

May 21, 1968

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3,383,899

BENDING BRAKE

Filed April 13, 1965

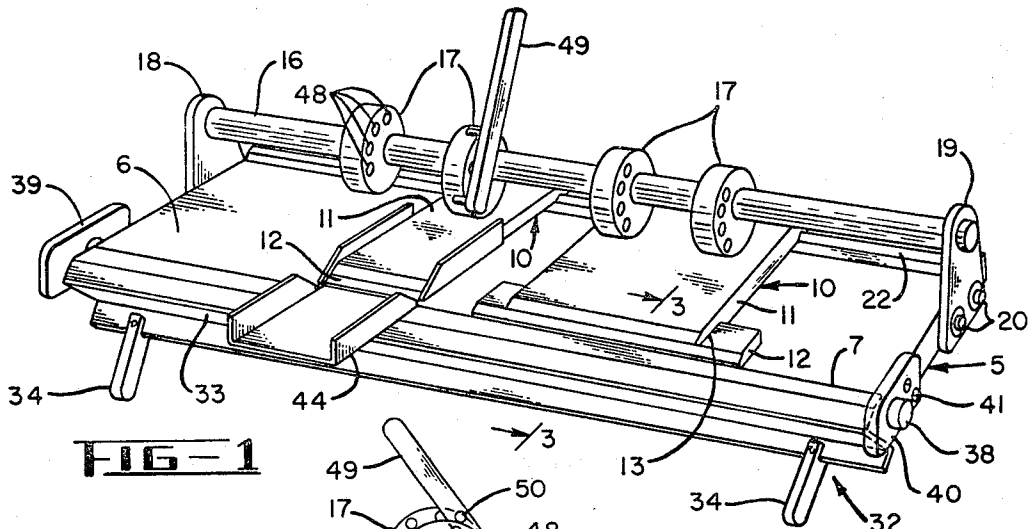


FIG-1

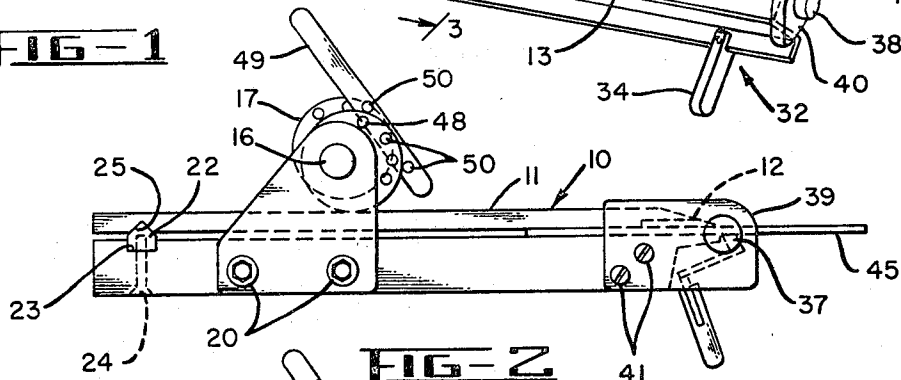


FIG-2

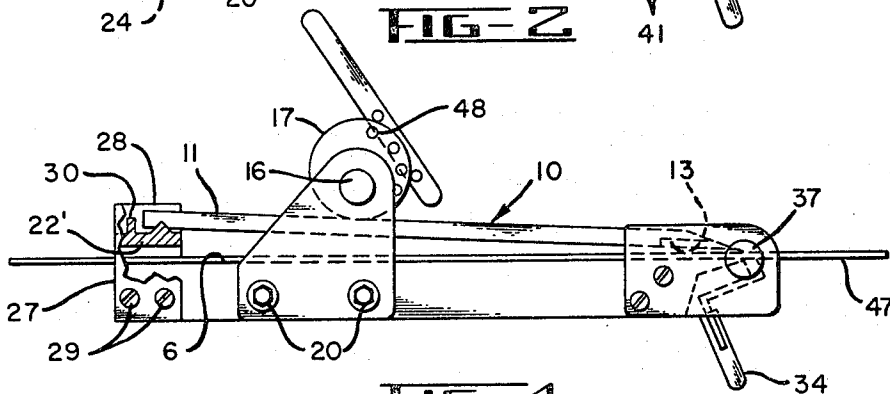


FIG-4

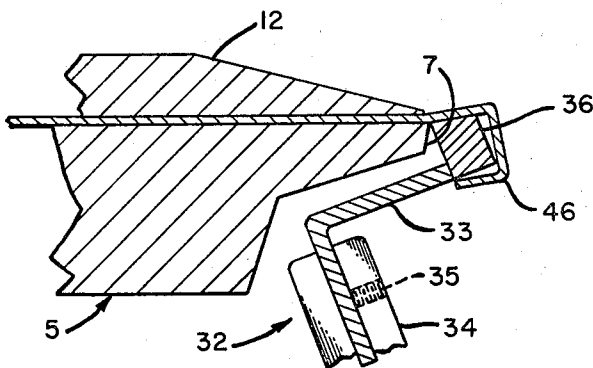


FIG-3

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BENDING BRAKE

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Filed Apr. 13, 1965, Ser. No. 447,924

2 Claims. (Cl. 72-319)

ABSTRACT OF THE DISCLOSURE

A bending brake comprising a body plate having a flat surface for receiving the workpiece to be bent. One or more bending die units are mounted on the body plate for movement toward the work surface to clamp a workpiece against said surface. A camshaft is mounted on the body plate, upon which a plurality of cams are rotatably mounted, which cams are adapted to engage the bending die unit, or units, to urge the same toward the work surface. A bending leaf is mounted for movement across one edge of the body plate for bending the workpiece. By using a plurality of bending die units a workpiece of non-uniform thickness is readily clamped to the body plate surface. Also, the bending die units are provided with a groove which fits over a fulcrum bar attached to the body plate to prevent longitudinal movement of the bending die units thereby assuring accuracy of the bend location.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates to the shaping of material into various forms by bending the material, and more particularly to bending apparatus of the type commonly known as bending brakes.

It is conventional construction for a bending brake to comprise a body plate, a bending die, some means for forcing the bending die against the body plate to clamp the work material therebetween, and a bending leaf pivotally mounted for movement across one edge of the body plate to engage the work material and bend it about the lip of the bending die.

One problem associated with conventional bending brakes of the type described is that the means for forcing the bending die against the body plate is so arranged that when the die is forced toward the body plate, the lip of the die moves. Since the lip of the die forms the line along which the intended bend is made, movement of the lip of the die results in inaccurate bends.

An object of the present invention is to provide an improved bending brake in which the lip of the bending die does not move when the bending die is forced toward the body plate.

Another problem associated with conventional bending brakes is that the bending leaf is shaped so that it is not possible to make certain complex bends such as a second bend closely adjacent a previous bend in the opposite direction.

Accordingly, another object of the invention is to provide a bending brake which is capable of making an unusual variety of complex bends.

Another object of the present invention is to provide a bending brake having an improved two-piece bending die construction wherein one of the bending die pieces is relatively small and can therefore be economically made expendable and custom designed for individual bending requirements.

A further object of the invention is to provide a bending

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brake which is usable with one or more of a plurality of bending dies of various widths. One advantage of this construction is the ability to have the work material fit up around the sides of the bending die, so that a bend can be made in a channel-shaped member. Another advantage is the ability to clamp only a portion of the work piece under the bending die.

Another object of the invention is to provide a bending brake involving a plurality of movable clamping means so that substantially uniform clamping pressure can be supplied throughout the length of the lip of the bending die.

A further object of the invention is to provide a bending brake having improved speed, ease and flexibility of set-up procedure.

By way of brief description a bending brake according to the invention comprises a body plate having a flat surface for receiving the work piece, usually in sheet form. A camshaft is mounted above the body plate, and a plurality of cams are pivotally mounted on the camshaft and movable along the shaft. A fulcrum bar is mounted on the body plate on one side of the camshaft. The die body constructions are each provided with a groove which fits over the fulcrum bar, and the cams are engageable with the tops of the die body constructions. The bending leaf is pivotally mounted on the body plate and comprises an elongated bar member plus an elongated bending head attached to the bar member in an offset relation.

The various objects and features of advantage of the invention will become more apparent from the following detailed description wherein reference is made to the accompanying drawings in which:

FIGURE 1 is a perspective view of a bending brake according to the invention and including a work piece in position preparatory to bending;

FIGURE 2 is a side elevational view of the bending brake of FIG. 1, but showing a differently shaped work-piece;

FIGURE 3 is an enlarged sectional view taken on the line 3-3 of FIG. 1 and showing a piece of sheet material in the process of being bent; and

FIGURE 4 is a side view similar to FIG. 2 but showing a modified arrangement for the bending fulcrum, and showing a longer workpiece.

Referring in more detail to the drawings the bending brake comprises a metal body plate 5 having a flat upper surface 6 and a forward or bending edge 7. The flat surface 6 forms the work surface on which the material to be bent is placed.

In order to clamp the material to be bent in position on the body plate, a bending die unit 10 is placed on the body plate. The bending die unit comprises a die body 11 and a die lip 12. The die body 11 has a recess 13 in its forward underside, and the rear portion of the die lip 12 is received in the recess. The die body and die lip are both preferably made of metal. The die lip is not attached to the die body so that the die lips are easily and quickly removable and interchangeable. In FIG. 1 two bending die units are shown, each comprising a die body and die lip. Obviously, more or fewer bending die units can be located on the body plate, and they can be used simultaneously or selectively. One of the features of the invention is the versatility afforded by the fact that each bending die unit can function completely independently of each other bending die unit, or they can be placed closely adjacent each other to serve simultaneously in operating on a single sheet of material.

The means for forcing the bending die units 10 toward the work surface 6 of the body plate comprises a camshaft 16 and a plurality of cams 17. The camshaft and cams are all preferably made of metal. The cams are

preferably in the form of simple eccentrics; that is, circles with their mounting bore positioned off-center. The cams are slidably mounted on the cam shaft so they can be adjusted along the camshaft. The camshaft 16 is mounted above the working surface 6 by means of a pair of mounting brackets 18 and 19. The mounting brackets are secured to the body plate 5 by screws 20.

The bending dies units are engageable on the top by the cams 17 and on the bottom by a fulcrum bar 22, as shown in FIGS. 1 and 2. The fulcrum bar 22 is preferably made of metal and positioned in a slot 23 in the body plate. The fulcrum bar is secured to the body plate by screws 24. The top of the fulcrum bar has a sharp pointed wedge shape as viewed in cross section. The rearward undersurface of each of the die bodies is provided with a fulcrum groove 25 which substantially matches the shape of the top of the fulcrum bar. In order to provide an apparatus which operates freely and yet with accuracy, the point angle of the top of the bar 22 is preferably about one degree smaller than the point angle of the fulcrum groove 25. For example, the point angles of the bar 22 and groove 25 have been found to work very well at 89° and 90°, respectively. The die bodies 11 are not bonded to the fulcrum bar 22 so that they are free to rock about the fulcrum bar and are easily removed and interchanged.

In the embodiment shown in FIGS. 1 and 2, the mounting for the fulcrum bar 22 is very simple and direct. However, such mounting is not suitable for use with long work pieces because it forms an abutment along the work surface 6. FIG. 4 shows a modification which does not limit the length of the workpiece. More specifically, FIG. 4 employs a fulcrum bar 22' which is spaced above the work surface 6. Bar 22' is held in place by being welded or otherwise secured to pair of mounting brackets 27 and 28 which are in turn secured to the sides of the body plate 5 by screws 29. The fulcrum bar 22' is not supported intermediate its ends and therefore is provided with a wider base than bar 22 and is reinforced by a web 30.

The mechanism which actually engages the workpiece and bends it around the forward or bending edge of the bending lip 12 is a bending leaf unit 32. The unit 32 comprises an elongated metal bending bar 33 which is preferably of angle iron cross section. One leg of bar 33 carries a pair of metal handles 34 held in place by screws 35. The other leg of bar 33 has welded or otherwise connected thereto a bending head 36 which projects toward the edge 7 of the body plate. The bending leaf unit is pivotally connected to the body plate by a pair of stub shafts 37 and 38 welded or otherwise attached to the ends of the unit. The stub shafts are journaled in a pair of mounting ears 39 and 40 which are connected to the body plate by screws 41. The parts are arranged so that the pivot axis formed by the center of stub shafts 37 and 38 coincides with the upper left edge of the bending head 36 as viewed in FIGS. 2-4.

A variety of work pieces 44, 45, 46 and 47 are shown in FIGS. 1-4, respectively, to help illustrate the use of the bending brake. It is believed that the operation is substantially obvious from the drawings and the preceding description. Thus, when the cams 17 are rotated clockwise as viewed in FIGS. 2 and 4, they will force the die body units downwardly to clamp the workpiece against the work surface 6. The workpieces can be re-

leased by rotating the cams counterclockwise as viewed in FIGS. 2 and 4. It has been found that light work can be handled satisfactorily when the cams are turned against the die bodies simply by hand pressure. However, for heavier work the cams are provided with bores 48 in their sides and a locking lever 49 is provided with three projecting pins 50. The center pin is engageable in one of the bores 48 while the end pins engage the periphery of the cam to apply a strong turning force.

As shown in FIG. 1, the fact that the die units 10 are completely separable makes it possible to bend a work piece 44 which has been preformed to have a channel-shape. FIG. 1 also shows that since the cams 17 can be moved along camshaft 22, a plurality of cams can be used with a single die unit 10 so that the clamping force will be applied at close locations along the width of the die body. FIG. 4 shows that the modified fulcrum bar 22' permits the use of a long work piece 47 whereas the length of workpiece 45 used with FIG. 2 is limited by the presence of the fulcrum bar 22. FIG. 3 shows that the bending head arrangement makes it possible to form a work piece 46 into close complex bends including reverse bends.

Although specific details of the present invention are shown and described herein, it is to be understood that modifications may be made therein without departing from the spirit and scope of the invention as set forth in the appended claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A bending brake comprising a body plate, a camshaft mounted on said body plate, a cam pivotally mounted on said camshaft, a fulcrum bar mounted on said body plate substantially parallel to said camshaft, said fulcrum bar being elevated above said body plate, a bending die unit having a fulcrum groove on one side engageable with said fulcrum bar, the other side of said bending die unit being engageable by said cam, a bending leaf, and means pivotally connecting said leaf to said body plate for movement across one edge of said plate.

2. A bending brake comprising a body plate, a fulcrum bar mounted on said body plate, said fulcrum bar being suspended above the surface of said body plate, a bending die unit having a fulcrum groove on one side engageable with said fulcrum bar, a bending leaf mounted for movement across one edge of said body plate, and means for forcing said die unit against said fulcrum bar and toward said body plate.

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