

[54] COUPLING DEVICES

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[22] Filed: Dec. 18, 1968

[21] Appl. No.: 784,672

[30] **Foreign Application Priority Data**

Dec. 18, 1967 Great Britain 57,404/67

[52] U.S. Cl..... 51/376, 64/23, 287/52.05

[51] Int. Cl..... B24d 17/00

[58] **Field of Search**..... 51/376, 358, 377,
51/209, 210, 170.2, 177, 168, 169;
287/52.05, 53; 15/230.19; 64/9, 14, 23; 32/58

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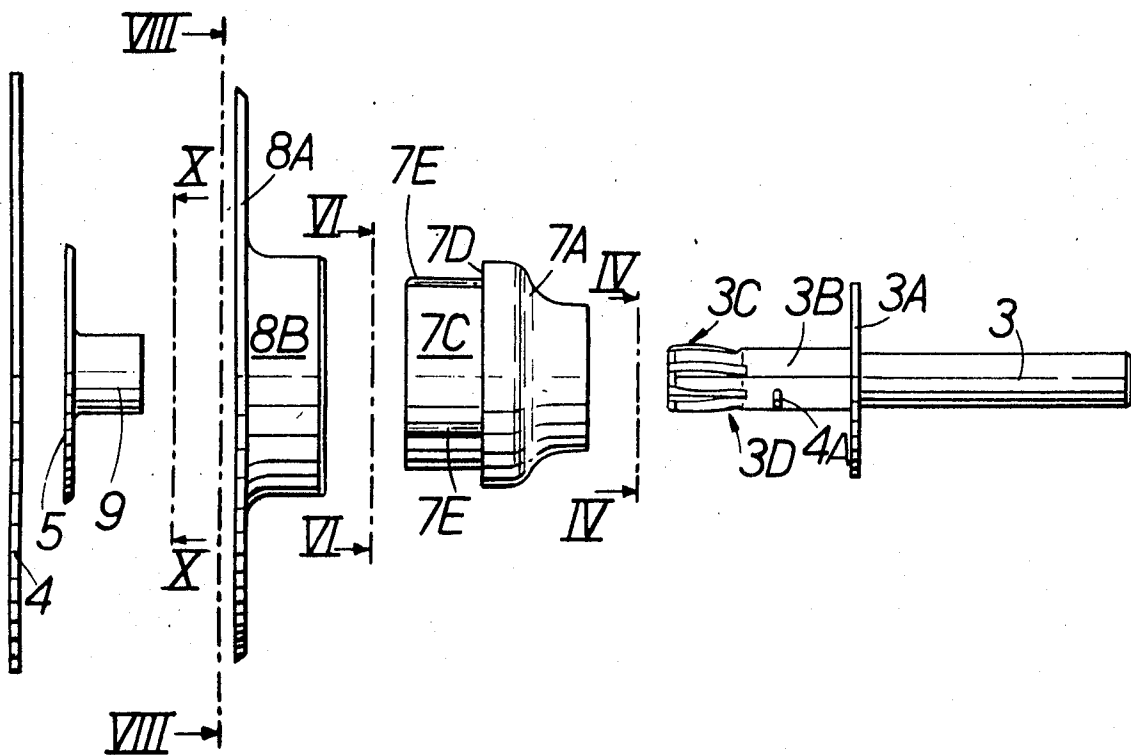
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[57] **ABSTRACT**

Coupling device for releasably connecting a first and a second member for rotation about a common axis, for example a powered shaft and an abrasive disc in a sanding tool. The first member comprises a rotatable shaft splined at one end for engaging an internally ribbed socket in the second member. A slidable collar fits around the shaft and may be used for disengaging the second member from the shaft.

12 Claims, 13 Drawing Figures



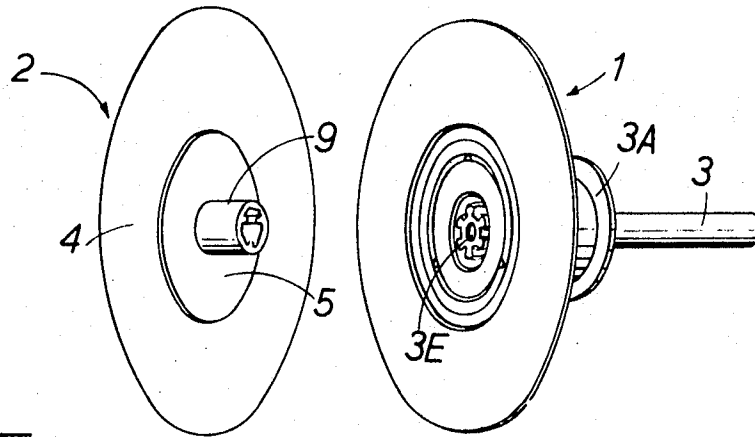


FIG. 1.

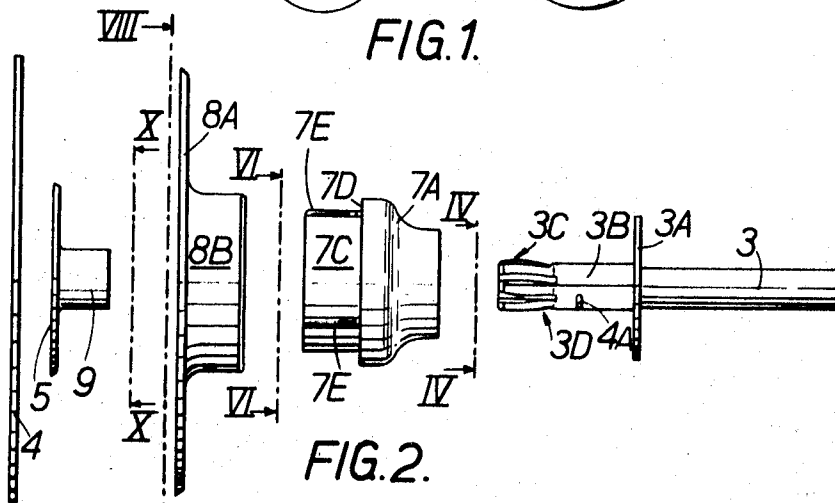


FIG. 2.

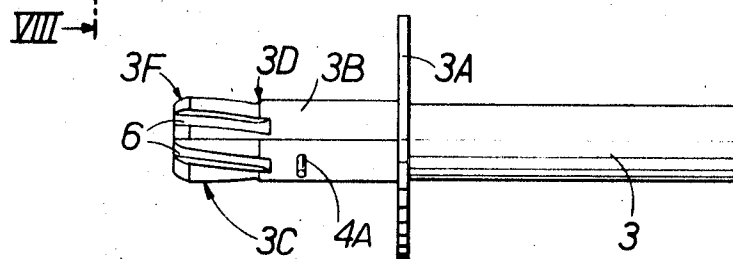


FIG. 3.

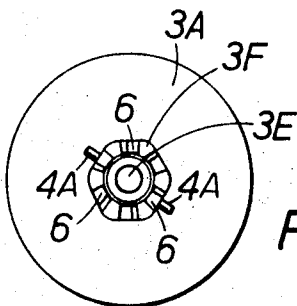


FIG. 4.

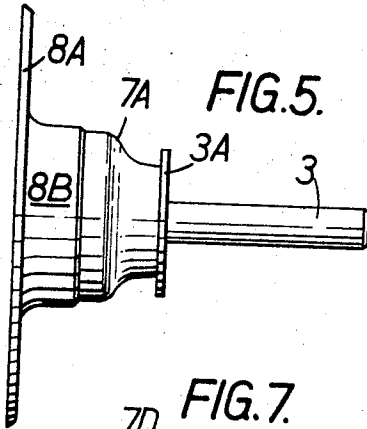
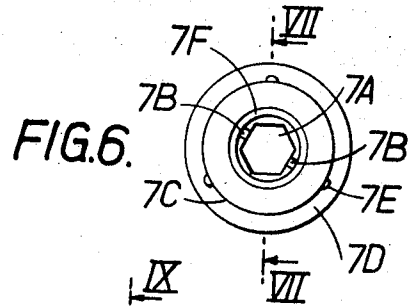
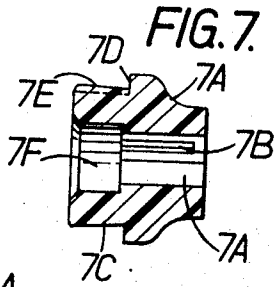
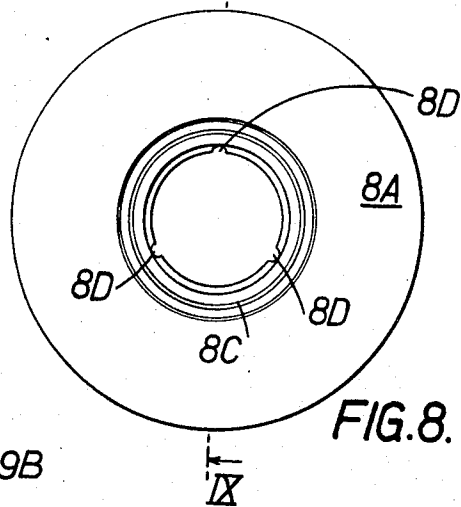
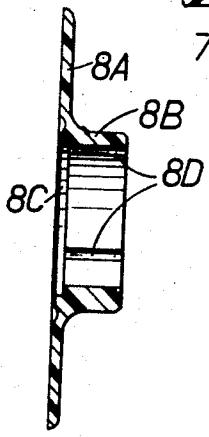
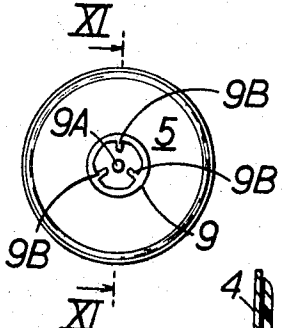
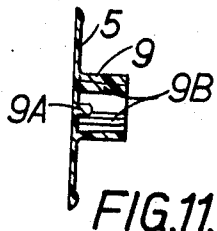
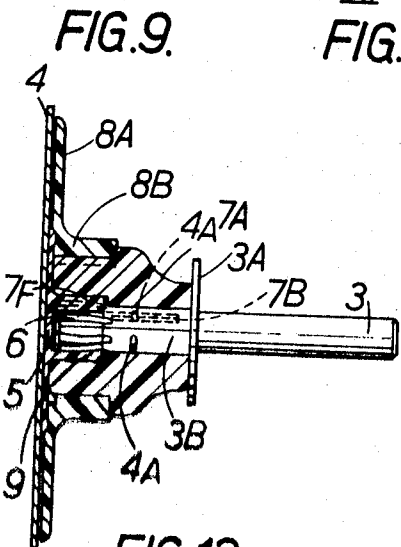
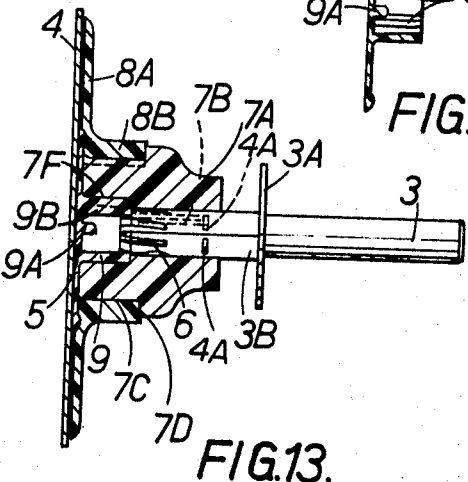


FIG. 12.

FIG. 13.

COUPLING DEVICES

FIELD OF THE INVENTION

This invention relates to a coupling for releasably connecting members for rotation together about an axis. Thus such a coupling can be used for connecting a disc, for example an abrasive disc or a polishing disc, to a power-driven surface-treating machine. The invention is of particular use for a power-driven sanding machine in which a holder is attached to the shaft of a motor, and a sanding disc is connected to the holder.

DESCRIPTION OF PRIOR ART

There is known a power-driven rotatable sanding tool, consisting of an abrasive disc stuck on a circular holder which is carried on a spindle rotatable axially of the disc and holder. The abrasive disc does not have a long life, particularly when used at high speed. To replace an abrasive disc it must be torn off the holder, and a fresh disc must be stuck on. This is done by the person using the tool and is a time wasting operation.

To avoid this disadvantage there have been proposed various couplings by which an abrasive disc may be removed and replaced. It is an object of this invention to provide an improved coupling, by which an abrasive disc for example may be simply and quickly replaced, yet which in use provides for secure retention of the disc.

SUMMARY OF THE INVENTION

According to the invention there is provided a device for connecting a first member and a second member for rotation about a common axis, the first member comprising a rotatable shaft splined at one end for engaging a socket, and the second member comprising an internally ribbed socket for engaging the splined shaft, a collar fitting around the shaft and axially slidable thereon for disengaging the second member from the shaft, the collar being incapable of rotation relative to the shaft.

The device may take the form of a sanding machine, in which case the shaft is connected to a power source, for example a pneumatic motor, and the second member comprises an abrasive disc.

Means is preferably provided for retaining the collar on the shaft and for limiting its sliding travel thereon. The shaft may for this purpose have a projecting pin which engages an axial slot in the collar, the slot being of limited length. The shaft may also for this purpose have a raised flange which abuts with the collar at one extremity of its travel. The collar may abut directly against the second member for disengaging the second member from the shaft, or alternatively an abutment member may be provided which is attachable to the collar for abutting with the second member and disengaging this from the shaft. The collar may have a raised annular shoulder coaxial with the shaft for engaging an annular hole in the abutment member, and one or more ribs for engaging grooves in the abutment member for preventing relative rotation of the collar and the abutment member. In use the abutment member is preferably in continuous contact with the second member while the first and second members are connected, the abutment member thereby helping to support the second member.

The splined end of the shaft may have any convenient number of grooves, for example one, three or six.

The grooves are preferably inclined at a small angle to the axis of rotation of the shaft, and the ribbed socket is preferably made from a resilient material for example a plastics material such as nylon with the ribs parallel to the axis of rotation and slightly smaller than the grooves in the splined end of the shaft. As a result, when the first and second members are engaged a jamming effect occurs when the ribs enter the grooves, helping to hold the members together. The splined end of the shaft is preferably slightly tapered so that it widens towards the end, the shaft preferably being waisted where the splined part joins the unsplined part.

The socket may have any practicable number of internal ribs, for example three.

The socket may have an axial boss adapted to engage an axial blind bore in the splined end of the shaft.

BRIEF DESCRIPTION OF THE DRAWINGS

An embodiment of the invention will now be described by way of example, with reference to the accompanying drawings in which:

FIG. 1 is a perspective view showing the two parts of the coupling separated;

FIG. 2 is an exploded side elevation;

FIG. 3 is an enlarged detail side elevation;

FIG. 4 is an end view as seen from plane IV—IV of FIG. 2;

FIG. 5 is a side elevation of the right hand part of FIG. 1;

FIG. 6 is an elevation on plane VI—VI of FIG. 2;

FIG. 7 is a section on plane VII—VII of FIG. 6;

FIG. 8 is an elevation as seen from plane VIII—VIII of FIG. 2;

FIG. 9 is a section on plane IX—IX of FIG. 8;

FIG. 10 is an elevation from plane X—X of FIG. 2;

FIG. 11 is a section on plane XI—XI of FIG. 10;

FIG. 12 is a section, with parts in elevation, of the two parts of FIG. 1 coupled together; and

FIG. 13 is similar to FIG. 12 but showing disengagement of the parts.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring to FIG. 1, a sanding tool has first and second parts or members 1 and 2 respectively. The first part includes a shaft 3 for connecting the tool to a power source (not shown) which may be for example a pneumatic motor. The second part has an abrasive disc 4 bonded to a disc 5 of nylon or other material. As will be explained, the two parts can readily be connected for use or disconnected for replacement.

Integral with the shaft 3 is a flange 3A; the portion 3B of the shaft is hexagonal (although another shape including round, could be used); the end portion 3C (see FIGS. 3 and 4) is also generally hexagonal and is tapered rearwardly as shown, the shaft being waisted at 3D. A pin extends through the portion 3B, projecting at each end 4A from opposed hexagonal faces (FIG. 4). The manner of insertion of this pin will be referred to below. The end of the shaft is rounded at 3F. The end portion 3C has grooves 6 each slightly inclined to the axis, as seen in FIG. 3. At the end of the shaft is a short, axial, blind bore 3E. Although six grooves 6 are shown, another number of grooves could be used, for example one or three.

Referring now to FIGS. 2, 5, 6, 7, 12 and 13 an annular collar 7 fits slidably over the shaft portion 3B. Externally the collar 7 is curved at 7A so that a user's thumb

and finger can, in use, readily move the collar 7 away from the flange 3A, that is, from the FIG. 12 position to that of FIG. 13, the former being the operative position and the latter the release position.

Although shown separated from the shaft in FIG. 2, the annular collar 7 is in practice retained on the shaft portion 3B in that the pin ends 4 ride in two corresponding slots 7B (FIGS. 6 and 7) in the hexagonal portion 7A of the axial bore of the annular collar. These slots, as can be seen, do not extend the whole length of the bore portion 7A, so that, once assembled, the collar 7 can be slidably moved on the shaft portion 3B but cannot be removed from it. At an appropriate location the collar 7 has a radial bore (not shown) so that, with the collar 7 in position on the shaft portion 3B the pin with the ends 4A can be inserted through the radial bore and into its receiving bore in the shaft portion 3B. This arrangement is well-known and need not be further described. Once the pin has been thus inserted and its ends 4A are in the slots 7B, the collar 7 is retained on the shaft portion 3B and is capable of limited axial movement, that is, between the FIG. 12 and FIG. 13 positions. When the shaft 3 is rotated, the collar 7 is rotated with it.

The axial bore of the collar 7 has an enlarged diameter portion 7F which receives a socket member 9 of the part 1, which member is described below.

The annular collar 7 has a reduced external portion 7C forming a shoulder 7D. The portion 7C is formed with axially extending locating ribs 7E (FIGS. 2, 6 and 7). The portion 7C may be slightly inwardly tapered from left to right, as viewed in FIG. 7.

An abutment member in the form of a backing member for the abrasive disc 4 has a main disc portion 8A and a neck 8B, the former being slightly recessed at 8C to receive the disc 5 in use, and the neck having three internal grooves 8D (FIGS. 8 and 9) to receive the ribs 7E when the backing member is pushed home on to the annular collar 7, as in FIGS. 5 and 12, so that the backing member is rotatable with the collar 7 and shaft 3. The backing member is moulded from a plastics material, the disc portion 8A being somewhat resilient.

The part 1 of the tool has now been described; it is shown assembled in FIGS. 5 and 12.

The part 2 is connected to the part 1 by means of the socket member 9 which is integral with the nylon disc 5 bonded to the abrasive disc 4. Referring to FIGS. 10 and 11 the socket member has an axial boss 9A which, in use, enters the bore 3E and assists in preventing distortion of socket member 9 when in operation. It will be appreciated that speeds of up to 20,000 r.p.m. may be used and that the disc 4 is not necessarily applied normal to the surface of the work, and considerable forces can be set up tending to pull the part 2 away from the part 1. Also the walls of the socket member taper slightly, that is towards the axis from left to right as viewed in FIGS. 11, 12 and 13. Since the socket member is of nylon, it has some resilience and the open end of the socket can be pushed over the rounded end 3F of the shaft portion 3C, so that the socket seats over the portion 3C with the open end fitting the waisted portion 3D; this also assists in preventing inadvertent removal of the part 2 from the part 1. Finally the socket member 9 has three axial ribs 9B each of which engages a groove 6. The axial ribs 9B are narrower than grooves 6 and when the socket member is pushed home on to the shaft portion 3C, axial ribs 9B enter inclined

grooves 6, and there occurs a jamming effect. This also assists in preventing inadvertent removal, as well as of course providing for rotation of the socket member 9, disc 5 and abrasive disc 4 when the shaft 3 is rotated.

As mentioned above, when the tool is assembled to the FIG. 12 condition, the socket member 9 is mounted on the shaft portion 3C within the bore portion 7F. The external axial length of the socket member is slightly greater than that of the bore portion 7F.

The coupling described above provides for secure retention of part 2 against part 1 during use, yet permits easy removal and replacement. The part 2 is of a consumable or "throw-away" nature. When a disc 4 is worn, the user inserts index finger and thumb in the space between the flange 3A and curved surface 7A (FIG. 12) and eases them apart to the FIG. 13 position, in which the shaft has been moved relatively to the remainder of the tool, so that the shaft portion 3C has been withdrawn from the socket member 9 and the abrasive disc can then be removed from the backing member 8A, 8B. The shaft is then pushed back to the FIG. 12 position and a fresh abrasive disc can be put on to the part 1. During these operations the backing member and the annular collar 7 are retained on the shaft so that the part 1 of the tool does not require re-assembly every time an abrasive disc is replaced.

It will be realised that there are six grooves 6 in the shaft portion 3C, but only three ribs 9B; this provides for readier insertion of the ribs 9B in grooves 6. Clearly other numbers of ribs and grooves could be used.

Although the co-operating tapered arrangement of the shaft portion 3C and the wall of the socket member 9 is preferred, this could be parallel sided, that is, parallel to the axis.

The inclination of the grooves 6 to the shaft axis is preferably more than 3°.

Where a small abrasive disc is to be used, a construction is possible from which the backing member 8A, 8B is omitted.

What I claim is:

1. A coupling device comprising a rotatable shaft having a splined end portion including a plurality of spline grooves, a cylindrical socket member of resilient plastic material engageable with said shaft end portion and deformable upon said engagement to provide a tight force fit with said shaft end portion, said cylindrical socket member having ribs projecting inwardly thereof engageable with said spline grooves, and a collar mounted axially slidably but non-rotatably on the shaft, the collar being adapted to disengage the cylindrical socket member from the splined end portion.

2. A coupling device forming part of a sanding machine, said device comprising a rotatable shaft having a splined end portion including a plurality of spline grooves, and a cylindrical socket member of resilient plastic material engageable with said shaft end portion and deformable upon said engagement to provide a tight force fit with said shaft end portion, said cylindrical socket member having ribs projecting inwardly thereof engageable with said spline grooves, said rotatable shaft being connectable to a power source, and said cylindrical socket member comprising an abrasive disc.

3. A device according to claim 1 including means for retaining the collar upon the shaft and for limiting its sliding travel thereon.

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4. A device according to claim 1 wherein the shaft has a projecting pin engageable with a slot of limited length in the collar parallel to the axis of the shaft.

5. A device according to claim 1 wherein the shaft has a raised flange for abutting with the collar when the collar is at one extremity of its sliding travel.

6. A device according to claim 1, including an abutment member attachable to the collar for abutting with the second member.

7. A device according to claim 6, wherein the abutment member is in continuous contact with the second member when the first and second members are connected.

8. A coupling device comprising a rotatable shaft having a splined end portion including a plurality of spline grooves, said shaft end portion being tapered with the widest part of the taper at the end of the shaft, and a cylindrical socket member of resilient plastic material engageable with said shaft end portion and deformable upon said engagement to provide a tight force fit with said shaft end portion, said cylindrical socket member having ribs projecting inwardly thereof engageable with said spline grooves.

9. A device according to claim 7, wherein the collar has a raised annular shoulder for engaging with the abutment member, one or more ribs for engaging with grooves in the abutment member for preventing relative rotation of the collar and the abutment member, and a curved portion adapted for use as a thumb or finger grip.

10. A coupling device comprising a rotatable shaft having a splined end portion including a plurality of spline grooves, and a cylindrical socket member of resilient plastic material engageable with said shaft end portion and deformable upon said engagement to provide a tight force fit with said shaft end portion, said cylindrical socket member having ribs projecting inwardly thereof engageable with said spline grooves, said spline grooves being inclined at a small angle to the shaft axis, and said ribs being parallel to the shaft axis and slightly narrower than said grooves.

11. A sanding device comprising a first member and a second member for rotation about a common axis, the first member comprising a rotatable shaft connectable to a power source, a splined end portion on the shaft including a plurality of spline grooves inclined to a small angle to the shaft axis, the splined end portion of the shaft being tapered with the widest part of the taper being at the end of the shaft, the second member comprising an abrasive disc integral with a cylindrical member of resilient plastic material, a socket in the cy-

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lindrical member, ribs on the cylindrical member, the ribs projecting inwardly in the socket, parallel to the shaft axis and slightly narrower than the grooves, being adapted to engage the splined end portion, a collar mounted slidably but non-rotatably on the shaft, said collar being adapted to disengage the second member from the splined end portion, the shaft having a projecting pin engageable with a slot of limited length in the collar parallel to the axis of the shaft for retaining the collar upon the shaft and limiting its sliding travel thereon, the shaft further having a raised flange for abutting with the collar when the collar is at one extremity of its sliding travel, an abutment member attachable to the collar in continuous contact with the second member when the first and second members are connected, the collar having a raised annular shoulder for engaging with the abutment member, at least one rib for engaging with grooves in the abutment member preventing relative rotation of the collar and the abutment member and a curved portion on the collar adapted for use as a thumb or finger grip.

12. An abrading implement, including a body, a tool spindle received in said body for unison rotary and relative longitudinal sliding motion, means connecting said spindle to said body for limited relative longitudinal motion, said spindle and body forming a rotary drive and support assembly, a work disc releasably installed in a rotary driven and supported relation to said assembly, and means utilizing longitudinal motion of said tool spindle relative to said body in advancing and retracting strokes to achieve a locking and release of said work disc relative to said assembly, said work disc having a side seating to a portion of said body, said side having a hub including a socket to receive an inner end of said spindle on an advancing stroke thereof, a retracting stroke utilizing said body as a reactant means to strip the disc from said spindle, said hub being formed of a resilient deformable material and said inner end of said spindle being oversize relative to inside dimensions of said hub, an advancing motion of said spindle to thrust the inner end thereof into said hub establishing a friction fit by which said disc is yieldingly retained on said spindle, said body having a recess to receive said hub and having an annular bearing surface surrounding said recess, said work disc having a complementary annular bearing surface surrounding said hub, said bearing surfaces interacting to allow said spindle end to be withdrawn from said hub upon a retracting motion of said spindle.

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