June 15, 1943. S. J. KOPEC 2,321,825

GEAR GRINDING WHEEL DRESSER AND GEAR FORM CHECKER

Filed Aug. 23, 1941 2 Sheets-Sheet 1

Fig. 1.

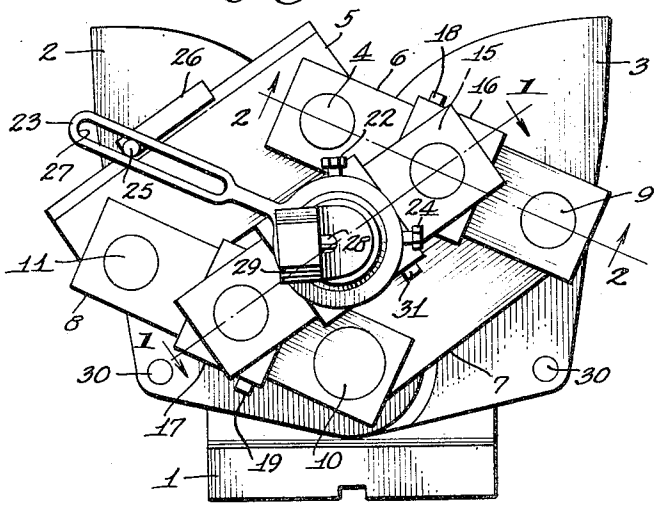

Fig. 2.

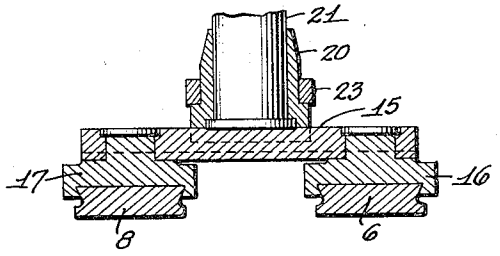

Fig. 3.

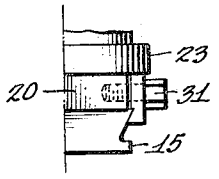

Fig. 5.

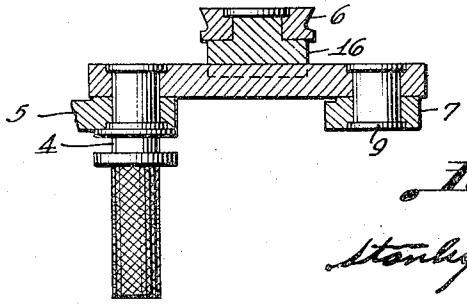

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Fig. 4.

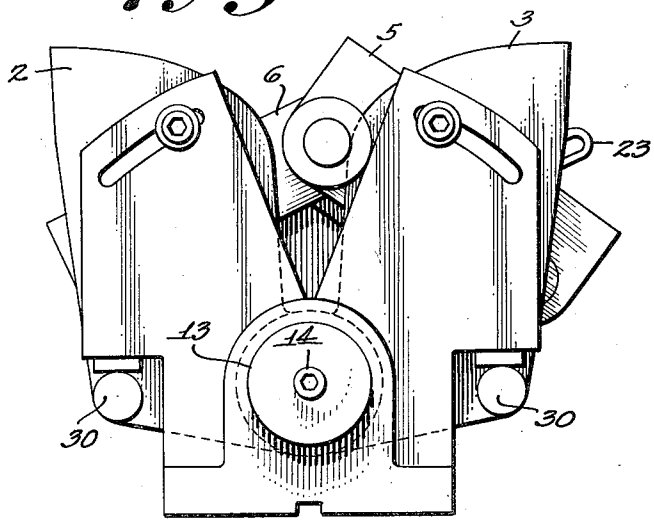


Fig. 2.

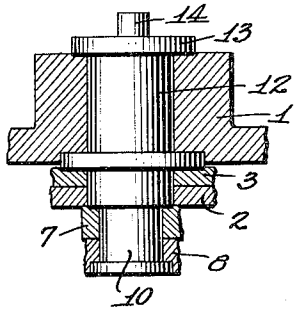
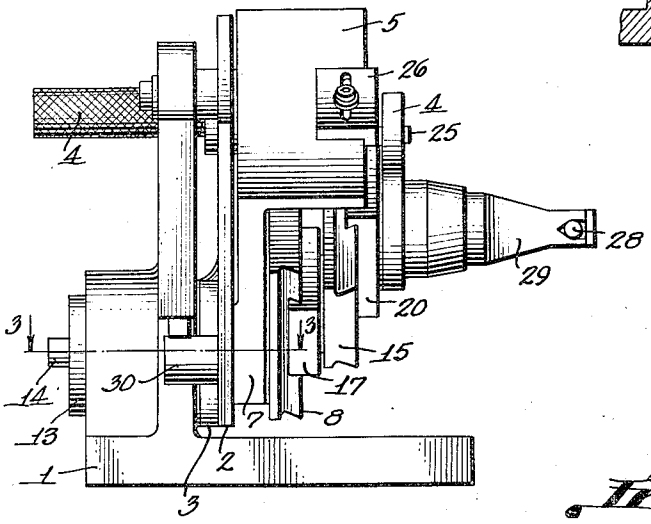


Fig. 6.



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UNITED STATES PATENT OFFICE

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GEAR GRINDING WHEEL DRESSER AND GEAR FORM CHECKER

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3 Claims. (Cl. 125—11)

This invention relates generally to gear tooth forming apparatus and, more particularly, to a gear grinding wheel dresser and gear tooth form checker.

All devices of this character made according to the teachings of the prior art and with which I am familiar have been very inefficient in operation in that it has been necessary to swivel the checker or dresser 180° when checking both sides of a gear tooth or when dressing a gear tooth grinding wheel. Much difficulty has been experienced in following both right and left hand master cams. It has been necessary to mount the dresser on the grinding machine for every operation involving loss of much time and expense.

It is, accordingly, an object of my invention to overcome the above and other difficulties in gear grinding wheel dressers and gear tooth form checkers, and it is more particularly an object of my invention to provide a gear grinding wheel dresser and gear tooth form checker which is efficient in operation, economical in cost, easy to manufacture and easy to set up.

Another object of my invention is to provide a gear grinding wheel dresser which may be mounted on a grinding machine entirely out of the way of the grinding job.

Another object of my invention is to provide a gear grinding wheel dresser, which may be used to follow right or left hand cam members, while said dresser is maintaining one position on the grinder.

Another object of my invention is to provide a gear grinding wheel dresser and gear tooth form checker whereby the width of the grinding wheel and the tooth thickness check setting is automatically controlled when the master cam members are positioned in the correct angular positions.

Another object of my invention is to provide a gear grinding wheel dresser and gear tooth form checker whereby the clearance below the working section of the tooth may be checked and also the thickness of the tooth may be checked.

Another object of my invention is to make a combined gear grinding wheel dresser and gear tooth form checker which will form both right hand and left hand involute curves of the gear tooth being ground and checked by using the same pantograph mechanism and right and left hand master cam members.

Another object of my invention is to provide a combined gear grinding wheel dresser and gear form checker whereby the cutter member or checking member moves radially tangent to the curve of the gear tooth being formed, which curve simulates the curve formed by the center of the follower on the master cam member.

Another object of my invention is to provide a combined gear grinding wheel dresser and gear tooth form checker wherein means are provided for guiding the tool at a predetermined angle when the cam follower engages the right or left hand master cam members.

Other objects of my invention will become evident from the following detailed description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a front elevational view of my novel combined gear grinding wheel dresser and gear tooth form checker.

Fig. 2 is a view taken on the line 1—1 of Fig. 1.

Fig. 3 is a fragmentary view, showing the connection of the tool holding chuck member to the cross link member.

Fig. 4 is a rear view of my novel combined gear grinding wheel dresser and gear tooth form checker.

Fig. 5 is a view taken on the line 2—2 of Fig. 1.

Fig. 6 is a side elevational view of my novel combined gear grinding wheel dresser and gear tooth form checker.

Fig. 7 is a view taken on the line 3—3 of Fig. 6.

Referring now to the drawings, Figs. 1, 2 and 3 show a base 1 having disposed thereon right and left hand master cam members 2 and 3. I have shown, for illustration, the surface of the cams in form parallel to an involute curve in order that the center of a follower 4 moving on the working surface of the cam members 2 and 3 will move in a line following an involute curve. It will be evident that other forms of curves for the working surface of the cam members 2 and 3 may be used. The follower 4 for the cam members 2 and 3 has pivotally connected thereto, link members 5, 6, 7 and 8 forming a parallelogram. The link members 5, 6, 7 and 8 are pivotally connected by pivot pins 9, 10 and 11 and pivot follower 4, the pivot pin 10 opposite to the follower being fixed and extending into the aperture 12 in the base 1 of the apparatus. The pivot pin 10 is secured in the aperture 12 in the base 1 by plate member 13 and a screw bolt 14 extending into the pivot pin 10. The cross-link member 15 is secured to the central portion of the link members 6 and 8 by adjustable pivot members 16 and 17. Cross-link member 15 may be disposed at different points on the cross-link members 6 and 8. The cross-link member 15 is adjusted and locked in position on the links 6 and 8 by means of the

adjustable pivot members 16 and 17 secured to the links 6 and 8 by lock screws 18 and 19.

The chuck member 20 is secured to a cross-link member 15 by lock screw 31 and has disposed therein a rotatable tool-holding arm 21 which is locked in the chuck member 20 by lock pin 22. The arm is free to rotate within the chuck 20 when the lock pin 22 is disengaged. A compensating member 23 surrounds the chuck 20 and controls the rotation of arm 21 when lock pin 24 is engaged. The compensating member 23 has a slotted arm extending outwardly therefrom in a direction opposite to that of the cross-link member 15 and parallel to links 6 and 8. A pin 25 extending from a bracket 26 extends into the slot 27 on the compensating lever 23. Bracket 26 is secured to the member 5 by means of a screw bolt 26a. Cross-link 15 takes care of the angular compensation of the tool 28 disposed in the tool-holder 29 when the follower engages the right hand cam member 2 and when the lock pin 22 engages the arm 21. When the lock pin 22 is disengaged and the lock pin 24 is engaged after the holder 29 is rotated 180° in the chuck 20, the follower is in a position to follow the left hand cam member 3, and the compensating lever 23 is provided to maintain the angular position of the tool 28 in the tool holder 29. Sine bar buttons 30 are provided to adjust the angularity of the right and left hand cam members 2 and 3.

In setting up my novel machine for dressing a grinding wheel, adjustable pivot members 16 and 17 are adjusted and locked on links 6 and 8; the chuck member 20 holding the tool-holder 29 is adjusted and locked on cross-link 15 so that the desired proportion is obtained between the parallelogram formed by lines connecting the centers of the pivot pins 9, 10 and 11 and the follower 4 and the triangle formed by lines connecting the centers of pivot pins 10, 17 and 29. The sine bar buttons 30 are used to obtain the correct angular setting for the right and left hand master cam members 2 and 3. This setting is one-half the included space angular between two gear teeth at the base circle. When the center of the follower 4 coincides with the beginning of the involute at the base circle of the theoretical master involute curve, the tool 28, preferably a diamond point cutter, coincides with the point of the beginning of the involute curve for which the dresser is set. Also, the body of the tool 28 is locked at right angles to the line joining the centers of the follower 4 and fixed pivot pin 10.

In setting the machine for following the right hand cam member 2, lock pin 24 is disengaged, and lock pin 22 is engaged, thereby causing the chuck member 20 and tool-holder arm 21 to move as one unit. In setting my machine for the follower 4 to move on the left hand master cam member 3, lock pin 22 is disengaged, and tool holder arm 21 is rotated 180° about its axis and locked to the compensating member 23 by lock pin 24 thereby placing it into position to follow the left hand master cam member 3.

In forming a right hand involute curve, the angular movement of cross-link 15 causes the body of the tool 28 to be substantially at right angles to the tangent of the involute curve formed by the movement of the center of the follower 4 on the right hand master cam member 21 at the point at which the tool 28 is contacting the involute curved surface being formed. In forming the left hand involute curved surface, the compensating member 23 and lock pin 24 lock the tool-holder arm 21 in chuck 20 in a position 180° from the setting for the right hand involute curve so that the angular positions of the body of the tool 28 exactly duplicate the angular position of the body of the tool 28 in dressing the right hand involute curved surface.

In dressing a grinding wheel, the machine is positioned so that the diamond point tool 28 is on the vertical center line of the wheel and so that the center of the base 1 is directly below the center of the wheel width. The machine is then set for cutting a right hand involute curve by engaging lock pin 22 and disengaging lock pin 24. The follower 4 is then moved in engagement with the right hand master involute cam member 2. This movement causes the diamond cutter tool 28 to move exactly in a path similar to the path of the center of the follower 4 on the master involute cam member. The machine is set for cutting a left hand involute curved surface on the grinding wheel by engaging lock pin 24 and disengaging lock pin 22. Then the follower is moved over the left hand master involute cam member 3. The clearance line on the grinding wheel in both cases is formed by continuing the movement of the follower 4 on a line tangent to the master involute curve formed by the center of the follower 4 moving over the working surface of the master cam members 2 and 3. This machine can be set for any size gear tooth within its range without making any special parts.

It will be evident that my machine will have a very wide range in that the cross-link 15 can be moved anywhere on the links 6 and 8 and chuck 20 on cross-link 15 thereby increasing or decreasing the proportion between the parallelogram formed by lines connecting centers of pivots 9, 10 and 11 and follower 4, and the triangle formed by lines connecting the center of tool holding arm 21 and pivots 17 and 10.

It will be evident that both right and left hand involute curved surfaces may be formed on a grinding wheel with one setting of my novel machine using the same pantograph mechanism with both right hand and left hand master cam members. This machine can be permanently mounted on the grinding machine entirely out of the way of the grinding job. Since the curve of the gear tooth and the tangent to the curve are formed on the grinding wheel in one continuous operation, the possibility of a bump on the side of the tooth at the base circle where the clearance is tangent to the involute curve is eliminated.

When mounted on the base of an index fixture, not shown, used to hold the gear for grinding, the machine can be positioned vertically so that the repeat dressing of the grinding wheel is positive in location. The machine can also be mounted on the spindle of the grinding machine in which case the repeat dressing will also be positive. The grinding width of the gear teeth is automatically controlled when the involute curves formed by the master cam members are located in their correct angular positions.

In addition to the above features, this machine may be used as a checker to provide a check on the clearance below the working section of the tooth and also a check on the thickness of the tooth. To adapt the machine for checking purposes, a set of suitable centers is used to hold the gear to be checked in the correct location with respect to the working mechanism. Any form of delicate instrument or checking tool may be disposed in the tool holder of my novel machine when it is desired to check the characteristics of gear teeth.

Various changes may be made in the specific embodiment of my present invention without departing from the spirit thereof or from the scope of the appended claims.

What I claim is:

1. In a combined gear grinding wheel dresser and gear tooth form checker, in combination, adjustable right and left hand master cam members, a follower for said cam members, links pivotally secured to said follower, forming a parallelogram, a cross-link pivotally secured to the central portions of two of said links forming sides of said parallelogram, a movable rotatably mounted chuck member disposed centrally of said cross-link adapted to hold a tool for dressing a grinding wheel or for checking the curvature of a gear tooth, and a guiding member for guiding said chuck member in a direction parallel with the two links of said parallelogram to which said cross-link is connected.

2. In a combined gear grinding wheel dresser and gear tooth form checker, in combination, right and left hand master cam members, a follower for said cam members, a linkage system forming a parallelogram connected to said follower, a movable cross-link member adjustably secured to two of said links of said system, a movable tool holder rotatably mounted on said cross-link and a compensating member disposed parallel with said links to which said cross-link is connected, adapted to be connected to said tool holder when said tool holder is in position to follow said left hand cam member, said compensating member forming an angular guide for said tool holder.

3. A combined gear grinding wheel dresser and gear tooth form checker, in combination, adjustable right and left hand cam members, a linkage system having a fixed pivot and an oppositely disposed freely movable pivot forming a follower for said cams, a movable cross-link member disposed on the side links of said linkage system movable in parallel relation with the top and bottom links of said linkage system, a longitudinally movable tool holder disposed on said cross-link member adapted to hold a tool for dressing a grinding wheel or checking the curvature of gear tooth, and a longitudinally movable arm secured to said tool holder in parallel relation with the side links of said linkage system to guide said tool holder when said follower is in engagement with said left hand cam member.

STANLEY J. KOPEC.