

April 28, 1964

T. F. TRIBE
CLINCHING TOOLS AND UNITS

3,130,770

Filed March 3, 1961

4 Sheets-Sheet 1

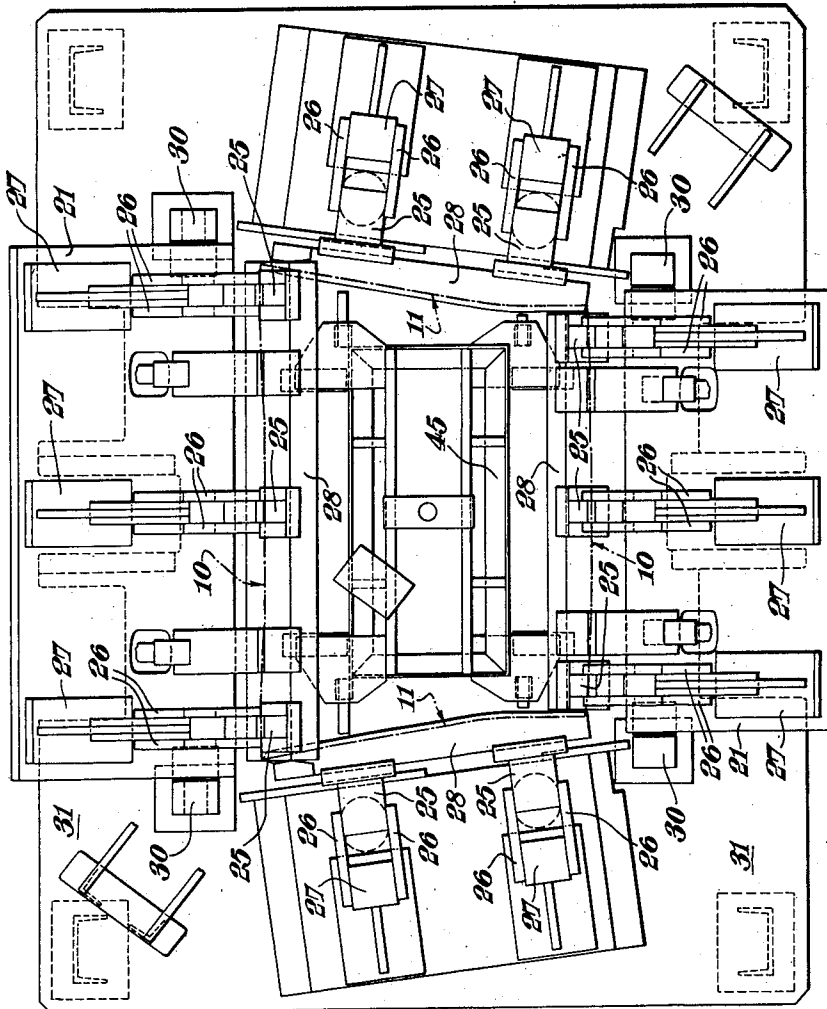


Fig. 1.

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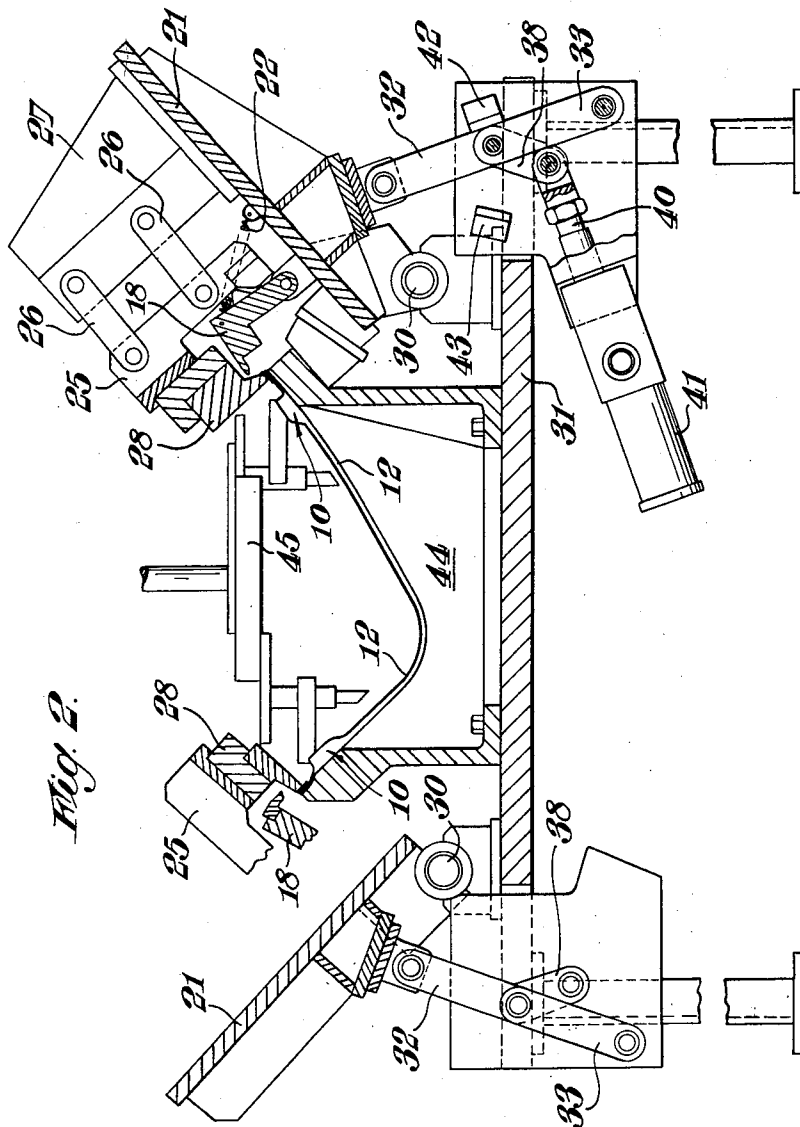


Fig. 2.

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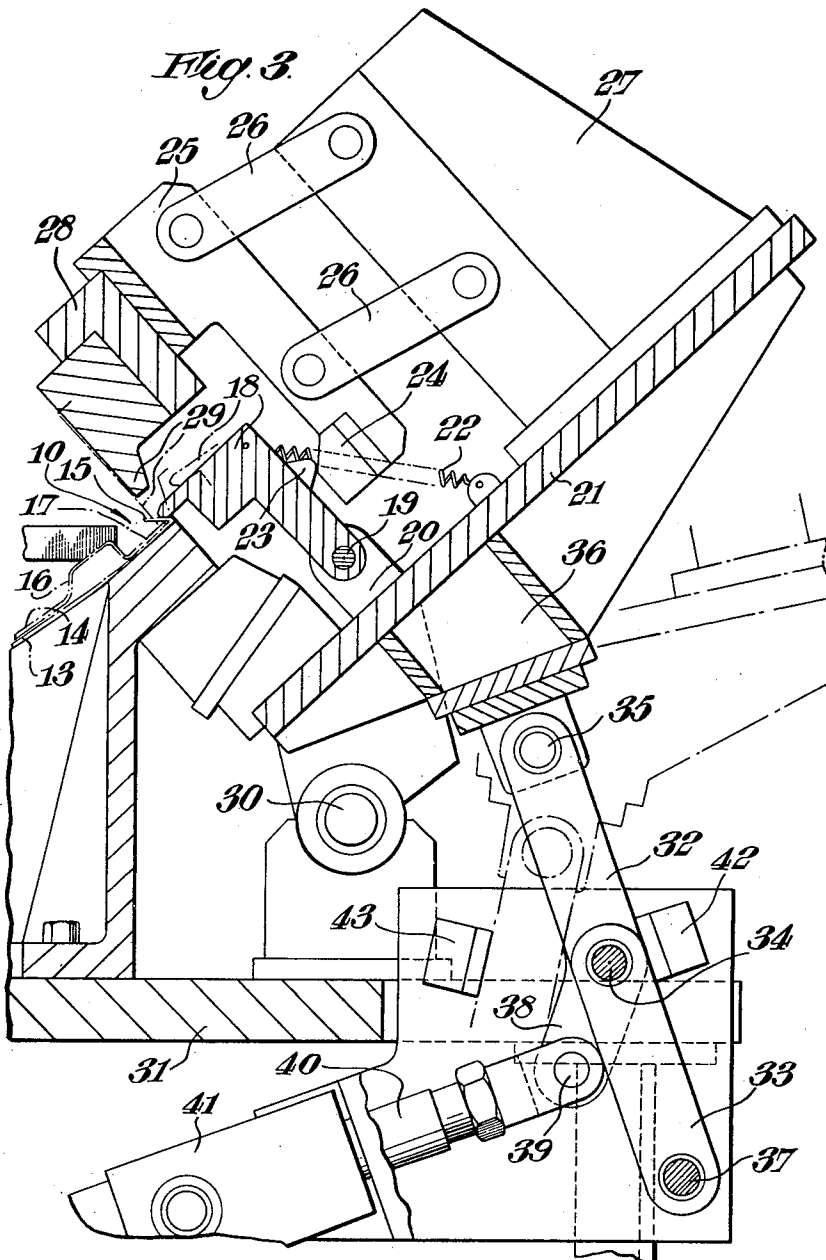
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Filed March 3, 1961

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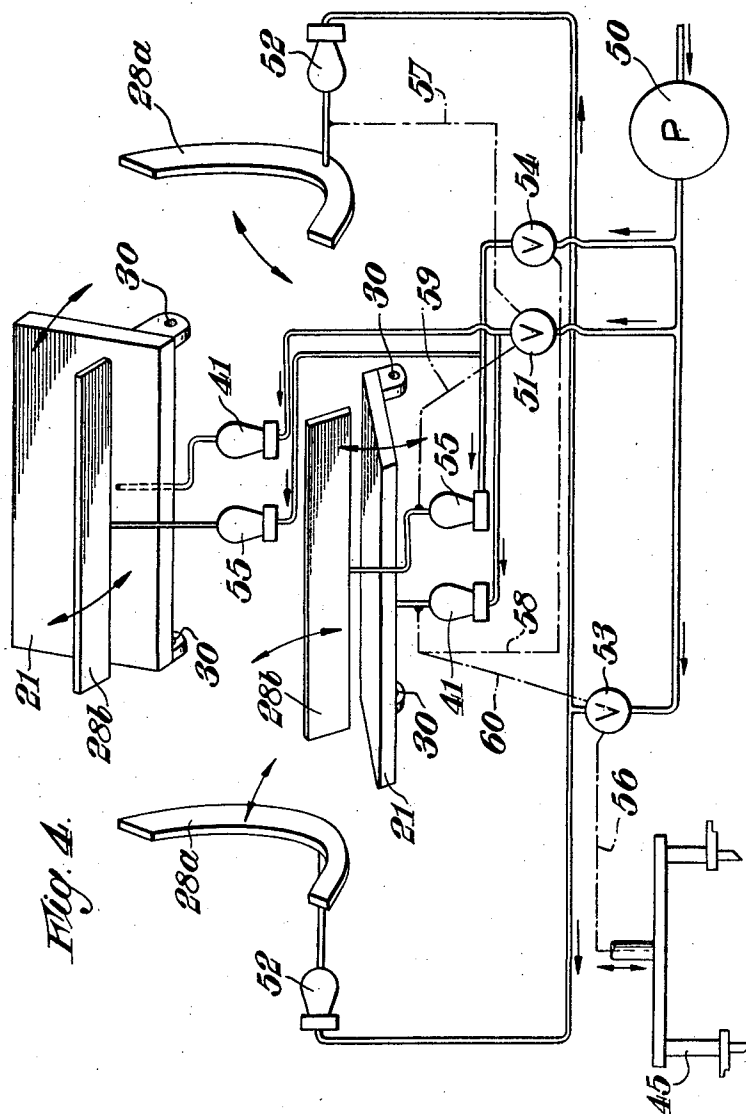
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4 Sheets-Sheet 4



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CLINCHING TOOLS AND UNITS

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Filed Mar. 3, 1961, Ser. No. 93,189

Claims priority, application Great Britain Mar. 11, 1960
9 Claims. (Cl. 153—12)

This invention concerns tools which are hydraulically, pneumatically or mechanically operated for bending the margins of sheet-metal panels and relates more particularly to tools for folding the margin of one panel over and around the margin of another panel and to press the margins firmly into engagement with each other to form a panel structure from the united panels. Such a procedure (which is referred to as clinching) is adopted, for instance, in the production of sheet-metal vehicle doors wherein inner and outer panels of a door are united around their marginal edges in the manner referred to.

For convenience it will be assumed that during the clinching operation the panel structure is in a horizontal plane and the disposition and operation of the several parts of the clinching tools will be described on this assumption but it is to be understood that the sheet metal panel may be in any other plane during clinching.

In our patent application No. 48,214 there is disclosed a clinching tool comprising a member for folding over an upstanding flange of a horizontal sheet-metal panel so that it is acutely inclined to the surface of the panel, a member for pressing the folded-over flange towards said surface and means for actuating the presser member is characterised in that the fold-over member is pivoted for horizontal movement towards the upstanding flange, the presser member is pivotally mounted by a parallelogram linkage for vertical movement and there is provided a mechanical connection between said members, said connection being such that during the first part of the movement of the pressing member the fold-over member is actuated thereby to fold the flange and thereafter the fold-over member is withdrawn from the flange before the presser member engages the folded flange.

It is preferred that the presser member be actuated by a pneumatic ram.

The mechanical connection between the presser member and the fold-over member is preferably a cam on the presser member and a follower on the fold-over member, the latter being urged to its non-operative position for engagement with the cam.

Certain panel structures are not generally in a horizontal plane. For instance, trunk lids for motor vehicles are commonly of V form as seen edge on in one direction the portions of the lid which constitute the limbs of the V being flat. It is necessary that the fold-over member is moved horizontally (i.e. in a direction parallel with the surface of the panel structure) and with a structure of V formation such actuation of the fold-over members must be provided for. It is the object of this invention to provide such actuation and according to this invention a clinching tool comprising a member for folding over an upstanding flange of a sheet metal panel so that it is acutely inclined to the surface of the panel, a member for pressing the folded-over flange towards said surface and means for actuating the presser member is characterised in that the fold-over member is pivoted for movement towards the upstanding flange and the presser member is pivotally mounted for movement in a direction substantially at right angles to the direction of movement of the fold-over member and is further characterised in that said members are mounted on a table which is adjustable to bring said members to a position at which the direction of

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movement of the fold-over member is substantially at right angles to the surface of the upstanding flange.

The invention also comprises a clinching unit comprising a plurality of clinching tools wherein at least one, but not all, of the clinching tools is as set forth in the preceding paragraph.

A clinching unit according to the present invention will now be described, by way of example only, with reference to the accompanying drawing whereof:

FIG. 1 is a plan view of the unit which is provided for clinching a pair of opposite ends and a pair of opposite sides of a trunk lid of rectangular form in plan,

FIG. 2 is a sectional elevation of the unit of FIG. 1 showing the clinching tools for shaping the opposite sides of the trunk lid,

FIG. 3 is a view of one of the clinching tools of FIG. 2 to a larger size, and

FIG. 4 is a diagrammatic view of the clinching unit and an automatic control therefor.

Referring to FIGS. 1 and 2: the trunk lid has a pair of opposite, parallel sides 10 and a pair of opposite converging ends 11 which converge slightly (see FIG. 1). The trunk lid is of V form in section (FIG. 2) the ends 11 being curved upwardly from near their centres, the side portions 12 of the trunk lid being flat and each being inclined to the horizontal at slightly different angles.

As shown more especially in FIG. 3 the trunk lid comprises an outer panel 13 and an inner panel 14. Panel 13 is pre-fabricated to V formation and with a surrounding edge 15 which is upstanding, substantially at right angles, from the marginal portions of the panel. Panel 14 is similarly pre-fabricated to V-formation and is provided with a marginal stiffening channel 16. Panel 14 has edges 17 which lie upon the rear surface of the panel 13 closely with the flange 15.

The clinching unit of this invention is provided to fold the flanges 15 around the edges 17 and to press the folded-over flanges tightly upon the edges, as shown in FIG. 3, thereby to produce a composite panel structure. For each end 11 and each side 10 there is provided a clinching tool comprising a fold-over member pivoted for movement towards flange 15 and a presser member mounted for movement in a direction at right angles to the direction of movement of the fold-over member.

The clinching tool is as disclosed in our patent application No. 48,214 and therefore the construction and operation will not be described in detail. However, in FIGS. 1, 2 and 3 there are shown the main parts of such a clinching tool which comprises a fold-over member 18 pivoted at 19 to a bracket 20 carried by a table 21, the member 18 being retracted by a spring 22 to bring a cam follower 23 into line for engagement by a cam 24 secured to a bar 25 carried by parallel links 26. The links 26 are mounted on a pedestal 27. The bar 25 carries the pressure member 28 which comprises a foot 29 to engage the bent-over flange 15.

As member 28 is lowered, this operation being performed by a pneumatic ram (not shown in FIGS. 2 and 3) the cam 24 engages the follower 23 and moves the fold over member inwardly against the upstanding flange 15 whereby the latter is bent at an acute angle to the surface of portion 12 e.g. at about 45°. The fold-over member is retracted by spring 22 when the cam has been lowered beyond follower 23. At this instant the presser member 28 is still above the bent-over flange 15 and with continued downward movement of the member 28 foot 29 engages the bent-over flange and squeezes it down upon the edge 17. Thereafter the presser member is raised and the clinching tool assumes its initial position.

In FIG. 3 the fold-over member 18 is shown (full lines) in the position which it assumes after the flange has been bent over to an angle of about 45° and prior to the flange

15 being pressed down. In the chain dotted position of FIG. 3 the member 18 is shown retracted and the foot 29 is in the fully lowered position pressing the flange 15 down upon the edge 17.

It is necessary that the fold-over member 18 is advanced, to bend the flange 15, in a direction which is substantially parallel with the portion 12 of the trunk lid (i.e. in a direction generally at right angles to the flange 15) as otherwise the forming operations cannot be performed with certainty and with accuracy.

The fold-over member and the presser member for the V-section ends 11 are of corresponding V-formation with the result that (even when the height of the upstanding flange 15 varies considerably due to manufacturing differences) the fold-over member will bend flange 15 to a predetermined angle and the presser member will press the bent-over flange down upon the edges 17 in such a manner that a uniform clinched joint is obtained and the overall size of the panel structure produced is maintained accurate within close limits.

The fold-over member and the presser member for the sides 10, which are not curved, have straight edges.

As it is necessary that member 18 for each side 10 moves in a direction substantially parallel with the surface of portion 12 the present invention provides that as said surface is inclined at a relatively large angle to the horizontal (see FIG. 2) the clinching tool may be tilted to such an extent that members 18 and 28 will be moved, the former in a direction parallel to the inclined surface of the panel structure and the latter in a direction substantially normal thereto.

To this end the table 21 is pivoted, at 30, for movement about a horizontal axis. The pivot 30 is carried by a frame structure 31 of the clinching unit.

A toggle linkage comprising links 32, 33, which are pivoted together at 34, are secure the former, at 35, to an anchorage block 36 carried by the undersurface of the table 21 and the latter, at 37, to a part of frame 31. An arm 38 is connected, at 39, to the ram 40 of a pneumatic jack 41. A pair of stops 42, 43 are carried by the frame 31. When the jack 31 is actuated in one direction the toggle linkage is moved against the stop 42 (see the full line position of FIG. 3) and in so doing the table 21 is raised. The stop 42 is adjustable in any suitable manner to provide that the table 1 is raised to a predetermined position at which the members 18 and 28 may adequately function on the flange 15 as indicated above. When the jack 41 is actuated in the opposite direction the toggle linkage is set in the chain dotted position shown in FIG. 3 and the table 21 is lowered to a position determined by the stop 43, which is adjustable if required.

The panels 13, 14 are placed upon a pad or cradle 44 (FIG. 2) and are secured thereto by a clamp 45 which is lowered to engage the panel. Thereafter the clinching tools for the end 11 are both actuated and the presser members of these tools are maintained in operation to assist the clamp 45 in holding the panel in position upon the cradle 44. While this is being done the clinching tools for the sides 10 are actuated, subsequently the tables 21 are lowered before the clinching tools for the ends 11 are released and the clamp 45 raised to permit withdrawal of the panel structure. The sequence of operations referred to is necessary where the V form of the panel structure is sufficiently deep as to result in the clinching tools for the sides 10 and the ends 11 interfering with each other. Thus, in the particular arrangement being described the clinching tools for the sides 10 when their members 28 are holding the flanges 15 pressed down against the edges 17 will interfere with the clinching tools of the ends 11 in that they will prevent retraction of these tools. It is for this reason that the tables 21 are lowered prior to the clinching tools for the ends 11 being retracted.

The sequence of operations briefly referred to will now be described with reference to FIG. 4. In this drawing (as a matter of convenience) only the presser members

for the clinching tools are shown, the fold-over members 18 being omitted, since the fold-over members 18, being coupled to members 28, are simultaneously actuated, as described above. Accordingly the presser members shown diagrammatically in FIG. 4 represent both members 18 and 28 and these members for the clinching tools associated with the V-section ends 11 are collectively indicated by the reference numerals 28a and these members for the tools mounted on tables 21 are collectively indicated at 28b.

The tables 21 are actuated by the pneumatic jacks 41 which are supplied with compressed air from a suitable source (indicated as a pump 50) through control valves 51, the valve 51 being common to both of the pneumatic jacks. The pump 50 also supplies, through a valve 53, a pair of pneumatic jacks 52 which are provided to operate the members 28a, the valve 53 being again common to both of the jacks 52. Similarly, a common valve 54 controls operation of pneumatic jacks 55 of the members 28b.

Assuming that both panels 13, 14 have been placed upon the cradle 44, a starting button is pressed by the operator whereupon the clamp 45 is lowered (e.g. by a pneumatic jack) to hold the panels in position. The clamp 45 is connected (by a coupling diagrammatically indicated at 56) with the valve 53 so that after the clamp has been lowered to hold the panels in position upon the cradle 44 the valve 53 will be opened. The jacks 52 are operated and the clinching operations on both of the ends 11 of the panel structure are simultaneously performed. When these clinching operations are completed the valve 53 remains open so that the presser members 28a assist in holding the panels to the cradle as described above.

The valve 51 is connected with one of the jacks 52 (by a coupling diagrammatically indicated 57) so that when the clinching operation on the ends 11 has been completed the valve 51 is opened and jacks 41 are actuated to tilt the tables 21 as already described. The table 21 at the left hand side of FIG. 2 will be tilted to a greater angle than the table 21 on the right hand side so that the fold-over member 18 of the left-hand table 21 and the associated presser member 28 will function in the most effective position having regard to the inclination of the left-hand portion 12 of the trunk lid, the table 21 on the right hand side being brought to a corresponding position in relation to the portion 12 on the right hand side of the trunk lid as seen in FIG. 2.

The valve 54 is connected with one of the jacks 41 by a coupling 58 so that when the tables 21 are in their fully tilted position the members 28b are actuated. Thereafter the valve 54 is opened either manually by the operator or electrically under control of a switch which is actuated by the pressure members 28b or pneumatically upon a build-up in pressure within the jacks 41. In any event the effect in that when the clinching operation has been full performed by members 28b the valve 54 is opened whereupon the jacks 55 retract members 28b from their operative position. Valve 51 is connected to jack 55 by a coupling 59 (which is independent of the coupling 57) the arrangement being that retraction of the members 28b adjusts valve 51 to operate jacks 41 so that tables 21 are lowered. When the tables 21 are lowered a coupling 60 between jack 41 and valve 53 (this coupling being independent of the coupling 58) sets the valve 53 so that the members 28a for the ends 11 are retracted. Either this retracting operation is used automatically to withdraw the clamp 45 or this operation is performed under manual control of the operator.

The sides 10 of the panel structure may be curved in a direction normal to the surface of the portions 12 (i.e. as seen in side view) in which event the related fold-over members 18 and the presser members 28 are correspondingly shaped. For instance, the sides 10 may be of V formation similar to the ends 11. Alternatively, or additionally, the edges of the sides 10 may be of curved form as seen in plan in which event the related members 18 and

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28 are of corresponding shape in plan. Again, of course, the ends 11 may have edges which are of curved or similar formation in plan. Indeed, as will be apparent from FIG. 1, the ends 11 in the particular example of trunk lid which has been illustrated are of shallow V form in plan and the members 18 and 28 associated therewith are similarly shaped.

Hydraulic jacks may be used instead of the pneumatic jacks. Alternatively the jacks may be replaced by mechanical actuators which may be electrically operated.

I claim:

1. A clinching tool comprising a frame, a table tiltably mounted on the frame, a member to fold over an upstanding flange of a sheet metal panel so that it is acutely inclined to the panel surface which member is pivotally mounted on said table for movement towards and away from the upstanding flange, means to tilt said table to bring the pivotal axis of such fold-over member to a position at which the direction of movement of said fold-over member is substantially normal to the surface of the upstanding flange, a member to press the folded-over flange towards the panel surface with a clinching action which member is swingably mounted on the table for movement towards and away from the panel surface, means to actuate such presser member and means to actuate said fold-over member by way of said presser member.

2. A clinching tool as claimed in claim 1 wherein the table is tiltable by a toggle linkage and there is a fixed stop engageable by a member of the toggle linkage to limit the tilting movement of the table.

3. A clinching tool as claimed in claim 2 wherein said stop is adjustable.

4. A clinching unit comprising a plurality of clinching tools wherein at least one, but not all, of the clinching tools is as claimed in claim 1.

5. A clinching unit as claimed in claim 4 wherein the table-mounted clinching tool performs its clinching operation after the unmounted tools have done so and wherein the mounted clinching tool is retracted from its operative

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position prior to retraction of the unmounted clinching tools.

6. A clinching unit as claimed in claim 5 characterised in that there are at least a pair of table-mounted clinching tools which are simultaneously operated and simultaneously retracted from the workpiece and wherein the tables are simultaneously tilted.

7. A clinching unit as claimed in claim 6 in which there are at least a pair of unmounted clinching tools, said tools being simultaneously operated to fold a flange of the sheet metal panel and being simultaneously retracted from the operative position.

8. A unit as claimed in claim 7 wherein the clinching tools are operated hydraulically or pneumatically and valves are provided to operate the table-mounted clinching tools, the unmounted clinching tools and tilting of the tables, the valves being coupled with moving parts of the clinching unit so that a sequence of operations is automatically performed which comprises, firstly, clinching flanges of the panel by the unmounted tools and maintaining said tools in clinching position, secondly, tilting the tables from an initial to a pre-selected position, thirdly, actuating the table-mounted clinching tools to clinch other flanges of the panel, fourthly, retracting the mounted clinching tools from their operative position, fifthly, returning the tables to their initial position and then retracting the unmounted tools from their operative position.

9. A clinching unit as claimed in claim 8 wherein the panels are placed upon a fixed cradle and are held thereon by a clamp, actuation of which to its clamping position initiates said cycle of operations.

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