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[54] **METAL-CUTTING SHEARS**
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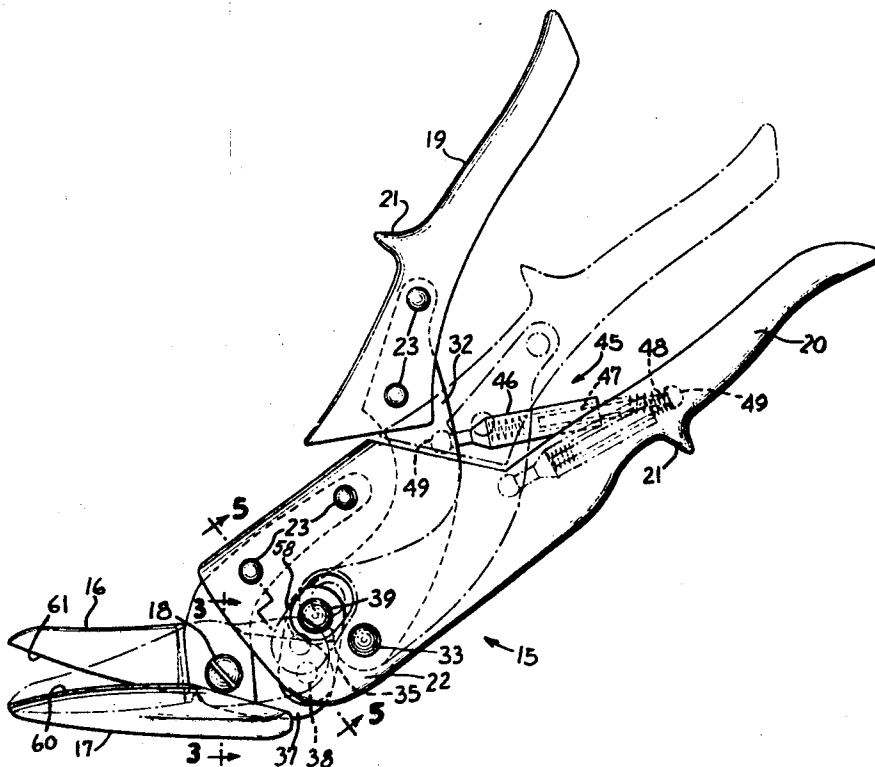
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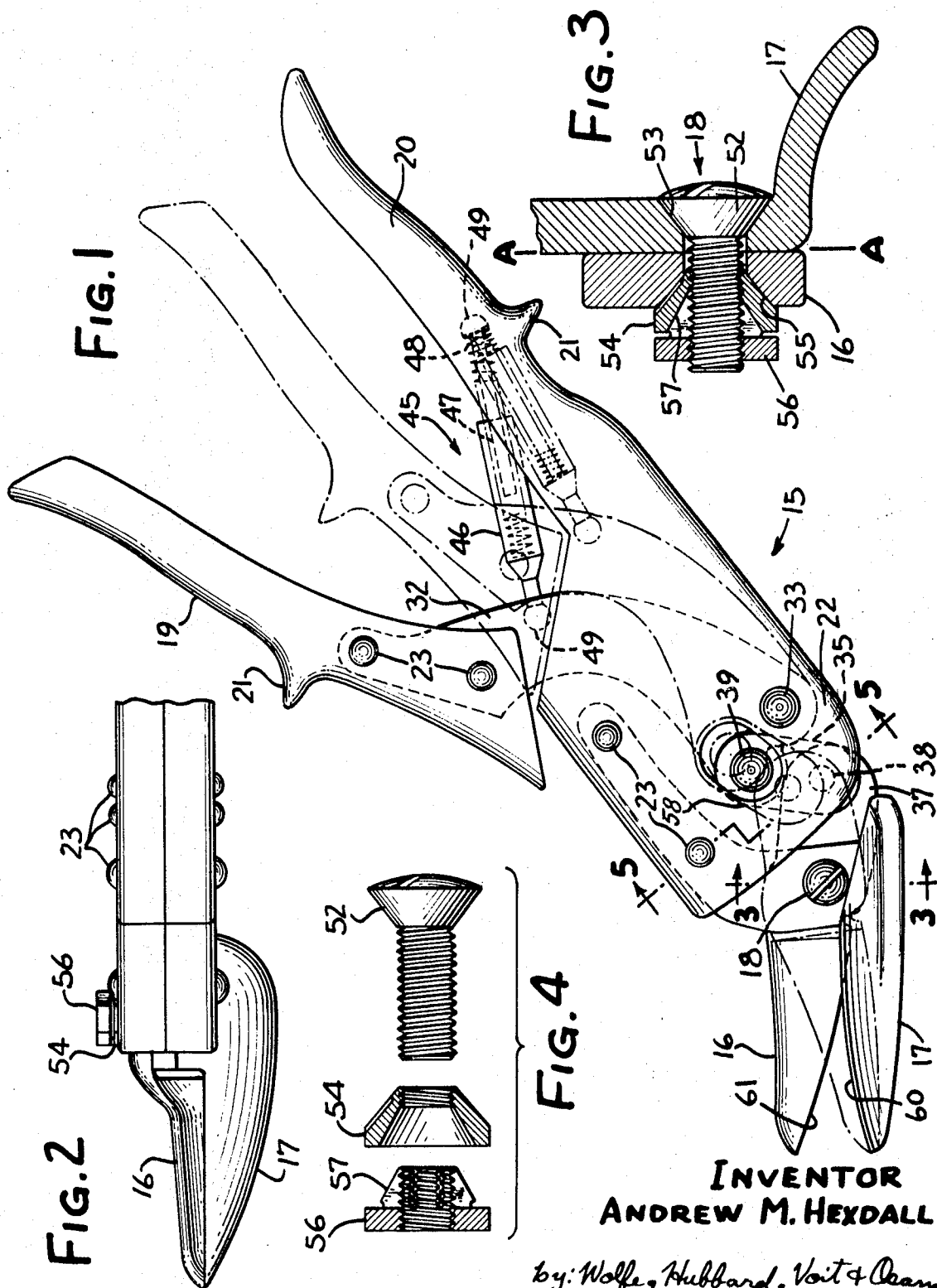
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ABSTRACT: A metal-cutting shear with laterally offset cutting blades formed with convex cutting edges and pivoted about a bolt having tapered head, nut and locknut portions is disclosed in one embodiment. In another embodiment one centrally located blade operates between a pair of laterally spaced blades. A handle and link arrangement with fixed length rivets is provided for operating the blades of either embodiment.





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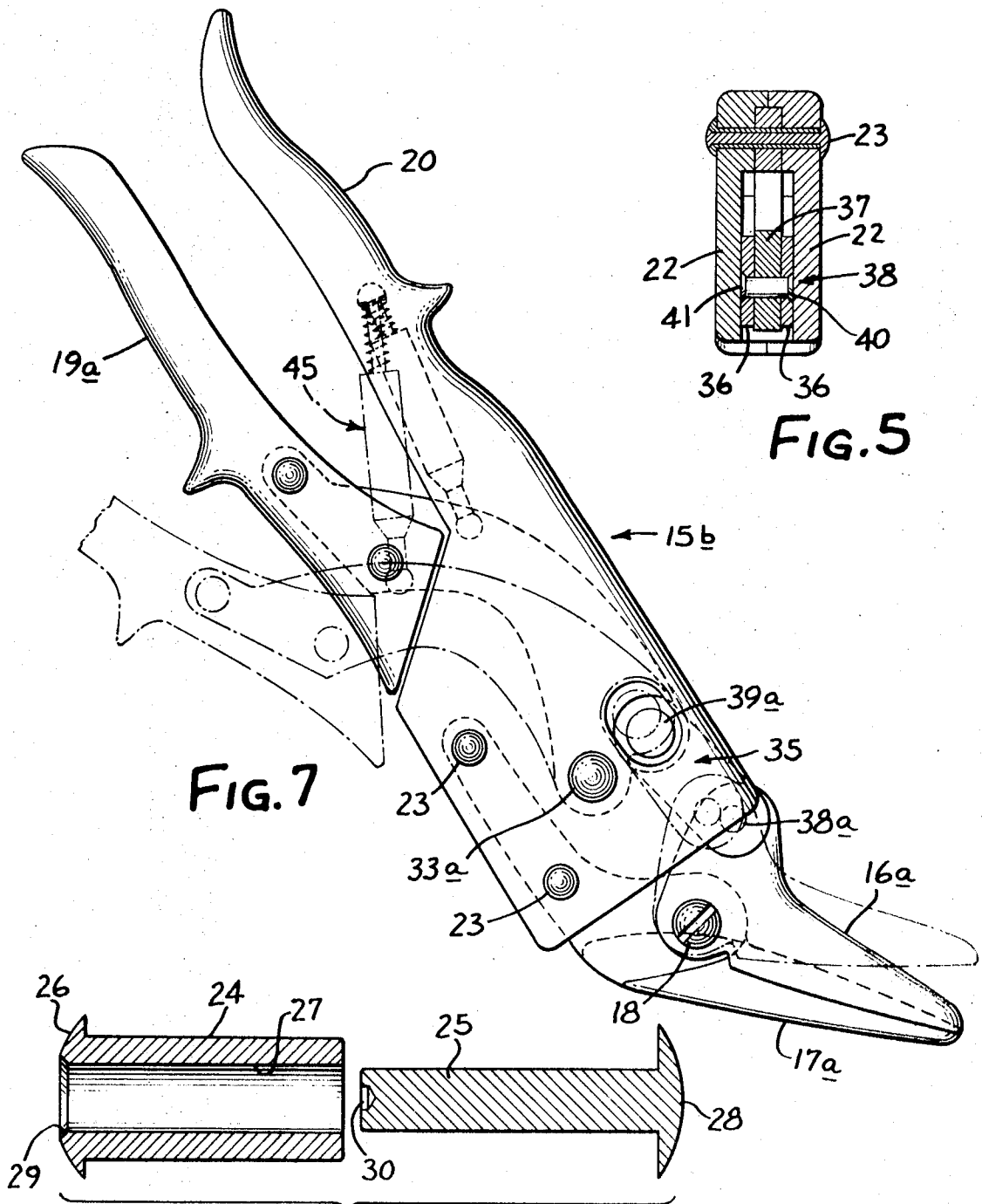


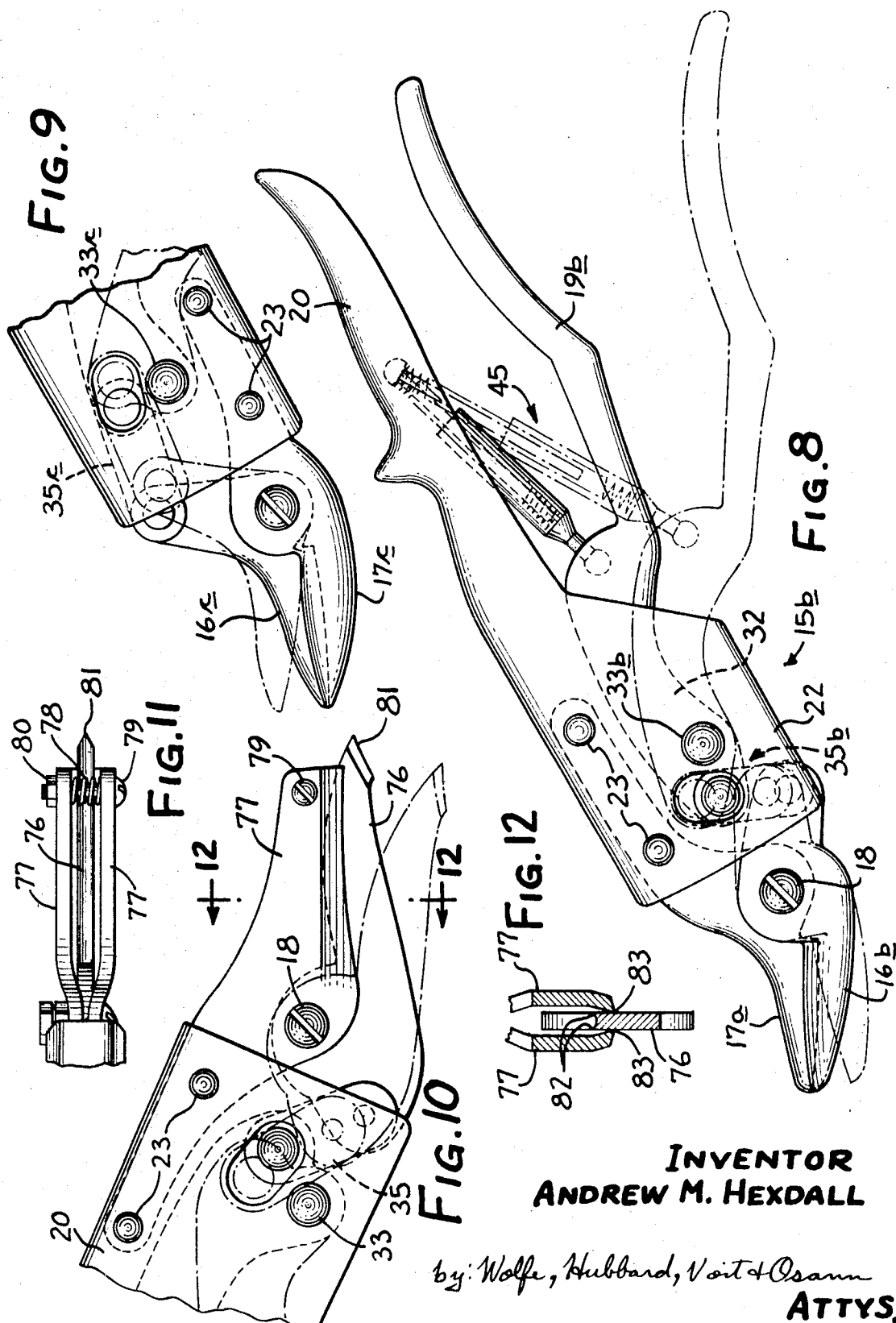
FIG. 7

FIG. 5

FIG. 6

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METAL-CUTTING SHEARS

This invention relates to metal cutting shears and more particularly concerns hand-operated metal shears or snips.

When cutting sheet metal or the like with conventional metal snips one edge of the cut metal often has a tendency to interfere with the body of the snips and makes it difficult to advance the snips into the metal. Also when cutting heavy gauge metal conventional snips and shears often bite or chew the metal instead of smoothly cutting it. This is caused by the tendency of the metal to slip away from the blade as they are closed resulting in short and inefficient cutting action. Also, conventional shears and snips require substantial force to be exerted by the operator in cutting heavy gauge metal and operator fatigue results rather quickly.

Accordingly, it is a primary aim of the present invention to provide an improved metal cutting shear with positive cutting blades and a handle arrangement which is both convenient and easy to operate.

A further object is to provide a metal-cutting shear with blades arranged to reduce interference of the cut metal with other parts of the shear.

Another object is to provide an improved pivot bolt and locknut arrangement for metal snips. A related object is to provide fixed length rivets for connecting together other elements of the snips without binding.

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings, in which:

FIG. 1 is a side elevation of one embodiment of the metal shears of the present invention with dashlines indicating the operating blade and handle in their closed positions;

FIG. 2 is a fragmentary plan view of the cutting blades of the shears shown in FIG. 1;

FIG. 3 is an enlarged fragmentary section taken along the line 3-3 in FIG. 1;

FIG. 4 is an expanded view of the pivot bolt and locknut arrangement shown in FIG. 3;

FIG. 5 is a section taken along the lines 5-5 in FIG. 1;

FIG. 6 is an enlarged and expanded view of one of the fixed length rivets;

FIG. 7 is a side elevation, similar to FIG. 1, of another embodiment of the invention with the operating handle and blade reversed;

FIG. 8 is a side elevation, similar to FIG. 1 of another embodiment of the invention employing a different operating handle structure;

FIG. 9 is a fragmentary side elevation similar to FIG. 8 but with the operating blade reversed;

FIG. 10 is a fragmentary side elevation of the cutting head of a double cut shear made in accordance with the present invention;

FIG. 11 is a fragmentary plan view of the cutting head in FIG. 10; and

FIG. 12 is a fragmentary section taken along the line 12-12 in FIG. 10.

Turning now to FIG. 1 there is shown one preferred embodiment of the metal cutting shears 15 of the present invention. The shears 15 include a pair of cutting blades 16 and 17 pivotally movable about a bolt 18 by a pair of handles 19 and 20. Each of the handles is preferably formed with an outwardly projecting ear 21 positioned just forwardly of the space normally occupied by the index finger and thumb of the operator to prevent forward slipping of his hand incident to use of the shear 15.

Within the forward portion of the handle 20, which is formed with laterally spaced side portions 22, the rear portion of the blade 17 is firmly secured, in this case by two piece rivets 23. As shown in FIG. 6, each rivet 23 includes a hardened sleeve 24 and a rivet pin 25. The sleeve 24 has a head 26 on one end and central bore 27 dimensioned to receive the body of the rivet pin 25 which also has a head 28 on one end. The rivet pin 25 is dimensioned to protrude axially from the sleeve head 26 so that the protruding portion of the pin may be clinched against the sleeve head without

diminishing the length of the rivet 23 between the sleeve head 26 and the pinhead 28. Preferably, this bore 27 through the sleeve head is slightly countersunk at 29 to facilitate clinching of the rivet pin 25. Also the pin is formed with a shallow recess 30 in its end to aid in centering a drill should the rivet 23 have to be removed after it has been clinched.

The handle 19, which is the operating handle of the shear 15, includes a forward portion 32 pivotally connected between the side 22 of the handle 20 by a pivot rivet 33. This rivet 33 is similar to the rivets 23 but of larger diameter. Additional rivets 23 are used to secure the forward portion 32 to the handle proper.

Pivotally interconnecting the operating blade 16 and the operating handle 19 is a link 35. As best seen in FIG. 5, the link 35 is formed of a pair of side plates 36 which straddle the rear end 37 of the blade 16 and the forward end 32 of the handle 19. The pivotal connections for the link 35 are also two piece rivets 38, 39, similar to the rivets 23, but shorter and with countersunk heads 40, 41.

As shown by the solid and dashline representations in FIG. 1, the link 35 and its pivotal connections are dimensioned and located with respect to the blade pivot 18 and handle pivot so that the blades may be opened and closed with moderate movement of the handle 19 relative to the handle 20. This permits an operator with a normal sized hand to firmly grip the handles at all times and to make a full cut without the handles exceeding the most powerful range of gripping action. Still the link and pivot arrangement affords some amplification in transmitting the power applied to the handles to the blades. As a result even heavy sheet metal can be cut readily without undue exertion and operator fatigue.

To open the shears 15 during cutting a spring-biased element 45 is inserted between the handles 19, 20. In the preferred embodiment, the element 45 is telescopic with an outer sleeve 46 and an inner slide 47 about which a compression spring 48 is wound. It will be appreciated, however, that the slide 47 could also be hollow in which case the spring would be fully enclosed between the two telescoping components. Preferably a ball 49 at each end of the element 45 cooperates with a socket formed in each handle 19, 20 to permit rocking movement of the element 45 as the handles are opened and closed.

In keeping with one aspect of the invention special locking means are provided to prevent loosening of the pivot bolt 18. As shown in FIGS. 3 and 4, the bolt 18 has a positively tapered head 52, adapted to cooperate with a countersink 53 in the blade 17. A nut 54 with a positive taper at one end is adapted to cooperate with a countersink 55 in the blade 16. The nut 54 has a negative taper at its outer end and a locknut 56 having split end 57 with a positive taper is adapted to fit into the outer end of the nut 54 wedging the split end 57 into firm locking engagement with the bolt 18.

To facilitate assembly of the shears 15 the side portions 22 of the handle 20 are each formed with an aperture 58. This aperture is provided to permit insertion and clinching of the rivet 39 connecting the link 35 to the forward portion 32 of the handle 19. It will be understood that the other end of the pivotal link 35 is riveted to the rear portion of the operating blade 16 before it is bolted to the fixed blade 17.

It is another important feature of the shears 15 that the blades 16, 17 are formed with laterally offset cutting edges. In the embodiment illustrated in FIGS. 1-5 the shears 15 are particularly adapted for straight and left-hand turning cuts. Accordingly, the cutting edges of the blades are laterally offset to the left from the plane A-A defined by the inner faces of the blades 16, 17 at the pivotal connection 18. Thus, the edge of the metal previously cut by the blades is free to pass the side of the blade 17 and the head of the pivot bolt 18 without interference. It will be appreciated, of course, that for right-hand turning shears the cutting edges of the blades would be reversed and laterally offset to the right.

In order to reduce the tendency of the metal being cut by the shears 15 to slip forward as the blades 16, 17 are closed 1

have found it advantageous to make the cutting edges of both blades convex as seen from the side, for example in FIG. 1. Desirably the fixed blade 17 has a convex cutting edge 60 defined by an arc whose chord forms the base of an imaginary isosceles triangle whose apex angle is 22°. However, I have found that if this angle is between 20° and 24° the blade will operate satisfactorily. The operating blade 16 is also provided with a convex cutting edge 61 defined by the arc whose chord forms the base of an imaginary isosceles triangle whose apex angle is within the range of 3° to 5°, with 4° being preferred.

As noted above, the shears 15 can be made for either left-hand or right-hand turning cuts. In addition, either the upper or the lower handle can be made the operative one. The former arrangement, of course, is shown in FIG. 1 and the latter is shown in the alternative embodiment illustrated in FIG. 7. It will also be noted that the rear portions of the blades 16a, 17a and the location of the pivotal link connections 38a and 39a are somewhat different in the shears 15a of FIG. 7 than in the shears 15 of FIG. 1 due to the change in operative handles. In other respects, the shears 15 and 15a are very much alike and, therefore, the same reference numerals have been used.

Turning now to FIG. 8 there is shown another embodiment of the invention in the form of shears 15b. Here a one-piece operating handle 19b is employed rather than the two-piece handle in the FIG. 1 and 7 embodiments. The one-piece handle 19b includes a relatively thin but deep forward portion 32 adapted to fit between the sides 22 of the handle 20 and a relatively flat but wide gripping portion. Such a form can be conveniently made by twisting and stamping and therefore handle 19b does not include an ear 21 as in the other embodiments.

As also shown in FIG. 8, the handle 19b operates the lower blade 16b rather than the upper blade as is the case in the previously discussed embodiments as well as that shown in FIG. 9. Again it will be noted that the handle pivots 33b and 33c and the links 35b and 35c are repositioned in these embodiments to obtain the desired blade movement.

Many features of the present invention also lend themselves to incorporation in double-cutting shears and snips 75 such as those partially illustrated in FIGS. 10-12. Here again either one-piece or two-piece operating handles may be employed and either the upper or the lower blade may be the operative one. In the illustrated embodiment the lower blade 76 is pivoted between a pair of upper blade elements 77 secured by rivets 23 within the sides 22 of the fixed handle 20. At their forward ends the blades 77 are separated by a spring 78 wound on a bolt 79 and the amount of blade separation can be adjusted by turning nut 80.

For piercing sheet metal, such as heating ducts and the like, the lower blade is provided with a sharpened tip 81. Also the lower blade is preferably hollow ground as shown in FIG. 12 to provide a pair of cutting edges 82. Each of the upper blade elements 77 are ground with a taper leading to an inner cutting edge 83, which cooperates with a respective one of the edges 82.

From the foregoing discussion and as illustrated in the drawings the features of the present invention are susceptible to various modifications and embodiments. For example, different cutting blade and handle orientations, including backward cutting snips, may be employed for specific purposes. Other variations will no doubt occur to those skilled in the art.

I claim:

1. A metal-cutting shear comprising, in combination, a pair of cutting blades and a pair of handles with one of the blades rigid with one of the handles, a first pivot interconnecting said handles intermediate the ends thereof and a second pivot interconnecting said blades intermediate the ends thereof, said blades each having an inner face at said first pivotal connection defining therebetween a plane perpendicular to said first pivotal connection, and said blades each having a cutting edge parallel to and laterally offset in one direction from said plane by an amount greater than the thickness of the blade on that side of said plane at said first pivotal connection whereby the edge of the metal previously cut by said blades and facing said

plane from the direction of said offset is free to pass said blades without interference as said shears are advanced into the metal, and a link pivotally interconnected at one end to the rear end of said other blade and at the other end to the forward end of said other handle, said link being dimensioned and said pivotal link connections being so located with respect to said first and second pivots that said other blade is rotated by said link about said second pivot to open and close said blades as said handles are opened and closed by rotating said other handle about said first pivot, and said one handle being formed with laterally spaced side portions enclosing said link and its pivotal connections and the rear portion of said one blade which is secured thereto by at least a pair of rivets.

2. A metal cutting shear as defined in claim 1 wherein said handle is formed with laterally spaced side portions enclosing said link and its pivotal connections and said first pivot comprises a two-piece rivet having a hardened sleeve with a head on one end and a bore therethrough and a rivet pin with a head on one end, said pin being dimensioned to fit within said bore and to protrude axially of said sleeve head whereby the protruding portion of said rivet pin may be clenched against said sleeve head without diminishing the length of said rivet between said sleeve head and said pinhead.

3. A metal-cutting shear as defined in claim 2 wherein said pivotal link connections also comprise two-piece rivet constructions similar to said first pivot and said lateral side portions of said one handle are provided with aligned apertures through which at least one of said two-piece rivets for one of said pivotal link connections may be inserted and clinched.

4. A metal-cutting shear as defined in claim 1 wherein said second pivot includes a bolt having a positively tapered head adapted to cooperate with a countersink formed in said one blade, a nut with a positive taper at one end adapted to cooperate with a countersink formed in said other blade as said nut is turned on said bolt, said nut having a negative taper at its other end, and a lock nut having a positive taper adapted to cooperate with said negative tapered end of said nut so as to prevent said nut from loosening during operation of said cutting blades.

5. A metal-cutting shear as defined in claim 1 including a spring-biased link interconnecting said handles rearwardly of said first pivot and adapted to urge said handles toward their open position and a stop interposed between said handles forwardly of said first pivot to limit the maximum open position of said handles.

6. A metal-cutting shear as defined in claim 5 wherein said spring-biased link includes a pair of telescopic parts with a compression spring therebetween, each of said telescopic parts having a substantially ball-shaped end adapted to be received in a socketlike depression formed in each of said handles whereby each of said telescopic parts is free to swivel with respect to its handle as said handles are opened and closed.

7. A metal-cutting shear as defined in claim 1 wherein said pivotal connection includes a pivot pin having a head protruding at least in part from the handle on the side of said plane in the direction of said offset and said offset is more than sufficient for said metal edge to pass said head without interference therewith.

8. A metal-cutting shear as defined in claim 1 wherein said one blade has a convex-cutting edge defined by an arc whose chord forms the base of an imaginary isosceles triangle whose apex angle is within the range of 20° to 24° and other upper blade has a convex-cutting edge defined by an arc whose chord forms the base of an imaginary isosceles triangle whose apex angle is within the range of 3° to 5° whereby said convex-cutting edges cooperate to reduce the forward slipping of metal between said blades as they are closed.

9. A metal-cutting shear as defined in claim 8 wherein the apex angle of said imaginary triangle for said lower blade is 22°.

10. A metal-cutting shear as defined in claim 8 wherein the apex angle of said imaginary triangle for said upper blade is 4°.

11. A metal-cutting shear as defined in claim 8 wherein the apex angle of said imaginary triangle for said lower blade is 22° and the apex angle of the imaginary triangle for said upper blade is 4°.