United States Patent

[11] 3,596,355

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[54] **SWIVEL SHEAR**
10 Claims, 11 Drawing Figs.

[52] **U.S. Cl.** **30/252,** 30/254
[51] **Int. Cl.** **B26b 13/26**
[50] **Field of Search** 30/177, 191, 193, 211, 247, 248, 252, 254

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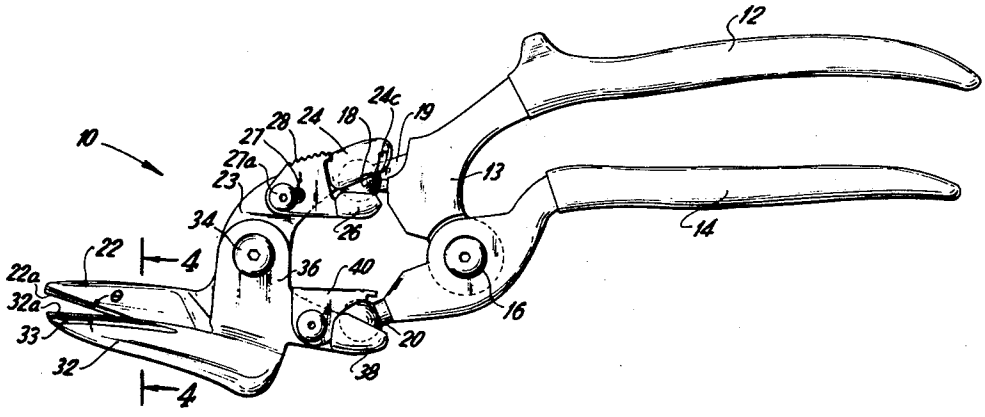
ABSTRACT: A shear implement having a movement based on either of two forms of compound levers, the intermediate pivotal connections of which are arranged to swivel by one or two ball joints. The ball joint is adapted for selective pivotal movement in azimuth, that is, laterally to the plane of the shear action and to allow for free pivotal movement about a horizontal axis. The swivel effect of the ball-joint connection connection provides for shearing action even with the blades swiveled as much as substantially 90° from the pivoting plane of the blades. A manually operated form includes two ball joints and a detent for holding the device to a plurality of angular positions. An electric-motor-operated form includes one ball joint and an adjustable swivel to allow for selected positions at any desired angle.



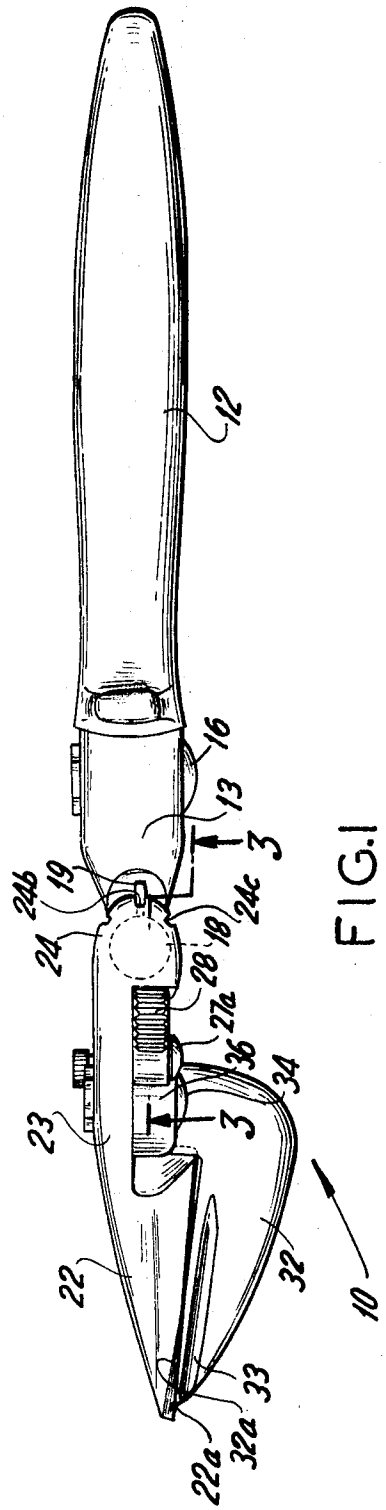


FIG.1

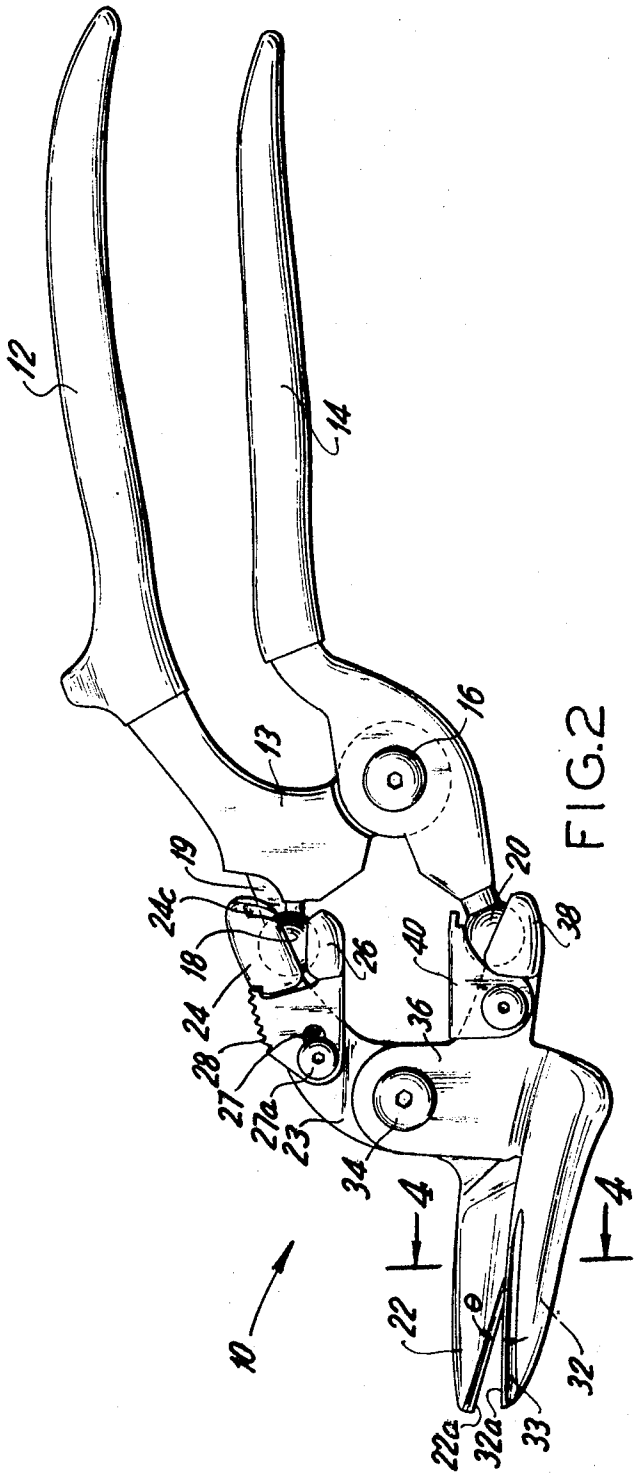


FIG.2

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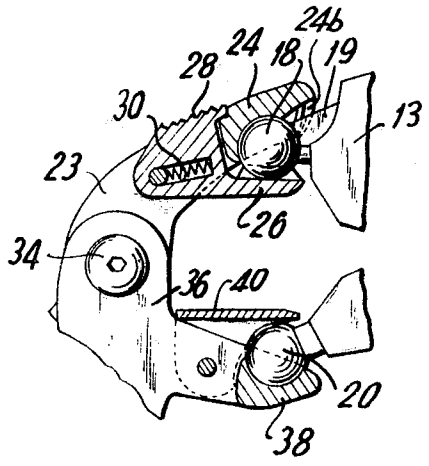

FIG. 3

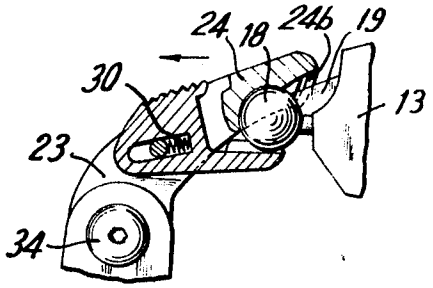

FIG. 3a

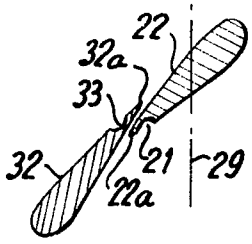

FIG. 4

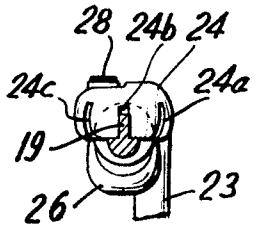

FIG. 5a

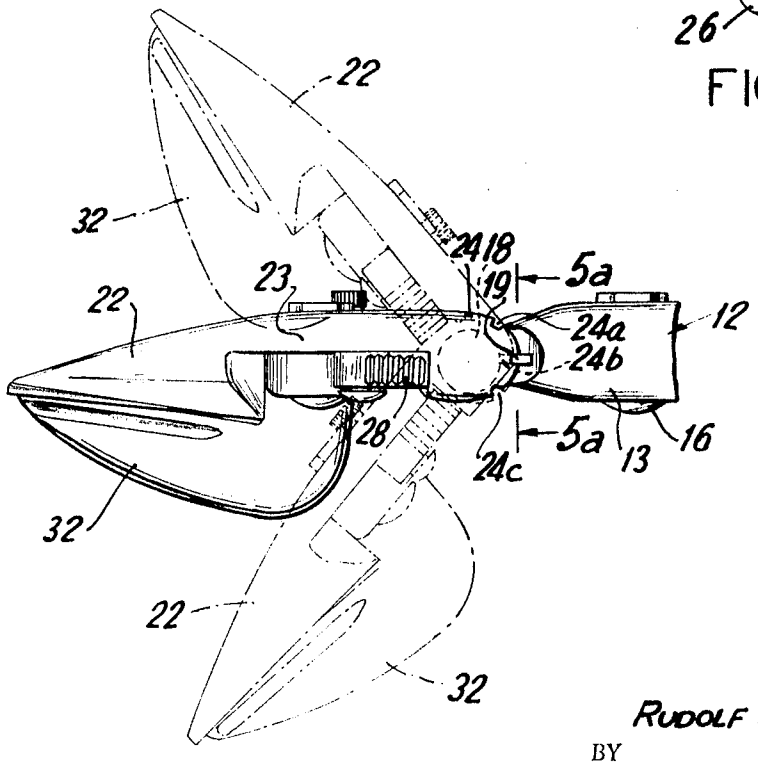

FIG. 5

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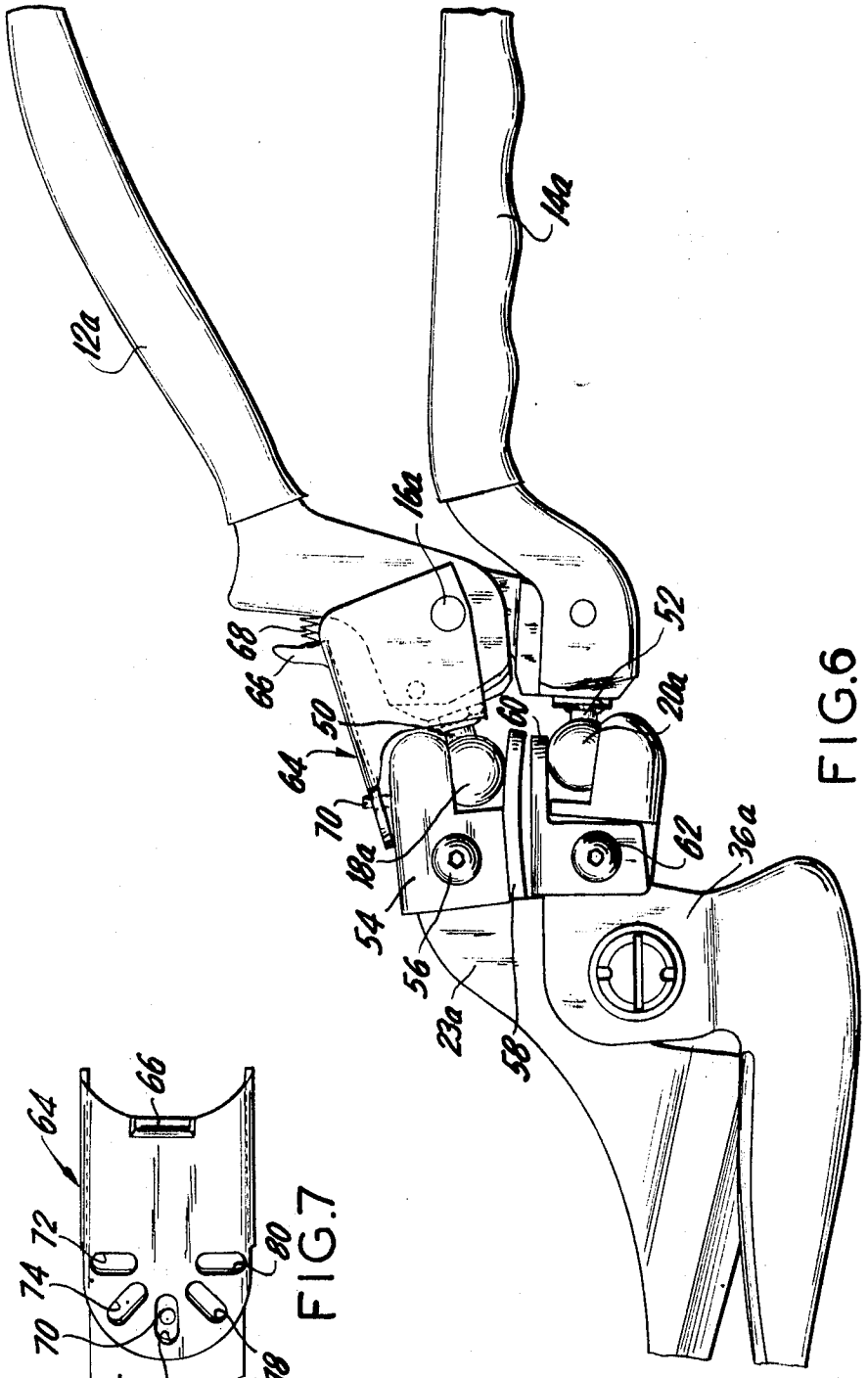

FIG.6

FIG.7

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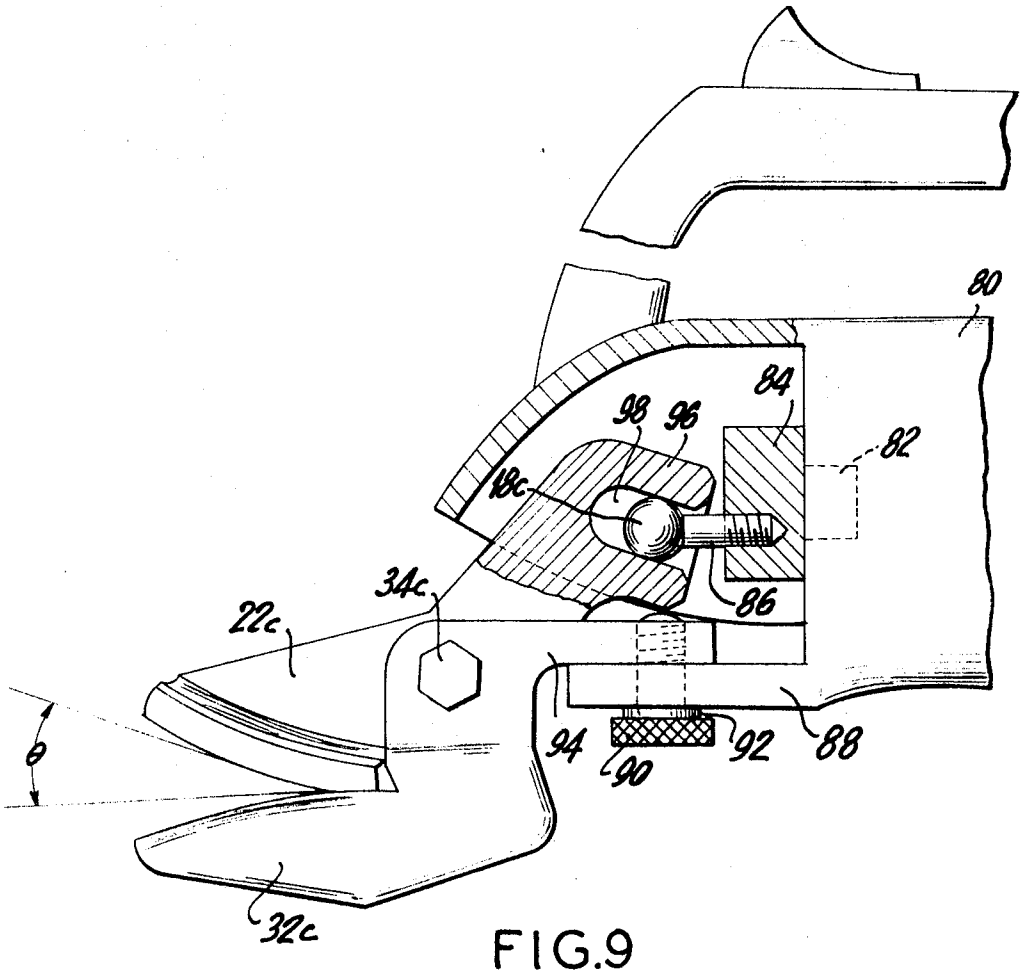

FIG.9

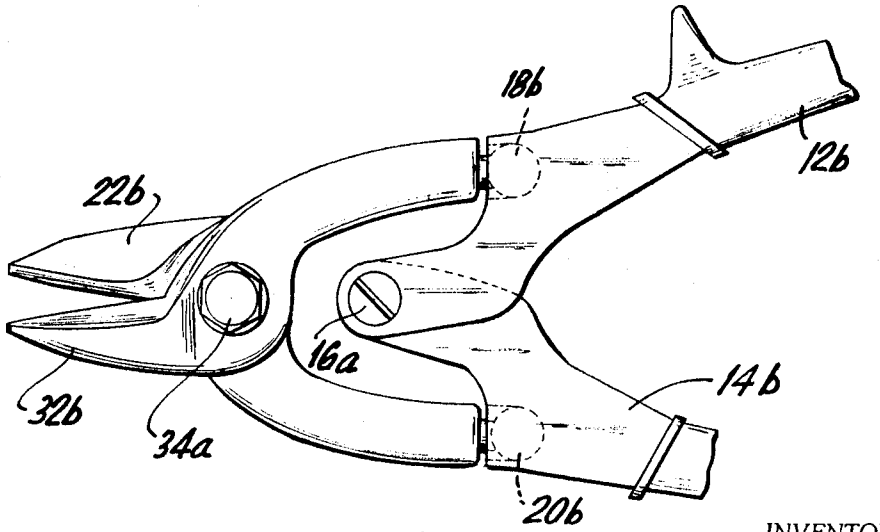

FIG.8

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SWIVEL SHEAR

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to shears, and more particularly, shears adapted for selective swiveling about the pivoting plane of the blades.

2. Description of the Prior Art

Shear implements are known having compound levers for actuating movement of the shearing blades. Such shears are limited in operation to shearing in a plane parallel to the plane of movement of the compound levers.

For certain uses of shears it is desirable, if not essential, to be able to adjust the relative angular position of the shearing blades with respect to the handles or actuating means. Such conditions arise, for example, when the shearing of material is needed in construction involving walls, ceilings, and the like, where access is restricted to but one position of the shears. Other situations arise wherein a shear is needed for cutting material in a limited accessible area requiring a nonlinear or turning action which may be impossible because of the size of the shearing tool.

Although attempts heretofore have been made to provide a shearing tool adjustable for the shearing blades relative to the handles, none have proved satisfactory.

It is a general object of the invention to provide a shearing implement arranged to allow for an adjustment of the shearing blades relative to the actuating means or handle to any selected angular position.

SUMMARY OF THE INVENTION

According to the invention I provide a shear implement having a compound lever movement intermediate the connection of the actuating means or handles and the cutting blades. The compound link is provided with at least one ball joint to allow for swivel action of the blades relative to the handles, which serve as the means to actuate the blades.

In the embodiment of the invention arranged for a manually operated shearing implement, a pivotal connection is provided for the cutting blades in the usual fashion, and a pivot is provided for cooperative action of the handles. Each handle portion is provided with an extension carrying a ball, and each ball is arranged for seating in a socket formed on the end of an extension of each of the cutting blades. Means are provided for selectively swiveling a pair of ball joints within the sockets to any one of a plurality of selected positions. A detent is provided for fixing a selected position against any swivel motion during the operation of the shear.

In another form of the invention adapted for operation actuated by an electric motor, a single ball extends from an eccentric rotary output of the motor. The ball is nested or seated within a slotted cavity formed on an extension of either blade, although preferably the cutting blade. The other blade, preferably the anvil blade, is connected to the housing of the motor and is provided with a locking swivel adjustment to lock the anvil blade in any selected position. The two blades are pivoted for shearing action in the usual manner. The ball seated in the slotted cavity is free to rotate within the cavity in any of the selected angular positions. The motor driving the eccentric ball produces reciprocation of the cutting blade relative to the stationary anvil blade to effect the cutting action, the ball moving freely laterally within the slot and alternately contacting the upper and lower wall of the slot for vertical reciprocation of the blade.

A more detailed description of several embodiments of the invention will now be described in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a top view of one form of a manually operated shearing implement according to the invention;

FIG. 2 is a side elevation of the implement shown in FIG. 1;

FIG. 3 is a fragmentary portion of the ball-joint connections of the implement shown in FIGS. 1 and 2, partly in section;

FIG. 3*a* is a view similar to FIG. 3 showing the ball-joint detent during the adjustment or release phase;

FIG. 4 is a sectional view taken on viewing line 4–4 of FIG. 2;

FIG. 5 is a top fragmentary view similar to FIG. 1 showing the several angular positions the blade may assume relative to the handle;

FIG. 5*a* is a sectional view taken along viewing line 5*a*–5*a* of FIG. 5, showing the socket with the detent slots;

FIG. 6 is a fragmentary view of a modification of the shearing implement illustrating a different form of detent;

FIG. 7 is a top view of the hood portion of FIG. 6;

FIG. 8 is another modification of a manual shearing implement;

FIG. 9 is a fragmentary view of a still further modification of a shearing implement adapted for operation by an electric motor.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1, illustrative of the general principles of the invention as embodied in a manually operated shear, there is shown a shear **10** comprising a first handle **12** and a second handle **14** arranged for pivotal movement about pin **16**, the portion **13** of handle **12** which functions as a lever arm of the compound movement, as will be explained. The pivot or pin **16** may be provided with a torsion spring, not shown, to resiliently urge apart the handles **12** and **14** upon release of pressure-closing forces. Attached to the portion **13** of handle **12** is a sphere or ball **18** including a rib **19** extending from a surface portion of the sphere to the arm **13**. Another ball **20** is connected to the handle **14**.

Cutting blade **22** having a cutting edge **22***a* is provided with a lever arm **23** extending generally normal to the cutting edge **22***a*. The arm **23** is extended to form a semispherical socket within the hooded portion **24**. A slidable cap **26** is provided with a knurled surface **28** for manual movement of the cap along the slot **27** through which pin **27***a* is seated. A spring **30** is arranged within the cap **26** for urging the cap in a closed position. (See FIG. 3). FIG. 3*a* illustrates the position of the cap **26** when it has been moved away from the closed position allowing for the ball **18** to be oriented within the socket **24**.

The slotted socket portion **24** is provided with a plurality of slots **24***a*, **24***b*, **24***c*, as shown in FIG. 5*a*, any one of which is adapted to seat over or bridge the rib **19**.

The anvil blade **32** having a cutting edge **32***a* is provided with a lever arm **36** extending generally normal to the cutting edge **32***a*. A pivotal pin connection **34** joins the anvil blade **32** to the cutting blade **22** for pivoting action of the two blades relative to each other.

The anvil blade **32** includes an extension provided with a semispherical cavity serving as a socket **38** to receive ball **20**. A screw-tightened pivot hood **40** is provided to substantially enclose the ball **20** to keep it in place with substantially free rotational movement therein. The balls **18** and **20**, it is to be noted, can be easily removed from the sockets thereby separating the handle portion of the implement from the blades.

The cutting blades **32** and **22** are preferably of the scroll type wherein the planes of the blades are at an acute angle relative to the plane perpendicular to the axis of pivot about the pivot **34**. See FIG. 4 wherein the blades **32** and **22** are shown at an acute angle relative to the center line **29** passing between the inner faces at pivot **34**. Such form of blades are well known to effect a sharp clean cut of material and as a means for guiding the cut material away from the cutting faces of the shear blades as well as the handle portion thereof.

The rear or noncutting face of each of the blades is preferably provided with a longitudinal groove, indicated as portions **33** and **21** as seen in FIG. 4. The blades **22** and **32** are shaped and pivotally mounted (at pivot **34**) relative to each other to effect the shearing action well known in the art

wherein the cutting edges 32*a* and 22*a* are in running contact defined by the well-known helical relief or clearance. Thus as the blades 32 and 22 are opened and closed about the pivot 34, the cutting edges 32*a* and 22*a* come into momentary contact in a progressive manner as one blade passes or crosses the other by sliding. Preferably the adjustment of one blade to the other is such as to effect ideal or optimum cutting by the running angle included between the two blades being between 23° and 28° as known in the art. This angle (theta) is shown in FIG. 2.

In operation, the handles 12 and 14 are manipulated to open and close relative to each other whereby the resulting lever action is carried through the balls 20 and 18 to the cutting and anvil blades 22 and 32 by the pivoting action of the balls within the sockets, and the cooperative pivoting action about pivot 34.

In order to change the angular position of the blades relative to the handles, the cap 26 is moved leftwardly, as shown in FIG. 3*a*, to allow for free movement of the ball 18 and the rib 19 under the slotted portions 24*a*—*c*. The ball 18 and rib 19 are oriented to a position under a selected slot and the cap 26 is released to seat thereby the rib within the selected slot. FIG. 5 illustrates the various positions that the blade may be adjusted relative to the handle, in each position the shearing is effected by manipulation of the handles.

Referring now to FIG. 6, there is shown a modification of the manually operated shear implement of the invention, noting that similar or identical parts of those previously described have the same reference numeral followed by a letter. This form of the invention includes handles 12*a* and 14*a* about a pivot 16*a*. Extending from the upper handle is a ball 18*a* connected to the handle as by a rod 50, and in a similar fashion a ball 20*a* extends from the lower handle 14*a* as by means of a rod 52. The cutting blade lever 23*a* extends into an integrally formed socket 54 provided with a recess for receiving the ball 18*a*. A retaining cap 58 is mounted suitably on the lever arm 23*a* for locking in place or replacement by screw 56, for example. The retaining cap 58 supports the ball 18*a* during the connection of the blade to the handle.

A similar arrangement is provided for the connection of the anvil blade to the lower handle 14*a* by means of the ball 20*a*, a retaining cap 60 and a screw 62.

Means are provided for indexing the blades to a selected swivel position by means of a hood 64 pivoted for convenience at pivot 16*a*. A thumb tab 66 is provided for pivoting the hood about the pivot 16*a*. A spring 68 suitable connected between the handle 12*a* and the hood 66 is provided for urging the hood in a counterclockwise position, that is, into the closed position, as shown. A pin 70 extending from the socket portion 54 serves as the indexing reference. A plurality of slotted holes 72, 74, 76, 78 and 80 are cut into the upper wall of the hood 64 and are arranged to receive freely pin 70. With the hood removed from the seated position, the pin is free to pass under the inside wall of the hood to allow the user to adjust the relative angular position of the blades to the handles. When the desired position is made by swivel of the freely pivoted parts the hood is released to engage the pin 70 in the slot at that position. The operation of the shearing implement is similar to that previously described.

Referring now to FIG. 8, there is shown another modification of the invention wherein the compound movement is modified by arranging the pivot of the handles to be between the ball joints and the pivot of the blades, noting that reference numerals on the drawing refer to similar parts of the previous embodiments with the reference letter "*b*" added thereto.

The blades 22*b* and 32*b* are of the straight type rather than the scroll type and serve to provide shears of the type used preferably with straight blades. An indexing device is provided and may be either of the form used for the embodiment described in FIGS. 2 through 5, or that for the embodiment illustrated in FIG. 6.

Referring now to FIG. 9, there is shown a modification of the invention wherein an electric motor in place of handles is used as the actuating means. The electric motor 80 is shown with a rotary shaft 82 connected to a disc 84 for providing an eccentric connection of the ball 18*c* attached thereto by means of a bolt 86, which may be integrally formed therewith. The housing, preferably in the form of a baseplate 88 extending from or attached thereto, serves as a connection to the anvil blade 32*a*. A screw 90 with a knurled head and a Belleville washer 92, or any suitable locking washer, is attached to the extension portion 94 of the blade 32*c* with a tapped hole, for example. The anvil blade 32*c* is pivotally connected to the cutting blade 22*c* by a pivot connection 34*c*. The upper extension of the cutting blade 22*c* is provided with a housing 96 with a U-shaped slotted or cavity recess 98 suitably dimensioned to allow for free-sliding motion of the ball 18*c* therein. The blades 32*c* and 22*c* may be adjusted to any desired angle relative to the electric motor by loosening the bolt 90 and merely positioning the blades and thereafter tightening the bolt 90.

In operation the electric motor rotates the eccentrically mounted ball 18*c* whereby the cutting blade 22*c* is reciprocated in a rapid manner relative to the fixed blade 32*c*.

It will be appreciated that as the eccentric action occurs the ball 18*c* is moved both laterally, as well as vertically, with respect to the central horizontal axis of the motor. The lateral displacement is lost motion, in effect, within the slot 38 but the vertical component of the eccentric motions are imparted alternately to the upper and lower wall of the slot to effect the up-and-down or reciprocating motion.

It should be appreciated that the operation of the swivel shear of the invention is based on the principle of a compound-lever movement comprising four pivoting coacting levers or momentum arms defined, for example, by the linkages between the pivots 34 and 16 of FIG. 2, and the pivots defined by the balls 18 and 20 and their sockets. The plane defined by or which includes the compound levers when the blades are in the normal nonangled orientation is flat. However, when shearing blades are oriented at an angle relative to the handles, a dihedral angle is formed at the intersection defined by the line connecting the central axis of the balls 18 and 20. During the operation of the shear implement of the invention, the dihedral angle is shifting slightly at each reciprocation of the handles as the pivots at 18 and 20 reciprocate to and away from each other. It is believed that if there were no shifting of the dihedral angle the compound-lever mechanism would bind.

It is believed, therefore, that there should be a certain amount of mechanical play left into the system as at the balls 18 and 20 so that this binding effect is obviated. It will be appreciated that this binding effect would occur only when the ball-and-socket joints are indexed to constrained movement in a given or desired angular position. This effect can not occur in the embodiments having a ball actuating the anvil blade by means of a channeled cavity or slot wherein there is free lateral movement during the operation thereof as, for example, illustrated and described in FIG. 9.

The shear implement may be made of any suitable material known in the art. Preferably, the blades should be made of a high carbon vanadium steel and the ball and sockets should be made of high-speed steel. The moving parts, such as the various pivot members, should be at least made of hardened steel. The handles for the manually operated shear implements may be formed of aluminum or sheet steel as well as any of the more recently developed plastics suitable for such purposes.

The size and dimensions of the shear implement shall be selected to accomplish the objective of cutting the material desired. It will be appreciated by those in the art that the shear of the invention may be used to cut material within a wide range of classes including soft cloths, silks and the like, tough plastics of phenol type including formaldehyde resins sold under the Trade Mark "Formica," and sheet metals including that made of steel. I have found that plastics which are quite

brittle can be cut or sheared sharply and cleanly with virtually no chipping or other effects that heretofore resulted from attempts to cut brittle plastics.

The compound-lever movement of the invention can be adopted for various purposes by changing the proportional length of each arm. For example, the stroke of the upper handle could have a relatively larger displacement than that of the lower handle to effect the shear action than as for example is useful in the carpeting trade.

It will be seen that I have accomplished the objects of my invention. I have provided a shearing implement that can be swiveled to any position from the normal and still operated to shear material without binding of the moving parts. The portion of the implement comprising the blades may be quickly interchanged with other blade implements of different size and purposes providing thereby a tool of wide use and flexibility.

While the invention has been described in particular detail with respect to the several embodiments above illustrated, it should be appreciated to those skilled in the art that the invention may be used in other forms including modifications of the embodiments herein without departing from the spirit of the invention.

It is, therefore, to be understood that my invention is not to be limited to the specific details shown and described.

What I claim is:

1. A shear implement including;
an anvil blade;
a cutting blade pivoted to the anvil blade;
actuating means for effecting relative reciprocal shearing motion of said blades about said pivot comprising;
a. a first handle pivotally connected by a first ball joint to said cutting blade;
b. a second handle pivotally connected by a second ball joint to said anvil blade;
c. a pivot joint connecting said handles and spaced from ball joints;
and means for selectively swiveling said blades relative to said actuating means which comprises:
detent means for selectively locking one of said ball joints in a desired swivel position and simultaneously allowing for reciprocal motion of said blades by relative movement of said handles.

2. An implement according to claim 1 wherein said blades are of the scroll type, the plane of the respective blades being disposed at an acute angle relative to the plane of motion of said blades.

3. An implement according to claim 1 wherein each said blade includes a longitudinal groove on the noncutting face thereof, said groove being formed to provide a tapered cutting edge having a width of dimension equal at least to one-half the thickness of the material to be sheared.

4. An implement according to claim 1 wherein said ball joints are located between the pivot of said blades and the pivot joint of the handles.

5. An implement according to claim 1 wherein the pivot joint of the handles is located between the pivot of said blades and the plane containing both of said ball joints.

6. An implement according to claim 1 including means for resiliently separating said handles.

7. An implement according to claim 1
wherein said first ball joint includes a ball connected to said first handle by a rib, and said cutting blade includes an extension portion having a socket for receiving said ball, and
wherein, further, said detent means includes a pivotal cover over said socket for retaining said ball in said socket, said cover including a plurality of slots each slot adapted to receive the rib on said handle,
whereby said ball and rib can be selectively positioned relative to said cover so that a selected slot on said cover will engage said rib and lock the ball joint in the selected position while the rib slides within the slot during manipulation of the handles.

8. An implement according to claim 1
wherein said first ball joint includes a ball attached to said first handle, and said cutting blade includes a socket for receiving said ball, and
wherein, further, said detent means includes a pivotal plate attached to said first handle, a pin extending from an extension portion of said cutting blade, a plurality of slots in said plate, each slot arranged to receive said pin in sliding relation and aligned in a different angular position relative to plane extending from both said handles,
whereby one of said slots may be positioned over a pin and the plate released over the pin to thereby constrain movement of the ball joint to the selected position during manipulation of the handles.

9. An implement according to claim 1 wherein said swiveling means includes means for releasably connecting said blades to said actuating means whereby said blades may be replaced with selected other blades.

10. A shear implement comprising:
an anvil blade;
a cutting blade pivoted to the anvil blade;
actuating means for effecting relative reciprocal shearing motion of said blades about said pivot; and
means for selectively swiveling said blades relative to said actuating means, said actuation means comprising:
an electric motor having a housing and a rotary shaft output;
a ball attached eccentrically to said shaft;
a slotted chamber in an extension portion of said cutting blade to receive said ball for free lateral movement therein and to effect reciprocating motion of said cutting blade in response to vertical movements of said ball; and
wherein said swiveling means comprises:
an adjustable swivel connecting said anvil blade to the motor housing.