March 26, 1963 W. I. BALLENTINE, JR., ET AL 3,082,519

METHOD FOR MAKING METAL PANELS

Original Filed Dec. 16, 1957 2 Sheets-Sheet 1

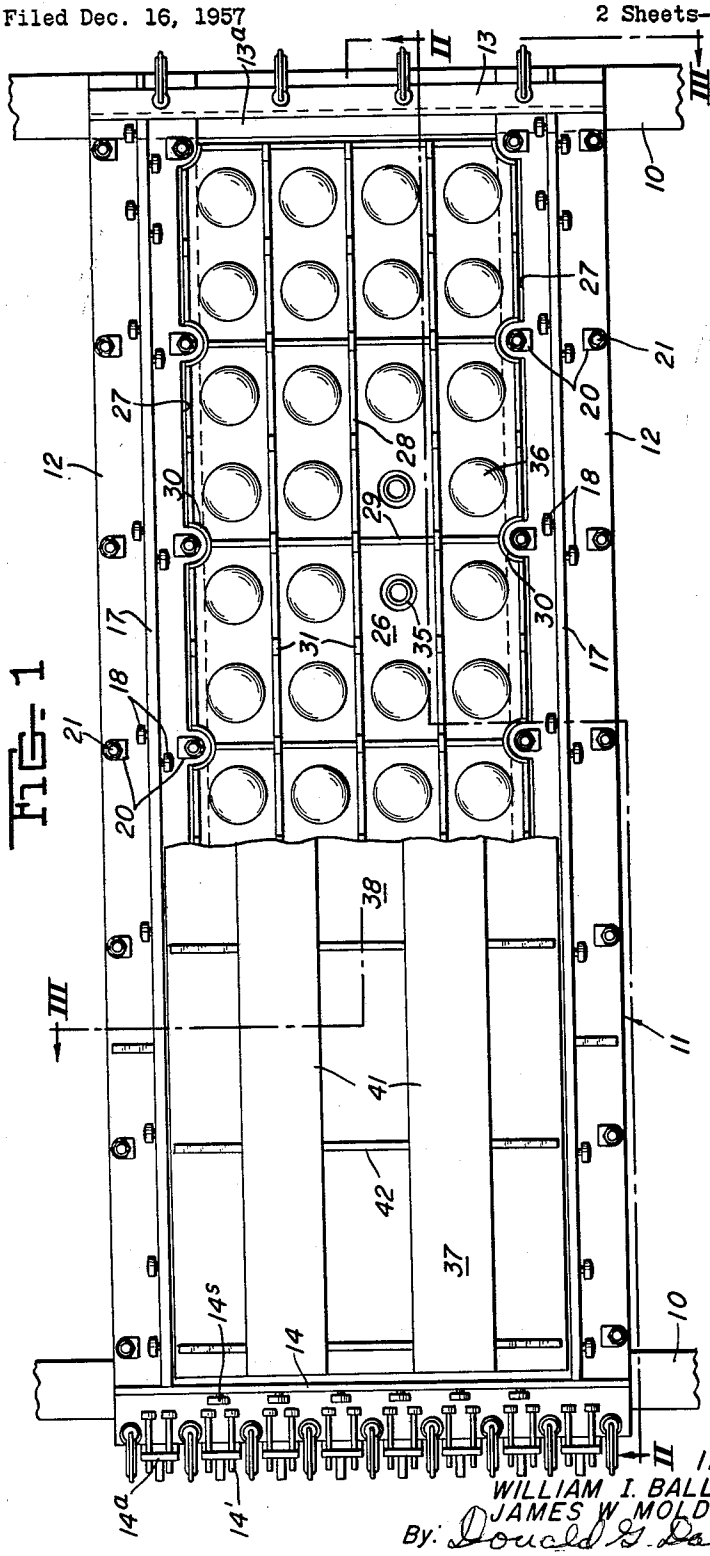


FIG. 1

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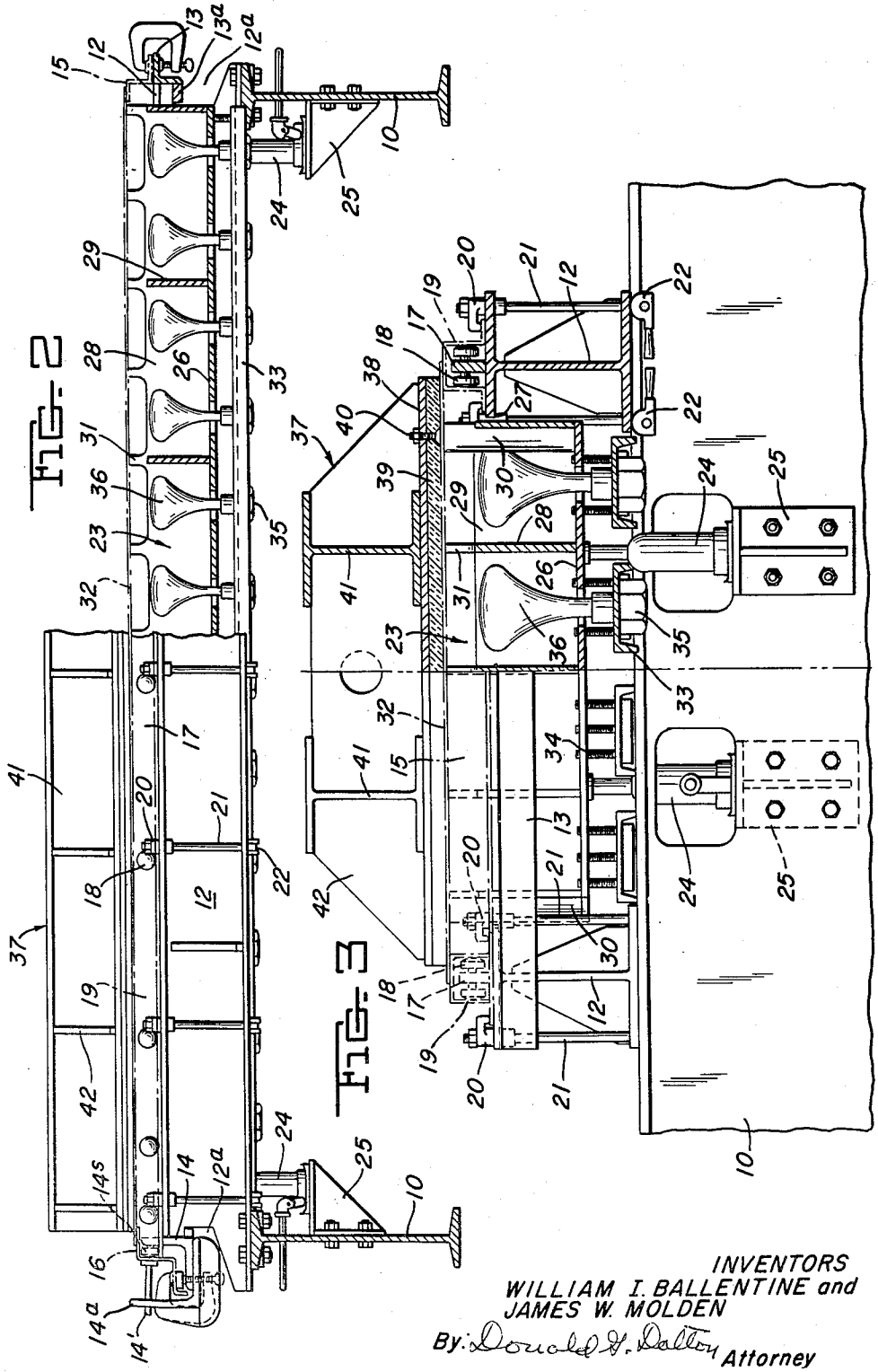


FIG. 2

FIG. 3

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METHOD FOR MAKING METAL PANELS

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Original application Dec. 16, 1957, Ser. No. 703,209, now Patent No. 3,020,867, dated Feb. 13, 1962. Divided and this application Feb. 24, 1960, Ser. No. 10,624

1 Claim. (Cl. 29—447)

This invention relates to a method for fabricating metal panels, specifically those composed of lengths of shapes as frame members and a "skin" sheet as a covering and, in particular, to the production of panels wherein the skin sheet is drawn flat under tension so as to avoid buckles, wrinkles, etc.

This is a division from our application, Serial No. 703,209, filed December 16, 1957, now Patent Number 3,020,867, in which the apparatus shown herein is claimed.

It is desirable for many purposes to employ metal panels including a frame and skin sheet. Examples of the use of such panels are found in building walls, car sides, metal doors and the like. It has proved impossible heretofore, however, to weld a sheet of ordinary hot-rolled steel strip (e.g., .070" thick) to a marginal frame of metal members so as to prevent the buckles and wrinkles which appear in the sheet after welding. The resulting wavy condition is very obvious and constitutes a distinct impairment of the appearance of the product. We have invented a novel method of fabricating such panels, which overcomes this objection.

Our method involves heating the sheet apart from the frame, to a temperature of about 300° F., bringing the sheet into position on the frame while hot, immediately welding the sheet to the frame, and maintaining a flattening pressure thereon during heating and welding, whereby on subsequent cooling and contraction, internal tensile stress is developed in the sheet to pull out any wrinkles or buckles and leave it substantially flat. Since contraction of the sheet may introduce camber into the frame members, we preferably effect a reverse bending thereof beyond the elastic limit to compensate for such camber. We pull the frame members straight, however, within the elastic limit, during welding so that they remain substantially true when the sheet has been welded on the frame and finally cooled, the internal tension developing in the sheet being sufficient to hold the frame members against the tendency to return to cambered condition.

The apparatus we prefer to employ for performing our method as outlined above includes a rectilinear frame disposed horizontally, a heating tray within said frame equipped with heating means and movable vertically, having spaced lugs to support a sheet horizontally, means for raising and lowering the tray and a thermally insulated platen disposable on a sheet resting on said lugs. The frame of the apparatus is provided with clamping means to pull the panel-frame members straight within the elastic limit before welding the sheet thereto.

A complete understanding of the invention may be obtained from the following detailed description and explanation which refer to the accompanying drawings illustrating the present preferred practice. In the drawings:

FIGURE 1 is a plan view of the apparatus with a part of the platen removed;

FIGURE 2 is a side elevation with a portion in section taken along the plane of line II—II of FIGURE 1; and

FIGURE 3 is an end elevation with a portion in section taken along the plane of line III—III of FIGURE 1.

Referring now in detail to the drawings, the apparatus we prefer to employ is mounted on a pair of spaced parallel supporting beams 10, of length sufficient to accommodate any desired number of panel-forming units 11, disposed side-by-side, one of which will now be described in detail. A unit 11 includes a pair of spaced parallel beams 12 extending between and secured to beams 10. The ends of beams 12 are notched or cut out as at 12*a* (FIGURE 2), the beams being connected by a transverse angle 13 and a bar 13*a* at one end and by a pair of angles 14 and 14*a* welded together at the other end. Angle 13 is adapted to support a longitudinal panel-frame rail such as a Z-section sill 15. Angles 14 and 14*a* are similarly adapted to receive a panel-frame rail spaced from and parallel to sill 15, such as an eave plate 16 for a car side. Angle 14 has knob-headed gauge screws 14*s* spaced therealong. The upstanding flange of angle 14*a* is slotted to accommodate C-clamps and is provided with similar gauge screws 14'. Screws 14*s* and 14' are adjustable and the C-clamps rigidly position eave plate 16.

A positioning bar 17 extends along the upper flange of each beam 12. Gauge screws 18 spaced along bars 17 are threaded into transverse holes in the bars from both sides thereof and have knobs or heads with spherical surfaces. These heads serve to position accurately a channel-section panel-frame side rail or post 19 when the latter is placed flanges down on beam 12 over each of bars 17.

The upper flanges of beams 12 are drilled at points spaced therealong to receive clamps 20 adapted to engage the flanges of posts 19 to draw them tightly against the beam flanges. Each clamp 20 is mounted on a pull rod 21 slidable in a hole in one of the lower flanges of beams 12. A cam lever 22 pivoted on the lower end of each pull rod permits it to be placed under tension or released when desired.

A heater tray 23 between beams 12 is movable vertically by jacks 24 carried on brackets 25 secured to beams 10. The tray has a bottom 26, and intersecting longitudinal and transverse walls or partitions 28 and 29, respectively. The upper inner flanges of beams 12 are recessed as at 27 to accommodate tray 23. The sides of the tray are notched and fitted with half cylinders 30 to clear the pull rods 21 on the inner sides of beams 12. The upper edges of partitions 28 extend above those of partitions 29 and are cut out so as to leave spaced upwardly projecting lugs 31. When tray 23 is in the illustrated position the ends of lugs 31 and the upper ends of half cylinders 30 lie in the same horizontal plane as the upper surfaces of the webs of posts 19 disposed on bars 17 and clamped to beams 12. The lugs and half cylinders are therefore adapted to support a sheet 32 in position for welding to posts 19 and rails 15 and 16.

Tray 23 has a plurality of parallel horizontal rails 33 suspended therebelow on adjusting screws 34. Rails 33 have receptacles 35 fitted in holes spaced therealong, adapted to mount heat lamps 36. The bottom 26 of tray 23 has holes therein to permit lamps 36 to be screwed into receptacles 35 from above. Screws 34 permit the adjustment of rails 33 to vary the spacing of the lamps from sheet 32. A spacing of about 2" will normally be satisfactory.

A platen 37 is adapted to be placed on sheet 32. It consists of a bottom plate 38 having a sheet of thermal-insulation board 39 secured to its lower face by bolts 40. Longitudinal beams 41 secured to plate 38 in spaced relation and transverse web plates 42 constitute a stiffening frame for plate 38 and render it sufficiently weighty to effectively flatten the sheet 32. The platen is placed on the sheet and removed therefrom by any suitable means such as an overhead crane.

In carrying out the method of our invention, we start with platen 37 removed and tray 23 in its lower position in which it is illustrated. We first place rails 15 and 16

in position on bars 13 and 14, respectively. We then place posts 19 on bars 17. All these panel-frame members 15, 16 and 19 are preferably bowed, precambered or bent slightly, beyond their elastic limit, to a curvature opposite that to which the tension in sheet 32 tends to draw them on cooling after it has been heated and welded thereto. The extent of precambering which is desirable may be readily determined by experiment. The precambered posts 19 are drawn down, within their elastic limit, so as to bear tightly against the upper flanges of beams 12, by operating clamps 20. Rails 15 and 16 are similarly drawn down against their supporting bars 13 and 14 by conventional C-clamps. When the panel-frame members have been thus assembled, they are welded together along their abutting surfaces.

Sheet 32 is next placed on the resulting panel frame and tray 23, and platen 37 is lowered thereon. Jacks 24 are then operated to raise the box and lift the sheet out of contact with the panel frame. Lamps 36 are then turned on and the sheet is heated thereby to a temperature between 250° and 350° F., preferably about 300° F. The thermal-insulation board 39 limits loss of heat from the sheet and therefore shortens the heating period. When the sheet has reached the desired final temperature, jacks 24 are again operated to lower the tray and bring the sheet edges into contact with the panel-frame members. The sheet is then welded to the panel frame as quickly as possible, preferably by submerged-arc welding. The welding should be completed while the sheet is still at elevated temperature, say 275° F. To this end, energization of the heat lamps is continued during welding. On completing the welding, the lamps are turned off. Thereafter, on cooling to atmospheric temperature, the contraction of the sheet sets up internal tension therein sufficient to pull it drum-tight and overcome the bowing tendency of the frame members introduced by precambering, when they are unclamped. The platen is then removed and the panel is complete.

It will be apparent from the foregoing that our method involves heating the sheet while supporting it out of contact with the panel frame, thereby extending slightly its length and width, then welding it to the frame. After the sheet has been welded to the frame in expanded condition, the subsequent contraction on cooling effectively tensions the sheet. Such tension as results would

cause bowing of the frame members in the absence of the contra-bowing tendency introduced by the precambering.

It will be further apparent that the apparatus we employ is simple to construct and easy to operate. It may readily be fabricated in multiple units arranged side-by-side, if it be desired to fabricate a large panel such as a car door, car side or building wall. All parts of the panel are rigidly held in properly assembled relation during the welding operation, following heating of the sheet in uplifted position.

Although we have disclosed herein the preferred practice of our invention, we intend to cover as well any change or modification therein which may be made without departing from the spirit and scope of the invention.

We claim:

A method of making metal panels composed of a frame and a surface sheet covering it which consists in assembling into a polygonal frame shaped metal members of such strength that they exhibit bowing under contraction of said sheet after application to the frame in heated condition, heating a metal sheet adapted to cover said frame, while maintaining the sheet out of contact with said frame, thereby expanding the sheet, placing said heated sheet on said frame, and then welding the sheet edges to said frame while expanded as a result of said heating, characterized by precambering certain of said members beyond their elastic limit, longitudinally in a direction opposite that in which contraction of the welded-on sheet tends to camber them and straightening said members within their elastic limit before welding the sheet thereto whereby the frame members will finally be substantially straight and free of the undesirable inward bow normally produced by contraction of said heated sheet upon cooling.

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