

May 23, 1944.

D. E. GILLUM ET AL

2,349,495

APPARATUS FOR PRODUCING SHEET-LIKE MATERIAL

Filed June 4, 1942

2 Sheets-Sheet 1

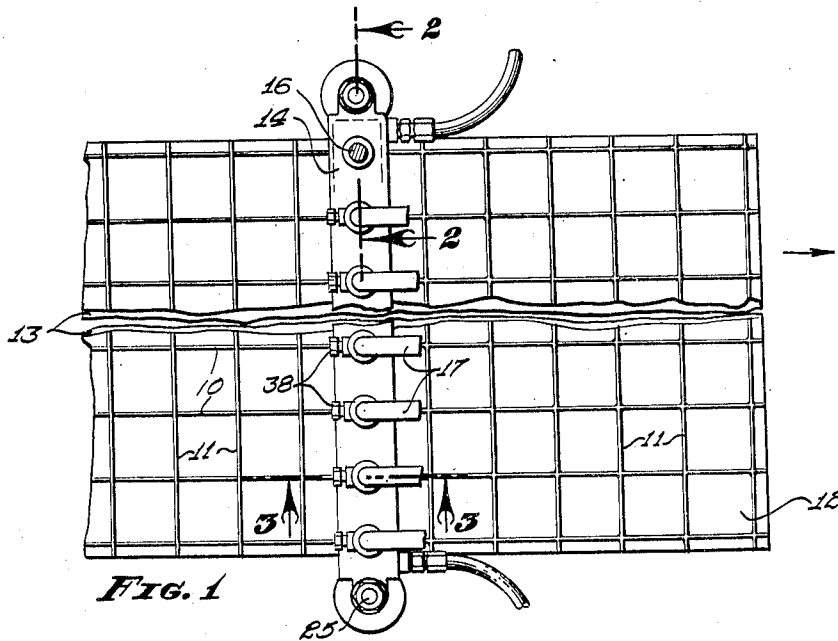


FIG. 1

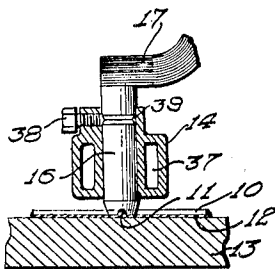


FIG. 3

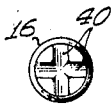


FIG. 4

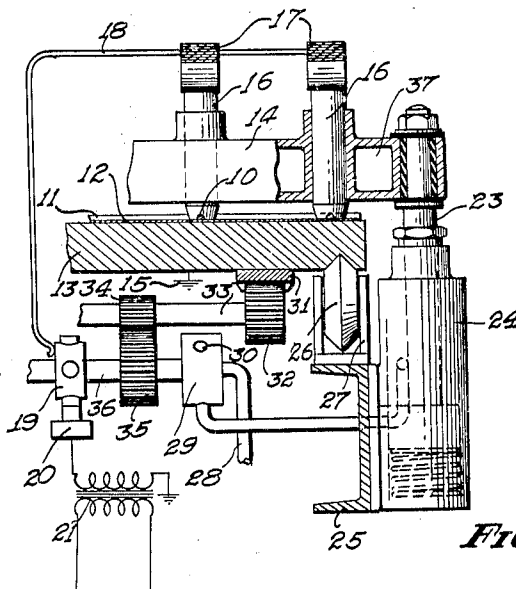


FIG. 2

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2 Sheets-Sheet 2

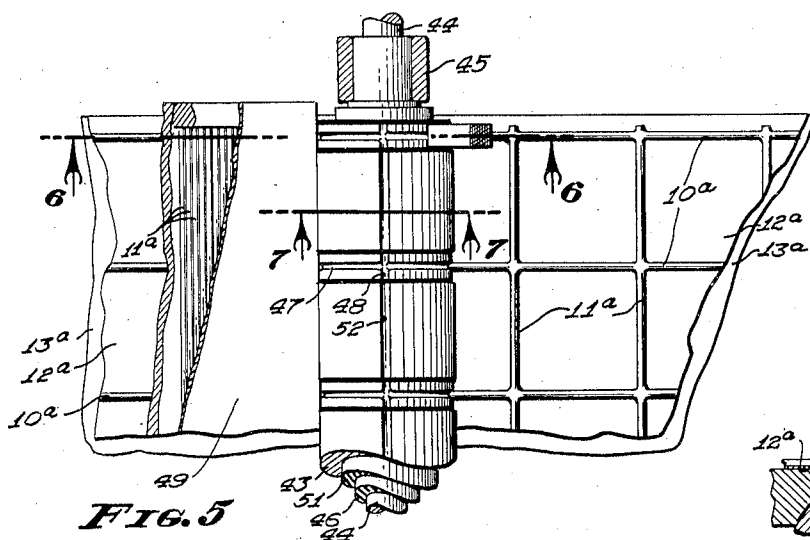


FIG. 5

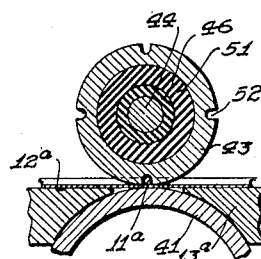


FIG. 7

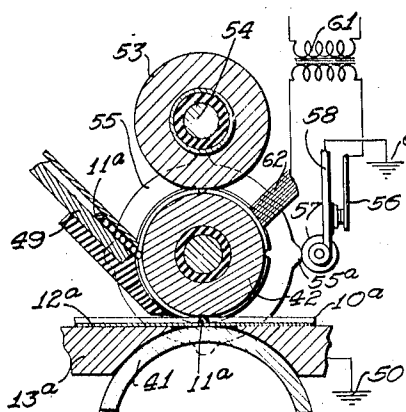


FIG. 6

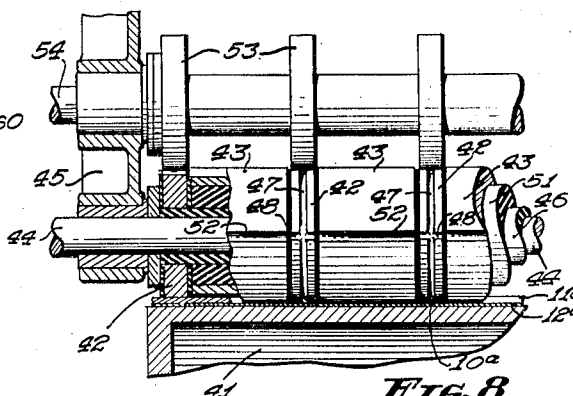


FIG. 8

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2,349,495

APPARATUS FOR PRODUCING SHEETLIKE MATERIAL

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Application June 4, 1942, Serial No. 445,822

4 Claims. (Cl. 219—4)

The present invention relates generally to a method and apparatus for producing reenforced sheet-like material having as its foundation sheet metal, such as sheet steel, sheet aluminum, and the like, for use where weight-stiffness ratio is of primary importance, as for example the skin coverings or panel construction of airplanes, airships, automobiles, railway cars, and in fact many other uses where such sheet metal is subjected to vibrating forces or influences.

The primary object of the invention is the provision of a method and apparatus whereby to apply stiffening or reenforcing elements to sheet metal in such manner as to become substantially an integral part of the metal sheet, and in such manner that the sheet will be greatly stiffened to resist vibrating forces and influences with comparatively little addition to its normal weight.

More particularly the present invention proposes a method and apparatus whereby stiffening wires in crossing relation are spot welded to sheet metal, the spot welding serving to thus intimately unite with the plate the wires and the wire joints, whether the wire is a pre-fabricated mesh, or the wires are separately laid on the sheet metal, and the spot welds serve to permanently unite the wires to each other at the joints and unite the joints to the sheet metal. Welds may also be made of the wires to the sheet metal, between the joints.

The invention also comprises novel details of construction and novel combinations and arrangements of parts, which will more fully appear in the course of the following description. However, the drawings merely show and the following description merely describes, certain selected embodiments of the present invention, which are given by way of illustration or example only. Reference is made to our co-pending applications, Serial No. 441,600, filed May 4, 1942, and Serial No. 454,974, filed August 15, 1942, as to matter disclosed but not claimed herein.

Fig. 1 is a top plan view of one form of the invention.

Figs. 2 and 3 are respectively a vertical transverse sectional view and a vertical longitudinal sectional view, partially through Fig. 1, taken substantially along lines 2—2 and 3—3 of said figure.

Fig. 4 is a bottom plan view of one of the upper or cross-head electrodes.

Fig. 5 is a top plan view, partly in section, showing another form of the invention.

Figs. 6 and 7 are vertical longitudinal sectional

views taken respectively on lines 6—6 and 7—7 of Fig. 5, and,

Fig. 8 is a vertical transverse sectional view, showing the welding roll partly broken away and in section.

Referring now to Figs. 1 to 4, there is shown an apparatus to spot weld crossing stiffening wires or wire-like elements 10 and 11 along their lengths and at their junctions or crossing points, to sheet metal 12. It is contemplated that the elements may be a pre-fabricated mesh, or one wherein the wire elements have been separately placed, and relatively held in any manner so that the joints are properly positioned definitely in alignment with the cross-over welding electrodes as hereinafter mentioned. The wires may be spot welded to the sheet metal not only at the crossing points or junctions of the crossing elements, but also at intervening points of the wires. It is also believed obvious that the mesh reinforcement may include wire elements at other than right angles with respect to one another.

The sheet metal 12 is for the above reasons supported upon a horizontally movable table 13 above which is a welding cross head 14. The table 13 may constitute one electrode and for this purpose may be grounded at 15.

The cross head 14 supports a battery of vertical welding electrodes 16, to the flexible brushes 17 of which a conductor 18 may lead from a distributor 19, through which current is supplied at regular intervals from a stationary contact 20 connected to one side of a transformer 21, or other suitable source of welding current.

The cross head 14 is connected at its ends to, and insulated from, vertical plungers 23, and these plungers may be spring supported in cylinders 24 anchored to supporting rails 25 beneath the table 13. It is preferable, to insure lateral and longitudinal stability and registration of the supporting table 13, that it be provided in its under surface with V-shaped grooves engaged by similar shaped supporting rollers 26, as seen in Fig. 2. These supporting rollers may be journaled in brackets 27 which are securely anchored on the above mentioned rails 25 and will, of course, be insulated therefrom.

The plungers 23 may have pistons in the cylinders 24 with springs beneath the pistons to urge the cross head 14 upwardly, air being supplied to the cylinders above the pistons from an air supply pipe 28, through a rotary valve, indicated at 29 in Fig. 2, which functions to alternately place the cylinders 24 in communication with the air supply and with an exhaust opening 30, to

control alternate up and down movements of the cross head.

As also seen in Fig. 2, the table 13 may be moved by providing therebeneath a rack 31 engaged by a pinion 32 on a suitably driven shaft 33. For coordinating the movements of the table with the supply of welding current and the lowering and raising of the welding cross head, shaft 33 may be connected by gears 34 and 35 with a shaft 36 upon which the distributor 19 and valve 29 are mounted. Movement of table 13 may be rendered intermittent through any suitable connections as by utilizing a mutilated pinion so that as successive joints of the wires 10 and 11 or single wires are registered beneath the welding electrodes 16, the table will be arrested as the cross head 14 is lowered to apply the lower ends of the electrodes to the joints or desired spot locations for effecting the welding operation.

As seen by a comparison of Figs. 2 and 3, the cross head 14 is preferably hollow to form therein a water cooling chamber 37, although water circulating connections, being so well known for this purpose, no showing of such connections has been made. Fig. 3 indicates that the electrodes 16 may be removably held in the cross head by set screws 38 entering annular grooves 39 of the electrodes, and from Fig. 4 it is plain the lower welding ends of these electrodes may have crossing grooves 40 to receive the crossing wires 10 and 11 when welding at the joints. Obviously the configuration of these grooves will coincide with the mesh of the wire reinforcement.

According to the form of the invention shown in Figs. 5 to 8 inclusive, the same method may be carried out by feeding cross wires 11a as the sheet metal 12a moves on table 13a after having had the longitudinal wires 10a applied thereto previously by any suitable method and apparatus, as for instance by a seam welding operation.

In this instance the table 13a is stationary and the sheet metal 12a moves thereon between a lower pressure roll 41 operating through a feed throat of the table, and an upper welding roll, the latter of which is made up of a series of alternating welding rollers 42 and pressure cylinders 43. These rollers and cylinders are mounted on a shaft 44 the ends of which are journaled in brackets 45, an insulating sleeve 46 being disposed around the shaft.

The welding rollers 42 have annular grooves 47 which receive the wires 10a, and axial grooves 48 intersecting the annular grooves at equidistantly spaced points circumferentially of the rollers which receive the wires 11a from a feed chute 49 and place the same across the wires 10a as welding current flows through the rollers and through the sheet metal 12a and table 13a to ground at 50.

For the above purpose the pressure cylinders 43 which contact the sheet metal 12a at all times and have yieldable cores 51 around the insulating sleeve 46, are provided with axially extruding surface grooves 52 somewhat greater in both width and depth than the grooves 48 of the welding rollers, with which grooves 52 aline. Thus the pressure cylinders straddle or walk over the applied cross wires 11a as the latter are welded, their yielding cores 51 pressing the same into snug, forceful contact with the sheet metal 12a at all times.

The welding rollers 42 are engaged at the upper portions thereof by pressure rollers 53 to thus hold the welding rollers against upward yield as they ride the applied cross wires 11a. Rollers

53 are mounted in spaced relation on, and insulated from, an upper shaft 54 paralleling shaft 44 and also journaled in the bearing bracket 45.

At a suitable point on shaft 44 which may be the driven shaft for causing feeding movement of the sheet metal 12a on the table, there is fixed a switch control roller or disc 55 as seen in Fig. 6, having radially outstanding bosses 55a at spaced points therearound in line with grooves 48 and 52. A roller 57 on a spring switch arm 58 tracks on the switch control roller 55 and when shifted by one of the peripheral bosses 55a, moves the switch arm 58 to bring a contact thereof into engagement with the contact of a switch arm 56. The arm 58 is grounded at 60, and the arm 56 is connected to one side of a transformer 61, or other suitable source of welding current. The same side of the transformer is connected to a series of brushes 62 engaging the surfaces of the several welding rollers 42.

Thus as the wires 11a fed into the grooves 48 and 52 are carried down to the wires 10a, welding current is applied to weld the same as they are pressed downwardly across the latter wires, with the result that the wire joints or junctions are formed and welded to the sheet metal, the spot welding of this form producing substantially the same result, according to the same method, as that first above described.

It is believed clear without further illustration that a battery of welding electrodes, such as shown on 14, may be positioned ahead of the welding rollers 42, to tack the longitudinal wires 10a on the sheet 12a. The longitudinal wires may be fed from any suitable sources, such as reels. Illustrations of such reels are believed unnecessary for those skilled in the art.

While we have illustrated and described what we now regard as the preferred embodiment of our invention, the construction is, of course, subject to modifications without departing from the spirit and scope of our invention. We, therefore, do not wish to restrict ourselves to the particular form of construction illustrated and described, but desire to avail ourselves of all modifications that may fall within the scope of the appended claims.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:

1. In an apparatus for strengthening sheet metal, a horizontally movable table for supporting sheet metal with wire mesh thereon, a welding cross head above the table, a series of welding electrodes carried by said cross head, means for shifting the cross head vertically to apply and retract the electrodes with respect to the work on the table, means for supplying welding current to said electrodes when lowered to engage the work, and mechanism actuated by the table and controlling, in timed relation thereto, the cross head shifting means and welding current supply means at each line of wire mesh joints.

2. In an apparatus for stiffening and strengthening sheet metal, means for supporting and moving sheet metal with wire mesh disposed upon its upper exposed surface, having the joints of its mesh in line across the sheet metal, a series of upper electrodes connected to move vertically in unison into, and out of, engagement with successive lines of joints of the wire mesh, the support of the sheet metal constituting a single lower electrode common to the several joints to which the upper electrodes are applied, means for raising and lowering the upper electrodes, means for supplying welding current simultaneously

through the upper electrodes and through the common lower electrode when the former are engaged with the mesh joints, and mechanism actuated by the sheet metal and wire moving means and controlling, in timed relation thereto, the said movements of the upper electrodes and the said supply of welding current as each line of mesh joints aligns beneath the electrodes.

3. In an apparatus for stiffening and strengthening sheet metal, means for supporting and moving sheet metal with wire mesh disposed upon its upper exposed surface, having the joints of its mesh in line across the sheet metal, a series of upper electrodes connected to move vertically in unison into, and out of, engagement with successive lines of joints of the wire mesh, the support of the sheet metal constituting a single lower electrode common to the several joints to which the upper electrodes are applied, a timing shaft connected to the movable support to be actuated in synchronism therewith, means controlled by said timing shaft for shifting the connected upper electrodes to and from engagement with the work

and means also controlled by the timing shaft for supplying welding current to the electrodes when the latter are lowered to engage the work.

4. In an apparatus for strengthening sheet metal, a horizontally movable table for supporting sheet metal with wire mesh thereon, a welding cross head above the table, having depending plungers at opposite sides of the table, cylinders in which said plungers operate to raise and lower the cross head, springs for elevating the plungers, a series of welding electrodes carried by the cross head and arranged to engage joints of the wire mesh when the cross head is lowered, means coordinated with movement of the table for supplying welding current to said electrodes when the latter engage the wire joints, and means also coordinated with movement of the table for controlling the supply of fluid pressure to the cylinders for lowering the cross head, and its exhaust therefrom.

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