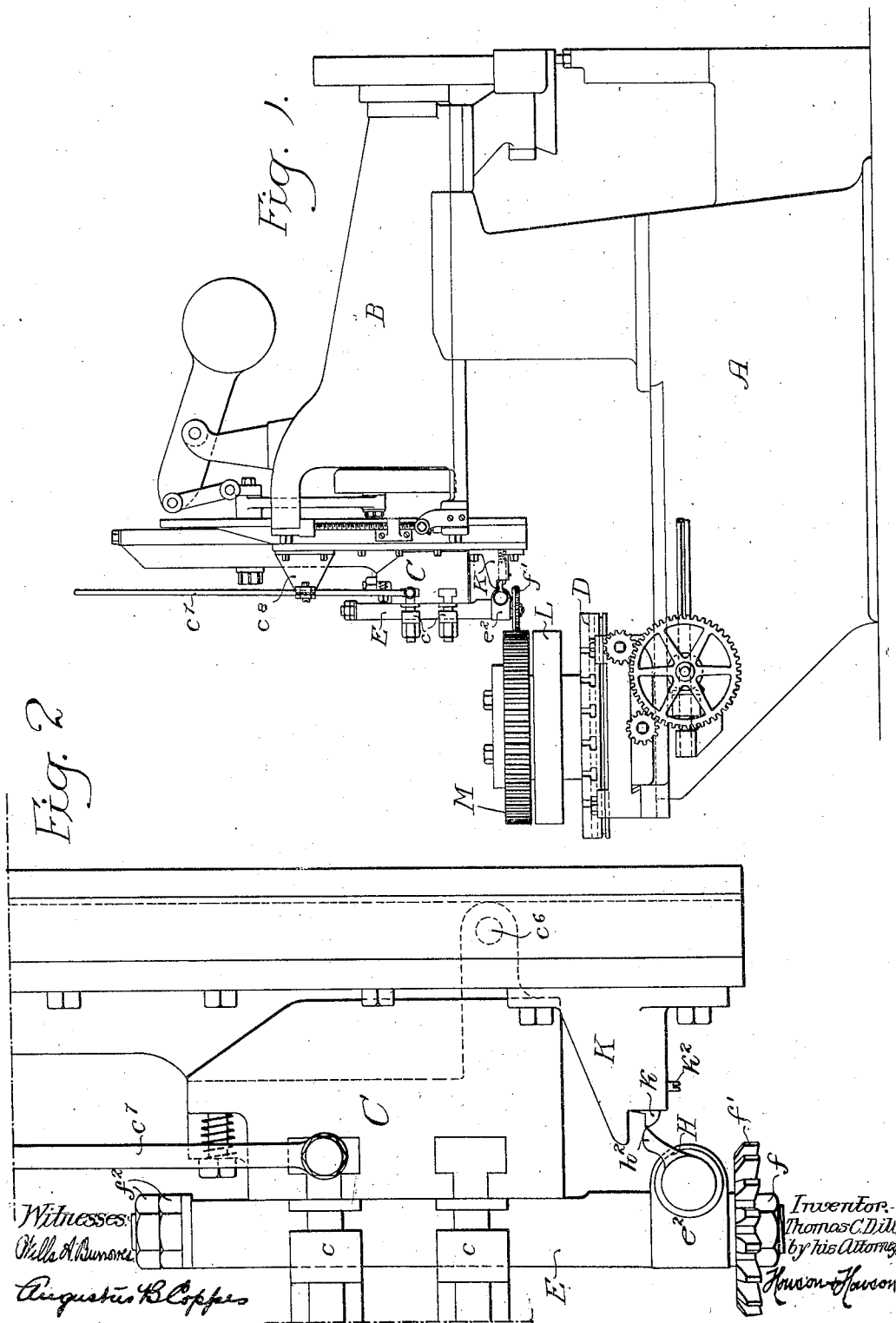


T. C. DILL.
 GEAR CUTTING MACHINE.
 APPLICATION FILED SEPT. 16, 1908.

938,304.

Patented Oct. 26, 1909.
 2 SHEETS—SHEET 1.



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2 SHEETS—SHEET 2.

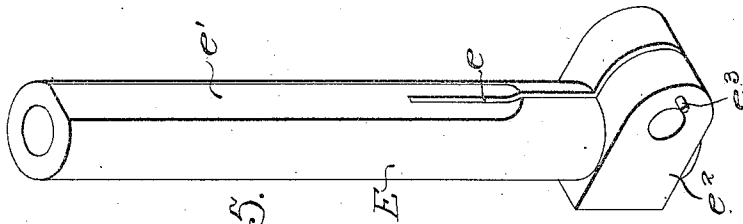


Fig. 5.

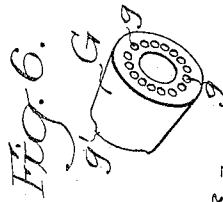


Fig. 6.

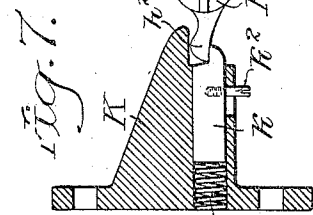


Fig. 7.

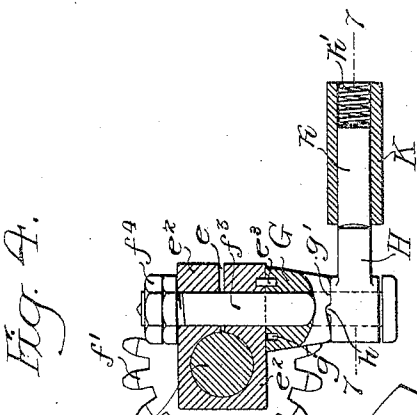


Fig. 4.

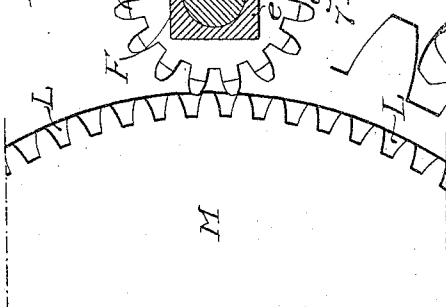


Fig. 9.

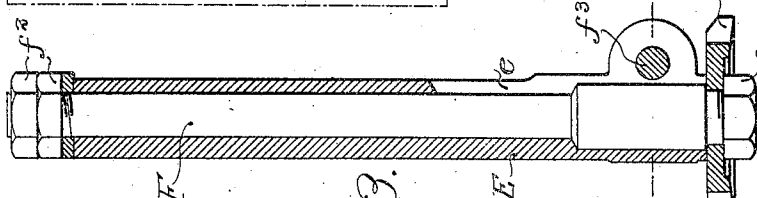


Fig. 3.

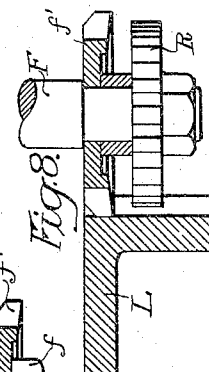
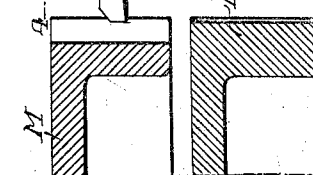


Fig. 8.



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UNITED STATES PATENT OFFICE.

THOMAS C. DILL, OF PHILADELPHIA, PENNSYLVANIA.

GEAR-CUTTING MACHINE.

938,304.

Specification of Letters Patent.

Patented Oct. 26, 1909.

Application filed September 16, 1903. Serial No. 453,296.

To all whom it may concern:

Be it known that I, THOMAS C. DILL, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain improvements in Gear-Cutting Machines, of which the following is a specification.

One object of my invention is to provide a machine tool of improved construction for cutting gears as well as other structures, which shall be relatively simple in construction as well as reliable and accurate in operation.

Another object of the invention is to provide a device which may be employed in connection with any of the well known forms of slotters whereby these latter may be rendered available for use in cutting gear teeth, etc., it being especially desired that the device shall be relatively inexpensive as well as uncomplicated and substantial.

These objects and other advantageous ends I secure as hereinafter set forth, reference being had to the accompanying drawings, in which:—

Figure 1, is a side elevation of the machine constructed according to my invention;—Fig. 2, is a side elevation on an enlarged scale, illustrating certain of the detail features of the tool-carrying head; Fig. 3, is a vertical section of the cutting tool employed in connection with my invention, and illustrating it as co-acting with a master gear in order that it shall properly operate upon a blank to be cut; Fig. 4, is a plan, partly in horizontal section, taken on the line 4—4, Fig. 3; Fig. 5, is a perspective view of the tool post; Fig. 6, is a perspective view of the cam structure employed as part of my invention; Fig. 7, is a vertical section on the line 7—7, Fig. 4, and Figs. 8 and 9 are respectively a side elevation partly in section, and a fragmentary plan illustrating a modified form of my invention.

In the above drawings A represents the base or main structure of a slotter which is preferably though not necessarily of the construction described and claimed in my Patent No. 776,501, dated December 6, 1904. This particular machine is provided with a horizontally adjustable head B upon which is mounted the reciprocable tool-carrying ram C, while in addition said base is provided with a work supporting table D which is not only horizontally adjustable in two

directions at right angles to each other but is also rotatable about a vertical axis.

I have not illustrated the detail mechanisms for operating the ram or the work supporting table, inasmuch as these are well known to the art and in themselves form no part of my present invention.

In the present instance the ram C, as shown in Figs. 1 and 2, has rigidly held to it by means of clamps *c* a vertically mounted tool post E, which is tubular and enlarged at its lower end; it being split or vertically slotted at *e* as shown in Figs. 3 and 5. Further, it is provided with a plane portion *e'* which is designed to fit against the flat face of the ram C so that when it is finally clamped in position it can by no possibility have any turning movement. Extending through this post is a tool spindle F enlarged at the lower end and having connected to it by a nut *f* a cutting tool *f'* made to have the general outline of a gear and provided with teeth of such number and dimension as may be required by the work to be performed. Said spindle is held to the post by means of a nut or nuts *f''* at its upper end, and while free to turn in the tool post, may be clamped by means of a bolt *f'''* so as to be rigidly connected thereto. This latter extends through the enlarged lower end *e''* of the tool post, and I provide means whereby the slotted portions of the lower end of this post may be drawn together to grip the spindle F to prevent it from turning. For this purpose I employ in the present instance a collar G mounted upon the bolt *f'''* and having in its face adjacent to the face of the end *e''* a series of holes *g* concentric with said bolt *f'''*.

The outer face of the collar G is provided with a plurality of cams *g'* and there is mounted upon the bolt *f'''* an arm H having on its hub a number of projections *h* designed to co-act with the inclined cam faces *g'* on the collar G. As shown in Fig. 4, the bolt *f'''* has a head between which and the enlarged end *e''* of the tool post the hub of the arm H and the collar G are confined, and is moreover provided at its opposite end with a pair of nuts *f''* whereby it may be held in any adjusted position to the tool post. The arm H is of such a length that it is capable of engagement with a structure K mounted upon the stationary portion of the head B of the slotter. This structure, as shown in Fig. 110

7, is provided with a longitudinally movable latch bolt k normally held outward by a spring k' to a distance determined by a pin k^2 . The end of said latch bolt k is partially cut away and is curved to co-act with the curved end h^2 of the arm H so that when said arm is moved upwardly, its curved end strikes the similarly curved end of the latch bolt k and causes this to move longitudinally without being itself caused to turn on the bolt f^3 until it strikes the overhanging portion of the structure K. When the arm H is moved downwardly its end strikes the projecting end of the latch bolt k , but being unable to pass it, is therefore turned through a considerable arc on the bolt f^3 into the position shown in Fig. 2.

With the above arrangement of parts I mount upon the work table a circular blank or disk L in which it is desired to cut gear teeth, or other forms, while immediately above and concentric with it I mount a master gear M. The ram of the slotter is now caused to be vertically reciprocated by the operation of the well known mechanism and the work table D is fed toward the cutting tool f' ; the stroke of the ram being so adjusted that the said tool at the upper end of its stroke meshes with the teeth of the master gear, and at the lower end thereof pauses below the blank operated on. The tool therefore begins a cut in the blank immediately under and in line with a space between two adjacent teeth of the master gear. I next start the mechanism for rotating the work table so that this latter is given a fraction of a turn while the tool is in engagement with the teeth of the master gear, and in order that said tool may be free to turn when the master gear is thus turned, and yet may be rigidly held while making a cut in the blank, I so adjust the bolt f^3 and its co-acting parts e^2 , G and H that when the arm H is in the position shown in Fig. 2, the projections h on the hub thereof are at the tops or highest portion of the cam faces g' on the collar G, with the result that these two parts act upon the bolt f^3 to cause it to draw together the two halves of the slotted end portion of the tool post E, thereby making it grip and rigidly hold the spindle F with the tool f' . As a consequence, said tool cannot turn during the downward stroke of the ram C.

Toward the end of the upward movement of the ram, the arm H first strikes the latch bolt k and moves it longitudinally against the action of the spring k' as above described, and then engages the overhanging part of the structure K, so that it is moved to bring its projections h opposite the low portions of the cam faces g' and thereby permits the two halves of the lower end of the tool post E to spring apart, thus releasing the tool spindle F. The subsequent par-

tial turning of the master gear M then gives a partial revolution to the tool and its spindle, which is immediately thereafter again clamped to the tool post by the engagement of the arm H with the end of the latch bolt k at the beginning of the downward stroke of the ram. The partial turning of the master gear with the blank thus brings successive uncut portions of said blank under the tool and the above described series of operations is repeated until one complete revolution of the work table has been made. This latter is then fed toward the tool so as to permit the teeth of the cutter f' to more deeply engage with the teeth of the master gear:—the operation being repeated after each revolution of said gear until finally teeth are cut in the blank in exact correspondence with those of the master gear M.

As is customary in some forms of slotting machines, the ram C has a rod c' pivoted to its upper portion and frictionally engaging a bearing in a standard c^3 which is fixed to the head B of the slotter. In addition, the tool-carrying portion of the ram is pivoted to the main part thereof so that it is turned on its pivot throughout its upward stroke into such a position that the cutting tool will clear the work operated on. Immediately upon the beginning of the downward stroke this pivoted head is restored to its normal position in which it remains during the remainder of the cut.

In Figs. 8 and 9 I have illustrated a modified form of my invention, in which in place of a master gear or form mounted concentrically with the blank to be cut or otherwise carried on the rotary work table, I have provided a guide form R mounted on a spindle F concentric with the cutting tool f' . The arrangement is such that this guide form R at all times remains in engagement with the partially cut teeth of the blank or at least is in such engagement while the cutting tool does not engage the blank. The construction of said guide form is such that its tooth shaped projections r transmit movement from the rotary work supporting table to the toothed spindle and tool when this latter is out of engagement with the blank, so that, as before, the tool is free to be turned while it is at the upper end of its stroke out of engagement with the blank, and is immediately thereafter rigidly clamped before it begins its cut. It will be understood that the tooth shaped projections r are so shaped and of such dimensions as to transmit the proper amount of movement to the tool and thereby cause it to properly cut teeth of the desired character and dimensions on the blank.

I claim:

1. A cutting machine consisting of a table for the support of a blank, a master form, a tool head, and a cutting tool for operating

on the blank carried by said table, with means for moving the tool head to cause the tool to alternately engage the master form and the blank.

5 2. A cutting machine consisting of a rotary table for the support of a blank, a master form mounted concentrically with the blank, a reciprocable tool head, a cutting tool mounted to be guided by the master
10 form and capable of operating on said blank.

3. A cutting machine consisting of a rotary work table for supporting a blank, a master form, and a reciprocable slotting head having a cutting tool placed to be
15 guided by the master form and arranged to alternately engage said form and the blank.

4. A cutting machine consisting of a work table for supporting a blank and having a master form mounted on it, a reciprocable
20 slotting head having a cutting tool arranged to alternately engage the master form and the blank, with means capable of permitting rotation of the tool while it is engaged with the master form, and preventing such rota-
25 tion while it is operating on the blank.

5. The combination with a machine having a reciprocable head, a multiple point tool carried thereon, means for automatically clamping and releasing said tool to
30 prevent its rotation at certain parts of its stroke and to permit it at others, with a work table for carrying a blank, and a master form meshing with the points of the tool.

6. The combination in a cutting machine
35 of a table for supporting a blank to be cut, a master form having means for supporting it concentrically with the blank, a reciprocable head, a tool spindle movably mounted thereon, a tool on said spindle capable of
40 being guided by the master form, and means for periodically clamping said tool spindle to prevent movement of the tool, the same including an arm on the reciprocable head and a projection on the fixed portion
45 of the machine placed to periodically engage said arm.

7. The combination in a cutting machine of a work table for supporting a blank, a master form, a reciprocable head having a
50 tubular tool post, a revoluble spindle in said

tool post having a cutting tool capable of being guided from the master form, means for clamping the tool post to the tool spindle, the same including a bolt, a cam structure thereon, an arm having a portion co-acting
55 with the cam structure, and a projection mounted on the frame of the machine so as to periodically engage the arm to operate the cam.

8. The combination in a cutting machine
60 of a work supporting table having a master form, a reciprocable head having a cutting tool arranged to co-act with said form, means for periodically clamping and releasing said tool to permit of its movement, the
65 same including a cam structure, an arm co-operating with the cam structure to operate the clamping means, and a device mounted upon the frame of the machine so as to co-operate with said arm, said device having
70 a spring pressed latch arranged to cause turning of the arm when the latter is moved in one direction and capable of yielding without causing turning of the arm when the latter is moved in an opposite direction.
75

9. The combination in a gear cutting machine of a rotary work supporting table having means for holding a blank, a master gear mounted on the table concentric with the blank, a reciprocable head having fixed to
80 it a tubular tool post, a spindle revolubly mounted in said tool post, and having a gear shaped cutting tool at its lower end capable of meshing with the teeth of the master gear, the lower end of the tool post being
85 slotted and having a transverse bolt, a cam structure and an arm mounted on said bolt, said arm having portions coöperating with said cam structure, with a device mounted upon the frame of the machine for period-
90 ically engaging and turning said arm to co-operate with the cam.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

THOMAS C. DILL.

Witnesses:

WILLIAM E. BRADLEY,
JOS. H. KLEIN.