This invention relates to improvements in reaming tools and more particularly to an expandable reamer for shaping a blind hole or well so that its inner end is larger than its outer end. It frequently happens in carpentry and cabinet making that it is desired to provide a blind hole or well having a tapered shape such that its inner end is somewhat larger than its outer end so that the hole acts somewhat as a dovetail construction to retain the end of a construction element therein. A good example of this type of construction is that frequently used in mounting the upper ends of chair legs in socket holes provided therefor in a chair seat or seat frame. In such a construction the hole or recess provided in the chair seat is blind, that is, it does not extend entirely through the seat but terminates short of the upper surface thereof. Such a blind hole or well may first be provided by a conventional cylindrical bit so that the diameters of the inner and outer ends are the same. Such a cylindrical hole may then be reamed by a special tool, such as constitutes the subject matter of the present invention, so that it flares from its open to its closed end and the closed end has a diameter somewhat greater than the open end. The end portion of the chair leg to be inserted in such a flared hole may then be split and provided with suitable wedges whereupon, when the leg is driven into the hole, the inner end of the leg is expanded into the larger inner end of the hole and the leg is firmly secured to the seat and will not become loosened or detached under conditions of ordinary use.

It is among the objects of the present invention to provide a reamer of simplified and durable construction wherein the various parts are operatively secured together at all times and there are no loose parts which can be lost or misplaced, wherein the cutting bits are firmly supported on the shank or stem portion of the reamer for expansive movement and against torsional forces imposed on the shank, and which is of durable and economical construction, easy to use, and substantially automatic in operation. Other objects and advantages will become apparent from a consideration of the following description in conjunction with the accompanying drawing, wherein.

Figure 1 is a longitudinal cross-section of an expandable reamer illustrative of the invention, the shank or stem portion of the reamer being shown in longitudinal elevation. Figure 2 is a bottom plan view of the reamer illustrated in Figure 1.

Figure 3 is a detail elevation of the fragmentary lower end portion of the shank shown in Figure 1. Figure 4 is a longitudinal elevation of the inside surface of one of the reamer bits shown in Figures 1 and 2. Figure 5 is a transverse cross-section taken substantially on the line 5—5 of Figure 1. Figure 6 is a diagrammatic view showing in cross-section the shape of blind hole produced by the reamer in an object such as a chair seat and a structural element, such as a chair leg, secured in the hole. With continued reference to the drawing and particularly to Figure 6, the numeral 10 generally designates a structure, such as a chair seat, table top, etc., to which a leg 11 is attached. The upper end portion of leg 11 is made cylindrical in shape and is received in a blind hole or well 12 provided in the seat structure 10 and opening to the underside thereof. The hole 12 is flared from its open to its closed end so that the closed end is somewhat larger than the open end thereof. The end portion of the leg 11 received in the hole 12 is split and the edges of suitable wedges 13 are entered into the outer end of the leg at the splits provided therein. The split end of the leg is then entered into the hole 12 and, after the blunt side of the wedges come in contact with the bottom of the hole is driven in until the upper end surface of the leg comes into contact with the bottom surface of the hole whereupon the wedges expand the end of the leg in the hole and prevent withdrawal of the leg from the seat structure. The chair, table or other structure, illustrated in Figure 6 and described above, is not new and is illustrated and described only to more fully explain the construction and manner of operation of the improved reamer illustrated in Figures 1 to 5 inclusive, to which reference may now be had.

The improved reamer comprises in general an elongated cylindrical shank 14, a plurality of cutting bits 15 in the form of elongated cylindrical sectors, a cylindrical cap 16 and a coiled compression spring 17. The shank 14 has, at the upper end portion thereof as illustrated in Figure 1, a head 18 receivable in the socket of a brace or drill press to hold and rotate the shank and has upon its lower or opposite end portion a plurality of longitudinally extending, relatively narrow spines 19 spaced at substantially equal angular intervals around the circumference of the shank. In
the arrangement illustrated there are four such splines which correspond in number to the four bits 15 carried by the shank. Each of the splines 19 comprises an upper portion having substantially straight, parallel side wall surfaces and a lower key portion 20 the side wall surfaces of which are longitudinally parallel but diverge radially outwardly so that the key portions have a dovetail shaped cross-section, as is clearly illustrated in Figure 2. The key portions 20 are relatively short, a length of one-fourth of an inch having been found sufficient for satisfactory operation of the reamer in average sizes.

Each of the bits 15 comprises a cylindrical sector having a convex outer surface and a concave inner surface of a curvature to fit the surface of shank 14, and substantially straight side faces joining the corresponding edges of the inner and outer surfaces. The convex outer surfaces of these cylindrical sectors are somewhat eccentric or annularly inclined so as to expose one edge of each sector as a cutting edge 21, as particularly illustrated in Figures 3 and 5.

The bits 15 are fitted about the lower, splined end portion of shank 14 in a manner to constitute a complete cylinder and the upper end portions thereof are externally annularly recessed, as indicated at 22, to receive the annular flange 23 of the cap 16, this cap being provided with a central aperture 24 which receives the cylindrical shank 14. The cap thus retains the upper end portions of the bits 15 in operative assembly with the shank.

The concave inner surfaces of the bits 15 are provided with respective longitudinally extending grooves 25 which terminate short of the upper, externally recessed ends of the bits to provide respective shoulders 26 which bear upon the upper or inner ends of the splines 19, as clearly illustrated in Figure 1, to limit outward movement of the bits relative to the shank 14. The grooves 25 have their side edges undercut to fit the key portions 20 of the splines and are inclined radially inwardly at the outer or lower ends of the bits, as indicated at 27 in Figure 1, so that when the key portions 20 are moved into the outer end portions of the respective groove 25 the outer ends of the bits are forced radially outwardly to taper a hole in which the reamer is operated, in the manner illustrated in Figure 6.

The key portions 20 of dovetail shaped cross-section, fitting in the undercut grooves 25 of the bits retain the outer end portions of the bits in operative assembly with the shank 14 so that the bits cannot at any time become loose from the shank. The splines 19 transmit torsional forces from the shank to the bits and the spring 17, surrounding the shank between the cap 16 and an abutment pin 28, inserted through an aperture provided transversely of the shank, resiliently urges the shank to retracted position relative to the bits in which relative position the bits have a generally cylindrical external shape. When the bits are moved inwardly of the shank by pressure on the shank acting against the force of spring 17, the outer ends of the bits are forced radially outwardly to provide a tapered or somewhat truncated conical shape to the external surface of the bit assembly. This spreading of the outer ends of the bits is automatically occasioned by pressure exerted on the shank 14 as the reamer is rotated in the hole.

The reamer may be completely disassembled when desired, by removing the abutment pin 28, removing the spring 17 and cap 16 and then withdrawing the bits 15 from the key portions 20 of the splines 19.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is, therefore, to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claim rather than by the foregoing description, and all changes which come within the meaning and range of equivalence of the claim are, therefore, intended to be embraced therein.

What is claimed is:

A reamer comprising a cylindrical shank having a head on one end and annularly spaced longitudinal splines on the opposite end portion thereof, each of said splines comprising a straight portion and a key portion at the outer end of the straight portion having radially outwardly diverging side edges, a plurality of bits equal in number to the number of splines on said shank each comprising a cylindrical sector with a convex outer and a concave inner face and having in its inner face a longitudinal groove receiving a corresponding spline and opening to one end of the bit, each groove being undercut to receive the corresponding spline key and having its bottom surface inclined inwardly adjacent said one end of the bit to force the corresponding ends of said bits outwardly when said keys are moved along the inwardly inclined portions of the grooves, said grooves terminating short of the other ends of the corresponding bits to provide shoulders respectively overlying the adjacent ends of the splines, and the outer surfaces of said bits being annularly inclined to expose a cutting edge at one side of each bit, a cap having an aperture receiving said shank and an annular flange surrounding said bits at said other ends of the latter, said cap and said spline keys holding said bits in operative assembly with said shank, an abutment on said shank spaced from said bits, and a compression spring surrounding said shank between said abutment and said cap holding said cap in engagement with said bits and resiliently urging said bits longitudinally of said shank to hold the bits in their contracted condition, said bits being moved to their expanded condition by forcing said shank longitudinally outwardly of said bits against the force of said spring.

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The following references are of record in the file of this patent:

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