

July 12, 1960

A. B. WILSON ET AL

2,944,503

CRIMPING TOOL FOR FORMING ROOF DECK

Filed May 12, 1954

3 Sheets-Sheet 1

Fig. 1.

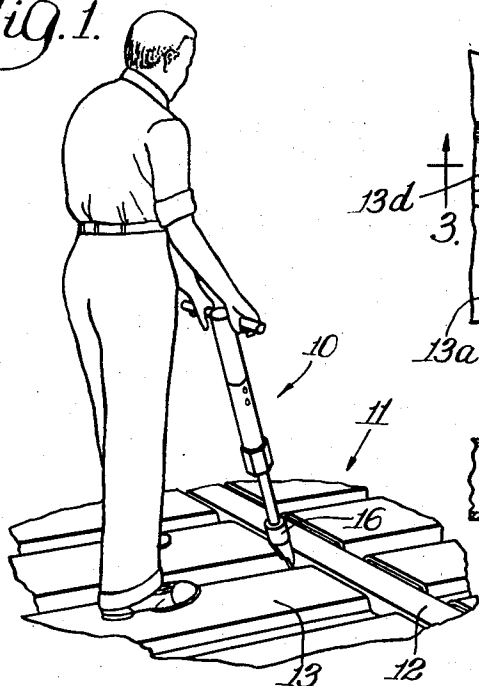


Fig. 2.

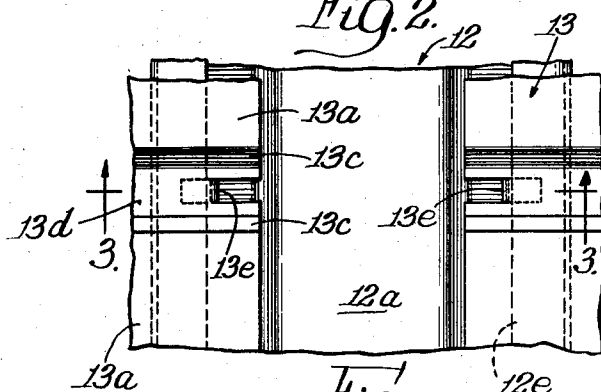


Fig. 3.

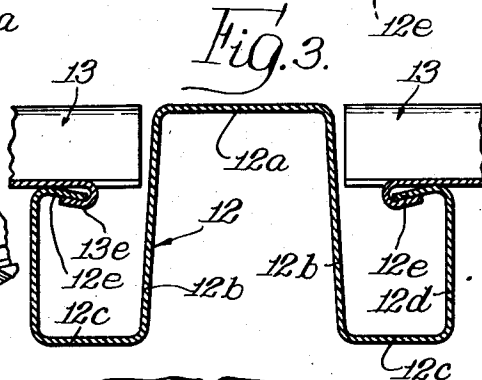
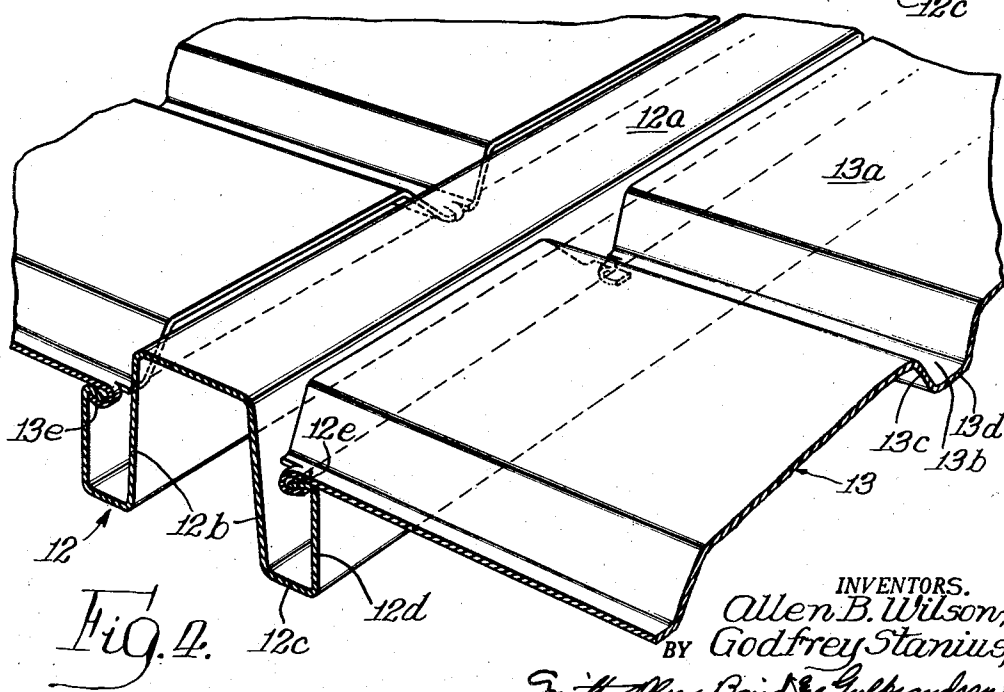


Fig. 4.

INVENTORS.
Allen B. Wilson,
BY Godfrey Stenius,
Smith, Olson, Baird & Gulbrandsen,
Attys.

July 12, 1960

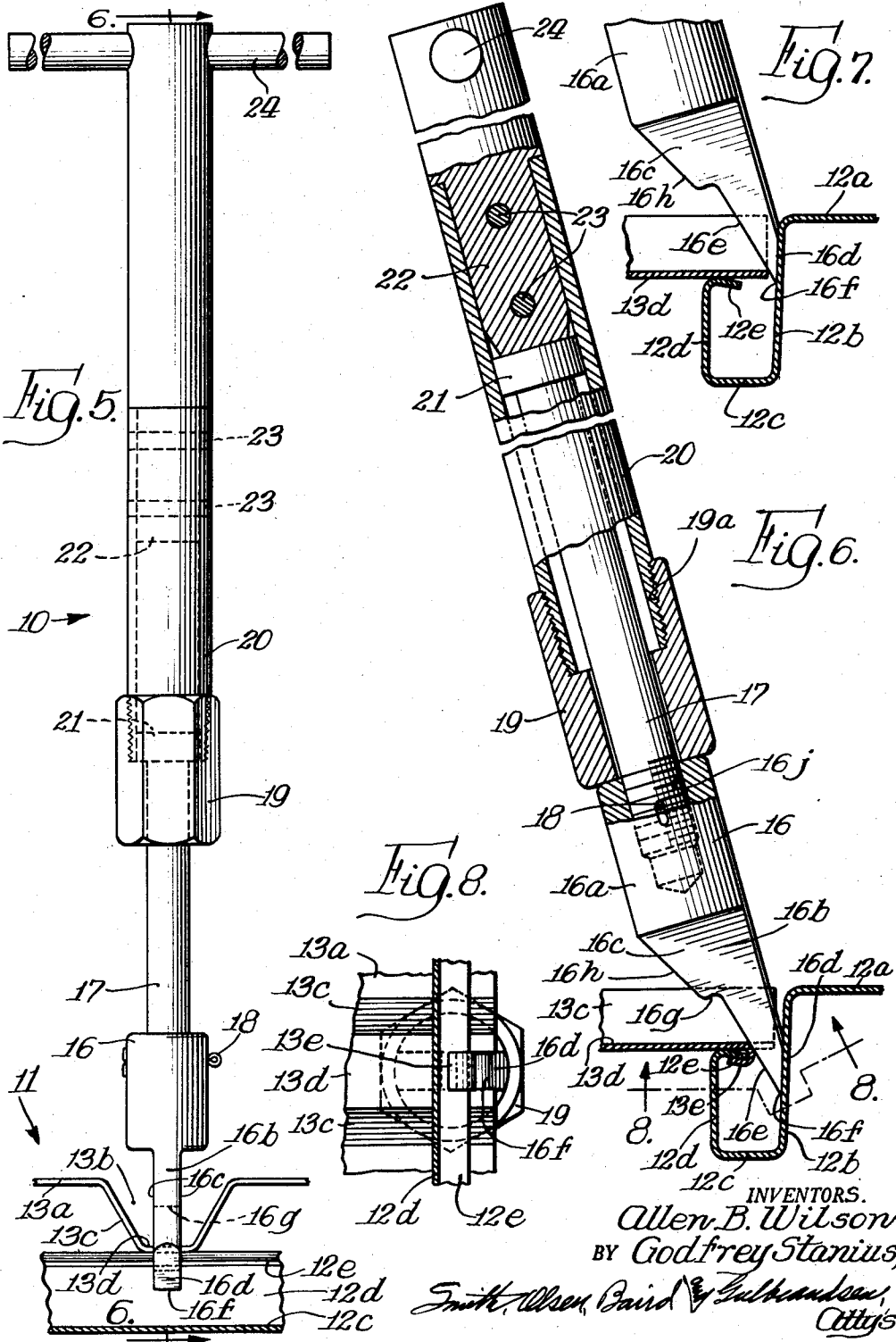
A. B. WILSON ET AL

2,944,503

CRIMPING TOOL FOR FORMING ROOF DECK

Filed May 12, 1954

3 Sheets-Sheet 2



July 12, 1960

A. B. WILSON ET AL

2,944,503

CRIMPING TOOL FOR FORMING ROOF DECK

Filed May 12, 1954

3 Sheets-Sheet 3

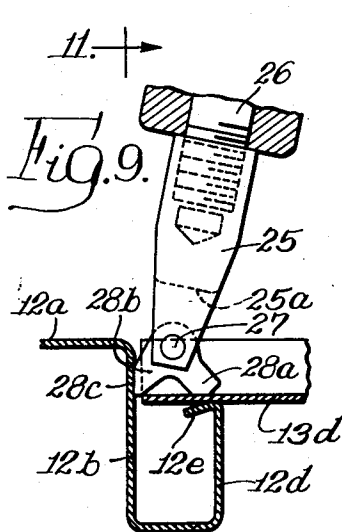
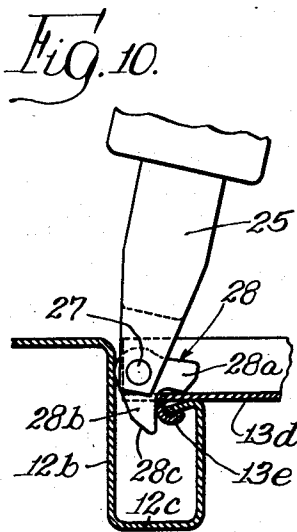
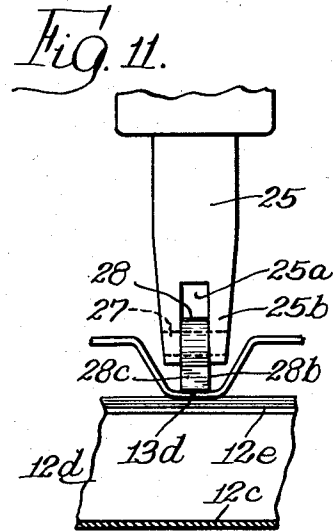
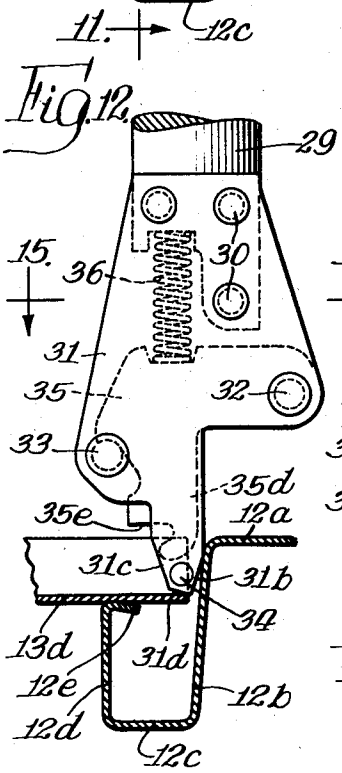
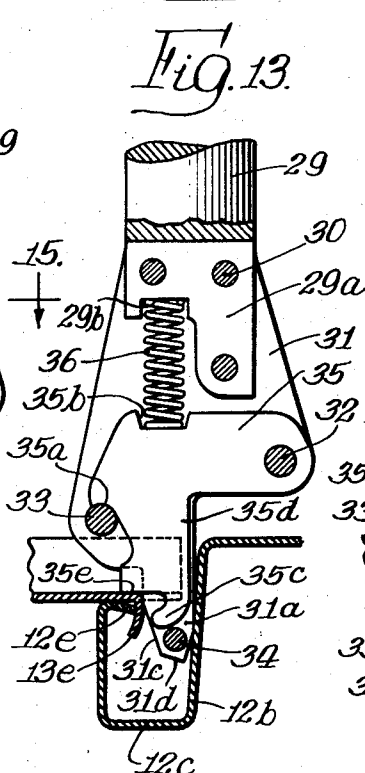
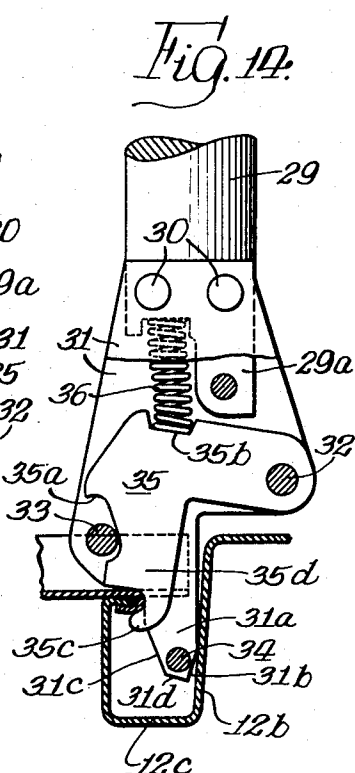
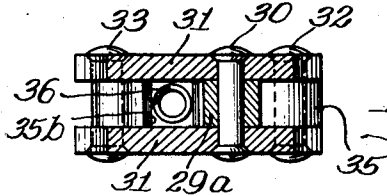


Fig. 15.

INVENTORS.
Allen B. Wilson;
BY Godfrey Stanius;
Smith, Wren, Baird & Sullivan,
Attys.

1

2,944,503

CRIMPING TOOL FOR FORMING ROOF DECK

Allen B. Wilson, Chicago, and Godfrey Stanius, Crete, Ill., assignors to Acme Steel Company, Chicago, Ill., a corporation of Illinois

Filed May 12, 1954, Ser. No. 429,237

10 Claims. (Cl. 113—54)

This invention relates to an improved crimping tool for use in forming joints between the parts of the roof decks.

In the building of a certain type of roof constructions, such as those employed in factories and other buildings, it is customary to provide a sheet metal roof deck, which rests upon the beams or other supporting structure of the roof, and which is covered with insulation, tar paper, asphalt, tar or other materials by which the outer covering of the roof is formed and the roof made weather tight. It is the usual practice to form the roof deck of sheet metal panels supported by sheet metal beams, thus providing a composite sheet metal structure which extends throughout the area of the roof. These sheet metal panels and beams are commonly secured together by means of specially formed fasteners which have added substantially to the cost of the roofing material and to the cost of the labor required to build the roof. Also, the use of these auxiliary fastening devices has not been satisfactory because of their tendency to become loose after use and because they sometimes require the punching of the panels and beams to form holes which do not always register properly when the roof deck is assembled.

The object of the invention is to provide an improved crimping tool which may be employed to cut a tongue from one roof member and curl it into interlocking engagement with another roof member. Other objects relate to various features of construction and arrangement which will appear more fully hereinafter.

The nature of the invention will be understood from the following specification taken with the accompanying drawings in which one embodiment of a roof deck and one example of forming it are illustrated in connection with three forms of the improved crimping tool. In the drawings,

Figure 1 is a perspective view of a portion of a roof deck formed using the crimping tool of the present invention and illustrating the use of the improved crimping tool in the hands of a workman;

Fig. 2 shows an enlarged top plan view of a portion of the roof deck illustrated in Fig. 1;

Fig. 3 shows a sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is an enlarged perspective view of a portion of the roof deck illustrated in Fig. 1 with parts thereof shown in vertical section;

Fig. 5 shows an enlarged front elevation of one form of the improved crimping tool adapted for use in forming joints between the parts of the roof deck illustrated in Figs. 1 to 4, inclusive;

Fig. 6 shows a sectional view taken on the line 6—6 of Fig. 5 with the plunger 17 positioned upwardly within the tube 20;

Fig. 7 is a view similar to the lower part of Fig. 6 illustrating the relative positions and conditions of the parts when the crimping tool shown in Figs. 5 and 6 is first put in place for use;

2

Fig. 8 is a sectional view taken on the line 8—8 of Fig. 6;

Fig. 9 is a vertical sectional view similar to that of Fig. 6 showing a modified form of the crimping tool of the present invention with the parts thereof in the relative positions which they occupy preliminary to forming the joint between the parts of the roof deck;

Fig. 10 is a view similar to that of Fig. 9 showing the relative positions of the parts of the tool after the joint has been formed;

Fig. 11 is a sectional view taken on the line 11—11 of Fig. 9;

Fig. 12 is a view similar to that of Fig. 6 showing a side elevation of a third form of the invention with the parts in the relative positions which they occupy when the tool is first placed in proximity to the parts of the roof deck preliminary to forming a joint;

Fig. 13 is a view similar to that of Fig. 12 showing the relative positions of the parts of the tool when the joint has been partially formed;

Fig. 14 is a view similar to those of Figs. 12 and 13 showing the relative positions of the parts of the tool when the formation of the joint has been completed; and

Fig. 15 is a sectional view taken on the line 15—15 of Fig. 12.

In Fig. 1 of the drawings, the improved crimping tool 10 is shown in the hands of a workman on a roof deck 11 which, as further shown in Figs. 2, 3 and 4, is made up of a plurality of parallel beams 12 upon which are mounted a plurality of sheet metal roof panels 13. The beams 12 are formed of sheet metal and extend parallel to each other with their upper surfaces at the same level as the upper surfaces of the panels 13. Each beam comprises a top wall 12a having side walls 12b extending downwardly therefrom and flared outwardly from the top wall to a slight extent. Each side wall 12b is joined with a bottom wall 12c and each bottom wall is joined with a vertically extending outer wall 12d, each of which terminates at its top edge in an inwardly turned flange 12e which is inclined downwardly away from the plane of the uppermost edge of the connected outer wall.

Each sheet panel 13 is of corrugated form, being made up of parallel convolutions including top wall portions 13a which are of substantial width and which are joined by the intervening channel portions 13b each comprising downwardly converging walls 13c which are formed integrally with the bottom walls 13d. The panels 13 rest upon the upper edges of the outer walls 12d of the beams and the top surfaces of the panels 13a are in the same planes as the top surfaces of the adjacent walls 12a of the supporting beams.

According to the present invention, the beams 12 and panels 13 are connected by means which are formed integrally with these members including tongues 13e which are formed at the ends of the bottom walls 13d of the channels 13b and which are curled or bent downwardly and laterally about the inclined flanges 12e of the beams, thus providing interlocking joints between the outer portions of each beam and the panels 13 which are supported thereon. The flanges 13e are formed by slitting the metal of the bottom walls 13d of the channels inwardly from their edges and bending these tongues downwardly and outwardly so that they underlie the flanges 12e and conform to the inclination of these flanges as shown in Fig. 3. In this way, the parts of the roof deck are securely connected together without the use of auxiliary fastening devices.

In Figs. 1, 5, 6, 7 and 8 of the drawings there is shown one form of the crimping tool 10 by which the tongues 13e are formed and curled about the flanges of the beams. This form of the crimping tool comprises

3

a shearing and bending head 16 having a body portion 16a of cylindrical form and a downwardly projecting blade portion 16b which has parallel side faces 16c and two relatively inclined and downwardly converging end faces 16d and 16e which terminate in a sharp edge 16f. At its upper end, the inclined surface 16e is connected by a shoulder 16g with another inclined surface 16h which extends upwardly to the lower end of the cylindrical portion 16a.

When this tool is put into use it is first placed in the position shown in Fig. 7 with the face 16d of the blade contacting the outer surface of a side wall 12b and with the surface 16e resting on the edge of the bottom wall 13d of the panel 13 which is then resting upon the upper edge of the adjacent outer wall 12d. In order to form the joint which has previously been described, the head 16 is then thrust downwardly with the result that the metal of the bottom wall 13d of the channel is sheared longitudinally to form a tongue which is at the same time bent downwardly and reversed about the edge of the flange 12e of the beam until it finally occupies the position shown in Fig. 6 where it is bent around the flange of the beam and lies in close contact therewith, thus holding the panel against relative movement in any direction with respect to the connected beam.

To facilitate the actuation of the head 16 in the formation of the interlocking joint between the beam and the panel, the cylindrical portion 16a of the head is provided at its upper end with a tubular bore 16j which is threadedly engaged by a plunger or piston rod 17. Relative rotation of the members 16 and 17 is prevented by a pin 18 which extends transversely through the threaded portions thereof.

The piston or plunger 17 has a loose sliding engagement with a block 19 having at its upper end an internally threaded recess 19a which is threadedly engaged by the lower extremity of a tube 20. The piston rod or plunger 17 is provided at its upper end with a piston 21 adapted to slide in the tube 20. When the piston rod and piston are in their upper positions the head 16 lies in proximity to the block 19 and the piston 21 lies in proximity to a plug 22 which is secured in the upper end of the tube 20 by transverse pins or rivets 23. The plug 22 extends upwardly beyond the tube 20 and provides with the tube 20 a handle for manipulating the tool. A transverse bar 24 is secured in the upper end of the plug 22 for engagement by the hands of the operator.

In the use of this tool, the tube 20 and the plug 22 are reciprocated on the piston 21 and the piston rod 17 in order to impart blows to the upper end of the piston rod or plunger 17, thereby causing the head 16 to be forced downwardly and to perform the previously described shearing and bending operations on the edge of the bottom wall of the channel in the roof panel. The tool may be operated in this manner by a workman standing on the roof deck, as shown in Fig. 1, and the roof panels may thus be quickly and securely connected to the side portions of the supporting beams.

In Figs. 9, 10 and 11 of the drawings, there is shown a modified form of the invention which is similar to that previously described except for the construction of the shearing and bending head 25 which is mounted at the lower end of a reciprocating piston or plunger 26 and actuated in the manner previously set forth. The lower end of the head 25 is bifurcated to form a slot 25a bounded by side walls 25b and these side walls are engaged by a pin 27 on which there is mounted a cutting and bending die 28. This die has one arm 28a which is adapted to rest upon the top surface of the bottom wall 13d of the channel and it also comprises a right-angulantly disposed shearing and bending arm 28b having a straight end face 28c which is adapted to engage the side wall 12b of the beam when the tool is first brought into operating position as illustrated in Fig. 9. When the head 25 is forced downwardly by the impact mechanism

4

previously described, the arm 28 moves downwardly from the position shown in Fig. 9 as the arm 28a rocks about the surface of the bottom wall 13d thereby shearing the metal of the bottom wall 13d to form a tongue which is curled about the edge of the flange 12e of the beam, thereby forming the previously described interlocking joint.

A third form of crimping tool is illustrated in Figs. 12 to 15, inclusive, as comprising a cylindrical head 29 adapted to be connected to the piston or plunger of the operating mechanism which is constructed and actuated as previously described in connection with the form of crimping tool shown in Figs. 5 to 8, inclusive. The lower end of the head 29 is provided with a projection 29a in the form of a flat plate which has side plates 31 secured to the opposite sides thereof by means of rivets 30. These plates are of irregular form and have their lower parts secured together by shouldered rivets 32, 33 and 34, being thus spaced apart to receive between them the bending die 35 which is pivotally mounted upon the rivet 32.

The bending die is provided with a curved surface 35a which normally lies in contact with the rivet 33, being held in that position by a coil spring 36 which seats in a recess 35b formed in the upper part of the die 35 with its other upper end seated in another recess 29b which is formed in the extension 29a of the head.

The side plates 31 are provided with downwardly extending projections 31a which form the shearing dies by which the tongues are cut from the bottom portions of the channels in the roof panels. These projections are provided with downwardly converging faces 31b and 31c which are connected by inclined end faces 31d. When the crimping tool is brought into operating position with respect to the roof, the extensions 31a of the side plates occupy vertical positions as shown in Fig. 12 with the end faces 31d resting upon the edge portions of the bottom wall 13d of a channel and, at that time, the surface 35a of the bending die is seated upon the rivet 33 and the bending jaw 35c which is formed on the lower projection 35d of the bending jaw then occupies a position between the side plates 31 and above the rivet 34. As the head 30 is forced downwardly by the impact mechanism disclosed in connection with the first form of crimping tool previously described, the projections 31a of the side plates are forced downwardly with the result that the edges 31d and 31c shear the metal of the bottom wall of the channel and form a tongue which is at the same time bent downwardly about the edge of a flange 12e, as shown in Fig. 13.

As the downward movement of the tool proceeds, the bottom wall 13d of the channel engages a surface 35e which is formed on the bending die in proximity to the jaw 35c. Then, upon further downward movement of the tool, the bending die 35 is rocked about its pivot 32 against the compression of the spring 36 and the jaw 35c is actuated to engage the tongue which has been sheared from the bottom wall of the channel and to bend this tongue about the flange 12e until it occupies the position shown in Fig. 14. The joint is then completed and, upon withdrawing the tool from the position shown in Fig. 14, the bending die 35 is restored to its normal position by the spring 36.

Although certain preferred embodiments of the improved crimping tool have been illustrated and described, it will be understood that all of these features of the present invention may be modified in various ways without departing from the scope of the appended claims.

We claim:

1. A tool to interconnect two contacting metal flanges extending toward a wall relatively immovable with respect thereto and disposed at an acute angle therewith, the flanges terminating at points spaced from the wall with the first flange extending toward the wall past the second flange, said tool comprising a head having a pair of spaced apart substantially parallel cutting edges thereon on one side thereof, an anvil surface on the other side of said head, said cutting edges and said anvil surface being dis-

posed at an acute angle with respect to each other and being spaced apart a distance such that the smaller end of said head can be inserted between the first flange and the wall with said cutting edges against the first flange and said anvil surface against the wall, said cutting edges and said anvil surface diverging such that the distance therebetween is greater than the distance between the edge of the first flange and the wall so that movement of said anvil surface along the wall serves to force said cutting edges against the edge of the first flange to shear the edge of the first flange at spaced apart points therealong and in a direction substantially perpendicular thereto and substantially to the edge of the second flange to form a tongue, and tongue bending means on said head to contact and progressively to bend the tongue as said cutting edges form the tongue to direct it around the edge of the second flange to clamp the flanges together.

2. A tool to interconnect two contacting metal flanges extending toward a wall relatively immovable with respect thereto and disposed at an acute angle therewith, the flanges terminating at points spaced from the wall with the first flange extending toward the wall past the second flange, said tool comprising a head having a pair of spaced apart substantially parallel cutting edges thereon on one side thereof, an anvil surface on the other side of said head, said cutting edges and said anvil surface being disposed at an acute angle with respect to each other and being spaced apart a distance such that the smaller end of said head can be inserted between the first flange and the wall with said cutting edges against the first flange and said anvil surface against the wall, said cutting edges and said anvil surface diverging such that the distance therebetween is greater than the distance between the edge of the first flange and the wall so that movement of said anvil surface toward the wall serves to force said cutting edges against the edge of the first flange to shear the edge of the first flange at spaced apart points therealong and in a direction substantially perpendicular thereto and substantially to the edge of the second flange to form a tongue, tongue bending means on said head to contact and progressively to bend the tongue into a U-shape as said cutting edges form the tongue to direct it around the edge of the second flange with the free end of the tongue directed away from the wall, and driving means operatively connected to said head to drive said head between the wall and the flanges, said driving means applying a force along a line in a direction parallel to a plane passing through the point of intersection of planes defined by said cutting edges and said anvil surface and included therebetween.

3. A tool as set forth in claim 2, wherein the driving means includes a cylinder, a piston shiftably mounted within said cylinder and connected to said head, and an impact member mounted in said cylinder in a position to be driven against and to move said piston to drive said head, the axes of said cylinder and said piston extending in the direction of the driving force and being disposed at an acute angle to both said cutting edges and said anvil surface and parallel to a plane passing through the intersection of planes defined by said cutting edges and said anvil surface and included therebetween.

4. A tool to interconnect two contacting metal flanges extending toward a wall relatively immovable with respect thereto and disposed at an acute angle therewith, the flanges terminating at points spaced from the wall with the first flange extending toward the wall past the second flange, said tool comprising a tube, a head mounted on said tube for reciprocation with respect thereto, said head having a blade portion provided with a pair of parallel spaced apart cutting edges on one side thereof, an anvil face formed on the other side of said blade portion, said cutting edges and said anvil face being disposed at an acute angle with respect to each other and being spaced apart a distance such that the smaller end of said head can be inserted between the first flange and the wall with

said cutting edges against the first flange and said anvil face against the wall, said cutting edges and said anvil surface diverging such that the distance therebetween is greater than the distance between the edge of the first flange and the wall so that movement of said anvil surface along the wall serves to force said cutting edges against the edge of the first flange at points spaced apart a distance equal to the width of said blade portion and in a direction substantially perpendicular to the edge of the first flange and substantially to the edge of the second flange to form a tongue, and a tongue bending face formed on said blade portion on the side thereof opposite said anvil face to contact and progressively to bend the tongue as said cutting edges form the tongue to direct it around the edge of the second flange to clamp the flanges together.

5. A tool to interconnect two contacting metal flanges extending toward a wall relatively immovable with respect thereto and disposed at an acute angle therewith, the flanges terminating at points spaced from the wall with the first flange extending toward the wall past the second flange, said tool comprising a tube, a piston mounted for reciprocation in said tube, a piston rod connected to said piston and extending therefrom and out of said tube, an impact member mounted to engage said piston to impart blows thereto, and a head mounted on the end of said piston disposed outside of said tube, said head having a blade portion provided with a pair of parallel spaced apart cutting edges on one side thereof, an anvil face formed on the other side of said blade portion, said cutting edges and said anvil face being disposed at an acute angle with respect to each other and being spaced apart a distance such that the smaller end of said head can be inserted between the first flange and the wall with said cutting edges against the first flange and said anvil face against the wall, said cutting edges and said anvil surface diverging such that the distance therebetween is greater than the distance between the edge of the first flange and the wall so that movement of said anvil surface along the wall serves to force said cutting edges against the edge of the first flange at points spaced apart a distance equal to the width of said blade portion and in a direction substantially perpendicular to the edge of the first flange and substantially to the edge of the second flange to form a tongue, and a tongue bending face formed on said blade portion on the side thereof opposite said anvil face to contact and progressively to bend the tongue as said cutting edges form the tongue to direct it around the edge of the second flange to clamp the flanges together.

6. A tool to interconnect two contacting metal flanges extending toward a wall relatively immovable with respect thereto and disposed at an acute angle therewith, the flanges terminating at points spaced from the wall with the first flange extending toward the wall past the second flange, said tool comprising a head having a pair of spaced apart parallel cutting edges thereon on one side thereof, an anvil surface on the other side of said head, said cutting edges and said anvil surface being disposed at an acute angle with respect to each other and being spaced apart a distance such that the smaller end of said head can be inserted between the first flange and the wall with said cutting edges against the first flange and said anvil surface against the wall, said cutting edges and said anvil surface diverging such that the distance therebetween is greater than the distance between the edge of the first flange and the wall so that movement of said anvil surface along the wall serves to force said cutting edges against the edge of the first flange to shear the edge of the first flange at spaced apart points therealong and in a direction substantially perpendicular thereto and substantially to the edge of the second flange to form a tongue, a tongue bending member pivotally mounted on said head, and means to actuate said tongue bending member to move it into engagement with the tongue after

forming thereof by said cutting edges to bend the tongue around the edge of the second flange.

7. A tool to interconnect two contacting metal flanges extending toward a wall relatively immovable with respect thereto and disposed at an acute angle therewith, the flanges terminating at points spaced from the wall with the first flange extending toward the wall past the second flange, said tool comprising a head having a shearing and bending die pivotally mounted thereon, said die having a pair of spaced apart cutting edges formed thereon on one side thereof, an anvil surface formed on said die and spaced from said cutting edges, said cutting edges and said anvil surface being disposed at an acute angle with respect to each other and being spaced apart a distance such that the smaller end of said die can be inserted between the first flange and the wall with said cutting edges against the first flange and said anvil surface against the wall, and an arm formed integral with said die and engageable with flanges to pivot said bending die to force said cutting edges against the edge of the first flange to shear the edge of the first flange in a direction substantially perpendicular thereto and substantially to the edge of the second flange to form a tongue and simultaneously and progressively to bend the tongue around the edge of the second flange to clamp the flanges together.

8. A tool to interconnect two contacting metal flanges extending toward a wall relatively immovable with respect thereto and disposed at an acute angle therewith, the flanges terminating at points spaced from the wall with the first flange extending toward the wall past the second flange, said tool comprising a cylinder, a piston mounted for reciprocation in said cylinder, a piston rod connected to said piston and extending therefrom and out of said cylinder, an impact member mounted in said cylinder to engage and to drive said piston, a head mounted on the end of said piston rod extending out of said cylinder, an L-shaped cutting and bending die including two legs, and means pivoting said die at the junction of the legs thereof on said head, one of the legs of said die having a pair of spaced apart cutting edges on the side thereof adjacent to the other leg, said one leg having an anvil surface formed on the side thereof disposed away from the other leg, said cutting edges and said anvil surface being disposed at an acute angle with respect to each other and having a smaller end that can be inserted between the first flange and the wall with said cutting edges against the first flange and said anvil surface against the wall, the other leg of said die being adapted to react against the flanges to move said one leg against the first flange to form a tongue therefrom and thereafter to bend the tongue around the second flange.

9. A tool to interconnect two contacting metal flanges extending toward a wall relatively immovable with respect thereto and disposed in an acute angle therewith, the flanges terminating at points spaced from the wall with the first flange extending toward the wall past the second flange, said tool comprising a head having a pair of spaced apart cutting edges formed on one side thereof, an anvil surface formed on the other side of said head, said anvil surface and said cutting edges being disposed at an acute angle with respect to each other and providing a smaller end of said head which can be inserted between the first flange and the wall with said cutting edges against the first flange and said anvil surface against the wall, said

cutting edges and said anvil surface diverging so that the distance therebetween is greater than the distance between the edge of the first flange and the wall so that movement of said anvil surface along the wall serves to force said cutting edges against the edge of the first flange to shear the edge of the first flange at spaced apart points in a direction substantially perpendicular thereto and substantially to the edge of the second flange to form a tongue, and a bending die pivotally mounted on said head, said bending die having an abutment member movable into engagement with the flanges after the formation of the tongue by said cutting edges to move said bending die against the tongue to bend the tongue around the edge of the second flange to clamp the flanges together.

10. A tool to interconnect two contacting metal flanges extending toward a wall relatively immovable with respect thereto and disposed in an acute angle therewith, the flanges terminating at points spaced from the wall with the first flange extending toward the wall past the second flange, said tool comprising a head having a pair of spaced apart cutting edges formed on one side thereof, an anvil surface formed on the other side of said head, said anvil surface and said cutting edges being disposed at an acute angle with respect to each other and providing a smaller end of said head which can be inserted between the first flange and the wall with said cutting edges against the first flange and said anvil surface against the wall, said cutting edges and said anvil surface diverging so that the distance therebetween is greater than the distance between the edge of the first flange and the wall so that movement of said anvil surface along the wall serves to force said cutting edges against the edge of the first flange to shear the edge of the first flange at spaced apart points in a direction substantially perpendicular thereto and substantially to the edge of the second flange to form a tongue, a bending die pivotally mounted on said head between said cutting edges, a spring member urging said bending die into a non-bending position between said cutting edges and said anvil surface, an abutment shoulder formed on said bending die in a position to engage a flange after formation of the tongue to move said bending die into a bending position, and a hook-shaped bending jaw depending downwardly from said bending die and movable against a tongue formed by said cutting edges upon engagement of said abutment member with the flanges to bend the tongue around the second flange.

References Cited in the file of this patent

UNITED STATES PATENTS

430,000	Clark	June 10, 1890
518,766	Plecker	Apr. 24, 1894
1,055,680	Stacy et al.	Mar. 11, 1913
1,148,672	Gessler	Aug. 3, 1915
1,306,920	Miller	June 17, 1919
1,430,807	Hoffmann	Oct. 3, 1922
1,729,946	Kuehn	Oct. 1, 1929
1,808,452	Cousins	June 2, 1931
1,816,556	White	July 28, 1931
1,891,767	Ketcham	Dec. 20, 1932
2,426,670	Cooley	Sept. 2, 1947
2,693,218	Freedom	Nov. 2, 1954

FOREIGN PATENTS

206,941	Great Britain	Nov. 22, 1923
---------	---------------	---------------