March 3, 1953 R. H. HARTWELL 2,629,927

CUTTING-TOOL FOR SHEET MATERIAL

Filed Aug. 31, 1950 2 SHEETS—SHEET 1

FIG. 1.

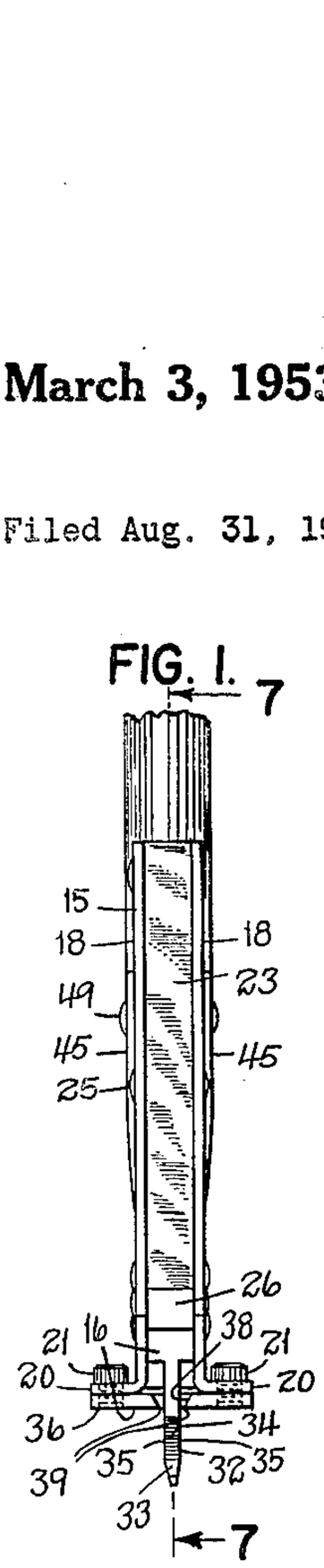


FIG. 2.

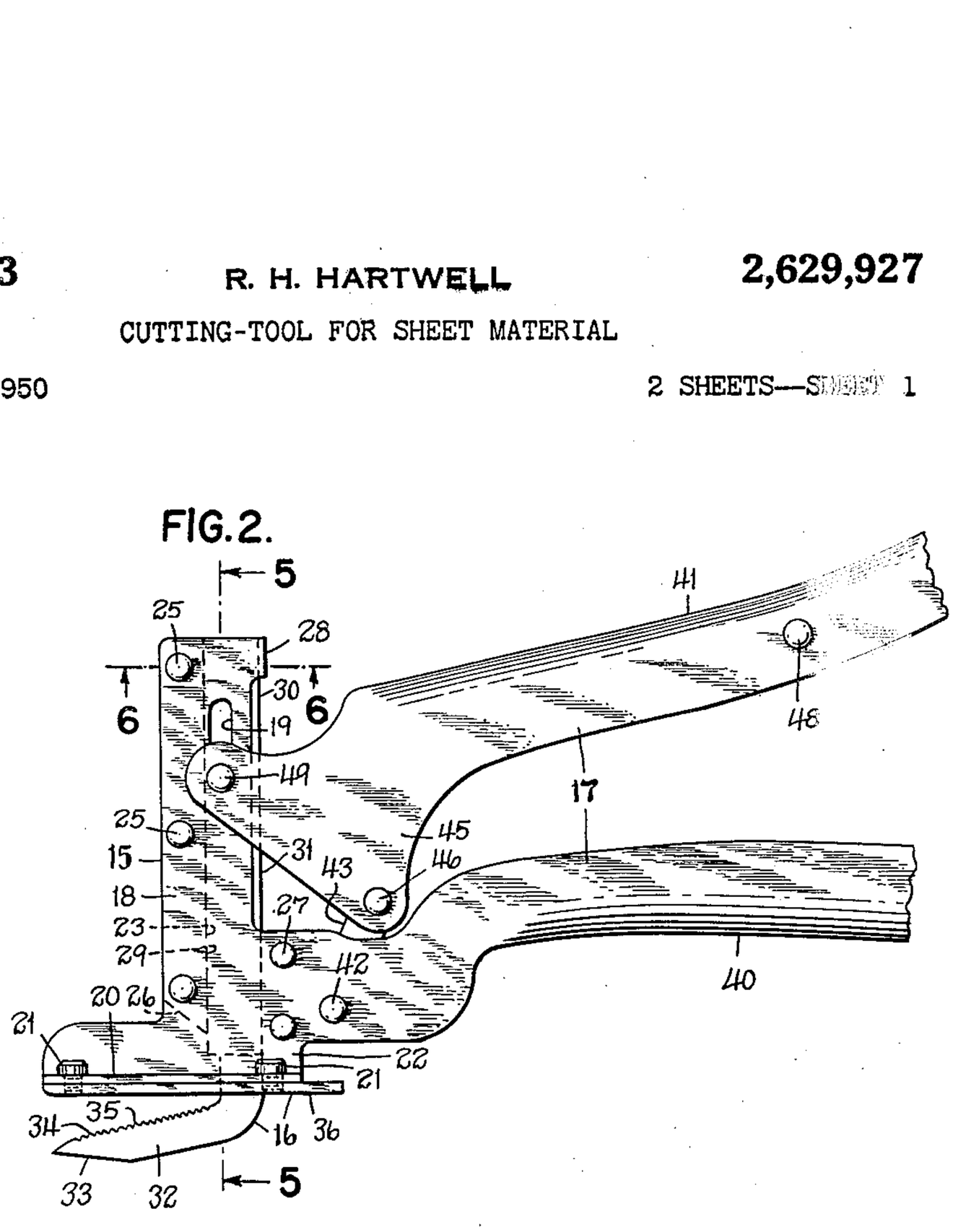


FIG. 3.

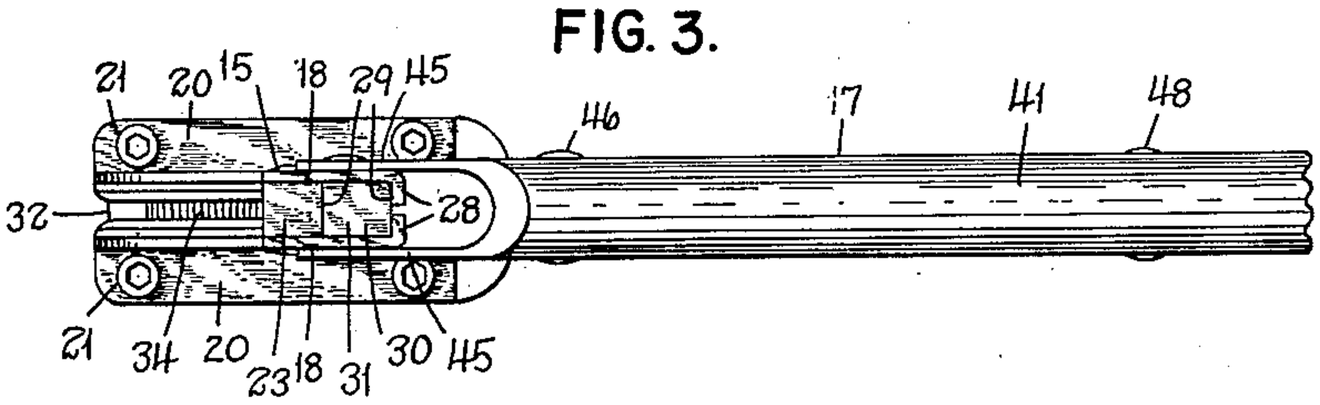


FIG. 5.

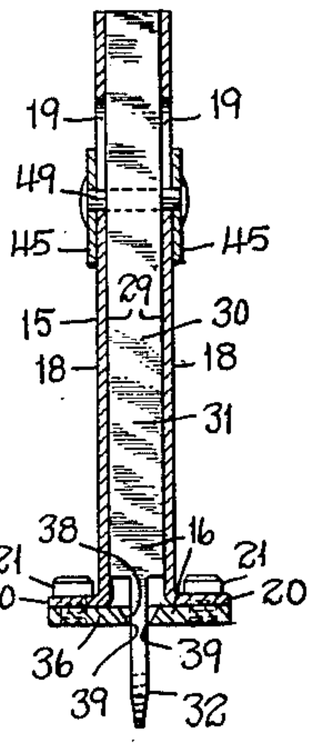
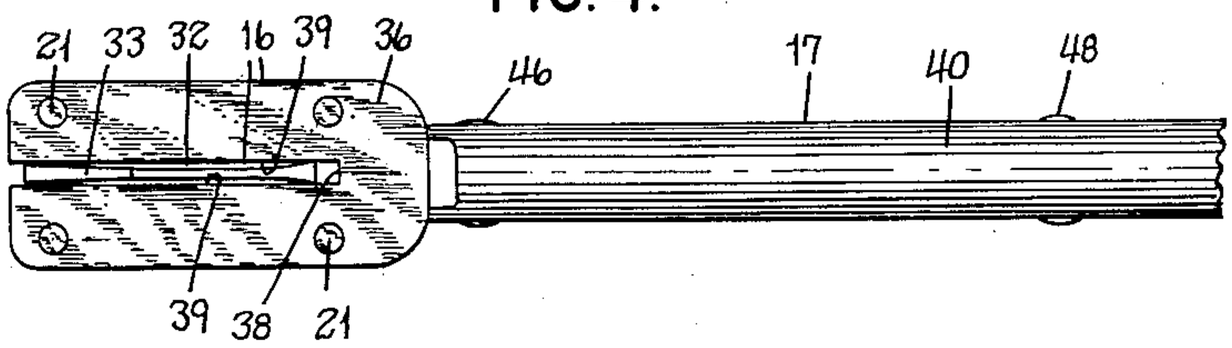


FIG. 4.



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CUTTING-TOOL FOR SHEET MATERIAL

Filed Aug. 31, 1950 2 SHEETS—SHEET 2

FIG. 6.

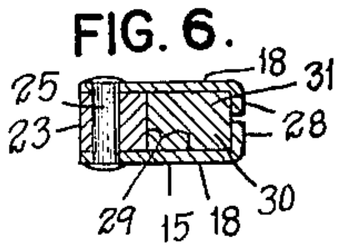


FIG. 7.

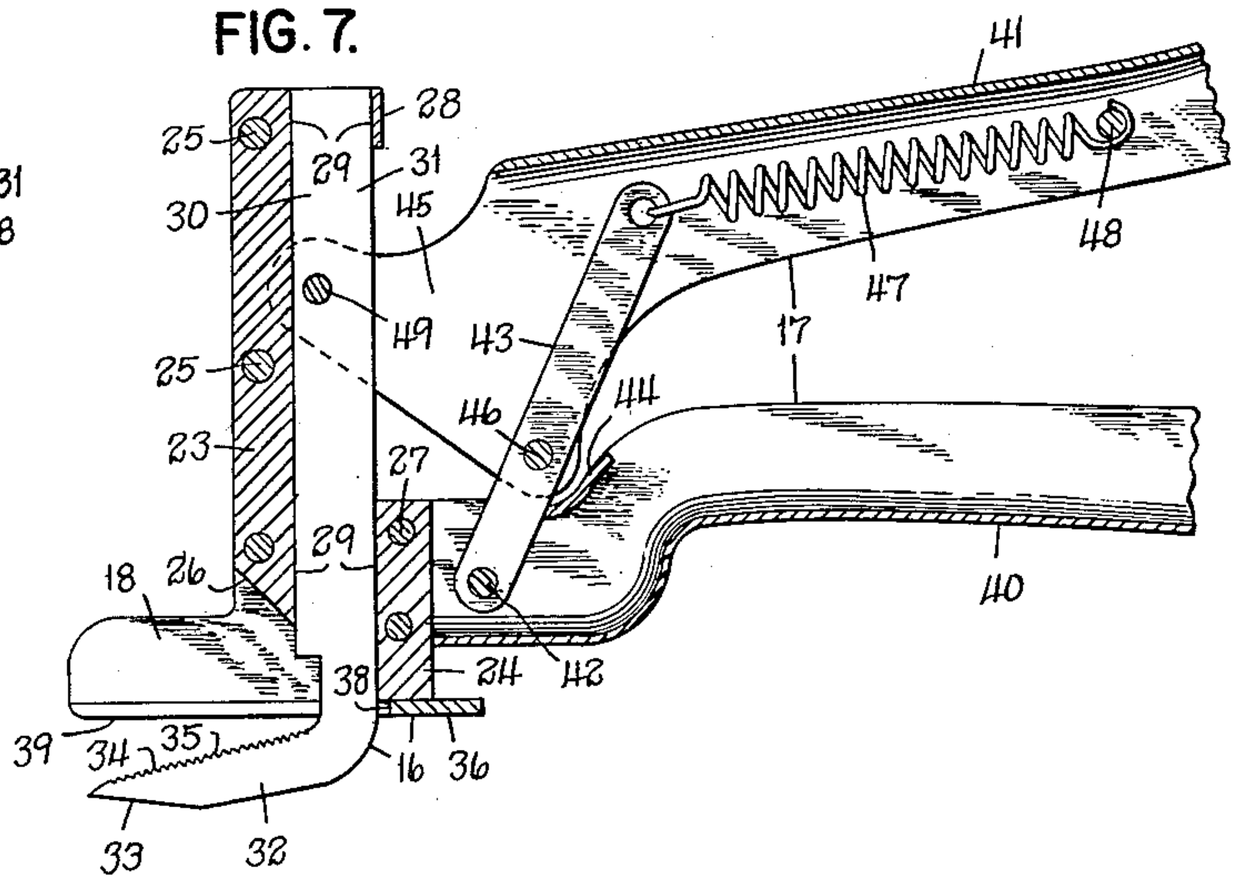


FIG. 9.

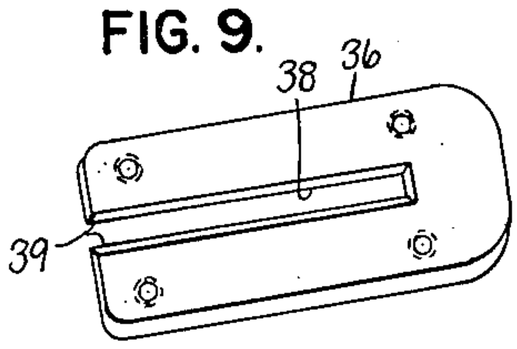


FIG. 8.

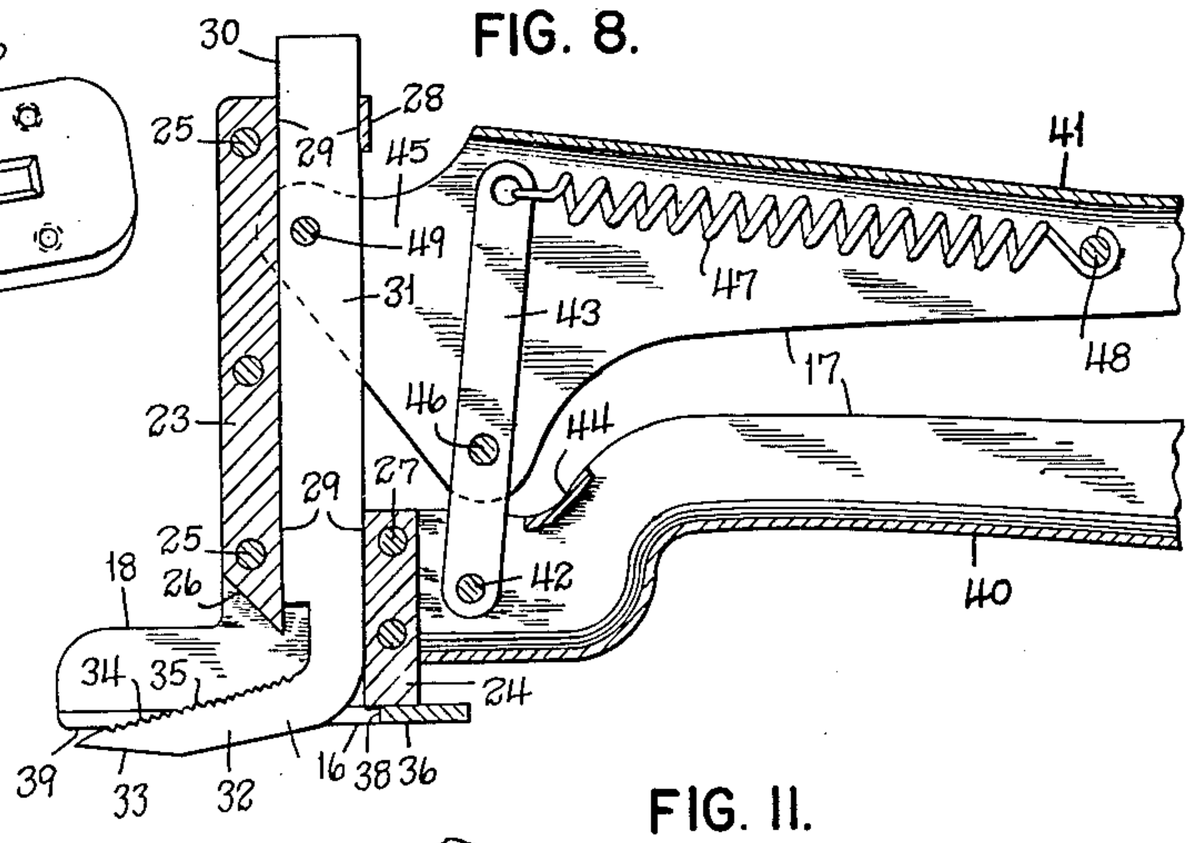


FIG. 10.

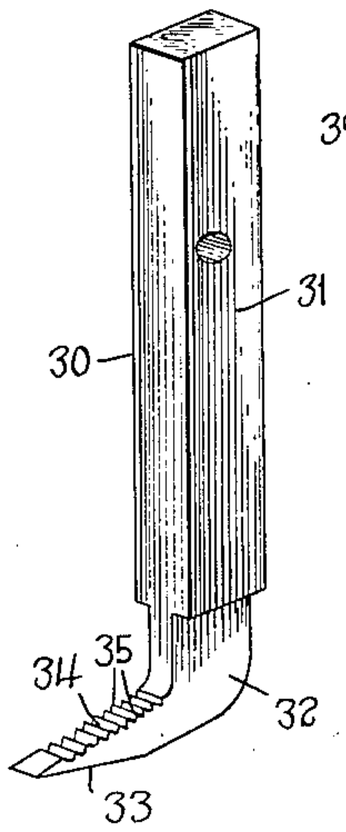
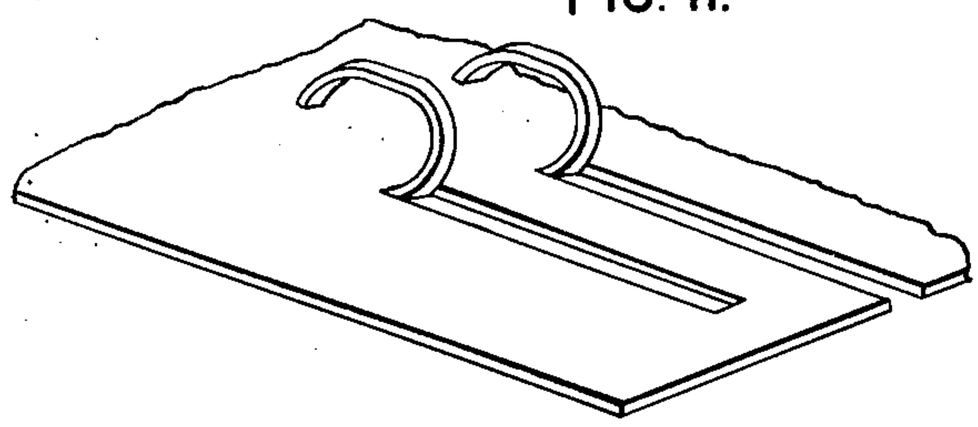


FIG. 11.



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UNITED STATES PATENT OFFICE

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CUTTING-TOOL FOR SHEET MATERIAL

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Application August 31, 1950, Serial No. 182,466

5 Claims. (Cl. 30—241)

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The present invention relates in general to cutting-tools for sheet material and more especially to a manually-operated shear especially suitable for cutting relatively-thin sheet-metal stock.

An object of the invention is to provide a superior shear for sheet metal and like materials.

A further object of the invention is to provide a superior sheet-material shear which is of durable and dependable construction, which is economical for manufacture, and which operates with ease and accuracy.

A still further object of the invention is to provide a manually-operated sheet-metal shear of the class described which will form a clean, even cut in thin sheet-metal stock.

A still further object of the invention is to provide a manually-operated metal shear of the class described which will cut a relatively-narrow slot in thin sheet-metal stock wherein the cut edges of the slot are maintained substantially flat and in substantially-parallel relationship.

Other objects and advantages will appear to those skilled in the art from the following, considered in conjunction with the accompanying drawings.

In the accompanying drawings, in which certain modes of carrying out the present invention are shown for illustrative purposes:

Fig. 1 is a view in outer edge elevation of a cutting-device for sheet metal and the like embodying the present invention and with the handle broken away;

Fig. 2 is a view thereof in side elevation;

Fig. 3 is a top or plan view thereof;

Fig. 4 is an underside view of the cutting-device;

Fig. 5 is a vertical sectional view taken on the line 5—5 of Fig. 2;

Fig. 6 is a transverse sectional view taken on the line 6—6 of Fig. 2;

Fig. 7 is a view in central-longitudinal section taken on the line 7—7 of Fig. 1;

Fig. 8 is a view similar to Fig. 7, but showing the handle-members moved together to lift the movable cutter;

Fig. 9 is a detached perspective view of the cutter-plate detached;

Fig. 10 is a perspective view of the movable cutter, detached; and

Fig. 11 is a broken perspective view showing the result of a cut being made in a piece of sheet material by the cutting-device illustrated in the previous figures.

The embodiment of the invention shown herein

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comprises, in the main, a head-member indicated generally at 15; cutting-elements, indicated generally at 16, and mounted on the head-member 15; and a pair of manually-operated handles indicated generally at 17.

The head-member 15 comprises a pair of identical substantially L-shaped side-plates 18—18, the vertical leg of each side-plate being provided with a substantially-vertical guide-slot 19 which is adjacent its upper end and offset rearwardly from its longitudinal axis. The lower forwardly-extending substantially-horizontal leg of each side-plate has a laterally-projecting flange 20 at substantially right angles thereto, each flange 20 being provided with internally-threaded substantially-vertical apertures at opposite ends thereof for accommodating suitable fastening-elements such as, for example, the screws 21. Projecting rearwardly from the rear edge of each side-plate 18 adjacent its lower end and in the vertical plane thereof is an integral substantially-rectangular flange-portion 22.

The two side-plates 18—18 of the head-member are adapted to be fixedly secured in spaced-parallel relationship by means of a pair of spacer-blocks 23 and 24 respectively, each block being substantially rectangular in cross section. The spacer-block 23 corresponds substantially to the length of the vertical legs of the side-plates 18—18 and is secured therebetween with one face substantially flush with the forward edges thereof by means of suitable fastening-elements such as rivets 25. As shown especially well in Figs. 7 and 8, the lower end of the spacer-block 23 is provided with an upwardly- and outwardly-sloping surface 26 to provide clearance at the lower end of the spacer-block 23 for the purpose hereinafter described.

The spacer-block 24 is considerably shorter than the spacer-block 23, the length of the spacer-block 24 corresponding substantially to the height of the flange-portions 22—22 of the side-plates between which the shorter spacer-block 24 is rigidly secured by fastening-means such as, for example, rivets 27, the rear face of the spacer-block being substantially flush with the rear edges of the flange-portions 22—22. It will be noted that the lower end of the spacer-block 24 is lower than the beveled end of the spacer-block 23, the lower end of the spacer-block 24 being in a horizontal plane substantially coincident with the horizontal plane defined by the underfaces of the flanges 20—20 of the side-plates.

The upper ends of the side-plates 18—18 may

be reinforced by integral lips 28—28 on the back edges thereof bent around or inwardly substantially perpendicular thereto so that the free ends of the lips are substantially in contact. The aforesaid lips 28—28 thus serve, in effect, as a rear wall at the upper end of the head-member, the rear wall being spaced rearwardly from the rear face of the spacer-block 23 to form therewith the upper end of a substantially-vertical guide-aperture 29, and which is substantially rectangular in cross section, the lower end of the guide-aperture being defined, in turn, by the rear face of the corresponding end of the spacer-block 23 and the forward face of the spacer-block 24.

Mounted to be reciprocated longitudinally in the guide-aperture 29 of the head-member 15 is the movable cutting-element of the shears. Referring especially to Figs. 7, 8 and 10, this movable cutting-element comprises a cutter 30 consisting of a shank 31 substantially rectangular in cross section and adapted to slidingly engage in the aforesaid guide-aperture 29 of the head-member, the length of the shank corresponding substantially to the over-all vertical dimension of the head-member. Extending below the lower end of the shank 31 of the cutter 30 is a substantially L-shaped blade-portion 32 of reduced transverse dimensions, the relatively-narrow blade-portion 32 being disposed at an obtuse angle with respect to the longitudinal axis of its shank 31. Thus, as clearly illustrated in Figs. 2 and 7, the blade-portion 32 is arranged to slope downwardly and forwardly with respect to the horizontal plane of the flanges 20—20 of the side-plates 18—18. The forward end of the blade-portion of the blade-portion of the cutter is provided with a relatively-sharp point by forming an upwardly-and-forwardly-sloping bevel 33 on its bottom face, while the upper face of the blade-portion 32 is provided with a plurality of relatively-fine saw-teeth 34. The laterally-spaced saw-toothed upper edges of the blade-portion 32 of the cutter are hereinafter identified as the cutting-edges 35—35 of the cutter 30. As indicated in Fig. 1, the blade-portion 32 of the cutter tapers in thickness from its upper saw-tooth face 34 to its bottom face, the width of the blade 32 being maximum between the cutting-edges 35—35 of its upper saw-tooth face 34.

The complementary cutting-element of the cutter 30 is a cutting-plate 36 which is a substantially-flat rectangular plate substantially equal in width to the distance between the outer edges of the respective flanges 20—20 of the head-member and securely fastened to the undersurfaces of the flanges 20—20 of the head-member by means of the aforesaid fastening-means or screws 21, the over-all length of the cutting-plate being preferably somewhat greater than the length of one of the aforesaid flanges. Formed on the longitudinal axis of the cutting-plate and intersecting its forward end is a slot 38, the length of which is only slightly greater than the length of the blade-portion 32 of the cutter. The sides of the slot 38 are beveled to slope downwardly and inwardly, as shown especially well in Figs. 1 and 9, the minimum width of the slot being defined by its lower edges which are hereinafter referred to as the cutting-edges 39—39 of the cutting-plate. As shown in Fig. 1, the distance between the cutting-edges 39—39 of the cutting-plate is only slightly greater than the distance between the cutting-edges 35—35 of the cutter whereby the latter are adapted to move in shear relative

to the cutting-edges 39—39 of the cutting-plate, in the manner hereinafter described.

The handles 17 of the tool comprise a lower handle 40 fixed with respect to the head-member of the tool and an upper handle 41 movable with respect to the lower handle and the head-member of the tool.

The lower handle 40 may be formed from stiff sheet-metal stock and is substantially U-shaped in cross section, the forward ends of the respective upstanding side walls of the handle 40 being fixedly secured to the rear edges of the aforesaid flange-portions 22—22 of the head-member 15 by welded joints or equivalent fastening-means, whereby the lower handle 40 and head-member 15 constitute a unitary assembly. Extending through opposite side walls of the lower handle 40 adjacent the forward ends thereof is a pair of axially-aligned apertures adapted to accommodate pivotal means 42 which is provided for pivotally securing the lower end of a link 43 between the upstanding side walls of the lower handle. As shown especially well in Figs. 7 and 8, a cross-piece 44 extends across the upper edges of the respective side walls of the lower handle immediately rearwardly of the pivotal means of the link 43, and serves both to reinforce the handle structure and as a stop to limit the pivotal movement of the link 43 in a clockwise direction, as and in the manner hereinafter described.

The upper handle 41 of the tool is similarly formed of relatively-stiff sheet-metal stock bent so as to be substantially U-shaped in cross section but is inverted with respect to the lower handle 40, as indicated in Figs. 7 and 8, the forward ends of the respective side-plates of the upper handle 41 being enlarged, as at 45—45. The extremities of each enlargement 45 are provided with apertures for accommodating pivotal means or equivalent fastening-means. Thus, the axially-aligned apertures in the lower extremities of the enlargements 45—45 of the upper handles are adapted to accommodate pivotal means 46 which passes through an aperture in the aforesaid link 43 at a point therein immediately above the upper edges of the lower handle. The upper end of the link 43 extends upwardly and is enclosed within the depending side walls of the upper handle 41. Secured to the upper end of the link 43 is the forward end of a coil spring 47, the rear end of which is secured by fastening-means 48 adjacent the outer end of the upper handle 41, as shown especially well in Figs. 7 and 8.

The axially-aligned apertures in the upper extremities of the enlargements of the side walls of the upper handle are provided with pivotal means 49 which extends through an aperture in the shank 31 of the cutter 30, the aperture in the shank 31 of the cutter being in axial alignment with the apertures in the upper extremities of the aforesaid enlargements of the upper handle when the cutter 30 is in its normal position, as shown in Figs. 1 and 7. Moreover, in extending through the apertured shank of the cutter, the pivotal means 49 is engaged in the guide-slots 19—19 of the side-plates of the head member, which slots serve to impart substantially-vertical reciprocable movement to the pivotal means 49 when the upper handle 41 is successively closed and opened with respect to the lower handle 40.

Normally, the tension of the coil spring 47 applies a force to the upper end of the link 43 which urges the latter to swing in a clockwise direction, as shown especially well in Fig. 7, whereby the lower pivotal means 46 of the upper

handle is resiliently held to the right of the pivotal means 42 at the lower end of the link 43, the pivotal means 49 of the upper handle being, at this time, moved downwardly to the lower ends of the guide-slots 19—19 in the side-plates 18—18 of the head-member 15. With the elements in these relative positions, the upper handle 41 is resiliently held upwardly away from the lower handle 40. Upon squeezing the two handles together, the upper handle moves downwardly relative to the lower handle, during which action the upper pivotal means 49 of the upper handle slides upwardly in the corresponding guide-slots 19—19 of the head-member, while the lower pivotal means 46 of the upper handle swings forwardly of the lowermost pivotal means 42 of the link 43, the latter simultaneously swinging in a counterclockwise direction whereby its upper end draws out or tensions the coil spring 47. Link 43 thus serves as a floating fulcrum for the movable handle 41, whereby the mechanical advantage of the handle in operating cutter 30 arises not only from the normal leverage determined by the respective moment arms of the handle about pivot 46, but also from the toggle effect produced by the counterclockwise rotation of link 43 about its pivot 42. This arrangement enables a far greater shearing force to be applied for the same pressure on the handles than would be produced were the fulcrum point 46 not movable in the manner described. As the pivotal means 49 of the upper handle moves upwardly in the guide-slots of the head-member, the shank 31 of the cutter 30 is carried upwardly in the guide-aperture of the head-member thereby drawing the blade-portion 32 of the cutter upwardly with respect to the cutting-plate 36. More particularly, the cutting-edges 35—35 of the blade-portion 32 of the cutter are moved past the cutting-edges 39—39 of the cutting-blade in a shearing action. Consequently, assuming a sheet of thin metal is interposed between the underside of the cutting-blade and the saw-toothed upper face 34 of the blade-portion of the cutter, then as the blade-portion 32 is moved upwardly into the slot 38 of the cutting-plate, the respective cutting-edges 35—35 of the cutting-blade move past the cutting-edges 39—39 of the cutting-plate, in shear, to form two longitudinal substantially-parallel cuts in the sheet of metal, the metal intermediate the two cuts automatically curling upwardly and forwardly in the form of a metal curl whereby a longitudinal slot of corresponding width is formed in the sheet of metal. As the upwardly-moving blade-portion 32 of the cutter engages against the sheet-metal stock, its face 34 serves to hold the sheet-metal stock firmly against the underside of the cutting-plate 36 thereby preventing the cut edges of the sheet metal from curling. Moreover, the saw-teeth of the cutting-edges 35—35 of the blade form minute indentures in the sheet-metal stock to prevent the latter from sliding forwardly relative to the cutting-edges of the blade and the cutting-edges of the cutting-plate, so that a slot is cut in the sheet-metal stock substantially equal in length to the length of the cutting-blade with each cutting stroke of the latter. The narrow strip of cut metal formed with each cutting stroke is carried upwardly by the upwardly-moving blade-portion of the cutter and curls forwardly in the manner illustrated in Fig. 11, the tapered lower surface 26 of the spacer-block 23 allowing clearance for the forward movement of the curled strip of metal.

While the shears may be engaged with the edge of a sheet of metal to cut a slot therein, the construction and arrangement of the blade-portion 32 of the cutter will permit the latter to puncture or pierce relatively-thin sheet metal inwardly of its edges, as illustrated in Fig. 11, and to form a slot therein starting at this point in the sheet of metal.

The superior sheet-metal cutting-shears of this invention is thus characterized by its simplicity and durability of construction and by the arrangement of the cutting-blade with respect to the cutting-plate of the shears, whereby opposite edges of the cutting-blade cooperate with corresponding edges of the cutting-plate to simultaneously perform a shearing cut on a sheet of metal or equivalent material to make two substantially-parallel cuts therein for performing a slot of an equivalent width, the operation of the cutting-blade being performed with facility by manual operation of the movable handle of the shears.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

I claim:

1. In a pair of manually-operated shears for cutting sheet material, the combination including: a head-member having a pair of laterally-spaced substantially-parallel cutting-edges thereon; a handle fixedly secured to said head-member; a cutter movably mounted with respect to said head-member, said cutter having a pair of laterally-spaced substantially-parallel cutting-edges adapted to be moved into and out of shearing relationship with the cutting-edges of said head-member; a movable handle; link-means arranged to pivotally connect said movable handle to said cutter and to said head-member so that movement of said movable handle relative to said fixed handle transmits substantially-vertical reciprocable movement to said cutter, whereby the cutting-edges of said cutter and said head-member move in shear to cut a slot in a sheet of material; and resilient means connected to said movable handle and to said link-means to automatically move said movable handle away from said fixed handle so as to separate the cutting-edges of the head-member and cutter respectively.

2. In a pair of manually-operated shears for cutting sheet material, the combination including: a head-member having a cutting-plate fixed thereon and provided with a pair of laterally-spaced substantially-parallel downwardly-and-inwardly-beveled cutting-edges; a handle fixedly secured to said head-member; a cutter movably mounted with respect to said head-member, said cutter having a pair of laterally-spaced substantially-parallel cutting-edges adapted to be moved into and out of shearing relationship with the cutting-edges of said cutting-plate; a movable handle; link-means arranged to pivotally connect said movable handle to said cutter and to said head-member so that movement of said movable handle relative to said fixed handle transmits substantially-vertical reciprocable movement to said cutter, whereby the cutting-edges of said cutter and said head-member move in shear to cut a slot in a sheet of material; resilient means connected to said movable handle and to said

link-means to automatically move said movable handle away from said fixed handle so as to separate the cutting-edges of the head-member and cutter respectively; and stop-means carried by said fixed handle, said stop-means being arranged to be engaged by said link-means to limit the movement of said movable handle away from said fixed handle.

3. In a pair of manually-operated shears for cutting a slot in sheet material, the combination including: a head-member having a substantially-vertical guide-aperture; a substantially-horizontal cutting-plate fixed on said head-member and provided with a pair of laterally-spaced substantially-parallel downwardly-and-inwardly-beveled cutting-edges; a handle fixedly secured to said head-member; a cutter movably supported in the guide-aperture of said head-member, said cutter having a toothed blade-portion which tapers downwardly from its upper surface and is provided with a pair of laterally-spaced substantially-parallel cutting-edges arranged to be moved into and out of shearing relationship with the cutting-edges of said head-member; a movable handle; link-means arranged to pivotally connect said movable handle to said cutter and to said head-member, whereby movement of said movable handle toward said fixed handle serves to move said cutter upwardly in the guide-aperture of said head-member, whereby the cutting-edges of said blade-portion and said cutting-plate move in shear to cut a slot in a sheet of material; and resilient means connected to said movable handle and to said link-means to resist the displacement of said movable handle toward said fixed handle and to urge said movable handle away from said fixed handle following displacement thereof so as to automatically separate the cutting-edges of the cutting-plate and blade-portion of the cutter respectively.

4. In a manually-operated shear for cutting sheet material, the combination including: a head-member having a cutting-edge provided thereon and a handle fixedly secured to said member, said head-member and fixed handle

constituting a unitary member; a cutter movably mounted for substantially vertical reciprocable movement with respect to said head-member, said cutter having a cutting-edge adapted to be moved into and out of shearing relationship with the cutting-edge of said head-member; a movable handle said handle being pivotally connected at its inner end to said cutter; a link-member pivotally connected at one of its ends to said unitary member, said link-member being pivotally connected to said movable handle to provide a toggle whereby movement of said movable handle with respect to said fixed handle transmits substantially vertical reciprocable movement to said cutter.

5. A manually-operated shear as defined in claim 4, in which said link-member is provided with a portion which extends beyond its point of pivotal connection to said movable handle and spring means acting upon said extended portion to urge said link-member to pivot in a direction which causes the cutting-edge of said cutter to be moved out of shearing relationship with the cutting-edge of said head-member.

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