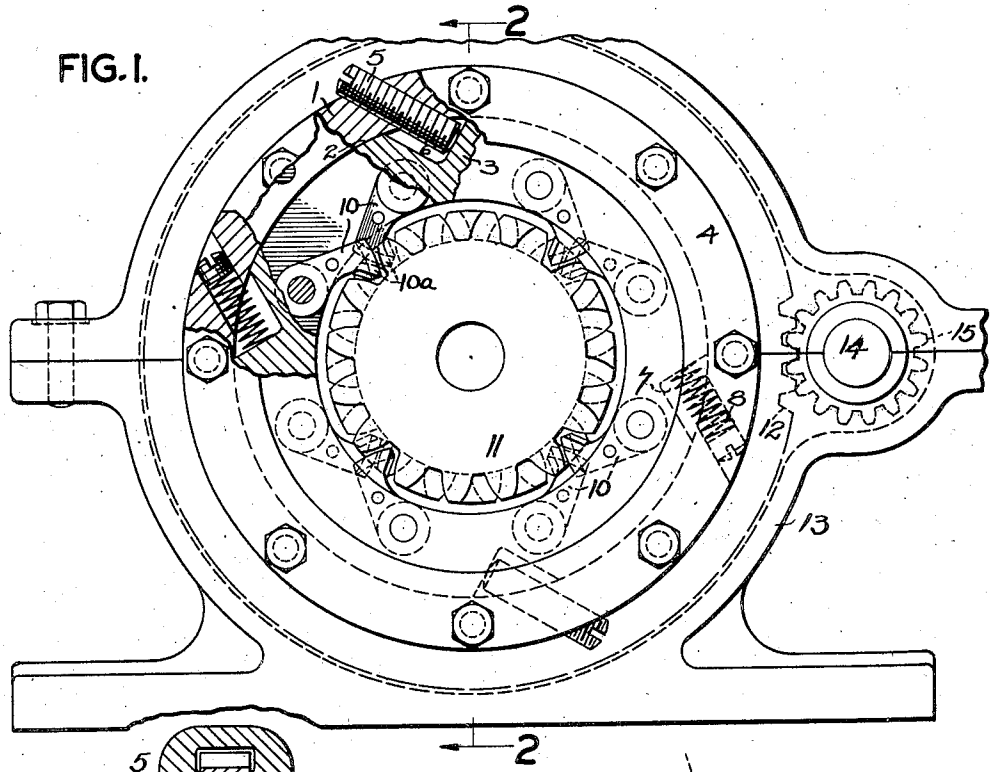
June 23, 1936. M. M. MATCHETT 2,045,156

FIXTURE FOR GEARS

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FIG. 1.



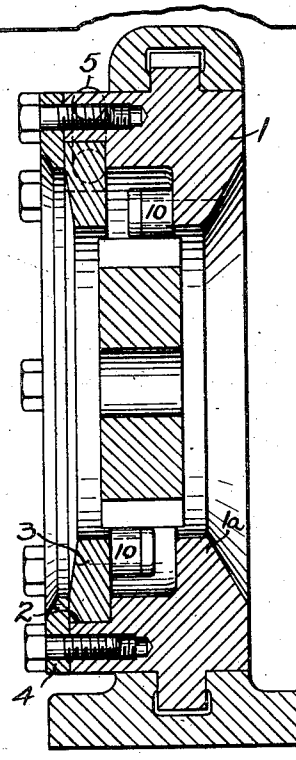


FIG. 2.

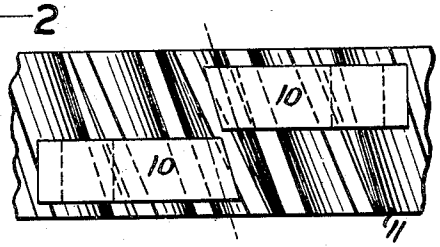


FIG. 3.

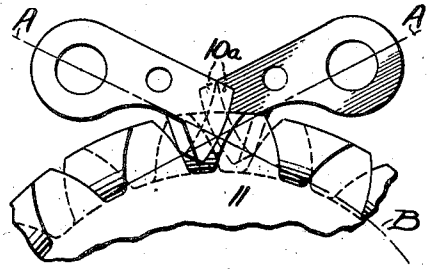


FIG. 4.

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FIXTURE FOR GEARS

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FIG. 6.

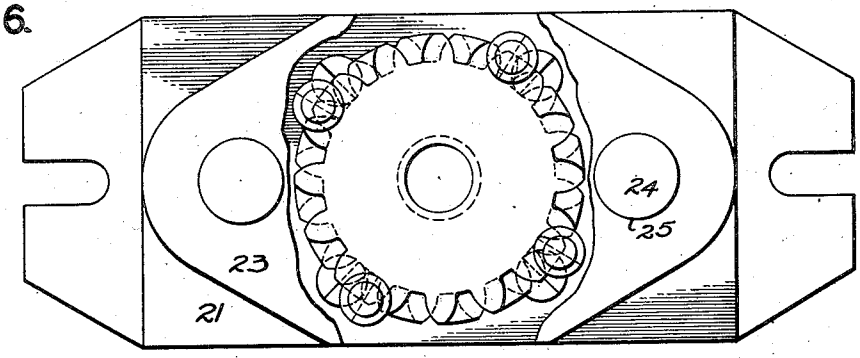


FIG. 5.

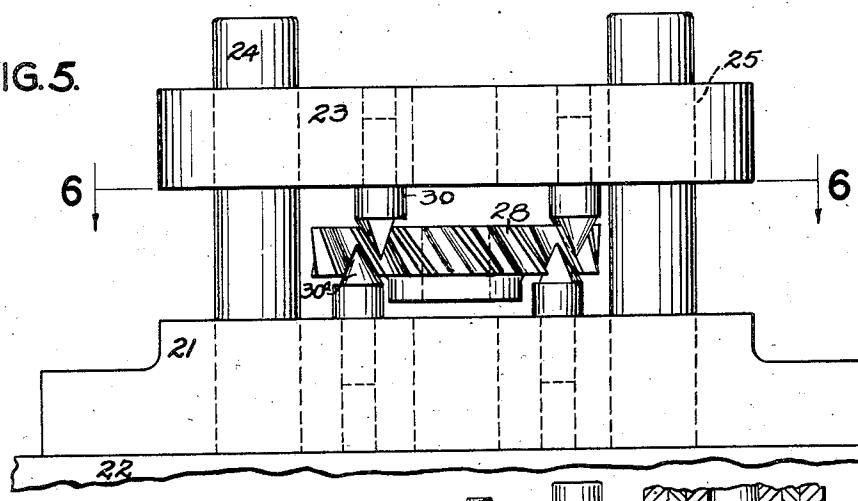
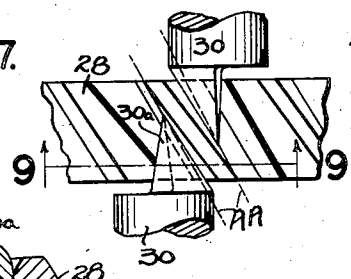


FIG. 7.



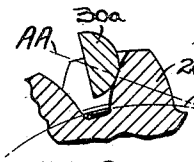


FIG. 9.

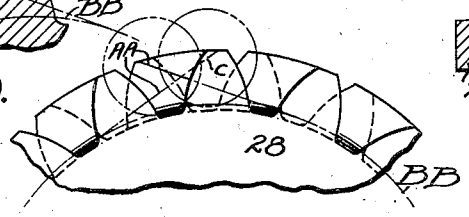


FIG. 8.

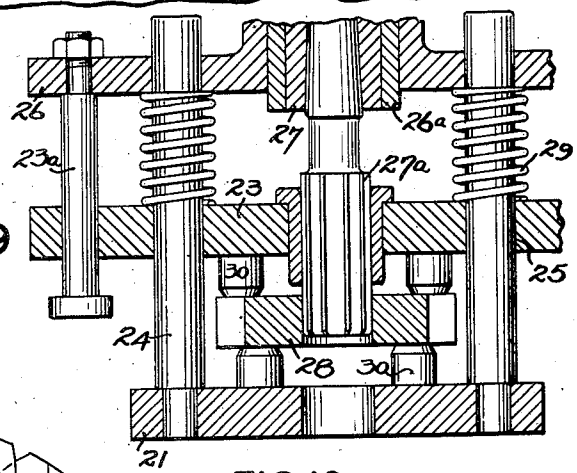


FIG. 10.

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FIG. 12.

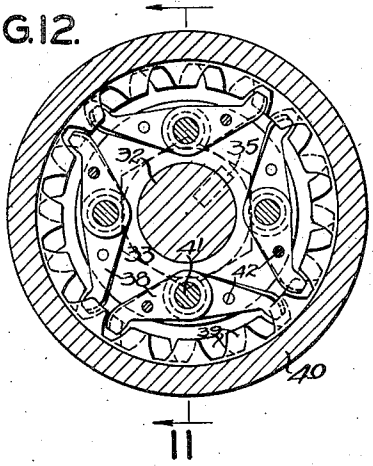


FIG. 11.

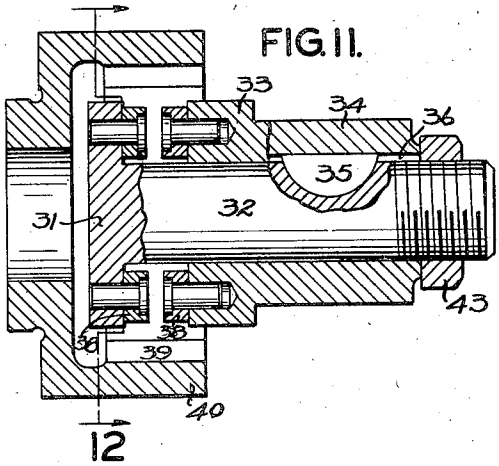


FIG. 16.

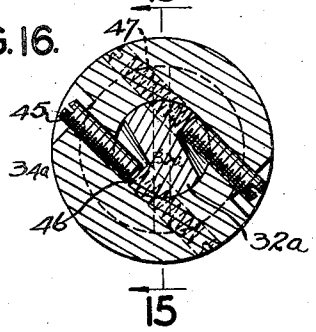


FIG. 15.

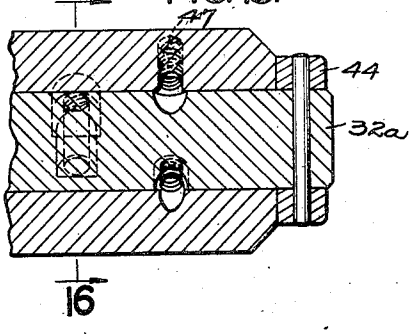
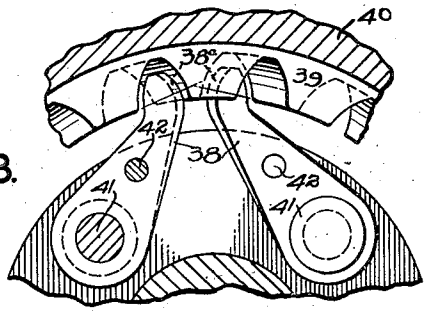


FIG. 13.



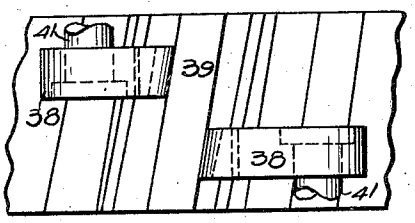


FIG. 14.

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Patented June 23, 1936

2,045,156

UNITED STATES PATENT OFFICE

2,045,156

FIXTURE FOR GEARS

Mahlon M. Matchett, Highland Park, Mich.

Application March 11, 1935, Serial No. 10,488

9 Claims. (Cl. 279—1)

This invention relates to improvements in fixtures for gears, and refers primarily to fixtures for helical gears though it may also be used for holding spur gears. I am aware that heretofore fixtures have been made for gripping the teeth of helical gears, but, owing to the inclination to the teeth to the gear axis together with the involute form of the teeth, it has been a common practice merely to provide the gripping members with localized, or point contacts, to engage the teeth, with the result that there is a tendency for the gear to rock or swing about these contacts; again, owing to the concentration of the gripping effort upon these localized contacts rapid wear of the latter results, so that frequent repairs and/or renewals are rendered necessary.

A flat bearing surface across any and all teeth of a helical gear may be located by drawing a straight line tangent to the base circle of the gear and projecting it transversely across one face of the involute portion of a tooth. It is an object of this invention to utilize the flat bearing surface thus located, and to provide gripping members to engage these flat bearing surfaces for an appreciable distance up to the full width of the tooth if desired. Thus I aim to provide gripping members having long flat bearing surfaces to engage the gear teeth and so do away with any possibility of the gear rocking when held; again the length of these gripping members insures relatively long life to the said members.

It is a common practice after a helical gear has been heat treated to grind one face, which may have become warped or otherwise distorted during treatment, and then to clamp the ground face upon a fixture for other finishing operations of the gear, though obviously the ground face may not be, and frequently is not, true with the teeth.

This invention then aims to provide a fixture with which, among other things, helical gears may be concentrically and axially held by their teeth, so that all other portions of the gear may be operated upon, and whereby a gear may be held after heat treatment in such a manner that if any distortion has occurred, the error due to this distortion is reduced to a negligible amount so far as the concentricity or axial alignment of the gear is concerned when the latter is mounted in the fixture.

A further object of the invention is to provide a fixture for either external or internal gears which is relatively cheap and simple to manufacture, easy to operate, and which positively holds gears concentrically and in axial alignment.

Having thus enumerated some of the major objects and advantages of the invention, I will now proceed to described preferred embodiments thereof, with the aid of the accompanying drawings, in which:

Figure 1 illustrates a front elevation of one form of my fixture.

Figure 2 is a vertical section on the line 2—2 of Figure 1.

Figure 3 is an enlarged partial plan of a helical gear showing two gripping members engaging opposite sides of a tooth.

Figure 4 is a side view of Figure 3.

Figure 5 is a front elevation of a modified form of my fixture.

Figure 6 is a plan view of Figure 5, with a portion of the top plate broken away, shown largely as a section on the line 6—6.

Figure 7 is an enlarged side view showing the gripping members in engagement with opposite sides of a gear tooth.

Figure 8 is a partial side view of the gear across which the bearing lines of the gripping members are indicated.

Figure 9 is a section on the line 9—9 of Figure 7.

Figure 10 is a reduced size view showing the preferred method of utilizing this embodiment of my fixture.

Figure 11 is a section on the line 11—11 of Figure 12 showing a modification of the invention to be used for holding internal gears.

Figure 12 is a section on the line 12—12 of Figure 11.

Figure 13 is an enlarged detail showing two gripping members in engagement with opposite faces of a tooth of an internal gear.

Figure 14 is a plan view of Figure 13.

Figure 15 is a section on the line 15—15 of Figure 16 and shows another modified arrangement of the shank and sleeve shown in Figures 11 to 14, to permit rotary adjustment of the gripping members, and

Figure 16 is a section on the line 16—16 of Figure 15.

Referring to the fixture shown in Figures 1 to 4 inclusive, 1 denotes a plate having an annular groove 2 formed in one face thereof to receive a second plate 3 and support it concentrically with the first plate 1. These plates 1 and 3 are held against axial movement by a ring 4 suitably secured to the plate 1 and extending over a portion of the outer face of the plate 3. Extending obliquely through the plate 1 at right angles to its axis and in threaded engagement therewith are one or more screws 5 the inner extremities of which bear against the bases of recesses 6 formed

in the periphery of the plate 3 so that by turning these screws inwardly the plate 3 is rotated relative to the plate 1. In order to retain the plates relatively so positioned that the inner extremities of the screws 5 remain in contact with the bases of the recesses 6 other oblique recesses 7, oppositely disposed to the recesses 6, are formed in the periphery of the plate 3. Against the bases of the recesses 7 pressure is exerted by springs 8 the outer extremities of which extend into tubular guides formed in the bore of the plate 1.

In the arrangement shown, the plate 1 is mounted for rotation in the following manner, though obviously other means of doing so may be resorted to if preferred. The plate 1, which is provided with an integral spur gear 12 around its outer periphery, is rotatably mounted in a bearing 13. Supported also in this bearing is a shaft 14 having a pinion 15 thereon in mesh with the gear 12 so that by turning the shaft 14 the fixture is rotated.

Parallel to and spaced from the inner face of the plate 3 is an inwardly projecting annular portion 1*a* of the plate 1. Rigidly secured upon the adjacent, spaced faces of the plates 1*a* and 3 are gripping members 10, which are disposed at right angles to the axes of the plates and extend along lines A tangent to the base circle B of the gear 11 to be supported. The outer faces 10*a* of the members 10 are in the form of partial cones, so that each coacting pair of members bears for an appreciable distance along the flat surfaces defined by the tangents A on opposite faces of one of the teeth of the gear 11.

In this instance engagement of the gear 11 is obtained by introducing the gear spirally between the coacting pairs of members 10, and then by tightening the screws 5 against the tension of the springs 8. The gear may be subsequently speedily released by loosening the screws 5 and permitting the plates 1 and 3 to be turned relatively in opposite directions by the springs 8 and then spiralling the gear out between the gripping members. Thus a grip upon the gear is in this case obtained by rotary movement of the plates as the lead of the teeth of helical gears permit a wedging action to be obtained either in this manner or by axial movement of the two plates towards one another.

It will also be noted that the arrangement of the gripping members 10 at right angles to the common axis of the plates 1 and 3 and of the gear 11 permits the provision of central apertures through the plates larger than the outside diameter of the gear. Consequently not only the bore of the gear but both entire faces thereof may be worked upon at one setting.

Referring now to Figures 5 to 10 inclusive wherein a modification of the fixture is shown, 21 designates a lower plate adapted to be secured upon a drill table 22. An upper plate 23 is held in vertical alignment with the plate 21 by guides 24 which extend upwardly from the latter and project through openings 25 formed in the plate 23. In the present instance the upper plate 23 is carried by bolts 23*a* depending from an element 26 mounted around the vertically movable quill 26*a* of a drill press. This quill travels downward a predetermined distance as the hollow spindle 27 and tool 27*a* move towards the bore of a helical gear 28 placed between the plates 21 and 23 and held between the latter in a manner hereinafter described. The plates 21 and 23 have aligned openings therethrough for the passage of the tool 27*a*. To exert downward pressure upon the plate 23 and force it towards the gear 28 when the quill 26*a* is lowered, springs 29 are provided around the guides 24 between the plate 23 and the element 26. The bolts 23*a* lift the plate 23 with the element 26 after the latter has moved up a predetermined distance to reduce the tension on the springs 29.

The method of holding the gear 28 in the fixture when the plates 21 and 23 are moved into proximity to one another is as follows: Projecting inwardly from both plates and preferably parallel with the axes of the latter are a plurality of gripping members 30 terminating at their outer extremities in cones 30*a* portions of which are cut away to provide clearance as is hereinafter explained. These gripping members 30 are arranged to project in coacting pairs from the plates 21 and 23 so that the conical extremities 30*a* of each pair engage the opposite faces of the same tooth of the gear 28.

As already stated any tangent AA drawn from the base circle BB of any helical gear which projects across the involute portion of one face of a tooth of the gear extends across a flat surface upon that tooth. Moreover two corresponding tangents AA projected across opposite faces of a tooth are parallel in one plane and are inclined in opposite directions to the gear axis in a second plane proportionately to the lead of the tooth. It therefore follows that straight line bearing surfaces may thus be located upon opposite sides of each gear tooth to be engaged, and that varying lengths along these bearing surfaces may be employed for holding purposes so that sufficient grip may be obtained upon the gear to preclude any possibility of movement of the gear while being machined.

The plates 21 and 23 are arranged in parallel relationship and are so retained by the guides 24. The gear 28 held between opposed pairs of members 30 is also coaxial with the plates 21 and 23. In order that the strain upon the gripping members shall be exerted at right angles to the plates I prefer that the axes of the members be located upon the tangents AA—as indicated at C in Figure 8—which denote the bearing surfaces along which contacts are made upon the teeth by the said members.

It will therefore be seen that as the distance between the plates 21 and 23 is decreased the conical extremities 30*a* of the members 30 are brought into firm engagement with opposite faces of teeth of the gear 28, and that the bearing surfaces or contacts thus established may be of appreciable length, sometimes up to the full width of the teeth. The conical extremities 30*a* are cut away in part as shown in Figures 7 and 9 to provide clearance for the teeth adjacent the ones engaged, and frequently also for the bases of the teeth engaged. The extent of this clearance depends upon various factors such as the length of the bearing required; the lead of the gear; and the proportionate size of the cone to the pitch of the gear.

This modified embodiment of the invention is highly satisfactory when only the bore of the gear is to be worked upon, but owing to the arrangement of the gripping members 30 the construction first described must be employed if the faces of the gear are to be machined.

I will now describe the modified constructions of the fixture shown in Figures 11 to 16 which are intended for holding internal gears.

Regarding Figures 11 to 14. A plate 31 is formed integral with a shank 32 around which a

second plate 33, which is annular, is arranged. Extending rearwardly from the plate 33 is a sleeve 34. The plate 33 and sleeve 34 are axially movable upon the shank 32 but are held against rotation thereon by a key 35 in the shank 32 which engages a keyslot 36 in the sleeve 34.

Secured upon the adjacent faces of the plates 31 and 33 are a plurality of gripping members 38. The latter are arranged in opposed pairs to engage opposite sides of teeth 39 of the internal helical gear 40, and are held against rotation about their supporting pins 41 as by dowels 42. The outer extremities 38a of the members 38 are in this case also in the form of partial cones and conform generally to the shape of the members 30 shown in Figures 5 to 10. In this particular embodiment however the plates 31 and 33 are moved axially into proximity with one another to cause the members 38 to engage the opposite sides of the teeth. This movement is obtained by tightening the nut 43 on the threaded extremity of the shank 32 and drawing the latter through the annular plate 33 and sleeve 34.

Figures 15 and 16 show a modification of the shank and sleeve arrangement just described to permit rotary instead of axial adjustment. In this case a collar 44 is provided upon the rear extremity of the shank 32a and rotary movement of the latter is obtained by tightening screws 45 which are in threaded engagement with the sleeve 34a and have their inner extremities in contact with the bases of recesses 46 formed in the shank 32a to receive them. Springs 47 also housed in recesses 48 partly within the shank 32a and partly within the sleeve 34a cause the former to turn in the other direction as the screws 45 are loosened. This adjustment arrangement is similar in construction and operation to that shown in Figures 1 to 4.

While in the foregoing the application of the fixture in various modified forms has been shown as applied to helical gears having teeth with perceptible lead or angularity to the gear axis, the fixture may of course be equally satisfactorily employed for gears having an infinite lead, commonly known as spur gears.

Having thus described my invention in various preferred embodiments, what I claim is:

1. A fixture for helical gears comprising two plates mounted in parallel relationship, a plurality of gripping members immovable on each plate and extending therefrom, the outer extremities of said members being in the form of partial cones the axes of which are disposed at right angles to said plates, the partially conical portions of the members extending from one plate each being adapted to engage one side of a tooth of a helical gear for an appreciable distance across it, and the partially conical portions of the members extending from the other plate each being adapted to engage the other side of a tooth of the gear for an appreciable distance across it, and means for moving the plates relative to one another to bring the partially conical portions of the member extremities into contact with the gear teeth to grip the gear.

2. A fixture for helical gears comprising the combination set forth in claim 1, wherein the partially conical member extremities are so tapered and proportioned that they each bear transversely across one face of a gear tooth along a line representing the intersection of a tooth surface with a plane tangent to the base circle of the gear.

3. A fixture for helical gears comprising the combination set forth in claim 1, wherein the conical portions of the gripping member extremities are inclined proportionately to the lead of the teeth of the gear so that the conical portions of the members will bear transversely against the teeth.

4. A fixture for gears comprising two plates, means for turning the plates relative to one another, gripping members extending from said plates, the members extending from one plate each being formed to engage one face of a tooth of a gear along a line representing the intersection of a tooth surface with a plane tangent to the base circle of the gear, and the members extending from the other plate each being formed to engage the other face of a tooth of the gear along a line representing the intersection of a tooth surface with a plane tangent to the base circle of the gear so that the teeth are supported from opposite directions by said members.

5. A fixture for helical gears comprising two plates, means for moving said plates, gripping members fixed on said plates and projecting therefrom, each member being formed to engage a tooth of a helical gear along a line representing the intersection of a tooth surface with a plane tangent to the base circle of the gear, and the members projecting from one plate engaging one side of the teeth they contact and the members projecting from the other plate engaging the other side of the teeth they contact.

6. A fixture for helical gears comprising the combination set forth in claim 4, wherein the outer extremity of each member is partially conical to bear against one face of a tooth of the gear.

7. A fixture for helical gears comprising the combination set forth in claim 5, wherein the outer extremity of each member is partially conical to bear against one face of a tooth of the gear.

8. A fixture for helical gears comprising the combination set forth in claim 4, wherein at least one of the plates is apertured for the passage of a tool to work upon the gear.

9. A fixture for helical gears comprising the combination set forth in claim 5, wherein at least one of the plates is apertured for the passage of a tool to work upon the gear.

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