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LE ROY D. LEVEY ET AL

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DENTAL APPARATUS

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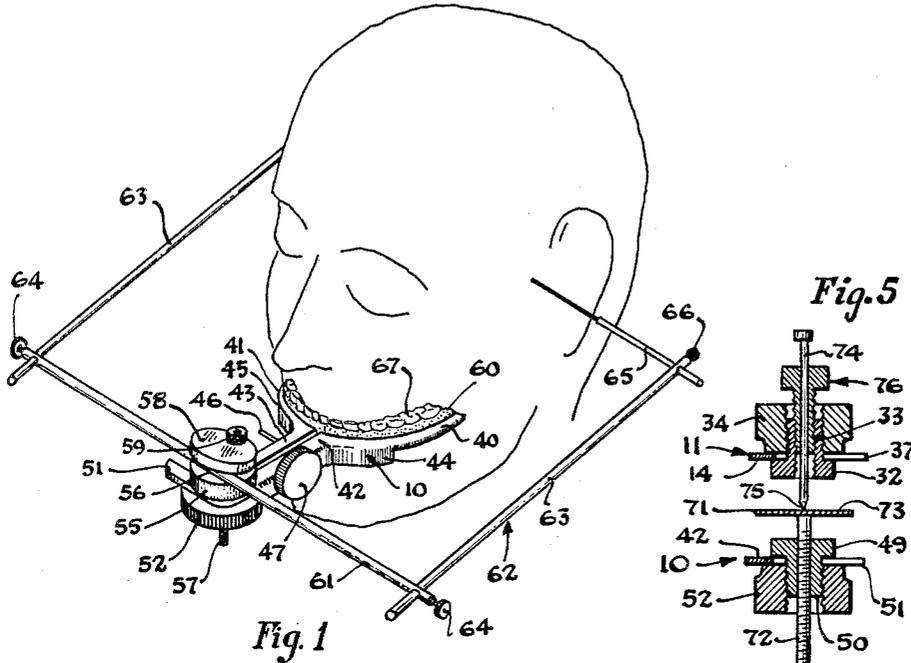


Fig. 1

Fig. 5

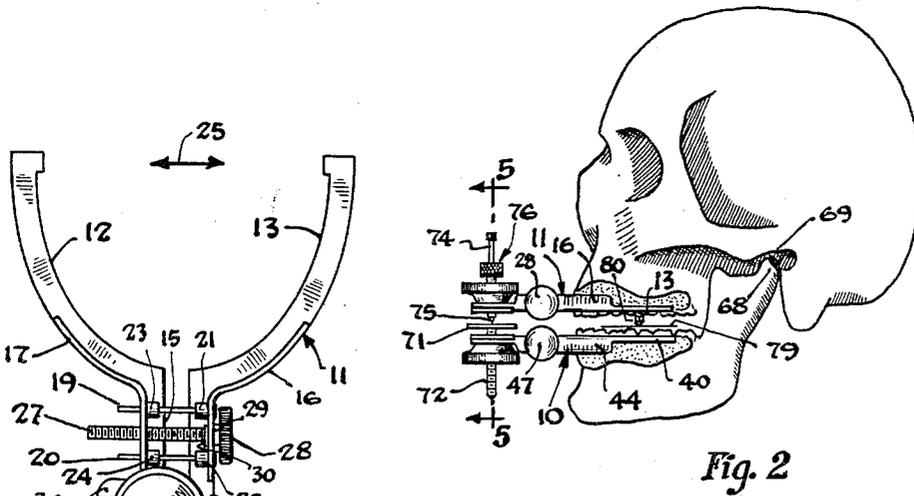


Fig. 2

Fig. 3

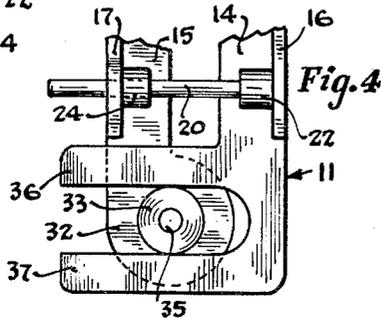


Fig. 4

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DENTAL APPARATUS

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The present invention relates to a dental apparatus for use particularly in preparing full or partial dentures, analysis of a patient's occlusion and correcting inaccuracies of existing occlusion.

While there is a general overall relationship in the shape and positioning of teeth of substantially all people, there are various differences in detail just as there are differences in the details of people's fingerprints. Factors that will vary from individual to individual include: the bite (centric, eccentric, and protrusive occlusal relationships), the inclination of the condyle path—a jaw joint in the head—as the jaw moves from the centric position to eccentric positions; the position of the mandibular teeth and the maxillary teeth with respect to each other and to the hinge axis of the jaws; the extent and relative paths of movement of the jaw during mastication; etc. In preparing artificial dentures for an individual, these various factors must be taken into consideration to the end that a correct and comfortable fitting denture may be produced.

During the construction of dentures, an articulator is used to hold the casts of the jaws or teeth in a position corresponding to that required by the individual's physical characteristics. However, in order to set up the articulator to duplicate the physical characteristics of the individual, it is first necessary that those physical characteristics be accurately determined. A principal object of our invention is to provide a new, novel, apparatus for achieving this purpose. The apparatus of our invention is characterized by the ease with which extremely accurate determinations may be made of the patient's physical characteristics in order to rebuild and replace the lost dentition of the patient. This element of ease not only pertains to the manipulations required of the dentist, but the patient also experiences less difficulty when the apparatus is used than is the case with some prior art devices.

A further advantage of our invention is that all of the tasks necessary to do the complete job are embodied in a single piece of apparatus including its several attachments. With many of the past devices it has been necessary to use a number of different pieces of apparatus, e.g. one to hold the hinge axis locator, a second to obtain a Gothic arch tracing, etc.

Further objects and advantages of our invention include: the device of our invention is relatively low in initial cost; it is of such a nature that it poses no unusual problems to keep it clean and sanitary; its use does not require extended special training but will be readily understood by a qualified dentist; it can be used effectively to produce partial dentures as well as dentures for an edentulous mouth; in use after the hinge axis has been located it is not necessary to remove the apparatus from the mouth nor to go to a separate piece of apparatus to make the Gothic arch tracing; when applying the apparatus to the existing teeth in order to analyze present dentitions, the clamping pressure to hold it in place is evenly applied to the teeth, i.e., the members of the instrument as they close together (by virtue of its parallel action) do not tend to crush or displace the front side teeth before the instrument contacts the side of the back teeth.

The instrument has a reinforcing lip to keep the instrument from distorting (bending) as the patient applies masticating pressures or mandibular (lower jaw) movements against the upper instrument.

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The instrument has its own attachment to hold the hinge axis locator.

In its use when building full and partial dentures, an intra oral central bearing pin is used to establish the vertical dimension that the dentist deems correct for the patient. However, this instrument has a magnetized extra oral tracing table on the mandibular element and a free floating pin on the upper (maxillary) member. By virtue of the magnetic action, intimate contact between the extra oral tracing pin and table is maintained and the movements of the mandible causing the tracings is readily observed.

The instrument not only has an adjustable ferruled nut to open and close the arms, but once in position this instrument can be locked with a front horizontal ferruled round nut to make sure the position of the arms is maintained.

This instrument also has a threaded pin, screw, so that it may be used to locate the first point of contact in a natural dentition. As this point is removed or accepted the threaded bolt can be turned down to allow more points of teeth to contact and be corrected and so on until all teeth come into uniform and simultaneous contact.

Further objects and advantages will become apparent from the following description, taken in conjunction with the drawings in which:

FIGURE 1 is a perspective view of an embodiment of our invention and illustrating diagrammatically its relative position to a head of a patient when it is used to locate the patient's hinge axis;

FIGURE 2 is a side view of an embodiment of our invention illustrating its relative position to the teeth and bones when in use in making a Gothic arch tracing of a dentulous or edentulous mouth;

FIGURE 3 is a plan view;

FIGURE 4 is a view corresponding to a portion of FIGURE 3 with the clamping nut removed; and

FIGURE 5 is a partial section as viewed along line 5-5 of FIGURE 2.

The apparatus of our invention comprises a mandibular holder member generally 10, a maxillary holder member generally 11 and a number of attachments therefor. For all practical purposes the holder members 10 and 11 are mirror images of each other. The maxillary holder member 11 will be described in detail. From that description and from the illustrations, particularly in FIGURES 1 and 2, it will be apparent that the structure of the mandibular holder member 10 is identical except for a reversal of parts.

The maxillary holder member 11 includes a left-hand quadrant 12 and a right-hand quadrant 13, as viewed in FIGURE 3. If considered with respect to the patient, the left and right hand designations would be reversed. The two quadrants are positioned side by side in a plane and the two are shaped to generally conform to the shape of the dental arch. Quadrant 12 has an arm 14 projecting therefrom and quadrant 13 has a corresponding arm 15. The two arms are respectively positioned on opposite sides of the midline of the dental arch and extend outwardly away from the quadrants and arch. A flange 16 extends along a portion of quadrant 13 and its arm 14. A corresponding flange 17 extends along the portion of quadrant 12 and its arm 15.

A pair of guides 19 and 20 are secured in bosses 21 and 22 of flange 16. The two guides are slidably received in bosses 23 and 24 of flange 17. It will be apparent that the structure of the two guides is such that the quadrants 12 and 13 and their respective arms may move toward and away from each other as indicated by the arrow 25 in FIGURE 3. The guides hold the two quadrants in the predetermined position with respect to each other and since the two guides are parallel they re-

strict the path of movement of the quadrants with respect to each other to straight lines (parallel to the guides).

Intermediate the two guides 19 and 20 is a threaded adjusting screw 27 having a peripherally knurled knob 28 and a cylindrical shank 29. Shank 29 has a portion of reduced diameter which is journaled in flange 16 with the larger portion of the shank abutting the outside of the flange. A C washer 30 is engaged in a slot on shank 29 and abuts the inside of flange 16. Thus the adjusting screw is free to rotate in flange 16 but is prevented from longitudinal movement with respect to the flange. The adjusting screw 27 is threaded into flange 17. Thus as the adjusting screw is rotated, the two quadrants 12 and 13 are moved toward or away from each other in a parallel fashion as indicated at 25, depending upon the direction of rotation of the screw.

Referring particularly to FIGURES 4 and 5, it will be seen that arm 15 has a generally cylindrical end 32. Extending upwardly from end 32, generally normal to the plane of quadrants 12 and 13, is a post 33. Post 33 is threaded on the outside to receive a threaded clamping nut 34. The post has an internally threaded opening 35 extending axially therethrough.

A pair of fingers 36 and 37 extend out at right angles to arm 14 and about opposite sides of post 33. Fingers 36 and 37 are positioned between the cylindrical end 32 of arm 15 and the clamping nut 34. When the clamping nut 34 is released, the two quadrants 12 and 13 may be moved toward or away from each other by rotating adjusting screw 27. When the desired position has been obtained, clamping nut 34 is tightened down against the top faces of fingers 36 and 37 to lock those fingers between the clamping nut and the cylindrical end 32 of arm 15. This structure permits the two quadrants 12 and 13 to be releasably locked with respect to each other. In some embodiments, the clamping nut and fingers may be dispensed with since the screw 27 will lock the position of the two quadrants 12 and 13 with respect to each other, so long as it is not rotated. Because of the possibility of accidentally rotating adjusting screw 27, it is more satisfactory to utilize the clamping means provided by nut 34 and fingers 36 and 37, in addition to the locking means provided by adjusting screw 27.

Referring briefly to the mandibular holder member 10, it includes a pair of quadrants 40 and 41, arms 42 and 43, flanges 44 and 45, a pair of parallel guides (one of which is seen at 46) and an adjusting screw between the guides having a knob 47. On the end of arm 43 is a general cylindrical end 49 (corresponding to end 32) having a post 50 projecting downwardly therefrom (FIGURE 5). Arm 42 has a pair of fingers (one of which is seen at 51) projecting at opposite sides of post 50. A clamping nut 52 is threaded onto post 50. Post 50 has an internally threaded opening (corresponding to opening 35) to receive various attachments, hereinafter described.

FIGURE 1 illustrates the hinge axis locator clamp which includes a generally cylindrical support 55 having a V notch 56 extending across the upper face thereof. A threaded screw 57 extends downwardly from support 55 and is engaged in the threaded internal opening in post 50 of the mandibular holder member. A clamping plate 58 has an opening through which the clamping screw 59 projects. Clamping screw 59 is threaded into a tapped opening in support 55.

The cylindrical crossbar 61 of a hinge axis locator generally 62 is received in the notch 56 and frictionally held in place by the pressure of clamping plate 58. Hinge axis locator 62 has side bars 63 which extend through openings in opposite ends of crossbar 61. Sidebars 63 may be fixed in place by set screws 64. On the ends of sidebars 63 are openings through which project locating pins 65, again held in place by set screws 66.

To use the hinge axis locator, the quadrants 40 and

41 of the mandibular holder 10 are covered with a soft plastic 60. The various plastic materials known to the art may be employed. We prefer a thermoplastic methyl methacrylate. The quadrants with the plastic thereon are then clamped about the buccal sides of the casts of the teeth. When the material becomes hard, the instrument with the plastic attached is transferred to the mouth and clamped about the buccal sides of the teeth as illustrated in FIGURE 1. Knob 47 of the thumb screw is tightened sufficiently to securely hold the mandibular member 10 in place about the mandibular teeth 67. Thereafter the clamping nut 52 is tightened to lock the quadrants of member 10 in place.

With the hinge axis locator in position, the patient's jaw is guided back into correct position. The patient then slowly opens and closes his jaw. At this time, of course, the condyle 68 rotates in the fossa 69 of the skull. If the ends of pins 65 describe an arc on the cheeks of the patient, they are not centered about the axis of rotation of the condyle in the fossa. By moving the various elements of the hinge axis locator 62, the position of pins 65 is varied until during the jaw movements of the patient the ends of pins 65 remain in a single position with respect to the cheeks of the patient rather than describing an arc. The ends of pins 65 are now aligned with the hinge axis of the condyle in the fossa. As is the usual practice, the patient's cheeks may be marked at the points of pins 65 so as to retain the location of the hinge axis. The clamping screw 59 is loosened and the crossbar 61 is removed from the mounting. After the removal of crossbar 61, support 55 may be rotated to disengage screw 57 from post 50.

FIGURES 2 and 5 illustrate the attachments used in making Gothic arch tracings. The tracing plate 71 has a threaded screw 72 secured to the bottom thereof. Screw 72 is threaded into the internal opening in post 50 of the mandibular holder member 10. Plate 71 is formed of magnetic material such as the alloy sold under the trademark Alnico and is suitably magnetized. Pin 74 may be made of a similar alloy and magnetized so that point 75 will be attracted to table 71. In some embodiments only table 71 or pin 74 need be magnetized with the other being formed of an unmagnetized magnetic material, e.g. soft iron. The upper face 73 is provided with a colored coating in which the Gothic arch is traced by scratching the coating. The blue or purple dye commonly used in machine shops is suitable for forming the coating.

A tracing pin 74 has a pointed end 75 to scratch the coating on face 73. Pin 74 is made of a magnetic material so that it will be attracted to magnetized plate 71. Pin 74 is slidably received in an internal opening in a tracing pin holder 76. Holder 76 is threaded into opening 35 in the maxillary holder member 11.

Assuming that the patient has sufficient teeth, both in the upper and lower jaws, to form a mounting for the two holder members 10 and 11, these members are both fixed in place in the same manner previously described for the mounting of the mandibular holder member 10. With the tracing pin and table in place as illustrated in FIGURE 2, the patient's jaw is moved through the lateral protrusive and retrusive movements that would occur during mastication. These movements are carried out without the jaw moving up and down and with the teeth not in occlusion. As the jaw moves, the point 75 of pin 74 cuts a path in the coating on face 73 of plate 71, thus tracing the Gothic arch onto plate 71.

In actual practice, the exact steps that will be performed in using our invention will depend upon the specific circumstances, more particularly the extent and location of the dentures to be made. These various factors will be known and taken into consideration by those skilled in the art. In general, the steps for a full or partial denture are as follows. Accurate impressions are taken, master models of the future denture bearing

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areas are made and roughly approximated in centric relationship on the articulator. The mandibular holder 10 and the maxillary holder 11 are aligned on a plastic covering (tray) which has been formed over the master models (casts). The mandibular member and tray are placed in the patient's mouth. The hinge axis locator 62 is used to locate the hinge axis as previously described and marked. The manibular tray and mandibular holder 10 are removed from the mouth. Holder 10 is removed from the tray, the hinge axis locator attachment 10 is removed from the holder. A flat tracing table is placed in its place on the holder and it is all set aside for future use.

Next the upper tray alone is placed in the mouth and a bite fork (a flat piece of semi-circular metal and having a front stud) is covered with soft wax. This is placed over the lower tray and placed in the mouth. The patient is asked to close against soft wax to hold bite fork in place. A rigid face bow is attached to the front stud of the bite fork while the patient maintains his occlusion against the wax of the bite fork (the wax has now cooled off and hardened). The ends of the face bow are adjustable and lined up over the hinge axis marks on the face. They are then locked in position.

The upper tray and lower tray are now removed from the mouth, the upper cast is placed into the upper tray and with the face bow the upper cast is plastered to upper member of the articulator. The face bow and bite fork and tray are then removed. The upper cast now is affixed to the articular in a manner as the upper jaw is related to the head. Next the maxillary and mandibular holders 10 and 11 are placed into pre-set grooves on the trays. The upper tray has a threaded central bearing pin 80 and the lower tray has a flat table 79 attached to it. With the elements in place, the trays are replaced in the mouth and the correct vertical height is established by screwing central bearing pin up or down. A free floating pin 74 is placed in maxillary holder 11 and a Gothic arch tracing is made on table 71.

Soft plaster now is placed between the trays in the mouth and allowed to set while the point of the free floating pin is at the apex of the Gothic arch. After the plaster has set, the upper and lower trays which are locked together with the plaster are removed from the mouth. The upper tray is placed back on the upper model which has been fixed to the upper arm of the articulator. The lower cast is placed into its lower tray and the lower model in this position is plastered to the lower arm of the articulator. The plaster connection between the two trays (the one that was done in mouth) is removed from between members while trays and members are in place in the articulator. By following Gothic arch tracing the adjustable parts of the articulator are set to follow the tracing. Now upper and lower casts are mounted in the articulator as they would be in the head of patient. The lower cast will move in the articulator with respect to the upper cast in the same manner as it would if it were in the jaw of the patient.

The foregoing description of a specific embodiment is for the purpose of complying with 35 U.S.C. 112 and should not be construed as imposing unnecessary limitations upon the appended claims inasmuch as modifications and variations thereof will be apparent to those skilled in the art. For example, instead of the tracing pin 74 being urged toward table 71 by magnetic force, weights or springs could be applied to urge the pin 74 into the desired position.

We claim:

1. A dental apparatus comprising in combination: a right hand quadrant and a left hand quadrant, said quadrants being shaped and positioned to generally conform to the dental arch, said quadrants comprising coplanar plates and flanges substantially normal to said plates and about at least a portion of the exterior sides of the plates commencing at the portion thereof adjacent the midline of

said arch; and means interconnecting said quadrants to permit said quadrants to be moved toward and away from each other only along straight lines.

2. A dental apparatus comprising in combination: a right hand quadrant and a left hand quadrant, said quadrants being shaped and positioned to generally conform to the dental arch, each of said quadrants respectively having an integral arm affixed thereto and projecting away from said quadrants, said arms being positioned on opposite sides of the midline of said arch, said quadrants comprising coplanar plates and flanges substantially normal to said plates and about at least a portion of the exterior sides of the plates commencing at the portion thereof adjacent said arms; means interconnecting said arms to permit said quadrants to be moved toward and away from each other only along straight lines; and means interconnecting said arms to releasably lock said arms and quadrants in a desired position with respect to each other.

3. A dental apparatus comprising in combination: a right hand quadrant and a left hand quadrant, said quadrants being shaped and positioned to generally conform to the dental arch, each of said quadrants respectively having an arm affixed thereto and projecting away from said quadrants, said arms being positioned on opposite sides of the midline of said arch; a plurality of spaced, parallel, guides interconnecting said arms, each guide being movable only longitudinally thereof in an arm whereby said arms are movable toward and away from each other while being maintained in a fixed alignment by said guides; an adjusting screw rotatably received in one arm and restricted against longitudinal movement with respect to said one arm, said screw being threaded into the other arm, said screw being positioned between a pair of said guides and parallel thereto; a threaded post projecting from a first arm in a direction generally normal to the longitudinal alignment of said guides; a pair of fingers extending from the second arm and on opposite sides of said post; and a clamping nut threaded on said post with said fingers being between said nut and said first arm to releasably affix the position of the second arm with respect to the first arm.

4. A dental apparatus for use with a hinge axis locator, said apparatus comprising in combination: a right hand quadrant and a left hand quadrant, said quadrants being shaped and positioned to generally conform to the dental arch, said quadrants being positioned generally in a plane, each of said quadrants respectively having an arm affixed thereto and projecting away from said quadrants, said arms being positioned on opposite sides of the midline of said arch; means interconnecting said arms to permit said quadrants to be moved toward and away from each other only along straight lines; means interconnecting said arms to releasably lock said arms and quadrants in a desired position with respect to each other; a threaded support on said arms and positioned generally normal to said plane; and mounting means for a hinge axis locator threaded onto said support.

5. A dental apparatus comprising in combination: a mandibular holder member and a maxillary holder member, each of said members including a right hand quadrant and a left hand quadrant forming a pair, each pair of quadrants being shaped and positioned to generally conform to the dental arch, each pair of quadrants being positioned generally in a plane respectively, each of said quadrants respectively having an arm affixed thereto and projecting away from said quadrants, said arms being positioned on opposite sides of the midline of said arch; means interconnecting the arms of each member to permit said quadrants of the member to be moved toward and away from each other only along straight lines; means interconnecting the arms of each member to releasably lock said arms and quadrants of the member in a desired position with respect to each other; a threaded support on each member respectively and positioned generally normal to the plane of the quadrants of the member; a trac-

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ing table threadably received on one of said supports; a tracing pin holder threadably received on the other of said supports; a tracing pin in said holder; and means to urge said pin against said table.

6. A dental apparatus comprising in combination; a mandibular holder member and a maxillary holder member, each of said members including a pair of quadrants consisting of a right hand quadrant and a left hand quadrant, said pairs of quadrants being shaped and positioned to generally conform to the dental arch, each of said quadrants respectively having an arm affixed thereto and projecting away from said quadrants, said arms of each pair being positioned on opposite sides of the midline of said arch; a plurality of spaced, parallel, guides interconnecting the two arms of each member, each guide being moveable only longitudinally thereof in an arm whereby the arms of each member are moveable toward and away from each other while being maintained in a fixed alignment by said guides; each member having an adjusting screw rotatably received in one arm of the two and restricted against longitudinal movement with respect to said one arm, said screw being threaded into the other arm of the two, said screw being positioned between a

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pair of said guides and parallel thereto; a threaded post projecting from a first arm of each member in a direction generally normal to the longitudinal alignment of said guides, said post having an internally threaded opening extending the length thereof; a pair of fingers extending from the second arm of each member and on opposite sides of the post of said member; clamping nuts threaded on each post respectively with said fingers being between the respective nut and first arm to releasably affix the position of the second arm with respect to the first arm; a tracing table threadably received in the internal opening of the post of the maxillary member; a tracing pin holder threadably received in the internal opening of the post of the mandibular holder member; a tracing pin in said holder; and means to urge said pin against said table.

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212,241 Great Britain ----- May 21, 1925

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,069,774

December 25, 1962

Le Roy D. Levey et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the grant, lines 1 and 11, and in the heading to the printed specification, line 3, for "Levy", each occurrence, read -- Levey --.

Signed and sealed this 3rd day of September 1963.

SEAL)

Attest:

ARNOLD W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents