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RESILIENT COUPLING FOR GRINDING TOOLS

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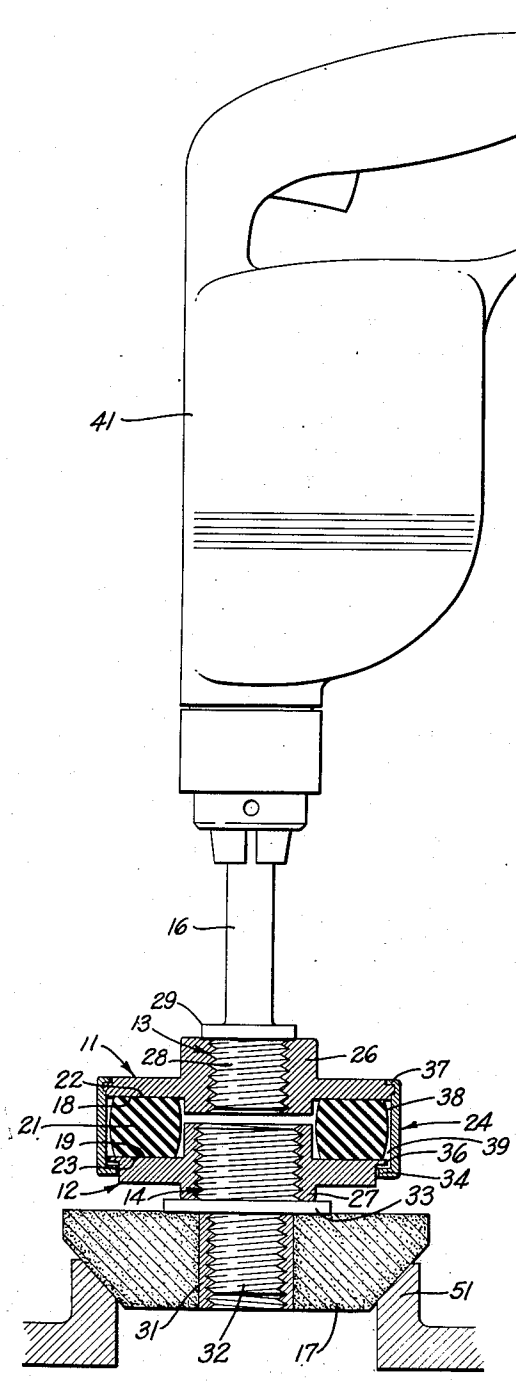


FIG. 1

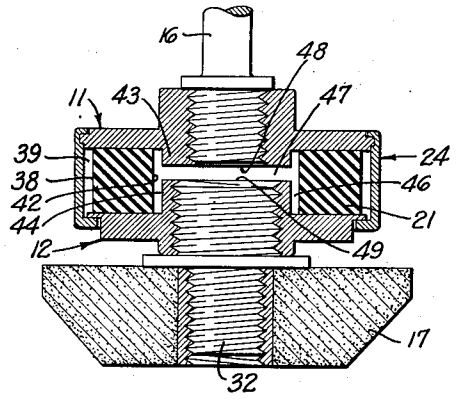


FIG. 2

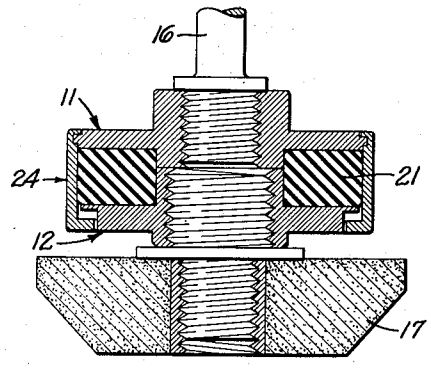


FIG. 3

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RESILIENT COUPLING FOR GRINDING TOOLS

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5 Claims. (Cl. 64—11)

1

The invention relates to couplings particularly designed for use in power grinding operations wherein the coupling is adapted for connection of a rotary drive shaft to a rotary grinder attachment. This application is a continuation in part of my application Serial No. 172,170, filed July 5, 1950, for Resilient Connector For Surface Grinding Tools now abandoned.

An object of the present invention is to provide a coupling of the character described which will afford an improved and controlled resilient connection between a rotary drive shaft and grinder attachment, affording a number of important advantages including greater precision in and more perfect finishing of the work; protection of the work against scoring, and protection of the grinding stone used against scoring and breaking; longer useful life of the grinding stone with less frequent dressing of the stone being required; substantially increased speed and efficiency of grinding operation, permitting a larger area of contact between the abrasive material and the work and enabling the use of lower rotating speeds; and cushioning the transmission of vibration and shock to the operator, thereby reducing operator fatigue.

Another object of the present invention is to provide a coupling of the character described, which is composed of a minimum number of sturdily formed parts designed for easy assembly into a unit possessing high strength and wear characteristics and being of minimum size and weight for convenient manual support and manipulation.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following descriptions of the preferred form of the invention which is illustrated in the drawing accompanying and forming part of the specification. It is to be understood, however, that variations in the showing made by the said drawing and description may be adapted within the scope of the invention as set forth in the claims.

Referring to said drawing:

Figure 1 is a cross-sectional view of a coupling constructed in accordance with the present invention, taken along its longitudinal axis and showing the coupling in connected position to a hand drill motor and a grinding stone, the coupling being illustrated in a stressed condition corresponding to a normal operating load.

Figure 2 is a cross-sectional view of the coupling as illustrated in Figure 1 but shown in a no-load condition.

2

Figure 3 is a cross-sectional view of the coupling as illustrated in Figure 1, but shown under maximum load conditions.

The coupling of the present invention consists briefly of a pair of sections 11 and 12, provided with co-axial means 13 and 14 for securing to a rotary drive shaft 16 and a grinder attachment 17, respectively. The sections are formed with confronting faces 18 and 19, symmetrical to the common axis of means 13 and 14, and mounted between these faces is a pad 21 of resilient, distortable material having opposite sides 22 and 23 clamped to the faces 18 and 19 by means of a surrounding casing 24 appropriately secured to the sections 11 and 12 so as to permit relative displacement between the sections. As an important feature of the present invention, the sections 11, 12 and casing 24 cooperate to define a chamber for the pad 21 of somewhat larger volume than the pad so as to provide a clearance between the pad and the surrounding parts into which the pad may be resiliently distorted when under load conditions. Of further importance is the co-action of such clearance and the size and resistance to distortion of the pad, so that the amount of the clearance will limit the distortion of the pad and thereby limit the extent of relative displacement permitted the sections.

To effectuate the above operation, the pad is preferably constructed of a material having a degree of softness and resistance to distortion but being substantially incompressible. Rubber in varying degrees of hardness is quite suitable for this purpose, as well as various synthetic rubbers. The degree of hardness or elasticity of the material is not critical and may be selected over a relatively wide range for best adaptation to various conditions met in grinding operations. Likewise the initial compression or preloading of the pad is not critical, it being sufficient that the pad be placed firmly under such a preload so as to constantly and firmly urge the sections into parallelism, as illustrated in the drawings.

With some types of rubber no special adherence between the sides 22 and 23 of the pad and the faces 18 and 19 of the sections is required, the initial and subsequent compression of the pad being sufficient to prevent slippage. With the use of softer rubber, however, it has been found advisable to secure the pad sides to the section faces by means of a suitable cement or by vulcanizing the rubber pad directly to the faces.

In the construction above described, the coupling provides a resilient cushion between the drive shaft and the grinder attachment wherein

limited resilient, torsional, axial and angular displacement is permitted between the sections up to the automatic stop provided by the filling of the aforementioned clearance by the distortion of the pad. The type and character of resilient displacement between the sections provided in the present coupling affords the many advantages in use hereinabove noted. In grinding, waste and grit from the stone and from the surface being ground, builds up between the stone and the surface. Where the grinding stone is rigidly connected to the drive shaft, grinding operations must be frequently halted, in order to remove the accumulation of this waste and grit, as otherwise it will cause a scoring and premature breaking of the stone and gouging of the work. With the use of the present coupling, the grinding stone may move momentarily away from the work, as the waste and grit builds up, so as to free itself and the work from any such accumulation of waste and grit. In this manner the stone will be constantly self-cleaning and thereby prevent scoring or breaking of the stone and damage to the work as well as constantly bringing fresh, sharp grit portions into grinding engagement with the work. Some of the results from the foregoing are, as above noted, improved precision and finish of the work; longer stone life with less frequent dressing of the stone; substantially increased speed and efficiency of grinding operations, and permitting lower grinding speeds and cushioning the normal vibration present in the grinding operations and thereby lessening operator fatigue. The co-action of the parts also permits the bringing of much larger abrasive areas into contact with the work and a much heavier loading of the grinding attachment than where a solid or rigid connection is used. In this connection it will be noted that the use of the resilient distortion of the pad as an automatic stop or limit to relative displacement between the sections provides a resistance to such displacement which increases as the stop is approached. Hence the greater the loading of the tool, the greater the effort of the pad to cause a freeing up of the accumulation of waste and grit in the grinding zone, making it virtually impossible to contain any substantial accumulation of such material in the grinding zone where damage to the stone and the work may occur.

In the form of the device illustrated in the accompanying drawing, the sections **11** and **12** are of disk shape, having enlarged center hub portions **26** and **27** formed with axial threaded bores providing the fastening means **13** and **14** above referred to. As here shown, the drive shaft **16** is provided with a threaded end portion **28**, which may be inserted into the bore **13**, and a shoulder or collar **29** engageable with the end of the hub **26** for limiting such insertion and securing the section **11** and shaft **16** for joint rotation. Similarly, the grinding stone **17** here illustrated is provided with a centrally arranged, threaded sleeve **31**, engaged with a threaded adapter **32** also threaded into the bore **14**, the stone and section **12** being spaced apart by a collar or flange **33** on the adapter, through which rotational force is transmitted from the section to the stone. The sections surrounding the hubs may be of flat, disk-like form, as illustrated, and of a thickness consistent with the required strength. The confronting faces **18** and **19** of the sections may be flat, as illustrated, although other forms symmetrical to the axis of rotation and suitable for interlocked engagement with the opposite sides **22** and **23** of the pad may be used.

The casing **24** is here of tubular form having an inturned flange **34** formed at one end for retaining within the casing a peripheral shoulder **36** formed on the section **12** and, as will be noted from the drawing and of importance in the operation of the device, the section **12** and its shoulder **36** are of smaller diameter than the casing **24** and its flange **34**, so as to provide a sufficient clearance therebetween to permit a tilting of the section **12** within the casing as well as a free axial and rotational displacement of the section in the casing. As a further feature of the present construction, the opposite end of the casing **24** is formed with a reduced section **37**, which is crimped or swaged over the periphery of section **11** so as to secure the pad **21** and section **11** firmly within the casing with a desired amount of initial compression of the pad. This type of assembly has several advantages in effecting reduction in waste, assuring concentricity of parts and dynamic balance and a precise preloading of the pad in a desired amount.

The aforementioned clearance for the pad is here provided in part by forming the pad with a circular periphery **38** of somewhat smaller diameter than the internal diameter of the casing so as to provide an annular space **39** therebetween, in which the pad may distort while resiliently resisting relative displacement of the sections **11** and **12**, including torsional displacement due to loading, axial displacement caused by forcing the stone **17** against the work, and angular displacement of the axis of the stone and drive shaft, as may be caused by shifting of the manual support for the hand-held drill motor **41**, here shown for driving the shaft **16**. As will be understood, the initial and subsequent compression of the pad provides an automatic self-restoring and self-aligning action of the sections functioning always to bring the sections **11** and **12** into their original axially aligned positions.

While the pad **21** may be of solid disk-shaped form, greater resilient action of the character described may be obtained by forming the pad in the shape of an annulus with a concentrically arranged hollow core defined by an internal wall **42**, which cooperates with internally spaced, concentric, cylindrical bosses **43** and **44** extending axially from the opposite faces **18** and **19** of the sections to provide a second clearance space **46**. As may be seen from the drawing, the bosses **43** and **44** are preferably of an equal diameter somewhat less than the internal diameter of wall **42**, so as to provide the annular space **46** therebetween, into which the internal portion of the pad may distort, while resiliently resisting relative displacement of the sections.

The clearances **39** and **46** between the pad and the casing and bosses are here proportioned so that the distorted portions of the pad will engage the casing and bosses at approximately the same time, whereby these parts co-act to jointly limit the further distortion of the pad and the relative displacement of the sections. Also the lengths of the bosses **43** and **44** are so proportioned as to provide a space **47** between their confronting faces **48** and **49** which progressively closes during relative displacement of the sections, whereby these confronting faces are brought into abutment upon engagement of the core wall **42** of the pad with the bosses. As will be seen in Figure 3, this co-action provides a

continuous smooth surface over the combined length of the engaged bosses for engagement with the distorted portions of the pad and obviates any danger of damage to the pad by sharp corners or by pinching or the like. The danger of damage to the pad is further eliminated by making one of the bosses 44 somewhat shorter axially than the other boss 43 so that their line of abutment is removed from the point of first contact of the distorted pad material with the boss surface.

While the coupling of the present invention has been shown and described in use with a manually supported hand drill motor 41 and tapered grinding stone 47 of the type used for grinding a valve seat 51 in which combination the coupling is particularly useful, other types of drives and grinder attachments may be used. For example, the coupling may be used in any power grinding set-up either of stationary or portable mounting, such as the hand-held motor as shown, or a flexible cable drive, or the like. The coupling is particularly adapted for use with almost any abrasive type grinder attachment and is well suited for use with sand paper or emery covered disks of either the flexible or rigid backing type. The coupling works very well with abrasive disks which are rigidly backed, due to the resilient flexibility provided by the coupling, and in such applications promotes increased efficiency while preventing danger of the disk digging into the surface being sanded or otherwise abrasively finished.

I claim:

1. A coupling of the character described comprising, a pair of sections mounted with opposite sides in confronting relation and concentric to a common axis, said sections having hub portions formed for securing to a drive shaft and a grinder attachment respectively and being formed with concentric cylindrical bosses extending in an axial direction from said faces, a pad of resiliently distortable material having opposite sides engaged with said faces and formed with a hollow core receiving concentrically therein said cylindrical bosses, means clamping said faces against said pad sides to place said pad under initial resilient compression and permitting relative rotational displacement of said sections, the inside wall of said core being spaced by a predetermined clearance from said bosses, said pad being distortable at said core into said clearance to permit relative displacement of said sections, and said bosses functioning to engage said pad core wall to limit the distortion thereat and the extent of relative displacement of said sections.

2. A coupling of the character described comprising, a pad of resiliently distortable material having opposed substantially parallel sides and a hollow core defined by an internal substantially cylindrical wall, a pair of disk-shaped sections having opposed confronting faces mounted against said pad sides, said sections having hub portions formed for securing to a drive shaft and a grinder attachment respectively and being formed with concentric cylindrical bosses of equal diameter extending axially from said faces and into said core from the opposite sides thereof, means clamping said faces against said pad sides to place said pad under initial compression and permitting relative rotational displacement of said sections, said means providing a predetermined spacing between the confronting end portions of said bosses, the diameter of said core wall being greater by a predetermined clearance than the outside diameter of said bosses, said pad being distortable at said core into said clearance to permit relative rotational displacement and axial approach of said sections, said bosses functioning to engage said core wall and to abut at said end portions to limit the distortion of said pad and the extent of relative displacement of said sections.

3. In a coupling of the character described, a pair of sections formed with co-axial means for securing a grind shaft and a grinder attachment respectively, said faces being formed with confronting faces symmetrical to the common axis of said means and having concentric cylindrical bosses extending in an axial direction from said faces, an annular pad of resiliently distortable material having opposite sides and a substantially circular periphery and a concentric hollow core, said pad being mounted between said sections concentrically to said axis with said pad sides engaged by said faces and with the pad wall defining said core surrounding in spaced relation said cylindrical bosses to provide a clearance therebetween, a casing having a substantially cylindrical internal wall surrounding said pad periphery in predetermined spaced relation thereto to provide clearance therebetween, said casing wall and said bosses cooperating with said faces to define an annular chamber containing said pad and having a volume exceeding the volume of said pad by the amount of said clearances, said pad being distortable at its periphery and at its core into said clearances to permit while resiliently resisting relative displacement of said sections, said wall and said bosses functioning to engage said pad periphery and core respectively to limit the distortion thereat and the extent of relative displacement of said sections.

4. In a coupling of the character described, a pair of sections formed with co-axial means for securing a grind shaft and a grinder attachment respectively, said faces being formed with confronting faces symmetrical to the common axis of said means and having concentric cylindrical bosses extending in an axial direction from said faces, an annular pad of resiliently distortable material having opposite sides and a substantially circular periphery and a concentric hollow core, said pad being mounted between said sections concentrically to said axis with said pad sides engaged by said faces and with the pad wall defining said core surrounding in spaced relation said cylindrical bosses to provide a clearance therebetween, a casing having a substantially cylindrical internal wall surrounding said pad periphery in concentrically spaced relation thereto to provide a clearance thereat, said bosses and said casing wall cooperating with said faces to define an annular chamber containing said pad and having a volume greater than the volume of said pad by the amount of said clearances, said pad being distortable at its periphery and at its core into said clearances to permit while resiliently resisting relative displacement of said sections, securing said casing to said sections and clamping said faces against said pad sides to place said pad under initial compression and permitting relative displacement of said sections, said last named means providing a predetermined spacing between the confronting end portions of said bosses, said bosses and said casing wall functioning to engage said pad core wall and periphery respectively and said boss end portions functioning to abut to limit the distor-

tion of said pad, and the extent of relative displacement of said sections.

5. In a coupling of the character described, a generally cylindrical annular pad of resiliently distortable material having opposed substantially parallel sides and a hollow core defined by an internal substantially cylindrical wall, a pair of disk-shaped sections having opposed confronting faces abutting said pad sides, said sections having hub portions formed for securing to a drive shaft and a grinder attachment respectively and being formed with concentric cylindrical bosses of equal diameter extending axially from said faces and into said pad core, a tubular casing mounted in encircling concentric relation about said pad and said sections and having an inturned flange at one end adapted to engage the outer side of one of said sections for securing said sections against withdrawal therefrom, the other end of said casing being formed in crimped engagement with the other of said sections for securing said casing thereto, with said pad clamped between said faces under

a predetermined degree of initial compression, the inside and outside diameters of said pad being of dimensions providing annular clearances between said pad and said bosses and casing respectively, and means preventing slippage of said pad sides relative to their abutting section faces, said last named means cooperating with the resilience of said pad to distort said pad at its periphery and at its core into said clearances to permit while resiliently resisting relative displacement of said sections, said wall and said bosses functioning to engage said pad periphery and core respectively to limit the distortion thereat and the extent of relative displacement of said sections.

WILLIAM J. HIGERT.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,366,502	Fitz Gerald	Jan. 2, 1945
2,514,051	Gredell	July 4, 1950