July 12, 1966 HIDEHARU HORIE 3,260,051

CHAIR RAISING AND LOWERING MECHANISM

Filed March 17, 1964 3 Sheets-Sheet 1

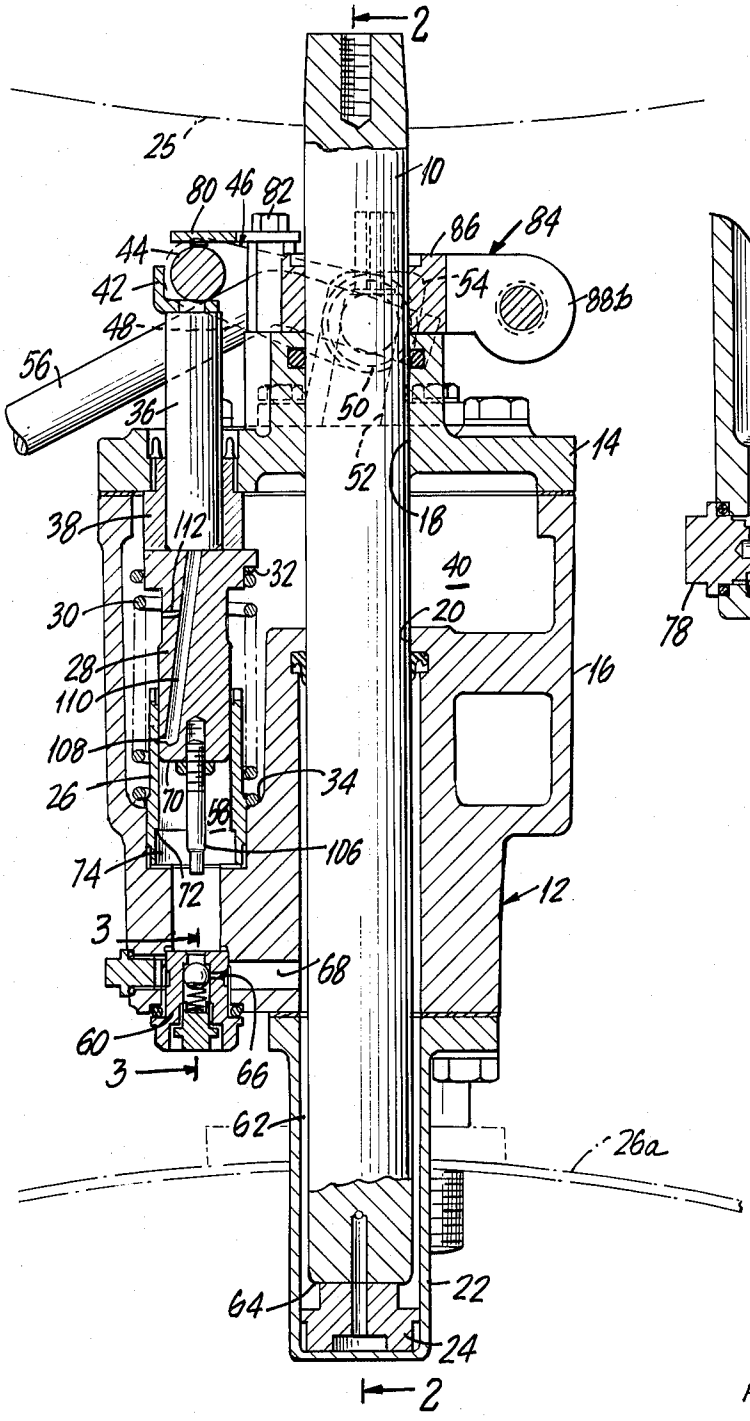


FIG. 1

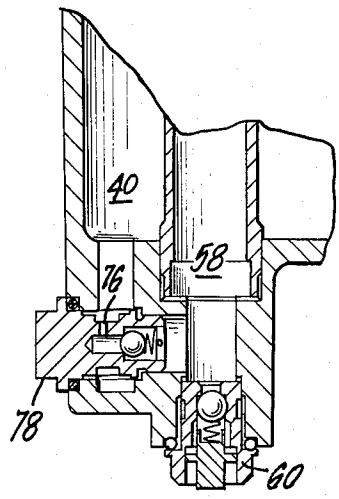


FIG. 3

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July 12, 1966 HIDEHARU HORIE 3,260,051

CHAIR RAISING AND LOWERING MECHANISM

Filed March 17, 1964 3 Sheets-Sheet 2

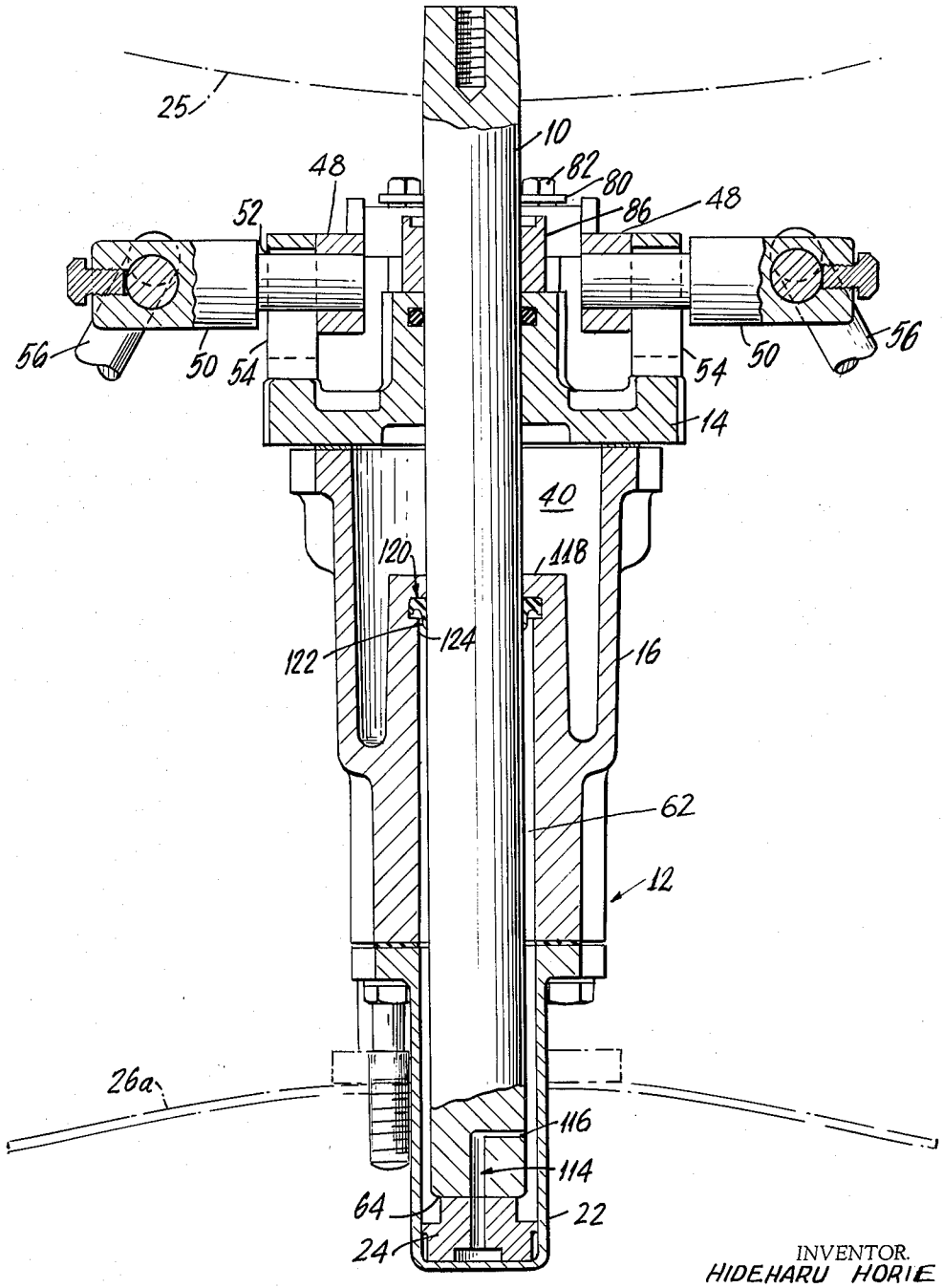


FIG. 2

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July 12, 1966 HIDEHARU HORIE 3,260,051

CHAIR RAISING AND LOWERING MECHANISM

Filed March 17, 1964 3 Sheets-Sheet 3

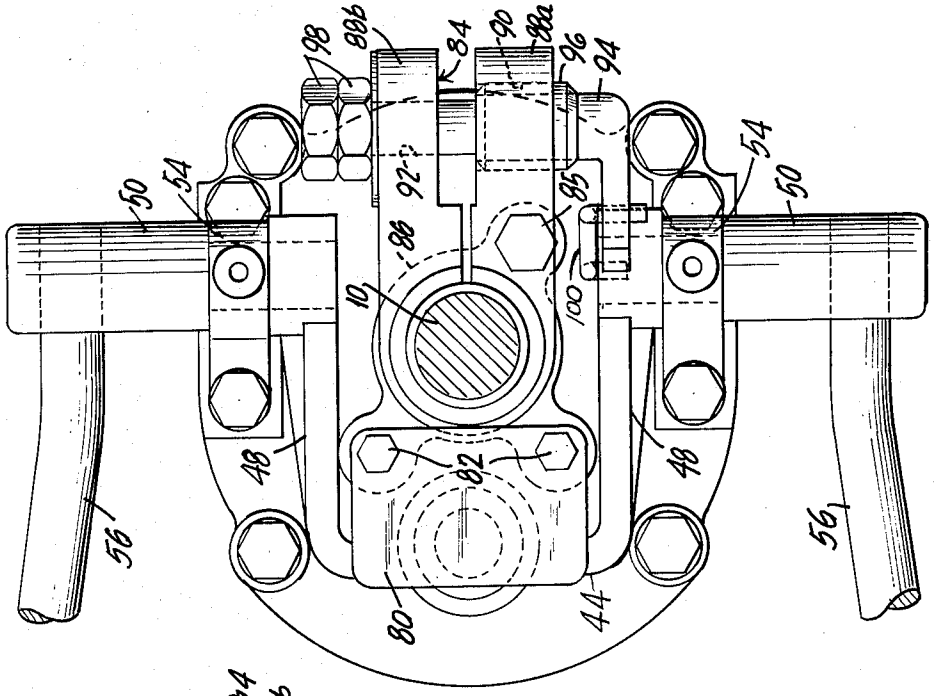


FIG. 5

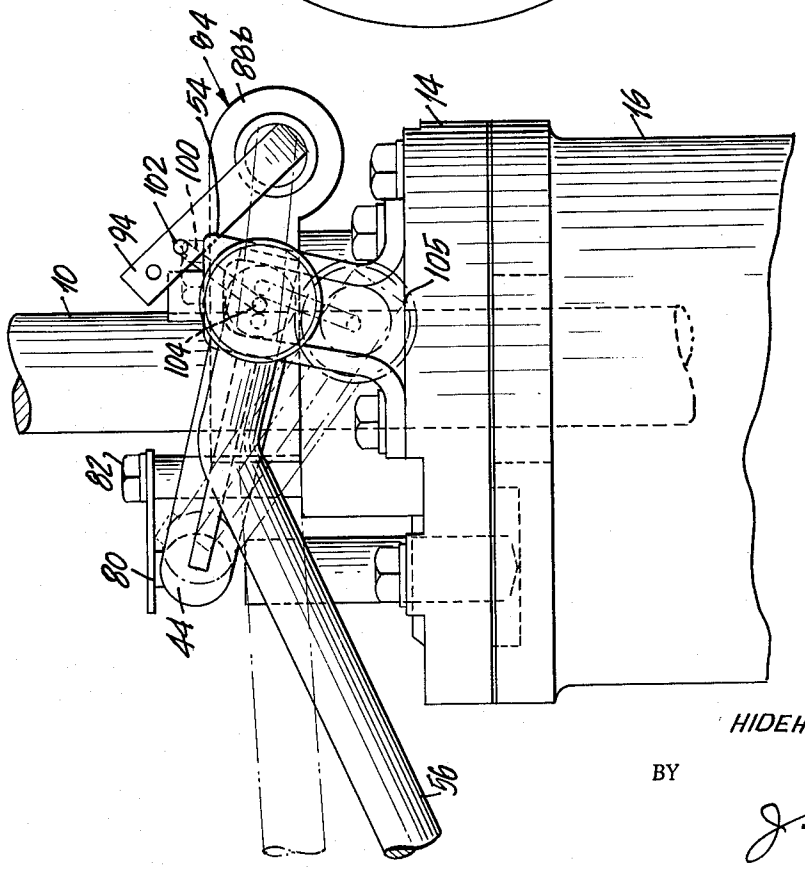


FIG. 4

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CHAIR RAISING AND LOWERING MECHANISM

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6 Claims. (Cl. 60—52)

This invention relates to a hydraulic mechanism for raising and lowering a chair, for example, a barber or beauty parlor chair.

An object of the present invention is to provide an improved hydraulic mechanism for raising and lowering a chair in a relatively simple fashion by the mere movement of a foot-operated pedal, and wherein relatively short up and down movements of the pedal lifts the chair to a raised position, and movement of the pedal to a lowermost position releases the chair from its raised position and lowers it to its lowermost position, and movement of the pedal to an uppermost postion locks the chair against movement.

Another object is to provide a hydraulic mechanism of the type indicated with improved valve control means.

A further object is to provide the indicated hydraulic mechanism with automatic means for preventing further chair-raising movement after the chair has reached an uppermost position.

Another object is to provide a hydraulic operating mechanism for a chair with improved hydraulic fluid sealing means.

Still another object is to generally provide a chair-raising and lowering mechanism of improved construction.

The above and other objects, features and advantages of the invention will be more fully understood from the following description of the invention considered in connection with the accompanying illustrative drawings of an embodiment of the invention.

In the drawings:

FIG. 1 is a vertical sectional view of a hydraulic chair operating mechanism in accordance with the present invention;

FIG. 2 is a vertical sectional view taken on line 2—2 of FIG. 1;

FIG. 3 is a vertical sectional view taken on line 3—3 of FIG. 1;

FIG. 4 is a side elevational view of the upper part of the mechanism; and

FIG. 5 is a top plan view of the mechanism.

Referring now to the drawings in detail, the hydraulic chair operating mechanism comprises a ram 10 mounted for vertical up and down movement in a housing 12 which has a head part 14 and a body part 16 provided with cylindrical bores 18 and 20, respectively, in which the ram slidably moves. A hollow cylindrical housing part 22 is secured to the bottom of body part 16 and encloses the lower end of the ram. A cushion 24 is suitably mounted in the bottom of cylinder 22 for cushioning the lower end of the ram. The upper end of the ram projects from the upper end of head 14 and it is to be understood that the chair seat 25 which is to be moved up and down by the ram is suitably secured to the projecting end of the ram, and the housing 12 is suitably secured at its lower end to an inverted disc-shaped base 26a.

Body part 16 of the housing is provided with a cylinder 26 in which a plunger 28 is slidably mounted for vertical up and down movement. The plunger is normally biased by a helical compression spring 30 into an uppermost position as shown and for this purpose the upper part of the plunger is provided with an undercut part 32 which is engaged by the upper end of spring 30. The lower end of the spring rests on seat 34 provided in body part 16.

A plunger rod 36 is mounted for vertical up and down movement in a cylinder 38 which is mounted in head part 14 of the housing and extends downwardly into recess or chamber 40 of body part 16. The chamber provides a reservoir for hydraulic fluid. The upper part of the plunger rod extends from the top of head 14 and its upper end is provided with an L-shaped member 42. The cross-bar 44 of a U-shaped crank 46 rests on member 42 and is operable to actuate rod 36 as will be more fully understood hereinafter. The crank has a pair of laterally spaced arms 48 (FIGS. 1 and 5) which are connected at one end thereof to cross-bar 44. The opposite ends of the arms are each connected to a companion crank pin 50 which are in axial alignment with each other. Each of the crank pins extends into a straight inclined guide slot 52 provided in a companion guide member 54. The guide members are laterally spaced from each other, as best seen in FIGS. 2 and 5, and are suitably secured to the top of head 14 of the housing 12.

The crank pins are operated by a pair of laterally spaced pedal arms 56 and each arm is suitably connected to a companion crank pin. A foot-operated pedal (not shown) interconnects the arms.

Ram 10 can be raised from the positions shown in FIGS. 1 and 2 by a series of up-and-down movements of pedal arms 56. More particularly, downward movement of arms 56 causes crank arms 48 to rotate in a counterclockwise direction as viewed in FIG. 1, so that cross-bar 44 of crank 46 moves downwardly, causing plunger rod 36 to move down against plunger 28. The plunger moves downwardly under the force of the plunger rod, compressing spring 30, and at the same time causing hydraulic fluid from chamber 58 to exert pressure on check valve 60 which opens the valve to permit flow of hydraulic fluid from chamber 58 to the annular space 62 around the ram as well as to the lower end 64 of the ram, via passage 66 in valve 60 and passage 68 in the lower part of body 16. The pedal arms are moved downwardly a sufficient distance so that the lower end 70 of plunger 28 is at the upper end 72 of an annular space 74 which is formed between the lower part of cylinder 26 and the lower part of the plunger when the latter is in its lowermost position, for reasons which will be more clearly understood hereinafter. The amount of downward movement of the pedal for each raising movement of the ram is readily determined by the operator after a short period of operating experience with the mechanism.

Upon release of the pedal after its downward movement, spring 30 returns the plunger 28 and plunger rod 36 as well as the pedal, pedal arms 56 and crank 46 to the positions shown in FIGS. 1 and 2, and the mechanism is again in position for another downward movement of the pedal arms and another upward movement of the

ram. Of course the ram does not move downward upon release of the pedal arms because valve **60** prevents any back flow of hydraulic fluid from space **62** into chamber **58**. Upward movement of the pedal arms results in the flow of additional hydraulic fluid into chamber **58** from chamber **40** via passage **76** (FIG. 3) of check valve **78** to replenish the fluid which flowed into space **62** during the previous downward movement of the pedal arms. The ram can be raised to various levels by additional downward-and-releasing movements of the pedal arms.

In accordance with another feature of the invention, the ram can be locked in its raised position against movement by moving the pedal arms into their uppermost position as shown by the broken lines in FIG. 4. For this purpose, a stop plate **80** is suitably secured by bolts **82** to the head part **14** of the housing and is positioned in the path of upward movement of cross-bar **44** of crank **46**. A split clamp **84** is secured to the top of the head of the housing by a bolt **85** (FIG. 5), and includes a split locking ring **86** which, in the unlocked position of the ram, loosely engages the ram and permits sliding movement of the ram relative thereto. The clamp includes a pair of laterally spaced arms **88***a* and **88***b* which, when arm **88***b* is squeezed toward arm **88***a*, causes closing of lock ring **86** to thereby lock the ram in position.

Arm **88***a* is provided with a threaded hole **90** and arm **88***b* is provided with a clearance hole **92**. An L-shaped handle **94** has a threaded portion **96** which is screwed into threaded hole **90** and the handle extends through clearance hole **92**. The extending end of the handle is threaded and provided with nuts **98** which are tightened against arm **88***b* of the clamp. It will be apparent that when the handle is rotated in a counterclockwise direction, as viewed in FIG. 4, arm **88***b* moves toward arm **88***a* and split ring **86** is tightened about the ram and locks it.

Handle **94** is operated by a link **100** which is pivotally connected at its upper end to the handle at **102**. The opposite and lower end of the link is pivotally connected at **104** to the right end of crank **46**, as viewed in FIG. 4.

As indicated above, to lock the ram in any position, the pedal arms **56** are moved into their uppermost position. Upward movement of the pedal arms results in clockwise rotation of crank pins **50**, as viewed in FIG. 4, so that cross-bar **44** of crank **46** moves in an upward direction until it engages stop **80**. Continued upward movement of the pedal arms causes the right ends of the crank arms **48** as viewed in FIG. 4, to move downwardly and to the left, about the cross-bar **44** as a pivot, and the crank pins **50** move downwardly and to the left in their companion guide slots **52** in guide members **54**. It is to be noted that since guide slots **52** are straight, cross-bar **44** is pulled slightly to the right, as illustrated by FIG. 4, but is restrained from any upward movement, and the right ends of the crank arms move in unison with the crank pins since they are secured to the pins. Downward movement of the crank pins results in the counterclockwise rotation of handle **94**, as viewed in FIG. 4, and arm **88***b* moves toward arm **88***a* to tighten clamp **84** and lock the ram in position. The upper stop and locking position of the pedal arms occurs when the arms engage the top of head **14**, at **105** in FIG. 4.

Lowering of the ram to its lowermost position is accomplished by moving the pedal arms **56** to their lowermost position. This movement results in the lowering of pin **106** (FIG. 1) of plunger **28** so that it engages the ball of check valve **60** to open the valve and permit flow of hydraulic fluid from around the ram back to reservoir **40**. The return-flow of the fluid is as follows: through passage **68** of body part **12**, passage **66** of valve **60**, by-pass chamber **74** which surrounds the lower part of the lowered plunger **28**, passages **108**, **110** and **112**, respectively, in the plunger, and into reservoir **40**.

Thus it can be seen that the structure for pumping, locking and unlocking, and lowering, comprising the crank **46**, crank pins **50**, and pedal arms **56** has no fixed axes

with respect to the housing **12**, and in effect "floats" between the limits defined by the stop plate **80** and the guide slots **52**. No part of this structure; **46**, **50**, **56**; is pivotally mounted on or in fixed relation to any fixed part of the hydraulic mechanism. The force of the spring **30**, acting through the plunger rod **36**, normally holds this structure; **46**, **50**, **56**; in the position shown in FIG. 1, which position comprises a neutral position. When the pedal arms **56** are moved upwardly from this neutral position to cross-bar **44** of crank **46** turns while at the same time moving to the right, as shown in FIG. 2, while crank pins **50** move linearly downwardly in the inclined guide slots **52**. Therefore, the motion of the crank arms **48** of crank **46** is not a rotation, but is a compound linear translation.

In accordance with another feature of the invention, means is provided for automatically preventing further upward movement of the ram after it has reached its uppermost position even though the operator continues to actuate the pedal. This is accomplished by providing the L-shaped passage **114** in the lower end of the ram. As a result, when the upper end **116** of the passage moves above the upper surface **118** (FIG. 2) of body part **16**, it is in communication with reservoir **40** and any additional fluid which is pumped into space **62** by the action of the operator results in the displacement of an equal amount of fluid from space **62** into the reservoir, whereby the ram remains in its uppermost position.

In accordance with still another feature of the invention, seal **120** (FIG. 2) which prevents leakage of fluid from space **62** into reservoir **40** is U-shaped and has a leg **122** which has one of its sides in sliding contact with the ram, and its opposite side is slightly spaced from the adjacent wall **124** of body part **16**. Accordingly, when the lower end of the ram moves above the seal, the latter is not damaged since hydraulic fluid is present on both sides of leg **122** to balance the pressure on the seal.

While I have shown and described the preferred embodiment of the invention, it will be understood that the invention may be embodied otherwise than as herein specifically illustrated or described, and that certain changes in the form and arrangement of parts and in the specific manner of practicing the invention may be made without departing from the underlying idea or principles of this invention within the scope of the appended claims.

I claim:

1. Chair raising and lowering mechanism, comprising a movable ram adapted to be secured to the seat of a chair for raising and lowering said seat, and means for locking said ram in a position thereof, said locking means comprising clamping means movable from an inoperative ram non-locking position to an operative ram locking position, and means for operating said clamping means comprising a guide member having a guide slot therein, a pin movable in said guide slot from one position corresponding to said inoperative position of said clamping means to another position corresponding to said locking position of said clamping means, means secured to said pin and having a part spaced therefrom to provide a pivot for moving said pin from said one position to said other position, a member connected to said pin for rotating the latter, and stop means in the path of movement of said spaced part, for stopping the movement thereof during an initial movement of said pin operating member in one direction so that continued movement of said pin operating member in said direction causes said pin to pivot about said spaced part and move from said one position thereof to said other position thereof for operating said clamping means, pumping means including a plunger for raising and lowering the ram, including means controlled by operation of said spaced part for controlling said plunger

2. Chair raising and lowering mechanism, comprising a movable ram adapted to be secured to the seat of a chair for raising and lowering said seat, and means for locking said ram in a position thereof, said locking means

comprising clamping means movable from an inoperative ram non-locking position to an operative ram locking position, said clamping means comprising a split ring encircling said ram and a pair of laterally spaced arms extending from said ring and movable toward each other to clamp said ring on said ram in said operative ram locking position, and means for operating said clamping means comprising a guide member having a guide slot therein, a pin movable in said guide slot from one position corresponding to said inoperative position of said clamping means to another position corresponding to said locking position of said clamping means, means secured to said pin and having a part spaced therefrom to provide a pivot for moving said pin from said one position to said other position, a member connected to said pin for rotating the latter, and stop means in the path of movement of said spaced part, for stopping the movement thereof during an initial movement of said pin operating member in one direction so that continued movement of said pin operating member in said direction causes said pin to pivot about said spaced part and move from said one position thereof to said other position thereof for operating said clamping means, pumpng means including a plunger for raising and lowering the ram, including means controlled by operation of said spaced part for controlling said plunger.

3. Chair raising and lowering mechanism, comprising a movable ram adapted to be secured to the seat of a chair for raising and lowering said seat, and means for locking said ram in a position thereof, said locking means comprising clamping means movable from an inoperative ram non-locking position to an operative ram locking, position, said clamping means comprising a split ring encircling said ram and a pair of laterally spaced arms extending frm said ring and movable toward each other to clamp said ring on said ram in said operative ram locking position, and means for operating said clamping means comprising a guide member having a guide slot therein, a pin movable in said guide slot from one position corresponding to said inoperative position of said clamping means to another position corresponding to said locking position of said clamping means, means interconnecting said arms and operable to move said arms toward each other for said clamping operation, a clamping means operating member connected to said arms interconnecting means and said pin for operation of said clamping means in response to movement of said pin, means secured to said pin and having a part spaced therefrom to provide a pivot for moving said pin from said one position to said other position, a member connected to said pin for rotating the latter, and stop means in the path of movement of said spaced part, for stopping the movement thereof during an inital movement of said pin operating member in one direction so that continued movement of said pin operating member in said direction causes said pin to pivot about said spaced part and move from said one position thereof to said other position thereof for operating said clamping means, pumping means including a plunger for raising and lowering the ram, including means controlled by operation of said spaced part for controlling said plunger.

4. Chair raising and lowering mechanism comprising a movable ram adapted to be secured to the seat of a chair for raising and lowering said seat, an operating member movable between upper and lower positions and in an intermediate range spaced from and between said upper and lower positions and means operable in response to movement of said operating member into said upper position thereof for locking said ram against movement, said ram locking means comprising clamping means movable from an inoperative ram non-locking position to an operative ram locking position, and means for operating said clamping means comprising a guide member having a guide slot therein, a pin movable in said guide slot from one position corresponding to said inoperative position

of said clamping means to another position corresponding to said locking position of said clamping means, means secured to said pin and having a part spaced therefrom to provide a pivot for moving said pin from said one position to said other position, said ram operating member being connected to said pin for rotating the latter, and stop means in the path of movement of said spaced part, for stopping the movement thereof during an initial movement of said ram operating member in one direction so that continued movement of said ram operating member in said direction causes said pin to pivot about said spaced part and move from said one position thereof to said other position thereof for operating said clamping means, pumping means including a plunger for raising and lowering the ram, including means controlled by operation of said spaced part for controlling said plunger.

5. Chair raising and lowering mechanism comprising a movable ram adapted to be secured to the seat of a chair for raising and lowering said seat, an operating member movable between upper and lower positions and in an intermediate range spaced from and between said upper and lower positions, and means operable in response to movement of said ram operating member into said upper position thereof for locking said ram against movement, said ram locking means comprising clamping means movable from an inoperative ram non-locking position to an operative ram locking position, said clamping means comprising a split ring encircling said ram and a pair of laterally spaced arms extending from said ring and movable toward each other to clamp said ring on said ram in said operative ram locking position, and means for operating said clamping means comprising a guide member having a guide slot therein, a pair movable in said guide slot from one position corresponding to said inoperative position of said clamping means to another position corresponding to said locking position of said clamping means,, means secured to said pin and having a part spaced therefrom to provide a pivot for moving said pin from said one position to said other position, said ramrotating member being connected to said pin for operating the latter, and stop means in the path of movement of said spaced part, for stopping the movement thereof during an initial movement of said ram operating member in one direction so that continued movement of said ram operating member in said direction causes said pin to pivot about said spaced part and move from said one position thereof to said other position thereof for operating said clamping means, pumping means including a plunger for raising and lowering the ram, including means controlled by operation of said spaced part for controlling said plunger.

6. Chair raising and lowering mechanism comprising a movable ram adapted to be secured to the seat of a chair for raising and lowering said seat, an operating member movable between upper and lower positions and in an intermediate range spaced from and between said upper and lower positions, and means operable in response to movement of said ram operating member into said upper position thereof for locking said ram against movement, said ram locking means comprising clamping means movable from an inoperative ram non-locking position to an operative ram locking position, said clamping means comprising a split ring encircling said ram and a pair of laterally spaced arms extending from said ring and movable toward each other to clamp said ring on said ram in said operative ram locking position, and means for operating said clamping means comprising a guide member having a guide slot therein, a pin movable in said guide slot from one position corresponding to said inoperative position of said clamping means to another position corresponding to said locking position of said clamping means, means interconnecting said arms and operable to move said arms toward each other for said clamping operation, a clamping means

operating member connected to said arms interconnecting means and said pin for operation of said clamping means in response to movement of said pin, means secured to said pin and having a part spaced therefrom to provide a pivot for moving said pin from said one position to said other position, said ram operating member being connected to said pin for rotating the latter, and stop means in the path of movement of said spaced part, for stopping the movement thereof during an initial movement of said ram operating member in one direction so that continued movement of said ram operating member in said direction causes said pin to pivot about said spaced part and move from said one position thereof to said other position thereof for operating said clamping means,

pumping means including a plunger for raising and lowering the ram, including means controlled by operation of said spaced part for controlling said plunger.

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