UNITED STATES PATENT OFFICE.

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MACHINE FOR GENERATING BEVELED GEAR-TEETH.

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To all whom it may concern:

Be it known that I, GEORGE B. GRANT, of Lexington, county of Middlesex, State of Massachusetts, have invented an Improvement in Machines for Generating Beveled Gear-Teeth, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

This invention relates to bevel gear teeth and the generation of the same. Generated gear teeth may be distinguished from cut gear teeth in that cut teeth are made to a copy of the tooth curve desired, such copy being either a cutter or a templet previously formed as nearly as may be to the curved form; while generated teeth are formed by a theoretical adaptation of mechanism so that it will properly form or generate a tooth in accordance with the theory of that form.

This invention is based upon the principle that if the pitch cones of two bevel gears be rolled frictionally together, without slip, any tooth form on one pitch cone will mate and run with a conjugate tooth form on the other pitch cone. Consequently when two pitch cones are rolled together, any tooth form on one pitch cone when constituted a cutting tool, will shape a tooth form on the other pitch cone which is conjugate to it; therefore a cutting tool on one pitch cone when shaped to correspond with the desired flank of a bevel gear tooth will necessarily generate a face on the other pitch cone which is conjugate to it and to the flank of the tooth with which the shape of the cutting tool corresponds, the cutting tool thus describing a surface which corresponds with the flank of a tooth of a mating gear.

A machine for generating bevel gear teeth in accordance with the foregoing principle is constructed to give to the cutting tool and the gear blank a relative movement as of the pitch cones of the two mating gears rolling one upon the other, the cutting tool being imagined as on one of the pitch cones, while the gear blank is attached to the other pitch cone. This relative motion may be obtained by imagining the axes of the pitch cones as fixed, a rolling movement being given both to the cutting tool and the gear blank; or one of the pitch cones may be imagined as stationary, while the other pitch cone carrying the gear blank or the cutting tool is rolled about it. For most practical purposes I prefer to have one imaginary pitch cone stationary and carrying the moving cutting tool, while the other imaginary pitch cone constituting the gear blank is rolled about it, the cutting tool thus describing the tooth flank surface of a gear with which the rolling gear blank is to work. A plane cutting tool having a straight cutting edge or flat surface is in every way the most simple cutting tool to employ in a machine, and I therefore prefer to employ such a tool in my machine, such a tool producing, however, a bevel gear tooth, which, though it embodies the essential characteristics above named, yet is of a shape which so far as I am aware is entirely new, such tooth consisting of flanks which are planes and faces which are curved surfaces conjugate to planes. This form of tooth differs from any bevel gear tooth heretofore known to me, in that its curved tooth surface differs from any other, and I have therefore named the tooth embodying such surface "a planoid tooth," such name being derived from its peculiar relation to the plane, as will be more fully hereinafter set forth.

This invention broadly, therefore, consists in a machine for generating bevel gear teeth, comprehending a cutting tool; a holder for the gear blank; and actuating devices to relatively change the positions of the said tool and holder as of the pitch cones of the gear blank and its mating gear (the latter pitch cone carrying the cutting tool) rolling one upon the other, whereby the said tool acting on the said blank is caused to generate a curved tooth surface conjugate to the flank of a mating tooth with which its cutting edge coincides, substantially as will be described.

Other features of this invention will be hereinafter described and particularly pointed out in the claims.

Figures 1 to 6 are diagrams illustrating my improved process of generating bevel gear teeth, the figures also illustrating a tooth formed by my improved process, having plane flanks and faces which are curved surfaces conjugate to such plane flanks; Fig. 7,