March 12, 1946. D. J. BINUS 2,396,311

DOOR APPARATUS FOR DENTAL UNITS AND THE LIKE

Filed Feb. 15, 1944 4 Sheets-Sheet 1

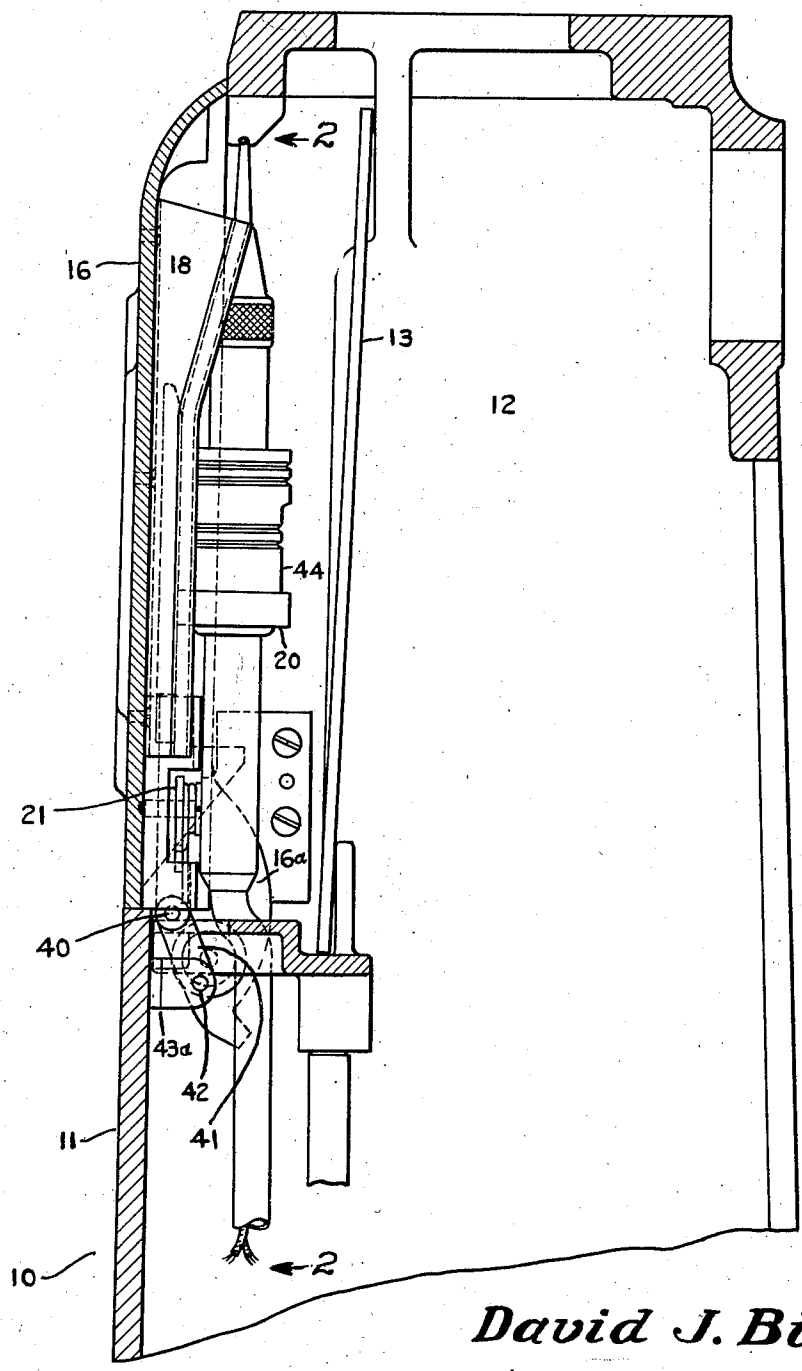


Fig. 1

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DOOR APPARATUS FOR DENTAL UNITS AND THE LIKE

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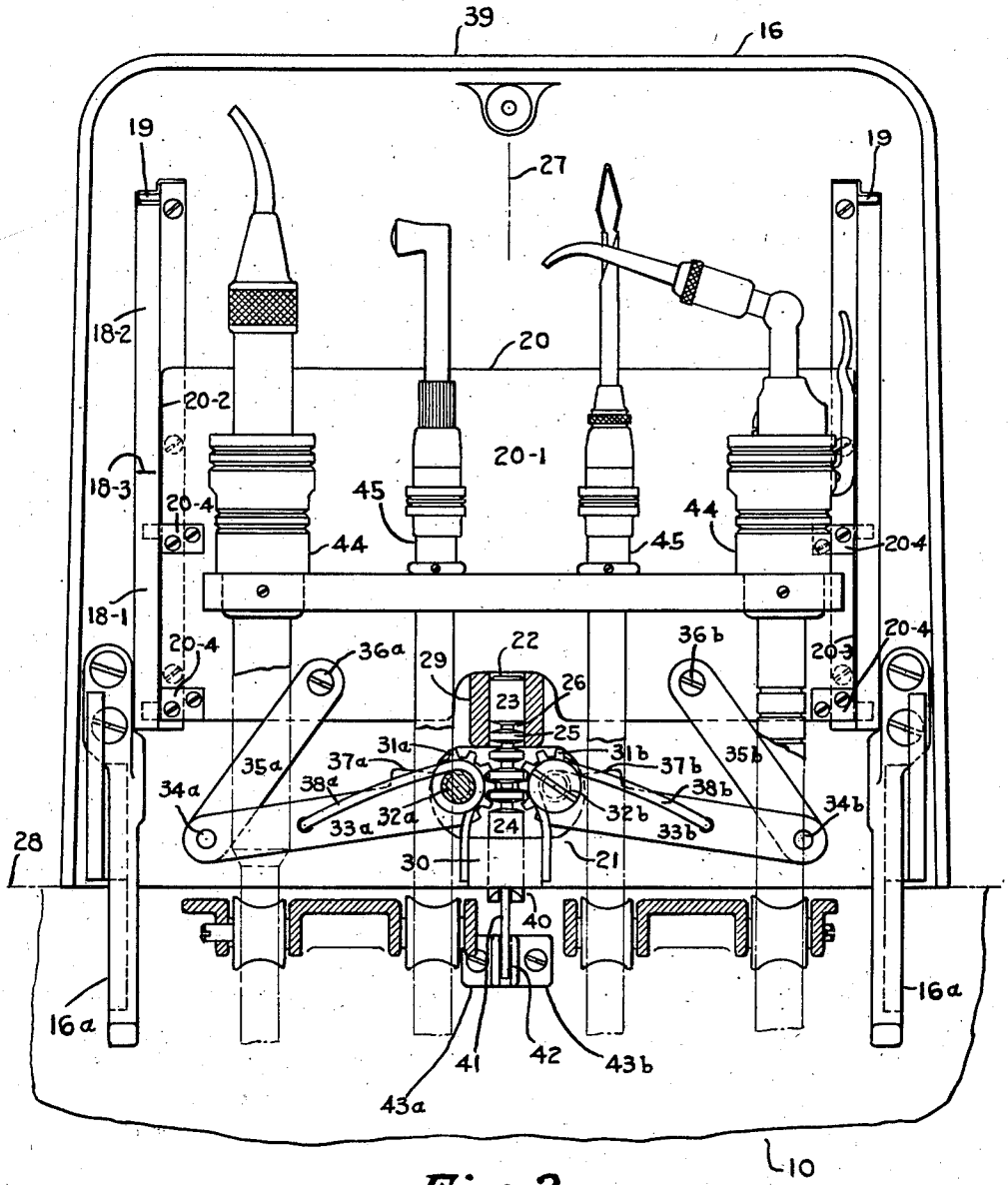


Fig. 2

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DOOR APPARATUS FOR DENTAL UNITS AND THE LIKE

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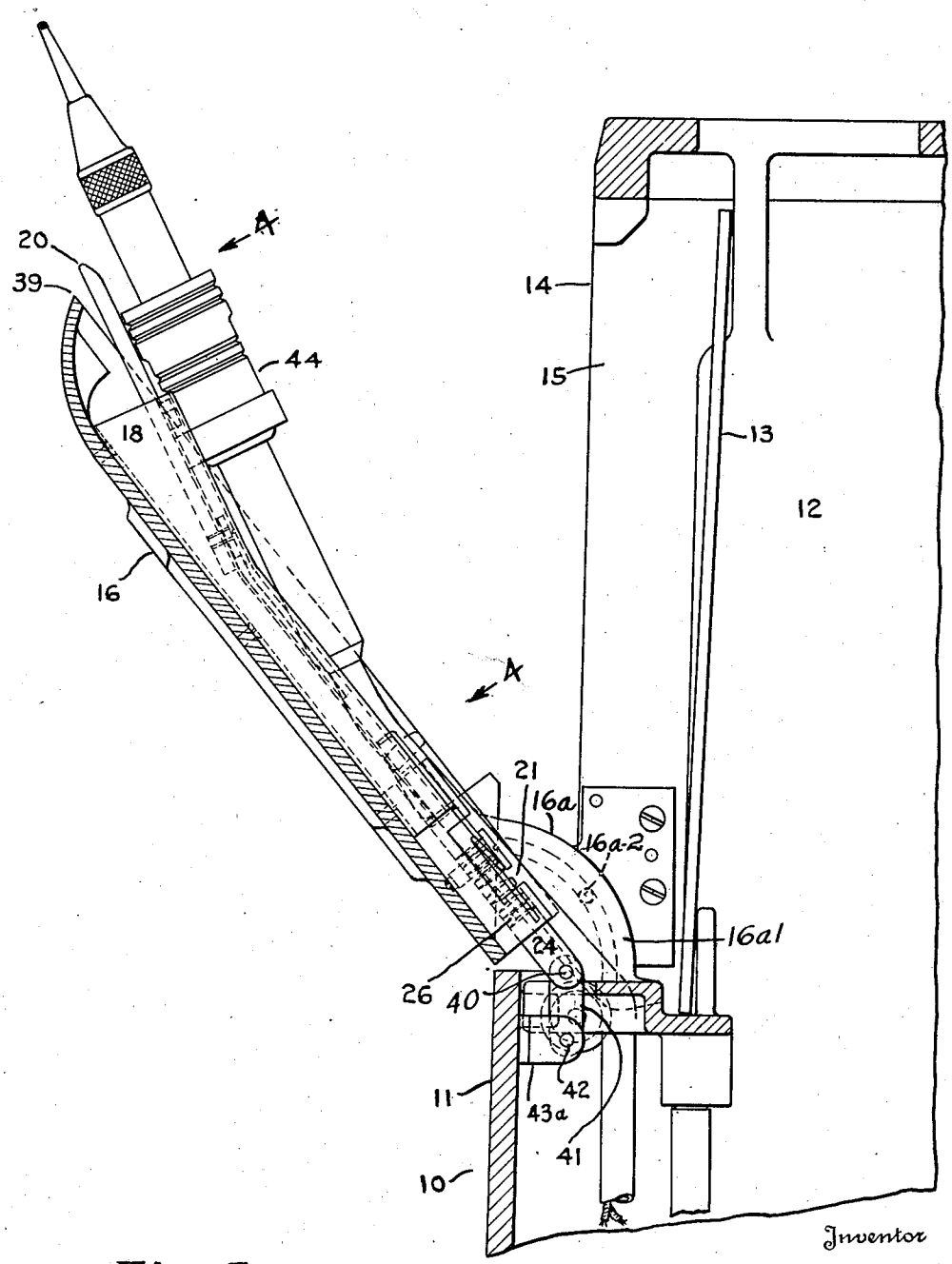


Fig. 3

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DOOR APPARATUS FOR DENTAL UNITS AND THE LIKE

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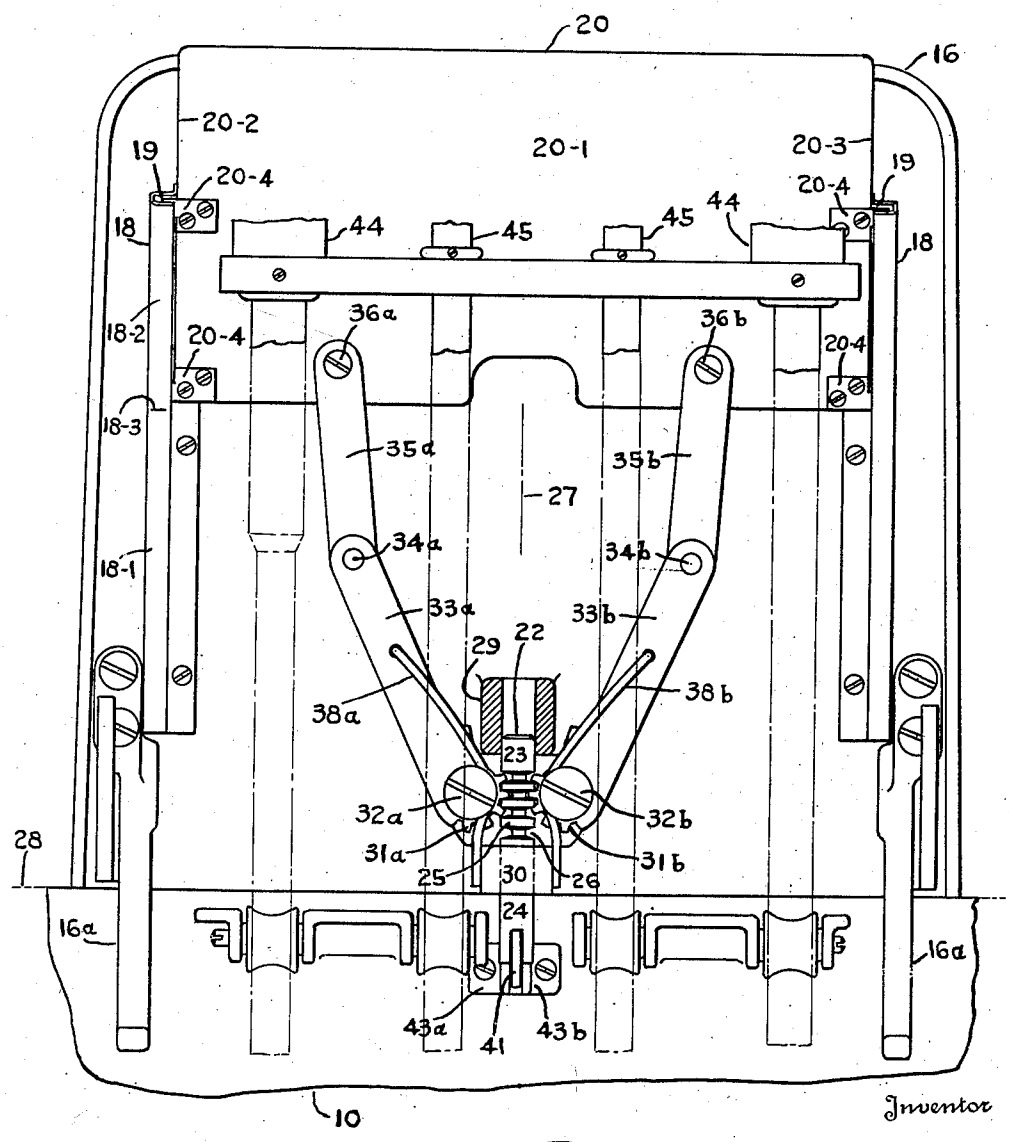


Fig. 4

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UNITED STATES PATENT OFFICE

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DOOR APPARATUS FOR DENTAL UNITS AND THE LIKE

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Application February 15, 1944, Serial No. 522,467

15 Claims. (Cl. 312—22)

The invention relates to door apparatus for dental units and the like, including a mounting member such as a door frame, a door or swinging member operatively mounted for swinging movement on the mounting member, and a slide operatively mounted for sliding on the swinging member.

In a dental unit, the door may swing to and from closed and open positions in the door frame opening of an instrument panel compartment, and the slide may be an instrument mounting bracket, the operation being such that when the door is swung about a horizontal hinge axis to an open position with respect to the opening, the instrument mounting bracket slide with the instruments mounted thereon slides outwardly on the door away from its horizontal hinge axis.

Various arrangements of such door apparatus have been used in an effort to obtain automatic operation of the swinging and slide parts with respect to each other, but prior to the present improvements none have been satisfactory to the desired degree in providing a definite and certain repeating cyclical operation of the parts without interference, and at the same time being of simplified construction and arrangement enabling rapid and economical production of the parts and easy and correct assembly and disassembly of the parts.

The objects of the present invention include the provision of door apparatus for dental units and the like in which a slide is operatively mounted on a swinging member, and in which relative movement of the parts is obtained in a positive manner so that the relative movements are exactly repeated in definite cycles without the use of pulleys and belts, thereby providing improved operating characteristics.

Further objects of the present invention include the provision of such door apparatus in which the parts are of simplified construction and arrangement, whereby the parts may be rapidly and economically manufactured, and easily and correctly assembled and disassembled, so that the apparatus as a whole may be economically produced and maintained.

The foregoing and other objects are attained by the door apparatus, parts, combinations, and subcombinations which comprise the present invention, and the nature of which is set forth in the following general statement, and preferred embodiments of which are set forth in the following description, and which are particularly and distinctly pointed out and set forth in the appended claims forming part hereof.

The nature of the improved door apparatus of the present invention may be stated in general terms as including a mounting member, a swinging member operatively mounted for swinging movement on the mounting member, and a slide operatively mounted for sliding on the swinging member, and gearing and linkage means operatively associated with the slide and swinging member for automatically moving the slide in repeating cycles during operation of the swinging member.

By way of example, preferred embodiments of the door apparatus of the present invention and of improved parts thereof, are illustrated in the accompanying drawings forming part hereof in which

Figure 1 is a fragmentary elevational view with portions in section showing a dental unit including one embodiment of the improved door apparatus hereof, the door parts being shown in their relative positions when the door is closed;

Fig. 2, a fragmentary view looking in the direction of the arrows 2—2, Fig. 1;

Fig. 3, a view similar to Fig. 1, the door parts being shown in their relative positions when the door is open; and

Fig. 4, a fragmentary view looking in the direction of the arrows 4—4, Fig. 3.

Similar numerals refer to similar parts throughout the several views.

The dental unit indicated generally by 10 includes a hollow standard or column 11 having an upper compartment 12 in which is located an instrument panel 13 at the rear of the door frame indicated generally by 14 formed in front walls of the column 11.

The door frame 14 surrounds the door opening 15, and a door 16 is operatively mounted on the column 11 as by hinge means 16a for swinging to and from closing position in the door opening 15 of the door frame 14.

The hinge means 16a may be usual pivot hinge means, but as shown each hinge means 16a includes an arcuately slotted plate 16a—1 secured to the door 16, the arcuate slot of the plate riding on a pin 16a—2 extending from one side of the door frame 14. This arcuate slot and pin hinge means 16a has been in common use.

The column 11 and its door frame 14 thus constitute a mounting member in which the door or swinging member 16 is operatively mounted for swinging about a horizontal hinge axis.

On the inner face of the door or swinging member 16, guide means are operatively mounted and include laterally spaced parallel guide channels

18 having opposite angled channel openings 19 opening toward each other, the channels 18 being secured to the door as a base.

A slide indicated generally by 20, as shown constituting an instrument mounting bracket, is slidable in the guide channels 18 toward and away from the hinge axes of the swinging member 16. Gearing and linkage actuating means indicated generally by 21 are operatively associated with the swinging member 16, and the slide member 20, and the mounting member 11.

As shown, the gearing and linkage actuating means 21 includes a generally cylindric rack member indicated generally by 22 having slide bearing portions 23 and 24 at its opposite ends, and central annular rack teeth 25 and rack grooves 26 forming opposite sets of rack teeth and grooves in any diametral plane of the rack member 22.

The door 16 is generally rectangular as shown and has a central axial plane indicated by the dot-dash line 27 at right angles to the axis of the hinge means 16*a* indicated by the dot-dash line 28. The longitudinal axis of the generally cylindric rack member 22 is in the plane 27. Cylindric slide bearings 29 and 30 are coaxial with each other and longitudinally spaced from each other and are secured on the inner face of the door 16, and the cylindric rack member 22 is slidably located in the bearings 29 and 30.

Between the bearings 29 and 30 and on opposite sides of the rack member 22, pinions 31*a* and 31*b* are pivotally mounted on the inner face of the door 16 as shown by pivot screws 32*a* and 32*b*, and the teeth of the pinions 31*a* and 31*b* are meshed with the teeth portions at opposite sides of the rack rod 22.

As shown the pinions 31*a* and 31*b* are sectoral and are integrally formed on the inner ends of links or arms 33*a* and 33*b* respectively. The outer ends of links 33*a* and 33*b* are provided with pivotal connections 34*a* and 34*b* respectively with ends of links 35*a* and 35*b*, the other ends of which are provided with pivotal connections 36*a* and 36*b* respectively with the slide 20.

The axes of the pivotal connections 36*a* and 36*b* are equally spaced from the axial plane 27 perpendicular to the axis 28; the links 35*a* and 35*b* are equal in length between their pivot axes; and the links 33*a* and 33*b* are equal in length between their pivot and pinion axes. The outer sides of the links 33*a* and 33*b* are provided with stop projections 37*a* and 37*b* respectively for abutment against the opposite sides of the cylindric guide bearing 29 when the slide 20 is in the extended position shown in Figs. 3 and 4.

Expanding V arm spring means 38*a* and 38*b* are operatively associated with the link arm 33*a* and pinion 31*a*, and with the arm 33*b* and pinion 31*b* respectively, and with the pivots 32*a* and 32*b* and with opposite sides of the bearings 30, urging movement of the link arms 33*a* and 33*b* towards the outer upper end 39 of the door 16.

The V arm spring means 38*a*, for example, includes a central spring coil which engirdles the shank of the pivot screw 32*a*, and one V arm has a hook end inserted in an aperture in the link 33*a*, and another V arm has a hook end inserted in an aperture in a transverse member on the door 16, as best shown in Figs. 2 and 4.

The outer extremity of the lower cylindric end portion 24 of the rack member 22 has a pivotal connection 40 with the upper end of link 41, the lower end of which has a pivotal connection 42 with inwardly directed legs of opposite angle brackets 43*a* and 43*b*, the other legs of which are secured to the inner face of the front wall of the column 11 below the door hinge axis 28.

The instrument mounting bracket slide 20 as shown includes a plurality of tubular holders 44 and 45 in each of which is inserted in a usual manner an instrument as shown, which may be served in a usual manner by a flexible tubular conduit extending into the column 11.

Each guide channel 18 has a lower end portion 18—1 substantially parallel with the inner face of the door 16 and an upper portion 18—2 which is angled with respect to the lower portion 18—1, the channel portions 18—1 and 18—2 having a central apex junction 18—3, and the upper channel portion 18—2 sloping from the junction 18—3 away from the inner face of the door 16.

The slide 20 preferably as shown includes a rectangular panel 20—1 extending laterally between the guide channels 18, the sides 20—2 and 20—3 of the panel 20—1 preferably being located adjacent but not extending into the channel openings 19. At each side 20—2 and 20—3 of the panel 20—1 are secured a pair of spaced tongues 20—4, the extremities of each tongue extending with clearance into one of the channel groove openings 19.

In operation, when the door 16 is closed, the parts of the improved door apparatus are in the relative positions shown in Figs. 1 and 2 with the instrument mounting bracket slide 20 retracted in the guide channels 18 to its position closest to the lower end of the door 16.

Upon opening the door 16 to the positions shown in Figs. 3 and 4, the preferred rack and pinion gearing and linkage actuating means 21 operates so as to slide the rack member 22 and the bearings 29 and 30 with respect to each other so that the end portion 24 of the rack member 22 extends below the bearing 30, whereby the pinions 31*a* and 31*b* are rotated towards the lower end of the door and arms 33*a* and 33*b* are swung outwardly towards the outer end 39 of the door, thereby moving the slide 20 in the guide channels 18 so that it slides first parallel with the inner face of the door 16 in the channel portions 18—1 and then slides and swings upwardly away from the inner face of the door 16 in the channel portions 18—2. In its outwardly extended position shown in Figs. 3 and 4, the instruments carried in the instrument bracket slide 20 are accessible for use.

Upon closing the door 16 from the open position shown in Figs. 3 and 4 to the closed positions shown in Figs. 1 and 2, reverse movements of the parts take place, and the relative movements of the door member 16 and the slide member 20 are exactly repeated in a cycle with each opening and closing of the swinging or door member 16, by the action of the gearing and linkage means 21. Thus there is no interference of the parts with each other or with the instruments carried on the slide 20.

The embodiments of the present improvements illustrated and described herein are by way of example, and the scope of the present invention is not limited to the same or to the particular details thereof, but is commensurate with any and all novel subject matter contained herein which may at any time properly under the United States patent laws be set forth in the claims hereof or originating herein, and the elements of any such claims are intended to include their reasonable, mechanical and functional equivalents.

I claim:

1. In apparatus including members movable with respect to each other, a mounting member, a swinging member operatively mounted for swinging movement on the mounting member, a slide operatively mounted for sliding on the swinging member, and gearing and linkage means operatively associated with the slide and swinging member for automatically moving the slide during movement of the swinging member.

2. In apparatus including members movable with respect to each other, a mounting member, a swinging member operatively mounted for swinging movement on the mounting member, a slide operatively mounted for sliding on the swinging member, and rack and pinion gearing and linkage means operatively associated with the slide and swinging member for automatically moving the slide during movement of the swinging member.

3. In apparatus including members movable with respect to each other, a mounting member, a movable member operatively mounted for movement towards and away from the mounting member, a slide operatively mounted for sliding on the movable member, and gearing and linkage means operatively associated with the slide and movable member for automatically moving the slide during movement of the movable member.

4. In apparatus including members movable with respect to each other, a mounting member, a movable member operatively mounted for movement towards and away from the mounting member, a slide operatively mounted for sliding on the movable member, and rack and pinion gearing and linkage means operatively associated with the slide and movable member for automatically moving the slide during movement of the movable member.

5. In apparatus including members movable with respect to each other, a mounting member, a first movable member operatively mounted for movement towards and away from the mounting member, a second movable member operatively mounted for movement on the first movable member, and gearing and linkage means operatively associated with the members for automatically moving the second movable member during movement of the first movable member.

6. In apparatus including members movable with respect to each other, a mounting member, a first movable member operatively mounted for movement towards and away from the mounting member, a second movable member operatively mounted for movement on the first movable member, and rack and pinion gearing and linkage means operatively associated with the members for automatically moving the second movable member during movement of the first movable member.

7. In apparatus including members movable with respect to each other, a mounting member, a first movable member operatively mounted for movement towards and away from the mounting member, a second movable member, means operatively mounting the second movable member on the first movable member for movement of the second movable member towards and away from the first movable member, and gearing and linkage means operatively associated with the members for effecting the movement of the second member during movement of the first member.

8. In apparatus including members movable with respect to each other, a mounting member, a first movable member operatively mounted for movement towards and away from the mounting member, a second movable member, means operatively mounting the second movable member for sliding on the first movable member and for movement of the second movable member towards and away from the first movable member, and means operatively associated with the members for effecting the movement of the second member during movement of the first member.

9. In apparatus including members movable with respect to each other, a mounting member, a first movable member operatively mounted for movement towards and away from the mounting member, a second movable member, means operatively mounting the second movable member for sliding on the first movable member and for movement of the second movable member towards and away from the first movable member, and gearing and linkage means operatively associated with the members for effecting the movement of the second member during movement of the first member.

10. In apparatus including members movable with respect to each other, a mounting member, a first member, means mounting the first member for movement with respect to the mounting member, a second member, means mounting the second member for movement with respect to the first member, a rack, means mounting the rack for reciprocation on the first member, first linkage means operatively connecting the rack with the mounting member, a pinion journaled on the first member and meshed with the rack, and second linkage means operatively connecting the pinion with the second member.

11. In apparatus including members movable with respect to each other, a mounting member, a first member, means mounting the first member for movement with respect to the mounting member, a second member, means mounting the second member for movement with respect to the first member, a rack, means mounting the rack for reciprocation on the first member, first linkage means operatively connecting the rack with the mounting member, a pinion journaled on the first member and meshed with the rack, and second linkage means operatively connecting the pinion with the second member, the second linkage means including a pair of links, means pivotally connecting the pair of links with each other, means pivotally connecting one of the links with the second member, and the pinion being connected with the other link.

12. In apparatus including members movable with respect to each other, a mounting member, a first member, hinge means mounting the first member for movement with respect to the mounting member, a second member, means mounting the second member for movement with respect to the first member, a rack, means mounting the rack for reciprocation on the first member, first linkage means operatively connecting the rack with the mounting member, a pinion journaled on the first member and meshed with the rack, and second linkage means operatively connecting the pinion with the second member.

13. In apparatus including members movable with respect to each other, a mounting member, a first member, hinge means mounting the first member for movement with respect to the mounting member, a second member, means mounting the second member for movement with respect

to the first member, a rack, means mounting the rack for reciprocation on the first member, first linkage means operatively connecting the rack with the mounting member, a pinion journaled on the first member and meshed with the rack, and second linkage means operatively connecting the pinion with the second member, the second linkage means including a pair of links, means pivotally connecting the pair of links with each other, means pivotally connecting one of the links with the second member, and the pinion being connected with the other link.

14. In apparatus including members movable with respect to each other, a mounting member, a first member, means mounting the first member with respect to the mounting member, a second member, means mounting the second member for movement with respect to the first member, a rack member having rack teeth and grooves on opposite sides, means mounting the rack member for reciprocation on the first member, first linkage means operatively connecting the rack member with the mounting member, a pair of pinions journaled on the first member, each pinion being on one side of the rack member and meshed with the rack teeth and grooves on that side of the rack member, and two sets of second linkage means, each second linkage means operatively connecting one of the pinions with the second member.

15. In apparatus including members movable with respect to each other, a mounting member, a first member, means mounting the first member with respect to the mounting member, a second member, means mounting the second member for movement with respect to the first member, a generally cylindric rack member having annular rack teeth and grooves, cylindric bearing means mounting the generally cylindric rack member for reciprocation on the first member, first linkage means operatively connecting the rack member with the mounting member, a pair of pinions journaled on the first member, each pinion being on one side of the rack member and meshed with the rack teeth and grooves on that side of the rack member, and two sets of second linkage means, each second linkage means operatively connecting one of the pinions with the second member.

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