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DENTAL PATIENTS' RECLINING CHAIR

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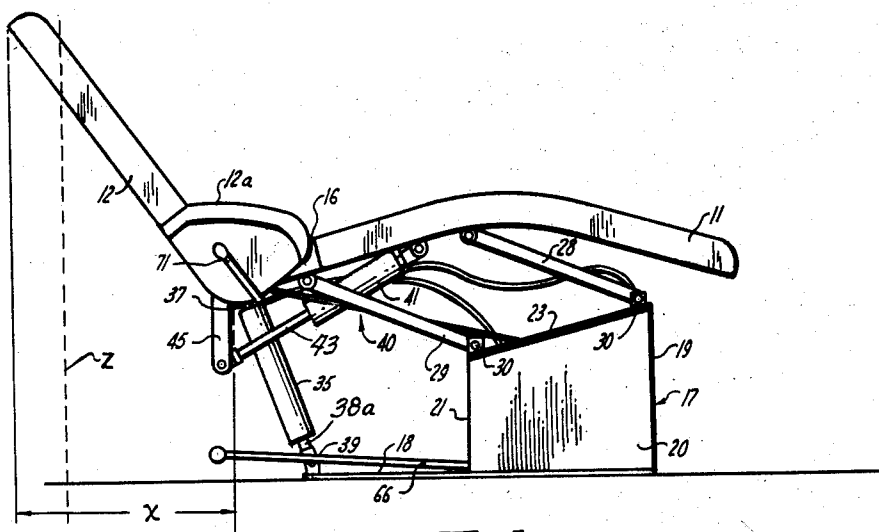


Fig 3

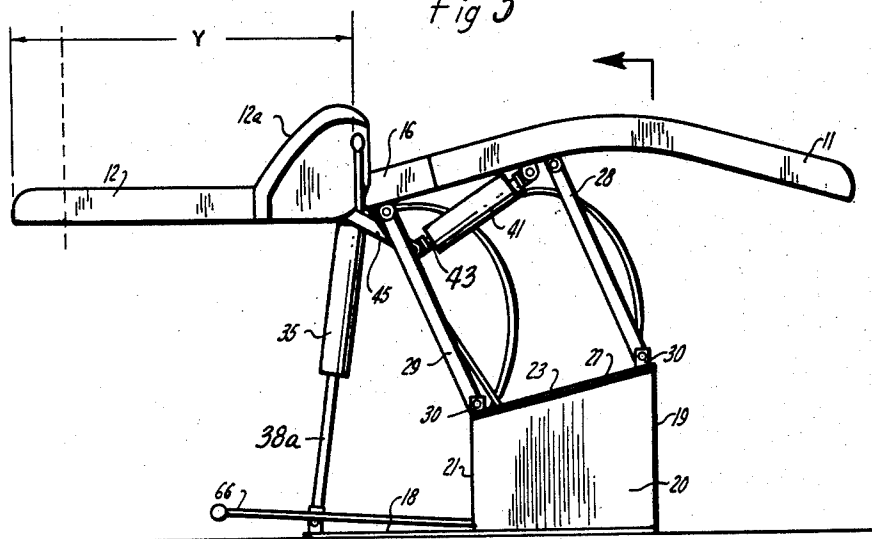


Fig 4

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DENTAL PATIENTS' RECLINING CHAIR

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This invention relates to chairs of reclining type and is particularly concerned with providing a chair of this type having special attributes of advantage to a dentist working on a patient seated or reclined in the chair. Although the invention was developed primarily as a dental patients' chair, the chair is applicable wherever its special structural and functional attributes are found to be useful, for example, in chairs for medical patients, for customers of cosmetologists, etc.

For many years dental chairs have been constructed similarly to barber chairs, with a heavy hydraulic lift providing a supporting base, so that the patient's position can be raised or lowered to suit the dentist. Most of these chairs have also provided for moving the patient backwardly and downwardly to a limited extent.

With the advent of new dental equipment and techniques, such as high speed drills and high volume evacuative suction units, it has been found advantageous to utilize a chair which enables a dentist to place his patient in reclining or semi-reclining position, as well as in the usual upright sitting positions. Thus, the advantages of direct-vision examination of and work on the mandibular or lower teeth can be had for the maxillary or upper teeth as well. It should be noted in this connection that, unless direct vision by the dentist is achieved, he must utilize a mirror. This is not desirable when employing the copious quantities of water required for so-called "washed field" dentistry.

It has become usual for a dentist to sit down on some kind of stool while working on a patient in the various sitting and reclining positions afforded by a modern dental chair of reclining type. This has had its disadvantages, however, for the several positions of the patient has required the dentist to frequently change his position during the course of the dental work on such patient. These changes of position by the dentist are inconvenient and require wasted activity in obtaining instruments and materials from storage cabinets and utilities from locations where they are normally maintained.

In the making of the present invention, it was a principal object to provide a modern type of reclining dental chair in which the patient's mouth will remain in substantially the same position along the horizontal regardless of how the patient's position is changed from sitting to reclining and vice versa, whereby the dentist can remain in substantially the same working position at all times and will have a reach of predetermined substantially constant extent to utilities, instruments, and materials. This means that cumbersome movable cabinets and utilities can be eliminated and that the dental office can be designed with conveniently built-in cabinets and fixtures.

The above object is accomplished largely by mounting the seat of the chair on a fixed support by means of legs arranged to impart a horizontal component of movement at the same time as the seat is being raised and lowered, and by pivoting the back of the chair to the seat for forward and backward swinging movement relative thereto. Means under the control of the dentist are provided for raising and lowering the seat, and other means under the control of the dentist are provided for raising and lowering the back. With this arrangement, it is possible for the dentist to adjust the height of the seat to obtain just that extent of horizontal movement which will compensate for horizontal displacement of the patient's mouth

when the back is lowered or raised to change the position of the patient from seated to reclined and vice versa.

By properly proportioning and positioning the seat-supporting legs, a working zone at convenient working height is established and maintained at substantially a fixed position along the horizontal regardless of whether the patient is in a sitting or reclining position.

Other objects of the invention include economical construction; the provision of easily operated controls, conveniently but unobtrusively positioned, and a back that can be quickly raised from reclining position, as for emergencies, and then returned slowly; the provision of an area beneath the chair back and immediately behind and beside the chair proper, void of structure which would limit working space; a pleasant aesthetic appearance; and a chair that is comfortable for the occupant in all positions.

In accordance with the invention, the chair advantageously has a pivot connection between a body-contoured seat and back; a raised, platform base located forwardly of the chair; and independently operable hydraulic motors for raising the seat and for swinging the back backwardly and forwardly, respectively. The hydraulic motor for pivoting the back advantageously includes a cylinder, a piston, a piston rod, and a sleeve, having a bleed port therein, surrounding the piston rod and attached to the back to allow the seat to be quickly raised in case of an emergency, with a gradual repositioning thereof. The other motor may be of conventional cylinder, piston, and piston rod arrangement, with the cylinder pivotally connected to the underside of the seat and the free end of the rod pivoted to a rearwardly extending base plate. The seat is pivotally connected to the base by means of forwardly and rearwardly positioned pairs of legs or links, and the base is positioned to counterbalance the weight of a person in the chair. When the chamber behind the piston of either motor is exhausted, the weight of the chair components it supports will move its rod and piston to the end of the cylinder opposite the end through which the piston rod extends.

All electrical controls and most of the hydraulic control circuitry for the motors are conveniently placed within the base.

There is shown in the accompanying drawings a specific embodiment of the invention representing what is presently regarded as the best mode of carrying out the generic concepts in actual practice. From the detailed description of this presently preferred form of the invention, other and more specific objects and features will become apparent.

In the drawings:

FIG. 1 is an isometric view of the chair, taken from the rear, with one arm and the fabric cut away to show the pivot linkage between seat and back;

FIG. 2, a sectional elevation view taken on the line 2-2 of FIG. 4;

FIG. 3, a side elevation with the back raised;

FIG. 4, a projection of FIG. 3, with the back lowered; and

FIG. 5, schematic representation of a preferred hydraulic and electric control system for the chair.

Referring now to the drawings:

In the illustrated preferred construction, the chair, shown generally at 10, includes a seat 11 to which a back 12 is pivotally connected, as by pivot pins 13 extending through brackets 14 on the frame of the seat and brackets 15 on the frame of the back at each side of the chair.

The seat is arcuately shaped to conform to the contours of the lower body. Thus, a person sitting or lying in the chair will have his knees slightly higher than his hips and feet, and his lower body will be comfortably supported over its entire length.

Fixed to the protruding from back 12 are arms 12a, which straddle backwardly converging sections 16 of the sides of the seat. The converging configuration of the seat allows the back and the arms carried thereby to freely pivot about pivot pins 13.

The chair base 17 is of enclosed box-like formation positioned well forward of the seat, with a rearwardly extending, heavy bottom plate 18, which serves with the rest of the base structure as an anchor to counterbalance the weight of a person sitting in the chair. A hole (not shown) is provided through the bottom plate and into the interior of base 17 to allow electrical lead wires to be passed to a floor outlet type of electrical receptacle (not shown). This hole is preferably elongated to allow some variation in positioning of the chair over the receptacle.

The base 17 further includes front wall 19, side walls 20, rear wall 21 having an opening 22 therethrough for a control lever to be more particularly described, and a top plate 23 having openings 24, 25, and 26 for conduits and a control lever, all to be more particularly described.

The rear wall 21 is shorter than front wall 19 and the upper edge 27 of the side walls slopes from front to rear. Therefore, the flat surface of the top plate, positioned on the walls, slopes from front to rear. Pivot links 28 and 29, of equal length, are each pivotally mounted at one end to pivot brackets 30, fixed to each corner of the top plate, and at their other ends to the underside of the seat of the chair, as by pivot pins 31 and 32. Front pivot links 28 are braced by cross-piece 33, and the rear links 29 by cross-piece 34.

The front pivot links are connected at the highest part of the contoured seat while the rear pivot links are connected adjacent the back edge. This allows the chair to be pivoted about the base, thereby moving upwardly and forwardly. Since, in most instances, raising of the chair will be accompanied by a lowering of the back to place the patient in a prone reclining position, and since it is more comfortable to have the legs raised slightly when in such a prone position, the use of sloped top plate and pivot links 28 and 29 of equal length will serve to raise that portion of the seat which supports the knee area to a greater and more comfortable height than would be true with a non-sloping top. Thus, as the seat is pivoted around the base, the forward links 28 hold the central section of the seat higher than the rear links hold the rear end of the seat. However, the contour shape allows the legs below the knee to be retained in a somewhat lowered position, and prevents their being raised to an embarrassingly or uncomfortably high level. Since the chair back 12 will at times move with the seat, the patient is not dragged across the back, as occurs in those chairs in which the back and seat do not move forwardly in unison.

A hydraulic motor 35 is advantageously used to raise the chair on and move it forwardly with respect to the base 17. It includes a cylinder 36 pivotally connected, as at 37, to the underside of the seat 10 near the back edge thereof; a piston 38; and a piston rod 38a fixed to the piston. The free end of the rod 38a is pivotally connected to bottom plate 18, as at 39. With this arrangement the motor is positioned under the hip area of a person sitting in the chair and will assist the base in preventing overbalancing of the chair.

Back 12 is rotated about pivot pins 13 in response to actuation of hydraulic motor 40. One end of cylinder 41 of the motor is pivotally connected to the underside of the seat, and piston 42, having rod 42a fixed thereto, reciprocates in the cylinder. Tightly surrounding the free end of rod 42a and reciprocable in cylinder 41 is a sleeve 43 having a closed end, with a bleed port 44 through the adjacent wall. The sleeve at its closed end is pivotally connected to a bell-crank lever 45, angularly fixed to square rod 46 extending transversely at the bot-

tom of the frame of the back. When piston 42 is hydraulically moved into engagement with sleeve 43, the sleeve is forced out of the cylinder to rotate the back about its pivot. Relief of the pressure behind the piston will allow the weight of the back and such person as may be in the chair to force the sleeve and the piston to their starting position at the other end of the cylinder.

In the event it becomes necessary to quickly lift the back, as for example, when a patient is choking, the sleeve 43 will be easily pulled out of the cylinder to allow free movement of the back. Upon its release the weight of the back and the weight of a person in the chair if there is one, will force the sleeve into the cylinder, until it contacts the piston. Since air in the space between the sleeve and the end of the piston rod is compressed and then bled out through port 44 to provide a dashpot action, the rate of return of the sleeve, and hence the back, to their set position determined by the location of piston 42, will be regulated by the size of bleed opening 44.

Hydraulic fluid is supplied to the rear of the piston of each hydraulic motor from reservoir 50 via pump 51. From pump 51 it passes to motor 35 through conduit 52, check valve 53, and conduits 54, 55, and 57, whenever supply valve 56 is opened, and to motor 40 through conduit 52, check valve 53, and conduits 54 and 59 whenever supply valve 58 is opened. When either piston reaches the end of its cylinder opposite the pressure supply connection, or whenever one supply valve is closed, excess hydraulic fluid is by-passed through conduit 60 and relief valve 61, back to the intake side of the pump.

To exhaust the fluid behind the pistons so that they will be weight biased back to the pressure end of the cylinders, the supply valve 56 or 58 of the motor to be exhausted is closed and the corresponding exhaust valve 62 or 63 opened. This will allow fluid to pass from motor 35 to conduits 57 and 64 or from motor 40 to conduits 59 and 65 to the intake side of the pump. Obviously, either motor may be operated independently of the other or if so desired they can be operated simultaneously by operation of their controls together.

Movement of either valve actuator 66 or 67 to operate a supply valve will close a respective micro-switch 68 or 69. This will complete a circuit to energize electric motor 70, which drives pump 51. It can be seen therefore that the pump and motor do not operate continuously, but only when required to move chair components.

The entire hydraulic system, with the exception of the two motors, parts of conduits 57 and 59, and the actuating levers, as well as the electrical control circuit are positioned in the base and do not detract from the appearance of the chair. Actuating lever 66 extends through opening 22 in the base and is positioned to be conveniently foot contacted by a dentist or his assistant from either side of the chair. Lever 67 is passed through opening 26 in top plate 23 and is connected to crank 71 pivotally fixed beneath the frame of the seat. The crank handle is positioned under the padded top of arm 12a, well out of the way of the dentist during his operations, and yet, convenient for use in changing the patient's position.

Since it is a prime object of this invention to provide a chair in which the patient's mouth can be put in the same vertical axis whether he is sitting, or prone, or at any intermediate position, it is necessary that the chair pivot connection between the back and the seat be capable of forward movement to compensate for the increase in horizontal length of the back as it is pivoted to its lowered position.

The horizontal length of back 12, when rotated to its foremost position, as shown in FIG. 3, is distance X. When the back has been rotated to its lowered or rearmost position, shown in FIG. 4, the length has increased to distance Y. In order to maintain the top of the back, or any other point on the back, in the same vertical axis, as for example, dotted line Z interconnecting FIGS.

3 and 4, the pivot connection between the back and the seat must move forwardly a distance $Y-X$.

Since pivot pins 13 move forwardly with the chair at the same time it is elevated, as a result of pivoting movement around the base, the forward distance of travel of the pins is determined by the length of travel and the length of piston rod 38a, as well as by the length of pivot links 28 and 29.

The amount of increase in the horizontal length of the back 12 will be determined by the length of such back, the positioning of hydraulic motor 40, the length of piston rod 42a and thickness of the closed end of sleeve 43, the length of bell-crank lever 45 and the angular relationship between the bell-crank lever and the flat surface of the back.

If any dimensions of the components determining the variable horizontal length of the back are changed, it is necessary that corresponding adjustments be made in the dimensions governing forward chair movement to establish the required relationship.

Whereas there is here illustrated and specifically described a certain preferred construction of apparatus which is presently regarded as the best mode of carrying out the invention, it should be understood that various changes may be made and other construction adopted without departing from the disclosed inventive concepts particularly pointed out and claimed herebelow.

I claim:

1. A chair for use by dentists and the like comprising; a seat, said seat being arcuately formed to position the knee area of a person sitting thereon at a higher level than are his hips or feet, and to provide support for his entire lower body; a back; means pivotally connecting said back to said seat; a base; links pivotally interconnecting said base and said seat, said seat and said back being supported on said links; a first hydraulic motor, including a cylinder and a piston rod; means connecting said cylinder adjacent the intersection of said seat and said back; means connecting said piston rod to said base beneath the pivot connection of the back and seat when they are positioned intermediate their extreme forward and rear positions; a second hydraulic motor, said second motor comprising a cylinder pivotally connected to the underside of said seat, a piston in said cylinder, a piston rod fixed to said piston and extending through the other end of said cylinder, a sleeve surrounding said rod and having one closed end, said sleeve slidably extending into said cylinder to abut said piston, and a bleed port through the wall of the sleeve adjacent said closed end, which end is pivotally connected to said back at the bottom thereof; and control means for said first and second hydraulic motors, said control means including a hydraulic system comprising a liquid reservoir, an electric motor driven pump, a conduit between said reservoir and the intake side of the pump, supply conduits through which liquid flows from the pump to said hydraulic motors, conduits for exhausting liquid from said hydraulic motors to the intake side of the pump, a supply valve in the supply conduit for each motor, an exhaust valve in the exhaust conduit for each motor, an actuator for the supply and exhaust valves of each first motor, an actuator for the supply and exhaust valves of the second motor, a by-pass conduit from the outlet to the intake of the pump, a pressure relief valve in the by-pass conduit, and an electrical system comprising electrical switch means closed by supply-valve-actuating-movement of either of said actuators to close a circuit and energize the pump motor.

2. A chair for use by dentists and the like comprising; a seat, said seat being arcuately formed to position the knee area of a person sitting thereon at a higher level than are his hips or feet, and to provide support for his entire lower body; a back; means pivotally connecting said back to said seat, a base of box-like configuration; links pivotally interconnecting said base and said seat, said

seat and said back being supported on said links; a first hydraulic motor; means connecting said first hydraulic motor to the underside of said seat adjacent the pivot connection of the seat and back; means interconnecting said first hydraulic motor, and said base beneath the pivot connection of the seat and back when they are positioned intermediate their extreme forward and rear positions, whereby actuation of said first hydraulic motor pivots said seat and back about said base; a second hydraulic motor; means pivotally connecting said second hydraulic motor to said seat and to said back, whereby actuation of said second hydraulic motor pivots said back with respect to said seat; control means for independently actuating said first and second hydraulic motors, said control means including a hydraulic system comprising a liquid reservoir, an electric motor driven pump, a conduit between said reservoir and the intake side of the pump, supply conduits through which liquid flows from the pump to said hydraulic motors, conduits for exhausting liquid from said hydraulic motors to the intake side of the pump, a supply valve in the supply conduit for each motor, and an exhaust valve in the exhaust conduit for each motor, a by-pass conduit from the outlet to the intake of said pump, a pressure relief valve in the by-pass conduit, a pair of levers, one of said levers controlling the supply and exhaust valves of the first hydraulic motor and extending through said base adjacent the bottom thereof, the other of said levers controlling the supply and exhaust valves of the second hydraulic motor and extending through the top of the base to a position beneath a padded upper portion of one of a pair of arms fixed to said back and straddling a portion of said seat, and an electrical system comprising electrical switch means closed by supply valve actuating movement of either actuator lever to close a circuit and energize the pump motor, said hydraulic control system and said electrical controls being enclosed in said base, with the conduits connecting the pump and the hydraulic motors extending through the base to the hydraulic motors.

3. A chair for use by dentists and the like comprising; a seat, said seat being arcuately formed to position the knee area of a person sitting thereon at a higher level than are his hips or feet, and to provide support for his entire lower body; a back; means pivotally connecting said back to said seat; a base; links pivotally interconnecting said base and said seat, said seat and said back being supported on said links; a first hydraulic motor means including a cylinder and a piston rod; means connecting said cylinder adjacent the intersection of said seat and said back; means connecting said piston rod to said base beneath the pivot connection of the back and seat when they are positioned intermediate their extreme forward and rear positions; a second hydraulic motor means, said second motor means comprising a cylinder pivotally connected to the underside of said seat, a piston in said cylinder, a piston rod fixed to said piston and extending through the other end of said cylinder, a sleeve surrounding said rod and having one closed end, said sleeve slidably extending into said cylinder to abut said piston, and a bleed port through the wall of the sleeve adjacent said closed end, which end is pivotally connected to the back at the bottom thereof; and control means for independently regulating operation of said first and second hydraulic motor means.

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