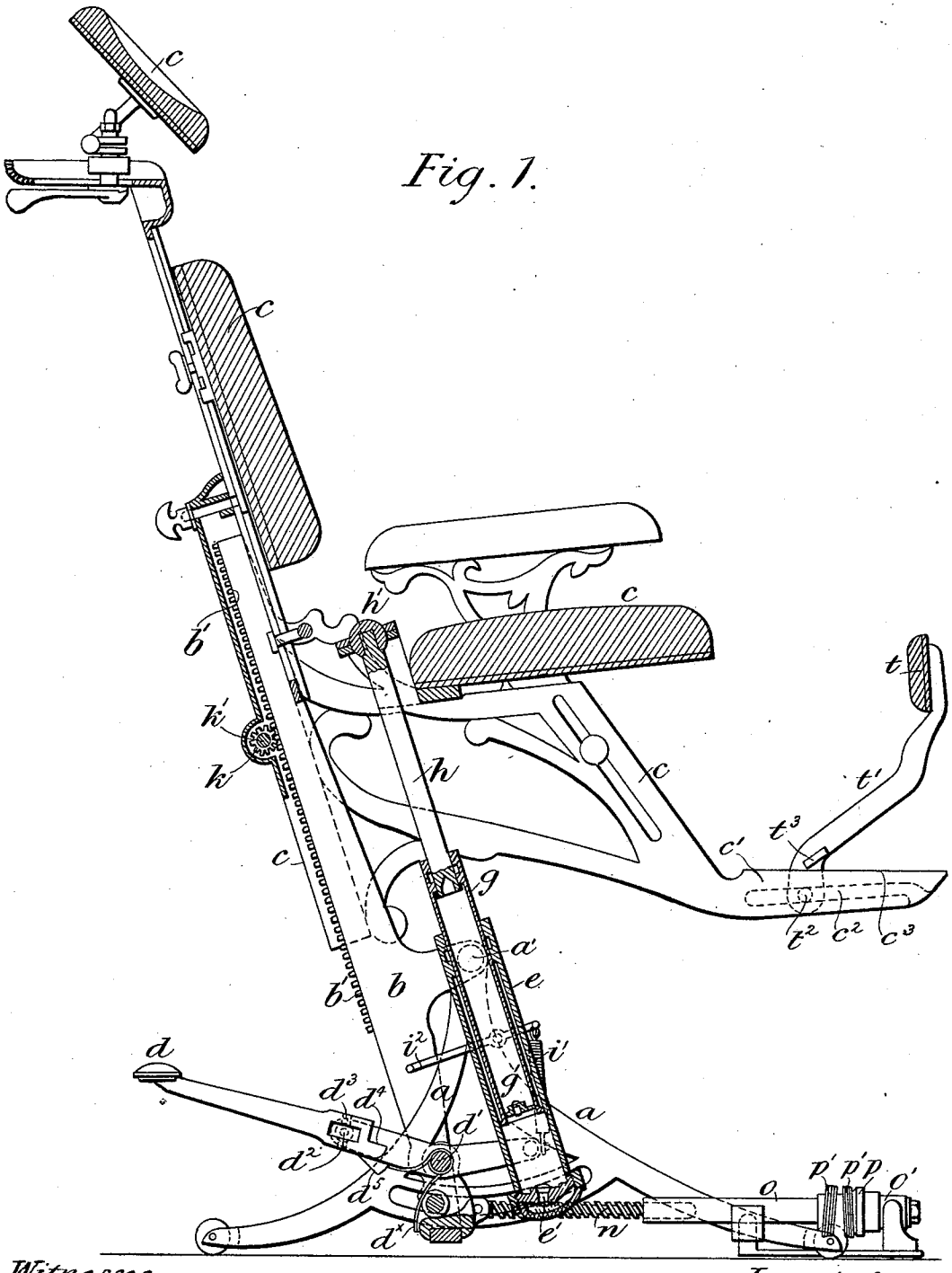
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D. D. HEPBURN & E. GARDNER.

DENTAL CHAIR.

No. 406,349. Patented July 2, 1889.

Fig. 1.



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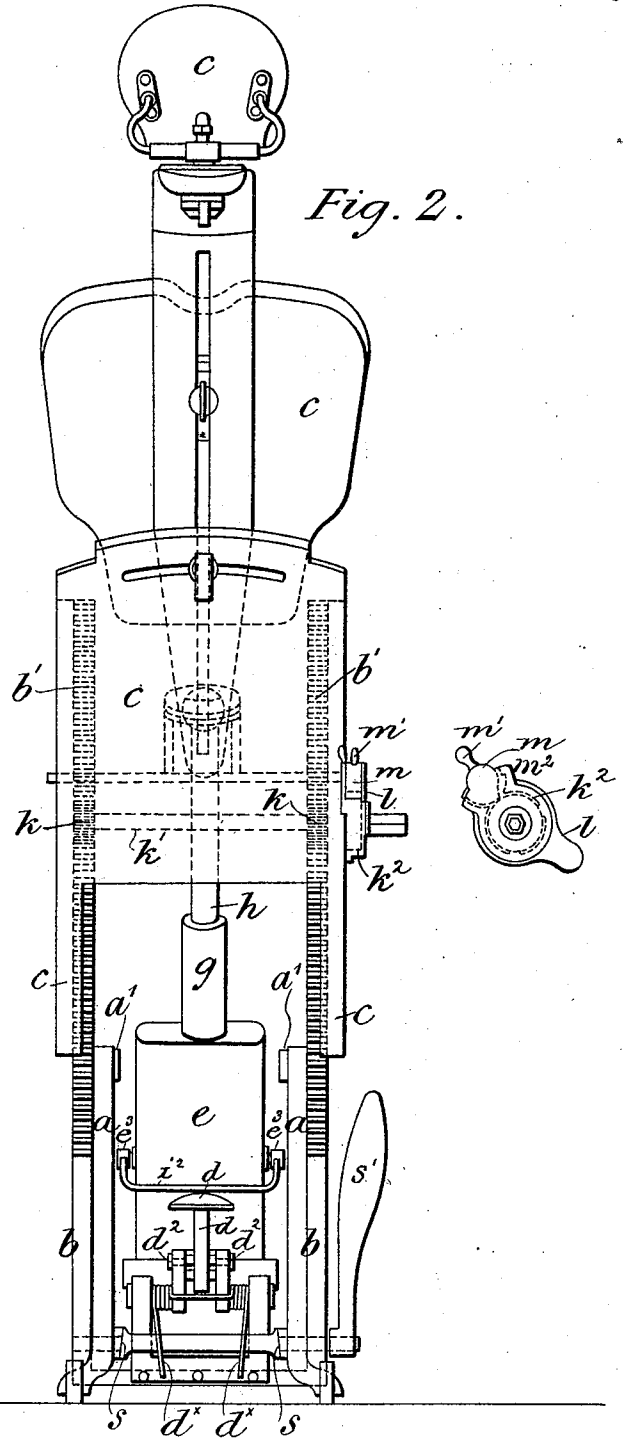
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Fig. 2.



Witnesses
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Fig. 3.

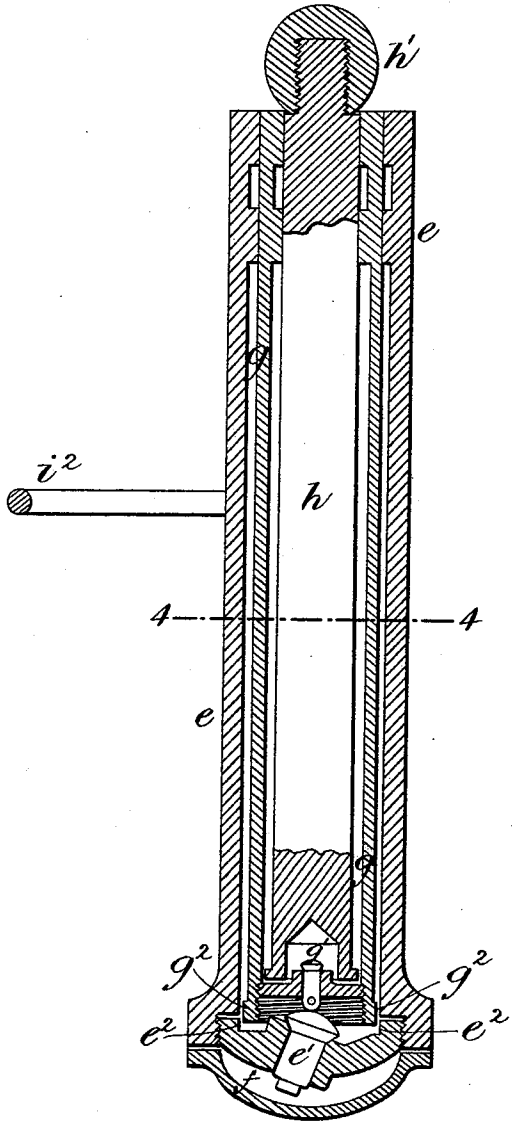
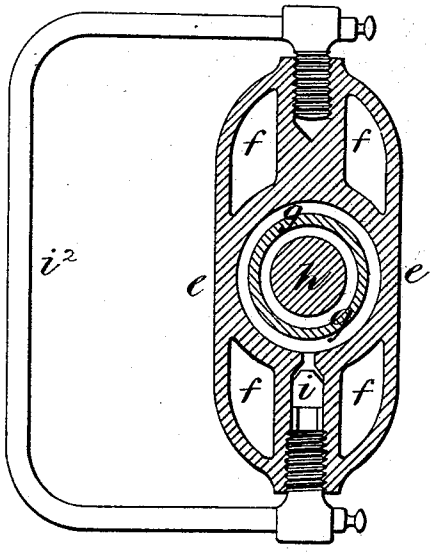


Fig. 4.



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Fig. 5.

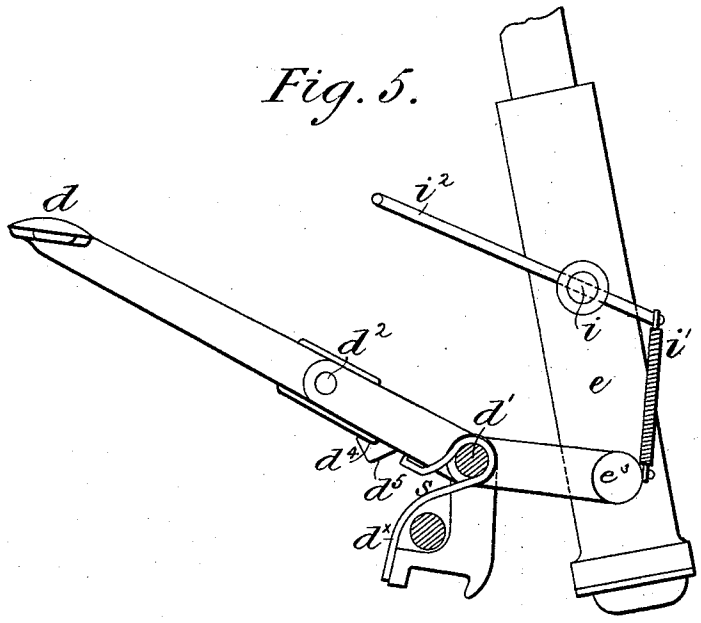
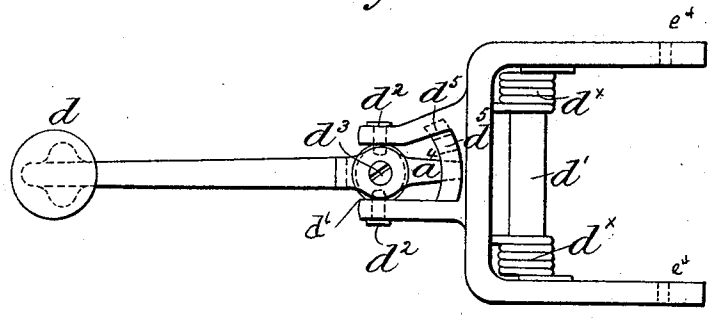


Fig. 6.



Witnesses
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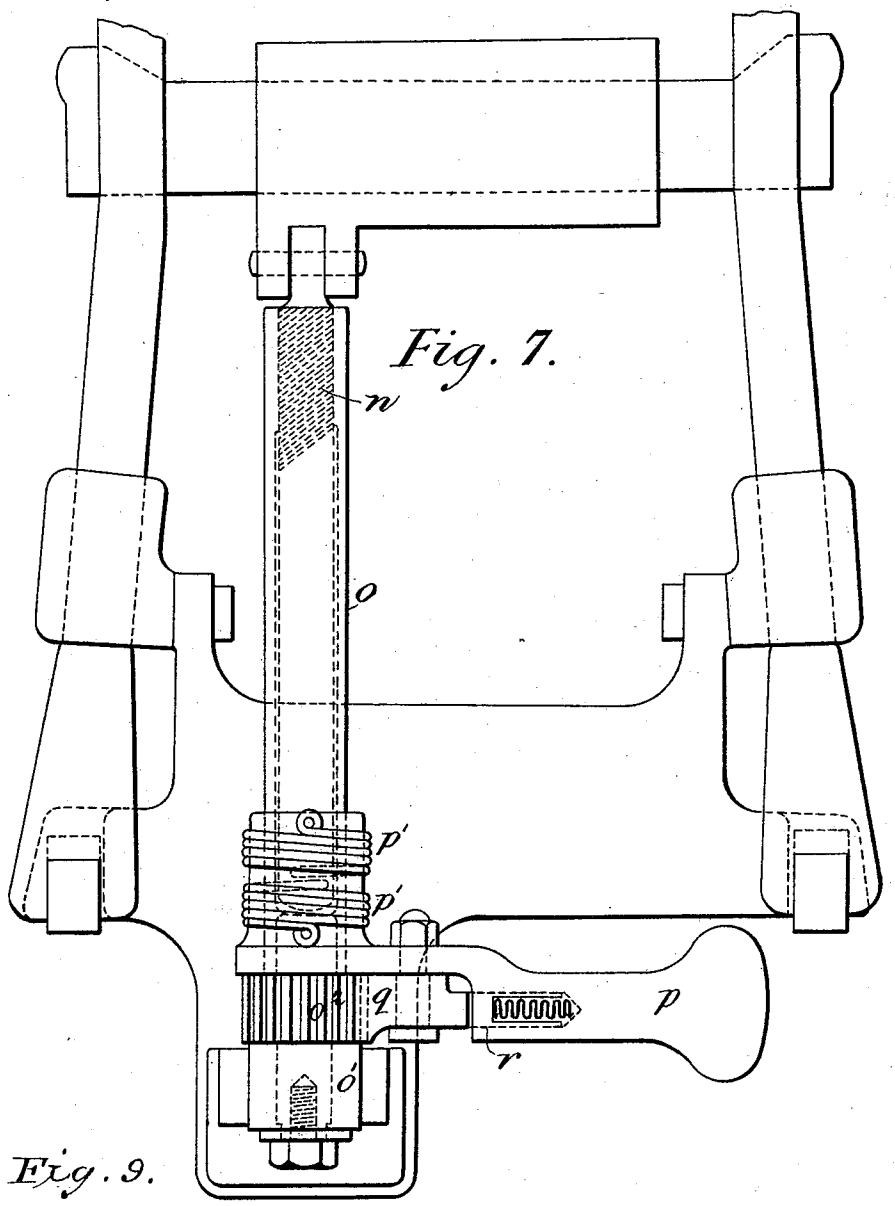


Fig. 7.

Fig. 9.

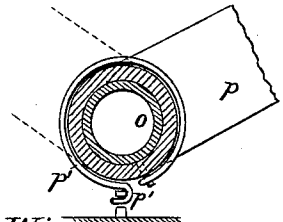
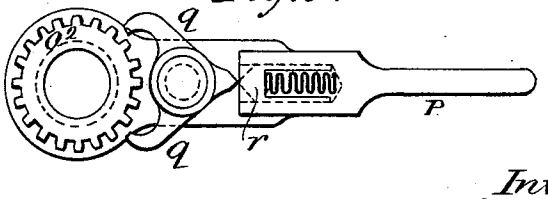


Fig. 8.



Witnesses
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UNITED STATES PATENT OFFICE.

DUNCAN DEWAR HEPBURN, OF LONDON, AND EDWARD GARDNER, OF CORNBROOK, MANCHESTER, ENGLAND.

DENTAL CHAIR.

SPECIFICATION forming part of Letters Patent No. 406,349, dated July 2, 1889.

Application filed November 26, 1888. Serial No. 291,850. (No model.)

To all whom it may concern:

Be it known that we, DUNCAN DEWAR HEPBURN, chairman of the Dental Manufacturing Company, residing at 6 to 10 Lexington Street, London, W., England, and EDWARD GARDNER, engineer, residing at Cornbrook, Manchester, England, both subjects of the Queen of Great Britain, jointly have invented certain new and useful Improvements in Dental Chairs, of which the following is a specification.

The first part of our invention relates to dental chairs of that class in which the chair proper—which for the sake of distinction we shall hereinafter term the chair-body—can be raised or lowered and locked at any desired elevation upon a support or frame adjustable at any desired inclination. The object of this part of our invention is to quickly, easily, and noiselessly raise or lower the chair-body, which end we attain by mounting the chair-body on a hydraulic apparatus which accompanies the chair-body in its movements.

The object of the next part of our invention is to hold a chair at any desired elevation, which end we attain by combining with hydraulic raising and lowering apparatus independent automatic locking mechanism, which retains the chair-body in its elevated position until released, when it allows the chair-body to be lowered by the hydraulic apparatus.

The next part of our invention relates to the adjustment of the inclination of the chair. Its objects are to actuate the adjusting mechanism from either side of the chair, and to hold the parts securely in their adjusted position, which ends we attain by combining with a chair frame or support, rocking on its base or standards, an adjusting-screw and ratchet-lever to adjust and hold the parts securely.

The subject-matter claimed is hereinafter specifically designated.

In the accompanying drawings, which show so much of a dental chair embodying all our improvements as is necessary to illustrate the subject-matter herein claimed, Figure 1 is a vertical longitudinal central section through the chair with the chair-body raised, and Fig. 2 a rear elevation thereof; Fig. 3, a vertical central longitudinal section through the telescopic hydraulic apparatus in its lowest position; Fig. 4, a horizontal transverse section therethrough on the line 4 4 of Fig. 3; Fig. 5, a side elevation of the lifting-treadle, together with the lower part of the hydraulic lifting apparatus; Fig. 6, a plan of the treadle-lever; Fig. 7, a plan of the gear for altering the inclination of the chair; Fig. 8, an elevation of the foot-lever actuating the gear, (shown in Fig. 7,) and Fig. 9 a detail of the foot-lever springs. Figs 3 to 8, both inclusive, are on an enlarged scale.

Standards a, upon a suitable base-frame, carry bearings a', in which the trunnions of the frame or supports b are mounted. The parts c, constituting the chair-body or chair proper, are arranged to slide vertically on this frame in well-known ways, and can be locked at any desired elevation thereon by mechanism hereinafter described.

A treadle d rocks on an intermediate horizontal axis or pivot d', held in brackets fixed to the bottom rail of the chair frame or support b, and is held with its outer or rear end in an elevated position by coil-springs $d^{\times}$, which, however, yield when the treadle is depressed. This treadle normally lies centrally and longitudinally relatively to the base-frame, which position is convenient for operation by foot-pressure. It is, however, sometimes desirable for the operator to work it with his knee, and this can be done more conveniently by moving the rear end of the treadle upward and to one side. In order to do this, we joint the treadle-lever between its pivot and rear end in the following manner: That part next the axis d' is forked and carries a horizontal disk d^6, rocking vertically on pivots d^2 in said forks and fitting a horizontal slot in the rear part or movable section of the lever. An upright pin d^3 connects this movable part of the lever with the disk. The lever is thus universally jointed, and its rear end can consequently be moved both vertically and laterally. It is, however, rigid against downward pressure, as the front end of the movable part underlaps the fixed part. When lifted, the rear end of the lever can be moved sidewise, which brings its front projecting

end or toe d^4 beneath one or the other of lugs d^5 on its inner or fixed end. Thus the operative position of the treadle can be altered as circumstances may require. The inner or front end of this treadle-lever d is bifurcated or forked, its prongs embracing the hydraulic apparatus, the lower member or cylinder e of which carries trunnions e^3 near its lower end, which rock in bearings e^4 in these prongs. A fluid reservoir or store-vessel f is provided in connection with this cylinder. The drawings show this store-vessel as combined with the cylinder in one case or shell, oval in outline, with the store-vessel at each end, (see Fig. 4,) and connected with the cylinder by passages underneath it. (See Fig. 3.) An ordinary plug-valve e', opening inward to the cylinder, allows liquid to pass thereinto from the store-vessel, but prevents its return. The escape of liquid from the cylinder e back to the store-vessel f is controlled by a screw cone-valve i, Fig. 4, which is opened to allow liquid to escape from the cylinder by depressing its bail or lever i^2, and closed by raising it. In Fig. 5 the valve is shown as normally held closed by a spring i', connecting the front ends of the valve-lever i^2, and a corresponding extension of the treadle d.

A hollow ram g works through an internal gland near the top of the cylinder e. The lower end of this hollow ram is closed by a diaphragm provided with a valve g', which likewise opens inward to allow liquid to enter the ram, but closes to prevent its escape therefrom when the ram is elevated. The spindle of the valve g', however, extends downward so far below the diaphragm that when the ram is fully down the valve-stem abuts against the bottom of the cylinder or against its valve e' and opens the valve g', thus allowing the contents of the hollow ram to escape. A narrow passage or outlet for the passage of the contents of the hollow ram is provided between the fitted surfaces of a shoulder e^2 in the bottom of the cylinder e and an annular flange g^2 on the ram. (See Fig. 3.) The limited area of this passage allows the liquid to escape slowly only, thus insuring the gradual descent of the ram. A second ram or solid plunger h works in the hollow ram g through glands similar to those above mentioned, its lower end being provided with a recess, in which the valve g' of the hollow ram works when the plunger is down, so as to leave the valve always free to open inward.

The parts constituting the chair-body are connected with the upper part of the plunger h by an ordinary ball-and-socket joint h', so that while movable together their relative angular relation may be varied.

It will thus be seen that the entire hydraulic lifting apparatus is carried by the lifting-lever, which is pivoted on the chair-support. The hydraulic apparatus is also connected with the chair-support through the chair-body, and only through it. By this organization the entire hydraulic apparatus is lifted as the chair-body rises, while the outer or lower cylinder rises and falls at each stroke of the treadle, thus lifting the chair-body with a step-by-step movement. The inclination of the chair-support can also be varied without disturbing the relation of these parts.

A horizontal transverse shaft or axis k', mounted in bearings on the back of the chair-body, carries pinions k, fixed therein, gearing with vertical racks b' on the chair support or frame b, and a disk k^2, inclosed by a casing l, on the chair-body. A cam m rocks on a pivot in this casing in the same vertical plane as the disk against the periphery, allowing the chair-body to rise freely, but jamming against the disk to prevent its descent, a light spring m^2 holding the peripheries of the disk and cam in contact. A handle m' on the cam serves to release it from contact, when the pinions are free to turn and travel down the racks with the chair-body when the hydraulic apparatus permits. This locking apparatus of course rises with the chair-body as it is lifted by the hydraulic apparatus, and automatically locks and holds it, until released, at the highest point to which it is lifted thereby, whether the hydraulic pressure is on or off.

We are aware that a chair lifted by mechanism or gearing has been lifted against descent by a toothed pawl and ratchet, but prefer our organization as being less noisy and not so liable to derangement.

The supports b, as before remarked, rock on trunnions in the base-frame, below which trunnions they extend and are connected by a cross-bar. The front end of a male screw n enters the rear end of a female screw o, the front of which turns in a trunnion-ring o', jointed to the front of the bed-frame. A ratchet gear or pinion o^2 is secured upon and turns with the female screw. A transverse foot-lever p, attached to and capable of swinging around this screw, is normally held at an angle of about eighty degrees from the horizontal by springs p', coiled in reverse directions around the screw or the boss of the foot-lever, so as to uphold the foot-lever whichever way it may be turned. These springs are respectively fastened at one end to the chair-base, Fig. 9, and at the other to the screw o, Fig. 1. The lever is thus adapted to be reversed or turned over and worked on either side of the screw to reverse its revolutions to incline the chair-frame. These springs, while upholding the lever, of course yield to the foot-pressure. A double pawl rocks vertically on a pivot in the foot-lever, and its forks are caused alternately to engage the ratchet-gear o^2 by a wedge-shaped spring-piece r, also on the lever, according to the side of the screw on which the front lever is working.

The chair-support may be locked at any inclination to which it may be set by a transverse right and left screw-locking gear

worked by a pedal *s;* but this is not essential, as the adjusting-screws hold the parts securely in position.

The parallel longitudinal side bars *c'* of the lower platform of the chair-body are provided on their under sides with longitudinal slots c^2, open at their front ends to receive laterally-projecting pins on the side arms *t'*, connected by a foot-board *t*. Intermediate laterally-projecting stops t^2 on these side arms rest on the upper edge of the side bars *c'*. By this means the foot-rest is firmly held in its adjusted position, and yet can be readily removed or replaced.

The mechanism operates in the following manner: Suppose it is desired to raise the chair-body from its lowest position in which the relation of the rams is shown in Fig. 3, while the lifting-treadle assumes the attitude shown in Fig. 2. In this position the rams are filled with liquid. The operator depresses the treadle, the effect of which is to raise all the rams and the chair-body the length of the stroke. As the treadle descends, preparatory to the next upward stroke, the automatic locking mechanism holds the chair-body and its supporting-plunger up while the hollow rams descend with the treadle. As they do so, liquid flows from the store-vessel into the cylinder *e* through the inlet-valve *e'* and then through the valve *g'* of the hollow ram *g*. This process is repeated at each reciprocation of the treadle and cylinder, the inflowing liquid being retained by the closing of the valve on the upstroke. The hollow ram is thus filled gradually and the plunger and chair-body lifted step by step until the plunger rises to its full extent, the automatic locking device holding it at all times at the highest point attained. At this point the pressure on the hollow ram is sufficient to close the valves *g'*, and the ram *g* in turn goes through the same elevating process step by step, carrying the plunger and chair-body with it, as shown in Figs. 1 and 2, until its highest point is reached. As the ram *g* is upheld by the chair-body locking device the cylinder *e* is filled also on its last downstroke, and the chair-body is thus upheld by the liquid and the automatic locking device. To lower the chair, it is only necessary to disengage the locking-cam and to open the cone-valve *i* slightly, which allows the liquid to escape at a determined rate from the cylinder to the store-vessel. The lower cylinder thus first empties itself until the hollow ram nearly reaches its lowest position, when the stem of its valve *g'* abuts against the inlet-valve *e'* or other stop, and is opened just as the bottom of the ram itself enters a shallow closed socket in the bottom of the outer cylinder bearing a small annular opening for the exit of the fluid, thus retarding the descent of the plunger to a degree corresponding with its diminished diameter, and causing it to descend at the same rate as its predecessor until it reaches its lowest position, at which moment, as shown in Fig. 2, the cavity in the bottom of the plunger leaves the valve *g'* free to open for the re-entrance of fluid for next lift.

The operation of the other parts of the mechanism will readily be comprehended from the foregoing description.

Having thus particularly described the construction, organization, and operation of our improved dental chair, what we claim therein as new, and desire to secure by Letters Patent, is—

1. The combination, substantially as hereinbefore set forth, of a chair-support, a lifting-treadle, a series of hydraulic rams all mounted on the lifting-treadle, and a chair-body mounted on one of the rams.

2. The combination, substantially as hereinbefore set forth, of a chair-support, a lifting-treadle, its pivot on the chair-support, a series of interposed hydraulic rams mounted on the treadle-lever, and a chair-body mounted on one of the rams, which are successively operated to lift the chair-body by a step-by-step movement.

3. The combination, substantially as hereinbefore set forth, of a chair-body, a series of hydraulic rams supporting it, and a lifting-treadle on which the rams are mounted and which lifts the chair-body by reciprocating one of the rams relatively to the others.

4. The combination, substantially as hereinbefore set forth, of a chair-body, a hydraulic elevating apparatus supporting it, a store-vessel connected with the elevating apparatus, and a lifting-treadle supporting both the elevating apparatus and store-vessel.

5. The combination, substantially as hereinbefore set forth, of a chair-body, hydraulic elevating-rams, on one of which it is mounted, a store-vessel connected with the rams, a self-closing inlet-valve and an outlet-valve between the store-vessel and rams, and a lifting-treadle on which the chair-body, rams, and store-vessel are mounted.

6. The combination, substantially as hereinbefore set forth, of a chair-body, hydraulic rams supporting it, a store-vessel connected therewith, an escape-valve between the rams and store-vessel, a lever on the valve-stem, a lifting-treadle supporting and actuating the rams, and a spring connecting the valve-lever and treadle normally to hold the valve closed.

7. The combination, substantially as hereinbefore set forth, of a chair-support, a chair-body, a series of telescopic rams, on one of which it is mounted, a store-vessel surrounding the rams, separate inlet and outlet valves for the outer cylinder, a combined self-acting inlet and outlet valve for the inner cylinder, and a lifting-treadle pivoted on the chair-support, on which treadle the chair-body, rams, and store-vessel are mounted.

8. The combination, substantially as hereinbefore set forth, of a chair-support, a chair-body, a solid ram or plunger on which it is mounted, a hollow ram inclosing the plun-

ger, an outwardly-closing self-acting inlet-valve in the hollow ram, a reciprocating cylinder inclosing this ram, a store-vessel, an outwardly-closing self-acting inlet-valve, a separate outlet-valve the opening of which causes the descent of the inclosed hollow ram, the opening of its valve, and the descent in turn of the plunger and chair-body, and a lifting-treadle and its pivots on the supporting-frame, on which lifting-treadle the rams, store-vessel, and chair-body are mounted.

9. The combination, substantially as hereinbefore set forth, of a chair support or frame, a chair-body movable vertically therein, an automatic locking device on the frame adapted to hold the chair-body at any desired elevation, hydraulic apparatus supporting the chair-body, and a lifting-treadle which lifts both the hydraulic apparatus and chair-body.

10. The combination, substantially as hereinbefore set forth, of a chair support or frame, a chair-body movable vertically therein, an automatic locking device adapted to hold the chair-body at any desired elevation, a lifting-treadle, and telescopic hydraulic rams supporting and lifting the chair-body and supported and actuated by the lifting-treadle

11. The combination, substantially as hereinbefore set forth, of a chair-support, a chair-body movable vertically therein, an automatic locking device on the chair-support adapted to hold the seat at any desired elevation, a plunger supporting the seat, a reciprocating hydraulic cylinder actuating the plunger, and a lifting-treadle supporting and actuating the cylinder.

12. The combination, substantially as hereinbefore set forth, of a chair-support, a chair-body movable vertically therein, an automatic locking device on the chair-support adapted to hold the seat at any desired elevation, a plunger supporting the seat, a hollow ram inclosing the plunger, a reciprocating hydraulic cylinder inclosing and actuating the ram and plunger with a step-by-step movement, and a lifting-treadle supporting and actuating the hydraulic cylinder.

13. The combination, substantially as hereinbefore set forth, of a base frame or standards, a chair support or frame pivoted thereon, mechanism for adjusting the angle of inclination of the chair-support, a chair-body movable vertically on the frame, a lifting-treadle pivoted on the chair-support, and telescopic hydraulic apparatus supporting and actuating the chair-body and supported and actuated by the lifting-treadle simultaneously to adjust all these parts as the inclination of the chair is varied.

14. The combination, substantially as hereinbefore set forth, of the base-frame, its standards, a chair-support, its intermediate transverse pivots on the standards, a longitudinal male screw pivoted to the chair-support, an inclosing female screw journaled in the base-frame, and its ratchet-gear and actuating-pawl to adjust and hold the chair-support at any desired inclination.

15. The combination, substantially as hereinbefore set forth, of a base-frame, a chair-support pivoted therein, a compound or telescopic adjusting-screw pivoted at one end to the chair, longitudinal male screw pivoted on the chair-support and inclosing female screw journaled in the base-frame, a ratchet-gear on the screw, a double-acting transverse pawl-lever journaled on the screw, and double-acting lifting-springs, so that the lever may be reversed and worked from either side of the chair to vary the inclination of the chair-support.

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