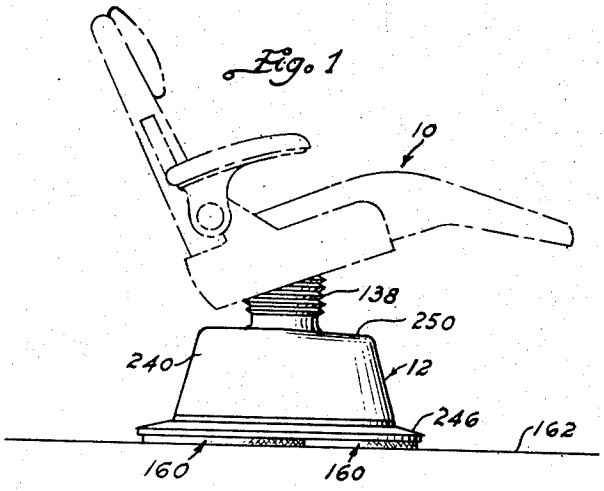
Oct. 17, 1967 W. R. HEATHE 3,347,330

SELF-LEVELING AIR SUPPORTED MOBILE CHAIR BASE

Filed July 12, 1965 5 Sheets-Sheet 1

Fig. 1



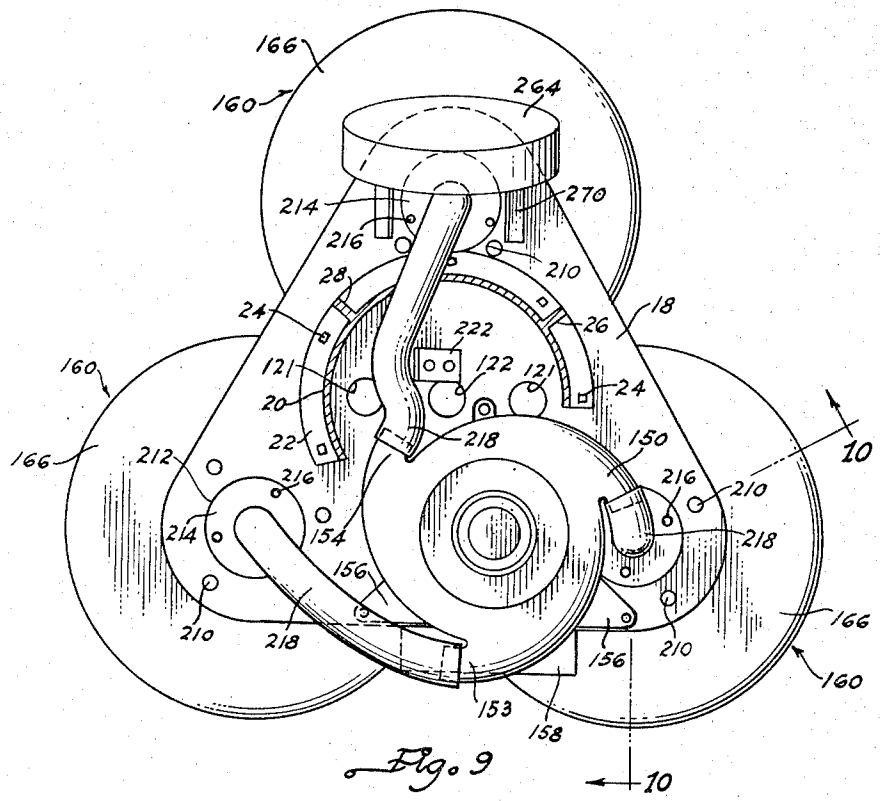


Fig. 9

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SELF-LEVELING AIR SUPPORTED MOBILE CHAIR BASE

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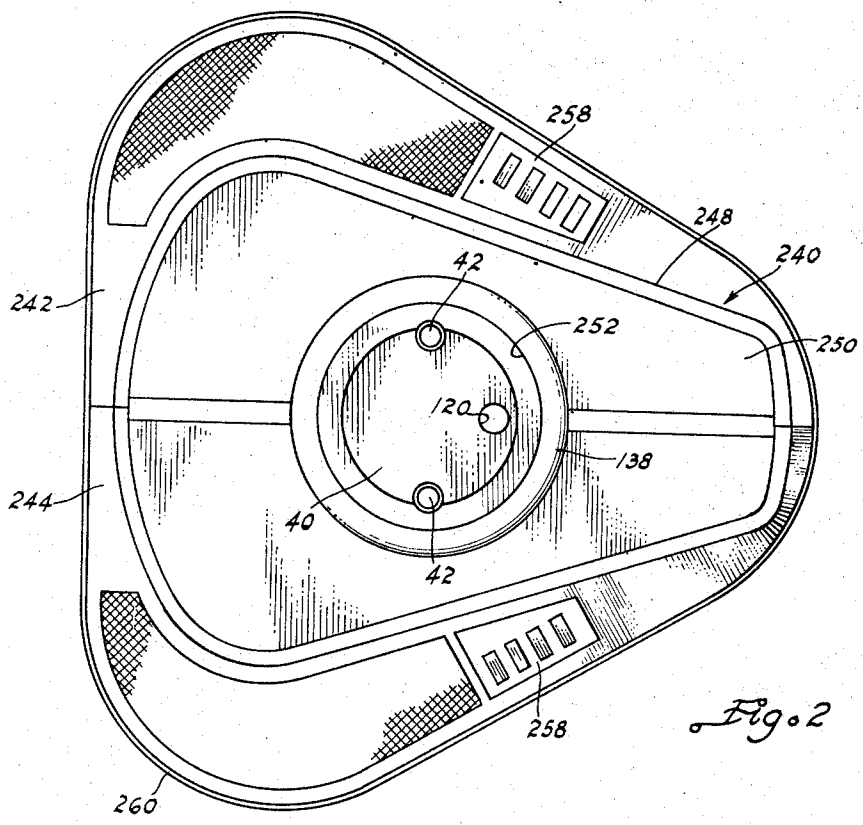


Fig. 2

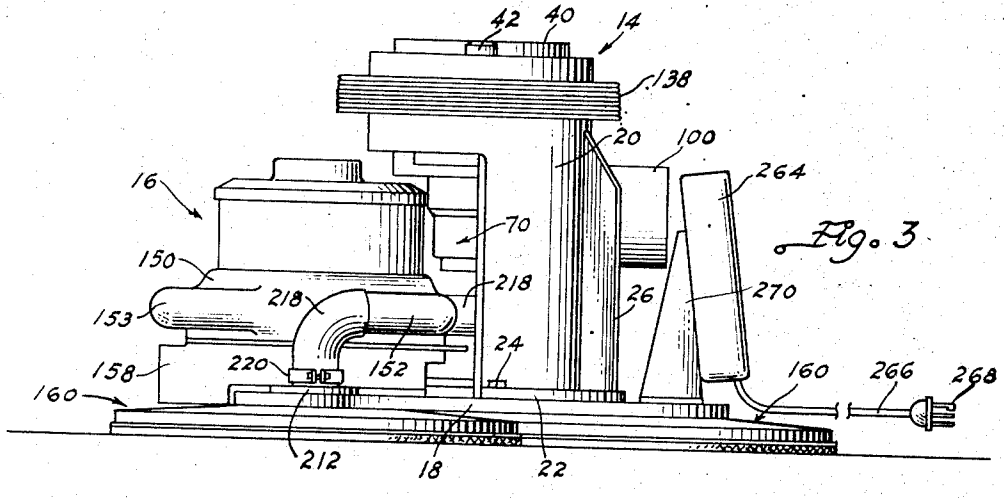


Fig. 3

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SELF-LEVELING AIR SUPPORTED MOBILE CHAIR BASE

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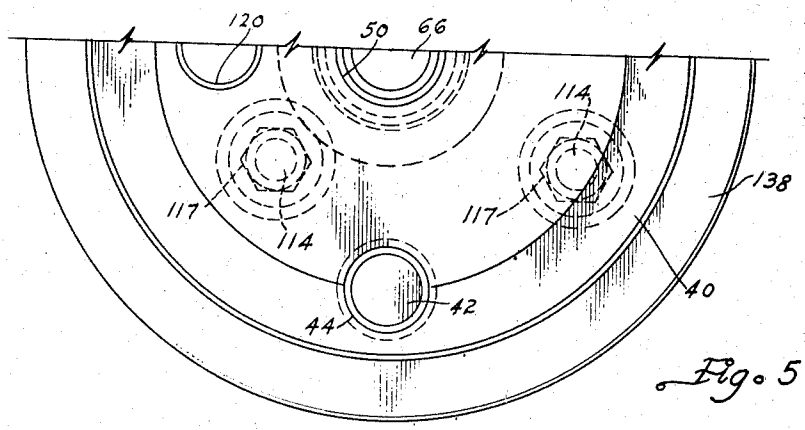


Fig. 5

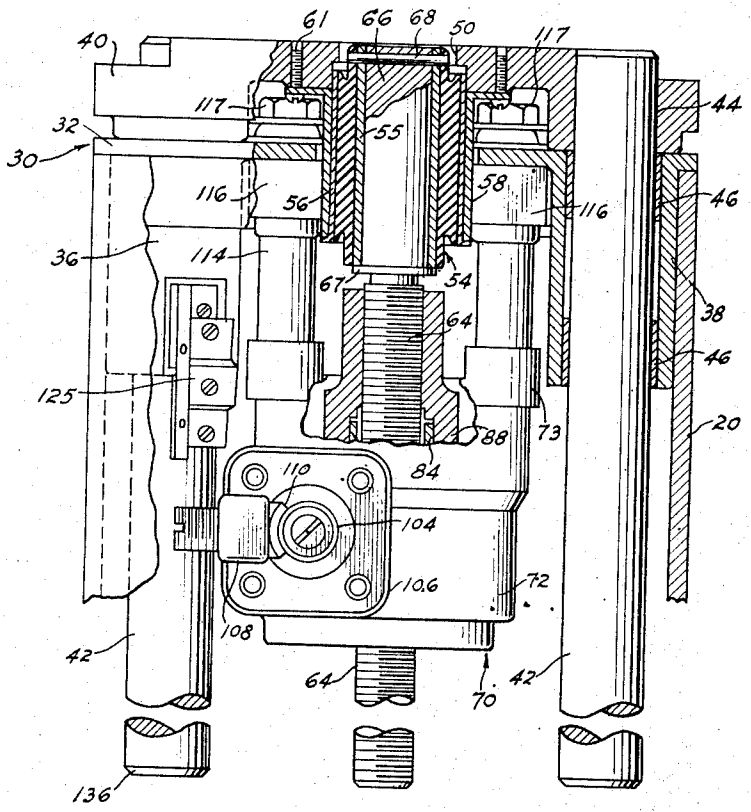


Fig. 4

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SELF-LEVELING AIR SUPPORTED MOBILE CHAIR BASE

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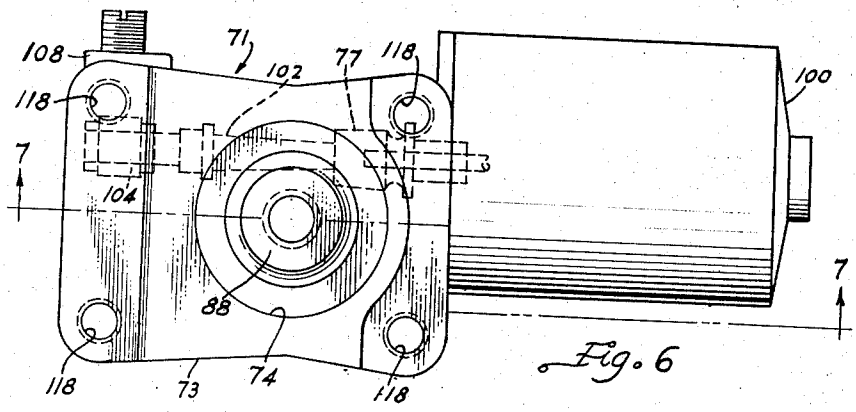


Fig. 6

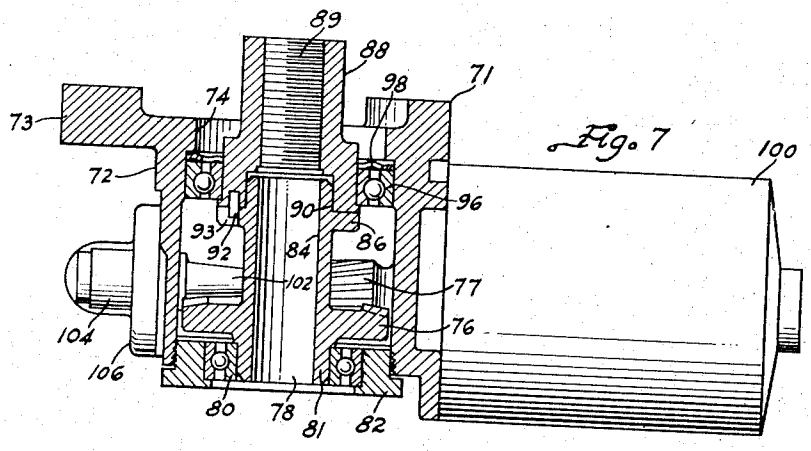


Fig. 7

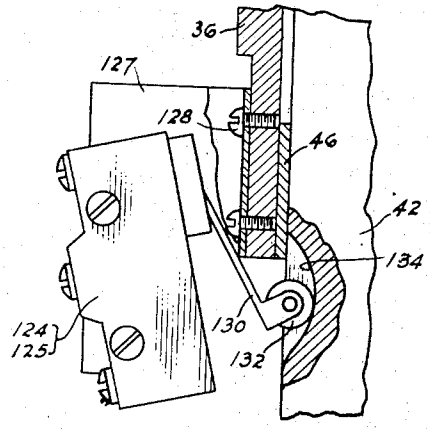


Fig. 8

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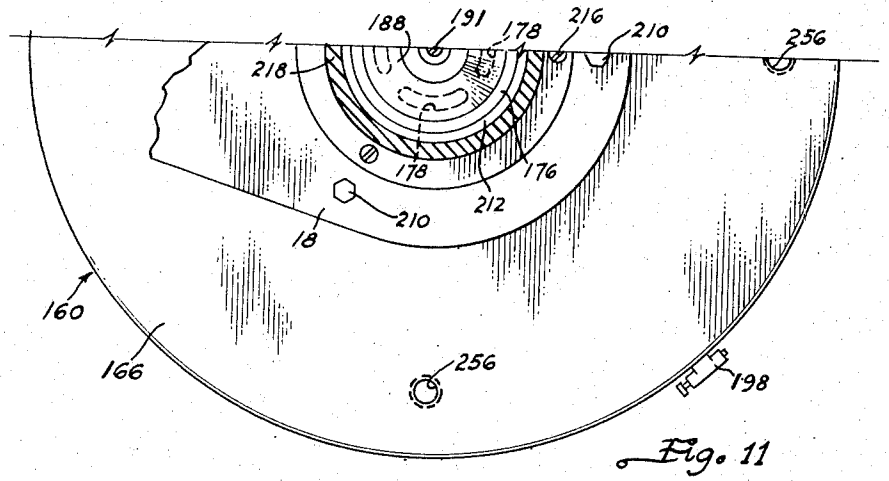


Fig. 11

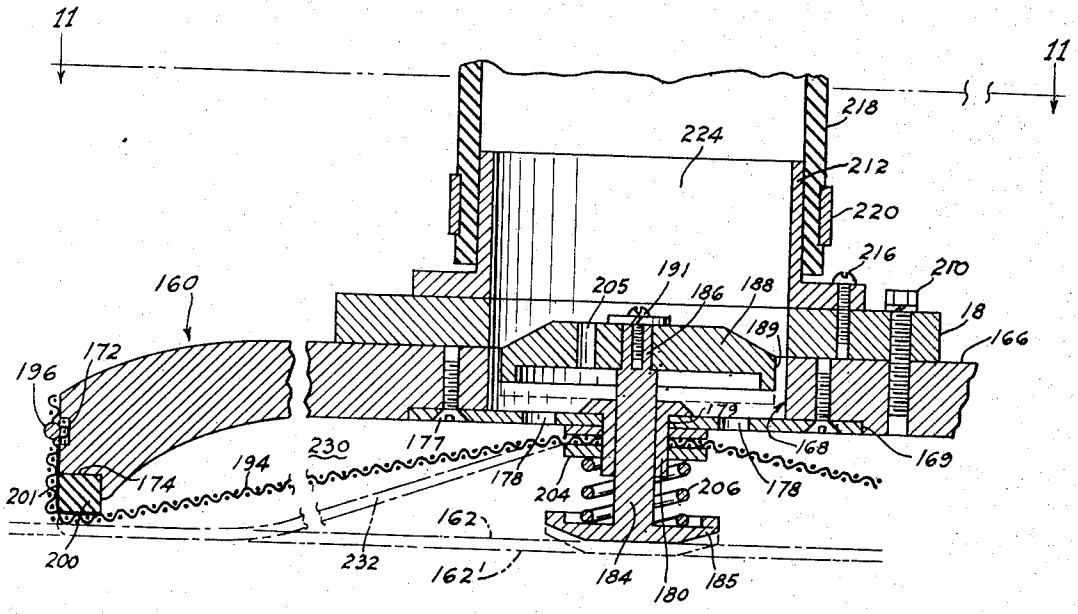


Fig. 10

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United States Patent Office 3,347,330 Patented Oct. 17, 1967

3,347,330

SELF-LEVELING AIR SUPPORTED MOBILE CHAIR BASE

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Filed July 12, 1965, Ser. No. 470,984
5 Claims. (Cl. 180—7)

ABSTRACT OF THE DISCLOSURE

A self-leveling base arranged to glide over a supporting surface upon a film of air discharged from a group of air levitation pads communicating with a source of air under pressure, each pad having porous discharge means across the bottom and flow of air to and through the same being controlled by a variable valve operated by a glide button engageable with the supporting surface and operable to increase or decrease the valve opening for corresponding flow of air from the pads as weight upon individual pads is increased or decreased and thereby produce leveling of said base relative to said supporting surface.

This invention relates to improvements in a mobile chair construction of the type suitable for use by dentists, barbers, beauticians and by others as, for example, opthamologists and opticians, whenever it is desirable to move the patient or patron from one location to another while seated or reclining in the chair and as described and illustrated in the co-pending applications of Haskin U. Deeley et al., which now have matured into Patent No. 3,254,733, issued June 7, 1966, and No. 3,295,621, issued Jan. 3, 1967.

In the mobile chair of said co-pending applications, air under pressure is utilized to produce a film of air between the bottom of the base of the chair and the floor supporting surface, whereby the chair base as well as any chair seat connected thereto may be moved on the film of air through the application of limited manual force applied in a horizontal direction against the chair seat or base, to effect desirable rotation or linear movement of the chair and base relative to the floor surface.

Movement of the chair and base over the floor surface depends on the maintenance of the film buoying or sustaining air between the base and floor surface as well as in maintaining the horizontal position of the base parallel to the floor surface. Should an imbalance occur by virtue of the load on the base shifting as the same is moved over the floor surface, tilting of the base will result from the unequalization of pressurized air beneath the base with a consequent likelihood of engagement of a part of the base directly with the floor surface to impede the movement of the base by the frictional drag of said base part with the floor surface. Such tilting of the base and chair due to such imbalance thereof is decidedly objectionable.

It is, accordingly, the principal object of this invention to provide in a mobile base for supoprting a chair, table, or the like which moves on a film of air, an air pressure levitation system for the base that will supply to and discharge beneath the base the requisite volume of pressurized air to provide the necessary film of buoying air to support the base and which system further operates on the principle of automatically discharging additional air under pressure where and when an increased pressure is required to offset any imbalance imposed upon the base during movement over a floor surface.

Another object of this invention is to provide a supporting base plate for the chair base that is of a polygonal configuration, a triangular shape being preferred, and having at each corner thereof an air pressure levitation pad

or unit, each including a chamber sealed by a flexible porous cover in opposed relation to the floor surface, the chamber receiving pressurized air from a compressor or blower and the cover providing a uniform and equal discharge therefrom of the pressurized air.

A further object of this invention is to provide each of the air pressure leviation pads with an air inlet conduit connection to the compressor or blower, and each pad having a valve structure at the air inlet into the chamber thereof to which the discharge end of the conduit is connected, the valve structure providing for a normal flow of pressurized air into said chamber to maintain the supporting base plate level on the film of buoying air discharged from the cover of each pad, and the valve structure of each pad being automatically operative to provide for an increase in the flow of pressurized air into the chamber thereof when the pad is tilted due to an imbalance of the load on the base plate in order to restore the base plate to its normal level position.

Still another object of this invention is to provide in the valve structure, a floor engaging glide button connected to a valve operating member operative to actuate the valve and thus automatically move the valve in accordance with the position the air levitating pad assumes with relation to the floor surface so as to control the volume of pressurized air supplied to the pad, the glide button being spring urged downwardly to maintain it in engagement with the floor surface.

Another object of this invention is to provide in the chair base and supported on the base plate, a chair lift structure and operating mechanism that is coordinated with the compressor or blower structure of the air levitation system such as to provide a center of gravity located substantially equidistant from the centers of each of the air levitation pads supporting the base plate.

Still another object of this invention is to provide for the chair lift structure, a hollow pedestal member centrally supported on the base plate and having suspended from the top thereof a motor and gear box assembly for raising and lowering a chair lift plate supported on a screw shaft coaxial with the pedestal, the chair lift plate being guided in its up and down movement by a pair of guide rods movable interiorly of the pedestal, and the motor and gear assembly including a one-way brake for preventing downward drift of the chair lift plate and screw shaft.

Details of the foregoing objects and of the invention, as well as the other objects thereof, are set forth in the following specification and illustrated in the accompanying drawings comprising a part thereof.

In the drawings:

FIG. 1 is a side elevation of a chair base provided with a housing and an exemplary chair seat and back supported by said base.

FIG. 2 is a top plan view of the chair base showing the housing, chair lift plate, platform and control switch arrangement.

FIG. 3 is a side elevation view of the chair base with the housing removed showing the arrangement of certain of the operating mechanisms included in the base.

FIG. 4 is an enlarged front elevation partly in section of the chair elevating mechanism showing the motor and gear box supporting structure.

FIG. 5 is a partial top plan view of the chair elevating mechanism showing the chair lift plate with attached motor and gear box supporting structure.

FIG. 6 is a detail plan view of the motor and gear box unit.

FIG. 7 is a side elevational view partly in section of the motor and gear box unit taken on line 7—7, FIG. 6.

FIG. 8 is a detail view showing the mounting of safety switches included in the chair elevating mechanism for limiting the lowering movement of the chair.

FIG. 9 is a top plan view of the air pressure levitation system showing the triangular plate with air supporting pads, blower and conduit connections.

FIG. 10 is an enlarged vertical sectional view of one of the air pads taken on line 10—10, FIG. 9, showing details of construction of air inlet, air exhaust and control valve.

FIG. 11 is a partial top plan view of an air pad taken on line 11—11, FIG. 10.

Referring to the drawings and particularly to FIG. 1, a supporting member of chair 10 is mounted on a mobile base 12 for vertical up and down movement with respect thereto. Contained within the base 12 is a chair elevating mechanism 14 and an air pressure levitation system 16, see FIG. 3.

The chair elevating mechanism

Utilized as a support for the chair base 12 and its associated structure is a base plate 18, see FIG. 3, which as shown in FIG. 9, is triangular in shape. Mounted centrally on the base plate 18 is a cylindrical pedestal 20 which is cut out at one side thereof to open towards the front of the base plate for a purpose to be hereinafter described. A flange 22 at the lower end of the pedestal 20 seats on the upper surface of the base plate 18 and is secured thereto by bolts 24. To reinforce the wall of the pedestal 20 there is provided at least two buttress walls or wings 26, 28 integral with the cylindrical wall of the pedestal and the flange 22.

Fitted to the open top of the pedestal 20 is a bearing casting having a circular flat upper support plate 32, and a skirt 34 and a pair of diametrically opposed depending bearing sleeves 36, 38, see FIG. 4. The skirt 34 telescopically fits within pedestal 20 such that the peripheral rim portion of the support plate 32, which is in effect a flange, will seat on the top edge of the pedestal 20. The bearing sleeves 36, 38 are so related to the skirt 34 and support plate 32 as to be disposed in contact with the inside wall of the pedestal 20, see FIG. 4. The bearing casting 30 is secured to the pedestal 20 in any desired manner (not shown).

Provided for vertical up and down movement above the support plate 32 is a circular chair lift plate 40. A pair of diametrically opposed parallel guide rods 42 are fixedly secured suitably to the lift plate 40, such as by having their upper end portions press-fitted into openings 44 provided therein, and with their top ends flush with the top surface of the lift plate. The guide rods 42 are of equal length and are respectively positioned within the bearing sleeves 36, 38 for reciprocal movement therein. Preferably, in order to reduce friction and wear, bearing liners 46 are provided in each of the bearing sleeves.

The lift plate 40 is provided with a central circular opening 50, the upper portion of which is of reduced diameter, and a pocket or recess 52 extending into the lift plate from the bottom thereof for a purpose to be hereinafter described. An isolation mount 54 of the type having inner and outer sleeves 55, 56 with a rubber bushing 57, either compressed therebetween or vulcanized thereto, has the upper end of the outer sleeve 56 snugly fitted within the larger diameter portion of the opening 50. A carrier sleeve 58 surrounds the outer sleeve in a press-fit relationship therewith and is provided at its upper end with an attaching flange 60 adapted to seat on the bottom of the recess 52 and is secured to the lift plate 40 by the screws 61. It is thus seen that the isolation mount 54 is fixedly secured to the chair lift plate 40 for movement therewith.

A threaded shaft 64 is provided at its upper end with an enlarged diameter shank 66 and a seating flange 67. The shank 66 is dimensioned to tightly fit as by a press-fit in the inner sleeve 55 of the isolation mount with the seating flange 67 in engagement with the lower edge of the inner sleeve 55. The outer end of the shank 66 lies flush with the outer edge of the inner sleeve 55 and is slightly below the top surface of the chair lift plate 40. A pin 68 extends transversely through the inner sleeve 55 and the shank 66 adjacent its outer end for locking the threaded shaft to the isolation mount to preclude any movement between the shank 66 and the inner sleeve 55. In the position of the parts shown in FIG. 4 it is seen that the chair lift plate 40 is in its lowermost position with the bottom surface thereof seated on the top surface of the support plate 32, and that the threaded shaft 64 depends axially therefrom within the pedestal 20. The purpose of the isolation mount 54 is to act as a shock absorber between the threaded shaft 64 and the chair lift plate with any object thereon. The rubber bushing 57 is resilient and therefore relieves the motor of a heavy starting load as well as minimizing shock to an occupant of the chair.

Suspended from the support plate 32 is an electric motor and gear box assembly 70 which is best shown in FIGS. 6 and 7. A gear box casting 71 provides a cylindrical casing 72 having at its upper end a substantially rectangular mounting plate 73. In the mounting plate 73 is a circular opening 74 coaxial with the cylindrical casing 72. Operative within the casing 72 is a somewhat beveled ring gear 76 driven by a correspondingly beveled pinion 77 in mesh therewith. Extending from each side of the ring gear 76 is a sleeve extension providing therewithin an axial bore 78. An antifriction bearing 80 in a cap 82 supports the lower sleeve extension 81, said cap 82 being threaded into the lower end of the cylindrical casing 72. The upper sleeve extension 84 is longer than the lower sleeve extension 81 and is provided with a flange 86 adjacent its upper end. A driving sleeve nut 88 having an axially threaded bore 89 and an enlarged diameter opening 90 at its lower end is seated on the flange 86. To secure the driving sleeve nut 88 to the ring gear sleeve 84 in driving torque relationship, a depending pin 92, which may be a spring pin or a shear pin, is fixed in the lower end of the driving sleeve nut 88 and extends into a slot 93 provided in flange 86.

If desired a retaining compound such as "Loctite" may be applied between the engaging surfaces of the terminal end of the driving sleeve extension 84 and the opening 90 into which it extends. An antifriction bearing 96 supports the lower end of driving sleeve nut 88 within the upper end of the cylindrical casing 72. It is to be noted that the diameter of opening 74 in mounting plate 73 is less than the inside diameter of the cylinder casing 72 and thus provides a shoulder 97. Positioned between the antifriction bearing 96 and shoulder 97 is a spring washer 98. The axial bore 78 in the ring gear sleeve extensions has a greater diameter than the threaded bore in the driving sleeve nut 88 so that the threaded shaft 64 when in threaded engagement with the driving sleeve nut 88 will freely extend therethrough.

An electric motor 100 is suitably mounted on the rear of the gear box casting 71 in lateral offset relation to the axis of the ring gear 76. A shaft 102 is suitably connected at one end to the pinion 77, which meshes with the ring gear 76, and at its other end the shaft 102 is provided with an anti-coast device such as a one-way clutch or a brake drum 104. The pinion 77 is fixed to the motor drive shaft and the end portion of the shaft 102 to which device 104 is connected has bearing support provided in a bearing housing 106, see FIGS. 4 and 7, attached externally to the cylindrical casing 72 and at the front of the gear box casting. It is to be noted that the brake drum 104 is external of the bearing housing 106. Included in the bearing housing 106 is a brake support bracket 108 in which a conventional adjustable spring-pressed rod (not shown) is axially movable towards the brake drum 104. Carried by the spring-pressed rod is a brake shoe 110 in frictional engagement with the brake drum 104 as shown in FIG. 4.

The motor and gear box assembly **70** is suspended from the support plate **32** of the bearing casting **30** by four members **114** which may be bolts surrounded by spacer sleeves. Each of the bolts **114** is carried by an isolation mount **116** which is of the same type as the isolation mount **54** and suitably attached to the support plate **32**. It will be seen from FIG. 4 that each bolt **114** extends downwardly through its associated isolation mount **116** with the head **117** of the bolt seated on the upper end of the isolation mount. Provided at each corner of the mounting plate **73** is a threaded opening **118** for receiving the threaded end portion of an associated bolt **114**, as shown in FIG. 6.

The motor and gear box assembly **70** is positioned between the guide rods **42** with its forward end carrying the braking mechanism **104**, **108**, **110** directed towards the cut-out side of the cylindrical pedestal **20**. The electric motor **100** extends through a suitable opening (not shown) in the pedestal **20**. The four bolts **114** securely support the motor and gear box assembly **70** in position and the isolation mounts **116** for the bolts **114** serve not only as shock absorbers but will also accommodate the parts to take care of any misalignment so that the driving sleeve nut **88** will freely turn on the threaded shaft **64** to move the same either up or down. This up and down axial movement of the threaded shaft **64** will impart a corresponding up and down movement to the chair lift plate **40** which is restricted to only this movement by the guide rods **42**. With the chair lift plate **40** in its raised position with the motor shut off, downward drift of the threaded shaft **64** through the driving sleeve nut **88** and ring gear **76** is prevented by the force of the braking action set up by the pressure of the brake shoe **110** on the brake drum **104**. However, the extent of the braking force is such that the motor **100** in reversely turning the ring gear **76** and driving sleeve nut **88** will overcome the friction of the braking force thus permitting a power lowering of the chair lift plate **40**.

The chair lift plate **40** is secured to the underside of the chair **10** in any desired manner. In the chair lift plate **40** is an opening **120** for receiving electric conductors for operational equipment, lights and controls. The triangular base plate **18** also may be provided with openings **121**, **122** respectively for receiving therein the ends of guide rods **42** and the end of the threaded shaft **64** when in their lowermost position, thereby permitting minimum height for the chair base assembly.

To automatically stop the raising and lowering movement of the threaded shaft **64** at its limits of movement in elevating and lowering the chair **10**, there is provided a pair of vertically spaced safety or limit micro switches **124**, **125**. In FIG. 4, it is seen that the safety switch **124** is mounted on one side of the bearing sleeve **36** for guide rod **42**. This is the lower limit switch. The other and upper limit switch **125** is mounted on the opposite side of the bearing sleeve **36**. The safety switches **124**, **125** are each supported on a bracket **127** which latter is secured to the wall of the bearing sleeve **36** by screw fasteners **128**. As seen in FIG. 8, lower limit safety switch **124** is provided with a control arm **130** having at its free end a roller follower **132**. Provided in the guide rod **42** at a predetermined location thereon is a recess **134** having a cammed bottom surface to accommodate the follower **132** of the lower limit safety switch **124**. Thus, with the guide rod **42** in its lowermost position, corresponding to the lowermost position of the threaded shaft **64**, the follower **132** will enter the recess **134** allowing the control arm **130** to move outwardly to thereby open the circuit to stop the motor **100**, in a manner well known, with a consequent stopping of the downward movement of the chair **10** at its lowermost position.

The upper limit safety switch **125**, which is similar to the lower limit safety switch **124**, but mounted on the opposite side of bearing sleeve **36** from switch **124**, has the follower on its control arm riding on the guide rod **42** and when the lower terminal end of the guide rod **42**, in its upward movement, passes the follower, the same along with its control arm will move inwardly towards the axis of the guide rod **42** in the same manner as the control arm **130** of safety switch **124** will move inwardly when the follower **132** enters the recess **134** to open the circuit and stop the motor **100**. Preferably the lower end of the guide rod **42** is beveled as at **136** to facilitate the movement of the follower. The other guide rod **42** may be similarly beveled, as is also the end of the threaded shaft **64**, in order to facilitate the entry of the guide rods and threaded shaft into their respective openings **121**, **122** in the triangular base plate **18**, when such openings are used.

A bellows **138** is fitted and secured in any suitable manner at its upper end to the chair lift plate **40**, and is similarly fitted and secured to the upper end portion of the pedestal **20** adjacent to the support plate **32**. The bellows **38** serves as a protective housing for the chair lift plate **40** and its associated structure movably supported by the pedestal **20** and to prevent the entrance of foreign matter thereinto. The bellows **138** further serves as an ornamental closure to conceal the lift structure for the chair lift plate **40** that would otherwise be visible.

The air pressure levitation system

An electric motor-driven compressor or blower **150** having three horizontal and circumferentially spaced air discharge outlets **152**, **153**, **154** is mounted by brackets **156** on the triangular base plate **18** adjacent its forward side, see FIG. 9. Preferably the brackets **156**, of which there are at least three, are each supported on an isolation mount (not shown) to reduce vibration, noise and shock. The air inlet **158** of the blower is located at the front of the blower and base plate **18**, and is provided, as is conventional, with a removable and disposable filter pad. Mounted beneath and at each corner of the triangular base plate **18** is an air levitation pad **160** each normally in supported engagement on a floor surface **162**. The pads are identical in size and structure though not necessarily so as will be hereinafter pointed out.

Referring to FIGS. 10 and 11, it is seen that the pad **160** preferably comprises a circular disc-shaped body or casting **166** having a central opening **168**, and a thickened downwardly flared peripheral rim portion **170** such that the casting **166**, which provides the pad body, is of inverted dish-shaped form. Provided in the rim **170** is a peripheral groove **172**, and in the lower face of the rim there is provided an annular shouldered recess **174**, both for a purpose to be hereinafter described. The lower end of central opening **168** is of enlarged diameter to provide a recess **169** for the reception of an air discharge plate **176** that is secured to the pad body **166** by screws **177**. The air discharge plate **176** is provided with a circular row of arcuate air discharge orifices **178** and a central opening **179**. Preferably the thickness of the air discharge plate **176** is such that the underside thereof will lie flush with the inside face of the pad body **166**, as shown in FIG. 10.

Press-fitted within the central opening **179** of the air discharge plate **176** is a guide sleeve **180** having a flanged upper end **182** seated against the upper face of the air discharge plate. A valve stem **184** slidably extends through the guide sleeve **180** and is formed at its lower end with a button-shaped head **185** and at its upper end with a reduced diameter extension **186**. A circular valve **188** having a depending peripheral flange **189** and a central opening **190** is positioned on the valve stem with the reduced diameter extension inserted through the central valve opening such that the valve **188** will seat on the shoulder formed on the valve stem by said reduced diameter extension. A screw **191** and associated lock washer secures the valve **188** to the stem **184**. It will be seen, in FIG. 10, the weight of the chair **10**, base **12**, and accessories which may be carried thereby is such that, when the assembly is at rest, with no occupant, the calculated length of valve stem **184** is adequate to cause

the peripheral flange **189** of valve **188** to be spaced vertically from the air discharge plate **176** a predetermined initial distance by the glide button **185** engaging the floor **162**. Under such condition, the air pressure levitating system is not operating and the periphery of the pad **160** is seated directly on the floor.

An air discharge and sealing cover **194** formed of a flexible, porous fabric sheet material, preferably of a textile nature, but not restricted thereto, extends across the bottom of the pad body **166** and has its edge portion bent upwardly to engage the periphery of the pad body **166**. A contractible clamping ring **196** including an adjustable clamp connector **198** (see FIG. 11) securely clamps the periphery portion of the cover within the peripheral groove **172**. A cushion ring **200** of rubber, felt, plastic or any other suitable material is seated within a shouldered recess **174** formed adjacent the periphery of the pad body and is suitably secured therein. The cushion ring **200** serves to prevent damage to the porous cover **194** and also enhances the sealing properties thereof with respect to the floor surface.

Further, to minimize nonuseful or waste discharge of air relative to cover **194**, an annular band of flexible sealant material **201** is applied to the inner surface of cover **194** to render the periphery thereof impervious to air passage for a limited distance radially inward from ring **200**.

Centrally in the cover **194** there is formed an opening for the reception of the guide sleeve **180**. Interposed between the inside face of the cover **194** and the air discharge plate **176** is a washed which encircles guide sleeve **180** and a like washer **204** is provided on the other or bottom face of the cover **194**. The washers **202**, **204**, preferably are slightly flexible and may, for example, be formed from synthetic resin or the like, the same being cemented or fused to the fabric of cover **194**. Said washers closely fit the guide sleeve **180** but are slidable thereon for purposes to be described hereinafter.

The valve stem **184** is of a greater length than the guide sleeve **180** so as to permit free axial movement of the valve stem therein for a limited distance. Positioned in surrounding relation to the guide sleeve **180** and valve stem **184**, and between lower washer **204** and glide button **185** is a compression coil spring **206**. The spring **206** acts to hold the glide button **185** in positive engagement with the floor surface **162** as well as to tend to load the valve **188** toward its closed position. Further, the valve **188** of each pad is provided preferably with one or more bleed holes **205** through which air under pressure passes from the supply through the valve **188** in limited quantity when the levitating unit **16** is operating. Thus, air pressure will build up against the inner surface of cover **194** and will tend to bias the washers **202** and **204** against spring **206** and preload it.

The triangular plate **18** is provided at each corner thereof with an opening **208**, each opening corresponding in diameter to that of the opening **168** in the pad body **166**. Each pad body **166** is secured to the underside of the triangular plate **18** at each corner thereof by a plurality of screw fasteners **210** with the openings **168** and **208** in registry. A cylindrical collar **212** having a bottom radial flange **214** is seated on the top of the base plate **18** and is secured thereto by screws **216**. The inside diameter of collar **212** is the same as that of openings **208** and **168**.

Referring to FIG. 9, it is seen that each of the blower air discharge outlets **152**, **153**, **154** is directed towards the collar **212** of an adjacent pad **160**. A flexible hose **218** connects each air discharge outlet with an associated collar **212** and provided at each end of the hose is a conventional hose clamp **220** for securing the hose in place. A bracket **222** (see FIG. 9) fixed to the triangular base plate **18** and located within the pedestal **20** serves to support and position the longest hose **218** connecting the blower air discharge **154** with the pad **160** at the rear of the base plate **18**.

In the operation of the air pressure levitation system, pressurized air from the blower **150** is delivered to each of the pads **160** by the hoses **218**. It is to be understood that, initially, all the pads **160** are seated on the floor **162** and that each of the valves **188** in each of the pads **160** is open a limited amount, as shown in FIG. 10. The pressurized air from the plenum chamber **224** supplying each pad **160** flows through the partially open valves **188** as well as through the bleed holes **205** in said valves for passage through air discharge orifices **178** into the chamber **230**. The porous cover **194** then discharges and distributes the air evenly throughout its entire extent inward from the periphery. In the reaction of the pressurized air against the inner surface of cover **194**, it will become inflated and cause a simultaneous elevation of the pad body **166**. Referring to FIG. 10, the inflated position of the cover **194** is shown in exemplary manner by the dotted lines **232** and the pad **160** and/or pad body **166** also is shown therein elevated from the dotted line indication of the floor surface **162'** and is supported by a film of air below the cover **194**. As the pad body **166** is elevated, the spring **206** will maintain the glide button **185** in contact with the floor surface **162**. This will cause the valve **188**, in the upward movement of the pad body **166**, to correspondingly move toward the air discharge plate **176** but not to a closed position, the valve **188** being sufficiently open to supply, in conjunction with bleed holes **205**, the requisite amount of pressurized air into the pad chamber **230** to inflate the cover **194** and also effect discharge air through the pores or perforations of cover **194** to form a film or air between the cover **194** and the floor **162** upon which the pad is sustained for relatively free horizontal movement over the floor surface. The formation of the air film is described in greater detail in Patent No. 3,295,621, referred to above and to which attention is directed. As this formation of an air film is substantially the same for each pad **160**, the chair with its base will be elevated equally for each pad and will be level.

It is to be understood that the air discharge orifices **178** in the air discharge plates **176** of the several pads **160** may be varied in size and shape, correspondingly to vary the volume of pressurized air delivered to the pad chamber **230** in order to accommodate necessary loads at various locations on the chair and/or base, such as lights, brackets, trays, etc. Hence, the air discharge orifices **178** need not necessarily be the same for each of the air discharge plates **176**, but may be different, as dictated by usage requirements. Also, the elimination of any inherent imbalance may be minimized or eliminated by the use of a different number of bleed holes **205** in the valve of one pad as distinguished from the number of such holes in the valves of other pads.

With the triangular base plate **18** level and the air pressure pads **160** in operation and raised to render the chair mobile over a floor surface, by virtue of the film of air between the various porous covers **194** and the floor surface **162**, the glide button head **185** on the valve stem **184** of all the pad units **160** will be in gliding engagement with the floor surface and all the valves will be opened substantially equally for equal discharge of pressurized air into the pad chambers and from the porous covers **194** thereof.

During movement of the mobile base over a floor surface there frequently are times when the triangular base plate **18** will tilt or be canted from its normal level position due to the center of gravity of the base or chair being shifted from its normal position equidistant from all three of the centers of the pads **160**. This tilting or canting of the base occurs, for example, because of an imbalance of the chair and base or because of lateral loads or forces applied to the base or chair being shifted such as movement of the patient, leaning of the dentist or attendant on the chair, movement of the light on a standard carried by the chair or base, or otherwise, any of which will tilt the base. Under such circumstances, one or more of the

corners or portions of the base plate **18** will be depressed vertically closer to the floor than the remaining corners or portions. The pad beneath the first-mentioned corner will also be moved correspondingly closer to the floor, compressing spring **206** which holds glide button **185** that extends therethrough in contact with the floor, thereby increasing the discharge of air from said pad and thus raising that corner or portion of the base and restoring the same approximately to a level condition, automatically.

Since the depressed valve **188** and glide button **185** will not be able to move downward while the pad is moving downward, it follows that the valve **188** will be raised with respect to air discharge plate **176** and thereby cause the valve to be opened more fully for increasing the supply of air under pressure to the pad chamber **230**, thereby consequently elevating the low side or corner of the tilted base substantially back to its normal, level position. The extent that the valve **188** opens varies and is dependent upon the amount of tilt of the triangular base plate. When any one valve is opened more fully to increase the supply of pressurized air to its pad, the valves on the other pads may remain at their normal opening position or may even be moved to a more closed position to reduce the supply of air to their corresponding pads if the pads in question should be raised during tilting of the base plate.

The preloading of springs **206** of the valves **188** of the various pads **160** serves further to prevent sudden vertical movement of the valves **188** to open position as when an imbalance of the type described above occurs or, as most frequently happens, such imbalance is caused simply by pushing the chair horizontally in a desired direction, whereby the pad on the side of the base opposite that to which the push is applied receives additional downward pressure which tends to open the valve of said pad to attempt to restore the level of that side of the chair with the opposite side. Sudden openings of said valves will tend to produce a chattering effect which can result in a sort of chain reaction among the various pads if the opening of the valves **188** occurs too abruptly.

Further, the provision of the bleed holes **205** serves very handily as a means to cause the various pads to receive different volumes of air, even when the valves **188** may all be open substantially equal amounts, for example. Such unequal amounts of air delivered to the pads is advantageous, for example, where a normal imbalance of substantial degree is present, such as a light standard carried by one side of the base to support an overhead light, or a pedestal rising from one side of the base to support a tray arm. Such known, and relatively fixed imbalances preferably are compensated for by pre-arranged means such as the provision of more bleed holes **205** in the valve **188** of the pad or pads nearest such imbalances, thereby tending to minimize the actuation of the self-leveling mechanism described above. A further possibility for such pre-arranged compensation also comprises increasing the areas of the main air discharge orifices **178** in the appropriate pads **160**.

Thus is accomplished one of the main objects of the invention, namely, a plurality of air levitation pads for supporting a base structure and automatic valve means for increasing the supply of air under pressure to any one or more of said pads when necessary to resist a tilting or canting movement of the base due to any imbalance of the load being carried. It is to be noted also that the glide button **185** need not actually contact the floor in normal gliding operation but, under such circumstances, the requisite amount of pressurized air would then be admitted through the bleed holes **205** in the valve heads **188**. Under such circumstances, the glide button **185** will be so close to the floor that upon any depression of one or more of the pads **160** toward the floor, the buttons **185** thereof will practically immediately contact the floor and open the valve more fully.

The triangular base plate **18** of the chair lift mechanism **14** and the air pressure levitation system **16** is enclosed by a shell or casing **240** formed in two symmetrical parts **242, 244** as best shown in FIG. 2, and separably connected together in any desired manner. When the parts are connected together, the casing **240**, as shown in FIGS. 1 and 2, is provided with a lower triangular shaped horizontal flange or ledge **246** extending preferably completely around the triangular base plate **18** and enclosing the pads **160**, an upwardly sloping wall **248**, trapezoidal in cross-section, and a substantially flat top **250** formed with a central opening **252** through which the chair lift plate **40** extends. The casing **240** is secured by screw fasteners (not shown) engageable with threaded openings **256** provided in the pad bodies **166** as shown in FIG. 11. Positioned on the ledge **246** on each side of the casing is a preferably foot-operated control switch unit **258**, each having a plurality of like switches for controlling the up and down motion of the chair lift and the blower mechanism as well as any other accessories carried by the chair. The peripheral edge of the ledge **246** is provided with a rim or molding **260** in the form of a depending flange partly over-hanging the pads **160**, the bottom edge of which is spaced slightly from the floor surface when the pads **160** are seated thereon with the air pressure levitation system not operating.

Located interiorly of the casing **240** is a reel **264** for an electric conductor **266** having at its end a plug **268** for connection to a floor or wall socket (not shown) providing a source of electric supply. The reel **264** is of the type that preferably will automatically wind up the conductor **266** when the plug **268** is disconnected from the socket. The reel **264** is suitably mounted on a bracket **270** secured at the rear of the triangular base plate **18**, see FIGS. 3 and 9. If desired, the reel **264** may be affixed to a wall or other support and a socket provided in the casing **240** for receiving the plug **268**.

While the invention has been described and illustrated in its several preferred embodiments, it should be understood that the invention is not to be limited to the precise details herein illustrated and described since the same may be carried out in other ways falling within the scope of the invention as claimed.

I claim:

1. Mobile supporting means for a chair seat comprising in combination;

(a) a triangular base plate normally supported on a floor surface,

(b) a vertically movable chair seat supported above said base plate,

(c) an air levitation pad mounted beneath each corner of said base plate, each pad comprising an upper pad body and a lower flexible porous cover defining an air chamber therebetween,

(d) a source of air under pressure carried by said base plate,

(e) means for conducting pressurized air from said source to each of said air chambers for application of pressure against and discharge of air through said porous covers, aerodynamically to support the base plate in substantially friction-free contact with the floor surface,

(f) separate valve means for each air pad included in said conducting means, and

(g) actuating means operatively connected to said valve means for automatically causing the same to admit additional air under pressure for discharge through said porous covers when an increased pressure is required to offset any imbalance of the base plate due to lateral forces tending to tilt the same, said actuating means comprising a stem extending downward from each valve means a glide button at the lower end of said stem adapted to engage the floor and responsive to contact with said floor for actuating said valve means variably to control the volume of pressurized air supplied to said chamber, and a spring acting upon said glide button and stem

and tending to urge said glide button into contact with the floor surface.

2. The mobile supporting means of claim 1 and wherein said valve means each comprise a valve member having a discharge opening of limited capacity therethrough operable to transmit air under pressure through said valve means at all times when said source of air is operating to produce air under pressure for delivery to said valve means.

3. The mobile supporting means of claim 1 in which said flexible porous cover of each pad has a portion through which said valve means extends and relative to which said cover portion is mounted for limited axial movement, and further including a compressible spring surrounding said stem of said valve actuating means and extending between said portion of said porous cover and said button on the lower end of said stem normally to urge said valve means toward closed position, said porous cover when inflated being operable to pre-load said spring, thereby to render the movement of said valve means to open position more gradual than otherwise and thus smooth the leveling operations of said levitation pads on said mobile supporting means.

4. Mobile base means for a chair seat comprising;

(a) a base structure normally in supported engagement on a floor surface, a member carried by said base structure for supporting an object,

(b) an air levitation system on said base structure comprising,

(c) a blower assembly mounted on said base structure,

(d) at least two air levitation pads mounted on the under side of said base structure in transversely spaced relationship to each other, each pad having an upper pad body and

(e) an air inlet defining a plenum chamber on each pad and located substantially at the center of each pad body,

(f) an air discharge plate having a plurality of air discharge orifices positioned in said air inlet,

(g) a conduit connecting said blower to each air inlet,

(h) a valve means in each air inlet overlying said discharge plate,

(i) actuating means extending axially through said air discharge plate for axial up and down movement therein and connected at its upper end to each valve means and operable to normally hold the same open to permit the discharge of pressurized air from said plenum chamber into its corresponding pad,

(j) a glide button on the lower end of each actuating means,

(k) a flexible porous cover extending across at least a part of the bottom of each pad and through which the pressurized air is discharged for reaction against said floor surface to form a film of air between said bottom and floor surface upon which said base structure may glide, said cover and pad body of each pad forming an annular chamber, and

(l) the button on each said actuating means engaging said floor surface and responsive to the position its pad assumes with relation to the floor surface so as to control the volume of pressurized air delivered to said pad from the plenum chamber, whereby the discharge of pressurized air from the bottom of the pads will effect a self-equalizing action on the pads and base structure to maintain the same level while the base structure is gliding upon a film of air.

5. The mobile base means of claim 4 further including;

(a) a guide means fixed centrally to said air discharge plate,

(b) means substantially on the central portion of said flexible cover engaging said guide means,

(c) said guide means supporting said actuating means in guided relation therein, and

(d) spring means on said guide means operative to urge and maintain said glide button in engagement with said floor surface.

References Cited

UNITED STATES PATENTS

3,097,718	7/1963	Jay et al.	180—7
3,243,004	3/1966	Mackie	180—7
3,251,432	5/1966	Fischer et al.	180—7
3,295,621	1/1967	Deeley et al.	180—7

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