

United States Patent

Nino et al.

[15] 3,680,348

[45] Aug. 1, 1972

[54] ADJUSTABLE DRAW DIE

[72] Inventors: **Fernando J. Nino**, Torrance; **Donald Q. Cole**, Los Angeles, both of Calif.

[73] Assignee: **Harvey Aluminum, (Incorporated)**, Torrance, Calif.

[22] Filed: **April 6, 1970**

[21] Appl. No.: **25,769**

[52] U.S. Cl. **72/291, 72/468**

[51] Int. Cl. **B21c 1/30, B21c 3/06**

[58] Field of Search. **72/468, 291, 478, 482**

[56] References Cited

UNITED STATES PATENTS

2,365,482 12/1944 Manken.....72/478 X

686,365 11/1901 Thackray.....72/478 X
295,898 4/1884 Billings.....72/291
629,501 7/1899 Haas.....72/468

Primary Examiner—Charles W. Lanham

Assistant Examiner—R. M. Rogers

[57]

ABSTRACT

An apparatus for drawing T-shaped members using a die assembly having a pair of die blocks each constructed to adjustably engage two adjoining sides of the members to be drawn. These die blocks can be adjusted simultaneously to uniformly vary the thickness of both the stem and head of a T-bar being drawn.

14 Claims, 13 Drawing Figures

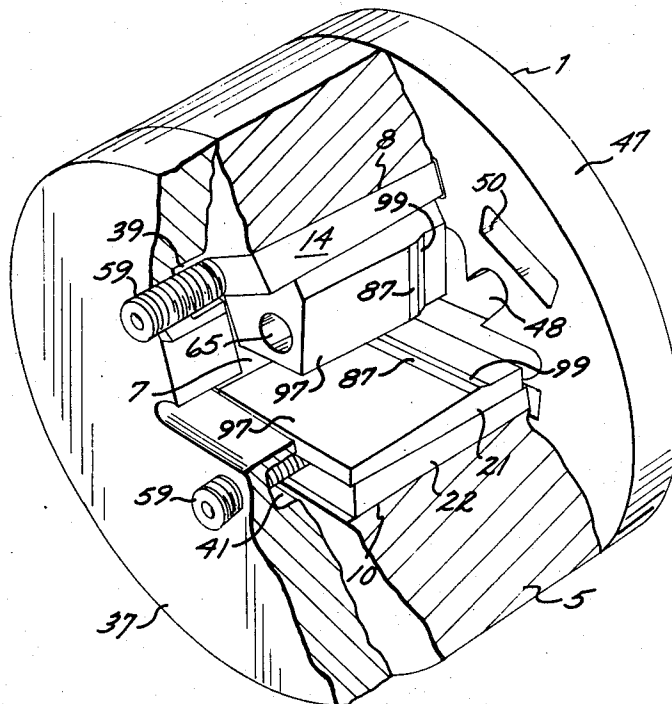


FIG. 1

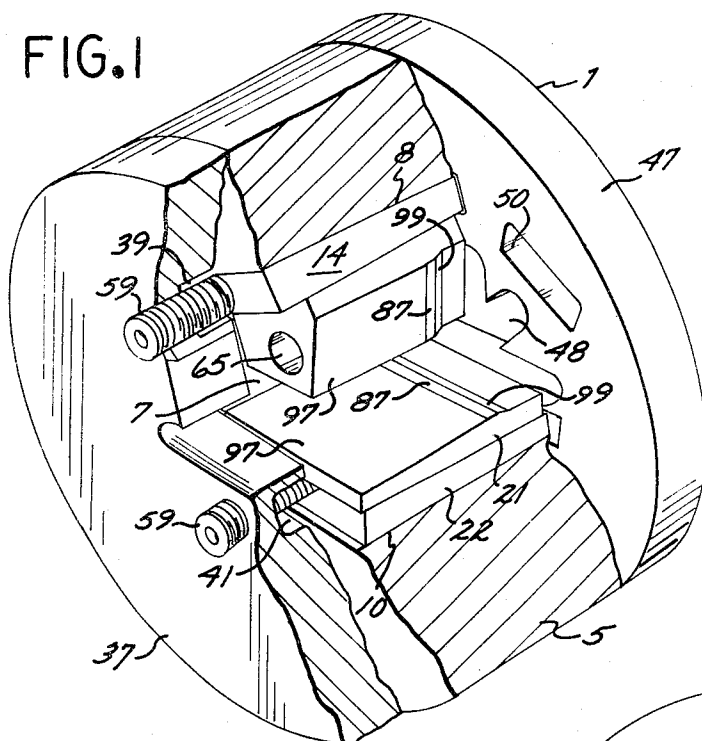


FIG. 2

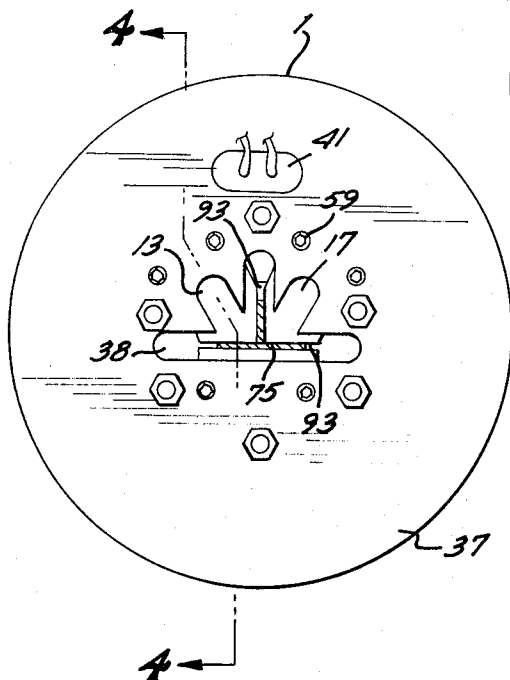
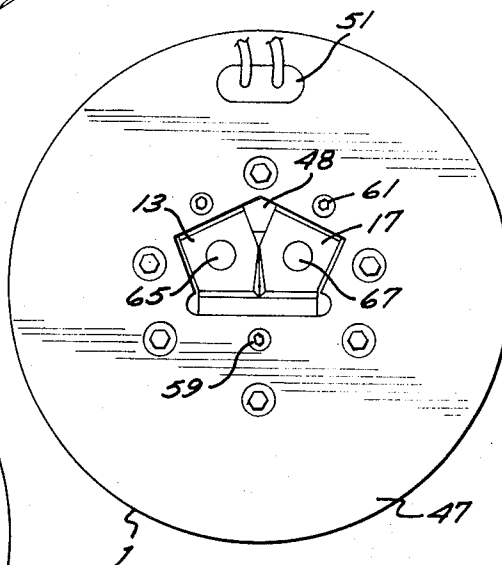
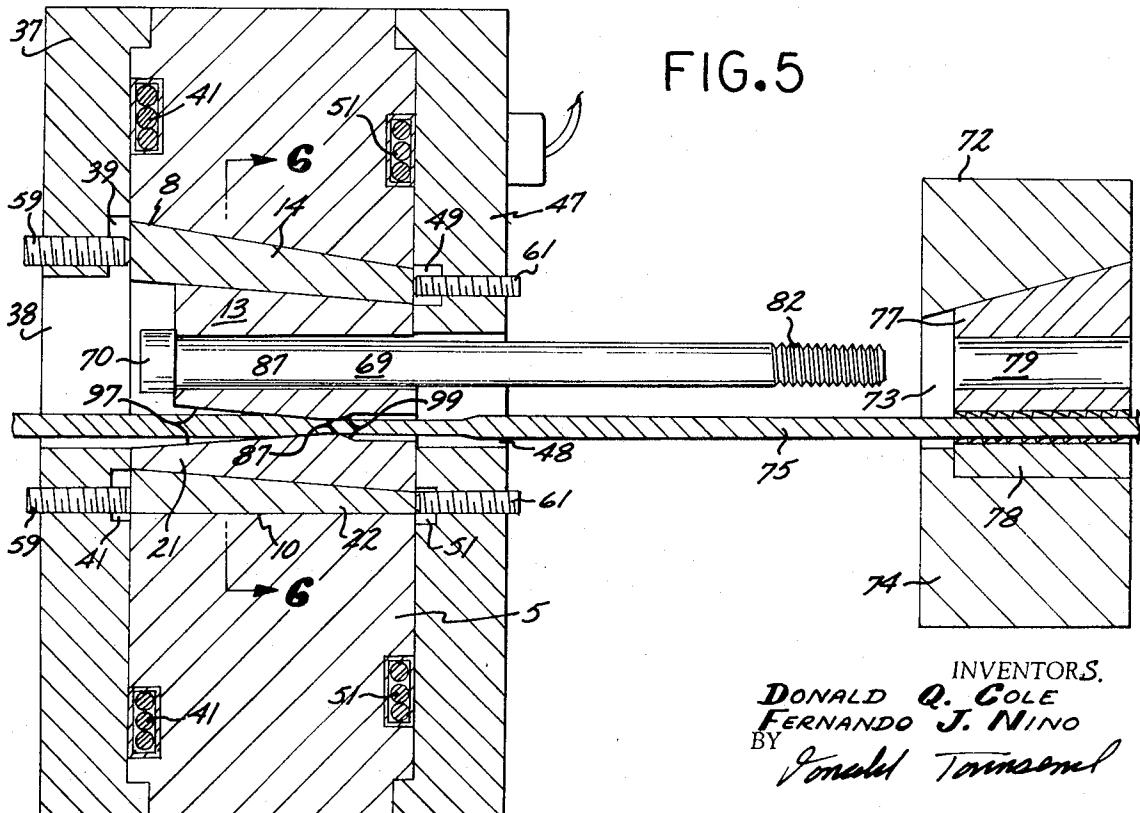
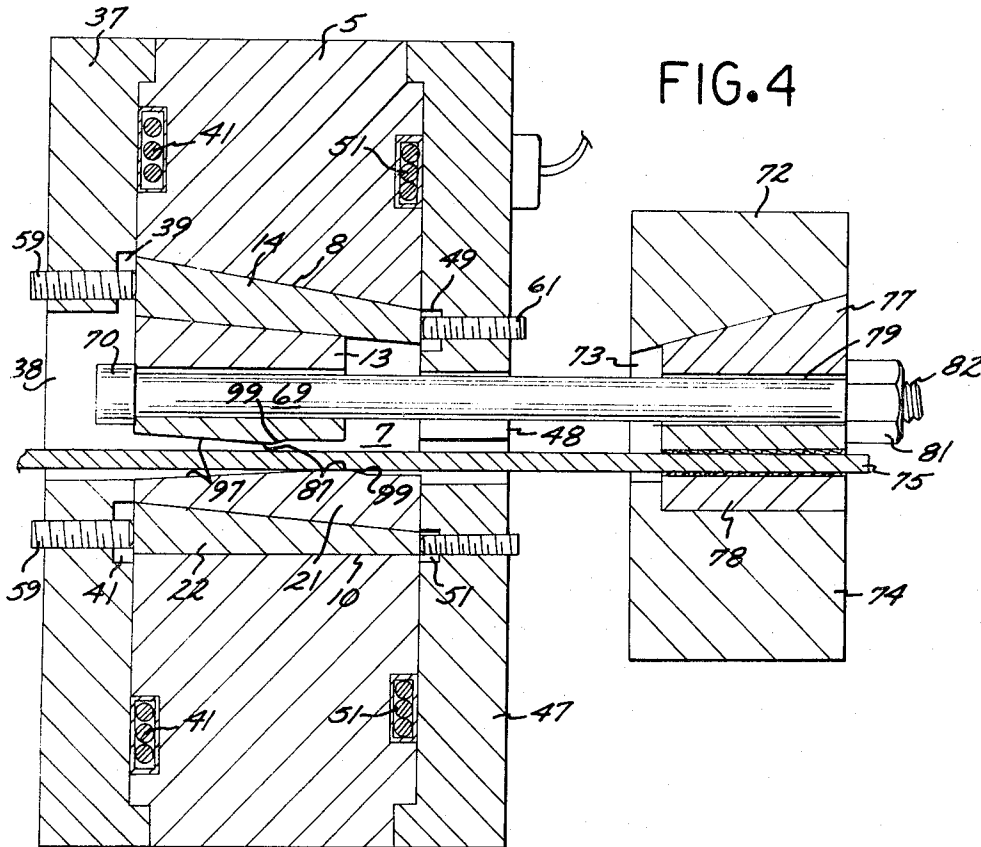


FIG. 3



INVENTORS.
DONALD Q. COLE
FERNANDO J. NINO
 BY *Donald Townsend*
 ATTORNEY



INVENTORS.
DONALD Q. COLE
FERNANDO J. NINO
 BY *Donald Townsend*
 ATTORNEY

FIG. 7

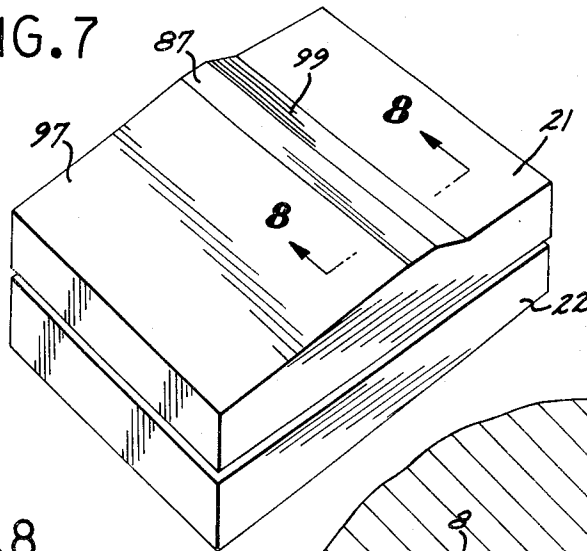


FIG. 6

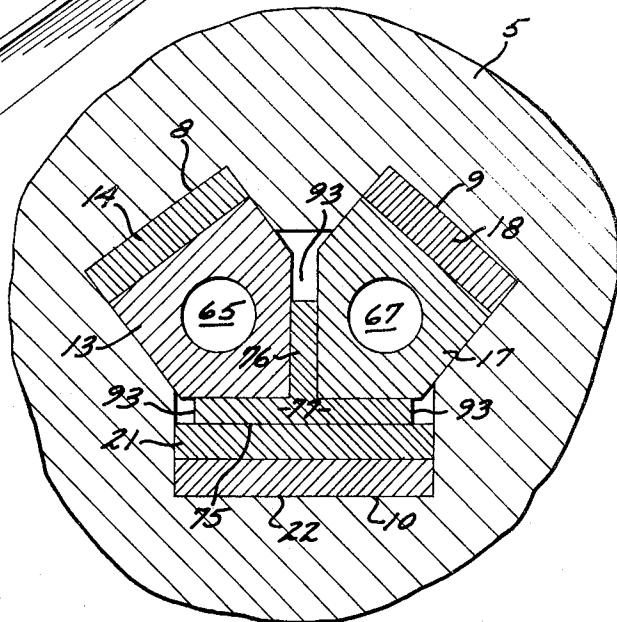


FIG. 8

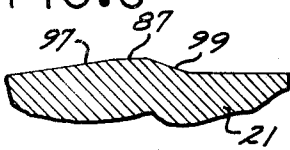


FIG. 9

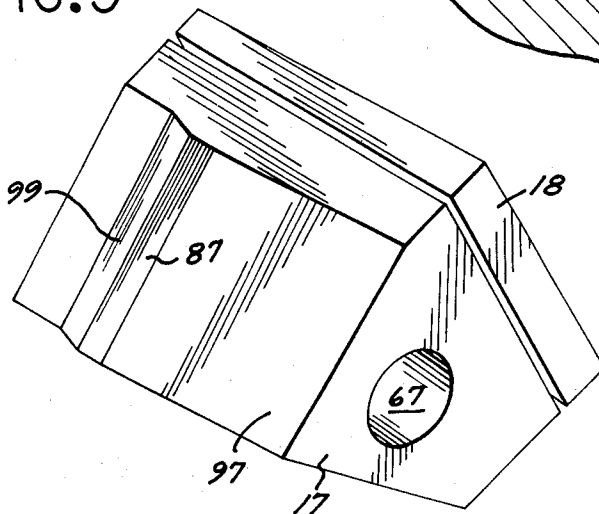
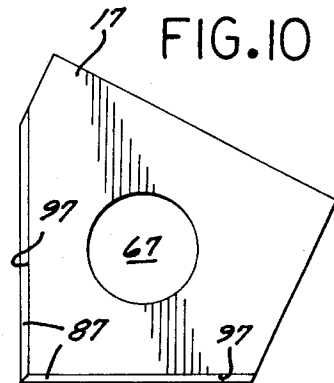


FIG. 10



INVENTORS.
DONALD Q. COLE
FERNANDO J. NINO
 BY *Donald Townsend*
 ATTORNEY

FIG. 11

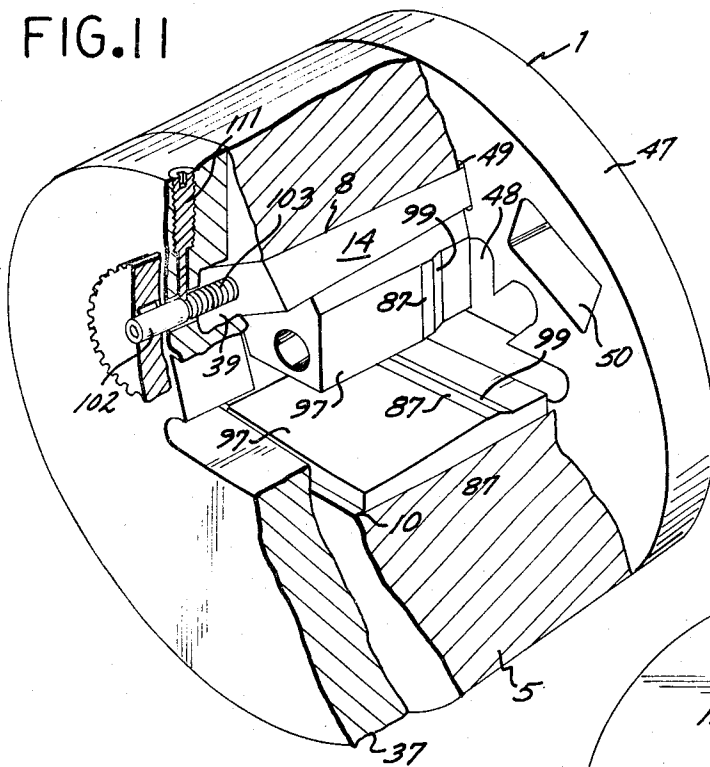


FIG. 12

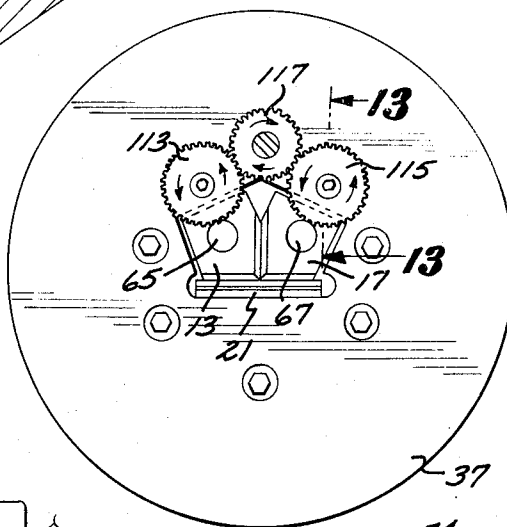
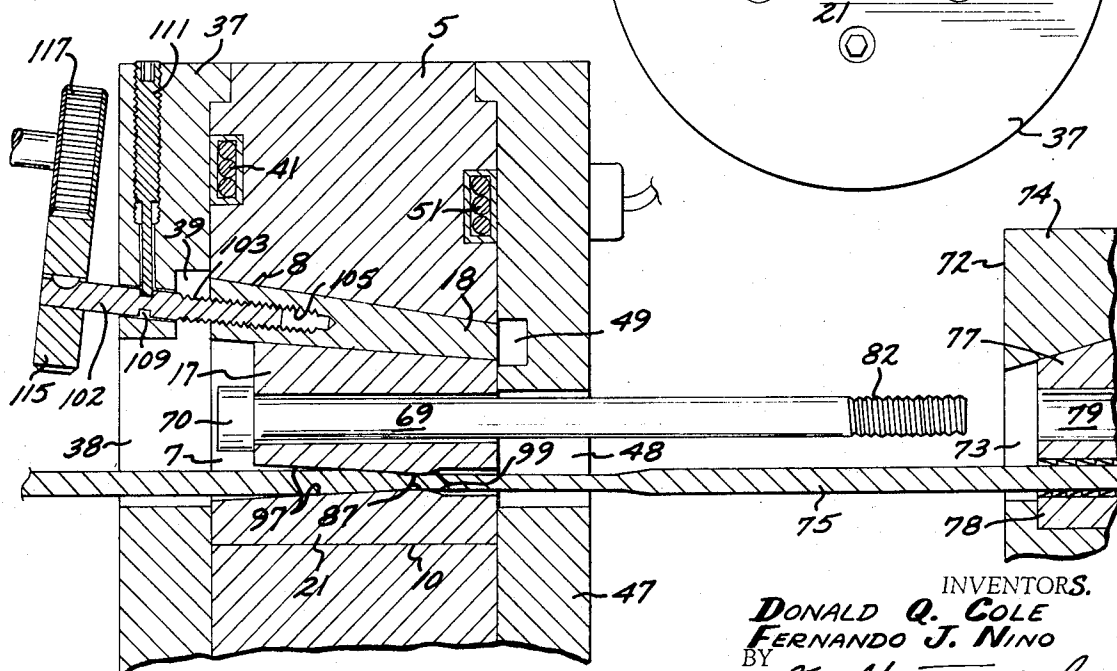


FIG. 13



INVENTORS.
DONALD Q. COLE
FERNANDO J. NINO
 BY *Donald Tamson*

ATTORNEY

ADJUSTABLE DRAW DIE

This invention relates to an adjustable draw die for drawing T-shaped members, and more particularly, to a die assembly which can be adjusted during drawing to taper the workpiece.

BACKGROUND OF THE INVENTION

In conventional die assemblies for drawing T-shaped bars, it is necessary to employ several wedge members to effect adjustment of each of the die blocks which engage adjoining sides of the workpiece to be drawn (see U.S. Pat. No. 629,502). When the wedge members are adjusted to effect a change in the thickness of the T-bar stem, undesirably there is a corresponding change in the length of the die opening through which the T-bar head is drawn. If the T-bar stem is to be thinned without shortening the length of the T-bar head, it is necessary to employ upper die blocks of different size. When the T-shaped bar is to be tapered during drawing, the several wedge members for each die block must be simultaneously and cooperatively adjusted to effect the desired uniform change in thickness of the T-bar. Manual adjustment of these die assemblies during drawing is generally unsatisfactory due to the coordination required. It is therefore desirable to provide a die assembly having means to coordinate during drawing this adjustment of the die blocks.

To accurately establish the dimensions of the die opening in these conventional die assemblies, the die blocks are adjusted to the desired size before insertion of work into the die opening. When adjustment of the die assembly is made with a workpiece in the die, deformation of the workpiece occurs as the die opening closes, resulting in movement of metal at the bearing surfaces and between the mating surfaces of adjacent die blocks. The displaced metal between the die blocks often retards or completely prevents travel thereof. These problems are in a large part eliminated by reducing the size of one end of the workpiece so that it may be passed through the die assembly after the die opening has been preset to the desired size.

The additional operations required to thin and point the end of the workpiece increases considerably the overall cost of the drawing operation, since the entire drawing force is transmitted through the pointed end of the workpiece. Further, the strength of this end section limits the drawing reductions that can be accomplished. In the drawing of certain harder materials such as titanium and hard steels, the drawing force required for a significant reduction may exceed the strength of the thinned work at or near the point where it is held, making any significant reduction difficult if not impossible.

OBJECTS OF INVENTION

It is therefore a principal object of the invention to provide in the drawing of T-bars an improved die assembly which can be adjusted to independently vary the thickness of the T-bar stem without affecting the length of the T-bar head.

Another object is to provide for the use in drawing T-bars a die assembly which can be adjusted with a workpiece therein without displacing metal between adjacent die-bearing surfaces.

Yet another object is to provide a die assembly for drawing T-bars which eliminates the need of reducing the size of one end of the workpiece to be drawn.

Another object is to provide a die assembly which can be adjusted during drawing to taper the workpiece.

Still another object is to provide a die assembly for drawing T-bars which can be adjusted simultaneously to uniformly vary the thickness of both the stem and head of the T-bar being drawn.

Upon further study of the specification and appended claims, other objects and advantages will become apparent.

SUMMARY OF INVENTION

To attain the objects of the invention, an adjustable die assembly for drawing T-bars is provided with a body having a cavity extending axially therethrough with a base die block and pair of upper die blocks arranged within the cavity and coacting to form a die opening. Wedge members are positioned intermediate the body and die blocks, each of the die blocks having a slanted side engaging a corresponding slanted side of its companion wedge member, and each of the wedge members having a slanted side engaging a corresponding slanted side of the body whereby sliding axial movement of a wedge member effects radial displacement of its companion die block, changing the size of the die opening through which both head and stem of the T-bar is drawn. The upper die blocks can be adjusted simultaneously during drawing to uniformly vary the thickness of both the stem and head portions of the T-bar being drawn.

A DETAILED DISCUSSION OF THE INVENTION

In accordance with the invention, a drawing apparatus is provided which includes a body or housing having a cavity or passage extending axially therethrough with three die blocks arranged within the cavity and coacting to form a T-shaped die opening. Two of these die blocks are constructed to engage adjoining sides of the T-bar, i.e., one side of the stem and an adjoining side of the T-bar head. A wedge member is positioned intermediate the body and each of these two die blocks, the wedge member having slanted sides which engage a corresponding slanted side or face of the body and/or die block. The wedge members, which are movable axially within the body, effect radial displacement of the companion die block in contact therewith. A transmission means is provided to effect coordinated movement of at least two of the wedge members. By cooperative and simultaneous adjustment of the wedge members with the transmission means, the die opening can be varied during the drawing to taper the T-bar.

For a better understanding of the invention, reference may be made to the following description of exemplary embodiments, taken into conjunction with the figures of the accompanying drawings, in which:

FIG. 1 is a perspective view in partial section of the adjustable draw die of the present invention.

FIGS. 2 and 3 are end views of the front and back cover plates, respectively, illustrating the operable position of the die blocks relative to the slots formed in the cover plates.

FIG. 4 is a sectional view taken along line 4—4 of FIG. 2, showing the die blocks in an open forward position with a gripper assembly for both moving the die blocks and pulling the workpiece through the die opening.

FIG. 5 is a sectional view of the die assembly in FIG. 4, illustrating the position of the die blocks in a rearward closed position when the work is being drawn and detachment of the gripper assembly from the die blocks.

FIG. 6 is an internal sectional view taken along line 6—6 of FIG. 5, showing the die blocks in the closed position with a T-bar being drawn in the assembly.

FIG. 7 is a perspective view of a base die block with a companion wedge member therefor.

FIG. 8 is an enlarged sectional view taken along line 8—8 of FIG. 7, showing in detail the beveled face of the base die block.

FIG. 9 is an enlarged perspective view of an upper die block together with a companion wedge therefor.

FIG. 10 is an end view of the upper die block of FIG. 9, illustrating the axial passage through which a portion of the gripper assembly is inserted.

FIG. 11 is a perspective view in partial section of the adjustable draw die of FIG. 1, illustrating a preferred embodiment with transmission means to effect adjustment of the wedge members and die blocks.

FIG. 12 is an end view of the draw die of FIG. 11, showing the gear assembly of the transmission means.

FIG. 13 is a sectional view taken along line 13—13 of FIG. 12, showing further details of the transmission means with a workpiece in the die assembly.

Referring now to the drawings, the adjustable draw die of the present invention indicated generally at 1, FIG. 1, comprises an annular casing or body 5 with a passageway or cavity 7 extending axially therethrough, together with a base die block or insert 21 and a companion base wedge member 22. Formed in the interface of cavity 7 are slots or grooves 8, 9, and 10 adapted to receive the die blocks 13, 17, and 21 together with the companion wedge members therefor. Front and back cover plates 37, 47, respectively, together with recessed ring heaters 41, 51 are secured to opposite ends of casing 5 thereby securing the die blocks and companion wedge members in the desired position within the cavity 7.

Formed in both cover plates 37, 47 are slots 38, 48, respectively, to permit passage therethrough of the workpiece, the slot 38 preferably being large enough to permit passage of the die blocks 13, 17 therethrough. In threaded engagement with front cover plate 37 are a plurality of set screws 59 which abut against the end of the wedge members facilitating adjustment thereof within the cavity. A similar set of screws 61 extending through and in threaded engagement with rear cover plate 47 abut against the rear end of the wedge members facilitating adjustment thereof in like manner. Formed on the inside face of cover plate 37 are recesses 39, 41 to accommodate travel therein of wedge members 14, 18, and 22, respectively. Similar cavities or recesses 49, 50, and 51 are formed in the interface of rear cover plate 47 to permit rearward travel therein of these wedge members, the cavity into which wedge member 18 moves being shown at 50, FIGS. 1 and 11.

Formed in the upper die blocks 13 and 17 are holes or passages 65, 67, respectively, preferably circular, through which is inserted a detachable rod or bar portion 69 of a gripper means indicated generally at 72. An enlarged head 70 formed integral with or attached to the end of rod 69 engages the front faces of the upper die blocks 13, 17. To facilitate rearward movement and closing of these die blocks when the gripper means moves rearward as shown in FIGS. 4, 5, and 13. A T-shaped bar 75 is held in gripper means 72 between a pair of serrated or roughened members 77, 78 which seat in locking engagement within cavity 73 formed in the body 74 of gripper means 72.

In a preferred embodiment as illustrated in FIG. 4, 5, and 13, the walls of cavity 73 taper toward die assembly 1 and member 77 as a corresponding taper to facilitate sliding axial movement thereof as the gripper is moved. When the die blocks are in the open position as shown in FIG. 4, rod 69 extends through a passageway 79 in gripper member 77, with a nut 81 being in threaded engagement with the other end of rod 69. The threads 82 are cut relatively shallow to facilitate rupture and stripping of the threads by nut 81 as the gripper means 72 moves away from the die assembly during drawing. In this way, the upper die blocks 13, 17 are pulled rearwardly sliding axially on companion wedge members 14, 18, respectively, until the upper die blocks are in contact with and stopped by rear cover plate 47 as shown in FIGS. 5 and 13.

As the die blocks move rearward into this preset closed position, the bearing faces 87 of the dies contact and compress workpiece 75, causing deformation and outward radial flow of metal by eliminating die blocks at the edges of the stem 76 and head 77 of T-bar 75 and leaving open the areas 93, FIG. 6, at these edges into which compressed metal can flow outwardly, it is thus possible to effect substantial drawing reduction of a T-bar by adjustment of only a pair of wedge members.

In the several illustrations of the preferred die blocks, FIGS. 7—10, the companion wedge members taper in the longitudinal direction and have one face in frictional contact with the interface of cavities 8 and 10 in body 5. The opposing face of the wedge members is in frictional engagement with its companion die block, these adjacent surfaces of the wedge member and die blocks preferably having the same contour. For ease of drawing and to minimize friction, each of the die blocks have an inclined face 97 at a predetermined approach angle to the bearing face 87 with a relief face 99 adjacent thereto (see FIGS. 7, 8, and 9).

To facilitate adjustment of the die assembly during drawing there is provided a transmission means comprising a stem 102 having threads 103 on one end which is in engagement and cooperates with threads 105 on the walls of cavity 107 in wedge members 14, 18, FIGS. 11—13. Extending into groove or recess 109 in stem 102 is a set screw 111 which prevents axial movement of the stem, rotation of stem 102 thereby effecting only axial movement of the respective wedge member into which it extends. Gears 113, 115, preferably having the same diameter, are secured to the two stems 102 which are in threaded engagement with wedge members 14, 18. The gear 117 coacts with both gears 113, 115 to effect simultaneous rotation thereof.

In FIG. 6 where upper die blocks are movable radially at an angle of about 45°, simultaneous adjustment of only these upper die blocks without adjustment of the base die block would not effect a uniform change in the thickness of both the stem 76 and head 77 of the T-bar. In most cases, where uniform thickness of the head and stem is desired, it is necessary to adjust the base die block when the upper die blocks are repositioned. FIGS. 11-13 show a die assembly lacking a companion wedge member for the base die block 21. When a uniform change in thickness of the head and stem is desired, it is necessary when using this type of die assembly that the upper die blocks are movable radially at an angle of 26°34' with respect to the plane of the T-bar stem 76. Displacement of only the upper die blocks in this die assembly will therefore uniformly change the thickness of all portions of the T-bar.

It must be understood that modification can be made to the die assemblies described by those of ordinary skill in the art of die design to adapt it to the drawing of different shaped workpieces. It is possible to employ an equivalent die assembly in the drawing of a generally T-shaped member, for example, irregular projections extending from the face of such a member. In other words, from the foregoing description, one skilled in the art can easily ascertain the essential characteristics of this invention, and without departing from the spirit and scope thereof, can make various changes and modifications of the invention to adapt it to various usages and conditions.

What is claimed is:

1. An adjustable die suitable for drawing T-bars without prior size reduction of one end of the work piece to be drawn, which comprises:

- a. A body having a cavity extending axially therethrough;
- b. A base die block positioned within said cavity;
- c. A pair of upper die blocks within said cavity, co-acting with said base die block to form a die opening, each upper die block having a slanted side and being axially and radially slideable within the cavity of said body;
- d. A pair of wedge members, each positioned intermediate said body and one of said upper die blocks, and each having a slanted side in frictional engagement with a corresponding slanted side of one of said upper die blocks;

whereby axial sliding movement of an upper die block effects radial displacement thereof, thereby changing the size of the die opening through which both head and stem of a T-bar are drawn.

2. The adjustable die of claim 1, wherein each of the

wedge members have a slanted side engaging a corresponding slanted side of the body whereby axial sliding movement of a wedge member effects radial displacement of its companion die block changing the size of the die opening through which both head and stem of the T-bar is drawn.

3. The adjustable die of claim 1, further comprising detachable cover plates partially closing open ends of the cavity and limiting movement of the die blocks and wedge members therein.

4. The adjustable die of claim 3, further comprising wedge adjustment means extending through at least one cover plate and adapted to engage the wedge members for axial adjustment thereof.

5. The adjustable die of claim 4, wherein the wedge adjustment means extends through and is in threaded engagement with both cover plates.

6. The adjustable die of claim 2, further comprising transmission means for cooperatively and simultaneously moving upper die blocks to effect uniform adjustment of the die opening.

7. The adjustable die of claim 6, wherein the transmission means operatively engages wedge adjustment means to effect simultaneous radial adjustment of both upper die blocks.

8. The adjustable die of claim 1, wherein a wedge member is positioned intermediate the body and the base die block whereby to effect a change in the thickness of the T-bar head being drawn.

9. The adjustable die of claim 5, wherein the wedge adjustment means and transmission means are adjustable during drawing to produce a taper in a workpiece being drawn.

10. An adjustable die of claim 1, further comprising gripper means for holding the end of the workpiece being drawn through the die opening.

11. The adjustable die of claim 10, wherein the gripper means detachably engages the upper die blocks and moves them axially within the body until contact is made with a cover plate whereupon the gripper means detaches from the upper die blocks.

12. The adjustable die of claim 1, wherein each of the upper die blocks is adjustable radially at an angle of 26°34' < with the plane of the T-bar stem, whereby to uniformly vary the thickness of both the stem and head of the T-bar being drawn.

13. The adjustable die of claim 12, further comprising transmission means for cooperatively moving upper die blocks simultaneously to effect uniform adjustment of the die opening.

14. The adjustable die of claim 1, wherein said base die block has parallel sides and is immovable radially.

* * * * *