

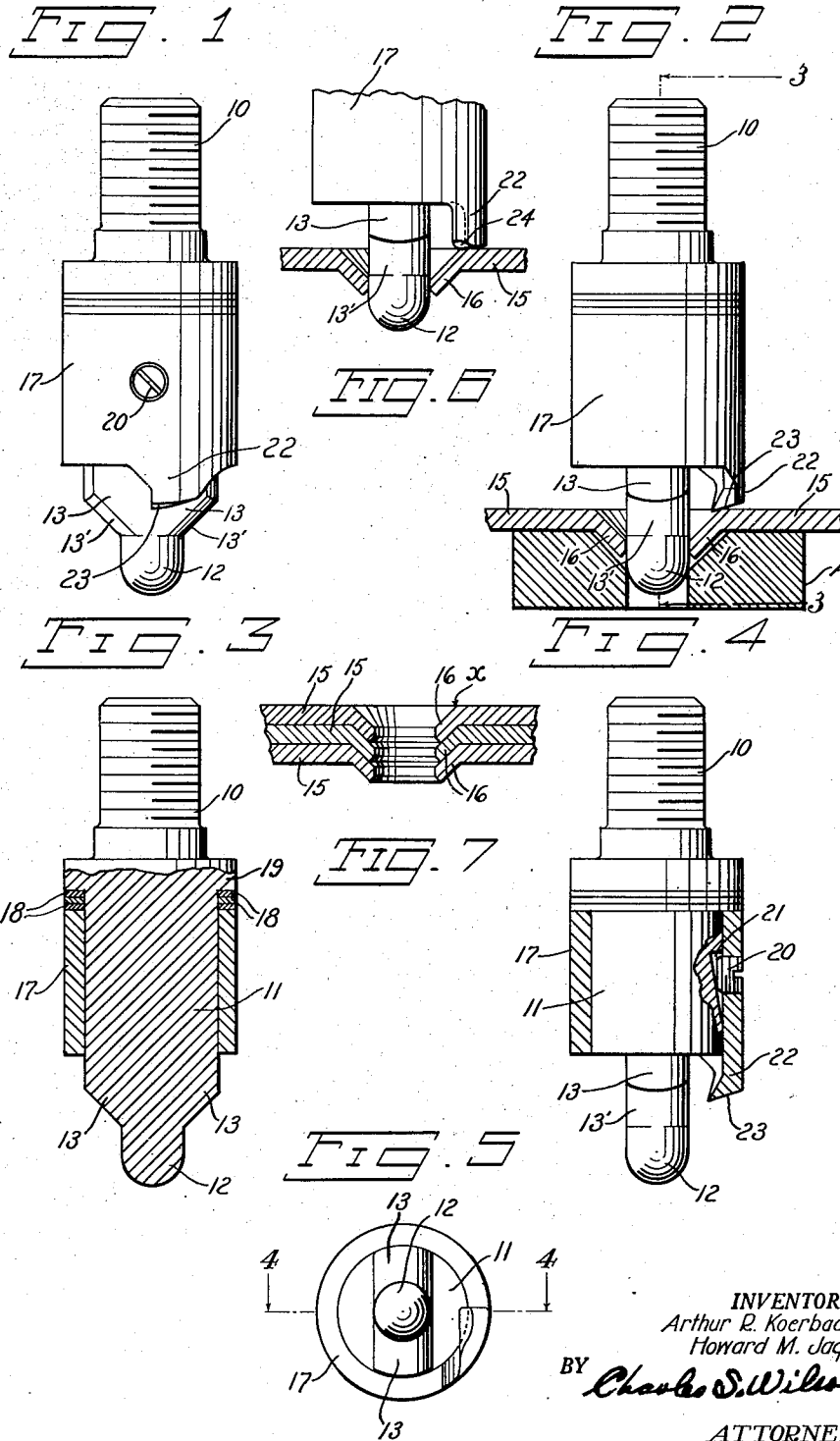
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DIMPLING TOOL

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DIMPLING TOOL

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This invention relates to tools for the creation of dimples in metal sheets for the reception and seating of the heads of rivets passing through holes are apertures formed in the sheets and has for its object the production of dimples or depressions having uniform shape, size and characteristics, at the same time maintaining the surface of the sheet perfectly flat and smooth particularly where the wall of the dimple or depression joins the body of the sheet.

Since it is customary to pierce each of two or more sheets with a series of rivet holes or apertures and then superimpose these sheets it is not only desirable that the dimples or depressions surrounding the several holes or apertures be of a uniform size and shape to facilitate the close and intimate nesting thereof but also that the walls of the several dimples be of a substantially uniform thickness and that no burr or rib occur where the wall of the dimple joins the body of the sheet which would prevent or interfere with the superposed sheets resting completely flush one on the other. Therefore the instant invention purposes a single tool for the repeated production of uniform dimples by spinning the metal of the sheet defining the holes therein and the simultaneous removal of any burr or rib which may result from this spinning where the wall of the dimple joins the sheet all without damaging, grooving or marring the sheet in so doing.

Among its other objects the present invention also contemplates a tool which may be employed in conjunction with standard equipment and which may also be driven by any standard and suitable machine.

With the above and other objects in view as will be apparent, this invention consists in the construction, combination and arrangement of parts all as hereinafter more fully described, claimed and illustrated in the accompanying drawings, wherein:

Fig. 1 is a side elevation of a dimpling tool constructed in accordance with the present invention;

Fig. 2 is a similar view taken at right angles to Fig. 1 to illustrate the tool operating to spin or form a dimple or depression in a sheet and remove any burr or rib occurring where the wall of the dimple joins the sheet;

Fig. 3 is a vertical section taken along line 3—3 of Fig. 2 parts whereof are in elevation;

Fig. 4 is a transverse section, partly in elevation, taken along lines 4—4 of Fig. 5;

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Fig. 5 is a bottom plan view of that form of the tool illustrated in Figs. 1 to 4 inc.;

Fig. 6 is a fragmentary elevation of the operative end of a modified form of the present dimpling tool and illustrates it forming a dimple in a metallic sheet and removing any burr or rib occurring where the dimple joins the sheet; and

Fig. 7 is a sectional view of a number of nested dimples formed by the instant tool in several superposed metal sheets.

In the riveting of metal sheets one to the other it is frequently desirable, especially in the production of aircraft, to produce an unbroken and smooth surface. To accomplish this it is necessary to countersink the heads of rivets employed in securing the metal sheets together and in place so that no part of the rivet projects beyond the plane of the outer sheet. It is generally the present practice to pierce the sheet with rivet holes or apertures after which the sheet is depressed or dimpled at and around each rivet hole to produce a cup or depression for the reception of the rivet head to the end that when the rivet is in place the outer face of its head will lie flush with the surrounding area of the sheet. Numerous tools have been heretofore developed to create these cavities or dimples at the rivet holes but their use has always resulted in the cracking or fracturing of the metal surrounding and defining the hole, or has been expensive and inefficient in operation and has rarely produced clean, uniform dimples without marring or damaging the sheet. The present invention proposes to create the dimple by spinning the metal of the sheet at the rivet hole, thereby depressing that part of the sheet surrounding and defining the rivet hole and disposing it at an angle to the remainder of the sheet. In doing this, the ribs or burrs may be, and frequently are, formed where the walls of the dimples join the sheet, and these are found to be a hindrance in the flush superimposing of several dimpled sheets. Therefore, the instant tool contemplates not only spinning a dimple into the body of the sheet surrounding the rivet hole but also purposes to remove this burr or rib which may occur where the wall or flange of the dimple joins the body of the sheet all without marring, cutting or otherwise damaging or affecting the body of the sheet or of the dimple.

Reference being had more particularly to the drawings, 10 designates the threaded shank of the present dimpling tool by which the tool is secured to a carrier and by it be mounted in the

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chuck of a drill press or other suitable rotating or driving instrumentality. Since the drill press chuck and the tool carrier are standard equipment and form no part of this invention, they are not illustrated nor will they be described herein.

At its lower end the shank 10 carries an enlarged body 11 preferably cylindrical in cross-section and positioned coaxially with respect to the shank 10. This body 11 terminates at its lower end in a spindle or pilot 12 which is concentric to the body 11 as well as to the shank 10. Aligned diametrically of the body 11 are a pair of spinners 13 which extend from the periphery of the body and converge inwardly toward and terminate at the pilot 12. It will be observed from Figs. 2, 4 and 5 that the sloping spinners 13 are disposed on opposite sides of the spindle or pilot 12 to align one with the other transversely thereof and of the body 11. The outer or operating surfaces 13' of the spinners 13 are convexly curved to operate against the metal of the sheet surrounding and defining the rivet hole or aperture as the spindle or pilot 12 enters and traverses said hole or aperture, as will be hereinafter described. While only two diametrically disposed spinners 13 are disclosed as carried by the body 11, it is apparent that two or more may be employed if desired, each of which is positioned on a radii of the body 13 and slopes toward the spindle or pilot 12.

The sheets 15 while in a flat or undimpled state are apertured at appropriate points for the reception and passage of the stems of rivets or other fastening means. The diameter of the pilot or spindle 12 of the instant tool is such that it may freely enter these preformed rivet holes formed in a flat, undimpled sheet to the end that the pilot or spindle 12 acts as a guide in finding the rivet hole and in directing the tool toward the sheet 15. The tool structure described to this point is placed in the tool carrier (not shown) which in turn is held by the chuck of a drill press or other device for rotating the tool. As the tool rotates and is moved toward the sheet 15 the pilot or spindle 12 enters the rivet hole or aperture to be dimpled bringing the convex operating surfaces or edges 13' of the spinners 13 into operating engagement with the metal of the sheet surrounding and defining the rivet hole or aperture. The movement of the tool downwardly forces the rotating spinners against the metal of the sheet and the rotation of the tool spins a dimple or depression adjacent the hole and bends the surrounding metal at an angle to the sheet to create the wall 16 of the dimple or depression. The angle, of the surfaces 13' of the spinners 13 to the axis of the tool or of its body 11 corresponds approximately to the angle or bevel of the head of the rivet, so that when the rivet is inserted in the rivet hole or aperture the inner face of its head will rest within or nest in the dimple and the outer face of the head thereof will be flush with the body of the sheet 15. Thus the shank 10, the body 11, the spinners 13 and the pilot 12, which constitute an integral concentric structure, will form the dimple 16 in the sheet 15 without resulting in any appreciable taper in the thickness of the sheet within or at the wall 16 of the dimple.

The foregoing structure is all that is necessary for the actual creation or formation of the dimple or depression but it has been found that in spinning the dimple or depression in the sheet, a burr or rib is on occasion produced where the wall 16 of the dimple joins the sheet 15, design-

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nated X in Fig. 7. This burr or rib is objectionable in that it prevents assembled sheets 15 from resting flush one on the other and also may interfere with full nesting of the dimples of the several sheets. Therefore it is desirable to remove the rib or burr without destroying the strength of the sheet, marring its surface adjoining the dimple, or causing the metal to crack or fracture in the wall of the dimple or where the wall joins the sheet. To that end, a sleeve 17 encloses or surrounds the body 11 of the tool to be secured thereto for rotation in unison therewith. The position of this sleeve on the body 11 may be determined by the shims 18 encircling the body 11 and located between the upper extremity of the sleeve 17 and the shoulder 19 at the upper end of the body adjacent the shank 10. To secure the sleeve 17 to the body 11 a set screw 20 pierces the sleeve and operates in a cavity 21 formed in the body 11.

This sleeve 17 has a carrier or ear 22 at its lower edge that projects beyond the end of the sleeve and is located in the plane thereof to operate over the junction between the wall 16 of the dimple and the body of the sheet 15 as the spinners 13 create the dimple or depression. The carrier or ear 22 is provided at its extremity with means for the removal of the burr or rib that may occur where the dimple joins the sheet. For that purpose the ear or carrier 22 in Fig. 1 is illustrated as having a cutting blade 23 integrally formed therewith, the cutting edge of which is generally disposed transversely of said carrier or ear and slopes downwardly from the outer face of the carrier or ear to beyond the inner surface thereof so that in operation the blade 23 travels at an angle to the plane of the sheet 15 and upon both sides of the junction between the sheet and the wall 16 of the dimple or depression, as shown in Fig. 2. By positioning the cutting tool or blade 23 thusly it will contact any burr or rib that is present at X after the major portion of the dimple has been formed by the spinners 13 and will remove it by cutting during the final or last stage in the production of the dimple or depression. Thus the blade 23 is so situated that in removing the burr it does not cut into the body of the sheet 15 and does not create a path or groove in the outer surface of the sheet concentric to the dimple.

An alternative implement is disclosed in Fig. 6 for the removal of the burr or rib during the last stage of the formation of the dimple. In this form no blade 23 is employed but on the contrary the ear or carrier 22 terminates in a slightly curved or convex wiping surface or edge 24. This wiping or edge surface 24 contacts with the junction between the sheet 15 and the wall 16 of the dimple when the latter is nearly completed to iron or press out the burr or rib which may result from the creation of the dimple with the result that the surface of the sheet 15 at and adjoining the dimple is flush with the remainder of the sheet, the metal which may have been displaced by the action of the spinners 13 being forced or pressed flat or flush by the wiping surface or edge 24 of the carrier or ear 22.

In addition to the tool structure Fig. 2 schematically illustrates the female die A which supports the sheet 15 and coacts with the tool during the formation of the dimple. While the tool is being rotated in and with the chuck of a suitable machine either the tool may be moved toward the female die A, or the latter may be

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moved toward the tool. In either event the pilot 12 after passing through the preformed hole in the sheet 15 enters the central opening in the die A while the spinners 13 deflect the metal immediately surrounding said preformed hole as illustrated in Fig. 2. It is to be understood that the female die A forms no part of the present invention and is disclosed for illustrative purposes only.

By the use of present tool the dimples or depressions are so produced that the angle of the wall 16 of each thereof with respect to the body of the sheet is identical in any number of dimples made with the same tool. The thickness of the walls 16 of a plurality of dimples made with the same tool in sheets 15 of the same gage is, to all intents and purposes, the same. This makes it possible to assemble a number of superposed sheets with the dimples or depressions therein closely and intimately nested, as shown in Fig. 7. Any variation in the thickness of the walls 16 of the dimples or depressions of several assembled sheets can only result from the variations in the gage of the several sheets 15.

When either the tool shown in Figs. 2 and 4 or that shown in Fig. 6 is used the sheet surrounding the dimple or depression is uninjured, unmarred or undamaged, while the formation of the dimple depression results in no cracking or damaging of either the wall 16 or of the sheet 15 adjoining the dimple.

What is claimed is:

1. A tool for spinning a dimple in the metal of a sheet defining an aperture therein comprising a rotatable cylindrical body, a pilot of reduced diameter coaxially secured to and projecting from one end of said body to be projected through the aperture in the sheet, a number of radial spinners integral with the body and the pilot, each having a transversely convexed operating surface and the operating surfaces of all of said spinners converging toward and meeting at a common point in the length of the pilot located inwardly of its extremity to depress the

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metal of the sheet adjacent to and defining said aperture during the approachment of the tool and sheet, a sleeve surrounding said body and adjustably secured thereto for rotation in unison therewith, and a projecting member having a convexed working edge formed at the outer end of said sleeve to operate over and bear against the junction between the dimple wall produced by depression of the metal as aforesaid and the body of the metal sheet.

2. A spin dimpler comprising a rotary pilot and at least two spinners radiating from said pilot mounted to rotate in unison with said pilot with the operating edges thereof sloping upwardly and outwardly at the same angle from a common point on the axis of the pilot, a single ear positioned parallel to the axis of the pilot adjacent to the upper extremities of the operating edges of the spinners and mounted to rotate in unison with the spinners, a transverse projection at the extremity of the ear extending inwardly toward the spinners and pilot, and a cutting edge on said projection and ear extending from the inner end of the projection to the outer surface of the ear and sloping toward the end of the pilot, said edge overlapping the path of rotation of the outer extremities of the spinners.

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