

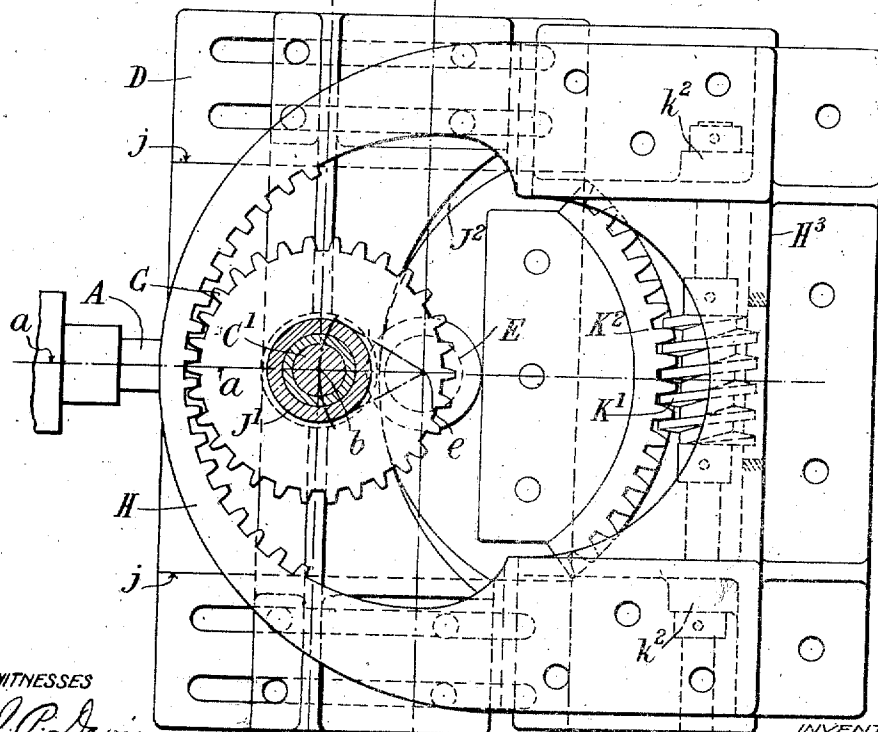
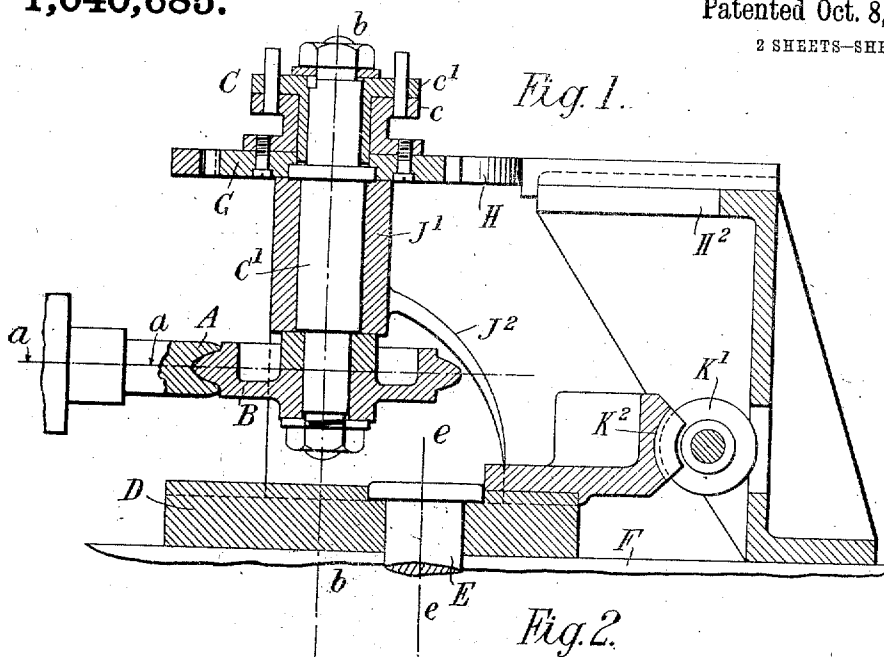
F. HUMPHRIS.
TOOTHED GEARING.

APPLICATION FILED SEPT. 21, 1911.

1,040,685.

Patented Oct. 8, 1912.

2 SHEETS—SHEET 1.



WITNESSES

J. P. Davis
C. B. Rollhaus

INVENTOR

Frank Humphris
BY *Munn Co.*
ATTORNEYS

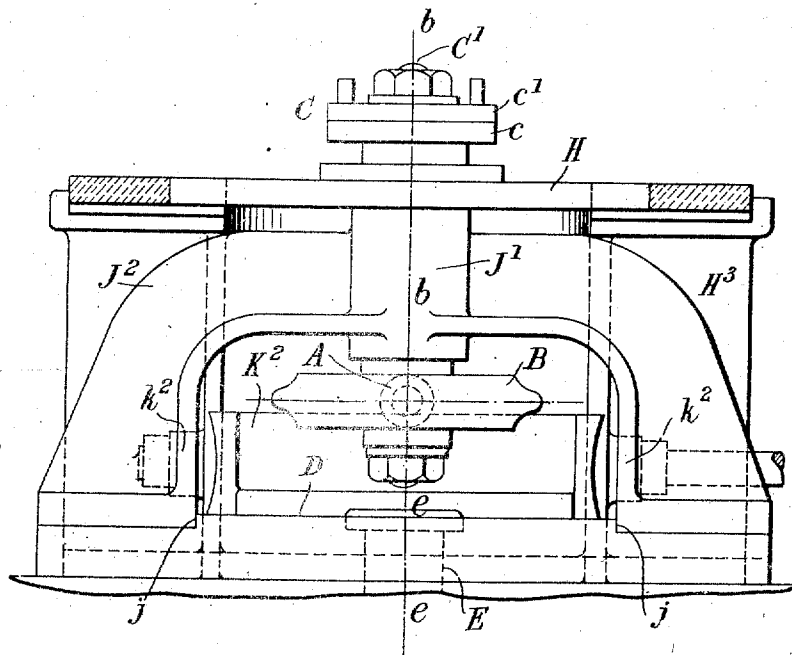
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Fig. 3.



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UNITED STATES PATENT OFFICE.

FRANK HUMPHRIS, OF BARTON PEVERIL, EASTLEIGH, ENGLAND.

TOOTHED GEARING.

1,040,685.

Specification of Letters Patent.

Patented Oct. 8, 1912.

Application filed September 21, 1911. Serial No. 650,502.

To all whom it may concern:

Be it known that I, FRANK HUMPHRIS, a subject of the King of Great Britain, and resident of Barton Peveril, Eastleigh, in the county of Hants, England, engineer, have invented certain new and useful Improvements in Toothed Gearing, of which the following is a specification.

This invention relates to apparatus for producing the operative surfaces of the so-called "generated" motion-transmitting elements in gearing wherein the operative surface of a motion transmitting element in one member is produced by the generative action of a rotary cutter having an effective profile which represents the operative surface of the coacting element in the other member of the gearing.

The invention relates more particularly to generating apparatus for use in the production of the operative surfaces of the helmet-shaped teeth and correspondingly shaped recesses or holes constituting the generated elements in the well-known "Humphris" type of gearing, described and illustrated in United States Patent No. 859662 and United States pending application Serial No. 467154.

The invention consists in the combination with means whereby the entire movement (hereinafter called "the generating movement") required to produce an effect equivalent to that of the proper relative motion at the predetermined velocity-ratio between the respective members of the gearing, each regarded as a whole, is communicated to the work alone, of means whereby further relative movement (hereinafter called "the feed movement") between the work and the cutter, each regarded as a whole, may be produced in a direction corresponding to that of the perpendicular to the common tangent to the pitch-lines of both members of the gearing.

The invention is thus distinguished from generative apparatus for use in the production of the operative surfaces of motion-transmitting elements in gearing of other kinds than those referred to above, and wherein a rotary cutter representing the operative surface of a motion-transmitting element in one member of the gearing is employed to generate the operative surface of the coacting element in the other member of the gearing; inasmuch as, although in some cases it has been proposed to communicate either to the work alone, or to the cutter

alone, the entire movement required to produce an effect equivalent to that of the proper relative motion at the predetermined velocity-ratio between the respective members of the gearing, no provision has heretofore been made for producing further relative movement between the work and the cutter in a direction corresponding to that of the perpendicular to the common tangent to the pitch-lines of both members of the gearing.

In the case of gearing of the "Humphris" type, wherein the motion-transmitting elements are constituted by helmet-shaped teeth and correspondingly shaped recesses or holes on the respective members, and more especially in cases where (as in the preferred form of said type of gearing) the maximum thickness of each tooth and the minimum thickness of the material which separates two adjacent holes, measured on the pitch-lines of the respective members of the gearing, is approximately 0.7 and 0.3 of the pitch respectively, it is necessary to provide means for producing (as above set forth) relative movement between the work and the cutter, each regarded as a whole, in a direction corresponding to that of the perpendicular to the common tangent to the pitch-lines of both members of the gearing, for the reason that, owing to the excessive (although varying) amount of strain, not directly balanced, to which during the generating operation the cutter is subjected in directions not coincident with its axis of rotation, it is found impracticable to produce on the work a complete surface presenting the true "generated" configuration unless the total depth of cut is performed in progressive stages, the depth of mutual engagement between the work and the cutter being gradually increased at successive traversing movements of the work and cutter relatively to one another, from a minimum to the maximum required. Generating apparatus constructed in accordance with the present invention further enables the necessary strength of parts, length of bearings, and consequent stability to be obtained (particularly in the case of the cutter-spindle) which are essential to the attainment of mechanically perfect results in the manufacture more especially of gearing of small dimensions.

In the accompanying drawings which represent (in a somewhat elementary form)

a typical embodiment of the invention, Figure 1 is a sectional side elevation, Fig. 2 a plan, and Fig. 3 an elevation looking from the cutter in a direction parallel to the axis thereof, showing a form of generating mechanism for use in the production of the pinion-member of internal spur-gearing.

The drawings show an example of mechanism for generating teeth or holes in the pinion-member of internal spur gearing.

A is a cutter, which rotates about the horizontal axis $a-a$; while B is a blank clamped on the lower end of a vertical spindle C^1 which is journaled in a bearing J^1 provided in a bracket J^2 which straddles the blank B and is adjustably fixed to a carrier D, the latter being rotatable about a vertical gudgeon E supported by some fixed portion F of the machine.

Angular movement of the carrier D about the gudgeon E (to an extent equal to the angular pitch of the teeth or holes to be produced in the blank) may be effected by any convenient means, such for example as a tangent screw K^1 rotatable in fixed bearings k^2 and engaging a toothed quadrant K^2 attached to the carrier. During such angular movement of the carrier D, simultaneous partial rotation of the blank B at the proper velocity-ratio is produced by the engagement, with a stationary segmental rack H, of a ring of teeth G fixed to and concentrically with the lower member c of a dividing-head C whose upper member c^1 is fast on the spindle C^1 ; the pitch-diameter of the ring of teeth G being equal to that of the blank B while the pitch-radius of the rack H is equal to that of the internal wheel whereof the cutter A represents one hole (or tooth).

To suit blanks of different diameters, the ring of teeth G is made detachable from the member c to which it is fixed; while to suit internal wheels of different diameters, the stationary segmental rack H (which is

always mounted concentrically with the fixed gudgeon E) is also made detachable from the support H^3 through the medium of which it is mounted on the fixed portion F of the machine. The bracket J^2 is further adjustable on guides j provided on the fixed portion F of the machine in a direction parallel to the axis $a-a$ of the cutter, for the purpose of varying the distance between the axes $b-b$ and $e-e$.

It will be obvious that the arrangement and construction of the machine may be considerably varied in detail within the scope of the claim provided the result aimed at remains the same in each case.

Claim.

In apparatus for producing the operative surface of a motion transmitting element in one member of peg and hole internal spur gearing by the generative action of a rotary cutter having an effective profile which represents the operative surface of the coacting element in the other member of the gearing, the combination with means for communicating to the work alone, the entire movement required to produce an effect equivalent to that of the proper relative motion with the predetermined velocity ratio between the respective members of the gearing, each regarded as a whole, of means for producing further movement of the cutter toward the work in a direction corresponding to that of the perpendicular to the common tangent plane to the pitch surfaces of both members of the gearing, the common axis of symmetry and of rotation of the cutter being also perpendicular to said common tangent plane when the prolongation of said common axis intersects the axis of rotation of the work substantially as set forth.

FRANK HUMPHRIS.

Witnesses:

ARTHUR G. PENDRELL,
ALBERT E. BURGESS.

Corrections in Letters Patent No. 1,040,685.

It is hereby certified that Letters Patent No. 1,040,685, granted October 8, 1912, upon the application of Frank Humphris, of Barton Peveril, Eastleigh, England, for an improvement in "Toothed Gearing," was erroneously issued to the inventor, said Humphris, whereas said Letters Patent should have been issued to *The Humphris Engineering Syndicate Limited, of London, England*, as shown by the records of assignments of this office; and in the heading of the printed specification an error appears requiring correction as follows: Strike out the line of "Application filed" and insert the words and figures, *Application filed June 18, 1910, Serial No. 567,582. Divided and this application filed September 21, 1911. Serial No. 650,502*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 11th day of February, A. D., 1913.

[SEAL.]

C. C. BILLINGS,

Acting Commissioner of Patents.

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