

Claims

What is claimed is:

1. A tool tip for a rotary press punch, comprising:
a body having a shank, an axial bore, and a flange on the shank adjacent a bottom end of the body, said bore constructed and configured to hold a fastener;
at least one workpiece displacer affixed along a periphery of the body surrounding the bore and adapted for displacing workpiece material around the outside of the fastener: and
wherein the at least one displacer has a profile to maximize the non-destructive deformation of the workpiece to affix the fastener to the workpiece without the loss of panel material.
2. The device of claim 1, wherein a distal end surface of the flange is orthogonal to the axial bore and having the at least one displacer that is vertically tapered along an arcuate ridge centered about said axial bore from a back end of the displacer of greatest height down to a front end of minimum height of the displacer where the ridge meets the end face.
3. The device of claim 2, wherein an inside edge of said at least one displacer is chamfered from the ridge to the axial bore and wherein said displacer is chamfered from the displacer ridge. to an outer edge of the displacer and wherein the width of said displacer is tapered such that the front end of said displacer intersects said distal end surface at a point.
4. The device claim 1 further including a punch for a rotary press having a casing with a top end, a bottom end, and a central rotational axis; the top end being adapted for affixation to a rotary and vertically reciprocal spindle of an industrial machine; and wherein the tool tip is releasably held within the bottom end of the punch.
5. The device of claim 1 wherein at least two of the displacer profiles are different.
6. The device of claim 1 wherein the profiles are spherical.
7. The device of claim 1 wherein all of the displacers are identical

8. The device of claim 6 wherein the displacers are rotatable ball bearings.
9. A tool tip for a rotary press punch, comprising:
 - a body having a shank, an axial bore, and a radially extending flange on the shank adjacent a bottom end of the body;
 - an axial bore within said body constructed and configured to hold a fastener;
 - a displacer ring captivated to the body and loosely affixed to the shank axially and radially, said ring having a 360 angular degree cutting edge at the bottom thereof; and
 - force transmission means located between the flange and the displacer ring constructed and configured to transmit a pressing force from the shank to the ring at a single point on the ring such that when the tool is pressed against a workpiece and rotated the ring performs a wobbling motion pressing only a portion of the cutting edge against the workpiece.
10. The device of claim 9 wherein the force transmission means is a single ball bearing.
11. The device of claim 9 wherein the force transmission means is a pinion gear meshing with a top ring gear affixed to the flange and a bottom ring gear affixed to the displacer ring.
12. The device of claim 9 further including a spring operative between a second flange at the bottom end of the body and an interior surface at the top of the displacer ring..
13. A method of non-destructively displacing workpiece material around a fastener to affix the fastener to a workpiece, comprising the steps of:
 - providing a malleable metal workpiece panel with a blind hole;
 - inserting a fastener having a flange adjacent its bottom end into the hole;
 - providing a tool according to claim 1; and
 - moving the tool axially and radially in a plurality of strokes against the workpiece to a predetermined first stroke level of workpiece deformation depth while rotating the tool after each stroke until a predetermined stroke or first group of strokes has been completed.
14. The method of claim 13 wherein the steps are thereafter carried out at a second predetermined workpiece deformation level deeper than the first level during a second stroke or group of tool strokes.

15. The method of claim 13 wherein number of tool rotations per depth level is determined by the amount of rotation in the tool following each stroke.
16. The method of claim 13 wherein said first group of strokes is completed when the tool has rotated a total of 360 angular degrees
17. The method of claim 14 wherein completed installation is achieved in incrementally advancing displacement depth levels.
18. The method of claim 11 wherein the tool is rotated the same number of angular degrees between the strokes.
19. The method of claim 13 wherein the displacers are spherical.
20. The method of claim 14 further including a final smoothing step where the tool is rotated 360 angular degrees while held at a predetermined stroke level.