A tapered reamer partially coated with abrasive particles grouped to form on an outer conical working surface of the reamer spatially isolated islands constituting service grinding zones of the island being distributed circumferentially about the body of the reamer and overlapping axially therealong to provide an improved grinding and shaping tool.

This invention relates to an abrasive tool for grinding and shaping a wall surface of a workpiece. More particularly, the invention is directed to a diamond coated tool having a convex, generally conical cutting and abrading surface for dressing a surface bounding a preformed conical hole in a workpiece of glass or physically related vitreous material. The tool of the invention finds particular utility in the shaping and finishing of sockets of stopcock assemblies so that these sockets conform precisely to peripheral wall contours of cooperating plug elements of such assemblies to establish smooth and uninterrupted substantially sealing contact along mating contigous surfaces thereof.

Many and varied diamond coated abrasive tools are known in the prior art, and some of these tools have been proposed specifically for the same applications in which the tools of the instant invention are used. However, each of these prior art tools has important deficiencies or shortcomings which have impaired their usefulness and prevented their general acceptance and utilization for the purposes intended. For example, some of the tools have been fabricated with their tapered surfaces covered completely with abundant, unduly increasing rotational torque requirements in the grinding operation. Others have utilized abrasive strip or zone formations which have tended to effect an axial “drawing in” of the tool during use thereof. Still others have relied upon unduly complex forms or patterns, such as continuous spiral helicies, for the abrading material. It is the aim of the present invention to provide diamond coated tapered grinding tools which obviate the deficiencies and shortcomings of prior art devices.

Considered broadly, the tapered abrasive tools of the invention include, in each case, a conical surface having embedded therein grouped abrading particles, the groups being spaced from one another to define islands or zones of abrasive material distributed over the tool surface. The tool-carried islands overlap axially so that for each rotation of the tool in the workpiece, the entire conical surface of the workpiece is traversed by abrasive material so that objectionable “grooving” or scoring of the workpiece surface is obviated.

The nature and advantages of the invention will appear more fully from the following description and the accompanying drawing wherein preferred forms of the invention are shown. It should be understood, however, that the description and drawing are illustrative only and are not intended to limit the invention except as far as it is limited by the claims.

In the drawing:
FIG. 21 is a side elevational view of a reamer embodying the features of the invention and depicting one geometric form of the abrasive zones;
FIG. 1A is a cross-sectional view taken on the line 1A—1A of FIG. 1;
FIGS. 2 through 8 are views similar to FIG. 1 but showing other suitable geometric configurations of the abrasive zones; and
FIG. 9 is a view, partly in vertical section, and showing a longitudinal bore and communicating radial ducts comprising conduit means for conveying lubricating and cooling fluid to the working areas of the tapered reamer.

Referring more particularly to the drawing, there is shown in FIG. 1 a grinding tool 20 including a tapered body 24, and an integrally formed coaxial shank or shaft 26 by means of which the tool is held and rotationally driven in use. Distributed over the conical surface 30 of the tool are spaced islands or zones 32 of abrasive particles 36, preferably diamond grit. While any preferred technique and means may be used to bond or to affix the diamond particles 36 to the body 24 of the tool in the illustrative example provided, the diamonds are electro metallically deposited utilizing a well known “plating” technique. Such a technique is described in Seligman et al. U.S. Pat. No. 2,360,798.

In preferred embodiments of the invention, as shown in FIGS. 1A and 9, the tapered tool 20 is provided with an internal longitudinally extending passage 40 communicating with generally radially disposed ducts 44 having ports 46 opening at the tool surface 30 at positions intermediate the abrasive islands. The internal conduits serve as means for conveying fluid to and from the working zones 32 to cool and lubricate the workpiece (not shown) and the tool 20 and to effect removal of abraded material from the regions being ground.

In accordance with the practice of the invention, the abrasive-surfaced islands may take any preferred, regular or irregular, shape or contour. They may be arranged in any desired formalized pattern or may be distributed in a random array, provided, however, that in all arrangements there is provided axial overlapping of cutting zones so that lengthwise continuity of abrasive material distributed longitudinally along the conical surface of the tapered tool is assured. In FIGS. 1, 2, and 3 the abrasive islands 32, 32a and 32b take the general shape of parallelograms, and in FIGS. 4, 5 and 7, trapezoids 32c, 32d, and 32f. Staggered rows of modified parallelograms 32g each including a pair of opposed arcuate sides are shown in FIG. 8, circular islands 32h in FIG. 9, and oval-shaped islands 32e in FIG. 6.

It will be evident upon consideration of the present disclosure that many other island shapes and distribution may be used. Arrays such as those illustrated in FIGS. 5 through 9 have the advantage of permitting either clockwise or counterclockwise rotational tool drive since in neither alternative mode of operation will there be any propensivity of the tool to be drawn into the hole in the workpiece or to bind. In all forms of the invention the multi-path continuous radial recess formed at areas of the tool which separate the islands ensure free, substantially unrestricted flow of cooling and lubricating fluid, whereby the fluid is readily discharged from the grinding zones and ultimately recirculated during grinding operations.

While preferred constructional features and spatial arrangements of the abrasive islands of the invention are embodied in the illustrative embodiments depicted herein, it is to be understood that changes and variations may be made by those skilled in the art without departing from the spirit and scope of the appended claims.

What is claimed is:
1. In a tapered reamer for shaping a generally mating preformed opening in a workpiece and for dressing a lat-
generally disposed conical wall surface bounding said opening, said reamer including a rigid and essentially incompressible body portion having a taper angle substantially the same as a taper of said opening in said workpiece, said body portion being of circular cross-section and defining along its longitudinally extending radial periphery a conical workpiece-engaging wall having embedded firmly therein to project radially outwardly thereof abrading particles for dressing said conical wall surface bounding said opening in said workpiece to shape said surface of said conical wall of said workpiece to an ultimate configuration corresponding to a peripheral contour correlated with a conical surface defined by said abrading particles of said reamer disposed longitudinally along a working surface of said reamer at radially outward limits thereof; the improvement wherein said abrading particles are grouped to define a plurality of multi-particle hard-surfaced, unyielding islands distributed circumferentially of said body portion of said reamer and longitudinally along said workpiece-engaging wall thereof; said islands comprising discontinuous, mutually isolated physically fixed abrading zones of said tool, said zones being circumferentially spaced and overlapping axially to define an array such that any plane passing through said tool normally of a rotational axis thereof intersects at least one of said zones.

2. The structure as set forth in claim 1 wherein said abrading particles are diamond particles.

References Cited

UNITED STATES PATENTS

449,217  3/1891  Good ---------------------- 51—206
959,262  5/1910  Rees.
2,383,464  8/1945  Bown ---------------------- 51—206
3,229,427  1/1966  Goodhew ---------------------- 51—241

OTHELL M. SIMPSON, Primary Examiner

U.S. Cl. X.R.