Sept. 20, 1960 G. B. STILLWAGON, JR 2,953,047

SPINNING TOOL

Filed Jan. 8, 1959

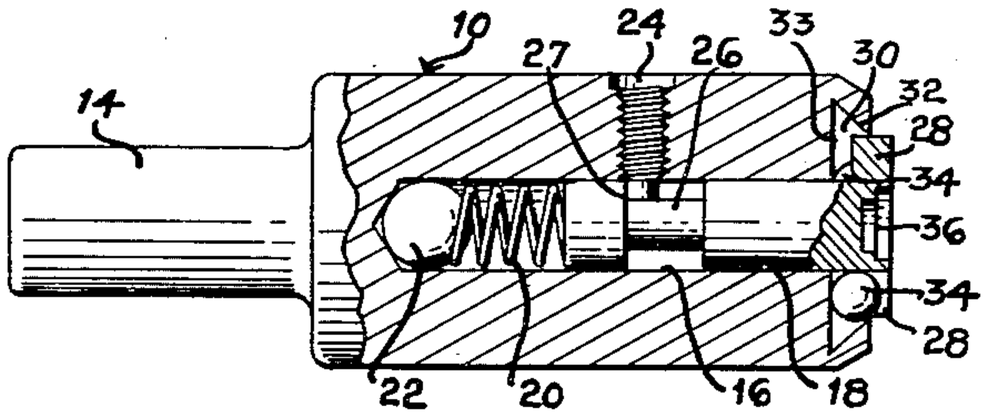

FIG. 1

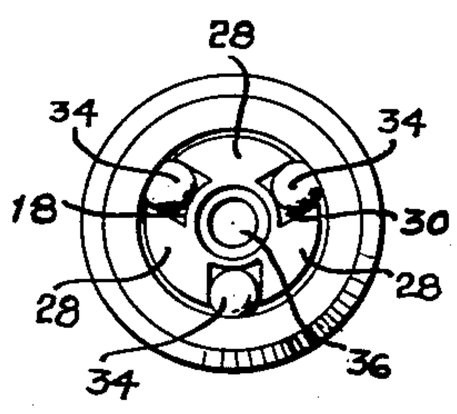

FIG. 2

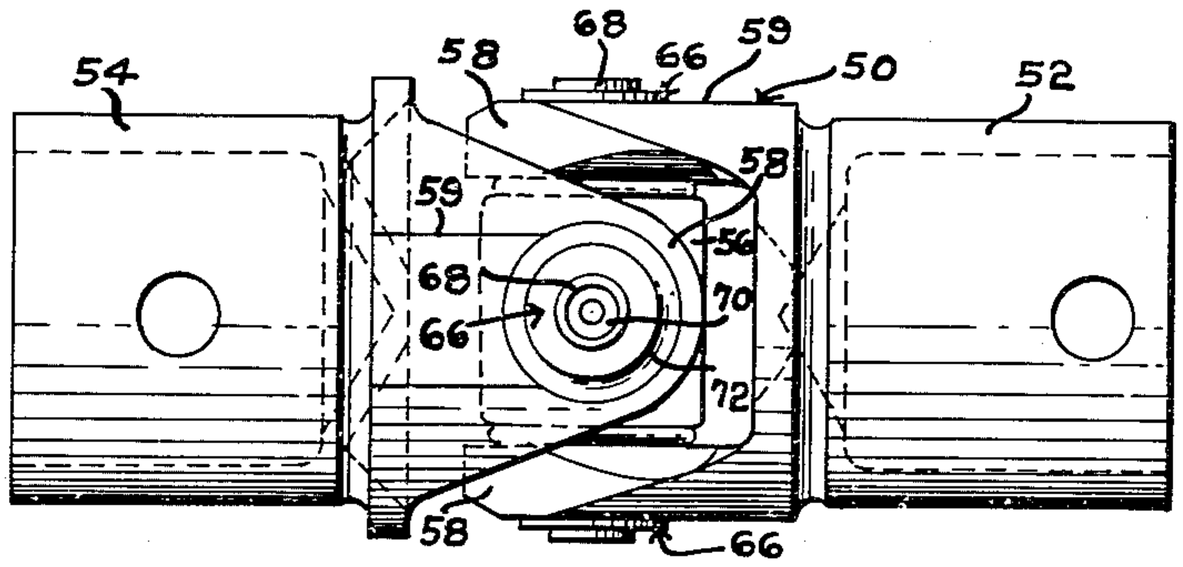

FIG. 3

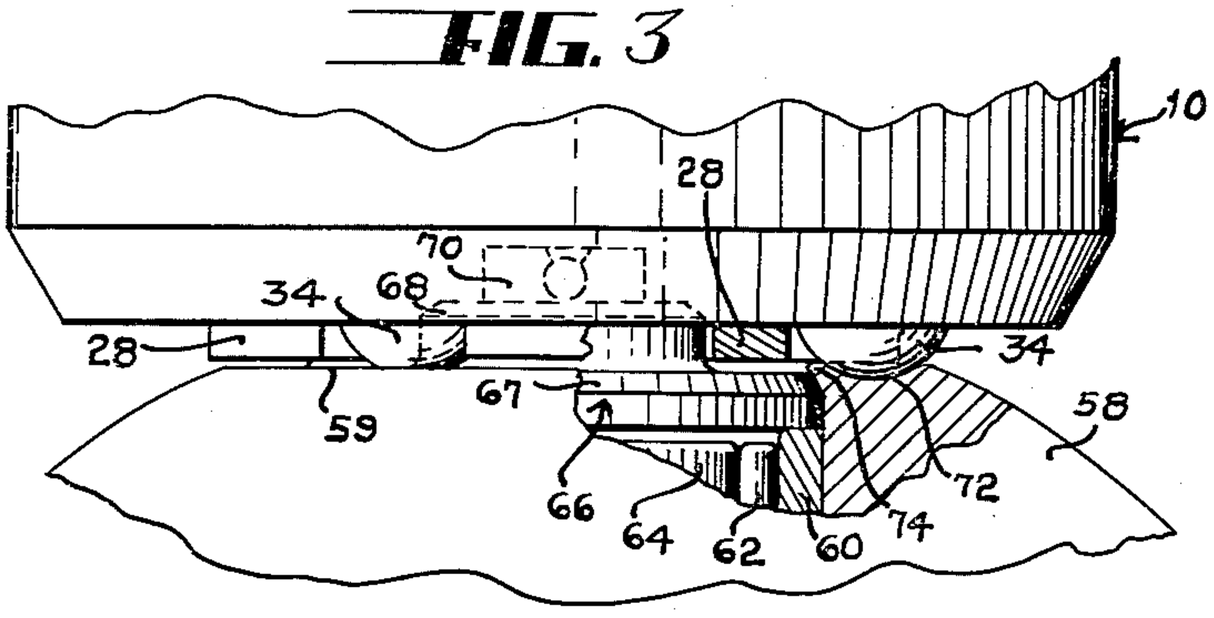

FIG. 4

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SPINNING TOOL

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4 Claims. (Cl. 80—1)

This invention relates to a spinning tool and more particularly to a tool adapted to swage an annular groove into a plane metallic surface, however, the invention is not necessarily so limited.

This application is a continuation-in-part of my copending application Serial No. 581,523, now Patent No. 2,903,868, filed April 30, 1956 for a Universal Joint.

An object of this invention is to provide an improved tool for spinning an annular groove into a flat surface.

Another object of this invention is to provide, in combination with a spinning tool for spinning an annular groove, means for accurately locating the tool relative to the surface in which the annular groove is formed.

Still another object of this invention is to provide a tool for supporting a plurality of ball elements in an annular ring and for rotating the ball elements in contact with a planar surface to swage an annular groove in the surface.

Other objects and advantages reside in the construction of parts, the combination thereof, the method of manufacture and the mode of operation, as will become more apparent from the following description.

In the drawing,

Figure 1 is a plan view of the spinning tool of this invention with portions broken away.

Figure 2 is an end elevation of the tool of Figure 1.

Figure 3 is a plan view of a universal joint assembled with the aid of the spinning tool of this invention.

Figure 4 is an enlarged fragmentary elevation view, with portions broken away, illustrating the operation of the spinning tool of this invention.

Referring to the drawing in detail, the spinning tool, as best seen in Figure 1, is assembled within a cylindrical body **10** having a shank **14** projecting from one end thereof. The shank **14** enables attachment of the tool to a suitable chuck or the like so that the tool can be rotated about the geometric axis of the body **10**.

Extending coaxially into the body **10** from the end opposite the shank **14** is a boring **16**. This end of the body **10** also has a recess **30** formed therein which is substantially frustum shaped. This recess **30** is inwardly diverging, such that the wall **32** which surrounds the recess forms an acute angle with the base **33** of the recess.

A spindle **18** is journalled for rotation and for sliding axial movement in the boring **16**. A coil spring **20** operating against a ball element **22** seated against the end of the boring **16** urges the spindle **18** outwardly. Outward movement of the spindle is limited by means of a set screw **24** threadedly engaging the body **10** and projecting into the boring **16**. The spindle **18** is provided with an annular groove **26** which receives the inner end of the set screw **24**. Outward movement of the spindle **18** is checked when the inner end of the set screw **24** engages the shoulder **27** which forms the inward margin for the groove **26**.

As best seen in Figure 2 the outer end of the spindle **18** comprises an axially disposed wall portion from which

project three equispaced radially extending lobes **28** which cooperate to equally space three ball elements **34** within the annular channel formed between the spindle **18** and the wall **32** which surrounds the recess **30**. The ball elements **34** each have a diameter which exceeds the axial depth of the recess **30** and is less than twice the axial depth of this recess. The dimensions of the recess **30**, the spindle **18**, and the ball elements **34** are such that after the ball elements have ben placed in the recess **30** and after the spindle **18** has been positioned in the boring **16** with the ball elements **34** situated between the lobes **28** of the spindle, the ball elements **34** are caged. That is, the ball elements are trapped between the axial wall portion of the spindle and the inwardly diverging wall **32** of the recess **30**. The ball elements **34** can be removed only after the spindle **18** has been withdrawn.

In the outer end of the spindle **18** is a stepped cylindrical cavity **36** which, as will become more apparent hereinafter, is used to center the spinning tool with respect to the work piece into which the annular groove is to be formed. To this end the cavity **36** is concentric with the spindle **18**.

Figure 3 illustrates a universal joint **50** which is formed with the aid of the spinning tool of Figures 1 and 2. The universal joint is formed of essentially cylindrical connecting members **52** and **54** coupled together by a coupling block **56**. To effect the coupling, each of the connecting members is provided with a pair of jaws **58** spaced to receive the coupling block **56**.

As best seen in Figure 4, each of the jaws **58** is provided with an initially flat surface **59** and an aperture therein which receives a bushing **60**. The connecting members **52** and **54** are secured to the coupling block **56** by pintles **64** seated within the coupling block **56** and projecting normally from the faces of the coupling block **56** into the bushings **60** in the jaws **58**. Needle bearings **62** are interposed in an annular ring between the bushings **60** and the pintles **64**. The assembly including the bushings **60**, the needle bearings **62**, and the pintles **64** is retained within each of the jaws **58** by means of a cap **66** fitted within the jaw aperture which receives the assembly. Each of the caps **66** is provided with a cylindrical centering boss **68** projecting outwardly therefrom.

The particular universal joint illustrated is designed so that it may be lubricated by means of a lubricant introduced through one of the caps **66**. To this end one of the caps is provided with a grease fitting **70** projecting outwardly from its centering boss **68**. It is to accommodate this grease fitting that the cavity **36** in the spinning tool is stepped.

Each of the caps **66** is beveled at its outer margin, as shown at **67** in Figure 4. The caps are secured by the following means. With a cap **66** seated in an aperture in one of the jaws **58** against the bushing **60** therein, the spinning tool is lowered upon that jaw and centered with respect to the aperture therein by the centering boss **68** which projects into the cavity **36**. The location of the spindle **18**, as fixed by the set screw **24** cooperating with a spring **20**, is such that the centering boss **68** moves into the cavity **36** before the ball elements **34** engage the surface **59** of the jaw **58**.

The body **10** is rotated about its geometric axis with the ball elements **34** sandwiched between the base **33** of the recess **30** in the body **10** and the flat surface **59** of the jaw **58**. Friction between the base **33** and the ball elements **34** causes the ball elements to roll in a circular path on the surface of the jaw **58** and with the application of pressure an annular groove **72** is formed in the initially flat surface **59** of the jaw **58**. With formation of this groove, a lip **74** is rolled into intimate contact with the beveled portion **67** of the cap **66**. It is this lip which retains the cap **66** in the jaw **58**.

As the annular groove is spun into the surface of the jaw **58** the base **33** of the recess **30** serves as a bearing race. For best operation of the spinning tool, this bearing race is hardened to a hardness materially exceeding that of the jaws **58**. The ball elements **34** must be similarly hardened.

It will be observed that successful operation of the spinning tool requires that the spindle **18** project far enough out of the body **10** that the centering bosses **68** on the caps **66** can seat within the cavity **36** in the spindle **18** before the ball elements **34** engage the surface of the jaws **58**. Furthermore, there must be enough axial movement associated with the centering boss **68** and the cavity **36** to enable the ball elements **34** to move into engagement with the surface **59** of the jaws **58** and to move into that surface the depth of the annular groove which is to be formed therein.

In some applications, this axial movement might be provided for by having an elongated centering boss **68** and a correspondingly deep recess **36**. However, as in the manufacture of modern universal joints, dimensional limitations frequently require that the centering boss be as small as possible. It is for this reason that the spindle **18** is permitted limited axial movement within the body **10**. It is to be understood, of course, that in different applications it may prove advantageous to place the centering boss on the spindle **18** and provide the work which is to receive the annular groove with a complementary centering cavity.

In the spinning tool disclosed, three ball elements are used to form the annular groove. The use of three ball elements is preferred for the reason that this provides a balanced three point contact with the surface which is to receive the groove. This same balanced condition can be obtained with a larger number of ball elements, however, as the number of ball elements is increased the pressure with which each ball element engages the groove receiving surface decreases. Thus, while three is the preferred number of ball elements, spinning tools using fewer than three or more than three ball elements may be successfully employed without departing from the scope of this invention.

Although the preferred embodiment of the device has been described, it will be understood that within the purview of this invention various changes may be made in the form, details, proportion and arrangement of parts, the combination thereof and mode of operation, which generally stated consist in a device capable of carrying out the objects set forth, as disclosed and defined in the appended claims.

Having thus described my invention, I claim:

1. A device for spinning an annular groove in a planar surface including a rotatable one piece body member having an elongate boring therein, one end of said body member having an inwardly diverging frustum shaped recess therein communicating with the boring in coaxial relation thereto, a spindle journalled for rotation in the boring and having an end portion projecting into the recess, and a plurality of like ball elements disposed within the recess in surrounding relation to the end portion of the spindle, the diameter of the ball elements being greater than the axial depth of the recess but less than twice the depth thereof, the end portion of the spindle cooperating with the inwardly diverging wall of the body member which surrounds the recess to cage the ball elements.

2. The device according to claim 1 wherein the end portion of the spindle has lobe portions which project radially outwardly between the ball elements to space the ball elements at equal intervals around the spindle.

3. A device for spinning an annular groove in a planar member having a centering boss thereon, said device including a rotatable one piece body member having an elongate boring therein, one end of said body member having a shallow inwardly diverging frustum shaped recess therein communicating with the boring in coaxial relation thereto, a spindle journalled for rotation and sliding movement in the boring and having an axially disposed end portion projecting into the recess, a plurality of like ball elements disposed within the recess in surrounding relation to the end portion of the spindle, the diameter of the ball elements being greater than the axial depth of the recess but less than twice the axial depth thereof, the axially disposed end portion of the spindle cooperating with the inwardly diverging wall of the body member which surrounds the recess to cage the ball elements, the end portion in the spindle having a centrally located cavity therein complementary to said centering boss, yielding means urging the spindle outwardly of the boring in the direction of the recess, and means limiting the outward movement of the spindle, said last named means cooperating with said yielding means to locate the end portion of the spindle for engagement with the centering boss.

4. The device according to claim 3 wherein the end portion of the spindle has lobe portions thereon which project radially outwardly between the ball elements to space the ball elements at equal intervals around the spindle.

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