# United States Patent

**Black, Jr.**

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[45] **Aug. 22, 1972**


[54] **PUNCHING TOOL FOR PRODUCING CONNECTOR NAIL PLATES**


[72] Inventor: **William Hill Black, Jr.**, P.O. Box 85, Edenton, N.C. 21932



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[52] **U.S. Cl.** ..... **72/325,** 72/476

[51] **Int. Cl.** ..... **B21d 31/02,** B21c 3/16

[58] **Field of Search** ...72/325, 326, 332, 476; 29/513



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*Primary Examiner*—Charles W. Lanham
*Assistant Examiner*—R. M. Rogers
*Attorney*—Imirie and Smiley



[57] **ABSTRACT**

A punching tool for producing, with minimum wear and maintenance of the tool, opposed prongs on a connector nail plate in which a rectangularly cross-sectioned tool has on its terminal cutting end a leading penetrating point developed from longitudinally spaced angular faces depending from a diagonal, relieved cutting edge in which angular faces merge on a transverse radius with opposed V-shaped side edges of the tool.


**10 Claims, 14 Drawing Figures**

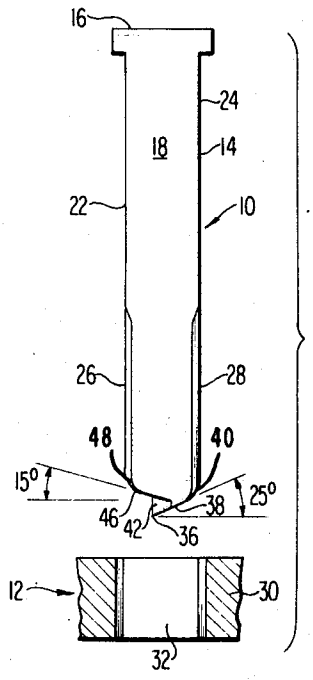


FIG. 2

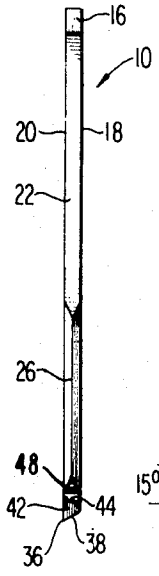



FIG. 1A

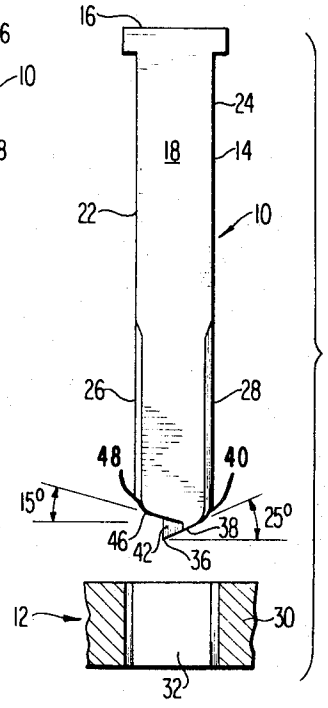



FIG. 3

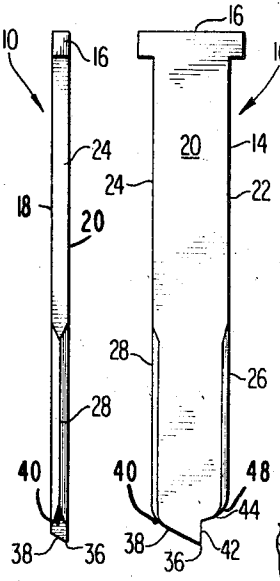



FIG. 1B




FIG. 4

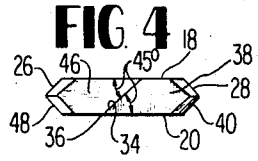



FIG. 5

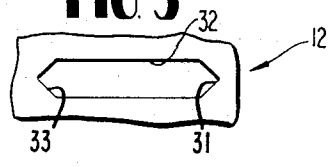



FIG. 6A

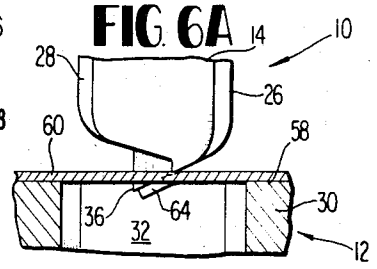



FIG. 6B

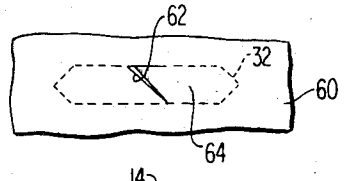



FIG. 7A

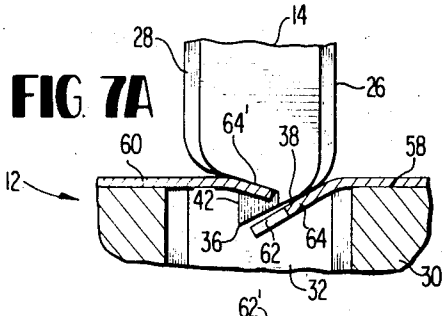



FIG. 7B

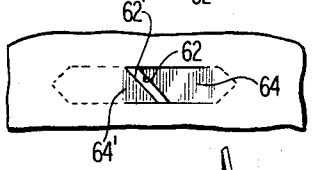



FIG. 8A

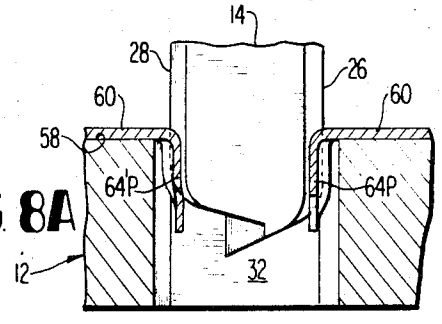



FIG. 8B

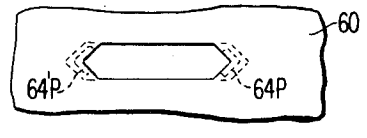



FIG. 9

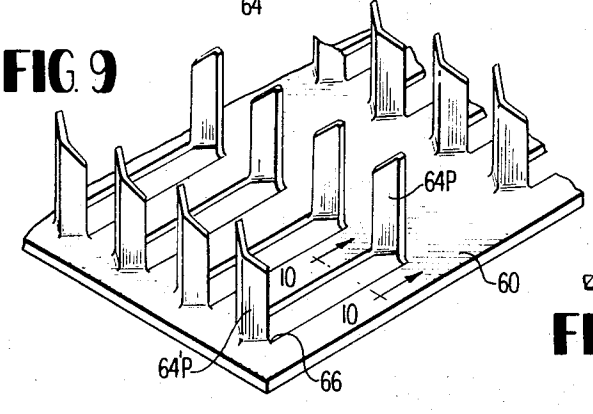
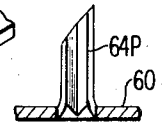



FIG. 10




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# PUNCHING TOOL FOR PRODUCING CONNECTOR NAIL PLATES

## BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to cooperating cutting tool and die sets in which a tool is driven into a sheet metal plate overlying a female die and forms a prong or nail normal to the plane of the plate.

2. Description of the Prior Art

The invention concerns connector nail plates of the character disclosed in detail in U.S. Pat. No. 3,382,752 and more particularly to an improved cutting tool somewhat similar to that disclosed in U.S. Pat. No. 3,473,362 and in which the applicant is a co-inventor.

Tools of the character disclosed in the latter patent mentioned above, generally subject the female die to an unusual amount of pressure since the tool actually punches the material being worked into the female die thus subjecting the female die edges to an unusual amount of pressure and wear resulting in continual maintenance and replacement, causing erratic deformaties on the nailing prongs being produced.

## SUMMARY OF THE INVENTION

A punching tool according to the invention comprises an angularly disposed cutting edge developed from a leading penetrating point and separating two abutment cutting faces to progressively and substantially simultaneously slice opposed a pair of connecting or nailing prongs from a flat sheet metal plate, imposing minimal wear and pressure through a progressive slicing action and producing a connector plate with uniform, regular nailing prongs.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1A** is an exploded side elevational view of punching tool and cooperating die, the latter being shown in section;

FIG. **1B** is a side elevational view of the tool, looking at the side opposite that shown in FIG. **1A**;

FIG. **2** is an edge elevation of the tool looking from left-to-right at FIG. **1A**;

FIG. **3** is an edge elevation of the tool looking from right-to-left at FIG. **1A**;

FIG. **4** is an enlarged bottom plan view of the tool;

FIG. **5** is a top plan view of the die;

FIG. **6A** is an enlarged fragmentary section showing a workpiece disposed on the die, shown in section, and showing initial penetration of the leading point of the tool;

FIG. **6B** is a top plan view of a workpiece illustrating the nature of the initial cut made according to FIG. **6A**;

FIG. **7A** is a fragmentary section, similar to FIG. **6A**, showing an intermediate stage of penetration of the tool into the workpiece;

FIG. **7B** is a top plan view, similar to FIG. **6B**, showing the nature of the cuts made as a result of tool penetration according to FIG. **7A**;

FIG. **8A** is a fragmentary section, similar to FIGS. **6A** and **7A**, showing a pair of prongs formed in the workpiece as a result of the tool completing the cutting stroke into the die;

FIG. **8B** is a top plan view of the workpiece as formed according to FIG. **8A**;



FIG. **9** is a fragmentary perspective view of a connector plate produced using tools and adapted according to FIGS. **1–8B**; and

FIG. **10** is a fragmentary sectional view taken substantially on the plane of line **10—10** of FIG. **9**.

## DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawing in detail, and first considering FIGS. **1-4**, a tool **10** is adopted to cooperate with a die **12**, shown in section. The tool comprises an elongated shank **14** having an upper terminal transverse head **16** for clamped receipt in a suitable tool holder (not shown). In this regard, a plurality of the subject tools may be utilized in a hydraulic ram or press, this being conventional and obvious to those skilled in the art.

The tool is ground or machined to finished dimensions and includes opposed flat or planar parallel side walls **18** and **20** and parallel side edges **22** and **24**. The side edges **22** and **24** have intermediately of the shank and extending to the lower terminal end of the tool a V-shaped edge profile converging to edge profiles **26** and **28**, and the faces of the side edges profiles, with respect to the flat side walls preferably are substantially 45°.

The die **12**, cooperative with the tool **10**, comprises a body portion **30** having a slot or opening **32**, with opposed flat side walls and converging end edge portions **31** and **33**; see FIG. **5**, for reciprocatably accommodating the lower terminal end of the tool shank and the workpiece material as illustrated in FIG. **8A**, for example.

Extending diagonally between the flat side walls **18** and **20** is a cutting edge **34** which originates from a leading terminal penetrating point **36** coincident with side wall FIGS. **2** and **3**. The cutting edge **34** and its leading penetrating point **36** are relieved or angled from side wall **20** to side wall **18** and comprise the forward cutting edge of a flat plane **38** which terminates in a curved portion **40** merging into the V-shaped edge profile **28**.

The cutting edge **34** is coincident with a depending vertical face **42** and longitudinally spaced or below the edge **34**, and relieved or angled from the base **44** of vertical face **42** is a laterally relieved, flat face **46** which terminates in a curved portion **48** merging with the other V-shaped edge profile **26**. Plane **38** is at an angle of approximately 25° with respect to a transverse plane, and the face **46** is at approximately a 15° angle with respect to a transverse plane, see FIG. **1A**.

Referring to FIGS. **6A** and **6B**, the female die **12** has juxtaposed on the upper surface **58** thereof a workpiece **60** generally comprising a sheet metal plate (galvanized or the like) preferably less than 20 gauge.

As the point **36** engages the upper surface of the workpiece **60** it moves through the material and produces a diagonal cut **62** in a shearing or slicing action, contrary to a punching or tearing action, to separate portion **64** from the plane of the plate and move it down into the die slot **32**.

The downward movement of the initially sliced portion **64** of the workpiece **60** continues laterally as the tool progresses into the die slot, see FIG. **7A**. Portion **64** will ultimately comprise a nailing prong or tooth having a terminal penetrating end at substantially a **45°** angle, see FIGS. **9** and **10**, for example. As the tool

progresses into the die slot, face **38** laterally displaces portion **64**, and face **46** which trails or is above face **38**, ultimately depresses portion **64'** into the die slot **32**. It will be understood that the flat side walls **18** and **20** cooperate with corresponding sides of the die slot **32** to shear the side edges of the portions **64** and **64'**. It will be further understood that portion **64'** is formed with a diagonal edge **62'** complementary or corresponding to the cut **62**, see FIG. **7B**.

Referring to FIG. **8A** continued movement of the shank **14** of the tool **10** results in profiled V-shaped side edge profiles **26** and **28** thereof cooperating with corresponding portions **31** and **33** of the die slot **32**, see FIG. **8A**, to ultimately displace the portions **64** and **64'**, respectively, substantially at right angles to the general plane of the workpiece **60** and form nailing prongs **64P** and **64'P** at right angles to this plane.

Referring to FIGS. **9** and **10**, it will be observed that nailing prongs **64P**, **64'P** formed in pairs, the prongs being in opposed relationship on opposite sides of a slot **66** from which they are displaced. Further, the terminal edges of these nailing teeth or prongs are oppositely angled and a transverse section will be generally V-shaped or at least concave-convex which provides a channel section of an unusual strength to the teeth.

As the connector plate **60**, i.e., the prongs or teeth **64P**, **64'P**, are driven into a piece of wood, the prongs will tend to be cammed angularly by the angulation of their ends and grip the grain of the wood to provide an unusually uniform and desirable gripping action.

I claim:

**1.** A tool for producing a nail plate having a tooth unit comprising a pair of substantially parallel nails or prongs having oppositely directed angular penetrating points, said tool comprising a shank portion of rectangular section and having opposed, parallel side walls and opposed, substantially parallel edge portions, said shank portion terminating at one end in a punching and cutting portion including a first face disposed diagonally between and intermediately of said side walls and substantially longitudinally of said shank portion, a second face extending angularly of the transverse of said shank portion from one said edge portion to the extreme end of said first face and jointly defining therewith a diagonal cutting edge, said second face extending between said side walls and defining therewith lateral cutting edges, and a third face extending angularly of the transverse of said shank portion from the other said side edge portion to said first face at the inner end thereof, said third face extending between said side walls and defining therewith lateral cutting edges, the inclinations of the angles of said second and third faces being in opposite senses from said edge portions longitudinally of said shank portion to said first face.

**2.** A tool according to claim **1**, wherein said diagonal cutting edge is disposed at an angle to the transverse of said shank portion and defines with one said side wall a piercing point.

**3.** A tool according to claim **2** wherein said shank edge portions are relieved relative to said side walls at said punching and cutting portion. **9**

**4.** A tool according to claim **3** in combination with a die having a slot to receive said tool and having parallel side walls having a close fit with said tool side walls to enable a shearing action by said lateral cutting edges, said slot having edge portions corresponding in configuration with and complimentary to said tool edge portions and spaced to accommodate the thickness of said plate between each said tool and slot edge portions to produce nail prongs of channel section.

**5.** A tool according to claim **4** wherein said second and third faces are planar and perpendicular to said side walls, the outer ends of said faces being curved and merging with the respective edge portions to bend without weakening the roots of the nail prongs into said die slot.

**6.** A tool according to claim **5** wherein said edge portions have V-shaped profiles.

**7.** A tool according to claim **3** wherein said first face is disposed at approximately 45° to the planes of said side walls.

**8.** A tool according to claim **7** wherein said second and third faces are planar and perpendicular to said side walls, the outer edges of said faces being curved and merging with the respective edge portions to bend without weakening the roots of the nail prongs.

**9.** A tool according to claim **8** wherein said second face is disposed at substantially 25° to the transverse of said shank portion.

**10.** A tool according to claim **9** wherein said third face is disposed at substantially 15° to the transverse of said shank portion.

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