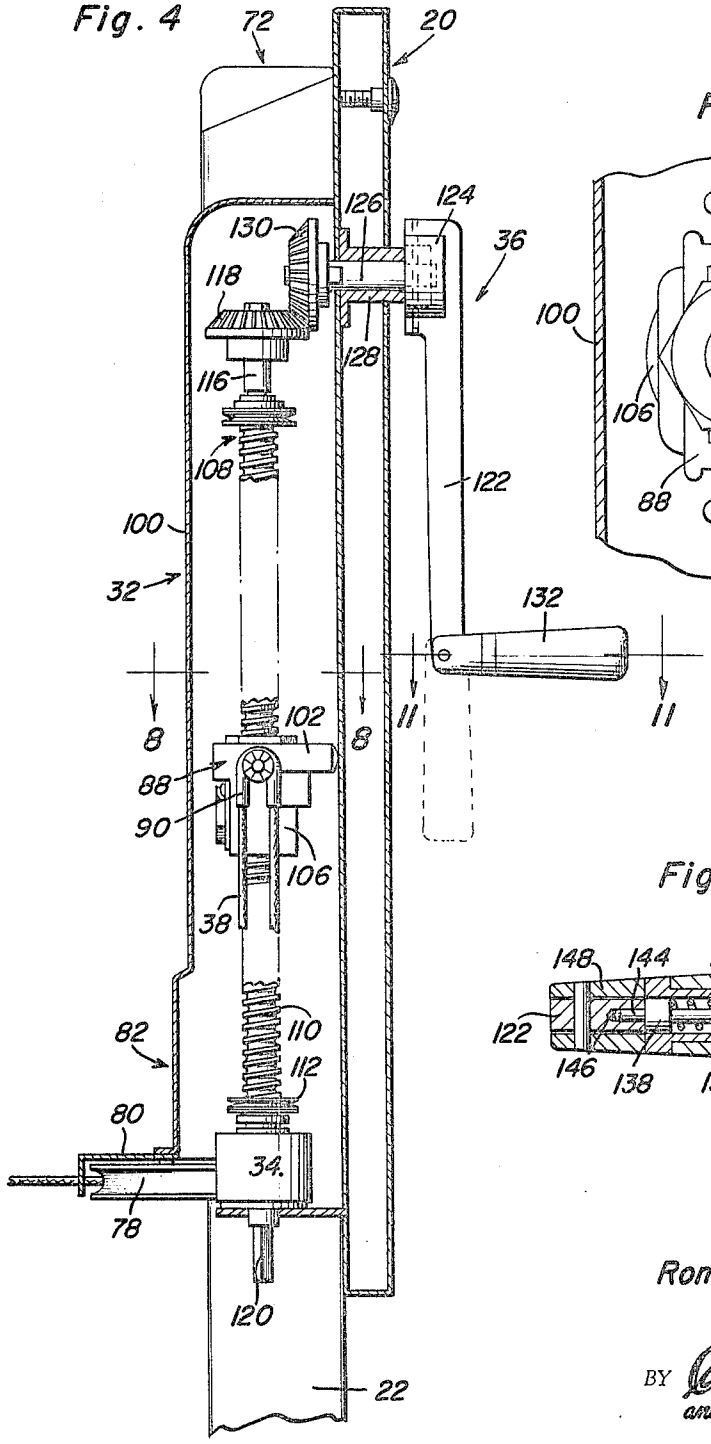


Fig. 8

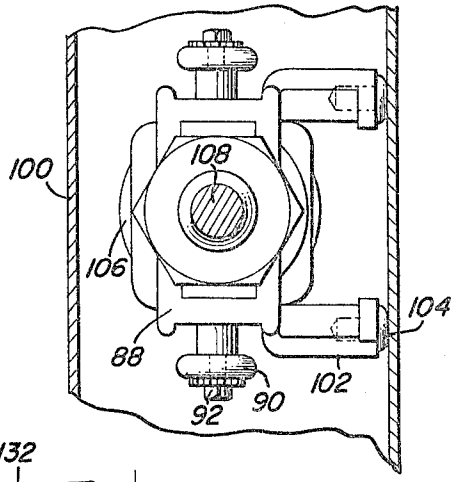
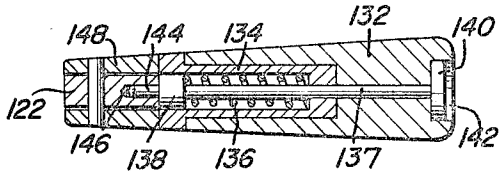


Fig. 11



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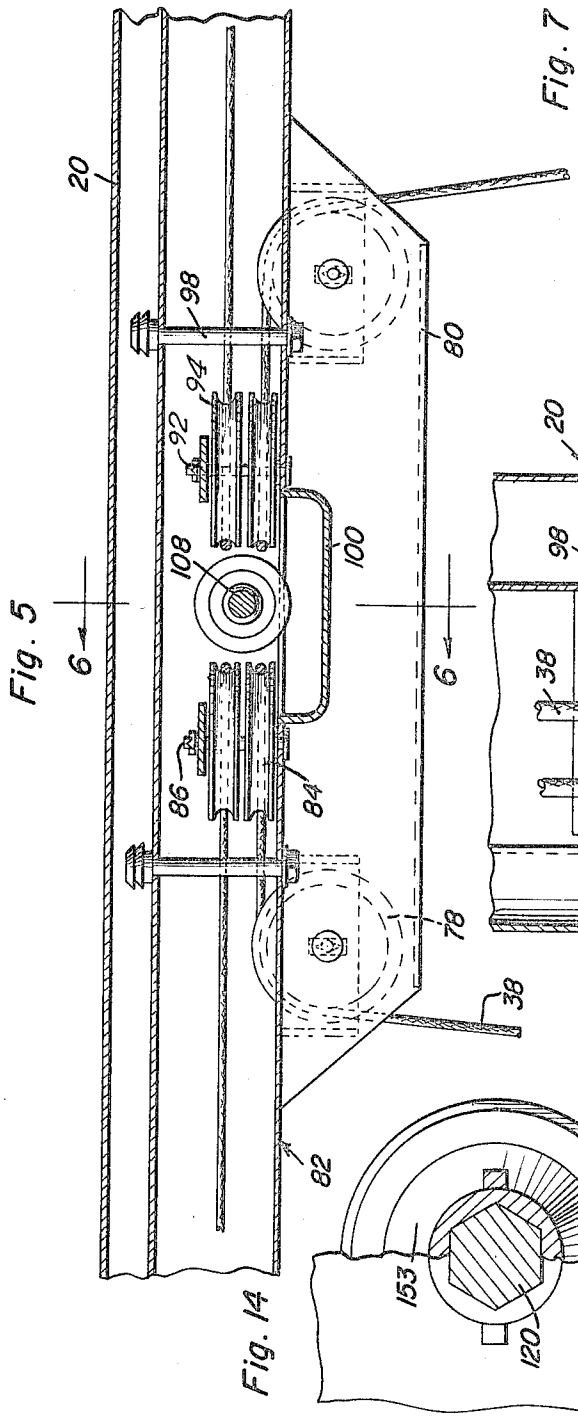
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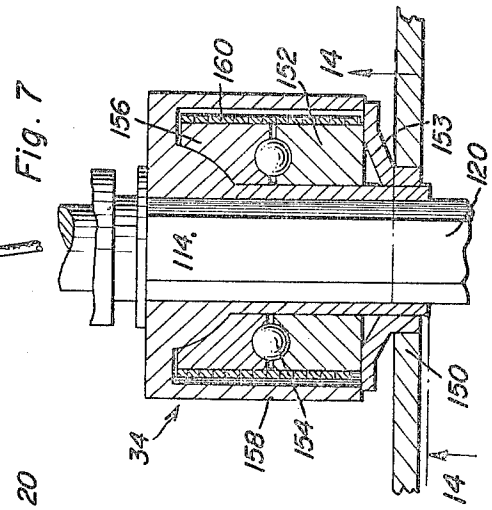
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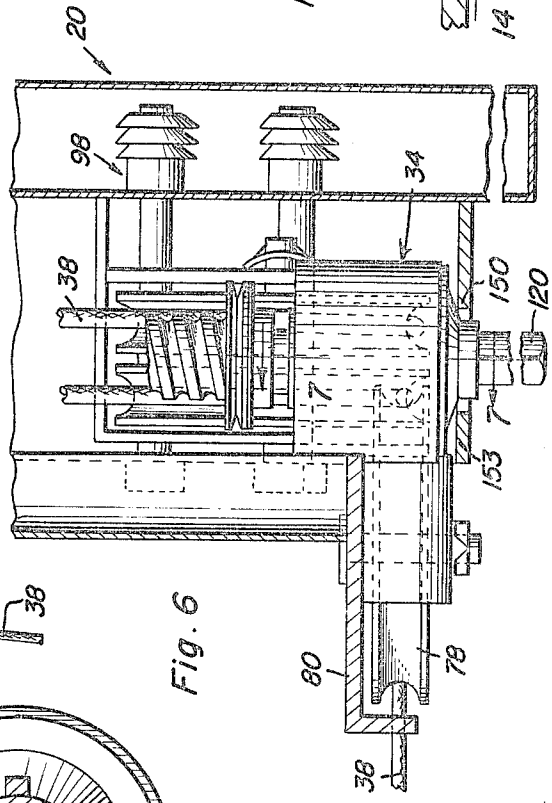
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3,281,872

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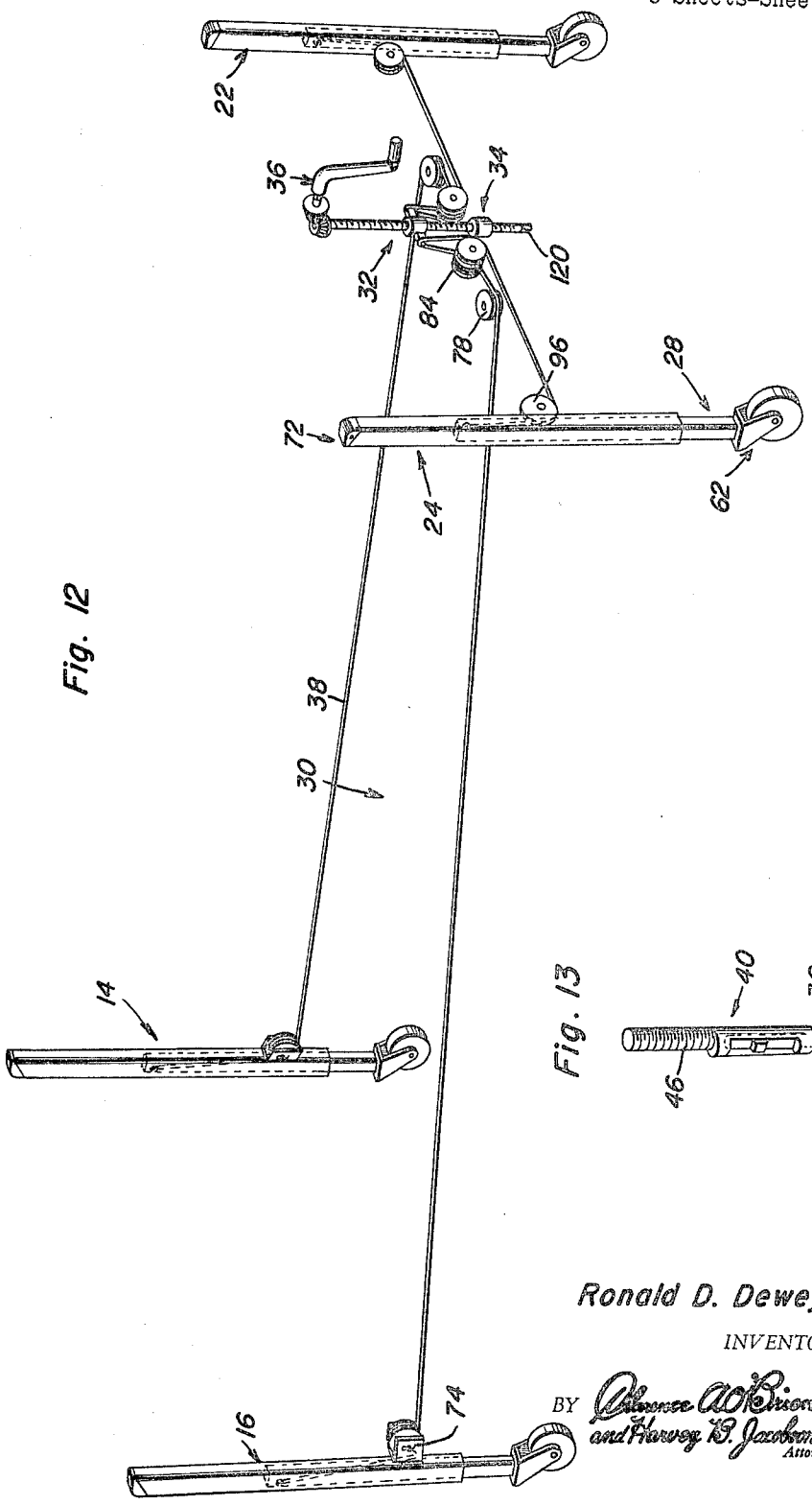


Fig. 12

Fig. 13

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HOSPITAL BED

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Filed Nov. 7, 1962, Ser. No. 235,954
8 Claims. (Cl. 5—63)

This invention relates to an adjustable bed construction particularly suited for hospital use by means of which the mattress supporting spring frame may be elevated or lowered as needed.

It is therefore a primary object of the present invention to provide an adjustable bed construction, adjustment of which is facilitated by a novel actuating mechanism and control assembly equally loaded for both elevating and lowering purposes and involving a minimum of parts cooperating in an efficient and smoothly operating manner.

Another object of the present invention is to provide an adjustable bed construction featuring telescoping post assemblies capable of receiving and supporting thereon support elements of auxiliary frame assemblies such as supporting rods of an overbed frame, the telescoping posts being protectively shielded from dust when not being used for auxiliary frame supporting purposes.

An additional object of the present invention is to provide a novel arrangement of a cable actuating mechanism at the foot end of the adjustable bed.

A still further object of the present invention is to provide an adjustable bed construction which may be alternatively controlled through the cable actuating mechanism by manual manipulation or by a power device adapted to be mounted at a most convenient location in driving relationship to the actuating mechanism.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is an elevational view of the adjustable bed construction from a foot end thereof with parts broken away and shown in section.

FIGURE 2 is a side elevational view of the head end of the adjustable bed construction with parts broken away and shown in section.

FIGURE 2*a* is a side elevational view of the foot end of the bed construction.

FIGURE 3 is a partial front elevational view of the head end of the bed construction as viewed from section line 3—3 in FIGURE 2.

FIGURE 4 is a sectional view taken substantially through a plane indicated by section line 4—4 in FIGURE 1.

FIGURE 5 is a sectional view taken substantially through a plane indicated by section line 5—5 in FIGURE 1.

FIGURE 6 is a partial sectional view taken substantially through a plane indicated by section line 6—6 in FIGURE 5.

FIGURE 7 is a partial sectional view taken substantially through a plane indicated by section line 7—7 in FIGURE 6.

FIGURE 8 is a partial transverse sectional view taken substantially through a plane indicated by section line 8—8 in FIGURE 4.

FIGURE 9 is a partial sectional view taken substantially through a plane indicated by section line 9—9 in FIGURE 1.

FIGURE 10 is a perspective view of the upper end portion of an inner leg assembly projecting from a broken away portion of an outer post assembly.

FIGURE 11 is a sectional view taken substantially through a plane indicated by section line 11—11 in FIGURE 4.

FIGURE 12 is a diagrammatic perspective view of the cable actuating assembly.

FIGURE 13 is a perspective view of one terminal end portion of the cable.

FIGURE 14 is a partial sectional view taken substantially through a plane indicated by section line 14—14 in FIGURE 7.

Referring now to the drawings in detail, it will be observed from FIGURES 1, 2, 2*a*, 3 and 12, that the adjustable bed generally referred to by reference numeral **10** includes a head end frame assembly **12** supported between a pair of outer post assemblies **14** and **16**, each of said post assemblies mounting intermediate the upper and lower ends thereof, a spring supporting bracket **18** by means of which a mattress supporting spring frame may connect the head end of the bed to the foot end thereof which includes a foot end frame assembly **20** supported between a pair of post assemblies **22** and **24** similar in construction to the post assemblies **14** and **16**. Each of the post assemblies is therefore formed from a tubular member **26** preferably rectangular in cross section telescopically receiving therewithin an inner leg assembly **28**. Each of the leg assemblies **28** associated with the respective post assemblies, are interconnected by means of a flexible cable assembly generally referred to by reference numeral **30** as more clearly shown in FIGURE 12. The cable assembly is further connected to an actuating mechanism generally referred to by reference numeral **32** mounted at the foot end of the bed by means of which each of the post assemblies may be simultaneously elevated or lowered with respect to the supporting leg assemblies so that the bed spring frame supported therebetween by the supporting brackets **18**, may be elevated and lowered for mattress height adjustment purposes. Associated with the actuating mechanism **32** is a control brake assembly **34** and a manual crank assembly **36**.

Referring now to FIGURE 12 in particular, it will be observed that the cable assembly **30** includes a pair of cables **38** disposed on opposite longitudinal sides of the bed having terminal end portions **40** at opposite ends as more clearly seen in FIGURE 13 by means of which the cable is anchored to the upper end portions of the inner leg assemblies **28** associated with the post assemblies at the opposite head and foot ends of the bed. As more clearly seen in FIGURE 10, the upper end **42** of the inner leg assembly **28** receives therewithin, an anchoring member **44** to which the threaded section **46** of the cable terminal portion **40**, is connected by means of the nut **48**. A slot **50** is also formed at the upper end portion of the inner leg assembly through which the terminal end portion **40** of the cable is exposed, the cable extending downwardly through the inner leg assembly which includes a tubular member **52** which is geometrically similar in cross section to the cross-sectional shape of the outer post assembly with which it is associated.

With continuing reference to FIGURE 10, it will be observed that mounted adjacent the upper end **42** of each of the inner leg assemblies **28**, are a plurality of spaced slide bearing elements **54** interconnected by the band **56** securing the slide elements to the tubular member **52** of the inner leg assembly. The slide bearing elements **54** are preferably made of nylon or other suitable bearing material for slidably engaging the inner wall surfaces of the tubular member **26**. The tubular member **26** is also provided adjacent the lower end **58** thereof with a similar slide bearing arrangement **60** as shown by dotted lines in FIGURE 3 for slide bearing contact with the projecting lower end portion of the inner leg assembly to which

caster wheel assemblies **62** are connected. Disposed within each of the inner leg assemblies, is a retracting spring member **64** as more clearly seen in FIGURES 2 and 3, the lower ends of said spring members being anchored to the inner leg assembly by a transversely extending anchor pin **66**. The upper ends of the spring members **64** on the other hand, include an elongated shank portion **68** terminating in a hook **70** secured to a post cap assembly generally referred to by reference numeral **72** as more clearly seen in FIGURES 9 and 10. Thus, the retracting spring members **64** associated with each of the post assemblies will be operative to bias the associated inner leg assembly toward a retracted position with respect to the post assembly so as to normally urge the bed to its lower adjusted position. The cable assembly **30** will however hold the post assemblies in extended position with respect to the supporting leg assemblies by tensioning of the cable members **38** through the actuating mechanism **32**. Each of the cable members is therefore anchored to the upper end portion of the inner leg assembly as hereinbefore indicated and extends downwardly through the inner leg assembly and out therefrom by being entrained about a pulley wheel. Accordingly, each of the post assemblies **14** and **16** is provided with pulley wheel supporting brackets **74** which rotatably mount pulleys **76** extending into the outer post assembly and inner leg assembly so that the cable member **38** may be entrained thereabout so as to accommodate an approximately 90 degree turn of the cable. The cable members **38** therefore extend from the post assemblies **14** and **16** toward idler pulley members **78** rotatably mounted by a protective housing portion **80** projecting rearwardly from a transversely extending frame assembly **82** secured to the foot end frame assembly **20** between the post assemblies **22** and **24** as more clearly seen in FIGURES 1 and 4. The cables **38** entrained about the idler pulleys **78** then extend transversely toward pulley wheels **84** rotatably mounted on spindles **86** secured to the frame assembly **82** on opposite sides of the actuating mechanism **32** as more clearly seen in FIGURE 5. The cable members **38** then extend upwardly from the pulley members **84** toward a cable carrier member **88** as more clearly seen in FIGURE 4. The cables extend through a 180 degree tubular guide member **90** carried on the carrier member **88** by supporting spindle assemblies **92** on opposite sides thereof so that the cable may then extend downwardly toward the pulley members **94** also rotatably mounted on the same spindles **86** on which the pulley members **84** are mounted. The cables thereby extend from the pulley members **94** in a transverse direction toward the pulley members **96** rotatably mounted adjacent the opposite transverse ends of the frame assembly **82**, said pulley members **96** projecting into the inner leg assemblies associated with the outer post assemblies **22** and **24** so that the cables may extend upwardly therefrom for anchoring to the upper end portions of the inner leg assemblies as hereinbefore described. It will therefore become apparent that the cables **38** may be tensioned for telescopically moving the post assemblies with respect to the leg assemblies by upward movement of the cable carrier member **88** of the actuating mechanism **32** in order to elevate the bed. Similarly, downward movement of the carrier member **88** will be effective to lower the bed by permitting the retracting spring members **64** to telescopically move the post assemblies and leg assemblies toward retracted positions.

The frame assembly **82** to which the protective housing portion **80** is connected, is secured to the foot end frame assembly **20** by means of anchor bolt assemblies **98** as more clearly seen in FIGURES 5 and 6 between which anchor bolt assemblies, the frame assembly **82** supports an upwardly extending housing portion **100** within which the cable carrier member **88** is slidably mounted. Accordingly, the cable carrier member is provided with a pair of projecting portions **102** as more clearly seen in FIGURE 8 carrying slide bearing elements **104** slidably engaging the rear wall portion of the housing **100**. The carrier member **88** is also supported for vertical movement within the housing **100** by means of a nut assembly **106** of the recirculating ball type having an anti-friction driving connection with the actuating screw shaft **108** provided with a spiral ball-receiving groove **110**. This type of nut assembly is per se well known as indicated for example in Patent No. 2,933,939. The screw shaft **108** is provided adjacent opposite ends thereof, with dish-type thrust spring assemblies **112** through which axial thrust is applied to sleeve portions **114** and **116** connected to opposite end portions of the screw shaft as more clearly seen in FIGURES 4 and 7. A bevel gear **118** is connected to the sleeve portion **116** for rotation with the screw shaft while the sleeve portion **114** at the lower end portion of the screw shaft extends through the control brake assembly **34**. The lower end portion of the screw shaft is also provided with a non-circular connecting portion **120** by means of which the output of an electric motor may be coupled to the screw shaft for rotation thereof. The motor under such circumstances, could then be conveniently bolted to the underside of the frame assembly. Alternatively, rotation may be imparted to the screw shaft **108** by manual manipulation of the crank assembly **36**.

Referring now to FIGURES 4 and 11 in particular, it will be observed that the crank assembly **36** includes a crank member **122** having a hub portion **124** fastened in any suitable manner to a gear shaft **126** projecting through a sleeve bushing **128** mounted by the foot end frame assembly **20**. Keyed to the end of the gear shaft **126** disposed within the housing **100**, is a driving bevel gear **130** which meshes with the bevel gear **118** connected to the upper end of the screw shaft. Accordingly, rotation imparted through the crank member **122** to the bevel gear **130**, may impart rotation in either direction to the screw shaft **108**. A retractable handle assembly is therefore connected to the lower end of the crank member **122** including a knob **132** rotatably mounted on a spring seating member **134** within which the spring **136** bears against a portion **138** of a plunger **137** on which the knob **132** is assembled. Connected to one end of the plunger **137**, is a button **140** disposed within a recess **142** of the knob so that when the knob is pulled outwardly the plunger **134** may retract the lockpin portion **144** thereof from the socket **146** at the lower end of the crank member **122** against the bias of the spring **136**. The handle may then be released so as to pivot the clevis element **148** with respect to the crank member **122** from the solid line position illustrated in FIGURE 4 to the dotted line position. The handle may thereby be disposed in a non-projecting position for safety purposes. It will also be observed that the entire crank assembly may be disconnected and removed should adjustment be effected by an electric motor coupled to the lower end **120** of the screw shaft.

The anti-friction driving connection between the recirculating type of ball nut assembly **106** and the screw shaft will provide an efficient driving connection from the power source, whether it be the handle assembly or the electric motor, to the cable carrier member **88** for slidable displacement thereof in a vertical direction. It will however be appreciated, that the cable carrier member will be loaded by the load of the bed when it is displaced in an upward direction only. Accordingly, pursuant to the principles of the present invention, the control brake assembly **34** is provided for the purpose of preventing rotation of the screw shaft member in one direction due to the load applied to the cable carrier and also to load the screw shaft member when being rotated in the other direction so as to lower the cable carrier member **88**, thereby equalizing the load against which the source of power must operate in lowering the bed with the load against which it must operate to elevate the bed. Referring therefore to FIGURE 7 in particular, it will be observed

that the brake assembly **34** is supported above a supporting plate portion **150** secured to the frame assembly **82** upon which a freely rotatable annular brake element **152** rests. When axially loaded in a downward direction, any rotational torque applied to the brake element **152**, will be resisted by a self-aligning, vibration absorbing the supporting plate washer **153** non-rotatably mounted in portion **150** to maintain uniform and constant brake contact with **152**. Axial thrust is transmitted to the freely rotatable brake element **152** by the ball bearing elements **154** which rotatably support the annular drum element **156** thereabove. The drum element **156** is keyed together with the enclosing housing **158** to the sleeve portion **114** which in turn is keyed to the screw shaft **108**. Accordingly, the upper drum element **156** will rotate with the screw shaft **108**. It will also be observed, that a clamping coil spring **160** anchored to the drum element **156**, is normally disposed in a contracted condition so as to clamp the lower drum element **152** for rotation with the upper drum element **156**. Torque applied to the upper drum element **156** in one directional sense will therefore be operative to cause expansion of the spring limited by the outer housing **158** so as to release therefrom the lower drum element **152**. Accordingly, when the screw shaft **108** is rotated in one direction so as to cause elevation of the cable carrier, an upward axial thrust will be applied to the screw shaft to immediately release the braking pressure applied to the lower drum element **152** while at the same time the rotational torque will be effective to expand the coil spring **160** so as to release the upper drum element **156** from the lower drum element **152** permitting free and unloaded rotation of the screw shaft except for the downward load exerted thereon through the cable carrier. When driving torque is removed from the screw shaft, the axial load of the cable carrier will then be effective once again to axially load the lower drum element **152** engaging the portion **150** while at the same time, the coil spring **160** will contract thereabout so as to thereby also prevent rotation of the screw shaft rotatably connected to the upper drum element **156**. When driving torque is applied to the screw shaft in that rotational direction as to lower the cable carrier, rotation will be retarded by virtue of the fact that the driving torque will maintain the coil spring **160** in contracted condition rotatably coupling the upper and lower drum elements **156** and **152**, with the lower drum element **152** being rotationally retarded by the washer **153**. Therefore, the driving torque in the lowering direction will be resisted so as to equalize the resistive torque which opposes driving torque applied to the screw shaft in the opposite direction for elevating the cable carrier. Equal driving effort will therefore be required for both elevating and lowering the bed.

From the foregoing description, the operation and utility of the adjustable bed of the present invention will be apparent. It will therefore be appreciated, that facilitated adjustment of the bed may be accomplished through use of the recirculating type of ball nut and screw type of actuating mechanism without requiring any complicated brake applying mechanism through use of the drive release brake assembly **34**. Also, equalization of the driving effort required for both raising and lowering of the bed will enable more accurate adjustments in either direction through use of an electric power source capable of being conveniently mounted as an alternative source of power for manual power.

The adjustable bed construction of the present invention also features means for anchoring the upper ends of the retracting springs to the post assemblies as well as to provide facilities for mounting the supporting rods of any type of overbed frame assembly. Accordingly, as more clearly seen in FIGURE 9, each of the post assemblies is provided with beveled upper ends **162** adapted to seat end closure portions **164** of the post cap assemblies **72**. Connected to the end cap closure portions **164**, are

downwardly projecting socket portions **166** having a downwardly tapering opening **168** within which to receive any supporting rod element **171** as shown by dotted lines. The socket portion **166** is also provided at the lower end thereof with a spring anchor portion **170** to which the hooks **70** of the spring members are connected. The cap assemblies **72** are secured in place by a pair of fasteners **172** that extend through the upper end portion of the post assemblies. In order to prevent accumulation of dust within the openings **168** of the cap assemblies, the closure end portions **164** thereof through which the openings **168** are exposed, are provided with socket cover elements **174** pivotally mounted on pins **176** and spring biased by the spring elements **178** to the position illustrated in FIGURE 9. A recess **180** is therefore provided within the end closure portion **164** for receiving the socket cover **174** when depressed downwardly by insertion of a supporting rod element **171** against the bias of the spring element **178**. Therefore, upon removal of the supporting rod element **171** from the opening **168**, the spring element **178** will automatically bias the socket cover **174** to its closed position as illustrated in FIGURE 9. Thus, the post cap assemblies **72** will function in cooperation with the cable assembly **30** to anchor the retracting springs **64** adjacent upper ends of the post assemblies for more effectively controlling the elevation and lowering of the bed and yet permit the post assemblies to supportingly receive supporting rod elements. Removal of the supporting rod elements will also automatically restore the end cap closure assemblies to a condition preventing accumulation of dust within the upper end portion of the post assemblies. It will therefore be appreciated from the foregoing, that the various attributes of the adjustable bed assembly considered either singly or in cooperation with each other, will find particular usefulness in connection with hospital purposes.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. In an adjustable bed construction having a foot end frame assembly supported between a pair of posts telescopingly mounting legs and cable means interconnecting the legs for extension thereof against the bias of retracting springs anchored to the legs and posts; actuating mechanism for the cable means comprising, anti-friction drive means mounted on the frame assembly and connected to the cable means for elevating and lowering the posts with respect to the legs, and drive release brake means operatively connected to the anti-friction drive means for loading thereof in one direction to substantially equal the elevating load when lowering the posts.

2. The combination of claim **1**, wherein said anti-friction drive means comprises an elongated screw shaft, recirculating ball nut means threadedly engageable with said screw shaft, a cable carrier mounted on the ball nut means and guidingly engageable with the frame assembly for vertical displacement with the ball nut means, gear means drivingly connected to the screw shaft at an upper end thereof adapted to be driven by a manually operated crank and means mounted on a lower end of said screw shaft below the drive release brake means for powered drive of the shaft.

3. The combination of claim **2**, wherein said drive release brake means comprises, a drive member connected to the screw shaft, a brake member rotatably mounted on the screw shaft in frictional engagement with the frame assembly, coil spring means releasably coupling the drive member and the brake member and responsive to rotation of the screw shaft in one direction to expand

and release, thrust bearing means rotatably mounting the drive member on the brake member and operative to transmit axial thrust to the brake member in response to rotation of the screw shaft in the other direction to frictionally load the brake member.

4. The combination of claim 3, including removable caps closing upper ends of said posts, each of said caps including downwardly projecting socket means to which one end of a retracting spring is connected, said retracting spring extending from an upper end of the leg, and a spring biased cover element mounted on each cap and retractable therewithin to expose said socket means whereby an auxiliary frame support element is adapted to be received therewithin.

5. In an adjustable bed having a frame assembly and cable means for elevating and lowering the bed, actuating mechanism for the cable means comprising, anti-friction drive means mounted on the frame assembly and connected to the cable means for elevating and lowering the bed, an elongated screw shaft, recirculating ball nut means threadedly engageable with said screw shaft, a cable carrier mounted on the ball nut means and guidingly engageable with the frame assembly for vertical displacement with the ball nut means, gear means drivingly connected to the screw shaft at an upper end thereof adapted to be driven by a manually operated crank and means mounted on a lower end of said screw shaft below the drive release brake means for powered drive of the shaft, said drive release brake means comprising, a drive member connected to the screw shaft, a brake member rotatably mounted on the screw shaft in frictional engagement with the frame assembly, coil spring means releasably coupling the drive member and the brake member and responsive to rotation of the screw shaft in one direction to expand and release, thrust bearing means rotatably mounting the drive member on the brake member and operative to transmit axial thrust to the brake member in response to rotation of the screw shaft in the other direction to frictionally load the brake member.

6. In an adjustable bed construction having a frame assembly supported between a pair of posts telescopingly mounting legs for extension thereof against the bias of retracting springs anchored to the legs and posts; removable caps closing upper ends of said posts, each of said caps including downwardly projecting socket means to which one end of a retracting spring is connected, said retracting spring extending from an upper end of the leg, and a spring biased cover element mounted on each cap and retractable therewithin to expose said socket means whereby an auxiliary frame support element is adapted to be received therewithin.

7. In a bed frame assembly having vertical posts, a removable cap closing an upper end of each of said posts, each cap including socket means projecting downwardly into the post, a spring biased cover element mounted on each cap and retractible therewithin to expose said socket means whereby an auxiliary frame support element is adapted to be received in the socket means, and means mounted within each post and connected to the socket means for yieldably holding the cap on the upper end of the post.

8. In adjustable bed construction having a frame assembly and extensible legs, means for elevating and lowering the frame assembly relative the legs comprising, anti-friction drive means mounted on the frame assembly, flexible means operatively connecting the drive means to the legs for loading thereof in an elevating direction only, biasing means interconnecting the legs with the frame assembly to overcome any resistance to movement in a lowering direction imposed by the anti-friction drive means, a source of power drivingly connected to the drive means to overcome the loading on the drive means in either direction for elevating or lowering the frame assembly and drive release brake means operatively connected to the drive means for loading thereof in the lowering direction only to equalize the loading on the drive means in both directions whereby equal efforts are required to elevate and lower the frame assembly.

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