April 26, 1938. H. F. McGRANE 2,115,116

ARTIFICIAL TOOTH

Filed May 4, 1935

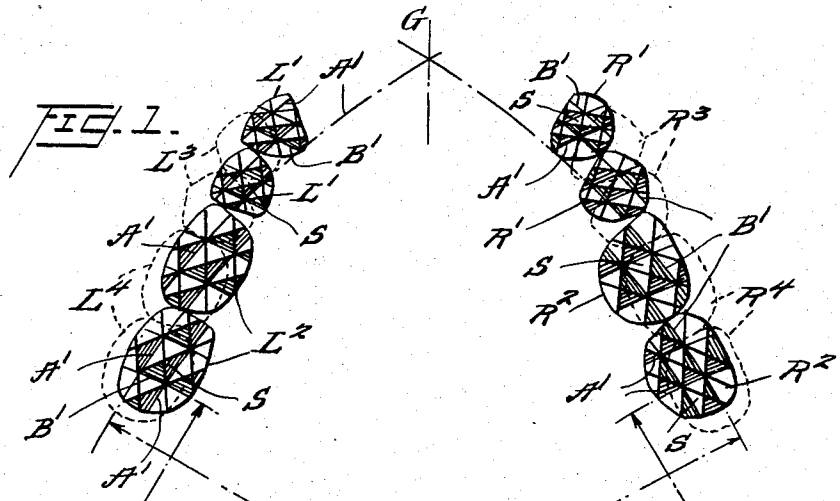



FIG. 1.

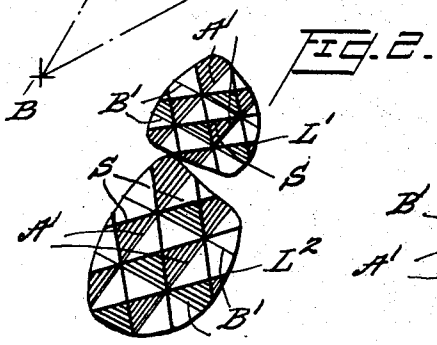



FIG. 2.

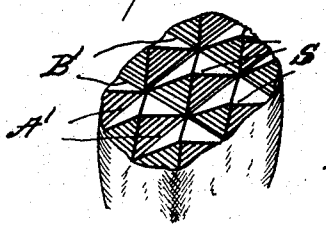



FIG. 5.

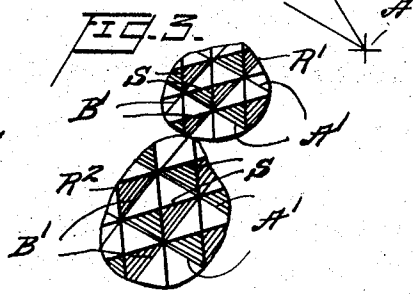



FIG. 3.

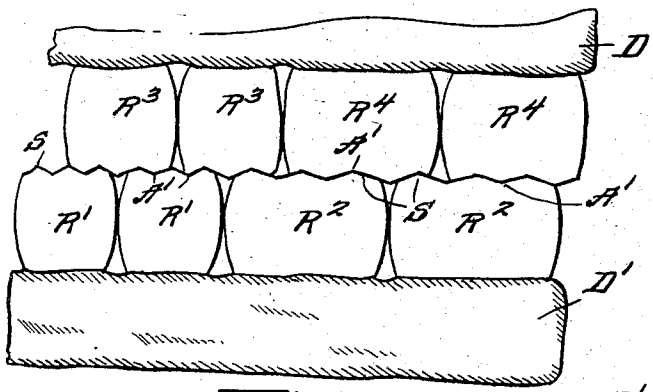



FIG. 4.

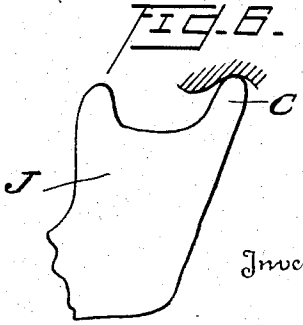



FIG. 6.

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# UNITED STATES PATENT OFFICE

2,115,116

## ARTIFICIAL TOOTH

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Application May 4, 1935, Serial No. 19,889

8 Claims. (Cl. 32—8)

This invention relates to artificial teeth and particularly to certain improvements in the formation of the occlusal surfaces of the posterior teeth (bicuspids and molars) whereby numerous objections and defects usually found in artificial dentures are largely eliminated. This invention is applicable in cases requiring full upper and full lower artificial dentures or in cases requiring full upper and partial lower, full lower and partial upper, or partial upper and partial lower dentures. The term "denture" as employed in the following specification and claims is intended to cover both removable dentures and stationary bridgework having artificial teeth thereon.

The invention is illustrated in the accompanying drawing forming a part hereof and in which

Figure 1 is a diagrammatic view illustrating the principle upon which the invention is based;

Figure 2 is a plan view of the occlusal surfaces of two adjacent teeth embodying the features of the invention, this view illustrating one molar and one bicuspid on the left side of a lower denture;

Figure 3 is a similar plan view looking toward the occlusal surfaces of two adjacent teeth on the right side of an upper denture;

Figure 4 is a side view of upper and lower dentures including molars and bicuspids formed according to the present invention and illustrating the relation of the same, this view being taken from the cheek or buccal side thereof;

Figure 5 is a perspective view of a tooth involving the invention and showing on an enlarged scale the arrangement of the grooves and cusps on the occlusal surfaces; and

Figure 6 is a detail view illustrating the relation between the condyle heads of the lower jaw or mandible and the cavities or sockets in which such heads are arranged.

The drawing illustrates the invention applied to the case where all the posterior teeth in both the upper and lower jaw are replaced by artificial teeth. In such cases it is the practice to provide two bicuspids and two molars on each side of the lower denture and the same on each side of the upper denture. The upper denture is, of course, relatively fixed in position on the upper jaw while the lower denture is mounted on and moves with the lower jaw or mandible. The mandible is articulated with the skull through the medium of the condyle heads which engage in the glenoid cavities or fossae formed in the skull. The mandible is so articulated that it can move anteriorly and retrude posteriorly to the starting point or it can move from this central starting point in a lateral direction toward the right and return to the starting point or it can move laterally to the left and return to the central starting point. This central point is generally referred to as the centric position and when the lower jaw is in that position, the jaws are said to be in centric relation.

When the mandible is in centric position the condyle heads thereof rest centrally in the glenoid fossae. When the mandible moves to the right from this centric position it rotates about a point displaced somewhat to the rear of the right condyle head and the left condyle head travels forwardly in its socket or cavity. Likewise when the mandible moves to the left from its centric position it rotates about a point displaced somewhat to the rear of the left condyle head and the right condyle head moves forwardly in its cavity. In other words, when the mandible moves to the right from its centric position every point thereon describes an arc about one center and similarly when the mandible moves to the left from its centric position, every point thereon describes an arc about another center. The lateral movements of the mandible to the right or left from its centric position are on the average about 5 millimeters.

The present invention aims to provide artificial teeth having their occlusal surfaces so formed as to permit the lateral movements of the mandible to take place, particularly during mastication, without objectionable cusp interference, the occlusal surfaces also being so formed as to produce efficient masticating surfaces. According to this invention the occlusal surfaces of the lower artificial teeth and occlusal surfaces of the upper artificial teeth for full or partial dentures are provided with complementary grooves and ridges or rows of cusps, which grooves and rows of cusps have a curved formation corresponding with the arcs of movement of the mandible as it moves laterally from the centric position toward the right and toward the left as above described. This arrangement will be clear from the accompanying drawing. The points A and B of Figure 1 represent respectively the right and left centers of rotation about which the mandible moves. A portion of the mandible J is illustrated in Figure 6 and the relation of one of the condyle heads with the cavity in which it engages. The upper right hand portion of Figure 1 represents in solid lines the occlusal surfaces of two lower bicuspids R′ and two lower molars $R^2$, and their relative positions on the right hand side of a lower denture. The upper left hand portion of Figure 1

represents in solid lines the occlusal surfaces of two bicuspids L' and two molars $L^2$ and their relative positions on the left hand side of a lower denture. The upper right hand portion of Figure 1 also represents in dotted lines two upper bicuspids $R^3$ and two upper molars $R^4$ and their relative positions on an upper denture, the bicuspids $R^3$ and molars $R^4$ being formed complementary to and arranged to cooperate with the lower bicuspids and molars R' and $R^2$. The upper left hand portion of Figure 1 further represents in dotted lines two upper bicuspids $L^3$ and two upper molars $L^4$, the occlusal surfaces of which cooperate with and are complementary to the occlusal surfaces of the bicuspids L' and molars $L^2$.

As before noted, the occlusal surfaces of the teeth are provided with grooves and rows of cusps. As shown, two series of spaced grooves are formed on the occlusal surface of each tooth. In the drawing the characters A' designate one series of such grooves and the characters B' designate the other series. In the case of most of said grooves both inclined side walls thereof are formed on one tooth, but where a groove passes across the denture at the margin of two adjacent teeth, the sides of the groove are formed partly on one tooth and partly on the adjacent tooth. As shown in Figure 1, the grooves A' are formed on arcs struck from the point A and the grooves B' are formed on arcs struck from the point B. These points A and B, as previously noted, correspond to the right and left centers of rotation of the mandible and the arcs struck from the same and intersecting at the median line G form what is generally known as the Gothic arch.

It will be seen that one set of the curved grooves above mentioned extends entirely across the occlusal surface of each tooth in a buccal-lingual direction and that the other set extends entirely across said surface in an anterior-posterior direction. The two sets of grooves intersect each other. The portions of the occlusal surface of each tooth bounded by these grooves are so shaped as to form a plurality of cusps S on each tooth. These cusps are preferably made pyramidal in form and the sides of the grooves form the faces of the pyramids. The tops of the cusps are positioned in curved lines corresponding to the curvature of the grooves so that when an upper and a lower denture are brought into engagement and moved laterally, the rows of cusps formed on the teeth of one denture will occlude in the grooves of the teeth on the opposing denture. In other words, the cooperating "teeth" on the upper and lower dentures are formed complementary to each other.

Some of the cusps S, at least one on each tooth, form complete or substantially complete pyramids and others form portions of pyramids. The side faces of the pyramidal cusps, as before stated, form the sides of the grooves A', B', and said faces are preferably arranged at an angle of about 25° to the horizontal. This inclination of the faces of the cusps is clearly illustrated in Figures 2 and 5 and also in the side view shown in Figure 4. This latter view also illustrates the occlusal relation between the bicuspids and molars $R^3$, $R^4$ of an upper denture D and the corresponding bicuspids and molars R', $R^2$ of a lower denture D'.

The number of grooves A' or B' on the surface of each tooth will depend, of course, on the spacing of the grooves. This spacing should be such that the cusps will be of substantial size. In some cases it may be desirable to provide a tooth with a single groove extending one way across the same and several grooves extending the other way.

From the foregoing it will be apparent that when the mandible is moved laterally to the right or left from its centric relation, the rows of cusps on the teeth of the upper and lower dentures will fit into the grooves of the teeth of the lower and upper dentures respectively. In other words, when the lower jaw is moved laterally toward the right or the left, the rows of cusps on each upper tooth and those on each lower tooth will move freely through the grooves in the opposing teeth. By this arrangement, cusp interference between the teeth is obviated. As is well known, cusp interference, technically termed cusp trauma, presents one of the chief difficulties of artificial dentures. This difficulty is overcome by the present arrangement since the mandible can move laterally in either direction from its centric position with the occlusal surfaces of the teeth in contact throughout the entire movement and no substantial interference between the cusps will occur and tipping of the plates or sliding of the same on the jaws during mastication is practically obviated.

Furthermore, the type of tooth as above described presents an occlusal surface that has the greatest amount of cutting and grinding efficiency in the mastication of food. As will be seen, each tooth of this type has approximately nine small cusps which cooperate with the grooves on the opposing tooth. This produces a very effective masticating arrangement. Also, the grooves on each tooth, all of which extend to the edges thereof, afford a sufficient number of escape gates or passages by which the food can escape from the occlusal surfaces during mastication, which effectively prevents jamming of the food on or between the teeth.

It will be understood that artificial teeth made in accordance with my invention may be used in stationary bridgework as well as in removable dentures.

Another advantage of the invention is found in the ease by which the practitioner can place the teeth of this invention on his articulator in forming the "set-up" for an artificial denture. The anterior-posterior grooves afford guides for making such set-up. Thus the first molar can readily be placed in position so that the groove on the occlusal surface (lingual third) thereof is in alignment with the occlusal groove (buccal third) on the second molar. Similarly the second bicuspid can be lined up with the first molar and the first bicuspid with the second bicuspid. By this means the operation of making the "set-up" is greatly facilitated.

It is well known, of course, that the surfaces of the glenoid cavities are so inclined that during the protrusive movement of the mandible the rear condyle heads thereof move downwardly to a slight extent. This inclination is on the average about 33°. Also, due to this inclination of the glenoid cavities, it follows that when the mandible is moved laterally toward the left from its centric position and the right condyle head moves forwardly, as heretofore described, the right side of the mandible moves downwardly to a slight extent due to the inclination of the glenoid cavity. Similarly the left side of the mandible moves downwardly to a slight extent when the mandible is moved toward the right from its centric posi-

tion. However, these slight downward movements of the mandible due to the shape of the glenoid cavities do not materially affect the principle of the present invention and do not prevent effective occlusion of the upper and lower dentures or materially interfere with the free lateral movements of the same.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. An artificial denture for an upper or lower jaw including a tooth having its occlusal surface provided with one series of curved grooves extending entirely across the same in a lingual-buccal direction, and also with a second series of curved spaced grooves extending entirely across the same from the front or anterior to the rear or posterior side thereof, said first named grooves being formed on an arc struck from the center of rotation of the lower jaw as it moves laterally from centric position in one direction, and said second series of grooves being formed on arcs struck from the center of rotation of the lower jaw as it moves laterally from said centric position in the other direction, said occlusal surface being bounded by said grooves and being shaped to form a plurality of cusps, the side walls of the grooves forming sides of said cusps.

2. In combination, cooperating dentures for an upper and a lower jaw, each denture including an artificial tooth arranged to cooperate with a tooth in the other denture, the tooth in said lower denture having its occlusal surface provided with a series of curved spaced grooves extending entirely across the same from the lingual to the buccal side thereof, and also with a series of curved spaced grooves extending entirely across the same from the anterior to the posterior side thereof, said grooves in one series being formed on arcs struck from the center of rotation of the lower jaw as it moves laterally from centric position toward the right and the other series of grooves being formed on arcs struck from the center of rotation of the lower jaw as it moves toward the left from said centric position, the portions of said occlusal surface bounded by said grooves being shaped to form curved rows of cusps extending in a lingual-buccal direction across said tooth, the side walls of said grooves forming sides of the cusps, the tooth in said upper denture having its occlusal surface provided with curved spaced grooves and rows of cusps complementary to and arranged to occlude respectively with the rows of cusps and grooves on said first named tooth, whereby lateral movement of the lower jaw toward the right or left from its centric relation is permitted without cusp interference between the teeth of said dentures.

3. An artificial tooth for a lower jaw having its occlusal surface provided with a series of curved spaced grooves extending entirely from the lingual to the buccal side thereof, said grooves being formed on arcs struck from the center of rotation of the jaw as it moves from its centric position toward the right, said tooth also having its occlusal surface provided with curved spaced grooves extending entirely from the front to the rear thereof, said last named grooves being formed on arcs struck from the center of rotation of the jaw as it moves from its centric position toward the left, the portions of said occlusal surface bounded by said grooves being shaped to form cusps thereon, the side walls of said grooves forming sides of the cusps.

4. An artificial denture for an upper or lower jaw, said denture having a plurality of teeth mounted therein in anterior-posterior relation, each of said teeth having its occlusal surface provided with a series of curved spaced grooves extending entirely across the same in a lingual-buccal direction, said grooves being formed on arcs struck from one center of rotation of the lower jaw, each of said teeth also having its occlusal surface provided with a series of curved spaced grooves extending entirely across the same in a posterior-anterior direction, said last named grooves being formed on arcs struck from the other center of rotation of the lower jaw, the portions of the occlusal surfaces bounded by said grooves in each of said teeth being shaped to form cusps, the side walls of said grooves forming sides of the cusps, said cusps on each tooth being arranged in rows extending in a lingual-buccal direction across the tooth and also in rows extending in an anterior-posterior direction across the tooth.

5. A construction as defined in claim 4 in which one of the posterior-anterior grooves in one tooth is arranged in alignment with a posterior-anterior groove in an adjacent tooth.

6. In combination, cooperating artificial dentures for an upper and a lower jaw, each denture having a plurality of teeth thereon arranged to cooperate with the teeth of the other denture, each tooth on said lower denture having its occlusal surface provided with a series of curved spaced grooves extending in a lingual-buccal direction entirely across the same, said grooves being formed on arcs struck from one center of rotation of the lower jaw, and also having on its occlusal surface a series of curved spaced grooves extending in an anterior-posterior direction entirely across the same, said last named grooves being formed on arcs struck from the other center of rotation of the lower jaw, the portions of the occlusal surface of each of said teeth bounded by said grooves being shaped to form cusps, the side walls of said grooves forming sides of the cusps, said cusps being arranged in rows extending in a lingual-buccal direction and also in rows extending in an anterior-posterior direction, the teeth on said upper denture also having their occlusal surfaces provided with two series of curved spaced grooves extending entirely across the same and corresponding to the curved grooves on said lower teeth, and also provided with rows of cusps corresponding to the rows of cusps on said lower teeth, the cusps on said lower teeth and said upper teeth respectively being arranged to occlude with and move in the lingual-buccal grooves of the opposing teeth when the lower jaw is moved laterally in one direction from its centric position, and the cusps on said lower teeth and upper teeth respectively being arranged to occlude with and move in the anterior-posterior grooves of the opposing teeth when the lower jaw is moved laterally in the other direction from its centric position.

7. An artificial denture for a posterior tooth in an upper or lower jaw, said denture having two series of parallel curved grooves extending entirely across the occlusal surface thereof, one series of said grooves being formed on arcs struck from the center of rotation of the lower jaw as it moves laterally in one direction from the centric position, the other series of said grooves being formed on arcs struck from the center of rotation of the lower jaw as it moves laterally from centric position in a direction opposite to said one direction, the occlusal surface of said denture

between said grooves being shaped to form cusps, the side walls of said grooves forming sides of the cusps.

8. An artificial denture for a posterior tooth on one side of the upper or lower jaw, said denture having two series of parallel spaced curved grooves extending entirely across the occlusal surface thereof, one series of grooves extending in the anterior-posterior direction and the other series in the lingual-buccal direction, the grooves in one series being formed on arcs struck from the center of rotation about which the lower jaw rotates in moving from its centric position in one direction and the other series of said grooves being formed on arcs struck from the center of rotation of the lower jaw as it moves laterally from centric position in a direction opposite from said first named direction, said two series of grooves intersecting and forming intersecting side enclosing portions of said occusal surface, thereby forming rows of cusps.

HENRY F. McGRANE.