EXPANDABLE FORMING TOOL

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ABSTRACT

An expandable forming tool has a body with a mounting stem on its upper surface and a transversely extending channel in its lower surface in which is slidably seated a wedge-shaped actuator for vertical sliding movement. The larger lower end normally depends from the body. A pair of slides are slidably seated in the channel on opposite sides of the actuator, and they have angular surfaces slidably bearing on the sloping surfaces of the actuator. Springs bias the slides against the side surfaces of the actuator, and a spring biases the actuator outwardly of the body. The actuator is driven vertically inwardly of the channel by movement of its larger end against a workpiece, and this inward movement pushes the slide members outwardly in the channel to project beyond the periphery of the body.
EXPANDABLE FORMING TOOL

BACKGROUND OF THE INVENTION

[0001] The present invention relates to tools for forming sheet metal workpieces and the like.

[0002] Machine tools are widely utilized to form sheet metal workpieces into a desired configuration by cooperating upper and lower dies which are configured to provide the contours in the workpiece. The configured forming tool is located in the head of the machine and is moved downwardly against the workpiece which is disposed upon a die that cooperates with the forming tool. Many of such dies have a resiliently deformable which facilitates the forming of the metal about the contours of the forming tool.

[0003] Generally, machine tools have a limitation as to the diameter of the forming tool which can be employed. If that diameter of the conventional forming tool is less than the length of the contour to be formed, multiple operations may be required to effect the formation of the full length of the desired contour. This is costly in terms of time required, and it can require use of multiple tools to obtain the desired formation.

[0004] It is an object of the present invention to provide a novel forming tool which can be expanded beyond the normal maximum diameter for the forming tool to enable the forming of a workpiece over a wider length.

[0005] It is also an object to provide such a forming tool which can be readily and relatively economically fabricated to provide a relatively long lived assembly.

SUMMARY OF THE INVENTION

[0006] It has now been found that the foregoing and related objects may be readily attained in an expandable forming tool having a body with a mounting stem on its upper surface and a transversely extending channel in its lower surface. A wedge-shaped actuator has its smaller, upper end slidably seated in the channel for movement vertically therein and has its larger, lower end normally depending from the body. The actuator has inwardly sloping side surfaces which bear against cooperatively sloping side surface of a pair of slide members slidably seated in the channel on opposite sides of the wedge-shaped actuator.

[0007] Slide member biasing means bias the slide members against the sloping surfaces of the actuator, and actuator biasing means biases the actuator outwardly of the body. The actuator is driven vertically inwardly of the channel by movement of the larger lower end against an opposing surface, and the inward movement of the actuator pushes the slide members outwardly in the channel so as to project beyond the periphery of the body.

[0008] Generally, the actuator and the slide member have their lower surfaces cooperatively configured to form a contour in a workpiece against which they are driven. Moreover, the slide member and the larger end of the actuator have their lower surfaces lying in a common plane when the actuator is fully moved inwardly of the body.

[0009] The body has depending portions at the upper and outer ends of the channel and the slides have cooperating upstanding portions at their inner ends. The slide member biasing means comprises compression springs seated between these depending and upstanding portions.

[0010] The stem and the body have aligned axial passages therein opening into the channel, and an actuator retainer is slidably seated in the axial passages. The actuator biasing means includes a compression spring acting between the upper end portion of the actuator retainer and a shoulder in the passage in the stem. Preferably, the axial passage in the body has a shoulder formed thereabout adjacent its upper end and the actuator retainer has a collar which abuts the upper surface of the shoulder to retain the actuator in the body.

BRIEF DESCRIPTION OF ATTACHED DRAWINGS

[0011] FIG. 1 is a perspective view of an expandable forming tool embodying the present invention;

[0012] FIG. 2 is a cross sectional view thereof;

[0013] FIG. 3 is an exploded view thereof;

[0014] FIG. 4 is a cross sectional view of the actuator drawn to an enlarged scale;

[0015] FIG. 5 is an end elevational view of a slide;

[0016] FIG. 6 is a bottom view of the forming tool with the slides extended; and

[0017] FIGS. 7a-7e are cross sectional views drawn to a reduced scale of the expandable forming tool and a cooperating die at various states of relative movement.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0018] An expandable forming tool embodying the present invention is shown in the attached drawings and is generally comprised of a body generally designated by the numeral 10, an actuator generally designated by the numeral 12, and a pair of slides generally designated by the numeral 14.

[0019] The body 10 comprises a generally circular housing 16 with a transversely extending channel 18 in its lower surface terminating in depending end walls 20. A concentric, generally cylindrical stem 22 on the upper surface has a bore or passage 24 extending therethrough. The upper end portion of the bore 24 is threaded and receives a threaded cap 26 and the lower portion seats a compression spring 28 which bears upon the cap 26. A concentric passage 27 extends through the body 10 from the bore 24 to the channel 18.

[0020] Slidably seated in the channel 18 are the slides 14 which have their bottom surface 29 configured to form the desired contour in a workpiece and an upstanding portion 30 on their inner ends which cooperate with the depending end walls 20 of the body to define recesses 31 in which are seated compression springs 32 which bias the slides 14 inwardly. The lower portions 34 of the inner end surface of the slides 14 are angled outwardly downwardly.

[0021] The actuator 12 is generally wedge shaped with outer end surfaces 36 which angled outwardly downwardly to cooperate with the lower portions 34 of the slides 14. The bottom surface 38 of the actuator is contoured cooperatively...
with the bottom surfaces 29 of the slides 14 to produce the desired contour in the workpiece.

[0022] The upper end of the actuator 12 has a threaded bore 40 which threadably seats the shank 42 of the bolt generally designated by the numeral 44 and which extends through the passage 27 in the body 10. The spring 28 bears upon the head 46 of the bolt 44 to bias the actuator 12 outwardly of the channel 18 in the body 10 as seen in FIG. 1 in which position the slides 12 are disposed within the periphery of the body 10.

[0023] In accordance with conventional practice, the expandable forming tool of FIGS. 1-6 cooperates with a die shown in FIGS. 7a-7e and generally designated by the numeral 48 to deform a sheet metal workpiece schematically illustrated and designated by the numeral 50.

[0024] As will be readily appreciated, the actuator 12 is retained in the body 10 by the retainer bolt 44. Since the actuator 12 is positively held in place, this also effects the retention of the slides 14 within the body 10.

[0025] In assembling the forming tool of the present invention, the slides 14 and the compression springs 32 are initially assembled in the body 10. The actuator 12 is then moved into place between them and the bolt 44 is threadably engaged therein. The compression spring 28 is then placed within the passage 24 in the stem 22, and the cap 26 is threaded inwardly of the stem to trap the spring 28 in position and to hold all of the elements in assembly.

[0026] Turning now to FIGS. 7a-7e, the operation of the expandable tool is diagrammatically illustrated. In FIG. 7a, the forming tool has been clamped in position in the machine tool (not shown) and the actuator 12 is in its at rest position extending substantially outwardly of the body 10. The springs 32 are biasing the slides 14 against its side surfaces of the actuator 12 so that they are fully disposed within the periphery of the body 10. The sheet material workpiece 50 is disposed on the die 48 located in the bed of the machine tool (not shown).

[0027] In FIG. 7b, the forming tool has been moved against the surface of the workpiece 50. In FIG. 7c, the continuing movement of the forming tool against the workpiece 50 has caused the actuator 12 to move vertically upwardly and this, in turn, has caused the slides 14 to move outwardly into the projecting positions which are illustrated. The bottom surfaces of the slides 14 and actuator 12 with the contours thereon are all aligned in a common plane. The continuing motion of the forming tool now causes the underlying deflectable portion of the die 48 to compress and deform about the workpiece to effect its bending until it assumes the shape shown in FIG. 7d across the full width of the expanded tool, i.e., the actuator and the projecting slides.

[0028] In FIG. 7e, the machine tool has now moved the forming tool upwardly so that the workpiece 50 can be removed.

[0029] As can be seen from the foregoing detailed drawings and description, the expandable forming tool of the present invention may be fabricated readily and economically and provides an expanded forming surface. This enables the fabrication of workpieces more quickly and enables far less complex forming dies that might otherwise be required.

Having thus described the invention, what is claimed is:

1. An expandable forming tool having:
   (a) a body with a mounting stem on its upper surface and a transversely extending channel in its lower surface;
   (b) a wedge-shaped actuator having its smaller end slidably seated in said channel for movement vertically therein and having its larger end normally depending from said body, said actuator having upwardly inwardly sloping side surfaces;
   (c) a pair of slide members slidably seated in said channel on opposite sides of said wedge-shaped actuator and having cooperating angular surfaces slidably bearing on said sloping side surfaces of said actuator;
   (d) slide member biasing means biasing said slide members against said sloping side surfaces of said actuator; and
   (e) actuator biasing means biasing said actuator outwardly of said body, said actuator being driven vertically inwardly of said channel by movement of said larger end against an opposing surface, said inward movement of said actuator pushing said slide members outwardly in said channel so as to project beyond the periphery of said body.

2. The expandable forming tool in accordance with claim 1 wherein said actuator and said slide member have their lower surfaces cooperatively configured to form a contour in a workpiece against which they are driven.

3. The expandable forming tool in accordance with claim 1 wherein said slide member and said larger end of said actuator have their lower surfaces lying in a common plane when said actuator is fully moved inwardly of said body.

4. The expandable forming tool in accordance with claim 1 wherein said body has depending portions at the upper and outer ends of said channel and said slides have cooperating upstanding portions at their inner ends.

5. The expandable forming tool in accordance with claim 4 wherein said slide member biasing means comprises compression springs seated between said depending and upstanding portions.

6. The expandable forming tool in accordance with claim 1 wherein said stem and said body have aligned axial passages therein opening into said channel, and wherein an actuator retainer is slidably seated in said axial passages.

7. The expandable forming tool in accordance with claim 6 wherein said actuator biasing means includes a compression spring acting between said actuator retainer and a shoulder in said passage.

8. The expandable forming tool in accordance with claim 7 wherein said axial passage in said body has a shoulder formed thereabout adjacent its upper end and said actuator retainer has a collar about its lower end, said collar abutting the upper surface of said shoulder to retain said actuator in said body.

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