Dec. 26, 1944. E. F. TUTTLE 2,365,918

DIMPLING TOOL WITH INTERCHANGEABLE HEAD

Filed Sept. 22, 1942

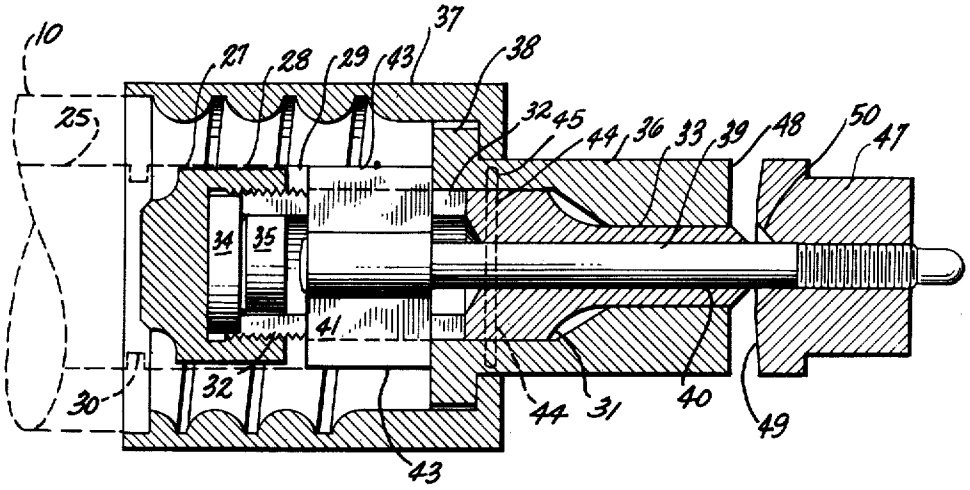


Fig. 1.

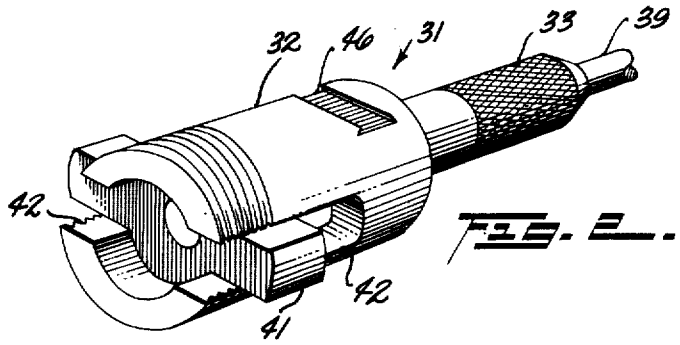


Fig. 2.

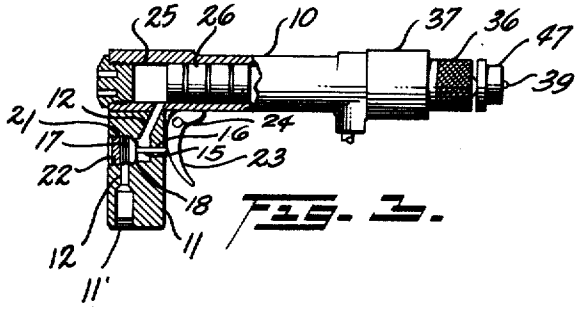


Fig. 3.

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DIMPLING TOOL WITH INTERCHANGEABLE HEAD

Eugene F. Tuttle, North Hollywood, Calif., assignor to Douglas Aircraft Company, Inc., Santa Monica, Calif.

Application September 22, 1942, Serial No. 459,327

9 Claims. (Cl. 153—21)

This invention relates to the art of dimpling rivet holes in relatively thin and resilient metal sheets preparatory to driving flush rivets or of otherwise forming such sheets adjacent apertures therein between a driving die and a bucking die or anvil. Specifically, the invention is contained in a dimpling tool adapted for use in closely restricted areas where it is difficult or impossible to employ two men, one "driving" the dimple and one "bucking" the impulses of the tool and is an improvement on the invention disclosed in U. S. Patent No. 2,344,944 for Dimpling tool, issued to James G. Hurst on March 28, 1944.

It is an object of this invention to provide a tool of the kind described in the aforesaid application which shall be constructed to permit ready change of dimpling heads to meet changing job requirements.

It is another object of this invention to provide a tool of the character described of simple construction and operation.

Further objects and advantages of the invention will be brought out in the following description taken in connection with the accompanying drawing and appended claims.

In the drawing which is for illustrative purposes only:

Figure 1 is a longitudinal sectional view of a dimpling tool embodying the invention, associated parts of the tool being shown in phantom.

Figure 2 is a perspective view of the dimpling die, tension rod and key of the dimpling head.

Figure 3 is an elevational view partly in section of the dimpling tool.

Percussive tools and the control thereof are well known in the art. For example, Patent Number 2,101,159 shows a pneumatic gun and its controlling mechanism in detail. The present invention is an improvement on such a tool and accordingly the description and drawing herein do not repeat the details of these known devices.

As best shown in Figure 3 of the drawing, the dimpling gun consists essentially of a cylinder or barrel 10 to which is assembled a pistol type grip handle 11. The grip handle is adapted at 11' to be connected to a fluid pressure supply line and is provided with an inlet duct 12 leading from the point of connection to the interior of the cylinder 10. A valve controlling the inlet duct has a stem 15 which is slidable in a bore 16 in the grip handle and has a head 17 mounted thereon and engageable with a seat 18 to thereby control the passage of fluid in the duct 12. A spring 21 is interposed between the valve head 17 and a threaded plug 22 to hold the valve yieldably against its seat 18. From the valve, a continuation of the duct 12 leads directly to the cylinder and delivers live motive fluid to the cylinder during the striking phase of the gun's operation and serves as an exhaust during the retractive phase.

The forward end of the valve stem 15 protrudes from the grip handle and bears against a trigger 23 pivotally carried by a pin 24 mounted on the handle 11.

The inner end portion of the bore of the cylinder 10 constitutes a piston chamber 25 in which reciprocates a striker piston 26. In forward movement this piston strikes a cylindrical head 27 formed with an internally threaded annular flange 28. The head 27 is slidably movable in the outer end portion 29 of the bore of the cylinder 10, being limited in its inward travel by the inwardly projecting annular flange 30 on the wall of the cylinder 10.

A driving dimpling die 31 has at its inner end a hollow cylindrical extension wall 32 which is threadedly secured to the flange 28, and at its outer end a hollow cylindrical shank 33 the forward end of which is frusto-conically shaped with an included angle suitable for dimpling operations. A thrust spacer 34 is clamped between the head 27 and die 31, and has a central cylindrical extension 35 fitting tightly within the wall 32 providing a rigid connection between the hammer and die suitable for transmission of the percussive blows delivered to the die in the operation of the tool.

The die 31 is reciprocatable over a limited range within a shell 36 which fits snugly within the outer end of the gun cylinder and is held therein by the clamping action of the inwardly flanged nut 37 against the outwardly projecting flange 38 on the shell 36. The nut 37 is threaded on the outer rim surface of the gun cylinder.

A tension rod 39, threaded for a limited distance at each of its ends, is seated within the bore 40 of the dimpling die 31, projecting well beyond the outer end of this die at its outer end and threadedly engaging a flat double ended key 41 at its inner end. The inner end of the rod 39 is peened to permanently secure the key 41 thereto. The arms of the key extend radially outward to engage two diametrally opposite keyway slots 42 in the wall 32 of the die 31 and two diametrally opposite slots 43 in the wall of the shell 36, preventing relative rotation of the tension rod 39, die 31 and shell 36. Since the shell 36 is stationarily clamped in place by the nut 37, the tension rod 39 cannot rotate relatively to the gun cylinder 10. The length of the key-

way slots 42, axially of the dimpling die is greater than the width of the arms of the key 41 permitting the limited reciprocative movement of the die 31 required for the dimpling operation. A retaining pin 44 seated in a small bore 45 eccentrically disposed crosswise of the shell 36 engages a slot 46 in the side of the die 31 to prevent accidental separation of the shell and die of the dimpling head assembly, when this assembly is not installed in the gun.

The dimpling head assembly comprises the hammer head 27, dimpling die 31, shell 36, spacer 34, key 41 and tension rod 39. The dimpling head assembly also includes a dimpling anvil or bucking die 47 which is axially bored and the bore of which is threaded to engage the outer threaded end of the tension rod 39. The shell 36 has a work engaging face 48 usually made normal to the axis of the tool, and the anvil die 47 has a work engaging face 49 usually of the same size as the working face 48 and preferably slightly inclined in conical fashion away from the face 48 and recessed at 50 to conform to the end of the die 31.

The gun may be used with different interchangeable dimpling head assemblies the parts of which are adapted for use with different sizes and styles of rivets and screws. Different nuts 37 may also be used to secure the different dimpling head assemblies to the gun, to suit the outside diameter of the shell 36 which may be a part of the assembly.

To use the tool, the gun with the dimpling head assembly secured in the end thereof and with the anvil die removed from the assembly, is placed against the sheet to be dimpled with the rod 39 inserted in the rivet or screw hole of the sheet. The conical end of the die 31 engages the sheet, pushing the die and hammer head 27 inwardly until the working face 48 engages the metal sheet.

The anvil die is then threaded in place on the tension rod and tightened against the metal sheet, the rim of the die being knurled to facilitate this operation. The key 41 prevents the die 31 from turning as the anvil die 47 is screwed into place.

The gun trigger is then pulled to admit air to impel the piston 26 forward, striking the hammer head 27. The die 31 is forced into the sheet to form the dimple, after which the trigger is released returning the striker piston 26 to its original position by the application of fluid pressure to the forward side of the striker piston through fluid passages (not shown) in the manner described in the above mentioned Patent Number 2,101,159. The anvil die is removed, readying the tool for the next dimpling operation.

If the anvil die 47 is located in a place which is inaccessible for turning it, the nut 37 may be loosened and the shell 36 rotated in a direction to turn the rod 39 within the threaded bore of the anvil die 47 in a direction to draw the anvil die against the sheet to be dimpled, the surface of the shell 36 being knurled for this operation.

While there have been described herein certain embodiments of this invention, the invention is not to be understood as confined to these particular embodiments, but is to be given the definition and scope expressed in the following claims.

I claim:

1. In a tool for die forming work articles comprising apertured plates, the combination of: a pneumatic gun with a percussion piston; a die support having a work engaging face and detachably secured to the outer end of the gun; a hollow bored die axially movable with respect to the piston and slidably secured in the support in position to receive the blows of the percussion piston and arranged to move forward in forming contact with the work article while the work article is held against work engaging face; a tension rod in the bore of the die, said rod projecting forwardly of the die and being held against forward movement by said support; an anvil member independent of the work article cooperating with said die and securable to the forward end of said rod forwardly of the work article; and means associated with said rod for pulling the anvil member toward the support to clamp the work article thereagainst.

2. In a tool for die forming work articles comprising apertured plates, the combination of: a pneumatic gun with a percussion piston; a die support having a work engaging face detachably secured to the forward end of the gun; a hollow bored die slidably secured in the support in position to receive the blows of the percussion piston and arranged to move forward in forming contact with the work article while the work article is held against said work engaging face; a tension rod in the bore of the die, said rod projecting forwardly of the die and threaded at its forward end, and being held against forward movement and against rotation by said support; and an anvil member independent of the work article co-operating with said die and threadedly securable to the forward end of said rod forwardly of the work article.

3. In a tool for die forming work articles comprising apertured plates, the combination of: a pneumatic gun with a percussion piston; a die support having a work engaging face and detachably secured to the forward end of the gun; a hollow bored die slidably secured in the support in position to receive the blows of the percussion piston and otherwise unsecured to said gun and arranged to move forward in forming contact with the work article while the work article is held against said work engaging face; a tension rod in the bore of the die, said rod projecting forwardly of the die and being limited in forward movement by the support; an anvil member independent of the work article co-operating with said die and securable to the forward end of said rod, said support, die and rod being removable forwardly from the outer end of the gun as a self contained unit; and means associated with said rod for pulling the anvil member toward the support to clamp the work article thereagainst.

4. The combination defined in claim 3 in which said movement of said rod is limited in each direction with respect to said support.

5. The combination defined in claim 3 in which movement of said die is limited in each direction with respect to said support and said movement of said rod is limited in each direction with respect to said die.

6. The combination defined in claim 3 in which said die support and die are formed to limit forward movement of the die, and said die has a hammer head at its inner end spanning the inner end of the bore of said die, and in addition thereto; a removable retainer limiting inward movement of said die on said support; and a radial key secured to the inner end of said rod and disposed forwardly of said hammer, said die and support being radially slotted to receive said key.

7. In a tool for die forming apertured plates, the combination of: a tool housing having a work engaging face; a forming tool projectable from

the housing; a hammer in the housing movable to engage the forming tool to project it from the housing; an anvil for co-operating with said tool, said anvil having a threaded bore; a tension rod in said housing, threadedly seated in said bore and having an end thrust engagement with a rearwardly facing surface on said housing adjacent the front end of said housing; means limiting inward movement of the rod in the housing; and means preventing rotation of the rod in the housing.

8. In a tool for forming apertured plates, the combination of: a barrel; a percussion piston reciprocatable in the barrel; pneumatic means for reciprocating the percussion piston; a cylindrical shell rigidly mounted in said barrel and having at its forward end a work engaging surface; a hollow bored forming die slidable within the shell and adapted to be struck by the piston; means limiting movement of the forming die forwardly of said work engaging face; means limiting movement of the forming die inwardly of the shell; a tension rod disposed in the bore of the forming die and projecting substantially beyond said work engaging face, said rod being threaded at its forward end; means limiting inward movement of said rod relative to said die; means preventing rotation of said rod relative to said shell; and an anvil die having a threaded bore for engagement with the threaded end of the rod.

9. In a tool for forming apertured plates the combination of: a barrel; a percussion piston reciprocatable in the barrel; pneumatic means for reciprocating the percussion piston; and a dimpling head assembly detachably securable in the barrel comprising a shell housing having a work engaging face at its forward end, means for rigidly securing the housing to the forward end of the barrel, a hollow bored die slidably mounted in the housing, said housing and die being formed to limit forward movement of the die to forming position with a die co-operating anvil element, a hammer head fixed on the inner end of the die for receiving the blows of said percussion piston, said shell having means for limiting inward movement of the die to a non-forming position, a tension rod in the bore of said die, said rod projecting forwardly substantially beyond said die when in forming position, a radially extending key secured to said rod and engaging said shell to prevent relative rotation thereof, said die and hammer head having end thrust surfaces engageable with said key and rod to limit movement of said rod in both directions, and a hollow bored anvil element formed to co-operate with said die and for threaded engagement with the projecting end of said rod.

EUGENE F. TUTTLE.

CERTIFICATE OF CORRECTION.

Patent No. 2,365,918. December 26, 1944.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 5, claim 1, after the word "against" insert --said--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 27th day of March, A. D. 1945.

Leslie Frazer

(Seal) Acting Commissioner of Patents.

the housing; a hammer in the housing movable to engage the forming tool to project it from the housing; an anvil for co-operating with said tool, said anvil having a threaded bore; a tension rod in said housing, threadedly seated in said bore and having an end thrust engagement with a rearwardly facing surface on said housing adjacent the front end of said housing; means limiting inward movement of the rod in the housing; and means preventing rotation of the rod in the housing.

8. In a tool for forming apertured plates, the combination of: a barrel; a percussion piston reciprocatable in the barrel; pneumatic means for reciprocating the percussion piston; a cylindrical shell rigidly mounted in said barrel and having at its forward end a work engaging surface; a hollow bored forming die slidable within the shell and adapted to be struck by the piston; means limiting movement of the forming die forwardly of said work engaging face; means limiting movement of the forming die inwardly of the shell; a tension rod disposed in the bore of the forming die and projecting substantially beyond said work engaging face, said rod being threaded at its forward end; means limiting inward movement of said rod relative to said die; means preventing rotation of said rod relative to said shell; and an anvil die having a threaded bore for engagement with the threaded end of the rod.

9. In a tool for forming apertured plates the combination of: a barrel; a percussion piston reciprocatable in the barrel; pneumatic means for reciprocating the percussion piston; and a dimpling head assembly detachably securable in the barrel comprising a shell housing having a work engaging face at its forward end, means for rigidly securing the housing to the forward end of the barrel, a hollow bored die slidably mounted in the housing, said housing and die being formed to limit forward movement of the die to forming position with a die co-operating anvil element, a hammer head fixed on the inner end of the die for receiving the blows of said percussion piston, said shell having means for limiting inward movement of the die to a non-forming position, a tension rod in the bore of said die, said rod projecting forwardly substantially beyond said die when in forming position, a radially extending key secured to said rod and engaging said shell to prevent relative rotation thereof, said die and hammer head having end thrust surfaces engageable with said key and rod to limit movement of said rod in both directions, and a hollow bored anvil element formed to co-operate with said die and for threaded engagement with the projecting end of said rod.

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