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TESTING FIXTURE FOR GEAR CUTTERS

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Fig. 1
The present invention relates to apparatus for testing the angles of the blades of face mill cutters such as are used in cutting spiral bevel and hypoid gears. The invention has particular reference to face mill cutters having inserted blades.

The purpose of the present invention is to provide a simple, efficient and inexpensive device for testing the blade angles of a cutter so as to determine whether corresponding blades outside or inside, have corresponding pressure angles. The device has, also, been made sufficiently rigid and sturdy to permit stowing of the bottom of any of the slots of the cutter head to correct for any error in the pressure angle of a blade should it be found to have a pressure angle different from that of the blade.

A feature of the present invention is that it permits the same indicating device to be used to test both inside and outside blades of the cutter.

The principal objects of the invention have already been mentioned. Other objects will be apparent hereinafter from the specification and from the recital of the appended claims.

In the drawings:
Figure 1 is a side elevation of a testing fixture constructed according to a preferred embodiment of the present invention, the cutter being shown in section mounted thereon;
Figure 2 is a partial elevational view looking at right angles to the view of Figure 1 and at the face of the cutter head;
Figure 3 is a fragmentary sectional view showing particularly the means for holding and clamping the cutter head against rotation on its carrier; and
Figure 4 is a view showing a detail of the means for adjusting the cutter head carrier angularly.

Face mill gear cutters have blades, the cutting portions of which project beyond the face of the cutter head in the general direction of the axis of the cutter. The side cutting faces of the blade are inclined to the axis of the cutter so as to produce teeth of the desired pressure angle on the gears to be cut. The opposite side cutting faces of the blades may have the same or different inclinations to the axis of the cutter depending upon the spiral angle, dedendum angle, etc. of the gears to be cut as is well known in the art. The apparatus of the present invention permits testing face mill gear cutters to determine whether or not the corresponding side cutting faces have all the same effective pressure angle.

In the drawings, 10 indicates the base of the testing fixture. This base has a plane horizontal upper face 11 with a dove-tail guide portion projecting therefrom. 13 designates a slide. This slide has a plane bottom face with a recess therein conforming to the shape of the dovetailed guide 12. The slide 13 is mounted on the upper face of the base 10 and is movable thereon for a purpose which will hereinafter be described. Mounted on the slide 13 for pivotal adjustment thereon is a cutter head carrier 15. The cutter head carrier 15 pivots about the axis of the pivot pin 16 which is carried in suitable lugs or ears formed on the slide 13. The cutter head carrier is adapted to be adjustably secured to the piece or bracket 17, which is clearly shown in Figure 4, by means of a bolt 18 that is mounted in the cutter head carrier 15 and passes through the arcuate slot 19 formed in the member or bracket 17 and by means of a nut (not shown) mounted on the bolt and manipulated by the lever arm 20. The piece or bracket 17 is mounted on the pivot pin 16, an opening being provided at one end, as indicated at 21 for this purpose. At its other end, the piece or bracket 17 is threaded to receive a set-screw 22 which is adapted to engage a ledge 24 formed on the slide 13 to adjust the piece or bracket 17 itself about the axis of the pivot pin 16 thereby to secure a fine adjustment of the cutter head carrier 15.

25 designates the head and 26 the blades of a face mill cutter of known construction. The blades 26 are adjustable radially of the axis of the cutter head by means of the usual shims 27 and wedges 28 and are secured to the cutter head by the bolts 29. The cutting portions of the blades project beyond the adjacent face of the cutter head in the general direction of the axis of the cutter head and the side faces of the blades are inclined to each other and to the axis of the cutter head in accordance with the pressure angle and number of the cutter.

Only four blades have been shown on the cutter illustrated in the drawings. It will be understood, however, that the present apparatus is intended to test cutters of the standard number of blades or of any desired number of blades. In the drawings, moreover, the cutter has been shown with alternate blades constructed to cut opposite side faces of the gear teeth. The apparatus of the present invention can be used, however, to test cutters having either all inside or all outside cutting blades or to test cutters in which each of the blades is constructed so as to have both outside and inside cutting edges.

The cutter to be tested is mounted on the cutter head carrier 15 with its rear face seating against the face 30 of the cutter head carrier.
and with the nose 31 of the cutter head carrier entering the bore 32 of the cutter head 25 and centering the cutter head on the cutter head carrier. The cutter head is held on the cutter head carrier by a clamping plate 33 which is removably secured to the draw rod 35 by the nut 36.

The draw rod 35 slides in a bore in the cutter head carrier 15 and in the chamber 36 of the cutter head carrier which communicates with the bore throughout and which may, in fact, be considered an enlarged portion of the bore. A portion 39 of the draw rod sliding within the chamber 36 is of increased diameter to correspond to the diameter of the chamber and between the inner end of this enlarged portion 39 and the inner end wall of the chamber there is interposed a coil-spring 40 that serves to hold the clamping plate 33 frictionally in engagement with the cutter head 25 to secure the cutter on the cutter head carrier. The draw rod 35 can be drawn up to clamp the cutter head on the cutter head carrier by a draw rod 35 in the boring of the cutter head carrier rotation by means of the nut 42 which is formed integral with the handle 34 and which threads on to the end of the draw bar. A washer 44 is interposed between this nut and the outer end wall of the chamber 36. A pin 41 in the enlarged portion 39 of the draw rod that projects into a slot 41 in the side wall of the chamber 36 serves to limit the movement of the draw rod in both directions.

Mounted at one side of the base 10 for sliding adjustment in a direction parallel to the direction of movement of the slide 13 is a bracket 45. This bracket can be secured in any adjusted position on the base 10 by means of T-bolts (not shown) which engage in the T-slots 46 formed in the side of the base. The bracket 45 is formed with a slot or socket in which the vertically disposed post 47 is slidable adjustable. The post can be adjusted by rotation of the shaft 48, this post carrying a pinion 49 which meshes with a rack 50 cut into one side of the post. The bracket 45 has a split-clamp portion engaging the post 47 which can be tightened by the bolt 51 to clamp the post in any adjusted position. This is a usual construction and will be understood without further illustration.

Mounted on the post 47 and clamped thereon by a split clamping bar and a screw 52 is an arm 53. This arm 53 serves to carry the movable contact member which is adapted to engage the blades of the cutter and the indicating means by which movement of this contact member can be read. The contact member and indicating means may be of any suitable form. In the drawings, the contact member is shown in the form of a pivoted lever 55 which has a contact tip at 56 that engages the blade and a nose at 57 that serves to operate a plunger forming part of a standard form of indicating device designated 60; as a whole at 59. A coil spring 60 serves to hold the nose 57 in engagement with the plunger of the indicating device.

To test a cutter, it is first positioned on the cutter head carrier 15 and the clamping plate 33 and nut 36 are then secured on the draw rod 35 to hold the cutter head in place on the carrier. The spring 40 is powerful enough to hold the cutter head against rotation for the purpose of testing a blade but will allow the operator to rotate the carrier head by hand without loosening up on the screw 36 to bring the successive blades into position to be tested.

With the cutter head 25 mounted on the carrier 15, the operator first adjusts the cutter head 25 roughly to bring the side face of one of the blades into a horizontal plane. This will be indicated by a zero reading on the dial of the indicating device 60.

With the cutter blade so set, the blade is moved under the contact member. This is done by moving the slide 13 on the base 10. For convenience in effecting this movement, the hand lever 65 is provided. This is pivoted mounted on a stud 66 which is secured in the base 10 and is pivotally connected by a stud 67 with the slide 13. As the operator manipulates the lever 65, the slide 13 moves on the base 10 to move the blade being tested beneath the contact member. If the indicator reads zero for the full length of this movement, the side face of the cutting blade will lie in a horizontal plane. If the zero reading is not obtained, the angular position of the cutter head carrier can be changed by changing the rough adjustment of the cutter head carrier on the piece 17 and by the fine adjustment which can be secured by manipulating the set screw 23.

When a zero reading has been obtained for the full length of the cutting face of one blade, the operator will rotate the cutter head bringing the next corresponding side of this blade into testing position. If a zero reading is not obtained for the full length of this new blade when the slide 13 is moved to move this blade lengthwise beneath the contact member 55, it will indicate that the pressure angle of the side face of this blade is not the same as the pressure angle of the blade by which the instrument has been adjusted. To bring this second blade into position where it will cut with the same pressure angle as the first blade, the second blade shall have to be removed from the cutter head with its shank and wedge and the bottom of the slot in which the blade is secured will have to be stoned until when the blade is reset in the cutter head its cutting pressure angle will be the same as the cutting pressure angle of the other corresponding blade. The testing fixture is sturdy and rigid enough to permit the stoning operation to be effected on the fixture itself. So a reading will be taken on all corresponding blades and stoning will be effected where necessary, until all corresponding blades have the same effective cutting pressure angle. For the stoning operation, the cutter head carrier 15 can be clamped rigidly against rotation by threading up on the nut 42.

In the drawings, the contact member 55 and the indicating device 60 are shown in full lines in position for testing the inside blades. The outside cutting blades can be tested by moving the post 47 vertically and by moving the bracket 45 horizontally on the base 10 to bring the contact member 55 into the dotted line position shown in Figure 3 where it will be in operative relation with the outside cutting blades when the cutting faces of these blades are in a horizontal plane. An operation similar to that already described for the testing of the inside blades will be proceeded with in the testing of the outside blades. The cutter head carrier will be adjusted angularly until a zero reading is obtained on the indicator for the full length of one of the outside cutting blades as that blade is moved beneath the indicator by movement of the slide 13. A succeeding outside blade will then be rotated into position for testing and so on. If a zero reading should not be obtained on one of these succeeding outside
blades, that blade would be removed and the bottom of its slot stoned until it could be secured to the cutter head to have the same effective cutting angle as the blade originally tested.

For convenience in setting the contact member, the arm 53 can be rotated angularly on the post 47 by loosening up on the clamping bolt 52 and a fine vertical adjustment can be obtained by manipulation of the set-screw 70 which engages this arm 53.

To avoid too great a movement of the slide 13 back and forth during the testing of the blades, the adjustable stop-screws 72 and 73 are provided. These are secured in lugs 74 and 75, respectively, formed on a bracket 76 that is secured by screws 77 to the side of the slide 13 and they are adapted to engage one side or the other of a lug 78, that is formed integral with the base 10 and projects at one side therefrom, to limit the movement of the slide 13 under manipulation of the operator.

The fixture, as described, is designed specifically as a comparator to permit securing the same effective cutting pressure angle on all the blades of a cutter head. It will be understood, however, that if desired a scale might be provided to permit setting the cutter head carrier 15 to the pressure angle desired on the blades to permit testing these blades exactly for this pressure angle.

The base 10 of the fixture may be mounted upon a bench or for convenience a stand may be provided, as shown in Figure 1 of the drawings. This stand is provided with a foot or pedestal 75 which is adapted to receive the post 76 that carries table 77 on which the base 10 of the fixture is secured by means of the bolts 78. The post 76 can be adjusted vertically in the pedestal 75 to permit adjusting the testing fixture to a convenient height to suit the operator and when adjusted the post can be secured in its adjusted position by tightening up on the bolts 79 which engage in a split sleeve portion forming part of the pedestal.

It will be understood that instead of reciprocating the cutter to move the contact member along a blade, the testing fixture may be constructed so that the contact member is reciprocated and the cutter carrier is held stationary.

In general it may be said that while the invention has been described in connection with a specific structure, it is to be understood that it is capable of various further modifications and that this application is intended to cover any adaptations, uses, or embodiments of the present invention, following, in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which it pertains and as may be applied to the essential features hereinafore set forth and as fall within the scope of the invention or the limits of the appended claims.

Having thus described my invention, what I claim is:

1. In a device for testing the angles of the blades of a face mill gear cutter, a base, a slide reciprocable on the base, a cutter carrier and a movable contact member, one of which is mounted on said slide and the other on said base, said cutter carrier being provided with means for rotatably supporting a cutter to be tested and being angularly adjustable on its support to permit adjusting a side face of one blade of the cutter so that it extends in parallelism to the direction of movement of the slide, an indicating member operatively connected with said contact member, means for securing the cutter in any position of its rotary adjustment, and means for reciprocating the slide on the base to move the contact member along the side faces of the blades of the cutter, said contact member being adjustable in the direction of movement of the slide and in a direction transverse thereto to permit bringing the contact member into engagement with opposite side cutting faces of blades of the cutter to be tested.

2. In a device for testing the angles of the blades of a face mill gear cutter, a base, a slide reciprocable on the base, a bracket, a cutter carrier adapted to rotatably support a cutter to be tested, means for securing a cutter in any position of its rotary adjustment on the carrier, means for mounting said cutter carrier pivotally on the base, said cutter carrier being also angularly adjustable with reference to the bracket, means for effecting a fine adjustment of the bracket on the base to adjust said cutter carrier about its pivot, a contact, means for mounting the same on the base for movement resiliently in a direction transverse of the direction of movement of said slide, and an indicating member operatively connected with the contact member, said contact member being adjustable on the base in the direction of movement of the slide and also in a direction transverse thereto.

3. In a device for testing the pressure angles of the blades of a face mill gear cutter, a base, a support reciprocable rectilinearly on the base, a support fixedly secured to the base, a cutter carrier mounted on one of said supports, a contact member mounted on the other of said supports for movement thereon in a direction transverse to the direction of movement of said reciprocable support, means for indicating the amount of movement of the contact member, means for frictionally holding a cutter on said carrier against rotation but permitting rotation of the cutter to bring the cutting edges of different blades of the cutter successively into operative relation to the contact member, separate means for positively clamping the cutter against rotation, means for adjusting the carrier angularly on its support to permit positioning a blade of the cutter so that its cutting edge extends approximately parallel to the direction of movement of the reciprocable support, and means for moving the reciprocable support to pass a cutting edge longitudinally across the contact member to determine the angle of inclination of the cutting edge relative to the direction of movement of the reciprocable support.

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