J. A. EDEN, Jr.

BROACH.

APPLICATION FILED MAY 16, 1917.

1,275,006.

Patented Aug. 6, 1918.

3 SHEETS—SHEET 1.

Fig. 1.
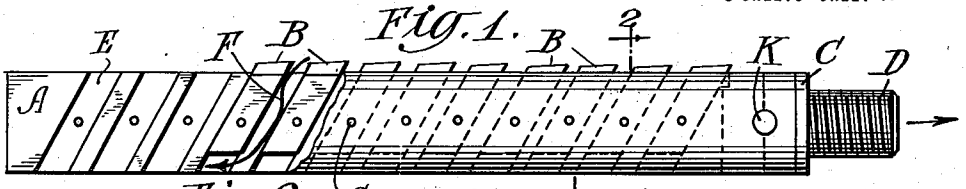



Fig. 2

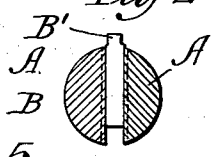



Fig. 4

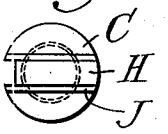



Fig. 3.

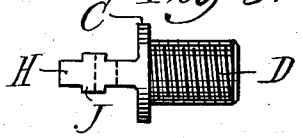



Fig. 5.

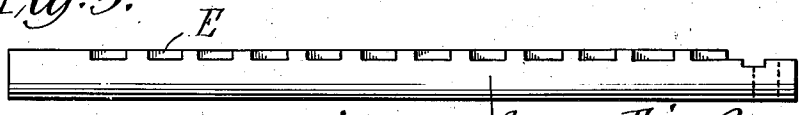



Fig. 6.

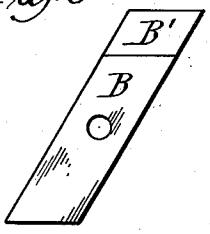



Fig. 7

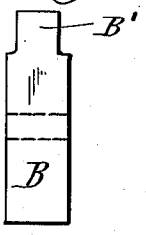



Fig. 8.

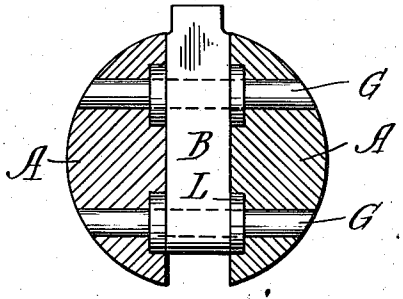



Fig. 10

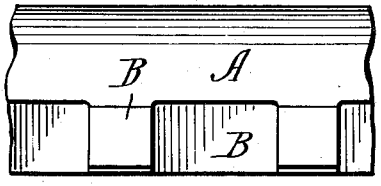



Fig. 9.

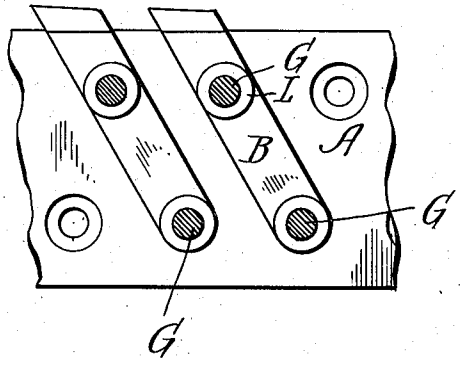
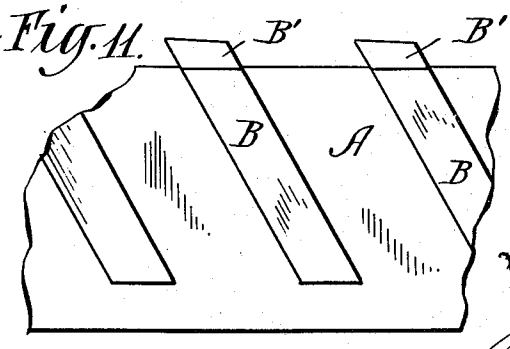



Fig. 11.




Inventor

James A. Eden, Jr.,

By Attorney

J. Anthony Ulina

J. A. EDEN, JR.

BROACH.

APPLICATION FILED MAY 16, 1917.

1,275,006.

Patented Aug. 6, 1918.

3 SHEETS—SHEET 2.

Fig. 12.

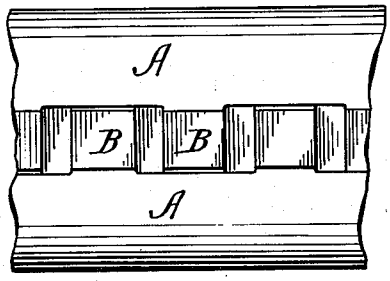



Fig. 13.

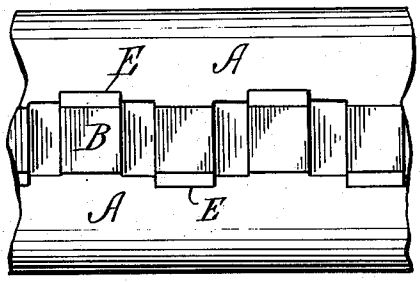



Fig. 14.

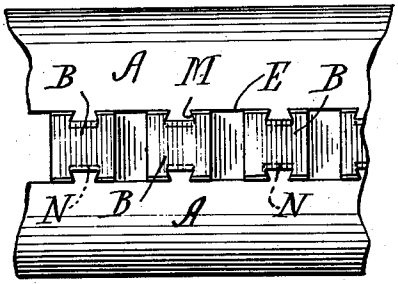



Fig. 15.

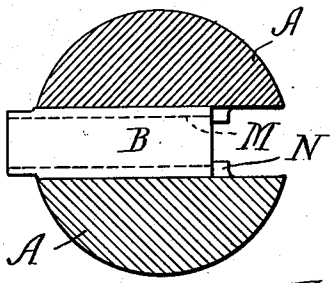



Fig. 16.

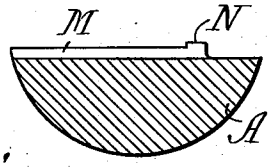



Fig. 17.

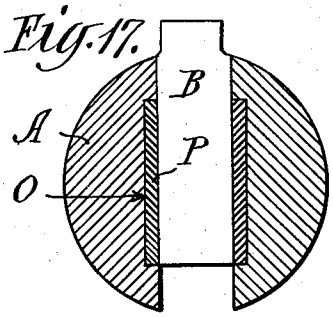



Fig. 18.

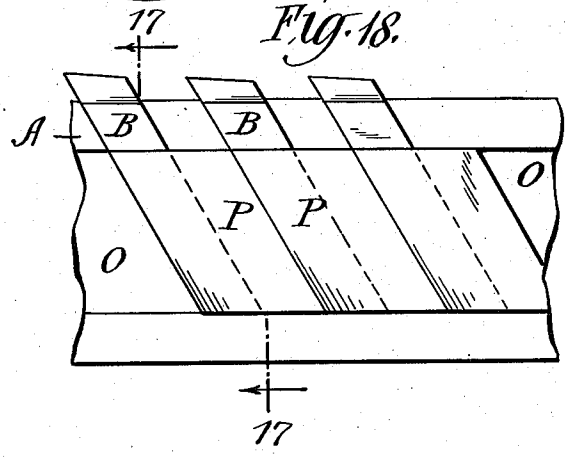
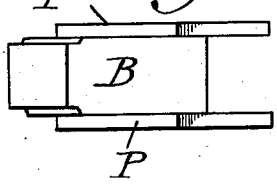



Fig. 19.




Inventor

James A. Eden, Jr.,

By Attorney

Anthony Ittner

J. A. EDEN, Jr.

BROACH.

APPLICATION FILED MAY 16, 1917.

1,275,006. Patented Aug. 6, 1918.

3 SHEETS—SHEET 3.

Fig. 20.

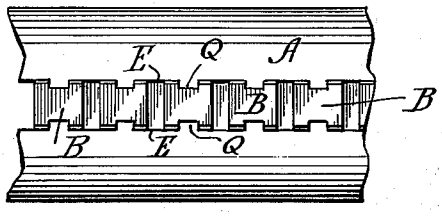



Fig. 21.

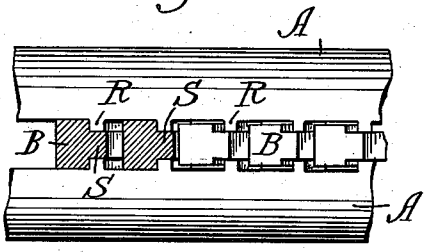



Fig. 23

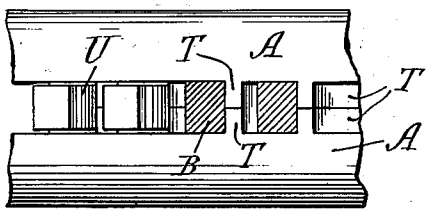



Fig. 22

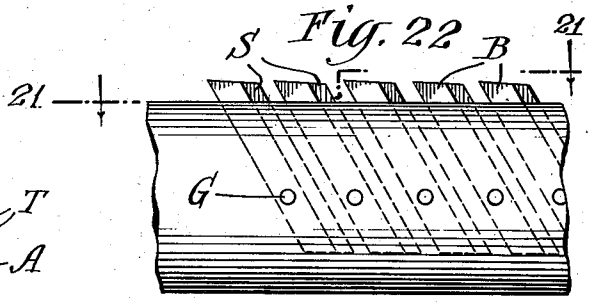



Fig. 24.

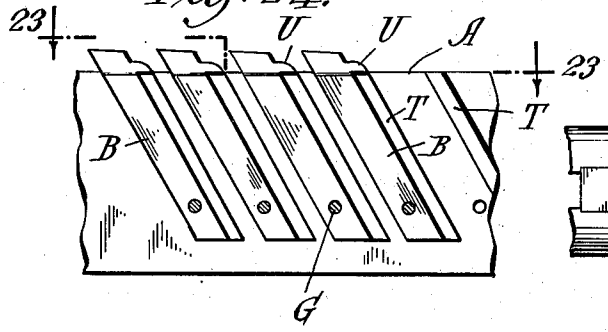
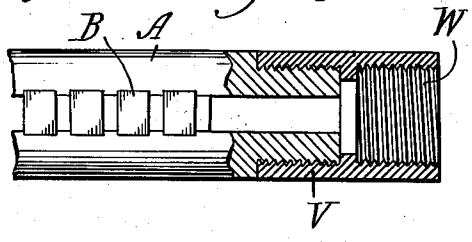



Fig. 25.




Inventor

James A. Eden, Jr.,

By Attorney

D. Anthony Usina

# UNITED STATES PATENT OFFICE.

JAMES A. EDEN, JR., OF SPRINGFIELD, MASSACHUSETTS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO JOHN OAKLEY, OF SPRINGFIELD, MASSACHUSETTS.

## BROACH.

1,275,006. Specification of Letters Patent. Patented Aug. 6, 1918.

Application filed May 16, 1917. Serial No. 168,948.

*To all whom it may concern:*

Be it known that I, JAMES A. EDEN, Jr., a citizen of the United States, residing in Springfield, Massachusetts, have invented certain new and useful Improvements in Broaches, of which the following is a specification.

My invention aims to provide a broach which shall be more easily operated and more durable than previous broaches and which shall have further advantages referred to in detail hereinafter.

The accompanying drawings illustrate embodiments of the invention.

Figure 1 is a side elevation of a broach, partly broken away;

Fig. 2 is a section of the same on the line 2—2 of Fig. 1;

Figs. 3 and 4 respectively are a plan and end view of the pulling head;

Fig. 5 is a plan of one of the side members;

Figs. 6 and 7 are respectively a side elevation and face elevation of one of the teeth of Fig. 1;

Fig. 8 is a cross section and Fig. 9 a longitudinal section of another style of construction;

Fig. 10 is a plan of one of the halves of another style of construction and Fig. 11 is a side elevation of the same;

Fig. 12 is a plan of a portion of a completed broach made up of parts like Fig. 10;

Fig. 13 is a plan of a construction similar to Fig. 12 but with a slight modification;

Fig. 14 is a plan of a still further modified construction;

Fig. 15 is a transverse section of Fig. 14;

Fig. 16 is a separated view of one of the side members of Fig. 15;

Fig. 17 is a cross section of another modification, taken on the line 17—17 of Fig. 18, and Fig. 18 is a side elevation of the cutters in place against one of the side members;

Fig. 19 is a plan of one of the cutters of Figs. 17 and 18;

Figs. 20 and 21 are plans of other modifications; Fig. 21 being partly in section on the line 21—21 of Fig. 22;

Fig. 22 is a side elevation of the construction of Fig. 21;

Fig. 23 is a plan of another modification, and Fig. 24 is a side elevation of the cutters of Fig. 23 in place; some of the cutters in Fig. 23 being shown in section on the line 23—23 of Fig. 24;

Fig. 25 is a plan partly in longitudinal section of a modified style of end piece for attaching a puller to the broach.

The invention, in its principal features of novelty, is applicable to broaches of various old styles. But the designs shown are of the style described in Oakley Patent No. 1,121,126 of December 15, 1914 in which there is a longitudinal passage open along one side of the broach and communicating with lateral passages between the cutters located at the opposite side of the broach, and the invention is preferably used in this form.

Referring to the embodiments of the invention illustrated, and first to Figs. 1 to 7 inclusive, the broach comprises two side members A with teeth B between them the ends of which constitute cutters of the usual or any suitable size and inclination. The parts are mounted on a head C carrying an externally threaded end D adapted to be fastened to the usual puller for pulling the broach through the work. The side members A are provided with grooves E shaped and directed to embrace the teeth B. The latter extend downward to a point slightly above the lower edges of the side members so as to leave a clear longitudinal passage for the chips which will move down between the teeth and curling forward will strike the rear face of the forward tooth and be deflected and pass out roughly in the direction of the arrow F. The teeth are preferably fastened against longitudinal movement in their grooves by means of pins or rivets G. The exposed end of each tooth B is reduced in width as indicated at B′ (Fig. 2) so as to cut a chip or shaving which will be of less width than the passage through the broach and will move easily through such passage.

The head or end member C is fastened to the side members in a manner similar to the teeth. It has an extension H which lies between the side members, with a vertical rib J on its side entering corresponding grooves in the side members, and a pin or rivet K holds the parts together.

Referring to Figs. 8 and 9, the teeth B are formed with lateral bosses L which fit within similar sockets in the inside face of the side members, and a pair of pins G (or a

single pin through either of the bosses would be sufficient for most work) is used for fastening each of the teeth in place. The side members A in this case can be cheaply made by a simple counter-boring operation.

The making of the teeth separate from the side members has the advantage that the teeth can be made of a higher grade of steel or a grade which is better adapted for cutting, while the side members can be made of a tougher steel better adapted to resist the pulling strain and not so brittle as the tool steel used for the teeth. It has also the advantage that if a single tooth is broken or damaged it can be replaced without scrapping any of the other parts, and all the teeth when worn out may be replaced by new ones, using the same side members. But the invention may also be embodied in a construction in which the teeth are not formed separately from the side members.

Figs. 10, 11 and 12 show side members A with teeth B formed integrally on the inner faces thereof. Each side is, preferably, formed with one half of the total number of teeth, the teeth on one side being staggered with relation to those on the other side when the parts are assembled as in Fig. 12. The two members may be fastened together by means of pins as in Fig. 1, or such fastenings may be omitted, the parts being embraced and held together as they pass through the hole in the work piece which is being broached. The two halves in this case would be made of high grade or tool steel such as is used for the separate teeth in the other constructions described. This construction simplifies the manufacture of the broach.

For maintaining the two halves more rigidly in correct relation to each other, they may be made as in Fig. 13, the teeth B being wider than the space between the side members and their free side edges fitting within grooves E on the opposite side member.

Figs. 14, 15 and 16 illustrate another way of holding the teeth in place and at the same time holding them in engagement with the opposite side members. Each side member is formed with grooves E having undercut shoulders M at their edges which engage similarly shaped overhanging portions of the teeth B. Also the side members A are formed with lugs N on their inner faces against which the lower ends of the teeth bear.

Figs. 17, 18 and 19 illustrate a design which simplifies the construction of the side members, the teeth being provided with projections which hold them in place. The side members A are formed with continuous longitudinal rectangular grooves O on their inner faces. Each tooth B is provided on each of its side faces with a wing P fitting in the groove O of the adjacent side member. The wings P are of such a width (see Fig. 18) that each wing extends backward beyond the body of the tooth B until its rear edge engages the forward edge of the contiguous wing of the next tooth, so that when they are assembled each tooth is held from backward movement by bearing with its wings against the wings of the tooth immediately behind it. The side members in this case are made by a simple slot milling operation. A stop of course is necessary at the back end of the broach to prevent the teeth from backward movement relative to the side members.

Fig. 20 shows a construction similar to Fig. 14 except that there is a rectangular, instead of an overhanging, engagement of the teeth B with the grooves E, or rather with the ribs Q on the inner faces of the side members A.

In Figs. 21 and 22 the backs of the teeth B bear against ribs R on the inner faces of the side members A, pins G being used for holding the parts together. Each tooth has a rearwardly extending tail S extending backward beyond the adjacent ribs R, so that a chip passing down between the teeth will bear against such tails S, which are of harder material generally than the side members and will resist longer the abrasive effect of the passing chips. It is generally preferable to use a construction in which the chip will pass between faces of hard steel, for the reason stated.

In Figs. 23 and 24, the teeth B bear against ribs T formed on the inner faces of the side members A and the ribs T are of such depth as to meet across the intervening space. This sacrifices the advantage above referred to of a hard metal face to receive the abrasion of the passing chip. But it has the advantage that the two half members may be fastened together by a single rivet or other means without the interposition of the teeth and may be turned to the perfectly cylindrical shape required before inserting the teeth. In the other constructions illustrated, in which the side members do not contact with each other, it is necessary to introduce fillers of the exact width of the teeth, but not projecting, between the side members to hold them accurately spaced while they are being turned to the exact cylindrical size required. In the construction of Figs. 23 and 24 the teeth may be held in place either by means of pins or rivets G as before described, or by means of lugs U on their rear faces adapted to bear on the tops of the ribs T of the side members; or by both means if desired.

Fig. 25 shows a style of puller head differing slightly from that of Fig. 1. The side members A and teeth B being assembled, a sleeve V is screwed on the externally threaded end of the assembled side mem-

bers, being provided with an internal thread W on its free end for attachment to the machine.

Though I have described with great particularity of detail certain specific embodiments of my invention, yet, it is not to be understood therefrom that the invention is restricted to the specific constructions illustrated. Various modifications thereof in detail and in the arrangement and manner of combining these parts may be made by those skilled in the art without departing from the invention as defined in the following claims.

What I claim is:

1. A broach made in a plurality of side members with teeth between them, such side members being segmental in cross section.

2. A broach made in a plurality of side members with teeth between them and having lateral passages extending along the forward faces of said teeth and a longitudinal passage communicating with the rear ends of said lateral passages.

3. A broach comprising longitudinally straight side members and separately formed teeth arranged in a row between said side members, the broach thus formed having interior chip passages which have faces formed by the faces of the teeth.

4. A broach made in a plurality of side members which are segmental in cross-section and have lateral grooves in their inner faces, teeth located in said grooves and means for holding the teeth firmly against movement in said grooves.

5. A broach made in a plurality of side members which are segmental in cross-section and detachably fastened together and teeth held between said side members.

6. A broach made in a plurality of side members which are segmental in cross-section, teeth between said side members, and a pulling head fastened to both side members.

7. A broach having separately formed teeth and having chip passages, which passages have faces formed by the faces of the teeth, said broach having a longitudinal passage communicating with the passages between said teeth.

In witness whereof, I have hereunto signed my name.

JAMES A. EDEN, JR.