No. 630,081. Patented Aug. 1, 1899.

H. S. BROWN.

REMOVABLE TOOTH MILLING CUTTER.

(No Model.) (Application filed Apr. 25, 1899.)

FIG. 9.

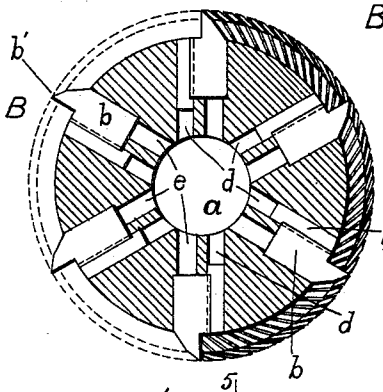


FIG. 8.

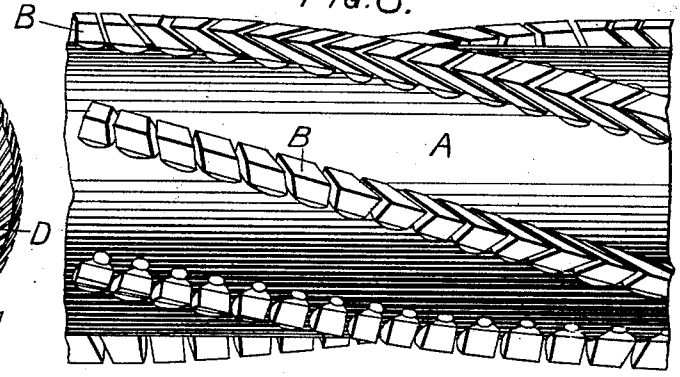


FIG. 4.

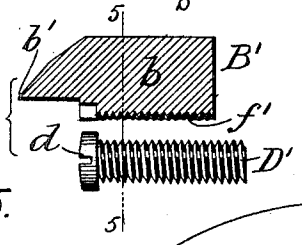


FIG. 7.

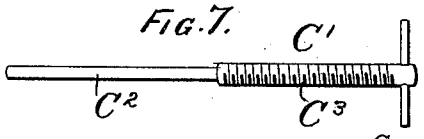


FIG. 5.

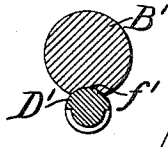


FIG. 1.

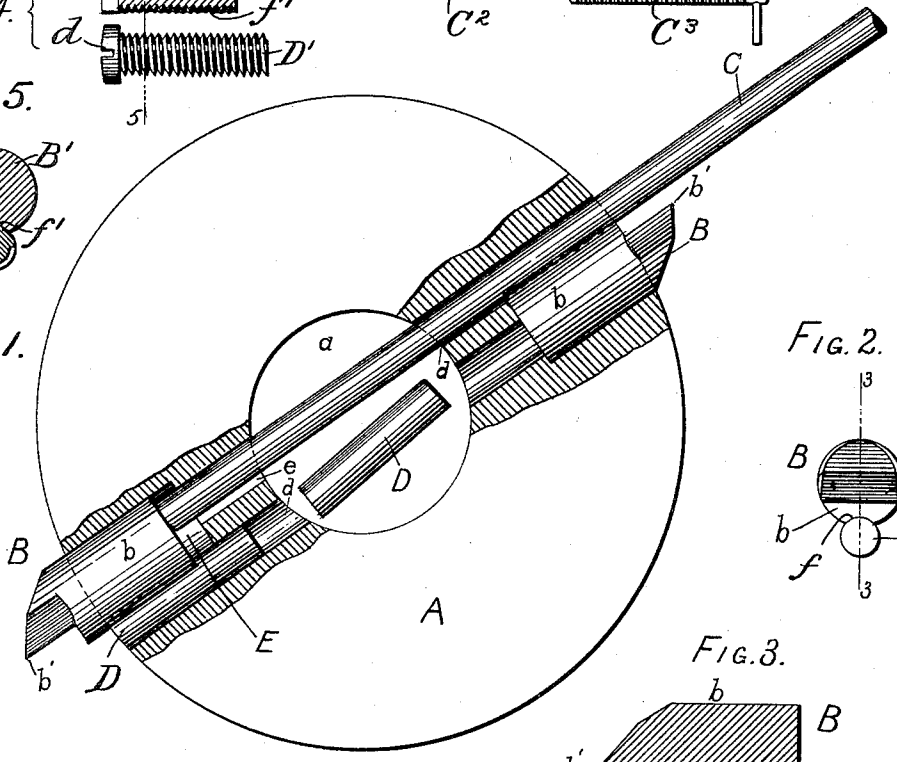


FIG. 2.

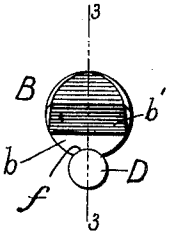


FIG. 3.

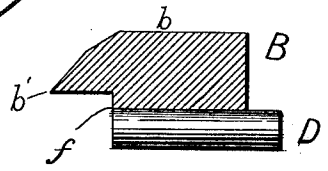
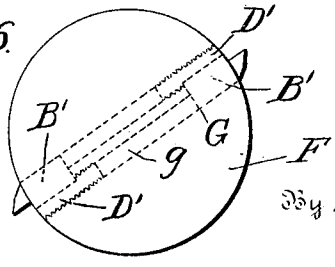


FIG. 6.



Witnesses
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By his Attorney
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UNITED STATES PATENT OFFICE.

HENRY SMITH BROWN, OF EASTON, PENNSYLVANIA.

REMOVABLE-TOOTH MILLING-CUTTER.

SPECIFICATION forming part of Letters Patent No. 630,081, dated August 1, 1899.

Application filed April 25, 1899. Serial No. 714,365. (No model.)

To all whom it may concern:

Be it known that I, HENRY SMITH BROWN, a citizen of the United States of America, and a resident of the city of Easton, county of Northampton, State of Pennsylvania, have invented certain new and useful Improvements in Removable-Tooth Milling-Cutters, of which the following is a specification.

My invention relates to milling-cutters, and comprises a cutter for milling or analogous machines which is provided with teeth which, while securely held in operative position, may yet be removed when desired—as, for instance, where a portion of such a tool has been damaged. By the employment of my invention it will be possible to replace the broken part and to so avoid the expense and wear which would follow were the whole instrument cut down into symmetry with the injured portion. In the drawings is shown a milling-cutter in which the teeth are arranged spirally upon a cylinder. With this construction the grooves which will be left by the interstices between the teeth will be removed by the succeeding teeth, making a smooth cut. The invention is not, however, limited to any particular form of cutter and may be used wherever applicable.

In the drawings, Figure 1 is an end view, partly in section, showing a milling-cutter with two teeth and also illustrating the method of removal. Fig. 2 is an end view of one of the teeth and its locking device. Fig. 3 is a section on the line 3 3, Fig. 2, the key being in full lines. Fig. 4 is a view similar to Fig. 3, except that the key and keyway are screw-threaded. Fig. 5 is a section on the line 5 5, Fig. 4. Fig. 6 is an end view on reduced scale, showing a milling-cutter without a central opening and indicating in dotted lines the positions of the tooth-sockets and keyways therein and also the use of screw-threaded keys. Fig. 7 is a detail view showing a screw-threaded tool for removing the teeth. Fig. 8 is a view in elevation, showing a cylindrical cutter to which the invention has been applied, and Fig. 9 is an end view of the cutter shown in Fig. 4.

As indicated in the drawings, Fig. 1, A is the body of a cutter, made of metal. B B are removable teeth on the opposite sides of the periphery thereof. C is a rod for driving out the teeth, and D D are locking pins or keys.

The teeth B comprise body portions *b*, which are desirably cylindrical in form, although this is not essential, and they may be made of angular form, if desired, the advantage of the cylindrical form being that the receiving-sockets can be produced by simple drilling or coring in the foundry if the body is of cast metal. The outer end of each tooth is formed with a cutting edge *b'* such as may be desired and a depression or keyway *f* for locking it in operative position. The teeth B are inserted into sockets E, formed in the periphery of the cutter or body A in the desired positions, and the bottoms of the sockets E are formed with a shoulder, so that the bodies *b* of the teeth will fit down and seat squarely against the bottoms of the said sockets, where they should be held as firmly as is consistent with removal. In the body A, parallel with and extending partly into the socket E, is formed a way *d* for the key D, which is driven down into its way *d* and at the same time engages the depression formed in the front or, it may be, in the side or back of the body of the tooth to receive it. The center of the cutter A, as shown, is hollow; but this is not essential so far as my invention is concerned. As shown in the drawings, an opening *e* of less diameter than the socket E is formed from the bottom of the socket into the central space *a* in the cutter, and the opening *e* is in line with the opening *d* on the opposite side of the tool, which normally contains the key for the tooth upon the opposite side.

The teeth upon the cutter are therefore arranged so that while their cutting edges are substantially upon the same axial line the opening in the base of the socket of one tooth is in line with the keyway of the locking device of the corresponding tooth upon the opposite side of the cutter, and the body A of said cutter may, so far as this is concerned, be hollow or solid. With this construction I am enabled to fit my removable teeth tightly into sockets which afford ample support, securing them and preventing them from turning therein by pins or screws, which are preferably arranged upon their front sides so as to give the full unbroken support to the back

of the tooth, making it practically as strong as though integral with its support.

In Figs. 1, 2, 3, 8, and 9 the locking pins or keys D are shown as short smooth pins of substantially even diameter throughout. These pins engage an equally smooth keyway, so that when it is desired to remove them they are driven through the keyway, as will appear. In Figs. 4 and 5 I have, however, shown the locking-pin in the form of a screw, and with this construction the keyway is screw-threaded, as is also that portion of the tooth—the depression—adjacent to and forming part of the keyway, and in referring to locking pins or keys it must be understood that both the plain and the screw-threaded keys are included, and, furthermore, I may use a screw with a head or one without. I also contemplate screw-threading the keyway from end to end, so that the screw-threaded key of one tooth might be driven through to eject the tooth in the opposite side, although for this purpose I prefer to use the tool shown in Fig. 7 after the key D′ has been removed. The said tool C′ has a smooth shank C^2 and is screw-threaded at its upper portion C^3 to register with the screw-threads in the keyway, by engaging which it can, when turned, be forced through the keyway in the body of the cutter to engage and eject the tooth on the opposite side.

As indicated in Fig. 6, the body F of the cutter may be solid, thereby differing from the usual form, which is indicated in Fig. 1. The tooth-sockets G and the keyway *g* are arranged in precisely the same relation as already described, the only difference being that the keyways are in the form of continuous passages by reason of the cutter-head being solid. I also illustrate in this figure the screw-threaded keyway *g*, which may in some instances be preferred, and with which I use a screw-threaded key D′ instead of the smooth pins D. Having a screw-threaded keyway, I can then use the tool C′, having a screw-threaded rear portion and a slightly-contracted front end, or the plain rod C, as preferred.

The method of removing the teeth is simple and sure. When it is desired to remove a tooth, the key of the opposite tooth is first unscrewed and removed or driven into the central opening *a*, when it can be removed, or if the body A of the cutter is solid it may be driven through to the base of the opposite tooth which is to be removed. The rod C or the tool C′ can then be inserted through the opening *d* vacated by the key D or D′ or following the key D and placed through the opening *e* in the base of the socket E of the tooth to be removed, which is then driven outward by force applied to the rod C or to the tool C′.

By the means described even a tightly-fitting tooth can readily be removed, and in order to secure this desired result the openings *e* in the bases of the sockets of the teeth and the ways *d* for the locking-pins of the opposite teeth are arranged in parallel lines in pairs about the cutter, the result of which is a symmetrical construction possessing the highest utility.

Milling-cutters are usually made with a central opening and when of any considerable length they are in the form of a sleeve adapted to fit the spindle of the machine on which they are used. I have referred to the central opening as a convenient means for removing the keys D when driven forward. It will be apparent, however, that an important feature of my invention resides in arranging the opening from the socket of one tooth in line with the keyway of the corresponding tooth on the opposite side of the cutter. Therefore if the cutter-head were a solid piece of metal the only difference between those shown and such a construction would be that the key would be driven by the driving-rod C through the head against the base of the tooth to be removed and would simply act as an extension of the said rod C.

While I have specifically described the construction shown in the drawings in order that the invention may be fully understood, I do not limit myself thereby, since minor modifications and changes in the structure may be made without the exercise of invention in view of the foregoing disclosure.

Having described my invention, what I claim is—

1. A removable-tooth milling-cutter having tooth-sockets on opposite sides of its periphery, an opening into the base of each socket and a keyway adjacent to each socket, the keyway on one side being in line with the opening into the base of the tooth-socket on the opposite side.

2. A removable-tooth milling-cutter having tooth-sockets on opposite sides, openings into the bases of said sockets, keyways for each socket, the keyways and the openings into the bases of the opposite sockets being on parallel lines.

3. A milling-cutter having tooth-sockets on opposite sides of its periphery, a keyway adjacent to each tooth-socket, the keyway of one socket being in line with and communicating with the opening in the base of the opposite tooth-socket.

4. A milling-cutter having sockets on opposite sides of its periphery, an opening on the side of each tooth-socket for the reception of a locking-key and an opening in the base of each socket, the opening in the base of the socket being in the same axial line as the opening for the locking-key of the opposite tooth.

5. A cutter-head having an opening through its center, a series of peripheral sockets, each socket having an opening connecting with the central opening but of less diameter than the socket, a series of smaller openings adjoining and opening into the sockets and into the central opening, removable teeth adapted to be contained within the sockets, and locking-pins adapted to be driven into the open-

ings adjoining the sockets and to engage the inserted teeth, said sockets when the pins are removed forming ways for a driving-pin adapted to pass through the opening of the locking-pin on one side of the head through the central space and through the opening into the opposite tooth-socket to drive out the teeth.

6. A removable-tooth milling-cutter formed with a central axial opening, peripheral tooth-sockets formed radially upon the periphery of said head, each socket having an opening of less diameter connecting with the central opening, a corresponding series of smaller openings or keyways adjacent to the tooth-sockets and connected therewith, each set of smaller openings being opposite to the opening into the base of the socket upon the opposite side of the head, removable teeth adapted to be inserted in the sockets, each provided with a groove upon one side, a series of locking-pins adapted to be inserted in the keyways and to engage the teeth, said pins being adapted to be driven through their keyways toward the center by a driving-pin adapted to be inserted in the keyway to act upon the base of the opposite tooth.

Signed by me at Easton, Pennsylvania, this 22d day of April, 1899.

HENRY SMITH BROWN.

Witnesses:
H. R. FEHR,
M. F. WOLFE.