Oct. 4, 1949. H. E. VEIT ET AL 2,483,799

DIMPLING TOOL

Filed June 26, 1945 2 Sheets-Sheet 1

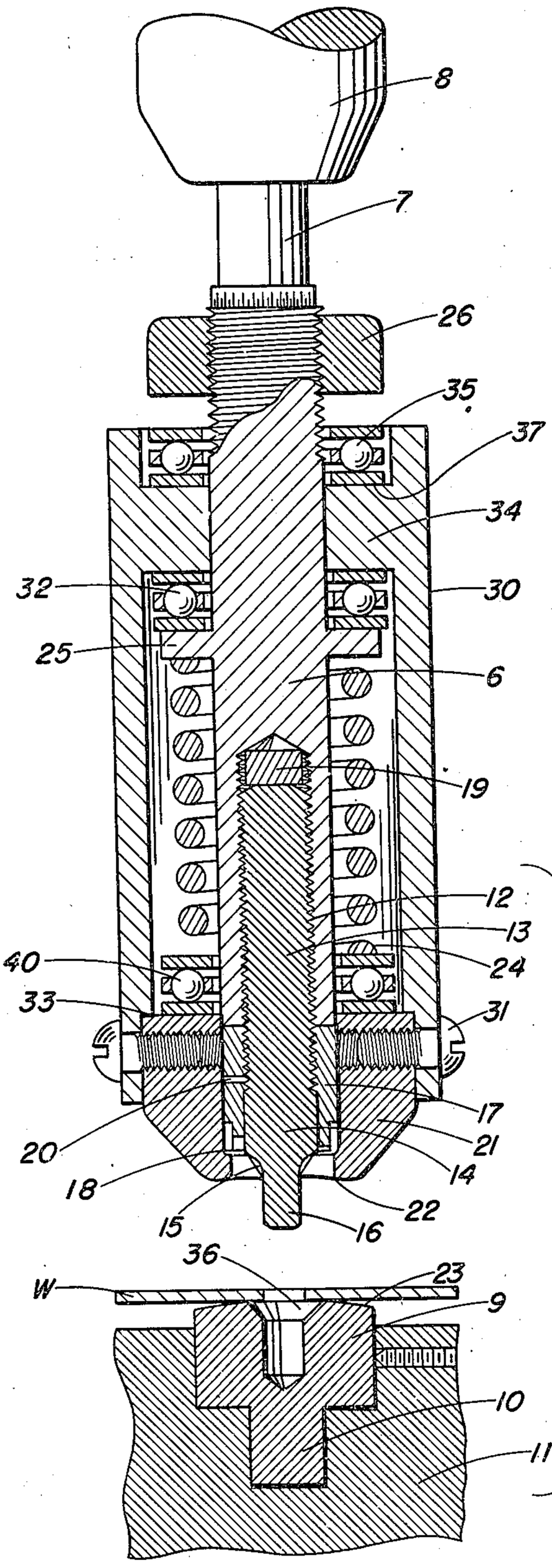

FIG. 1

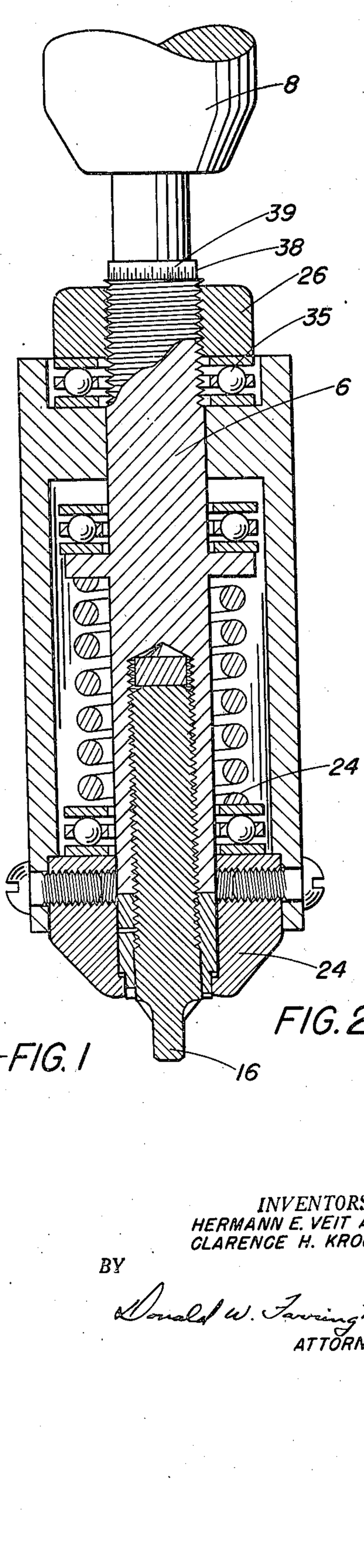

FIG. 2

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Filed June 26, 1945 2 Sheets-Sheet 2

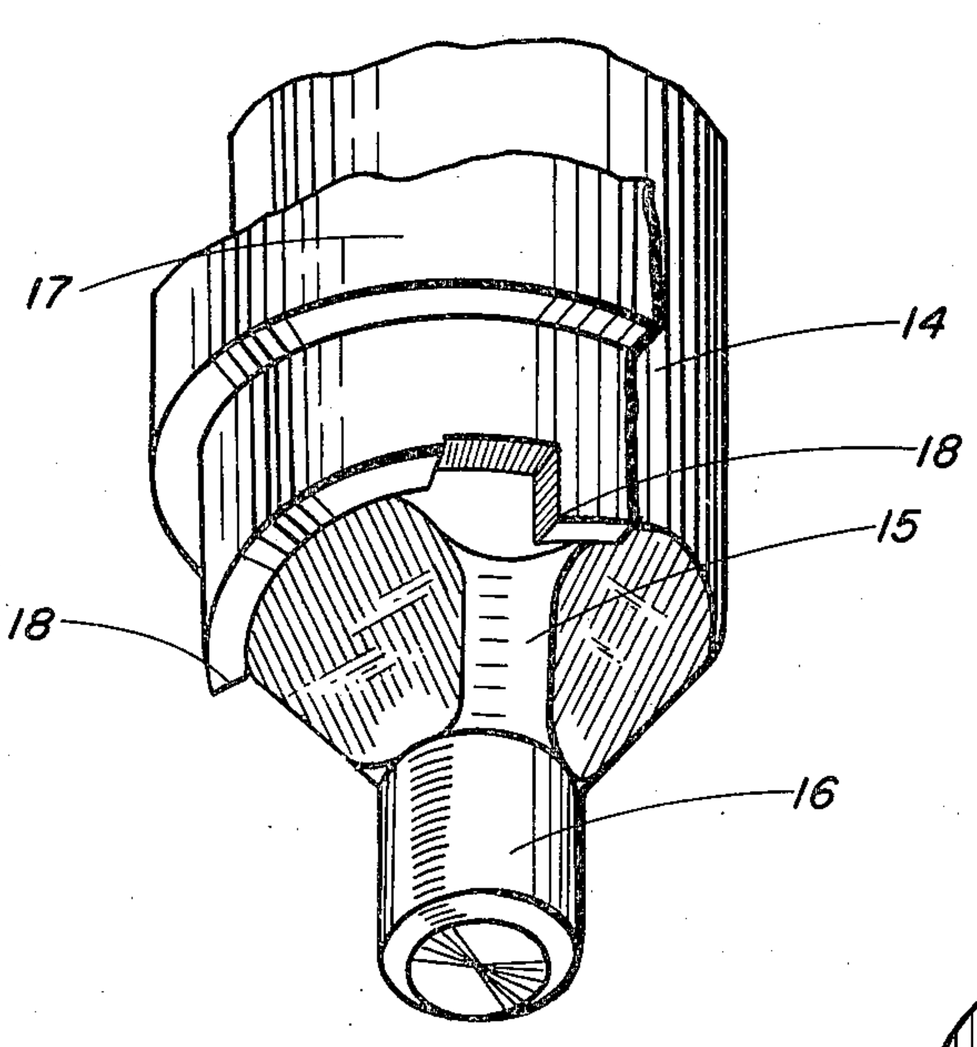

FIG. 4

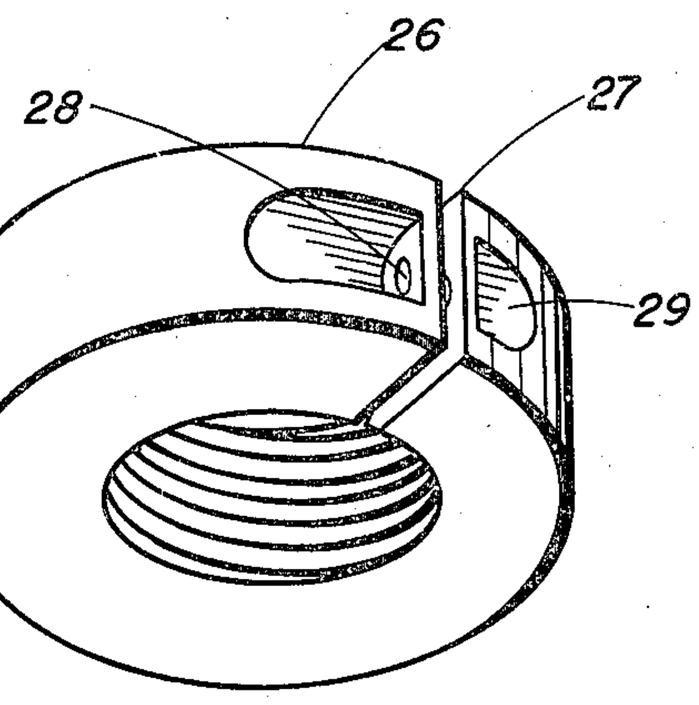

FIG. 5

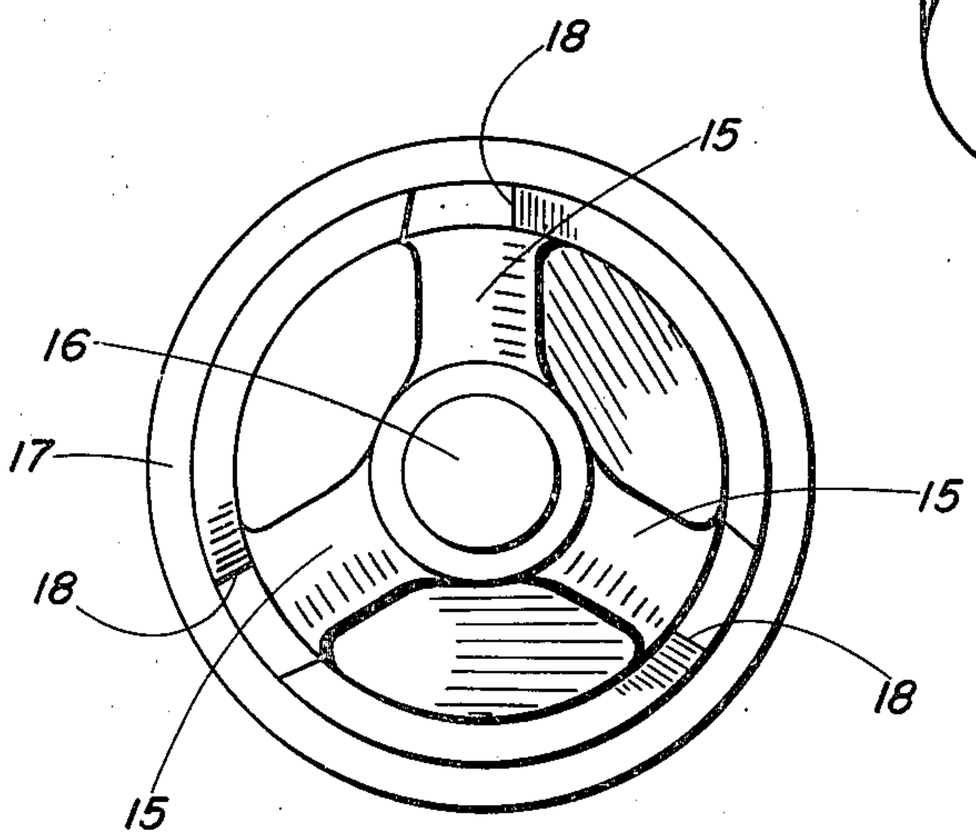

FIG. 3

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UNITED STATES PATENT OFFICE

2,483,799

DIMPLING TOOL

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Application June 26, 1945, Serial No. 601,668

4 Claims. (Cl. 153—21)

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Our invention relates to an apparatus for forming dimples, and more particularly to an improved dimpling tool including means whereby the depth of the dimple to be formed may be precisely controlled.

Our present invention relates to improvements in dimpling tools of the type described and claimed in the copending application, Veit, Method and apparatus for the dimpling of hard metal alloys, Serial No. 548,073, filed August 4, 1944. The tool of the instant invention provides many of the advantages described in connection with the device of said Veit application and has been developed and is utilized for similar purposes.

Our improved dimpling tool also includes means for controlling the final position of the tool body with respect to the top surface of the sheet being dimpled to insure that the spinning tool will move down into the sheet far enough to form an adequate dimple but not so far that the burr remover will cut into the surface of the sheet. The construction is such that this has been achieved while retaining the advantages of the tool of the said copending application.

It is possible for a skilled operator to achieve a careful control of the depth of each dimple with existing dimpling tools. This, however, requires considerable experience in the handling of the tools. When unskilled operators use such tools, variations of several thousandths of an inch in the depth of the dimple, and damage to the surface of the sheet adjacent the dimple by the burr remover, may occur. In sheet metal work requiring precision and accuracy of the degree involved in the construction of aircraft, and the like, such variations and imperfections lead to excessively high costs, and are to be avoided if possible.

To provide equipment suited to use by unskilled operators, drill presses are conventionally equipped with adjustable frame stops to limit the movement of the tool at a predetermined point with respect to the frame. Such apparatus, however, does not stop the movement of the tool at a predetermined point with respect to the surface of a sheet. All large metal sheets possess thickness variation from point to point over their surface. Consequently the various portions of the sheet surface are not on the same plane. When the conventional drill press frame stop is so adjusted as to produce the desired dimple on the thick part of the sheet the tool would not at a thinner portion of the sheet come down far enough to complete the dimple or to remove the burr formed by the dimpling operation. When

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the frame stop is adjusted for the thin portion, the tool would cut too deeply into the thicker part. As a result, control arrangements which involve regulatory means apart from the dimpling tool itself require the skilled operator to make frequent adjustments to compensate for the variations in the thickness of metal being worked. The unskilled operator being unfamiliar with the thickness variations inherent in sheet stock and lacking the experience that would provide the proper "feel" of the working tool finds it difficult to form acceptable dimples.

It is an object of our invention to provide a spin dimpling tool having dimple control means integral therewith whereby the operator may produce uniform, acceptable dimples regardless of the thickness variation in the sheet being worked.

It is a further object of our invention to provide a tool for forming a dimple about a hole in sheet metal that includes a metal spinning element adapted to be advanced into the sheet to spin a conical dimple about the hole and trim the burr occasioned by the spinning, and wherein means are provided to insure that the tool advance will complete the dimple and trim the burr flush with the surface of the sheet without being advanced to a point where the burring operation penetrates the surface of the sheet.

It is another object of our invention to provide a tool for forming a dimple about a hole in sheet metal that includes a metal spinning element adapted to be advanced into the sheet to spin a conical dimple about the hole, and burr trimming means surrounding said metal spinning element adapted to be advanced with said spinning element whereby said trimming element will trim the burr occasioned by the spinning, and wherein control means are provided to insure that the tool advance will complete the dimple to a predetermined depth in the sheet and will trim the burr flush with the surface of the sheet without permitting the trimming element to penetrate the surface of the sheet.

It is another object of our invention to provide a tool according to the preceding object wherein the said control means includes a pressure pad mounted for axial and rotary movement relative to said spinning and trimming means, and cooperating stops on the tool body and pressure pad limiting the relative axial movement between the pressure pad and tool body.

It is another object of our invention to provide a tool according to the preceding object wherein

the cooperating stops may be quickly and accurately adjusted.

It is another object of our invention to provide a dimpling apparatus having a tool body, a pressure pad mounted for relative axial movement with respect to the tool body, and wherein such axial movement may be accurately controlled by adjustable means on the tool body.

These and other objects of our invention will appear more fully in the following description and in the accompanying drawings, wherein:

Figure 1 is a cross sectional view of our dimpling tool with the sheet to be dimpled in place on the anvil, and with the tool in raised position;

Fig. 2 is a similar view showing the spinning element lowered with respect to the pressure pad;

Fig. 3 is an enlarged end view of the spinning and burring elements of the tool;

Fig. 4 is an enlarged fragmentary perspective view showing the spinning, burring, and pilot elements of the tool; and

Fig. 5 is an enlarged detail in perspective of the adjusting collar of our dimpling tool.

A preferred embodiment of our invention comprises a rotating tool body 6 having at one end a shank 7 adapted to be secured to and driven by the chuck 8 of a conventional drill press, and an anvil 9 including a depending centering boss 10 held in a suitable fixture, or vise, 11 in alignment with the axis of the tool body 6 as shown in Figure 1. The lower end of the tool body 6 is provided with an axial bore 12 interiorly threaded to receive the threaded shank 13 of a metal spinning element 14. At its lower end the metal spinning element 14 is formed with a plurality of radial ribs (see Figs. 1, 3 and 4), each having a rounded outer edge, to work the metal of the dimple, as described in the copending application, Serial No. 548,073. The extreme tip of the spinning element 14 is formed to function as a pilot 16. Surrounding a portion of the spinning element which extends below the tool body 6, and in threaded engagement with the spinning element, is a burrer 17 formed at its lower end with cutting teeth 18.

Shims of varying thickness may be inserted between the spinning element 14 and the top of the bore 12 to accommodate adjustment of the spinning element and burrer occasioned by wear and sharpening of the teeth 18. A shim 19 is shown abutting the end of shank 13 to prevent further movement into the threaded bore 12 due to axial pressure and turning of the tool body. When the cutting teeth 18 become worn or shortened by re-sharpening it is necessary to move the spinning element 14 upwardly in relation to the burrer 17 in order to preserve the proper spacing between their working edges. Consequently the shim 19 would in that event be replaced by a thinner one. An aperture 20 is provided in one side of the burrer 17 to accommodate a spanner wrench whereby the burrer may be tightened on the spinning element 14. A slidably mounted cylindrical pressure pad 21 is provided for the major portion of its length with an axial bore which is adapted to receive the burrer 17 and the adjacent portion of the tool body 6. The pressure pad is provided with a concave end surface 22, which cooperates with the convex anvil surface 23 to flex the sheet metal slightly in a direction opposite that of the dimple itself to obtain the advantages of the arrangement shown and described in Veit patent, No. 2,288,378, granted June 30, 1942. The pressure pad 21 is urged downwardly by a spring 24 extending from the shoulder 25 on the tool body 6, and to insure that the pressure pad will not be driven by the tool body as the pad engages the work sheet W, an upper thrust bearing 32 and a lower thrust bearing 40 are provided to effect free rotation between the tool body 6 and sleeve 30.

The end portion of the tool body 6 adjacent the shank 7 is threaded to receive an interiorly threaded collar 26 which is adapted for adjustable movement on the threaded portion of the tool body. The collar 26 is shown in detail in Figure 5. To prevent the rotation of the collar on the tool body after its adjustment, the collar 26 is split on one side, as at 27, and may be clamped on to the tool body 6 as by a threaded bolt being passed through a hole 28 which is cut through portions of the collar on both sides of the break 27. A notch 29 may be cut in the collar to provide working surface for adjusting and securing of the bolt.

A sleeve 30 surrounds the tool body and is secured at one end to the pressure pad 21 as by screws 31. The sleeve is cut out as at 33 adjacent its end to receive the top portion of pressure pad 21, thereby forming a more secure and rigid bond between the sleeve and the pad.

To limit the axial movement of the sleeve and pressure pad with respect to the tool body, the sleeve 30 is provided adjacent its opposite end with an interiorly extending ledge 34 arranged to provide a seat 37 for outer thrust bearing 35. When the tool body is raised free of the work sheet (Fig. 1) the collar 26 is spaced a short distance from the top of outer thrust bearing 35, this distance depending on the adjustment of the collar 26 on shank 7. When the tool body is in its lowered position relative to the pressure pad (Fig. 2) the collar 26 bears an outer thrust bearing 35.

As the chuck 8 is lowered the entire assembly moves toward the sheet W to be dimpled, and the pilot 16 enters through a rivet hole in the work sheet. The spring 24 urges the pressure pad 21 against the work coaxially of the rivet hole, thereby stopping the turning of the pad. The sheet is first held and bent slightly upwardly around the edges of the rivet hole by the cooperating faces of the pressure pad and the anvil, to eliminate the depression which would otherwise form in the area adjacent the dimple. As the downward movement is continued the spring 24 is compressed and the ribs 15 of the metal spinning element 14 and the teeth 18 of the burrer 17 move vertically through the opening in the pressure pad 21 to engage the uppermost surface of the sheet area to be dimpled. The sheet stock forming the dimple is progressively worked into the die recess 36 of the anvil 9. In the event a burr is formed at the upper edge of the dimple by the spinning element, the rotating teeth 18 of the burrer 17 remove it.

The extent of the movement of the tool body, spinning element and burrer with relation to the pressure pad is limited by the relationship between the upper surface of ledge 34 of the sleeve 30 and the collar 26 on the tool body 6. When the tool body has moved downwardly through the sleeve to the point where the collar 26 contacts the thrust bearing 35 further downward movement of the tool body is prevented. Thus by limiting the relative movement between the tool body and the pressure pad and sleeve the depth of the dimple is accurately controlled within narrow limits regardless of

variations in work sheet thickness. The extent of movement which is permitted between the thrust bearing **35** and the collar **26** may be varied, by raising or lowering the collar **26** on the tool body **6**.

Preferably shank **7** is provided with an enlarged unthreaded base portion **38** formed slightly less in diameter than the diameter of tool body **6**. Indicia **39** may be placed on said base portion **38** and an index line may be so positioned on the top of the collar **26** as to show in fractions of an inch the displacement of the pressure pad sleeve with respect to the tool body. The user may thus determine with micrometer exactness the character of the dimple to be produced and assure removal of any burr formed adjacent the dimple.

If it is desired the sleeve **30** may be prevented from rotating relative to the tool body **6** by a laterally extending member secured to the sleeve that engages a stop on the dimpling tool stand.

With the use of our invention it will be appreciated that the depth of the dimples will be the same regardless of variations in the thickness of the sheet being worked and that no skill is required to consistently obtain uniform dimples.

Our invention is capable of many modifications within the scope of this specification and is not to be limited to the precise arrangement shown nor otherwise than as set out in the following claims.

We claim:

1. A tool for dimpling sheet metal stock comprising an anvil having a conical recess and a coaxial pilot bore, means adapted to be moved toward and away from said anvil including a pilot to center the stock with respect to said bore, a metal spinning member rotatable about the axis of said pilot to spin the stock to be dimpled into the recess of said anvil as the pilot is advanced with respect to said bore, a metal cutting means placed radially relative to and carried by the spinning member for rotation therewith to trim the burr at the juncture between the surface of the sheet stock and the stock spun into the anvil recess, a pressure pad journaled on the spinning member, and means on the spinning member and pad adapted to limit the movement of said spinning member toward said anvil and thereby control the amount of spinning of the stock.

2. A tool for dimpling apertured sheet metal stock comprising an anvil with a convex surface having a conical recess and a coaxial pilot bore, means adapted to be moved toward and away from said anvil including a tool sleeve formed with an interiorly extending ledge spaced from one end, a tool body adapted for rotatable mounting in said sleeve having a shoulder adapted for engagement with said interiorly extending ledge of the sleeve with one end of said tool body formed for connection to a rotative driving device and the other end thereof provided with an element receiving bore, an apertured pressure pad mounted as an extension of said sleeve having a concave bearing surface aligned with the convex surface of the anvil, spring means spaced between said shoulder of the tool body and the pressure pad arranged to urge the tool body shoulder into contact with said ledge, a metal spinning means mounted in said bore end of the

tool body comprised of a work centering pilot aligned with the anvil pilot bore and a conical spinning element formed with a plurality of radial ribs adapted for uniform engagement with a metal sheet stressed over the anvil for spinning metal of said sheet into the conical recess of said anvil, a burr removing element mounted on the tool body for rotation adjacent the spinning element, an adjusting means mounted on the tool body having a lockable collar spaced from the tool sleeve and adapted for locked engagement with the tool body to limit axial movement of said tool body relative to the sleeve.

3. A tool for forming a conical dimple about a hole in sheet metal comprising a tool body formed at one end for connection to a rotative mechanism with the other end thereof provided with a ribbed, conical metal-spinning element, a burr-removing element carried by the tool body having cutting teeth normal to the axis of the tool body arranged at the outer end of the ribs of said metal-spinning element and adapted to trim flush with the surface of the sheet being dimpled a burr occasioned by the spinning, and means to control the movement of said tool body toward the surface of the sheet, said control means comprising a pressure pad mounted for axial and rotary movement relative to said spinning and burr-removing means, cooperating stops on the tool body and pressure pad limiting the relative axial movement between the pressure pad and tool body, and regulating means on the tool body whereby the stop on the tool body may be adjusted to vary the limits of said axial movement.

4. A tool for forming a conical dimple about a hole in sheet metal comprising a tool body formed at one end for connection to a rotative driving mechanism and the other end provided with a ribbed, conical metal-spinning element, cutting means mounted on the tool body for rotative movement with the spinning element to provide a circular cutting path adjacent said metal-spinning element so as to cut off a burr, occasioned by the spinning, flush with the surface of the sheet of metal being dimpled, and means to control the movement of the tool body toward the sheet comprising a pressure pad mounted for axial and rotary movement relative to the tool body, said pad mounting including bearings providing for free rotation of the tool body within the pressure pad, and cooperating stops carried by the tool body and the pressure pad and arranged to limit the relative axial movement between the pressure pad and tool body whereby the advance of the tool body toward the surface of the sheet is controlled by said stops.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
14,878	Miller et al.	May 13, 1856
173,808	Nugent	Feb. 22, 1876
245,678	Weaver	Aug. 16, 1881
2,288,378	Veit	June 30, 1942
2,308,447	Greenbaum	Jan. 12, 1943