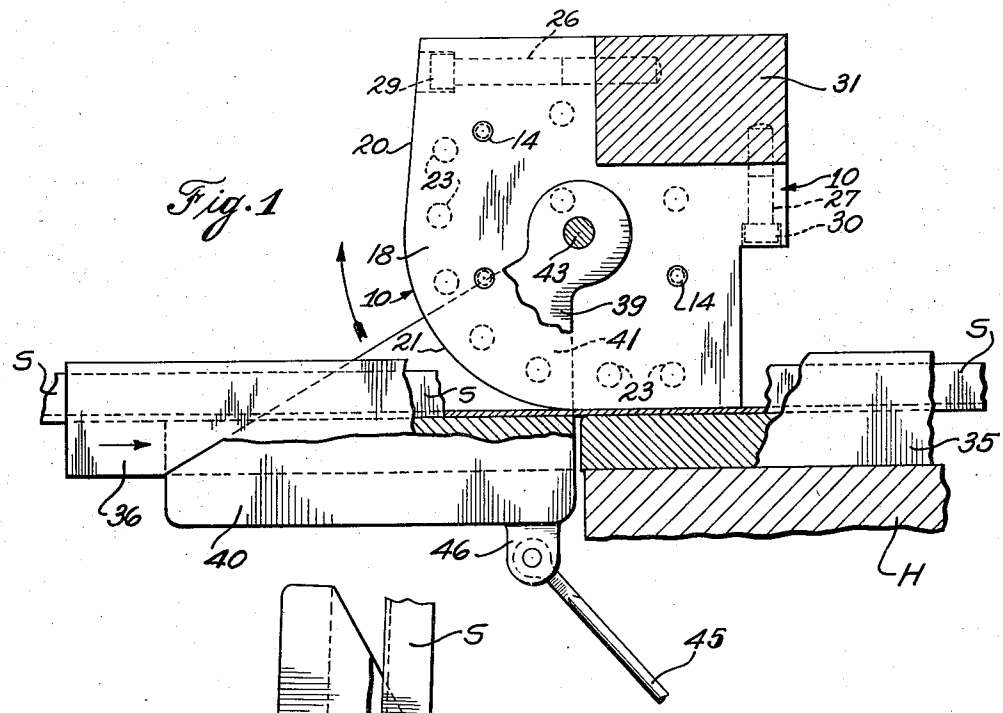
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ADJUSTABLE AND YIELDABLE MALE BENDING DIE

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Fig. 1



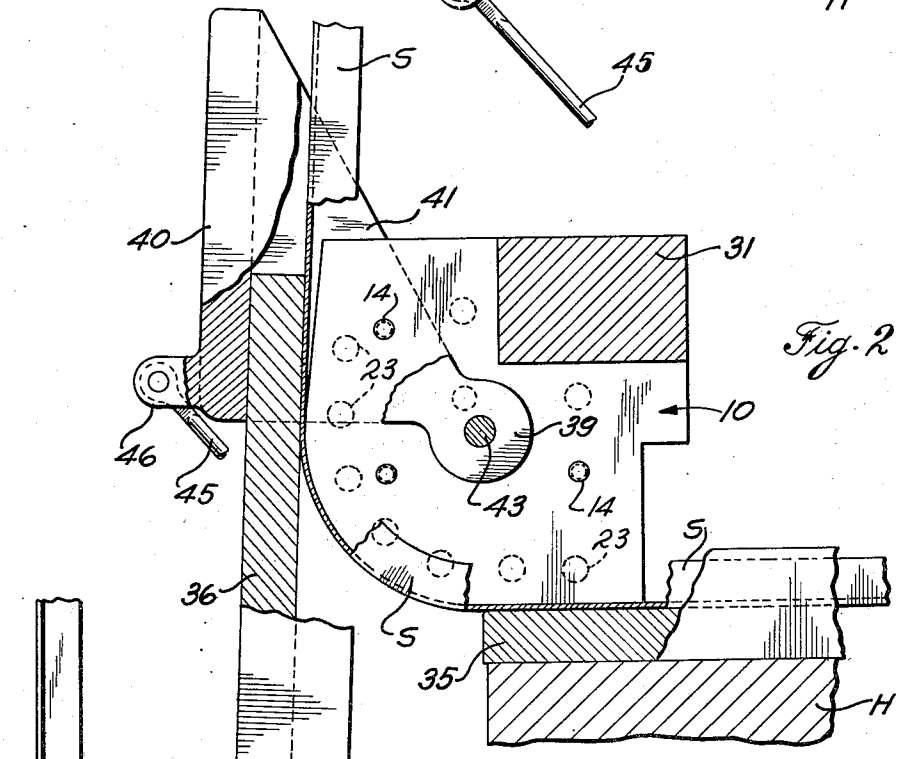


Fig. 2

Fig. 5

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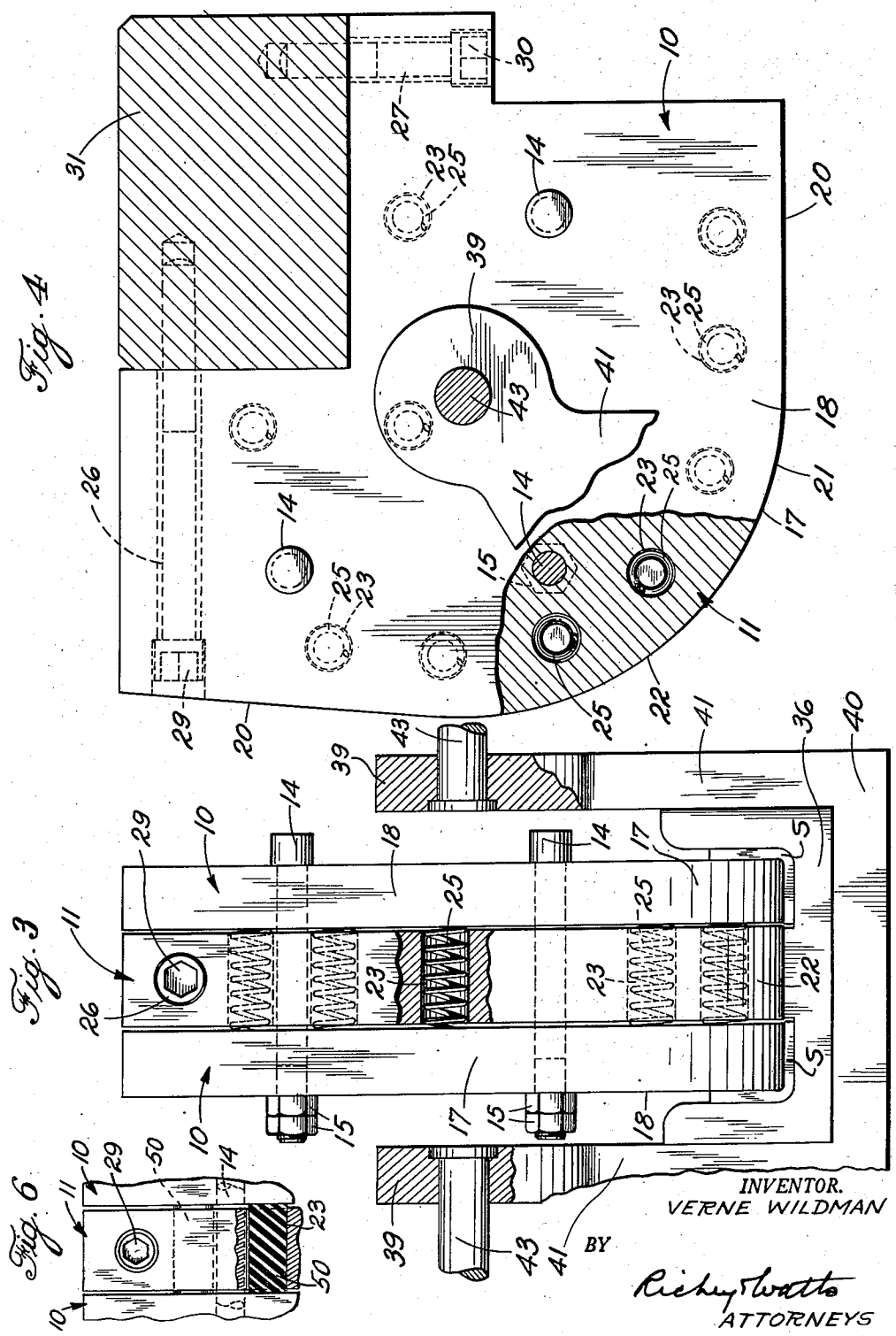
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ADJUSTABLE AND YIELDABLE MALE BENDING DIE

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ADJUSTABLE AND YIELDABLE MALE BENDING DIE

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5 Claims. (Cl. 153—46)

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The present invention relates generally to metal shaping and forming dies and is more particularly concerned with a novel and very useful male die for bending metal angle stock without wrinkling or buckling said stock.

When a length of angle stock is bent in accordance with conventional practice, the final article is usually wrinkled in the vicinity of each bend for lack of the application of a positive shaping or retaining force upon the sides of the stock while adjacent portions are being bent. In efforts to overcome this difficulty others have devised die means intended to preserve the flange shape as bending is accomplished, but such means have been of limited utility and value due to the fact that a given die of this type can be used only with stock of one particular flange thickness. To overcome this difficulty these devices may be provided with adjustment means, but would then require special attentions involving careful measurement with each variation of stock thickness, and would thus be uneconomical and impractical.

In accordance with the present invention, these various shortcomings of the prior art can be overcome easily and economically through a novel combination of relatively few uncomplicated elements which do not require high precision work in their manufacture and assembly, but are nevertheless fully effective in preventing the wrinkling of stock in metal bending operations. Moreover, the present device is automatically adaptable to variations in stock thickness since it may expand and contract resiliently, depending upon the thickness of various portions of the stock to which it is applied. In other words, because of its design and the principles upon which its operation is based, the present device inherently is much more adaptable than any heretofore known analogous device. In addition, my die is easily and quickly assembled and disassembled without special skill or care, and can be used for long periods without either adjustment or maintenance attentions.

A more thorough understanding of my present invention and a further realization of the advantages which it possesses will be gained by those skilled in the art from the following detailed description of this invention in a preferred form, illustrated in the drawings accompanying and forming part of this specification, in which,

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Figure 1 is a side elevational view, partly in section and with parts broken away, of an angle-stock bending die assembly including a male die embodying this invention, and showing a length of stock in position just prior to bending;

Figure 2 is a view similar to that of Fig. 1, showing the female die in its extreme advanced position at the end of the stock-bending operation;

Figure 3 is a front end elevational view of the Fig. 1 assembly with a portion of the male die broken away to show its internal construction;

Figure 4 is a side elevational view, partly in section, of the male die of Fig. 1, showing its internal construction;

Figure 5 is a reduced scale view of the angle segment shown in Fig. 1, illustrating the final shape of the segment after its release from the die assembly; and,

Fig. 6 is a fragmentary, end elevational view of the Fig. 1 assembly with a portion broken away in the interest of clarity.

The illustrated male die of my invention comprises a pair of side plates 10 and a middle plate 11 all of which are of the same general shape and dimensions and provided with three registered transverse apertures through which extend three bolts 14 carrying nuts 15 and limiting movement of plates 10 outward relative to plate 11. Plates 10 have edge surfaces 17 and side surfaces 18 at right angles thereto to engage substantially the entire inner surface of an angle stock segment S just prior to and during the bending operation, and the end portions 20 of these edges, as viewed in Fig. 4, are straight and define an included angle of about 85°, while the mid-portions 21 are arcuate and define the curvature to be produced in stock S. Plate 11 has an edge 22 of similar contour disposed alongside of the said side plate edges, and further is provided with a pluraltiy of transverse apertures 23 most of which are adjacent to edge 22 and in all of which compression springs 25 are disposed, extending between and at all times firmly and resiliently bearing against opposing inside surfaces of the side plates. The middle plate also has two laterally extending apertures 26 and 27 through which two bolts 29 and 30 extend with their threaded ends being screwed into aligned threaded holes in a carrying bracket 31 whereby

the die is secured to a die holder or machine (not shown) suitably of conventional construction and having means for moving the die vertically to engage or disengage stock S.

Referring to Figs. 1 and 2, the female die of the illustrated assembly comprises a fixed shoe **35** and a sliding shoe **36**, both of which, however, are of substantially the same effective dimensions and configuration. In end view each of these shoes has an inner generally U-shaped working surface to engage substantially the entire outer surface portions of both segments of stock S during the bending operation. Fixed shoe **35** is carried by a conventional die holder or machine indicated at H, while shoe **36** is supported by a pivotally mounted bracket **39** having a portion **40** extending under and engaging the bottom of the shoe **36** and having a pair of spaced apart parallel arms **41** disposed on opposite sides of the male die. Arms **41** are transversely apertured near their free ends to receive shafts **43** which are on the center of curvature of edge portions **21** and are rotatably carried by the aforementioned die holder whereby the bracket **39** and sliding shoe **36** are maintained in relative position with respect to edge surfaces **11**. Thus shoe **36** in the bending operation is moved outwardly and upwardly around shafts **43** as pivots, from the position shown in Fig. 1 to that shown in Fig. 2, with bracket **39** sliding over shoe **36**, the force causing this movement being provided by means including a rod **45** pivotally attached to an apertured lug **46** carried by bracket **39** and operatively engaged with means (not shown) such as a piston actuated by pneumatic pressure.

As will be clear from the drawings, angle stock S is bent by the assembly of Fig. 1 by moving the stock segment into engagement with fixed shoe **35** and sliding shoe **36** and then gripping both segments between the male and female dies as illustrated in Fig. 3. Shoe **36** is then moved, turning the stock around the curved face of edge **17** and bending it through slightly more than 90°, thus allowing for spring-back, since a 90° bend is in this case desired. The operation may be repeated any desired number of times, depending upon the length of the stock and the use to which the bent stock is to be put, and the finished bends will uniformly have the perfect contour illustrated in Fig. 5. Due to the firm engagement of the sides of the male and female dies with the flanged portion of the stock at all critical times, there is no possibility of the stock wrinkling during bending.

It will be understood that the number, location and strength of springs **25** will be determined by the force which is required to prevent wrinkling of the stock during bending. It will be apparent furthermore that resilient means other than springs, such as rubber elements, may satisfactorily be employed in male dies of the present invention through routine modification of said dies. This construction is illustrated in Fig. 6 wherein solid soft rubber bars **50** of slightly smaller diameter than apertures **23** are disposed in these apertures in place of springs **25**, the ends of these bars **50** projecting from plate **11** and bearing against opposed faces of plates **10**.

Having thus described the present invention so that others skilled in the art will be able to understand and practice the same, I state that what I desire to secure by Letters Patent is defined in what is claimed.

What is claimed is:

1. A die for bending metal angle stock which comprises side plates and a middle plate therebetween and spaced from the side plates, said side plates having edge surfaces along which the stock is to be bent and side surfaces to engage and prevent wrinkling of said stock during such bending, means extending through said plates to limit outward movement of the side plates relative to the middle plate, and resilient means carried by the middle plate and bearing against said side plates and constantly urging said plates outwardly away from said middle plate, said resilient means being disposed between said stock engaging side surfaces of the side plates.

2. A die for bending metal angle stock which comprises side plates and a middle plate therebetween and spaced from the side plates, said side plates having edge surfaces along which the stock is to be bent and side surfaces to engage and prevent wrinkling of said stock during such bending, means extending through said plates to limit outward movement of the side plates relative to the middle plate, and resilient means including a plurality of springs carried by the middle plate and bearing against said side plates and constantly urging said plates outwardly away from said middle plate, said resilient means being disposed between said stock engaging side surfaces of the side plates.

3. A die for bending metal angle stock which comprises side plates and a middle plate therebetween and spaced from the side plates, said side plates having edge surfaces along which the stock is to be bent and side surfaces to engage and prevent wrinkling of said stock during such bending, and said middle plate having a plurality of transverse apertures, means extending through said plates to limit outward movement of the side plates relative to the middle plate, and resilient means in the apertures of the middle plate and bearing against said side plates and constantly urging said plates outwardly away from said middle plate, said resilient means being disposed between said stock engaging side surfaces of the side plates.

4. A die for bending metal angle stock which comprises side plates and a middle plate therebetween and spaced from the side plates, said side plates having edge surfaces along which the stock is to be bent and side surfaces to engage and prevent wrinkling of said stock during such bending, and said middle plate having a plurality of transverse apertures in its edge portion adjacent to the stock-engaging edge surfaces of the side plates, means extending through said plates to limit outward movement of the side plates relative to the middle plate, and resilient means including a plurality of springs in the apertures of the middle plate and bearing against said side plates in the region of the stock-engaging side surfaces of said plates and constantly urging the side plates outwardly away from said middle plate.

5. A die for bending metal angle stock which comprises side plates and a middle plate therebetween and spaced from the side plates and having a plurality of transverse apertures in register with transverse apertures in the side plates, said side plates having edge surfaces along which the stock is to be bent and side surfaces to engage and prevent wrinkling of said stock during such bending, and said middle plate having a plurality of transverse apertures, means including bolts extending through the registered

apertures of said middle plate and side plates to limit outward movement of the side plates relative to the middle plate, and resilient means carried by the middle plate and bearing against said side plates and constantly urging said plates outwardly away from said middle plate, said resilient means comprising a plurality of springs disposed in said transverse apertures of the middle plate, said resilient means being disposed between said stock engaging side surfaces of the side plates.

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