# United States Patent

**Kuchyt**

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[54] **SHEARING MACHINE**


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[52] **U.S. Cl.** .....**83/624,** 83/636, 83/639

[51] **Int. Cl.** .....**B26d 5/12**

[58] **Field of Search**.....83/636, 624, 639



[56] **References Cited**

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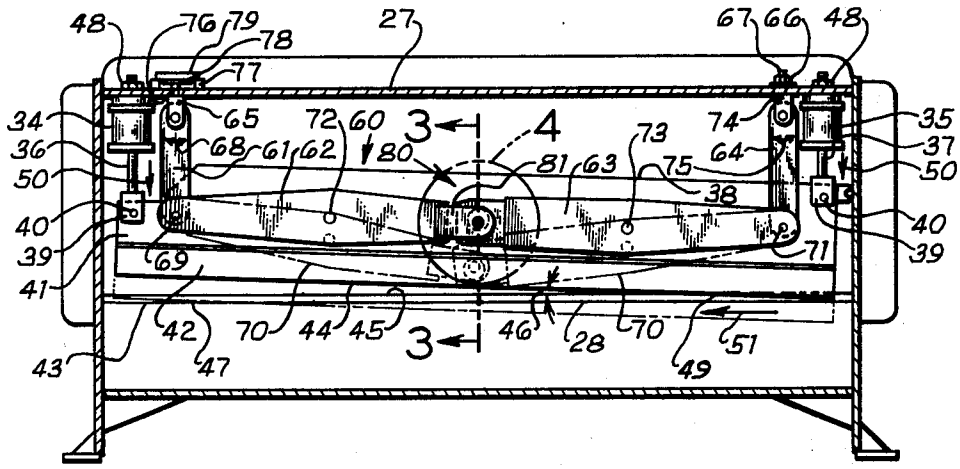
[57] **ABSTRACT**

A machine for shearing sheets of metal. The machine has an upper knife movable toward a fixed lower knife with the cutting edge of the upper knife being positioned at an angle with respect to the cutting edge of the lower knife. A pair of hydraulic cylinder motors force the upper knife toward the lower knife with the point of intersection of the cutting edges being moved progressively along the length of the knives. A pair of links have proximal ends pivotally connected to the machine frame and have distal ends pivotally interconnected. Each link is pivotally connected to the upper knife so as to maintain a constant angle between the cutting edges during movement of the upper knife. Adjustment means are provided to preset the angle between the cutting edges.


**8 Claims, 6 Drawing Figures**



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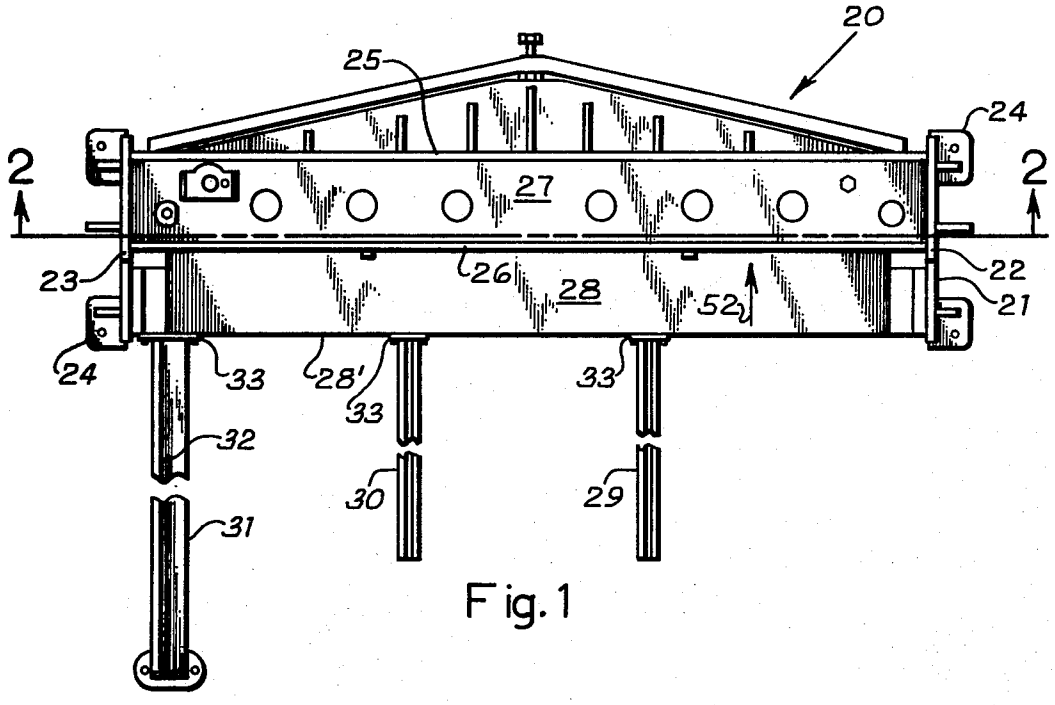


Fig. 1

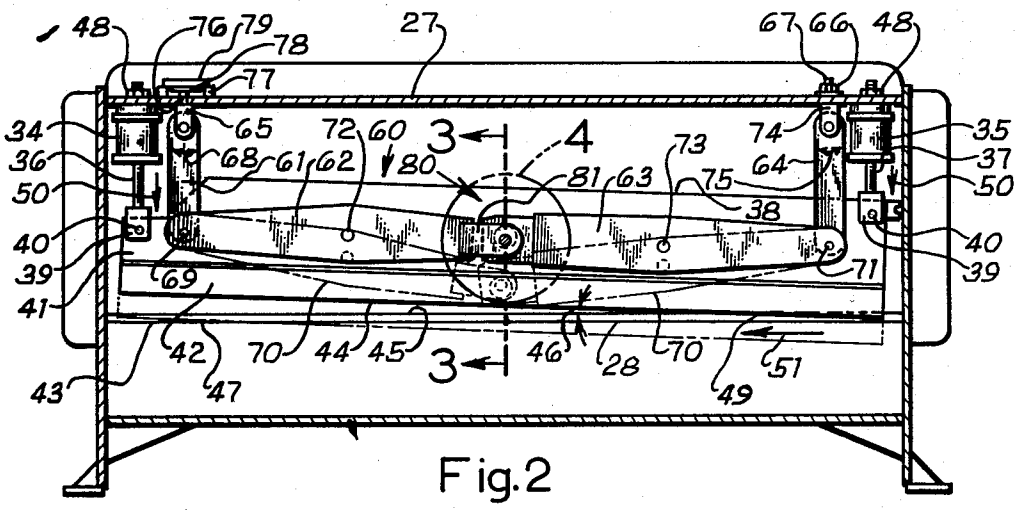


Fig. 2

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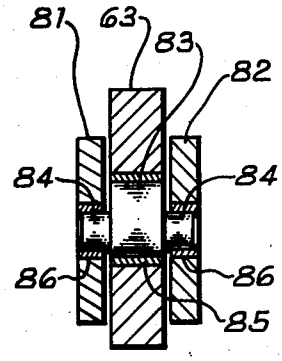


Fig 3

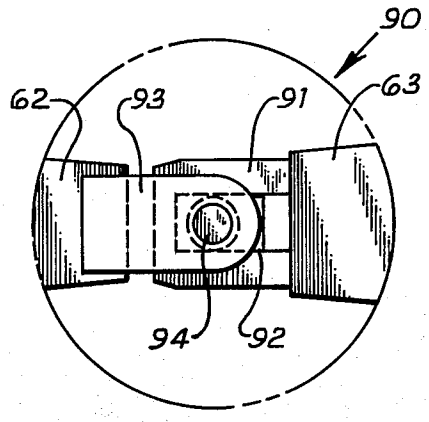


Fig 4

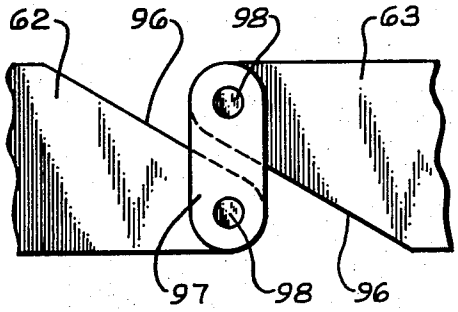


Fig. 5

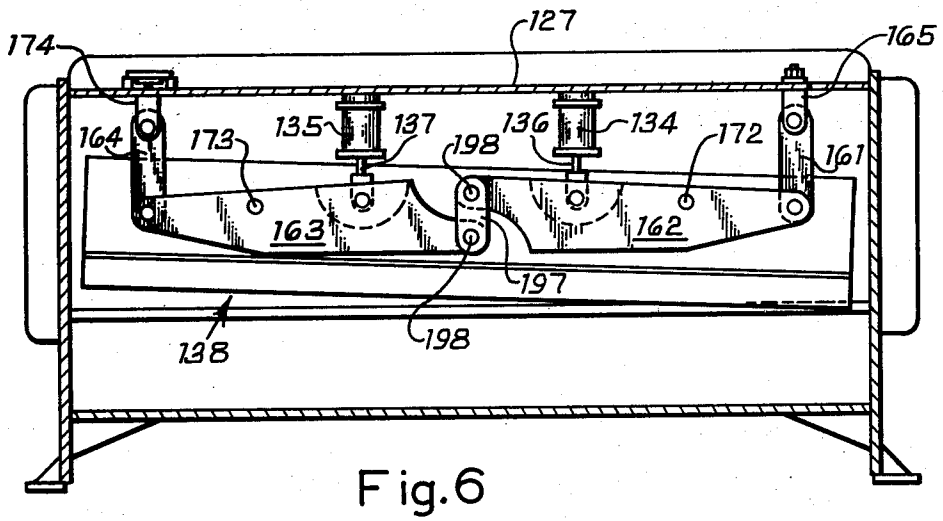


Fig. 6

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# SHEARING MACHINE

## BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is in the field of machines for shearing sheets of material.

2. Description of the Prior Art

It is known to cut or shear large sheets of material, such as metal, with a knife forced against the sheet of metal. Typically, these shearing machines have a top knife movable toward a bottom knife with the cutting edges of the knives being angularly positioned so as to intersect progressively along the length of the knife severing the sheet of metal in a scissor-like method. A representable sample of the prior art is disclosed in the following U.S. Patents: No. 3,074,304 issued to Cole; No. 3,157,084 issued to Meinholdt; No. 3,183,756 issued to Dehn; No. 3,211,037 issued to Diolot; No. 3,316,791 issued to Greis; No. 3,495,489 issued to Savory; No. 3,524,374 issued to Diolot; and, No. 3,530,761 issued to Erwin. Some of these prior art machines utilize various cylinder motors and control means to first force one end of a movable knife toward a fixed knife and to then subsequently force the opposite end of the movable knife to the fixed knife thereby achieving the angular positioning of the cutting edges. Other prior art shearing machines have adjustment features for presetting the angle or "rake" between the knife cutting edges. Both ends of the movable knife are then forced simultaneously toward the fixed knife with a pair of hydraulic cylinder motors. A major disadvantage of these latter prior art machines is that failure of one of the hydraulic cylinder motors results in a change of the angle between the cutting blade edges. In addition, the adjustment means for predetermining the angle between the cutting edges typically requires a relatively large amount of effort and time to set the angle. The shearing machine disclosed herein has a pair of links connected to the movable knife in such a way so as to maintain the angle between the cutting edges even in the event of failure of one of the hydraulic cylinder motors utilized to force the knives together. The machine disclosed herein also has a new and improved adjustment feature allowing preset of the angle between the cutting edges in a quicker and easier manner than previously known. In addition, the pair of links insure that the cutting force is constant across the sheet of material being cut.

## SUMMARY OF THE INVENTION

This invention is a shearing mechanism comprising: support means; a fixed member with a first edge; an elongated knife movable to and from said fixed member with a cutting edge positioned at an angle with respect to said first edge; power means operable to move said cutting edge toward said first edge with the point of intersection of said first edge and said cutting edge being moved progressively along said knife; and, first and second links pivotally connected to said support means and each having distal ends pivotally connected together, said links being pivotally mounted to said knife preventing said angle from changing as said knife is moved by said power means.

It is an object of the present invention to provide a shearing machine having a pair of blades movable together at a constant "rake" angle by a pair of hydraulic cylinder motors.



In conjunction with the above object, it is an object of the present invention to provide such a machine having a guide stabilizer to insure a constant "rake" angle even in the event of failure of one of the hydraulic cylinder motors.

In addition, it is an object of the present invention to provide a shearing machine which applies a constant shearing force across the width of the sheet of material being severed.

Yet another object of the present invention is to provide a new and improved shearing machine having adjustment means for changing the "rake" angle in a relatively quick and easy manner.

Related objects and advantages of the present invention will be apparent from the following description.

## BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a fragmentary top view of a machine incorporating the present invention.

FIG. 2 is a cross-sectional view taken along a line and viewed in the direction of arrows 2—2 of FIG. 1.

FIG. 3 is an enlarged cross-sectional view taken along a line and viewed in the direction of arrows 3—3 of FIG. 2.

FIG. 4 is a view if the distal ends of the links of FIG. 2 enclosed by circle number 4 showing an alternate embodiment of the link connection.

FIG. 5 is the same view as FIG. 4 only showing a second alternate embodiment of the connection between the links.

FIG. 6 is the same view as FIG. 2 only showing an alternate embodiment of the upper knife suspension and driving means.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

For the purposes of promoting an understanding of the principles of the invention, reference will now be made to the embodiment illustrated in the drawing and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended, such alterations and further modifications in the illustrated device, and such further applications of the principles of the invention as illustrated therein being contemplated as would normally occur to one skilled in the art to which the invention relates.

Referring now more particularly to FIG. 1, there is shown a shearing machine 20 incorporating the present invention having a frame 21 for supporting a pair of knives for cutting large sheets of material such as steel. Frame 21 has a pair of upstanding walls 22 and 23 integrally joined together by a pair of cross walls 25 and 26. Plates 24 are provided at the bottom corners of walls 22 and 23 for securing the frame to a suitable support surface such as a floor. A horizontal wall 28 extends across the front of the machine being integrally joined to walls 22 and 23 and forming a bed for supporting the sheets of material to be cut which are fed between the knives in the direction of arrow 52. The front wall 28' of the frame has a plurality of plates 33 secured thereto by conventional fastening devices with each plate having an outwardly extending support arm. These support arms 29, 30 and 31 cooperatively with bed 28 support the sheet of material as it is being sheared. Support arm 31 has an upstanding flanged

portion 32 which is perpendicular to the cutting knives therefore allowing the operator to square or line up the sheet of material with the knives.

FIG. 2 is a cross-sectional view taken along a line and viewed in the direction of arrows 2—2 of FIG. 1 showing a pair of hydraulic cylinder motors 34 and 35 suspendedly mounted from support wall 27 which is integrally joined to cross walls 25 and 26 and upstanding walls 22 and 23. A variety of fastening means 48 may be utilized to secure the hydraulic cylinder motors to support wall 27. For example, the cylinder motors may have threaded members extending through wall 27 being received by hexagonally shaped nuts. Each cylinder motor has an extendable piston rod 36 and 37 secured to upper knife 38 by U-shaped brackets 39 and fasteners 40. Knife 38 has a main body 41 with a blade 42 secured thereto. The cutting edge 44 of blade 42 is positioned at angle 46 with respect to the cutting edge 45 of lower knife 43. The lower knife 43 is formed by the bed 28 shown in FIG. 1. Bed 28 may be slotted so as to receive blade 42 with the upper edge of the bed being sharp so as to define cutting edge 45. Operation of the hydraulic cylinder motors to force the knife 38 in the direction of arrow 50 will result in blade 42 moving to the dashed position shown by arrow 47. Cylinders 34 and 35 are operated in unison so as to move piston rods 36 and 37 equal distances. Cutting edge 44 crosses cutting edge 45 at intersection 49 which progresses across the length of the knives in the direction of arrow 51 as the upper knife moves in the direction of arrow 50. Likewise, as the upper knife moves upward in a direction opposite of arrow 50 the point of intersection 49 moves in a direction opposite of arrow 51.

As previously explained, it is desirable that angle 46, otherwise referred to as "rake", remain constant even though one of the hydraulic cylinder motors fails. Thus, a guide stabilizer 60 is provided. The stabilizer has a pair of links 61 and 64 pivotally mounted to support wall 27. U-shaped bracket 74 has a threaded member 67 received through support wall 27 and hexagonally shaped nut 66. The top end of link 64 is pivotally mounted to bracket 74 and may be pivoted in the direction of double headed arrow 75. The bottom end of link 64 is pivotally connected by pin 71 to link 63 which is connected to link 62 by coupling 80. Link 62 is pivotally connected to the bottom end of link 61 by pin 69. Each link 62 and 63 is pivotally mounted by pins 72 and 73 to main body 41. Thus, as the main body 41 moves in the direction of arrow 50, links 62 and 63 will move downwardly to the dashed position shown by leader 70. Suitable bearings are provided in main body 41 and links 62 and 63 to receive pins 72 and 73. Likewise, bearings are provided in links 61 and 64 to receive pins 69 and 71.

Angle 46 may be preset by adjusting the distance between link 61 and support wall 27. A U-shaped bracket 65 is pivotally mounted to the top end of link 61 so as to allow the link to pivot in the direction of double headed arrow 68. A threaded member 76 attached to bracket 65 extends through the support wall being received by a threaded insert 78 positioned within a ring 77 secured to the support wall. A cap 79 is secured to ring 77 by means such as welding to prevent the escape of threaded member 78. Insert 78 may be a hexagonally shaped nut so as to receive a wrench either through ring 77 or cap 79. Insert 78 may be turned so as to force threaded member 76 upward or downward as desired. Of course, insert 78 could also be permanently secured to the support wall with threaded member 76 being rotatably mounted to bracket 65. In this latter case, the threaded member could then be turned so as to move link 61 upward or downward. By moving link 61 farther away from support wall 27, angle 46 will be decreased. Likewise, by moving link 61 toward support wall 27, angle 46 will be increased. Excellent results have been obtained by utilizing an angle 46 of approximately two degrees. In one embodiment of the present invention shearing machine was capable of shearing a steel sheet having a thickness of one-fourth inch and a width of ten feet.

In the embodiment shown in FIG. 2, coupling 80 has a cam for connecting links 62 and 63 together. FIG. 3 is an enlarged cross-sectional view taken along a line and viewed in the direction of arrows 3—3 of FIG. 2 illustrating the positioning of cam 83. Link 62 has a pair of spaced apart parallel flanges 81 and 82 which receive the distal end of link 63. Cam 83 is received by link 63 and has a pair of outwardly projecting rods 84 which are received in bearing 86 provided in flanges 81 and 82. A bearing 85 is provided in link 63 for receiving cam 83.

FIG. 4 is a fragmentary side view of the area enclosed by circle 4 of FIG. 2 showing an alternate coupling. Coupling 90 has a rod slidably received in a slot provided in link 63. An end plate 91 secured to link 63 is provided with slot 92 receiving rod 94 mounted between a pair of spaced apart flanges 93 integrally connected to link 62. Another embodiment of the coupling is shown in FIG. 5. The coupling shown in FIG. 5 has a pair of plates 97 positioned on both sides of links 62 and 63 being secured to the links by bearing pins 98. The ends of links 62 and 63 have complementary tapers 96 so as to allow the links to pivot.

A hydraulic oil reservoir and the various motors and electrical circuitry required are positioned beneath bed 28 and behind the front wall 28'. Suitable switching devices are mounted to the front of the frame to allow the operator to easily control the movement of the upper blade. It should be noted that the guide stabilizer 60 applies the force exerted by the hydraulic cylinders equally to two locations, namely at pins 72 and 73 of knife 38. Thus, a constant shearing force is applied across the width of the sheet of material being sheared. Pin 72 always maintains the same vertical attitude with respect to pin 73 as the upper knife is vertically moved. Thus the rake between the cutting edges remains constant during shearing.

FIG. 6 is the same view as FIG. 2 only showing an alternate embodiment of the suspension and driving means. The upper knife 138 is suspendedly mounted to horizontal links 162 and 163 which are in turn suspendedly mounted to links 161 and 164 and cylinder motors 134 and 135. Links 161 and 164 pivotally depend from mounting brackets 165 and 174 which are suspendedly mounted to wall 127. Brackets 165 and 174 are identical to brackets 65 and 74 previously described and illustrated. Thus, the distance between wall 127 and link 164 may be adjusted as required to control the rake angle between the upper and lower blades. Links 162 and 163 are pivotally connected to the bottom

ends of links **161** and **164** and are pivotally interconnected by pins **198** and plates **197** as previously described for the connection shown in FIG. **5**. Knife **138** is secured to links **162** and **163** by pivot pins **172** and **173**. Links **162** and **163** are pivotally secured to brackets, similar to brackets **39** (FIG. **2**), fastened to the bottom ends of piston rods **136** and **137**. Cylinder motors **134** and **135** are suspendedly mounted to wall **127**. Extension of piston rod **136** and/or piston rod **137** will force links **162** and **163** to pivot downward thereby forcing blade **138** toward the lower blade.

While the invention has been illustrated and described in detail in the drawing and foregoing description, the same is to be considered as illustrative and not restrictive it being understood that only the preferred embodiment has been shown and described and that all changes and modifications that come within the spirit of the invention are desired to be protected.

The invention claimed is:

**1**. A shearing machine comprising:

support means;

a fixed member with a first edge;

an elongated knife movable to and from said fixed member with a cutting edge positioned at an angle with respect to said first edge;

power means operable to move said cutting edge toward said first edge with the point of intersection of said first edge and said cutting edge being movable progressively along said knife; and,

first and second links pivotally connected to said support means and each having distal ends pivotally connected together, said links being pivotally mounted to said knife preventing said angle from changing as said knife is moved by said power means.

**2**. The machine of claim **1** and further comprising:

adjustment means connected between said support means and said first link operable to change said angle.

**3**. The machine of claim **2** wherein:

said power means is a pair of hydraulic cylinder motors mounted to said support means with piston rods connected to the opposite ends of said knife.

**4**. The machine of claim **3** and further comprising:

third and fourth links pivotally depending from said support means and being positioned each adjacent to one of said motors, said third and fourth link connect said first and second link to said support means, said third and fourth link have bottom ends pivotally connected to said first and second links.

**5**. The machine of claim **4** wherein:

said adjustment means is a bracket pivotally disposed between and connecting said fourth link to said support means, said bracket is movable to and from said support means.

**6**. The machine of claim **1** wherein:

said distal end of said first link has a pair of spaced apart flanges receiving said distal end of said second link and further comprising:

a cam rotatably mounted to said flanges and bearingly receiving said distal end of said second link.

**7**. The machine of claim **1** wherein:

said distal end of said first link has a pair of spaced apart flanges receiving said distal end of said second link and further comprising:

a bearing rod mounted between said flanges and slidable in a slot in said second link.

**8**. The machine of claim **1** wherein:

said distal end of said first link and said distal end of said second link have a plate pivotally mounted thereto and disposed therebetween.

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