Feb. 27, 1968 R. S. L. ANDREWS 3,370,901

DENTAL APPARATUS

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Fig. 2.

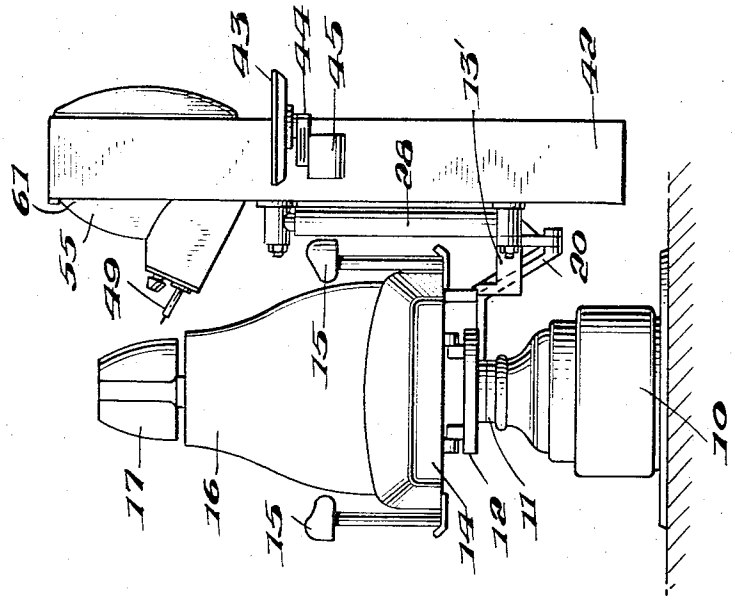
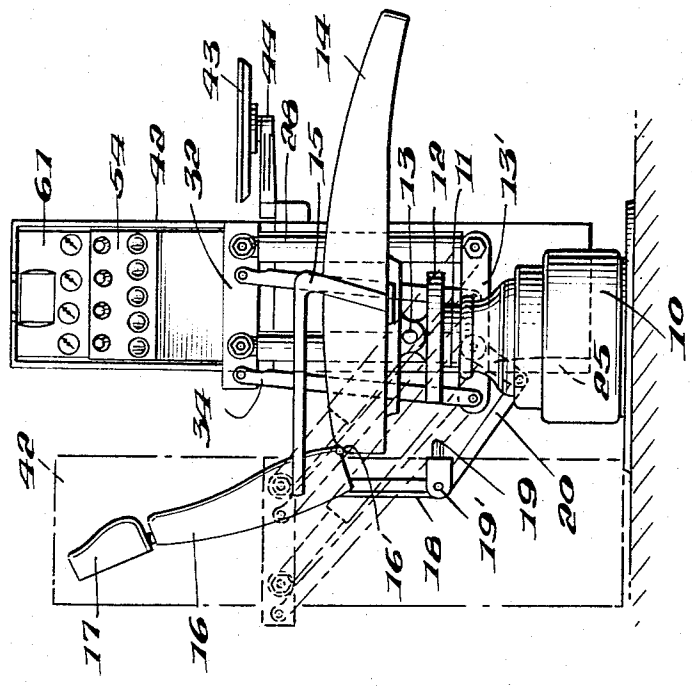


Fig. 1.



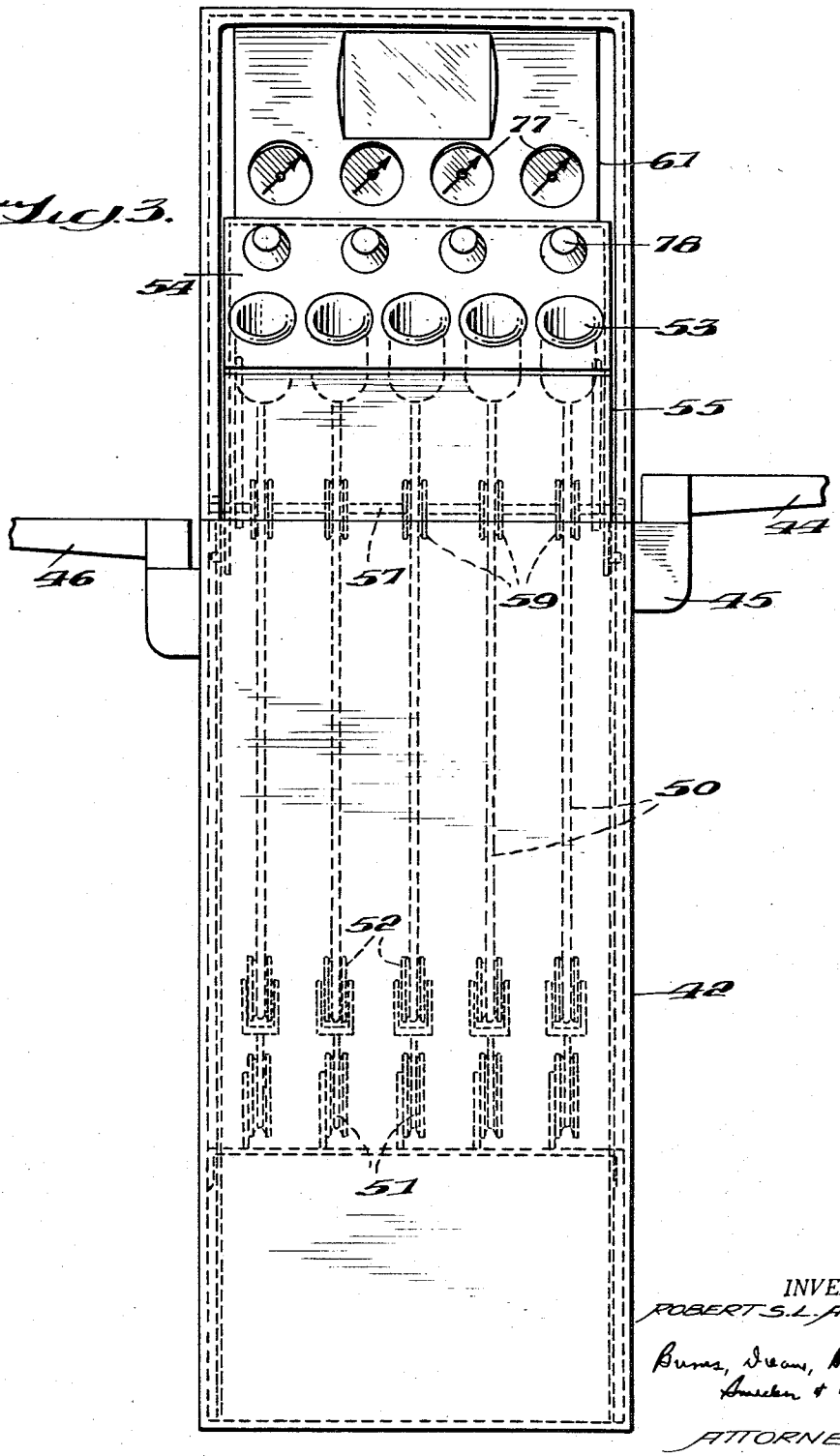
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Fig. 3.



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Fig. 5.

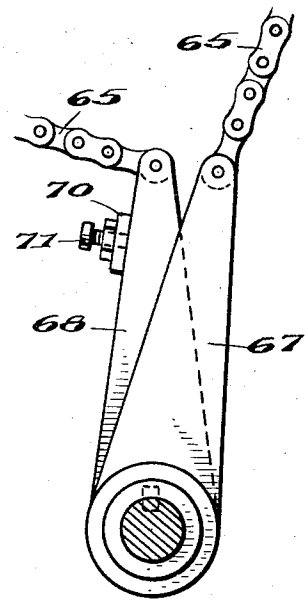


Fig. 6.

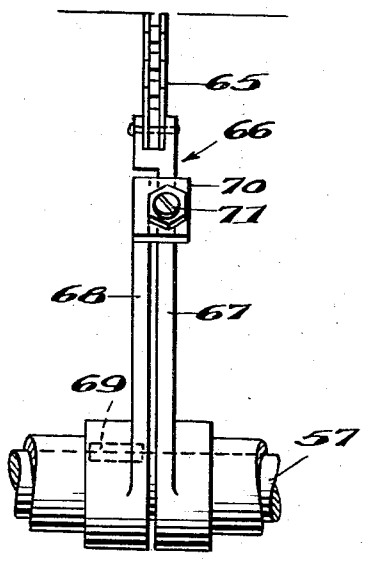
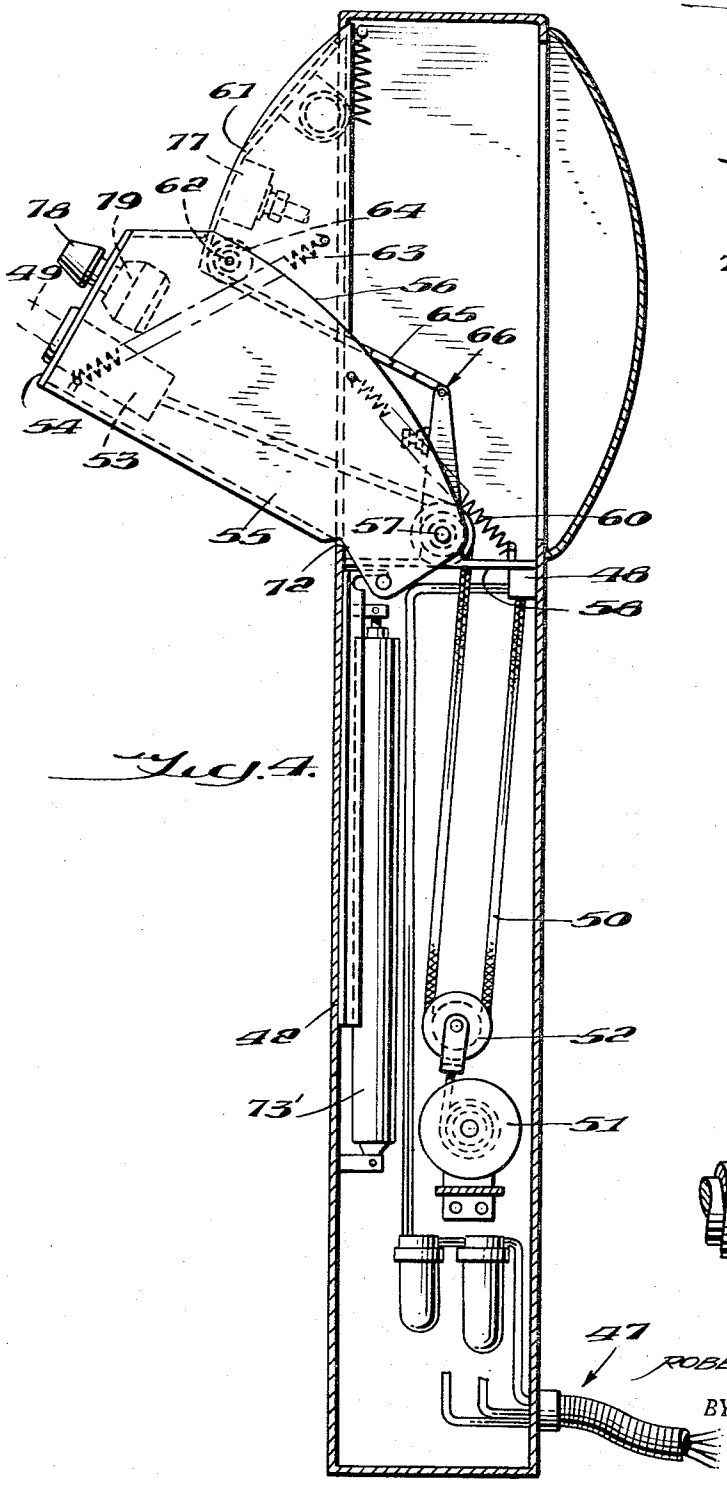


Fig. 4.



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Fig. 9.

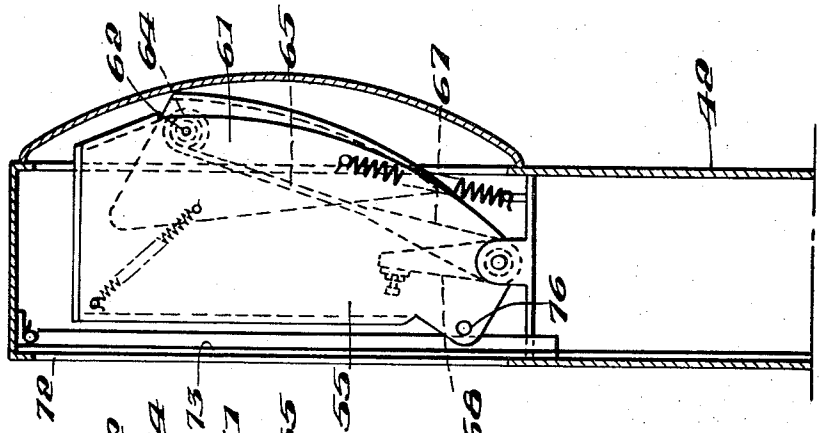


Fig. 8.

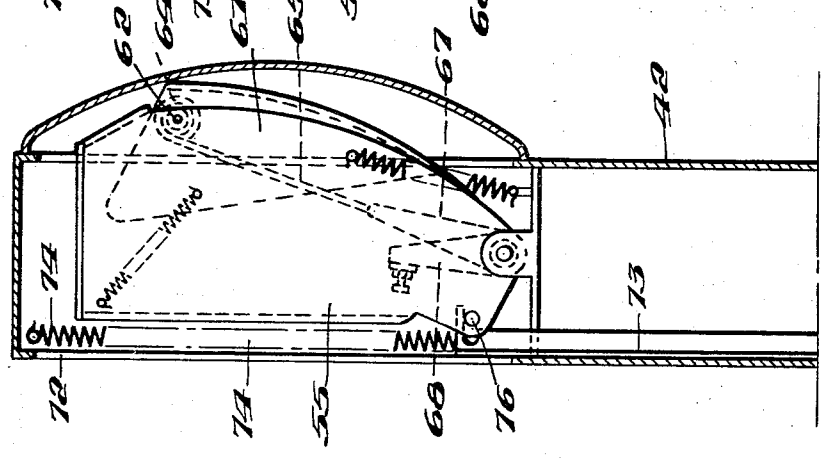
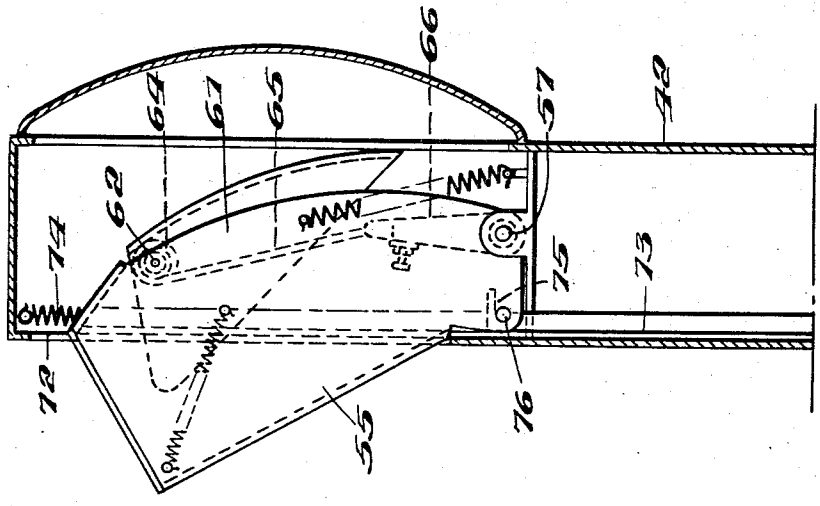


Fig. 7.



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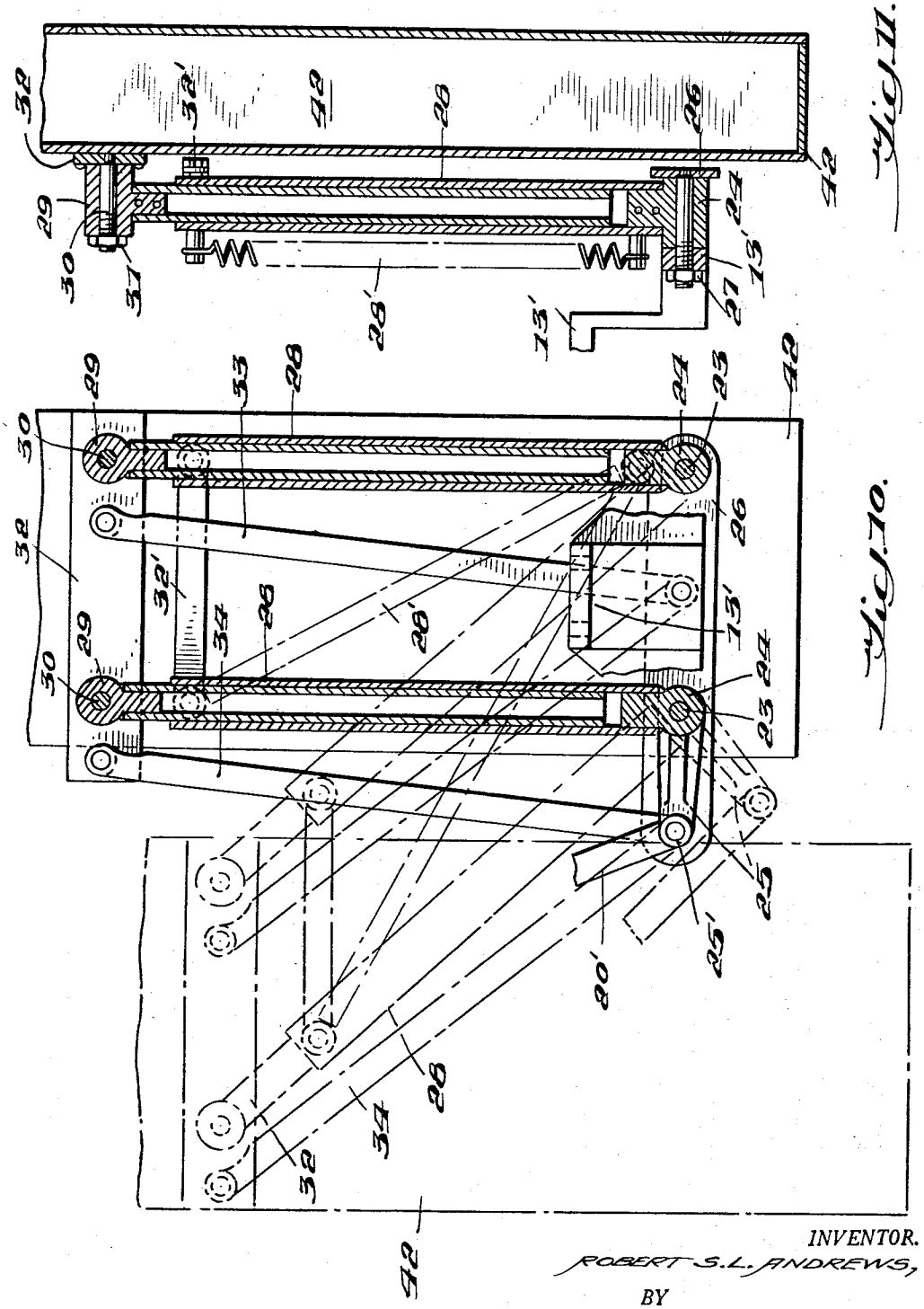


Fig. 11.

Fig. 10.

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DENTAL APPARATUS

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14 Claims. (Cl. 312—209)

ABSTRACT OF THE DISCLOSURE

A dental chair is provided with a cabinet supported by a pair of parallel arms mounted beside the chair so as to move the cabinet lengthwise of the chair as the chair back is moved backward and forward with respect to the seat. The cabinet contains a primary quadrant in which one or more dental instruments are mounted for swinging movement into and out of the cabinet so as to be accessible with respect thereto within convenient reach of the dentist.

This invention relates to improvements in dental apparatus and, more particularly, to apparatus for automatically positioning dental instrument units in convenient relation to dental chairs.

It is customary practice at the present time for a dentist to use various power operated instruments which are initially mounted in side-by-side relation in a suitable cabinet or holder. The patient very often is in a seated or reclining position, according to the work to be performed, and variations in position of the patient may require the doctor to be in different positions with respect to the cabinet. Frequently, the cabinet is fixed on the floor of the office or on the wall, and even where it is mobile it is not changed in position for variations in position of the patient in the chair. Frequently, this leaves the instruments beyond the reach of the doctor and requires multiple motions of extended nature in gaining access to the required instruments.

Modern techniques in the dental profession often involve the operation by the doctor in a seated position rather than a standing or stooping position for greater speed, precision and less fatigue. However, the instruments required, which are initially located in a cabinet or other unit, may not be within convenient reach of the doctor when seated in his operating position. Consequently, an assistant is often necessary to reach and to hand to the doctor the respective instruments when needed.

One object of this invention is to simplify and improve dental equipment and to make it more practical for maintaining accessibility of the instruments when required.

Another object of the invention is to provide for automatically maintaining a constant relationship between the doctor in his operating position and the required instruments, regardless of the position of the patient in the chair, either seated or reclining in intermediate or extended positions.

Still another object of the invention is to provide for the automatic imparting of proportional motion to the instrument unit according to the position of the chair, moving with the back or headrest thereof and thus maintaining the instruments within convenient reach of the doctor.

A still further object of the invention is to provide for the effective enclosing and storage of the instruments so as to prevent possible accidental injury to the patient as he enters or leaves the dental chair.

These objects may be accomplished, according to one embodiment of the invention wherein the instrument unit is mounted so as to be moved with movement of the chair or a part thereof. A swinging motion may be used for this purpose, having the operating means connected

with the chair back, for example, so as to shift the instrument unit in proportion to the reclining of the chair or the back thereof and thus to maintain substantially a constant positioning of the instruments with respect to the head of the patient.

An extendable parallel motion device is mounted on the chair support and is operatively connected with the back of the chair, to be moved by swinging motion of the back in shifting the position of the patient. This will cause the bodily displacement of the instrument unit, while maintaining it in a vertical position in proportion to the tilting of the back for the purpose described.

Provision is made also for enclosing the instruments, when not in use, within a cabinet that may be opened and closed by the doctor before and after use. A suitable door is employed for this purpose and the instruments are mounted in a swinging case or support within the cabinet so as to be projected within convenient reach of the doctor when the cabinet is opened. When the cabinet is closed it will prevent possible accidental injury to a person as he enters or leaves the dental chair.

This embodiment of the invention is illustrated in the accompanying drawings, in which:

FIG. 1 is a front elevation of a dental chair and instrument unit, having the invention incorporated therein;

FIG. 2 is an end elevation thereof at right angles to FIG. 1;

FIG. 3 is a front elevation of the cabinet, with other parts detached therefrom;

FIG. 4 is a vertical section, with parts in elevation through the instrument unit;

FIG. 5 is a detail cross section through the quadrant casing mounting shaft and showing the lost motion connection therewith;

FIG. 6 is a detail view at right angles to FIG. 5;

FIG. 7 is a vertical section through the instrument unit with the secondary quadrant casing folded and the primary quadrant casing partly withdrawn;

FIG. 8 is a similar view with the primary quadrant casing fully withdrawn but before closing of the door;

FIG. 9 is a similar view with the door fully closed;

FIG. 10 is a vertical section through the swinging means supporting the instrument unit; and

FIG. 11 is a similar view at right angles thereto.

The invention is shown as applied to a conventional form of dental chair merely as an example and it will be understood that the invention may be used with any desired form of chair, with or without a movable back, but wherein the chair is movable in part or entirely, to dispose the patient in different relative positions with respect to the doctor.

In the form illustrated, the chair is shown in FIGS. 1 and 2 as having a base **10** which may be provided with either a manual or an electro-hydraulic power unit, with an elevating cylinder **11** for raising and lowering the patient with respect to the floor. It is customary with most chairs to provide also for rotating the chair and for locking it in a desired position, which means may be used, if desired, although not illustrated in the drawings.

Supported by the elevating cylinder **11** is a seat plate **12**, which is illustrated as having a journaled support or pivot support **13** for a seat **14**. The seat **14** is shown as having the usual arm rests **15** operatively connected thereto and to the chair back **16**. The chair back **16** is pivotally connected at **16'** (FIG. 1) for tilting movement of the back **16** with respect to the seat **14**. The hinge or pivotal connection **16'** permits the back **16** to be moved from an upright position to a substantially horizontal position or to any desired intermediate position, according to the needs of the doctor. A headrest is shown at **17**, which may be used on the back **16**, if desired.

The chair back **16** is preferably moved to the respective positions by power, and accordingly the back **16** has a depending lever **18** to which either an electric power device or a fluid power device may be connected, as illustrated generally at **19**. This device is not illustrated in detail because any suitable or desired form thereof may be employed and is pivotally connected at **19'** with the lower end of the lever **18** to move the lever and thereby to shift the position of the chair back. A drive link **20** is also connected to the pivot **19'** and extends therefrom to the operating means for the positioning of the instrument unit, as hereinafter described.

Dental chairs that have no suitable attachment point for the drive link **20** to impart motion to the crank arm **25** may be provided with a miniature selsyn control system. In such a system, the master unit would be mounted on the chair back **16** while the slave unit would be mounted on the bracket **13'**. Power for swinging the tubular links **28** would be provided by an amplidyne unit under the control of the slave unit. The output shaft of the amplidyne unit would carry a worm in mesh with a worm wheel reduction gear directly coupled to one of the links **24** to rotate it in either direction.

In the event that the doctor prefers to operate in a seated position, a stool may be located beside the chair, and be positioned in either one or another desired relation to the chair, according to whether the patient is sitting upright or reclining. In the event that a dental assistant is employed, a separate stool may be used for such person within convenient reach of the instruments so as to permit the assistant to hand the instruments to the doctor when needed.

A universal mounting bracket **13'** is secured in a fixed position with respect to the base **10** of the chair. In this illustrated embodiment, the bracket **13'** is bolted or otherwise fastened securely to the seat plate **12** and extends laterally therefrom beyond the superstructure of the chair, as shown, for example, in FIG. 2.

As illustrated in FIGS. 10 and 11, the mounting bracket **13'** has a pair of pivotal supports or stub axles **23** projecting laterally therefrom to form journals for hubs **24**. One of the hubs **24** has a crank **25** connected at **25'** with an end of the drive link **20** described above. The pivots **23** are spaced horizontally from each other and are also connected with the opposite end portions of a lower mounting plate **26**, which mounting plate extends at one end parallel with the crank **25**. These hubs are retained on the stub axles by suitable fastening means such, for example, as nuts **27**.

The hubs **24** have connected with them and extending upwardly therefrom telescopic slide tubes **28**. These two sets of telescopic slide tubes **28** extend in parallel relation to each other and have their upper ends connected rigidly to hubs **29** journaled on pivots or stub axles **30**. Each of the tubes **28** is formed of sections slidable relative to each other for lengthening motion to accommodate the swinging action as described. The hubs are retained on the stub axles **30** by suitable fastening means as, for example, nuts **31**.

The upper stub axles **30** are mounted on the instrument unit by an upper mounting plate **32**. The mounting plate **32** may be bolted to a side of the unit through the wall thereof by suitable fastenings (FIG. 11). The two sets of tubes **28** may be connected together by a link **32'** pivoted thereto, and may also have a counterpoise spring **28'** interposed therebetween, if desired, as shown in FIGS. 10 and 11.

The universal mounting bracket **13'** is constructed so as to provide suitable space laterally beyond the superstructure of the chair for the hubs **24**, as well as for the crank **25**, which is connected with one end of the drive link **20**.

Also connected with the lower and upper mounting plates **26** and **32** and pivoted thereto without interference with the swinging motion of the tubes **28**, are inner and outer trace bars **33** and **34**. The bar **34** is pivoted to the lower mounting plate **26** on the axis of the pivot **25'**.

These trace bars **33** and **34** are spaced apart on opposite sides of one of the telescopic tube assemblies providing clearance for the latter as well as for the trace bars and serving to hold the telescopic tube assemblies in parallel relation to each other. These trace bars **33** and **34** impart stability to the instrument unit through its bodily movement and hold it rigidly vertical at all times.

The instrument unit is designated generally at **42** and comprises an enclosed housing which is supported bodily by the telescopic tubes **28** from the mounting bracket **13'**. Upon swinging motion of the parallel tubes **28**, the instrument unit may be moved bodily from the full line position shown in FIGS. 1 and 10 to the dotted line position illustrated therein or to any suitable or desired intermediate position according to the tilted position of the chair back **16**. The instrument unit is maintained in a stable vertical position at all points during the bodily movement.

In one specific embodiment of the invention, the path followed by the instrument unit **42** in moving from the full line position to the dotted line position mentioned will involve a travel of the instrument unit in a curvilinear path through approximately twenty inches of horizontal movement, combined with a proportionate vertical travel downward of approximately four inches. The stools may be mounted on casters for ease of movement to any extent required as the position of the patient in the chair is changed.

Based on average proportions associated with the anatomy, the substantially constant reach of twenty-one inches is maintained between the operating doctor and the instrument unit **42** when the latter is moved through a curvilinear travel of twenty inches, combined with a fall of four inches. This relationship closely approximates the ideal when the instruments mounted in the unit will always be maintained in a position ready for use and conveniently within reach of the doctor in the respectively different positions of the chair.

The instrument unit may have mounted thereon other accessories such, for example, as a swing tray **43** supported on an arm **44** from a pivot bracket **45** secured to a side of the instrument unit **42**. On the opposite side, a cuspidor and drinking fountain may be mounted by means of another swing arm **46** (FIG. 3).

The details of the instrument unit **42** are shown more fully in FIGS. 3 to 9, wherein I have illustrated an enclosed cabinet as a self-contained unit to be mounted on the swinging device as described. This cabinet has provisions for supplying power for the dental instruments such, for example, as compressed air, warm water, suction and electrical energy which may be brought into the cabinet of the unit by a multi-cored umbilical cord **47** (FIG. 4), although separate connections therefor may be used, if desired.

The cord **47** is connected with a manifold block **48** within the cabinet of the unit **42**, and in the event of electrical connections there may be a terminal strip provided within the cabinet. The cord **47** may have a surrounding flexible metal shield to protect the cord against mechanical damage and to insure of maintenance of the power connections therethrough.

The dental instruments are illustrated at **49**, each of which has an individual power supply, hose or electric cord, generally illustrated at **50** connected with the instrument **49** and leading therefrom to the manifold block **48** or the terminal strip mentioned.

It is preferred that suitable means be provided in the cabinet for retracting the instruments, for which purpose I have shown a spring-loaded retractor reel **51** for each cord connected with a guiding pulley **52** through which the respective hose or cord extends slidably and so as to act on

the latter to pull the connected instrument 49 into seated position within its individual rest or cup 52 in an instrumetn panel 54. These respective instruments are disposed in side-by-side relation and any suitable number or type thereof may be employed as needed.

The instrument rests 53 may be on axes at acute angles to the plane of the instrument panel 54 so as to maintain alignment of the instrument hoses 50 that leave the holders 53 at an angle of twenty degrees due to the inclination of the instrument panel 54. This angularity presents the instruments directly to the doctor and equalizes the amount of reach between the first and the last instrument in the row.

The instrument panel 54 is mounted in the front end of a primary quadrant casing 55 which is in the form of a rectangular tube having an arcuate back wall 56. The end of the primary quadrant casing 55 opposite the instrument panel 54 is substantially open and receives therethrough the respective hoses or cords 50 extending to the instruments 49, which hoses or cords pass freely through the casing, as will be apparent from FIGS. 3 and 4.

The primary quadrant casing 55 is pivotally mounted in the instrument unit 42 on a fixed shaft 57. The fixed shaft 57 is mounted on suitable supporting brackets 58 secured within the instrument unit 42, as shown in FIG. 4. Pulleys 59 are journaled on the shaft 57 for guiding the cords or hoses 50 in their passage to the instruments 49.

The opposite sides of the primary quadrant casing 55 are journaled on the shaft 57 so as to permit to to swing outward to the position shown in FIG. 4 and to remain thus projected from the instrument unit 42 until manually returned to the respective positions shown in FIGS. 7, 8 and 9. A counterbalance spring 60 extends from a fixed point in the instrument unit 42 at each opposite side of the primary quadrant casing 55 to a point of connection with the latter, which springs 60 tend to retract the casing 55 from the position shown in FIG. 4 to the respective positions shown in FIGS. 7, 8 and 9.

A secondary quadrant casing 61 is pivotally supported on a cross shaft 62 mounted in the upper portion of the primary qaudrant casing 55 for swinging movement relative thereto to open and closed positions, as shown respectively in FIGS. 4 and 7 to 9. In the open position shown in FIG. 4, the secondary quadrant casing 61 extends from the top of the primary quadrant casing 55 at the upper end of the curved wall 56 into the top portion of the instrument unit 42, thereby substantially closing this space. Coiled springs 63 at opposite sides of the respective quadrant casings 55 and 61 interconnect these, thereby normally tending to close the secondary quadrant casing 61.

The mounting shaft 62 protrudes through bosses on the respective quadrant casings 55 and 61 at opposite sides thereof and is fixed by keys or otherwise to the secondary quadrant casing 61 so as to rotate the latter upon rotating movement of the shaft 62. This rotating movement is imparted to the shaft 62 by a wheel 64 which is keyed to the shaft. The wheel 64, in turn, is attached to one end of a chain 65 which extends from the wheel and is partly wrapped around the wheel, as shown in FIG. 4, to a lost motion anchor lever mechanism, generally indicated at 66. This anchor lever 66 is shown more in detail in FIGS. 5 and 6.

The anchor lever mechanism comprises a lever member 67 connected at one end with the chain 65 and having the opposite end thereof journaled on the shaft 57 for freedom of turning movement relative to the latter. The lever member 67 is located beside a lever member 68 keyed or otherwise fixed at one end at 69 to the shaft 57 so as to be anchored rigidly against rotating movement by the fixed position of the shaft 57.

The opposite end of the lever member 68 carries a bracket 70 which overlaps the face of the lever member 67 and has an adjusting screw 71 therein to be adjusted in position and thereby to limit the swinging movement of the lever member 67 in a counterclockwise direction as viewed in FIGS. 4 and 5.

This lever member 67 may be stopped, for example, in a vertical position or its angular position may be changed relative thereto. This adjustment of position of the lever member 67 permits the secondary quadrant casing 61 to be rotated through different angular degrees for the degree of swinging movement of the primary quadrant casing 55.

The quadrant casings 55 and 61 swing through an opening 72 in the front of the instrument unit 42, which opening 72 is adapted to be closed by a sliding door 73 suitably guided within the casing of the instrument unit 42 to be raised substantially to closed position in the top of the casing by the action of coiled springs 74 which are attached to this door.

The door 73 also has fixed thereto near its upper edge linear cams 75 in position for abutting connection with rollers 76 fixed to the end portions of the primary quadrant casing 55 at the opposite sides thereof and adjacent the open end. These cams 75 and rollers 76 are so proportioned that upon downward sliding movement of the door to an open position from the position shown in FIG. 9 to the position shown in FIG. 8, the linear cams 75 will be moved substantially into engagement with the roller 76.

Then, upon further downward movement of the door 73, the primary quadrant casing 55 will be projected initially, as shown in FIG. 7, and finally as shown in FIG. 4. Any suitable means may be used for opening and closing the door such, for example, as an air cylinder if desired, although it may be moved manually or by other suitable means.

When the quadrant casings are fully closed, as shown in FIG. 9, it will be apparent that the lever member 67 will have moved away from the adjustable stop 71, and as the quadrant casing 55 is opened, the lever member 67 approaches and finally abuts the adjustable stop 71 in the relation shown in FIG. 7, when the continued swinging movement of the quadrant casing 55 will open the secondary quadrant casing 61 relative thereto to the position shown in FIG. 4. During the closing movement of these parts, the secondary quadrant casing 61 will complete its closing rotation relative to the primary quadrant casing 55 as soon as the linear cams 75 have completed approximately 10% of their total travel.

Suitable instruments may be provided for indicating and controlling the supply of power to the dental instruments 49. These indicating and control instruments may include indicators at 77 which may be mounted, if desired, on secondary quadrant casing 61, and control knobs 78 connected with pressure regulators 79 mounted on the primary quadrant casing 55. The connections between these indicating and control instruments and the power supply to the dental instruments are not shown in detail, but may include suitable regulating and indicating connections, as will be well understood in the art.

It will be apparent from the foregoing explanation that the device is capable of automatically maintaining a constant relationship between the doctor operating and the required instruments, regardless of whether the patient in the chair is seated upright, reclining in intermediate positions or fully reclined. The instrument unit is moved automatically by the mechanism that shifts the position of the chair or the back thereof and the instruments are readily available to the doctor even when seated beside the chair.

While the invention has been illustrated and described in one embodiment, it is recognized that variations and changes may be made therein without departing from the invention as set forth in the claims.

I claim:

1. In dental equipment, the combination with a chair including a back portion mounted for swinging movement, of a dental cabinet having means for mounting one or more dental instruments therein, means for mounting the dental cabinet for bodily translating movement

lengthwise of the chair, and means operatively connected with a chair back portion for actuating said cabinet mounting means for moving the cabinet upon swinging movement of the chair back portion.

2. In dental equipment according to claim 1, wherein the mounting means includes an arm pivotally supporting the cabinet on one end thereof and pivotally mounted with respect to the chair for swinging motion to move the cabinet.

3. In dental equipment according to claim 1, wherein the mounting means includes a pair of extendable parallel arms having pivot axes normal to the direction of swinging movement of the back portion and pivotally mounting the cabinet on one end thereof and pivotally mounted at the opposite end with respect to the chair for swinging motion to move the cabinet.

4. In dental equipment according to claim 3, including means operatively connected with the back portion of the chair for swinging said back portion, said means being connected with the swinging arms for moving the cabinet bodily upon movement of the back portion.

5. In dental equipment according to claim 3, including linkage connected with the chair back portion and with the extendable parallel arms, and means connected with the linkage for moving said chair back and cabinet.

6. In dental equipment according to claim 3, wherein the pivotal mountings of the arms with respect to the chair are in fixed positions, each of said arms having relatively slidable portions for lengthening movement during said bodily movement of the cabinet.

7. A dental cabinet comprising a housing having an opening at the front thereof, a primary quadrant casing pivotally mounted at one end in the housing in position for swinging movement through the opening, and means mounted in the opposite end of the quadrant casing for supporting dental instrument.

8. A dental cabinet according to claim 7, wherein the instrument supporting means includes an instrument panel having instrument holders mounted therein, instruments in the holders, and supply conduits connected with the instruments and extending through the housing.

9. A dental cabinet comprising a housing having an opening at the front thereof, a primary quadrant casing pivotally mounted at one end in the housing in position for swinging movement through the opening, and means

mounted in the opposite end of the quadrant casing for supporting a dental instrument, a secondary quadrant casing mounted pivotally on the primary quadrant casing and mounted in the housing in position for movement into shielding relation with the primary qaudrant casing in the outer position of the latter, and means for connecting the secondary quadrant casing with the primary quadrant casing for operation thereof.

10. A dental cabinet according to claim 9, including a sliding door for closing said opening, means for moving the door, and means operated by the door for moving the primary and secondary quadrant casings in one direction.

11. A dental cabinet according to claim 9, said primary quadrant casing standing upright in the casing in a retracted position for outward swinging movement therefrom to project the dental instrument to accessible position, and linkage connecting the primary quadrant casing with the secondary quadrant casing to cause movement thereof upon said projecting movement.

12. A dental cabinet according to claim 7, said primary quadrant casing standing upright in the housing from the pivot end thereof in position for the opposite end portion thereof to swing outward from the housing, and means to shield the opening in the housing above the projecting end portion of the quadrant casing.

13. A dental cabinet according to claim 7, including a door for closing said opening the housing, and means operated by the retracting movement of the quadrant casing for closing the door.

14. A dental cabinet according to claim 7, including a door slidably mounted in the opening of the housing, operating means for the door, and means actuated by the retracting movement of the quadrant casing for closing the door.

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