

Nov. 28, 1961

L. L. SMITH ET AL

3,010,199

TOOL AND METHOD FOR SECURING SHEET METAL PIECES TOGETHER

Original Filed Feb. 24, 1955

2 Sheets-Sheet 1

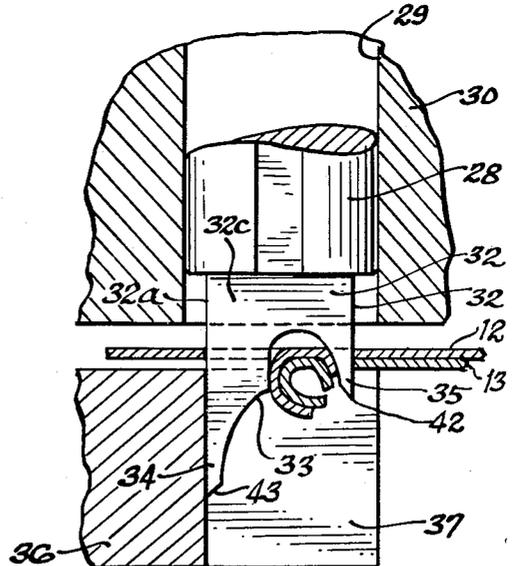
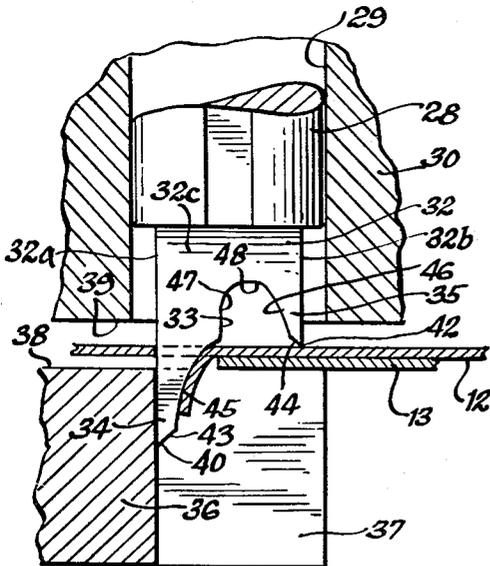
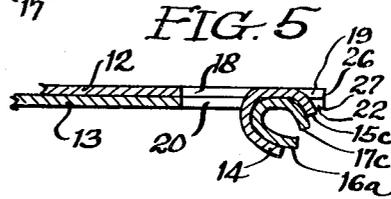
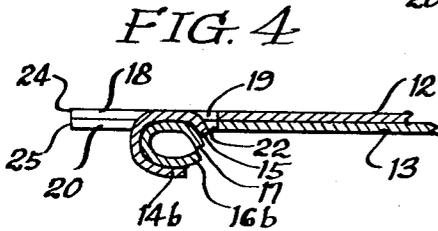
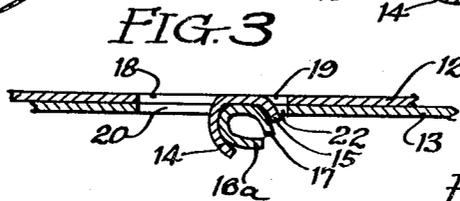
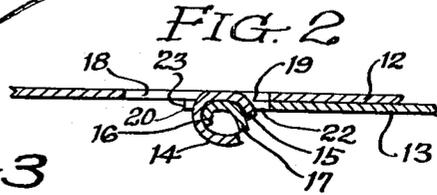
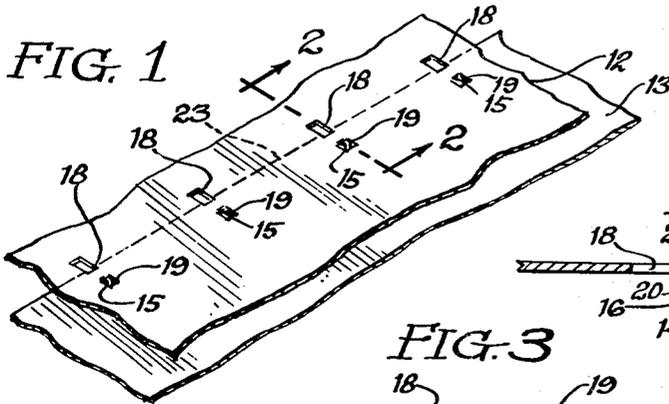


FIG. 6

FIG. 7

INVENTORS:
Lester L. Smith
Frank E. Randall

By
Horton, Davie, Brewer & Prugman
Attorneys

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FIG. 8

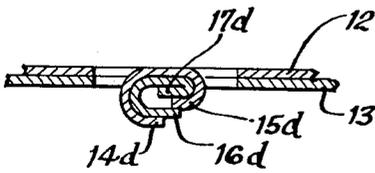


FIG. 9

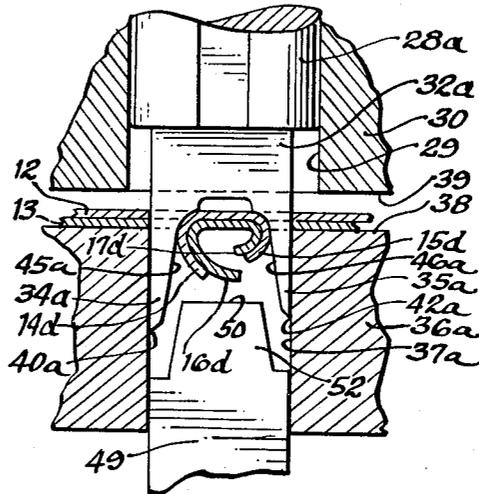
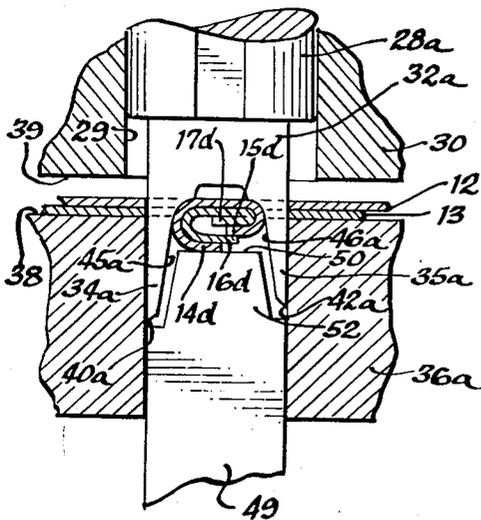


FIG. 10



INVENTORS:
Lester L. Smith
Frank E. Randall

By
Horton, Davis, Brewer & Crugman
Attorneys

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TOOL AND METHOD FOR SECURING SHEET METAL PIECES TOGETHER

Lester L. Smith, 3300 N. Adams St., Peoria 3, Ill., and Frank E. Randall, Peoria Heights, Ill.; said Randall assignor to said Smith

Original application Feb. 24, 1955, Ser. No. 490,338, now Patent No. 2,901,816, dated Sept. 1, 1959. Divided and this application Sept. 10, 1958, Ser. No. 760,212
2 Claims. (Cl. 29-509)

This invention relates to a method for securing sheet metal pieces together without utilizing separate or additional fastening elements, such as rivets.

This application is a division of our copending application, Serial No. 490,338, filed February 24, 1955, now Patent No. 2,901,816, for Tool and Method for Securing Sheet Metal Pieces Together.

One of the general objects of our invention is to provide a fastening method adapted to effect relatively quick and rapid securement of sheet metal stock or pieces in face-to-face relationship by the punching and orderly deformation of small areas of the stock or pieces while they are held in the position in which they are to be secured.

Our invention further has within its purview the provision of a method for fastening sheet metal pieces in face-to-face relationship and which comprehend the use of a punching and forming die having two portions in spaced and opposed relationship which each punch and form the metal of the pieces and which are shaped and related so as to effect their respective punching and forming operations in a predetermined sequence, whereby the punched and deformed parts of the pieces have predetermined gripping engagement.

The invention has for another object the provision of a method for securing sheet metal pieces in face-to-face relationship by die punching and forming relatively small portions of the metal pieces either at the edge region of one or both of the pieces or internally of the margins of the pieces.

As another object, our invention comprehends the provision of a method for securing metal sheets in surface contact with one another and wherein a single die may be used which includes two punching and forming portions which act in relative and opposed relationship to one another in such a way that they tend to prevent relative movements between the sheets during the punching and forming operations.

It is also an object of our invention to provide a method for securing metal sheets in surface contact and by which spaced tongues are punched from the sheets and formed together into gripping relationship by contacts with related and curved surface portions of parts of the tool which accomplish the punching.

Our invention comprehends the provision of a method which is adapted to use on metal sheets of various thicknesses, as well as to use in either manually or power operated hand or bench tools, or in conjunction with larger machines, such as punch presses.

Furthermore, our tool and method have within their purview the provision of a punching and forming die adapted to produce tongues in gripping relationship and an anvil for pressing the tongues into tighter holding relationship.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings in which similar characters of reference indicate similar parts throughout the several views.

In the two sheets of drawings:

FIG. 1 is a fragmentary perspective view showing two pieces of sheet metal secured together in predetermined

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relationship to one another by our preferred method without the aid of separate fastening elements, and in accordance with this invention;

FIG. 2 is a fragmentary sectional view taken substantially as indicated by a line 2-2 and accompanying arrows in FIG. 1;

FIGS. 3, 4 and 5 are fragmentary sectional views similar to FIG. 2, but illustrating the use of our fastening method of this invention with the pieces of sheet metal stock associated in different superposed and face-to-face positions;

FIG. 6 is a fragmentary side elevational view depicting a portion of one form of fastening tool during a stage of the operation of securing sheet metal pieces together by our disclosed method and in the relationship disclosed in FIGS. 1 and 2;

FIG. 7 is a view similar to FIG. 6, but illustrating the operation of the tool after it has progressed beyond the stage shown in FIG. 6;

FIG. 8 is a fragmentary side sectional view of sheet metal pieces secured together in superposed and face-to-face relationship by a method and tool which are modified in respect to those illustrated in FIGS. 1 to 7 inclusive; and

FIGS. 9 and 10 are fragmentary side sectional views of portions of one type of tool adapted to use in accordance with our method for producing the fastening illustrated in FIG. 8, the views of FIGS. 9 and 10 differing in the stage of operation of the tool.

In the exemplary embodiment of our invention, which is described herein for illustrative purposes, we have disclosed the method and one type of tool for securing metal parts together in superposed face-to-face relationship, as illustrated in FIGS. 1 to 5 inclusive and 8. In the fastening structures there illustrated, pieces of sheet metal stock 12 and 13 are laid together in superposed and face-to-face relationship, as illustrated in FIGS. 1 to 5 inclusive and 8. In the fastening structures there illustrated, pieces of sheet metal stock 12 and 13 are laid together in superposed and face-to-face relationship, and integral tongues 14, 15, 16 and 17 are punched therefrom in aligned, opposed and spaced relationship, and those tongues are formed by the punching tool during the punching operation to effect the formation of opposed holding elements in gripping relationship; that is, as depicted particularly in FIGS. 1 and 2, the tongue 14 constitutes metal punched from the sheet 12 and which leaves in that sheet a slot type opening 18. The tongue 15 is also integral with the sheet 12 and is punched therefrom to leave a slot type opening 19 in spaced and opposed relationship to the opening 18. The tongues 16 and 17 are each integral with the sheet 13 and are provided by metal removed from slot type openings 20 and 22 directly below and aligned with the openings 18 and 19 respectively.

In the fastening illustrated in FIG. 2, the length of the tongue 16 is limited by the fact that the fastening is applied to the sheets close to an edge 23 of the sheet 13. The tongues, in order to secure the sheets 12 and 13 against separation from one another and also against face-to-face sliding movements in any direction, are formed away from one face of the superposed sheets, with the tongues, such as 14 and 15, from one sheet, overlying the tongues, such as 16 and 17, of the other sheet.

Also in the disclosed embodiment of our invention the opposed tongues from each sheet are formed in opposite directions, so that their ends approach one another. In fact, as illustrated, the tongues of the two sheets are curled longitudinally into a gripping and interlocking relationship which holds the two sheets tightly together.

As depicted in FIG. 3, the fastening is utilized at a position spaced from the edges of the secured pieces of

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sheet metal stock. In this instance the tongue 16a is of the same length as the tongue 14, and is longer than the tongue 16 of FIG. 2, which latter tongue was shortened by its placement relative to the edge of the sheet 13. Otherwise, the structures depicted in FIGS. 2 and 3 are similar and corresponding reference numerals refer to like parts.

As shown in FIG. 4, edges 24 and 25 of the pieces 12 and 13 are adjacent and slots 18 and 20 extend to those edges. In this instance the lengths of tongues 14b and 16b are each dependent upon the placement of the fastening structure relative to the edges 24 and 25 of the pieces 12 and 13 should of course be sufficient to provide reasonable overlapping of the tongue 14b with the tongue 16b to afford good gripping engagement therebetween.

Referring to FIG. 5, the slot type openings 19 and 22 extend to adjacent edges 26 and 27 of the sheet metal pieces 12 and 13, so that the lengths of tongues 15c and 17c depend upon the distance between the fastening structure and the adjacent edges. It may be observed, however, that the opposed tongues 14 and 16a in the sheet metal pieces 12 and 13 conform substantially in structure and length to the corresponding tongues illustrated in FIG. 3.

From the foregoing illustrations of our fastening structure, it may be readily understood that it is not limited to any particular position of the sheet metal pieces which are being secured together thereby. That is, the fastening structure may be adjacent the edge or edges of one of both sheet metal pieces, or may be located entirely within the margins of the sheet metal pieces. Also, it is worthy of note that the opposed tongues may be punched so that they are in parallel, perpendicular or angular relationship to the edges of the sheets which are secured together thereby. As depicted in FIG. 1, the securement of large pieces in superposed face-to-face relationship may require a series or plurality of the fastenings in order securely to hold such sheets of larger area in their intended positions.

FIGS. 6 and 7 provide illustrations of one type of tool adapted to produce fastenings of the type described and serve to illustrate steps which occur in our preferred method of producing such fastenings. As there shown, a punch 28 is supported for linear sliding movement in a bearing bore 29 of a punch guide 30. The punch 28 may be of a size suited to the thickness and kind of sheet metal pieces 12 and 13 that are to be secured together thereby, and depending somewhat upon the thickness and kind of material, the punch may be adapted to either manual or various types of power operation.

The punch 28 has an end portion 32 which conforms in its external dimensions and shape to the shapes and dimensions of the fastening tongues which are to be produced thereby. In the disclosed structure the end portion 32 is generally rectangular in its external sectional shape, having relatively narrow end surfaces 32a and 32b and longer side surfaces such as 32c, which end surfaces, in the present instance, are in parallel and opposed relationship to one another, as are the side surfaces such as 32c.

As viewed in FIGS. 6 and 7, the mid-region of the end portion 32 is cut away intermediate the end surfaces 32a and 32b and from one of the side surfaces to the other to provide a recess 33 of irregular contour and to provide punch prongs 34 and 35 adjacent the end surfaces 32a and 32b. In the forms shown in FIGS. 6 and 7, the punch prongs 34 and 35 are of different lengths. The end portion 32 of the punch operates in conjunction with a die 36 having a cavity or slot 37 therein and into which the end portion 32 of the punch is longitudinally movable. A top surface 38 of the die serves as a support for metal pieces such as 12 and 13 which are being secured together, and a slot 39 is provided between the top surface of the die and the lower end of the punch guide 30,

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into which slot the pieces 12 and 13 are inserted for the fastening operation.

The punch prongs 34 and 35 respectively have end cutting edges 40 and 42 at their ends and adjacent the surfaces 32a and 32b. These cutting edges are adjoined by beveled end surfaces 43 and 44 respectively on the two prongs 34 and 35, which end surfaces are in acute angular relationship to the surfaces 32a and 32b. Then, the end surfaces 43 and 44 respectively are adjoined by material forming surfaces 45 and 46 on the interiors of the prongs 34 and 35 and oppositely disposed, which material forming surfaces extend inwardly in angular relationship to the surfaces 32a and 32b and are curved to effect an inward formation in the nature of a curl in the tongues during the progress of the punching operation which is started by the cutting edges 40 and 42 and continued by the action of relatively sharp edges on the opposite sides of the surfaces 45 and 46. In the form shown in FIGS. 6 and 7, the inward curvature of the surface 45 increases for a distance away from the end surface 43, and then is reversely curved to adjoin a relatively straight inner surface portion 47. The inner surface 46 of the prong 45 increases somewhat in curvature away from the end surface 44, and the surfaces 46 and 47 are adjoined through a curved surface 48 to complete the recess 33.

The force required for starting the punching operation is limited by making the punch prongs of different lengths so that they enter the surfaces of the superposed metal pieces at different times. However, the gripping of the metal pieces by the prong 35 after the prong 34 has progressed to some extent with its punching and forming operation has a tendency to insure the holding of the metal pieces 12 and 13 in fixed positions during the punching and forming operations. Also, the opposed relationship of the inner cutting and forming surfaces and edges on the two prongs 34 and 35 has a tendency to maintain the pieces 12 and 13 in fixed relationship to one another during the punching and forming operations. The widths of the two prongs determine the lengths of the opposed tongues which are punched and formed thereby, while the space provided by the surface 48 between the inner surfaces of the prongs effects a separation between the tongues of each opposed pair. It may also be understood that the variation in the curvature of the inner surfaces of the prongs has the effect of varying the degree of abruptness of the curvature of the tongues which are formed thereby. In the form disclosed, the prongs not only punch and form the tongues in opposed relationship during a single downward stroke of the punch, but they also effect a curling or inward curvature of the prongs toward one another to such an extent that the superposed tongues on the two pieces are in a gripping relationship which prevents both relative sliding movement of the pieces and separation of the pieces in a direction perpendicular to their superposed surfaces.

In the modified form of tool shown in two stages of its operation in FIGS. 9 and 10, and which tool is adapted to the production of the attaching structure illustrated in FIG. 8, as in the form described, a punch 28a is supported for linear movement in the bearing bore 29 of the punch guide 30 toward and from a slot type opening or cavity 37a in a die 36a. Also like the form previously described, the punch 28a has an end portion 32a of reduced section which, in the form disclosed, is rectangular and has thereon prongs 34a and 35a with cutting edges 40a and 42a respectively at their ends. In the forms shown in FIGS. 9 and 10, the prongs 34a and 35a are more nearly the same lengths than the prongs of the punch shown in FIGS. 6 and 7, but they are of different lengths for reasons similar to those set forth with respect to the structure of FIGS. 6 and 7. Also, the opposed inner surfaces 45a and 46a of the prongs 34a and 35a are more nearly straight and of more nearly

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the same configuration. Thus, the punch depicted in FIGS. 9 and 10, in its operation, effects the punching and formation of opposed tongues 14d and 15d in the piece 12 and opposed tongues 16d and 17d in the piece 13, the tongues 14d and 15d being superposed upon and curved around the adjacent surfaces of the tongues 16d and 17d respectively, as shown in FIG. 9. In the operation of this punch, the action of the punch itself terminates with the tongues in substantially the positions shown in FIG. 9, wherein the ends of the opposed tongues are somewhat more open than those illustrated in FIGS. 2 to 5 inclusive.

In contrast to the tool depicted in FIGS. 6 and 7, the tool shown in FIGS. 9 and 10 has a lower anvil or platen 49 which is linearly movable into the opening 37a of the die 36a from the bottom and in opposed relationship to the reduced end portion 32a of the punch 28a. The anvil or platen 49 has a relatively flat end surface 50 thereon and an end portion 52 of reduced section which is adapted to extend between the prongs 34a and 35a of the punch 28a while the punch 28a is in its extreme inner punching position, as shown in FIG. 10, to compress and effect close and tight gripping action between the overlapped ends of the tongues. The holding structure thus produced by the punch illustrated in FIGS. 9 and 10 is shown in FIG. 8.

From the foregoing description and reference to the accompanying drawings, it may be readily understood that we have provided a method by which sheet metal pieces may be quickly and securely fastened in face-to-face and superposed relationship without the aid of separate fastening elements. As may also be readily understood, the method is particularly adapted to operation on sheet metal pieces and is adaptable to such sheet metal pieces varying in thickness and size. Also, depending somewhat upon the thickness and sizes of the pieces, the tool may be either manually or power operated.

While we have illustrated a preferred embodiment of our invention, many modifications may be made without departing from the spirit of the invention, and we do not wish to be limited to the precise details set forth, but desire to avail ourselves of all changes within the scope of the appended claims.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

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1. The method of securing sheet metal pieces together in superposed face-to-face relationship which comprises the steps of punching pairs of superposed three edged tongues of different lengths in aligned oppositely disposed and spaced relationship to one another from the superposed pieces, said punching being characterized by starting the punching of the longer pair of tongues prior to starting the punching of the other pair, forming the superposed tongues of each pair along substantially their full lengths and in different amounts as they are punched and so that the opposed tongues of the pieces curl toward one another into practically a closed loop and into gripping relationship with the tongues of one piece overlying the adjacent tongues of the other piece and the ends of the tongues of said other piece in adjacent relationship to one another at a position to one side of the center of the space between the tongues.

2. The method of securing sheet metal pieces together in superposed face-to-face relationship which comprises the steps of progressively punching the pieces from one face and at two positions and with separate punch starting times to cut therefrom pairs of superposed tongues of different lengths in oppositely disposed relationship to one another and spaced apart a distance less than the length of the longer pair of tongues, forming the superposed tongues of each pair at different rates and in different amounts throughout practically the full lengths thereof during the punching operation to effect curling of the oppositely disposed tongues in different amounts and in opposite directions toward one another into practically a closed loop with each tongue from one piece overlying and gripping the superposed tongue of the other piece.

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