

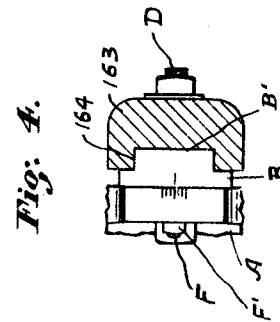
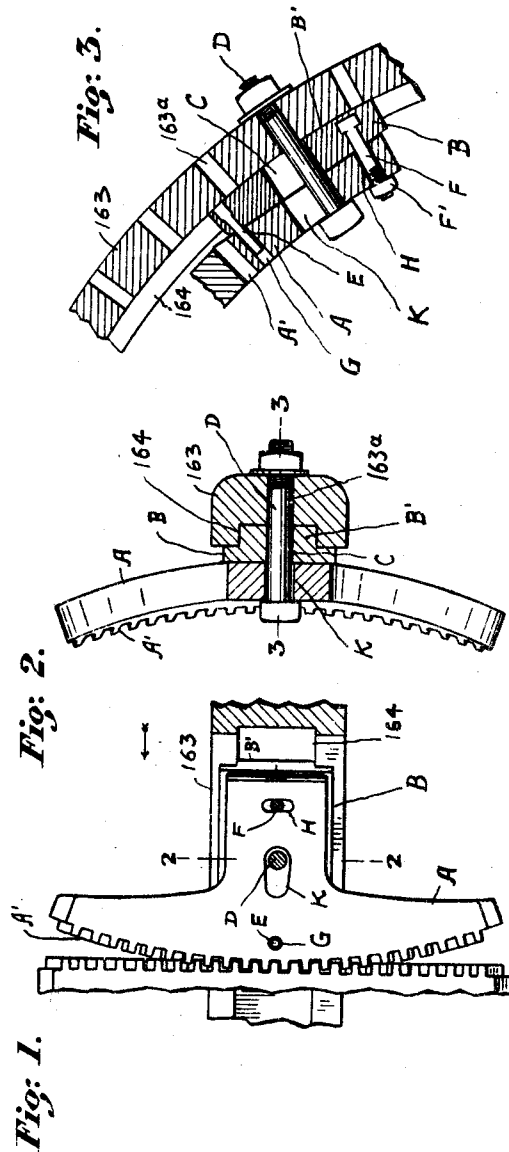
F. E. POMEROY & J. D. HARBAUGH.

GEAR GENERATING MACHINE.

APPLICATION FILED JUNE 28, 1911.

1,038,650.

Patented Sept. 17, 1912.



WITNESSES:

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# UNITED STATES PATENT OFFICE.

FREDERICK E. POMEROY AND JOSEPH D. HARBAUGH, OF MUNCIE, INDIANA.

## GEAR-GENERATING MACHINE.

1,038,650.

Specification of Letters Patent.

Patented Sept. 17, 1912.

Application filed June 28, 1911. Serial No. 635,727.

*To all whom it may concern:*

Be it known that we, FREDERICK E. POMEROY and JOSEPH D. HARBAUGH, citizens of the United States, and residing at Muncie, in the county of Delaware and State of Indiana, have invented certain new and useful Improvements in Gear-Generating Machines, of which the following is a specification.

10 This invention relates to improvements in gear-generating machines.

With the modern-day heavy demand for perfectly constructed gearings there has come the necessity, in their manufacture, of the generating of the curves or working faces of the teeth of the gear wheels, by mechanical means, whereby such gear wheels besides having their teeth of precise and accurate formation, may be completed rapidly and economically. Inventions having for their objects to accomplish the aforesaid results have been embodied in machines of different designs. On account of the peculiar nature of the work performed such a machine must in all of its parts be capable of correct and precise adjustment and of being maintained at such adjustment, because the slightest inaccuracy that occurs in the formation of the working surface of the tooth renders the gear wheel imperfect. A machine constructed on a true principle, for performing this work of generating the curve of the working surface of gear teeth, is that shown in United States Letters Patent numbered 950766 and dated March 1, 1910. This machine is built to accommodate bevel gears having pitch cones of varying angles and embodies means for simultaneously operating the blank and the tools, to generate the curves of the gear teeth thereon, on the rolling principle, and furthermore, includes devices for indexing the gear blank, and also there are included interchangeable devices capable of being readily applied to the machine which correspond to the angle of the pitch cone of the gear wheel to be formed. The said machine operates on the principle of a tooth of a crown gear cooperating with a bevel gear having a pitch surface corresponding substantially with that of the gear to be generated, the working faces of the tools corresponding to the opposing faces of the two adjacent teeth of the crown gear, and operating to cut away the metal of the blank on curves or lines deter-

mined according to the movements of the tools while the latter and the pitch surface of the gear blank are moving at the same velocity. The generating movements of the tools and gear blank are controlled and proportioned by a pair of cooperating gear members, one of the members being attached to the tool support and being in the form of a crown gear, and the other gear member having the form of a segment of a bevel gear and designated in this instance as a sector gear and being operatively connected to the gear blank, said sector gear having a pitch cone corresponding in angle to that of the gear to be generated, the said operative connection between the crown gear and the sector gear in the present instance consisting of a curvilinear segmental arm which carries the gear sector through an arc and at a velocity to correspond to the velocity at which the gear blank is moved; and a set of said sector gears of varying cone angles being provided and adapted to be interchangeably fitted to said segmental arm so that the machine may be set to generate gears having pitch cones of various angles. In the practice of operating this machine, so long as there is precise and perfect alinement relatively of the segmental arm, the crown gear segment, and the sector gear, the swinging of the tool support in a correct and true plane will be had, and the curvature of the gear teeth will be generated accordingly. However in the subjecting of the machine to the test in the shop of the continuous and practical performance on the every-day run of work intended to be done by it there are encountered the usual effects of wear and strain and the inevitable result to follow from the failure in the maintenance of the most precise alinement relatively of the segmental arm, the crown gear segment and the sector gear, is, that the crown gear segment (in the course of its travel upwardly or downwardly) is moved slightly in one direction or the other concentrically of the segmental arm. Such false movement of the crown gear segment (and of the tool support carried or moved thereby), even though very slight, is fatal to the generation of the correct curve at the gear blank. And now, accordingly, the objects of our invention are to provide means capable of being applied to this machine whereby such correct adjustment between the several elements named

may be maintained that the swinging of the tool guides or supports to the true line may be assured.

Our invention is embodied in and includes a sector gear to mesh with the crown gear segment and which is capable of being easily secured to and as easily detached from the segmental arm, means being also included whereby it is possible to accomplish adjustment of the sector gear on the segmental arm so as to vary the relation of its pitch surface to that of the crown gear segment.

The invention is illustrated in the accompanying drawings, and is described in this specification and clearly defined in the appended claims.

The several parts of the invention are identified by similar characters of reference applied thereto in the different views in the drawings, wherein—

Figure 1 is a side view of our sector gear device in position on the segmental arm 163, the bolts D and F being shown in section. Fig. 2 is a sectional view taken on the line 2—2 in Fig. 1. Fig. 3 is a sectional view taken on the line 3—3 in Fig. 2. Fig. 4 is an end view of the device as seen in the direction indicated by the arrow in Fig. 1, the frontal portion of the sector gear being broken away.

A designates the sector gear member, the teeth A<sup>1</sup> thereof being of usual form and pitch to mesh with the teeth of the crown gear segment. The flat reverse side of this sector gear will lie against a corresponding frontal flat surface of a base block B and which base block is of the form in cross section as shown in Fig. 2. The rear side of this base block is curvilinear and has the longitudinal rib B<sup>1</sup> to fit correctly in the usual groove of the segmental arm of the machine. This arm and its groove we have designated as 163 and 164 respectively.

C designates a slot in the base block and which is of width sufficient to permit the bolt D to be easily passed therethrough.

Toward the front end of the base block is secured a stud E, and near the rear end is secured the bolt F the end of which is threaded and provided with a nut F<sup>1</sup>. Near the base line of the teeth and centrally of the sector gear is a hole G, and at the rearward portion of the body of the sector gear is an arcuate slot H.

K designates a slot in the body portion of the sector gear, of the form relative to the diameter of the bolt D, as shown in Fig. 1.

To constitute our device complete and ready to place at operative position on the segmental arm 163, the base block and sector gear are connected together; the stud E occupying the hole G, and the bolt F occupying the arcuate slot H. To hold the two members together the nut F<sup>1</sup> is turned

down on the bolt F. The sector gear may be moved on the base block about the stud E as a pivot, the slot K being of sufficient width to give clearance for the bolt D. Graduations on one of the parts, as shown in Fig. 4, assist the operator in adjusting the sector at the desired position, and in which adjusted position with reference to the base block, it may be held by screwing down the nut F<sup>1</sup>. The normal position of the sector gear with reference to the base block is that shown in Fig. 1, the radius line of the pitch curve of the sector gear being coincident with the center line of the base block.

To practise the invention this device including the sector gear member and the base block, as above described, is disposed at position, the rib B<sup>1</sup> being in engagement with the groove 164 of the segmental arm. The bolt D is then passed through the slots C and K and through one of the holes 163<sup>a</sup> in the segmental arm. The device is then slipped forwardly, the teeth of the sector gear being brought into mesh with the teeth of the crown gear segment.

The usual trial operation of the machine, preparatory to putting it to work on the actual generating of the teeth of the gear blank, is then had. If correct travel of the crown gear segment in the true plane relative to the gear blank, is not proved, it is evident that there is incorrect relation between the sector gear and the crown gear segment, same being the result of inaccuracy in the relative alinement of the arm 163, and of the mandrel bearing the gear blank, and of the crown gear segment. Thus, there being no true center for the sector gear it will, with the swing of the segmental arm 163, carry the crown-gear segment to one side or the other of the true line. An apparently trifling variation from true alinement at the parts above named, is sufficient to cause a considerable inaccuracy and fault at the gear blank. Now it is at this stage in the operation, that our invention is effective. The operator having determined the amount of variation of the sector gear from the true line; loosens the bolt D, draws back the device, and then unscrews the nut F<sup>1</sup>. The sector gear is then shifted, the same being moved, in such shift, about the stud E as a center. Then by tightening the nut F<sup>1</sup> the sector gear is held at the adjusted position relative to the base block. The device is then returned to meshing engagement with the crown gear segment and secured by tightening the bolt D and the machine is in readiness for operation.

It will be understood that theoretically the center from which the sector gear is swung for the adjustment above described, should be coincident with the meeting of the pitch lines of the crown gear segment and

the sector gear; with our invention however it is possible to locate the center E at such proximity to the meeting point of these pitch lines, that the variation is inconsiderable.

6 What we claim, is—

1. In a machine of the kind described, the combination with the segmental arm 163 of an interchangeable base block, a cooperative  
10 rib and groove on the said base block and said arm for interchangeably locking them, a sector gear, means carried by the base block to permit the sector gear to be moved to and secured at different adjusted positions  
15 thereon concentrically of the meeting point of the meshing pitch lines of the sector gear and the crown gear segment.

2. An interchangeable sector gear device for a machine of the character described,  
20 comprising a base block having a frontal flat surface and its rear side being of curvature and having a longitudinal rib to fit the corresponding groove in the segmental arm 163, a pivot stud projecting from the face  
25 of the said base block, a sector gear member adapted to mesh with the crown gear segment and having a pitch to correspond to that of the gear to be generated, there being a hole in said sector gear located adjacent  
30 to the pitch line and equidistant from its ends, a threaded stud projecting from the face of said base block, to engage an arcuate slot provided in said segmental gear member, a nut on said threaded stud to be  
35 screwed down thereon to lock the sector gear member to the block, and means to lock the base block to the arm 163.

3. In a machine of the kind described, the combination with the segmental arm 163 of  
40 an interchangeable base block, means to secure the base block to the arm, a stud on the said base block, a sector gear having a hole adjacent the pitch line of its teeth to cooperate with the said stud, means to lock  
45 the sector gear at different positions concentrically of the said stud.

4. In a gear generating machine of the character described, the combination with the segmental arm 163 of an interchangeable  
50 base block carried by said arm, a sector gear, means carried by the base block to permit the sector gear to be moved to and secured at different adjusted positions thereon concentrically of the meeting point  
55 of the meshing pitch lines of the sector gear and the crown segment.

5. In a gear generating machine of the kind described, in combination with the segmental arm 163, a sector gear capable of adjustment to varied positions longitudinally  
60 of said arm and concentrically of the crown gear segment, and means to hold the sector gear at different adjusted positions.

6. An interchangeable sector gear device  
65 for a machine of the character described,

comprising a base block adapted to be connected to the segmental arm 163, a pivot stud projecting from the face of said base block, a sector gear member adapted to mesh with the crown gear segment and having  
70 a pitch curve to correspond to that of the gear to be generated there being a hole in the said sector gear located adjacent to the pitch line, a threaded stud projecting from the face of the base block to engage  
75 an arcuate slot provided in the segmental gear member, a nut on said threaded stud to tighten the sector gear member against the block, and means to lock the base block to the arm 163.

7. In a gear generating machine of the character described comprising a tool carrier, a crown gear segment attached to the tool carrier, a segmental arm operatively  
85 connected to the gear blank and a sector gear having a pitch cone corresponding in angle to that of the gear to be generated, the combination with said sector gear, of means to permit of the variation of the position of the sector gear pitch surface relatively to the pitch surface of the crown  
90 segment, and means to lock the sector gear at different adjusted positions on the segmental arm.

8. In combination with the segmental  
95 arm, a sector gear having its pitch surface to cooperate with the pitch surface of the crown gear segment, said sector gear being capable of adjustment to varied positions longitudinally of the segmental arm and relatively to the pitch surface of the crown  
100 gear segment, and means to hold the sector gear at different adjusted positions.

9. In combination with the segmental arm, a sector gear having its pitch surface  
105 to cooperate with the pitch surface of the crown gear segment, said sector gear being capable of adjustment to varied positions on said arm relatively to the pitch surface of the crown gear segment, and means to  
110 hold the sector gear at different adjusted positions.

10. In a gear generating machine of the kind described, in combination with the segmental arm, a sector gear capable of adjustment to varied positions concentrically of  
115 the crown gear segment, and means to hold the sector gear at different adjusted positions.

11. In a gear generating machine of the kind described, in combination with the segmental arm, a sector gear capable of adjustment to varied positions concentrically of  
120 the crown gear segment and of being held on said arm at different adjusted positions.

12. In a gear generating machine of the kind described, in combination with the segmental arm, a sector gear member capable of adjustment to varied positions longitudinally of the segmental arm and concentri-  
130

cally of the crown gear segment and of being held on said arm at different adjusted positions.

13. In a gear generating machine comprising a tool carrier, a crown gear segment attached to the tool carrier, a segmental arm operatively connected to the gear blank and a sector gear having a pitch cone corresponding in angle to that of the gear to be generated, the combination with the sector gear, of means to permit of the variation of the position of the sector gear pitch surface relatively to the pitch surface of the crown gear segment.
14. In a gear generating machine of the kind described comprising a tool carrier, a crown gear segment attached to the tool car-

rier, a segmental arm operatively connected to the gear blank and a sector gear having a pitch cone corresponding in angle to that of the gear to be generated, the combination with the sector of means to hold the sector gear to the segmental arm and which means will permit of the variation of the position of the sector gear pitch surface relatively to the pitch surface of the crown gear segment.

In testimony whereof we affix our signatures in presence of two witnesses.

FREDERICK E. POMEROY.

JOSEPH D. HARBAUGH.

Witnesses:

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