

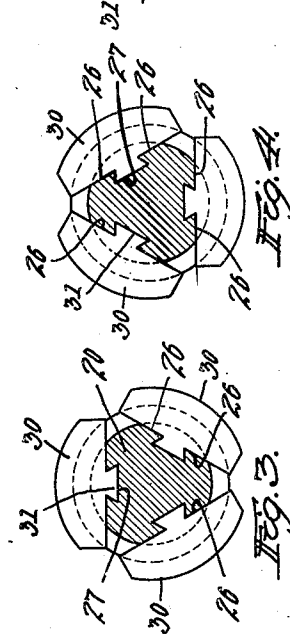
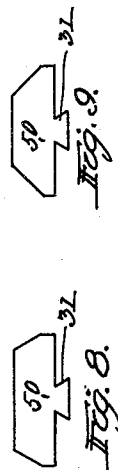
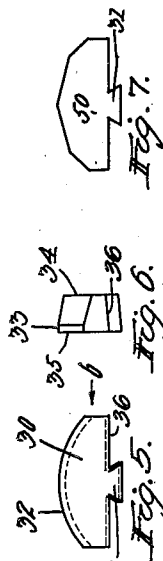
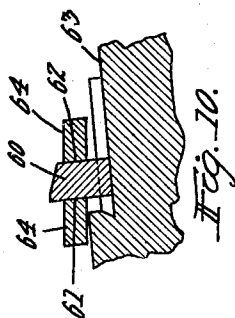
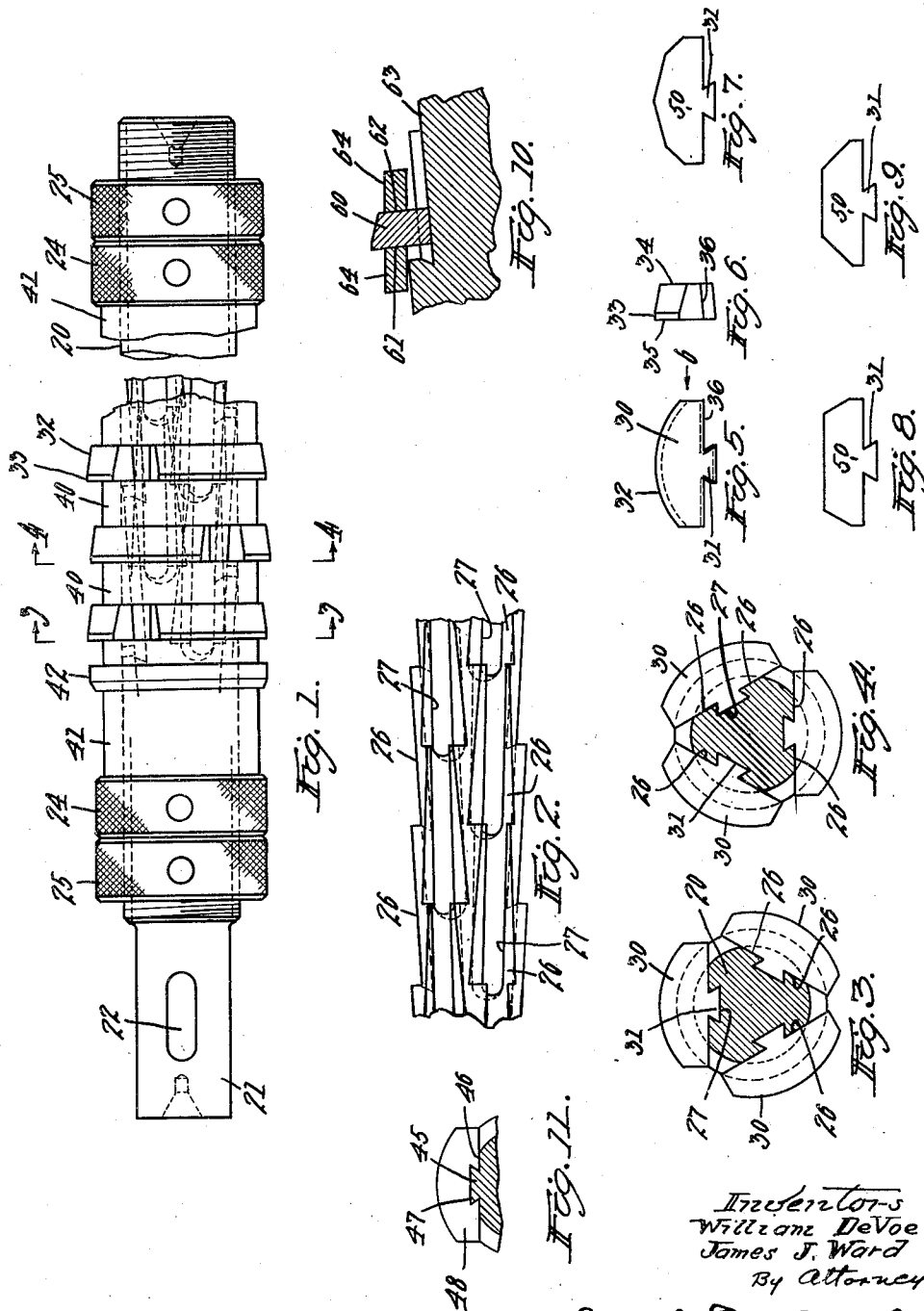
Nov. 27, 1928.

1,692,977

W. DE VOE ET AL

BROACH WITH ADJUSTABLE BROACHING MEMBERS

Filed May 23, 1927



Inventors
William DeVoe
James J. Ward
By Attorneys

Southgate Hay + Hawley

UNITED STATES PATENT OFFICE.

WILLIAM DE VOE, OF WORCESTER, MASSACHUSETTS, AND JAMES J. WARD, OF DETROIT, MICHIGAN, ASSIGNORS TO DETROIT BROACH CORPORATION, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

BROACH WITH ADJUSTABLE BROACHING MEMBERS.

Application filed May 23, 1927. Serial No. 193,467.

This invention relates to a broach such as is used for accurately finishing holes to a desired form and size. Such tools are widely used to finish center holes in cams, gears, collars or sleeves, for providing spiral key-ways, and for many other similar purposes. In the general use of a broach of this nature the cutting elements partake of a substantially longitudinal movement, although in the use of cutting a spiral key-way there will, of course, be a slight rotary movement accompanying the longitudinal movement, that is to say, the general cutting action of the broach is substantially longitudinal, but contains a small proportion of rotational movement.

It is the general object of our invention to provide a broach with a plurality of separate broaching members which may be easily adjusted radially. With this construction, a worn broach may be restored to size by setting the broaching members outward and then grinding their peripheral surfaces again to size, instead of by face grinding the cutting faces of the broach, as is necessary with the usual one-piece broach.

A further object of our invention is to provide an improved construction for securing the broaching members to the supporting body or shaft of the broach, and for simultaneously adjusting said members axially and radially, as and when desired.

Our invention further relates to certain arrangements and combinations of parts which will be hereinafter described and more particularly pointed out in the appended claims.

A preferred form of the invention and certain modifications thereof are shown in the drawings in which

Fig. 1 is a side elevation of one form of our improved broach;

Fig. 2 is a side elevation of a portion of the supporting shaft;

Figs. 3 and 4 are transverse sectional elevations, taken along the lines 3—3 and 4—4 in Fig. 1;

Fig. 5 is a side view of one of the broaching members;

Fig. 6 is an end view thereof;

Figs. 7, 8 and 9 are side views of broaching members for cutting different shaped holes;

Fig. 10 is a detail sectional side elevation, illustrating a modification; and

Fig. 11 is a partial sectional end elevation, showing a further modification.

Referring to the drawings, our improved broach comprises a supporting shaft 20 having an end portion 21 adapted to fit into a broach holder or chuck and having a transverse opening 22 through which a key or stud may be inserted to hold the broach in the holder. Both end portions of the shaft 20 are preferably threaded to receive adjusting nuts 24 and lock nuts 25.

The middle portion of the supporting shaft 20 is provided with a plurality of flat bearing surfaces 26, spaced about the axis of the broach as indicated in Figs. 3 and 4, and each provided with an undercut or dove-tailed guideway or recess 27. The bearing surfaces 26 are inclined with respect to the axis of the broach, the angle shown in the drawings being substantially 10°. This angle is illustrative only and may be increased or decreased in accordance with the work to be performed.

The surfaces 26 are preferably arranged in groups, each of which, as shown in Figs. 3 and 4, comprises three surfaces 26 symmetrically arranged about the axis of the broach. The bearing surfaces of one group preferably overlap the bearing surfaces of the next group, and are positioned axially and angularly substantially midway between the bearing surfaces of the next successive group.

A broaching member 30 is mounted on each bearing surface 26 and is provided with an over hanging or dove-tailed projection 31, fitting the guideway or recess 27. The broach as illustrated in Figs. 1 to 6 is designed for broaching a circular hole, and the outer face 32 of each broaching member 30 preferably forms a segment of a cone with the extreme edge portion 33 substantially cylindrical.

The side faces 34 and 35 of the broaching members are disposed at such an angle to their inner faces 36 that they will be perpendicular to the axis of the broach when in working position. The broaching members 30 are of such circumferential width that the broach members of successive groups overlap at their ends, as shown in Figs. 3

and 4, thus broaching the complete inner surface of the hole to be finished.

In the operation of our improved broach, the broaching members 30 are mounted in the dove-tailed recesses 27, and spacing collars 40 are interposed between successive groups of broaching members. Collars or sleeves 41 of greater length may be used at the ends of the broach to fill up the space not occupied by the broaching members. The collars 41 are engaged by the adjusting nuts 24, which are used to clamp the collars and broaching members firmly together, after which the broaching members may be ground on their outer peripheral surfaces to the desired size of the finished hole.

After a large number of broaching operations have been performed, so that the sharp edges of the broaching members have become dull or worn, the broaching members are adjusted toward the right, as viewed in Fig. 1, by loosening the right hand nut 24 and advancing the left hand nut 24. This will produce axial movement of all of the broaching members, with a corresponding outward or radial movement of said members. When the broaching members have thus been slightly expanded, the broaching members may be again ground on their peripheral faces to restore the size and sharp cutting edges of the broaching members.

It will be noted that the only grinding operation is plain cylindrical grinding and that no face grinding is necessary, as was the case in the old style broaches. This operation of expanding and regrinding will be repeated as often as is necessary, until the broaching members have been moved to the extreme outer ends of the bearing surfaces 26, when they may be removed and replaced by new members at relatively small expense. One or more pilot collars 42 may be used at the entering end of the broach if desired.

While we have indicated the broaching members as arranged in alternate groups of three members each, it will be understood that any other desired number of broaching members may be used, and that they may be variously grouped. It is evident also that our broach may be modified by forming the dove-tailed projections 45 (Fig. 11) on the bearing surfaces 46 and by forming the dove-tailed recesses 47 in the broaching members 48.

While we have shown and described a broach for finishing circular holes, we have indicated in Figs. 7, 8 and 9 that the broach members 50 may be variously shaped, to broach hexagonal or octagonal holes, or holes having any other desired cross section. In a broach of the type designed for cutting keyways, it will be appreciated that the cross-section of the broach member will be suitably shaped.

While the general cutting movement of the

broach is longitudinal with respect to the work-piece it is evident that a small proportion of rotational movement may be introduced if desired or necessary.

In Fig. 10, we have illustrated a further modification in which the broaching members 60 have their side faces 61 and 62 formed perpendicular to the bearing surfaces 63, instead of perpendicular to the axis of the broach. The spacing collars 64 used with such broaching members will be provided with bevelled ends corresponding to the inclination of the surfaces 61 and 62 with respect to the axis of the broach. This form of broaching member provides a natural rake for the cutting face, without the necessity of undercutting the side faces of the broaching members, and is very desirable in many cases.

Having described our invention and the method of using the same, the advantages thereof will be readily apparent. The broaching members may be expanded outwardly and reground to size a great number of times and when entirely worn out may be replaced with broaching members of a different size or outline. A single supporting shaft or broach body may be thus used for broaching a very considerable number of different sizes and shapes of holes by merely changing the broaching members, thus substantially reducing the user's investment, compared with that of maintaining a stock of the old-style, solid broaches.

Having thus described our invention and the advantages thereof, we do not wish to be limited to the details herein disclosed, otherwise than as set forth in the claims, but what we do claim is:

1. An adjustable broach for finishing internal work by relative movement longitudinally thereof, comprising a supporting shaft having a plurality of bearing surfaces spaced apart, both axially and circumferentially, and inclined outwardly with respect to the broach axis, and a separate broaching member seated on each bearing surface and firmly retained in position thereon, said broaching members being adjustable axially of said broach to vary the radial position of their outer circumferential surfaces.

2. An adjustable broach for finishing internal work by relative movement longitudinally thereof, comprising a supporting shaft having a plurality of bearing surfaces spaced apart, both axially and circumferentially, and inclined outwardly with respect to the broach axis, a plurality of broaching members slidably mounted on said bearing surfaces, and means to move said broaching members simultaneously axially on said surfaces to vary the radial position of their outer circumferential surfaces.

3. An adjustable broach for finishing internal work by relative movement longitudinally thereof, comprising a supporting shaft hav-

ing a plurality of bearing surfaces arranged substantially on the periphery thereof and spaced apart, both axially and circumferentially, and inclined outwardly with respect to the broach axis, a plurality of broaching members slidably mounted on said bearing surfaces, said broaching members being located in successive parallel planes along the axis of said broach, and means to secure said broaching members on said bearing surfaces.

4. An adjustable broach for finishing internal work by relative movement longitudinally thereof, comprising a supporting shaft having a plurality of bearing surfaces arranged substantially on the periphery thereof and spaced apart, both axially and circumferentially, and inclined outwardly with respect to the broach axis, a plurality of broaching members slidably mounted on said bearing surfaces, said broaching members being located in successive parallel planes along the axis of said broach and the broaching members in one plane having their ends circumferentially overlapping the ends of the broaching members in each next adjacent plane.

5. An adjustable broach for finishing internal work by relative movement longitudinally thereof, comprising a supporting shaft having a plurality of bearing surfaces spaced apart, both axially and circumferentially, and inclined outwardly with respect to the broach axis, a plurality of broaching members slidably mounted on said bearing surfaces and arranged in circumferential groups, spacing collars separating said groups of broaching members, and means to move all of said collars and members axially to adjust the radial positions of said broaching members.

6. An adjustable broach for finishing internal work by relative movement longitudinally thereof, comprising a supporting shaft having a plurality of bearing surfaces arranged substantially on the periphery thereof and spaced apart, both axially and circumferentially, and inclined outwardly with respect to the broach axis, a plurality of broaching members slidably mounted on said bearing surfaces, spacing collars separating said broaching members, and lock nuts threaded on said supporting shaft and effective to move said collars and said broaching members axially on said shaft to adjust the radial position of said broaching members.

7. An adjustable broach for finishing internal work by relative movement longitudinally thereof, comprising a supporting shaft having a plurality of bearing surfaces arranged substantially on the periphery thereof and spaced apart, both axially and circumferentially, and inclined outwardly with respect to the broach axis, a plurality, of broaching members slidably mounted on said bearing surfaces, each of one set of parts hav-

ing an undercut axially-extended guiding recess and each of the other set of parts having a corresponding overhanging projection fitting therein.

8. An adjustable broach for finishing internal work by relative movement longitudinally thereof, comprising a supporting shaft having a plurality of bearing surfaces arranged substantially on the periphery thereof and spaced apart, both axially and circumferentially, and inclined outwardly with respect to the broach axis, a plurality of broaching members slidably mounted on said bearing surfaces, said shaft having undercut axially-extended guiding recesses formed in said bearing surfaces, and said broaching members having dove-tailed projections fitting said recesses.

9. An adjustable broach for finishing internal work by relative movement longitudinally thereof, comprising a supporting shaft having a plurality of bearing surfaces, arranged substantially on the periphery thereof and each inclined outwardly from the axis of the broach, said surfaces being arranged in axial rows angularly spaced about said shaft, and having each bearing surface in each row displaced axially with respect to the bearing surfaces in the adjacent rows, and broaching members slidably mounted on said bearing surfaces.

10. An adjustable broach for finishing internal work by relative movement longitudinally thereof, comprising a supporting shaft having a plurality of bearing surfaces, arranged substantially on the periphery thereof and each equally inclined outwardly from the axis of the broach, said surfaces being arranged in parallel axial rows equally spaced angularly about said shaft, and having each bearing surface in each row displaced axially with respect to the bearing surfaces in the adjacent rows by substantially half the length of a bearing surface, and broaching members slidably mounted on said bearing surfaces.

11. An adjustable broach for finishing internal work by relative movement longitudinally thereof, comprising a supporting shaft having a plurality of bearing surfaces arranged substantially on the periphery thereof and each equally inclined outwardly from the axis of the broach, said surfaces being arranged in parallel axial rows angularly spaced about said shaft, and having each bearing surface in each row displaced axially with respect to the bearing surfaces in the adjacent rows, broaching members slidably mounted on said bearing surfaces, and arranged in circumferential groups, and means to secure the broaching members in each group to said supporting shaft with their cutting edges in a single plane.

12. An adjustable broach for finishing internal work by relative movement longitudinally thereof, comprising a supporting shaft having a plurality of bearing surfaces arranged substantially on the periphery thereof and each equally inclined outwardly from the axis of the broach, said surfaces being arranged in parallel axial rows angularly spaced about said shaft, and having each bearing surface in each row displaced axially with respect to the bearing surfaces in the adjacent rows, broaching members slidably mounted on said bearing surfaces, and arranged in circumferential groups, and means to secure the broaching members in each group to said supporting shaft with their cutting edges in a single plane.

nally thereof, comprising a supporting shaft having a plurality of bearing surfaces, each equally inclined outwardly from the axis of the broach, said surfaces being arranged in
 5 parallel axial rows equally spaced angularly about said shaft, certain of said bearing surfaces being displaced axially with respect to the other bearing surfaces, broaching members slidably mounted on said bearing surfaces,
 10 certain of said broaching members being displaced axially with respect to the other broaching members, means to prevent outward displacement of said broaching members, and means to move said members simultaneously axially along said broach, thereby
 15 also moving said members radially outward.
 13. An adjustable broach for finishing internal work by relative movement longitudinally thereof, comprising a shaft, having a
 20 plurality of bearing surfaces arranged substantially at the periphery thereof and spaced apart, both axially and circumferentially, a plurality of broaching members each slidably mounted on one of said surfaces, said
 25 broaching members being located in successive planes along the axis of the broach, the members in one plane having their ends circumferentially overlapping the ends of the broaching members in each next adjacent
 30 plane.

14. An adjustable broach for finishing in-

ternal work by relative movement longitudinally thereof, comprising a shaft, having a plurality of bearing surfaces arranged substantially at the periphery thereof and spaced
 35 apart, both axially and circumferentially, a plurality of broaching members each slidably mounted on one of said surfaces, said broaching members being located in successive planes along the axis of the broach, the
 40 members in one plane having their ends axially overlapping the ends of the broaching members in each next adjacent plane.

15. An adjustable broach for finishing internal work by relative movement longitudinally thereof, comprising a shaft, having a plurality of bearing surfaces arranged substantially at the periphery thereof and
 45 spaced apart, both axially and circumferentially, a plurality of broaching members each slidably mounted on one of said surfaces, said broaching members being located in successive planes along the axis of the broach, the members in one plane having their ends
 50 circumferentially and axially overlapping the ends of the broaching members in each next adjacent plane.

In testimony whereof we have hereunto affixed our signatures.

WILLIAM DE VOE.
 JAMES J. WARD.