E. J. LEES.

CUTTER HEAD FOR GEAR CUTTING MACHINES.

APPLICATION FILED DEC. 23, 1907.

905,084.

Patented Nov. 24, 1908.

2 SHEETS—SHEET 1.

Fig. 1

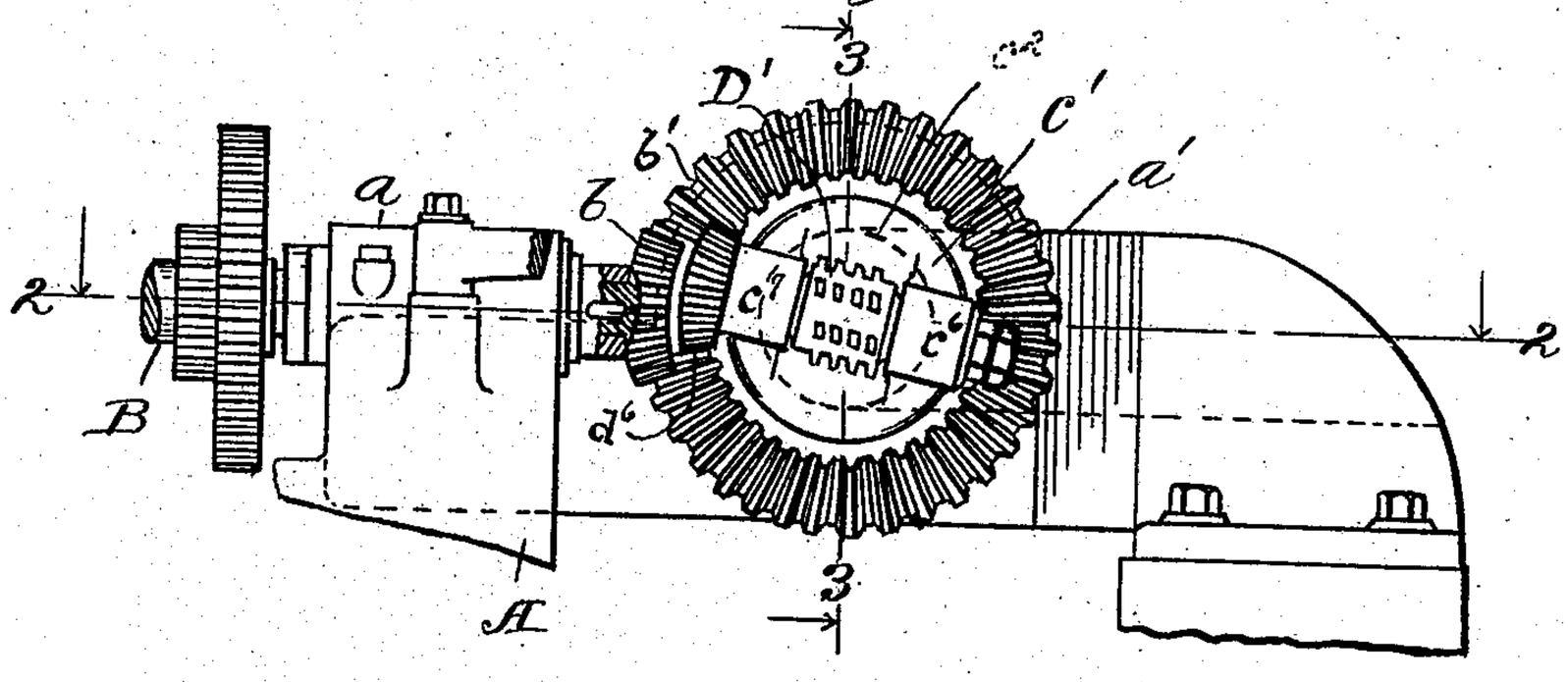


Fig. 2

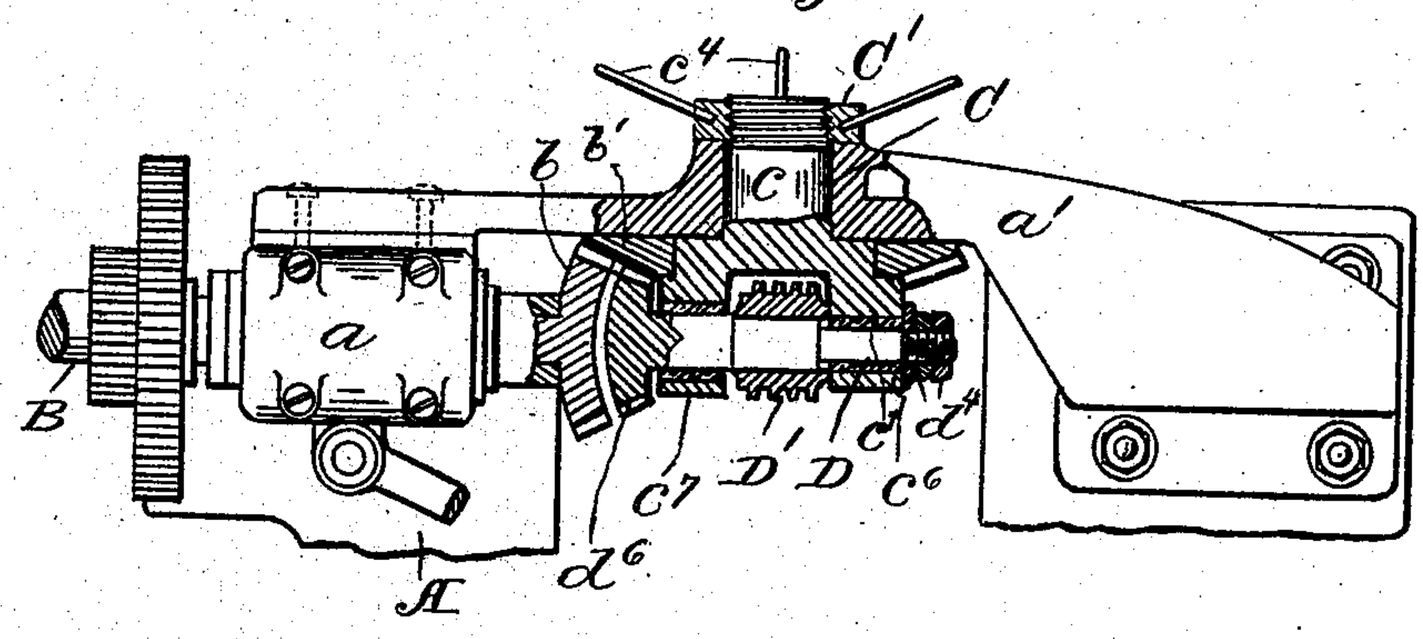
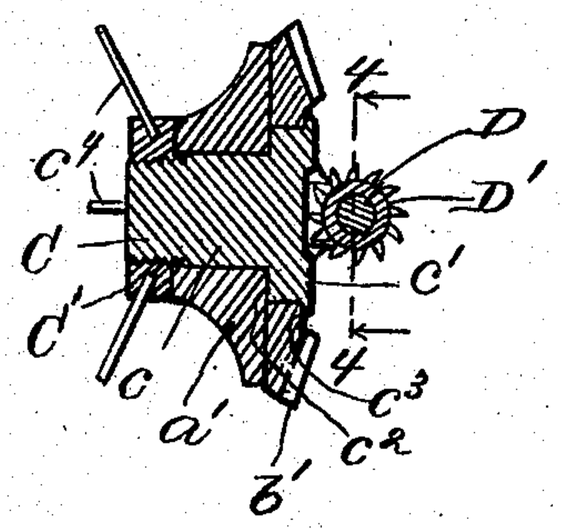


Fig 3



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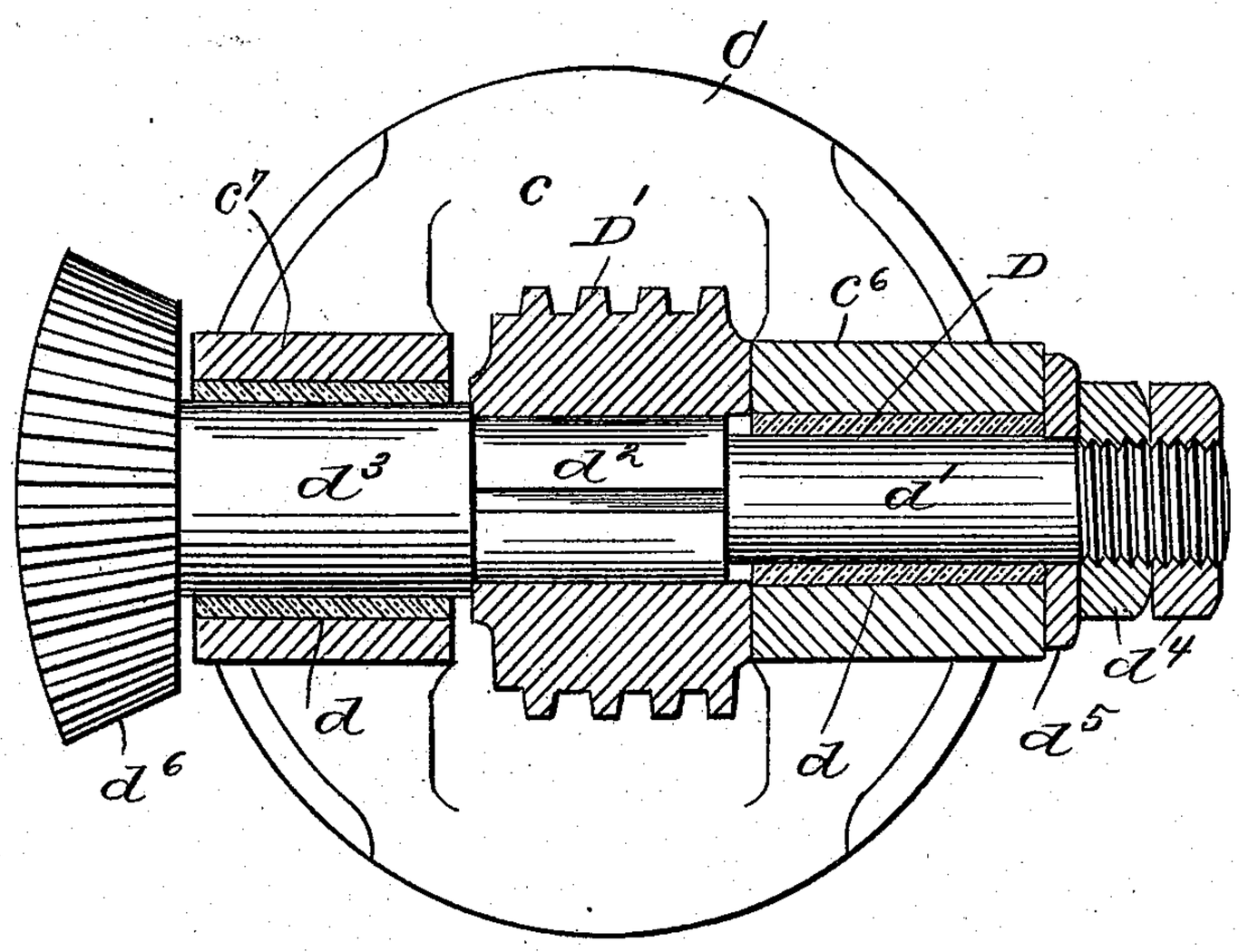
2 SHEETS—SHEET 2.

Fig. 4



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UNITED STATES PATENT OFFICE.

ERNEST J. LEES, OF CLEVELAND, OHIO, ASSIGNOR TO THE GRANT-LEES MACHINE COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

CUTTER-HEAD FOR GEAR-CUTTING MACHINES.

No. 905,084. Specification of Letters Patent. Patented Nov. 24, 1908.

Application filed December 23, 1907. Serial No. 407,672.

To all whom it may concern:

Be it known that I, ERNEST J. LEES, citizen of the United States, resident of Cleveland, county of Cuyahoga, and State of Ohio, have invented a new and useful Improvement in Cutter-Heads for Gear-Cutting Machines, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

As indicated, the present invention relates to an improved form of cutter head designed for use particularly in gear cutting machines which is recognized as an especially difficult kind of milling work. Obviously, however, such head is equally well adapted for use in any milling machine where a universal adjustment of the cutter is necessary or desirable.

The general subject-matter of this application originally formed a part of my co-pending application for gear cutting machine, filed September 21, 1906, Serial No. 335,565, from which it has been divided out. In addition I here show the details of construction involved in the mounting of the cutter spindle, which, although the same as in the original structure, were not thus minutely illustrated and described in the application just referred to.

The object of the present invention is to provide a universal cutter head, that, while affording every desired adjustment for the cutting of spur, worm or spiral gears, will nevertheless be simple in construction and operation.

To the accomplishment of these and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims.

The annexed drawings and the following description set forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawings: Figure 1 represents a front elevation, with portions shown in section, of a cutter head embodying my several improvements; Fig. 2 is a horizontal cross section through such cutter head taken on the line 2—2 Fig. 1; Fig. 3 is a similar vertical section through the head; and Fig. 4 is a horizontal section on an enlarged scale of the cutter spindle mounting.

In the aforesaid figures only so much of the frame A of the machine is shown as is necessary to indicate the manner in which the several parts, that constitute the head proper or are directly connected therewith, are supported. Such frame portion includes the head stock a in which is mounted the driving shaft B for the cutter head, such shaft being driven at various desired rates of speed by means of a cone pulley (not shown) or other suitable mechanism.

To the rear of the head stock and extending in the same general direction is a cross member a' wherein is mounted the head proper. The latter comprises essentially a swiveling support C rotatably mounted in a bearing therefor provided in such cross member a'. This swiveling support consists of a solid cylindrical body c provided at one end with an enlarged face c' between which and the body proper are formed two spaced shoulders c^2, c^3 of different diameters. The other end of such body is screw-threaded to receive a nut C′, that, for convenience, is provided with radially extending arms c^4. By means of this nut, the head is adapted to be drawn longitudinally of its bearing in cross member a' until the first c^2 of the spaced shoulders on its forward end rests solidly against the face of such member a'. In this way the head is adapted to be secured in any desired angular position about its axis, such axis, as will be evident, lying at right angles to that of the driving shaft B and intersecting the same. Upon the front, enlarged, face c' of the head are provided two bearings c^6 c^7, alined upon a diametrical line, in which bearings is journaled the cutter spindle or arbor D. Such cutter spindle will obviously lie substantially in the same plane with the driving shaft B. Mounted upon the cutter spindle intermediately between the two bearings just referred to, is the cutter D′, which, in the machine chosen for illustration, (the same as that shown in my co-pending application), is of the spiral type commonly denominated a hob. Use of this type of cutter involves a different principle of operation from that involved in the use of the ordinary, or straight, type of cutter, which principle and its advantages need not here be more than referred to, being fully set up in my other

application wherein a specific modification of such principle is exemplified. Aside from these general advantages, however, a particular advantage in mounting the cutter arises from the fact that where such cutter is in the form of a hob it does not require to be centered with respect to the axial line of the blank. The reason for this need not be further considered, being obvious, but attention is directed to the manner in which this feature is adapted to the taking up of wear in the mounting of the cutter spindle in order to secure the steadiness essential to accurate work.

Referring to Fig. 4, the cutter spindle D will be seen to comprise three alined portions d', d^2, d^3 of successively increasing diameter. The terminal portions d' d^3 are respectively journaled in the bearings c^6, c^7, suitable bushings d being of course provided; and upon the corresponding projecting extremities of the spindle are mounted two lock, or clamp, nuts d^4 and a bevel pinion d^6. A washer d^5 is interposed between the innermost of nuts d^4 and the adjacent bearing c^6. Upon the intermediate portion d^2 of the spindle, which is shorter than the space between bearings c^6 c^7, is keyed the hob D'. Such hob is preferably a trifle longer than the portion d^2 of spindle D upon which it is mounted. Upon drawing the spindle to the right, Fig. 4, by means of nuts d^4 it will accordingly be seen that the hob may be held with any desired degree of tightness between the inner side of bearing c^6 and the offset or shoulder on the spindle between portions d^2 and d^3. Absolute steadiness in running may be thus secured. By leaving sufficient clearance between pinion d^6 and the bearing c^7 adjacent thereto, as also between intermediate portion d^2 of the spindle and bearing c^6, provision is easily made for an indefinite amount of wear without the slightest decrease in the accuracy of the work turned out, chattering of the tool being just as effectively prevented after a long period of service as when new. At the same time dismounting of the tool is much facilitated, since by simply removing the nuts d^4, the whole spindle, together with pinion d^6 and the hob D', are free to be removed from their mounting on the cutter head.

Rotatably mounted upon the head C between the cross member a' and the second of the shoulders c^3 wherewith the head is provided, is a beveled gear b' that serves as an idler for the beveled pinion b mounted upon the end of the driving shaft B contiguous to the cutter head and the bevel pinion just described as being mounted upon one end of the cutter spindle D. Such bevel gear or idler b' has a face wide enough to accommodate both the pinions, even when the spindle and shaft, whereby they are respectively borne, are alined. In other words the head may be adjusted about its axis without any interference between the pinion borne by the cutter spindle and that borne by the driving shaft. The simplicity of the adjustment of the cutter head, whereby the hob D' may be quickly and easily set at any desired angle to the live spindle, is further enhanced by the directness of the drive for by avoiding the use of complicated gearing the loss of power is reduced to a small fraction.

Incidentally to the tightening of the hob D' in its bearings by the endwise adjustment of the spindle D above described, the pinion d^6 meshing with idler b' will at the same time be drawn radially inward with respect to such idler. This will obviously result in tightening the connection between the pinion and gear by drawing the teeth of the former into the narrowing portion of the face of the latter. The one adjustment is thus seen to simultaneously accomplish two results, taking up not only wear of the hob bearing but also of the teeth of pinion and gear.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. In a device of the character described, the combination of a driving shaft; a head angularly adjustable about an axis at right angles to said shaft; a cutter spindle rotatably mounted upon said head and lying in substantially the same plane as said shaft; a bevel gear rotatably mounted upon said head, the face of said gear extending beyond said head; and bevel pinions borne by said shaft and spindle respectively but both in mesh with said gear, the pinion borne by said spindle being adapted to pass by the one borne by said shaft without interference, as said head is adjusted about its axis.

2. In a device of the character described, the combination with a suitable support; of a driving shaft; a head, provided with a shoulder, mounted in said support so as to be angularly adjustable about an axis at right angles to said shaft; a cutter spindle rotatably mounted upon said head and lying in substantially the same plane as said shaft; a bevel gear rotatably mounted upon said head between such shoulder and said support, the face of said gear extending beyond said head; and bevel pinions borne by said shaft and spindle respectively but both in mesh with said gear, the pinion borne by said spindle being adapted to pass by the one borne by said shaft without interference, as said head is adjusted about its axis.

3. In a device of the character described,

the combination with a suitable support; of a driving shaft; a head rotatably mounted in said support so as to be angularly adjustable about an axis at right angles to the axis of said shaft, said head being provided with two spaced shoulders of different diameters; means adapted to draw the first of such shoulders against said support to retain said head in desired angular position; a cutter spindle rotatably mounted upon said head and lying in substantially the same plane as said shaft; a bevel gear rotatably mounted upon said head between such second shoulder and said support; and bevel pinions borne by said shaft and spindle, respectively, the pinion borne by the latter being adapted to pass by the other without interference.

4. In a device of the character described, the combination with a suitable support; of a driving shaft; a head rotatably mounted in said support so as to be angularly adjustable about an axis at right angles to the axis of said shaft, said head being provided with two spaced shoulders of different diameters; a nut threaded upon the rear end of said head and adapted to draw the first of such shoulders against said support; two diametrically alined bearings upon the front end of said head; a spindle journaled in said bearings; a hob mounted upon said spindle between said bearings; a bevel gear rotatably mounted upon said head between such second shoulder and said support; and bevel pinions mounted upon the end of said shaft and spindle, respectively, the pinion borne by the latter being adapted to pass by the other without interference.

5. In a device of the character described, the combination of two alined bearings, a spindle mounted in said bearings and longitudinally adjustable with respect to the same, and a cutter mounted upon said spindle between said bearings, said spindle being formed with a shoulder disposed to bear against said cutter and press the latter against one of said bearings upon longitudinal adjustment of said spindle.

6. In a device of the character described, the combination of two alined bearings, a spindle mounted in said bearings and longitudinally adjustable with respect to the same, said spindle comprising two portions of unequal diameters of which portions the smaller extends between said bearings, and a cutter mounted upon such smaller spindle portion, the shoulder between such portions bearing against one side of said cutter and adapted upon longitudinal adjustment of said spindle to press the other side of said cutter against the adjacent bearing.

7. In a device of the character described, the combination of two alined bearings, a spindle mounted in said bearings and longitudinally adjustable with respect to the same, said spindle comprising three portions of successively increasing diameter, the intermediate portion lying between said bearings, and a cutter mounted upon such intermediate spindle portion, the shoulder between such portion and the adjacent larger portion bearing against one side of said cutter and adapted upon longitudinal adjustment of said spindle to press the other side of said cutter against the adjacent bearing.

8. In a device of the character described, the combination of two alined bearings, a spindle mounted in said bearings and longitudinally adjustable with respect to the same, said spindle comprising three portions of successively increasing diameter, the intermediate portion lying wholly between said bearings and the terminal portions being journaled in said bearings, respectively, and a hob mounted upon such intermediate spindle portion, said hob being longer than such portion and the shoulder between such portion and the adjacent larger portion bearing against one side of said cutter and adapted to press the other side of the same against the adjacent bearing.

9. In a device of the character described, the combination with a suitable support; of a driving shaft; a head, formed with a shoulder, mounted in said support so as to be angularly adjustable about an axis at right angles to said shaft and provided on its face with two alined bearings; a spindle mounted in said bearings and longitudinally adjustable with respect to the same; a cutter mounted upon said spindle between said bearings; said spindle being formed with a shoulder disposed to bear against said cutter and press the latter against one of said bearings upon longitudinal adjustment of said spindle; a bevel gear rotatably mounted upon said head between such shoulder and said support; and bevel pinions borne by said shaft and spindle respectively, the pinion borne by the latter being adapted to pass by the other without interference.

Signed by me this 16th day of December, 1907.

ERNEST J. LEES.

Attested by—
E. R. RODD,
JNO. F. OBERLIN.