

Aug. 25, 1942.

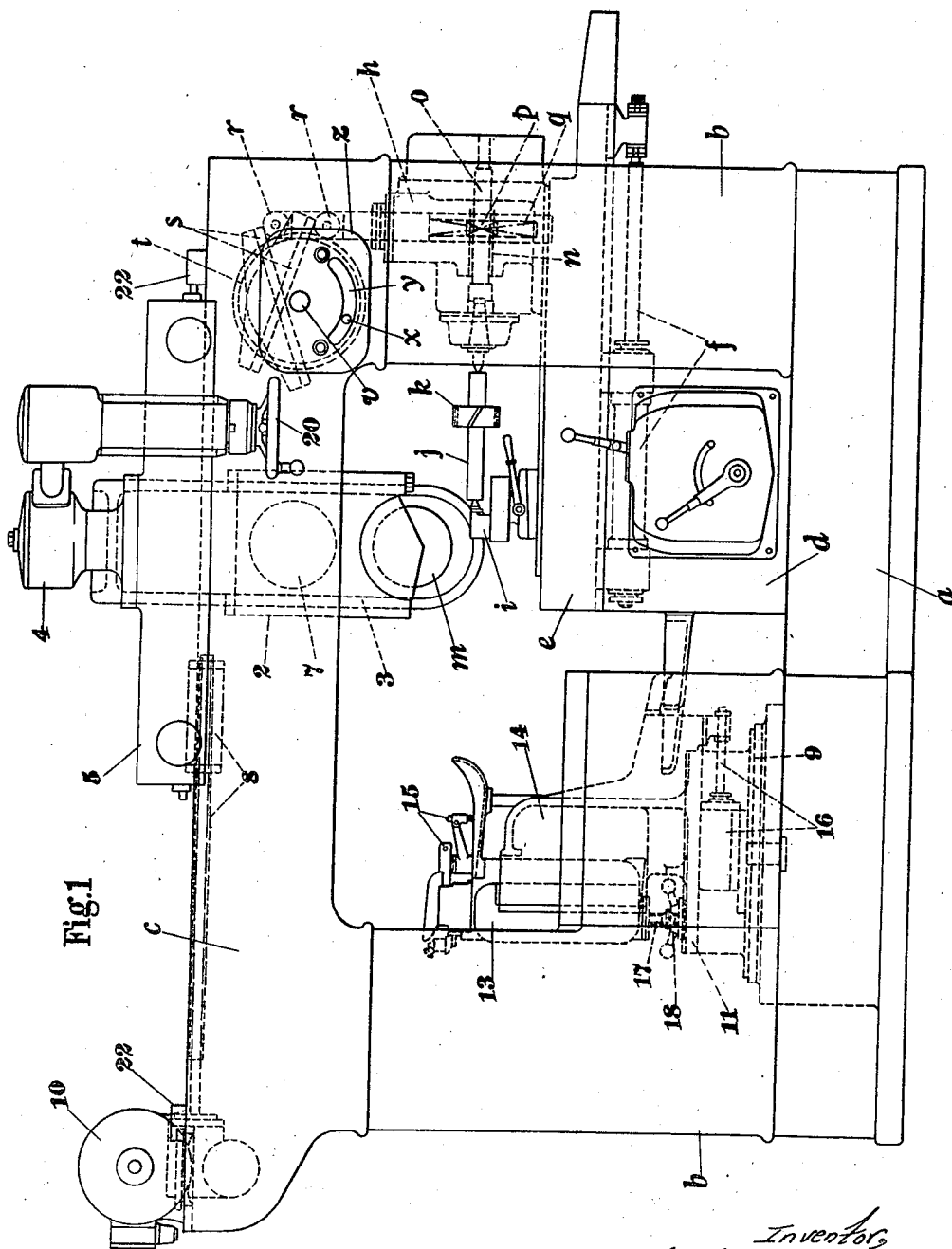
A. H. ORCUTT

2,294,045

GEAR GRINDING MACHINE

Filed July 12, 1940

5 Sheets-Sheet 1



Inventor,
A. H. Orcutt

By Glascock Downing & Lebold
Attys.

Aug. 25, 1942.

A. H. ORCUTT
GEAR GRINDING MACHINE

2,294,045

Filed July 12, 1940

5 Sheets-Sheet 2

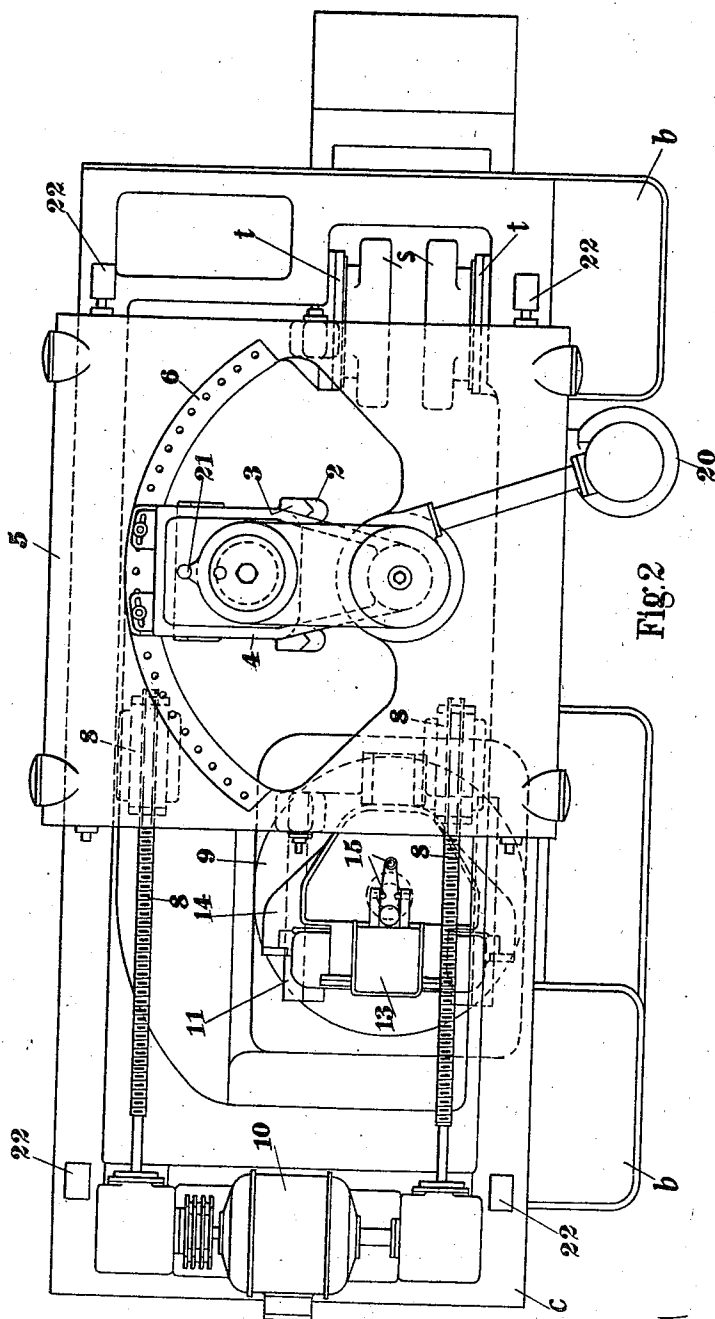


Fig. 2

Inventor
A. H. Orcutt

By: Glascock Downing & Peck
Attorneys

Aug. 25, 1942.

A. H. ORCUTT

2,294,045

GEAR GRINDING MACHINE

Filed July 12, 1940

5 Sheets-Sheet 3

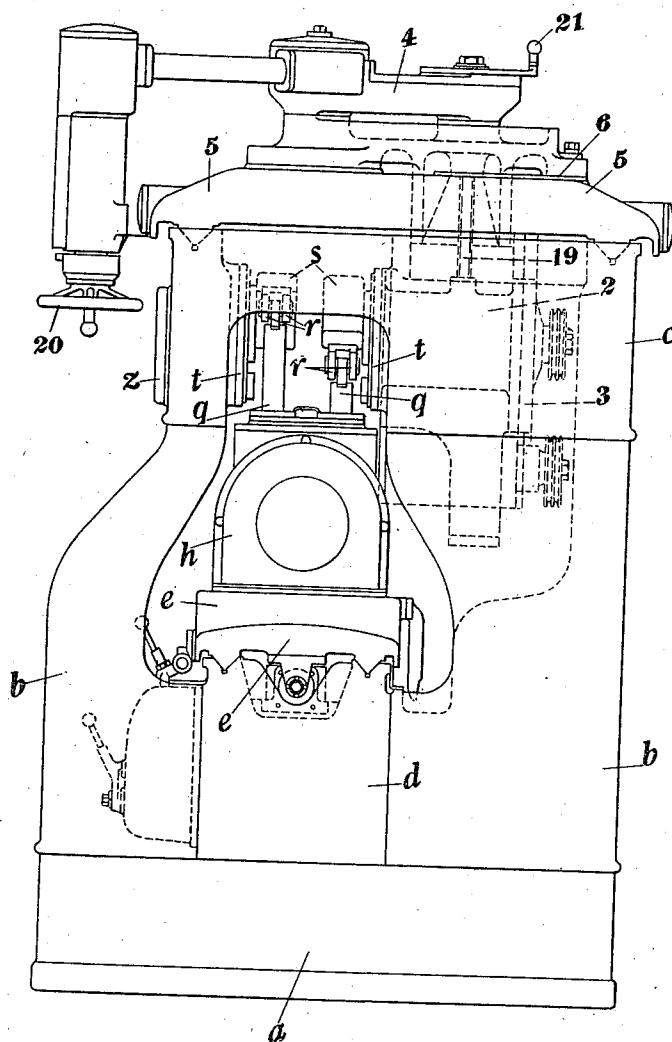


Fig. 3

Inventor
A. H. Orcutt

J. Gascoyne Downing & Co.
Attorneys

Aug. 25, 1942.

A. H. ORCUTT

2,294,045

GEAR GRINDING MACHINE

Filed July 12, 1940

5 Sheets-Sheet 4

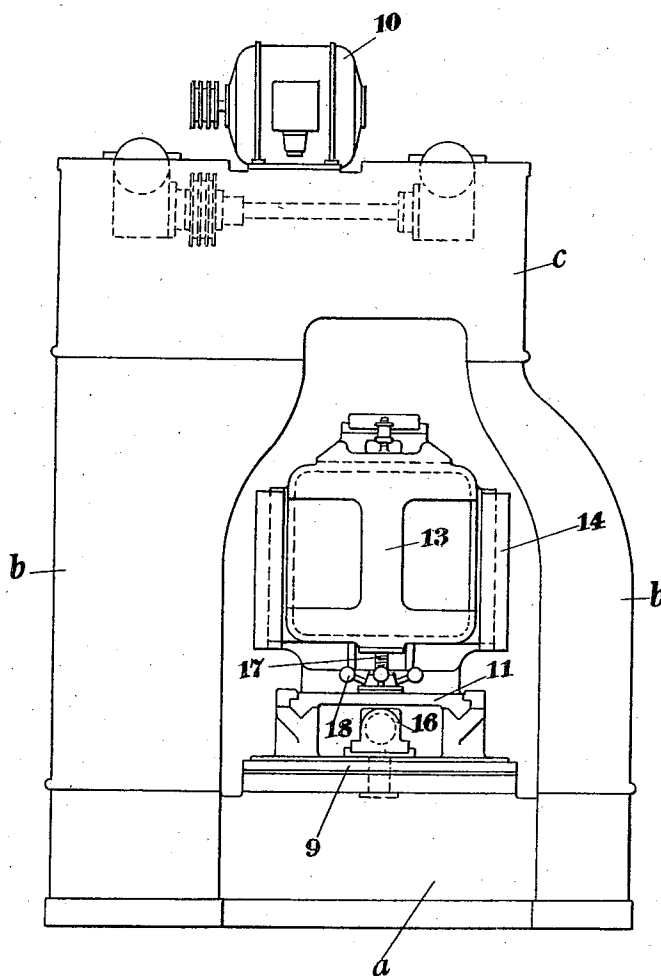


Fig. 4

Inventor,
A. H. Orcutt

By: Glascock Downing & Hubbell
Attys.

Aug. 25, 1942.

A. H. ORCUTT

2,294,045

GEAR GRINDING MACHINE

Filed July 12, 1940

5 Sheets-Sheet 5

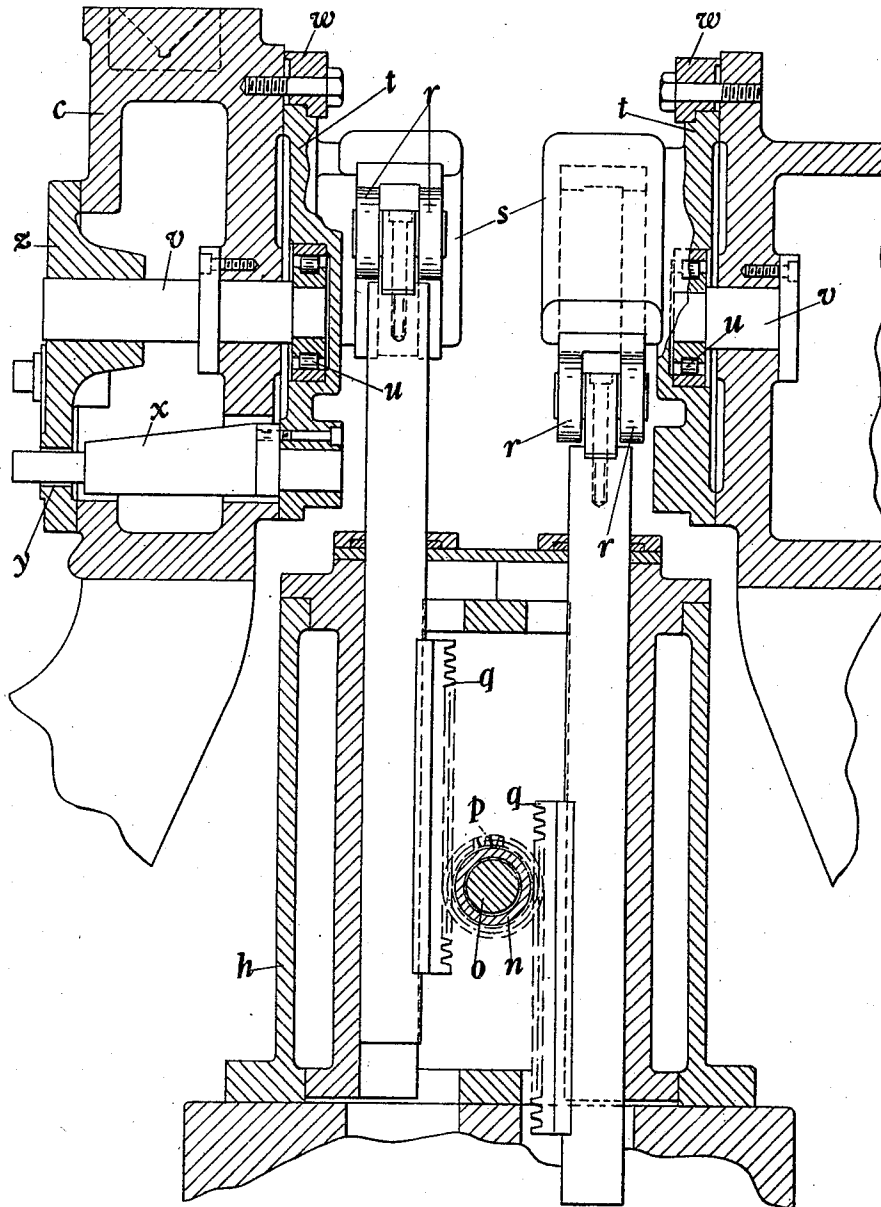


Fig.5

Inventor
A. A. Orcutt

By: *Glascock Downing & Seebolt*
Attys.

UNITED STATES PATENT OFFICE

2,294,045

GEAR GRINDING MACHINE

Arthur Hitchcock Orcutt, Shirley, Birmingham,
England, assignor to The Gear Grinding Com-
pany Limited, Shirley, Birmingham, England

Application July 12, 1940, Serial No. 345,243
In Great Britain July 22, 1939

4 Claims. (Cl. 51—123)

This invention has for its object to provide an improved machine for grinding to the required forms the teeth of so-called helical gear wheels.

The invention comprises the combination of a frame, a horizontally movable slide carrying a member on which a formed grinding wheel can be adjustably mounted and which is angularly adjustable about a vertical axis to enable the central plane of the grinding wheel to be moved to any desired position relatively to the axis of the work piece, a reciprocatory saddle for carrying the work piece, means for imparting oscillatory movements to the work piece during the reciprocatory movements, and a grinding-wheel trimming mechanism which is horizontally slidable and angularly adjustable about a vertical axis.

The invention also comprises the combination of a spindle on the saddle which operates the work piece, a pair of reciprocatory members operatively connected to the spindle, and a pair of ramps angularly adjustable on the frame, the ramps serving to impart through the medium of the said reciprocatory members opposite angular movements to the spindle during the reciprocation of the work piece relatively to the grinding wheel.

In the accompanying sheets of explanatory drawings:

Figure 1 is a front elevation, Figure 2 a plan, and Figures 3 and 4 opposite end elevations of a gear grinding machine constructed in accordance with the invention.

Figure 5 is a fragmentary part sectional end view illustrating to a larger scale than Figures 1 to 4, the means for imparting oscillatory movements to the work piece.

In carrying the invention into effect as shown, I employ a rigid frame comprising a base *a*, end columns *b*, and an upper transverse member *c*. On the base *a* is mounted a bed *d* carrying a horizontally reciprocable saddle *e* which is adapted to be actuated by for example, hydraulic means as *f* also carried by the bed. On the saddle *e* is mounted a headstock *h* and a tailstock *i* which support opposite ends of a horizontal spindle *j* for carrying and actuating the work piece *k*.

For imparting the required oscillatory movements to the spindle *j* during the reciprocation of the work piece *k* with the saddle *e* relatively to the grinding wheel *m*, there is mounted in the headstock *h* a hollow spindle *n* within which is arranged another spindle *o*. One end of the

latter spindle is connected in any convenient manner to the adjacent end of the work spindle *j*. At their ends remote from the work spindle *j* the two spindles *n*, *o* are interconnected by any suitable mechanism (not shown) which is arranged in the headstock *h* and enables the required indexing movements to be imparted to the work spindle, an example of such mechanism being described in the prior Patent Specification No. 2,066,220. On the hollow spring *n* is mounted a pinion *p* which is engaged at its opposite sides by a pair of vertically slidable racks *q*. At the upper end of each rack *q* is provided a roller or rollers *r*, and over and in contact with the roller or rollers on each rack there is mounted on the upper transverse member *c* of the frame an angularly adjustable ramp *s*. The two ramps *s* are oppositely inclined. During one movement of the saddle *e* one of the ramps *s*, by its downward pressure on the corresponding rack *q*, imparts an angular movement to the pinion *p* in the one direction, and during the opposite movement of the saddle the other ramp imparts (in like manner) the opposite angular movement to the pinion. In the example shown the ramps *s* are provided on disc-like carriers *t* which are supported by ball or roller bearings *u* on the adjacent ends of coaxial shafts *v* secured to the transverse frame member *c*, clamping pieces as *w* being provided for securing the carriers to the adjacent parts of the transverse frame member after the ramps have been brought to the required adjusted positions by angular movements of the carriers on their supporting shafts. For enabling such movements to be imparted to the carriers *t* an actuating member *x* is secured at its inner end to one of the carriers, and extends at its outer end through an arcuate slot *y* in a cover piece *z* closing an opening in the front of the transverse frame member *c*. By moving the actuating member *x* along the slot *y* the carrier *t* secured to the actuating member can be moved angularly on its supporting shaft *v* for adjusting the corresponding ramp *s*, and the adjusting movement of this ramp causes similar adjusting movement in the opposite direction to be imparted to the other ramp *s* through the racks *q* and pinion *p*.

The grinding wheel *m* is carried by a slide *2* which is vertically adjustable on a vertical guide *3* under the action of a screw as *19*, the latter being operable by the attendant through either of a pair of sand wheels *20*, *21*, in the usual manner. The guide *3* depends from a horizontal

arm 4 which at one end is pivoted to a horizontally movable slide 5 on the upper frame member c, and which at the other end is movable along and securable in any desired position to a segmental guide 6 on the latter slide, the arrangement being such that the arm is angularly adjustable about a vertical axis to enable the central plane of the grinding wheel *m* to be brought into any desired relationship with the axis of the work piece *k* corresponding to the helix angle of the teeth to be ground. Rotation of the grinding wheel *m* is effected by an electric motor 7 or other convenient means on the vertically adjustable slide 2 carrying the grinding wheel. Any convenient screw and nut or other means as 8 operable by an electric motor 10 are provided for moving the horizontally movable slide 5 along the frame member c.

The mechanism for trimming the grinding wheel *m* comprises a support 9 mounted on the base *a* of the frame and adapted in any convenient manner to be adjusted about a vertical axis, a horizontally movable slide 11 on the support, a pillar 13 on the horizontally movable slide, a vertically adjustable slide 14 on the pillar, and trimming tools 15 on the upper end of the latter slide, any suitable means (not shown) being provided for imparting motions to the trimming tools corresponding to the contours of the working faces of the grinding wheel. The pillar 13 is slidable horizontally with the slide 11 and is also angularly adjustable about a vertical axis with the support 9 so that the line of travel of the pillar corresponds with the plane of the grinding wheel *m*. Any convenient hydraulic or other means as 16 are provided for moving the slide 11 and pillar 13 towards and away from the grinding wheel *m*. Moreover any convenient provision is made for vertical adjustment of the tools 15. Thus in the example shown, a non-rotatable screw 17 extends from the bottom of the slide 14, carrying the trimming tools 15, and engages an axially immovable nut 18 on the horizontally movable slide 11, so that rotation of the nut causes vertical adjustment of the trimming tools.

When the machine above described is in operation the work piece *k* is reciprocated relatively to the rotating grinding wheel *m* and during each reciprocation the work piece is also given the required angular movements by the ramps *s* above-mentioned. After the grinding of an adjacent pair of tooth faces of the work piece *k* by the formed surfaces of the grinding wheel *m*, the work piece is given an angular movement by the indexing mechanism in the head stock *h* to bring the next pair of faces into position for grinding. Feeding of the grinding wheel *m* towards the work piece *k* is effected by the attendant through the means provided for vertically adjusting the slide 2 carrying the grinding wheel. When trimming of the grinding wheel *m* is required, the slide 5 carrying the arm 4 is moved from one of its end positions (determined by stops 22) on the upper frame member *c* to another, and the slide 11 of the trimming mechanism is then advanced to bring the trimming tools 15 into their operative position. After trimming, the slide 11 is retracted and the slide 5 is returned to its initial position.

By this invention I am able to provide a machine for grinding helical toothed wheels by means of a formed grinding wheel in a manner which enables the required accuracy of work

and convenience of manipulation to be achieved in a very satisfactory manner.

The invention is not limited to the example above described as subordinate details may be varied to suit requirements.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. A gear grinding machine as claimed in claim 4, in which the means for imparting oscillatory movements to the work piece comprise the combination of a spindle on the saddle which operates the work piece, a pair of reciprocatory members operatively connected to the spindle, and a pair of ramps angularly adjustable on the frame, the ramps serving to impart through the medium of the said reciprocatory members opposite angular movements to the spindle during the reciprocation of the work piece relatively to the grinding wheel.

2. A gear grinding machine as claimed in claim 4, in which the means for imparting oscillatory movements to the work piece comprise the combination of a pinion on a spindle on the saddle which operates the work piece, a pair of vertical racks engaging opposite sides of the pinion, and a pair of ramps angularly adjustable on the frame, the ramps serving by co-operation with the racks to impart opposite angular movements to the pinion during the reciprocation of the work piece relatively to the grinding wheel.

3. A gear grinding machine comprising the combination of a rigid supporting frame consisting of a base, end columns, and an upper transverse member, with a bed on the base, a horizontally reciprocable saddle mounted on the bed and adapted to carry the work piece, a horizontally movable slide on the said transverse member, an arm mounted on the slide and capable of angular adjustment about a vertical axis, means for adjustably mounting a formed grinding wheel on the arm so that angular adjustment of the arm enables the central plane of the grinding wheel to be moved to any desired position relatively to the axis of the work piece, a spindle mounted on the saddle and adapted to impart oscillatory movements to the work piece during the reciprocatory movements of the saddle, a pair of vertically slidable racks engaging opposite sides of the pinion, and a pair of angularly adjustable ramps mounted on the said frame and adapted to co-operate with the racks for imparting opposite angular movements through the pinion to the spindle during reciprocation of the saddle.

4. A gear grinding machine comprising the combination of a rigid supporting frame consisting of a base, end columns, and an upper transverse member, a horizontally movable slide on the transverse member of the frame, an adjustable member carried by the slide and provided with means for adjustably supporting a formed grinding wheel, the said adjustable member being capable of angular adjustment about a vertical axis to enable the central plane of the grinding wheel to be moved to any desired position relatively to the axis of the work piece, a reciprocatory saddle on the base of the frame for carrying the work-piece, and means on the frame and saddle for imparting oscillatory movements to the work piece during the reciprocatory movements of the saddle.

ARTHUR HITCHCOCK ORCUTT.