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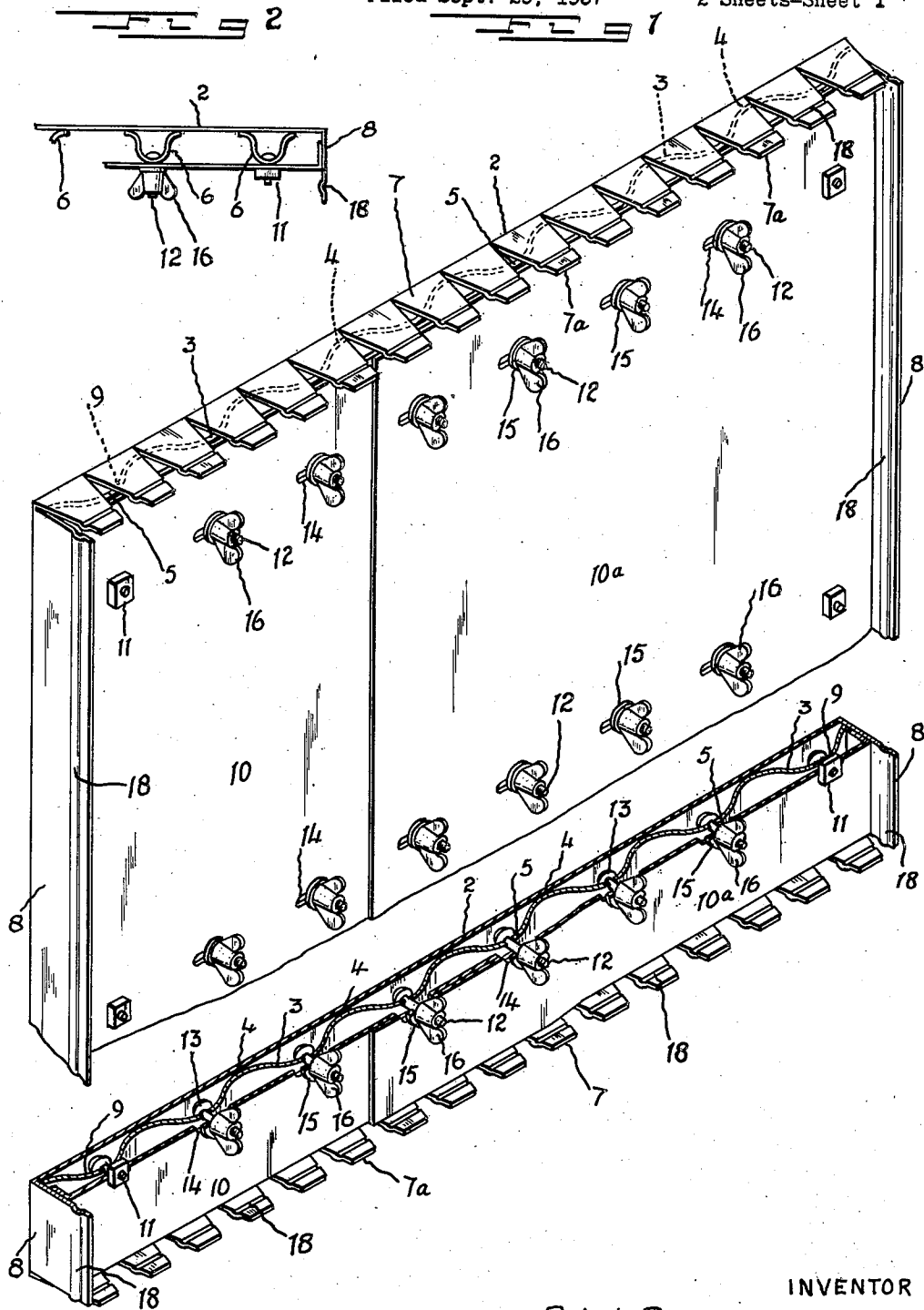
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2,197,318

ADJUSTABLY CURVABLE STRUCTURAL SHEET

Filed Sept. 29, 1937

2 Sheets-Sheet 1



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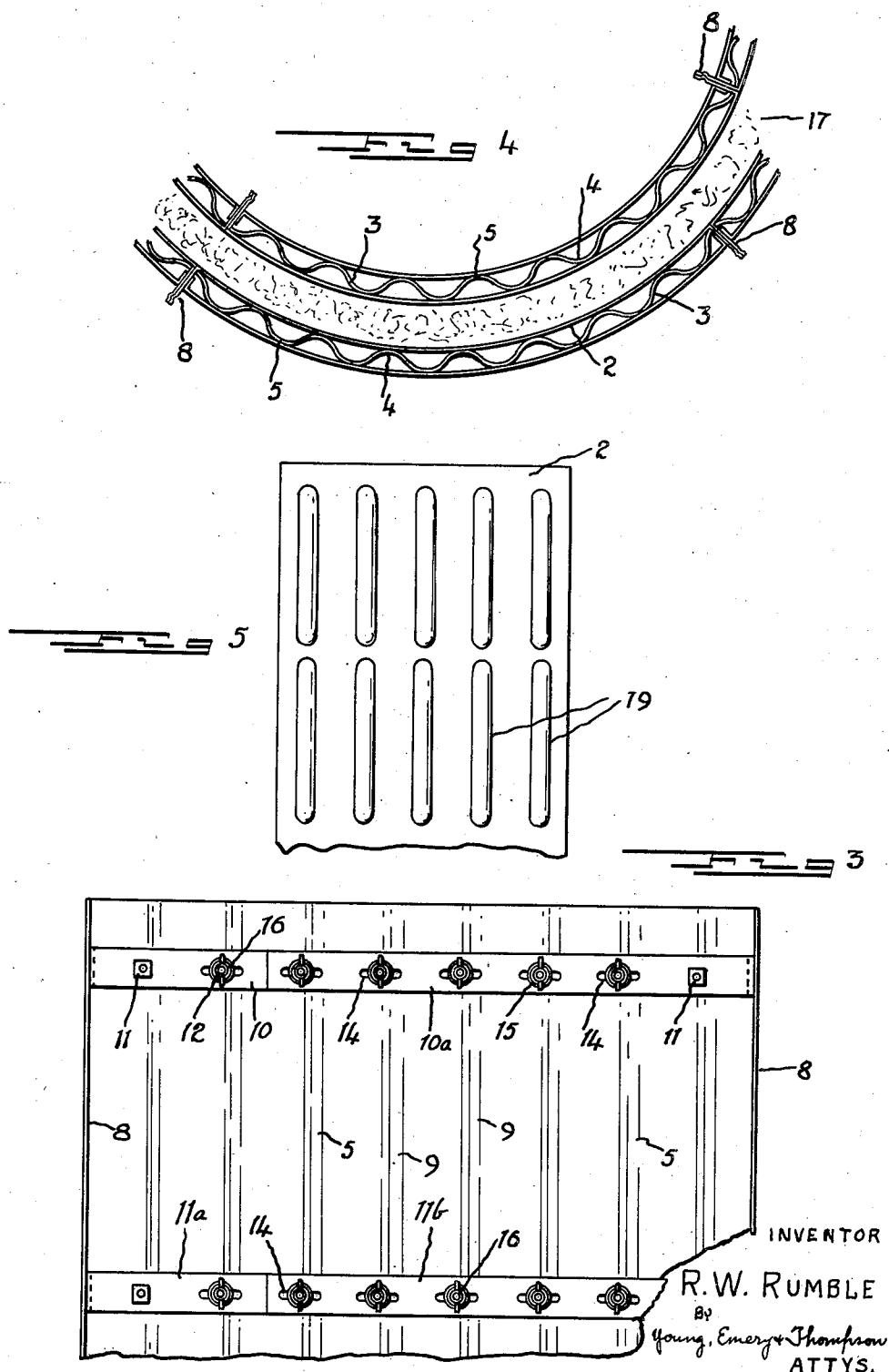
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

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ADJUSTABLY CURVABLE STRUCTURAL SHEET

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8 Claims. (Cl. 189—34)

This invention relates to adjustably curvable structural sheets.

The object of the invention is to provide such a sheet having a rectilinear face which is well reinforced to withstand deformation by pressure on it, the sheet being capable of cylindrical curvature to any desired radius or radii within its range of bending and of being then made rigid against change of curvature; and being also capable of repeated readjustments to different curvatures.

The word "rectilinear" as applied to the face of the composite sheet is here used in the special sense of being composed of parallel straight lines; and is intended to include plane and curved faces. The term "cylindrical" or "parti-cylindrical form" is intended to include any curved form in which the face of the composite sheet remains rectilinear in the sense defined.

A structural sheet according to the invention comprises a flat sheet preferably of metal and of sufficient flexibility to bend readily to the desired cylindrical curvature. From the back of said flat sheet extend a series of parallel ribs which permit the flat sheet to bend transversely to the ribs, but which make it substantially rigid in the direction of the length of the ribs. The ribs are sufficiently close to one another to provide substantial support to the strips of the flat sheet lying between them, and to enable the sheet to bend in a smooth curve. The structural sheet further comprises adjustable means for making it rigid transversely to the corrugations, so that it is then rigid in all directions.

In the preferred embodiment of the invention the reinforcing ribs are provided by a metal sheet which is thin enough to be readily flexible and which is formed with parallel corrugations, and is conveniently a sheet of commercial "corrugated iron."

The invention is illustrated in the accompanying drawings in which:

Figure 1 is a perspective view of the back of the structural sheet, with a portion broken out of its vertical length.

Figure 2 is a detail sectional plan showing an alternative form of the ribs.

Figure 3 is an elevation of part of the back of the sheet showing an alternative form of the adjustable tying means.

Figure 4 is a sectional plan showing several sheets curved and assembled to form shuttering for a curved wall.

Figure 5 is an elevation of part of the front of the sheet showing ornamental formations.

2, 3 indicates a composite sheet comprising a flat metal sheet 2 and a sheet of corrugated iron 3, both being of thin enough gauge to be readily flexible. The flat sheet and the corrugated sheet are assembled face to face with the ridges 4 of the corrugations on one side of sheet 3 in contact with the flat sheet; and they are permanently connected in that relationship by securing said ridges to the flat sheet, as by welding. Thereby the corrugations form, at the back of the flat sheet, a series of parallel ribs 5 which render the composite sheet 2, 3 rigid against bending in the direction of the ribs, but leave it flexible transversely to the ribs; the ribs moreover being sufficiently close to reinforce the flat sheet against local deformation. In the alternative construction shown in Figure 2 the series of ribs is provided by separate bars such as 6 secured to the flat sheet 2 parallel with one another.

7, 7 and 8, 8 are flanges provided at the edges of the composite sheet 2, 3 for securing several of such sheets to one another. They are conveniently formed by turning back marginal strips of the sheet 2. Positioned at the back of the corrugated sheet 3 or the bars 6 and so as to lie on the ridges 9 of the ribs 5 thereof is a flat flexible sheet 10. Said sheet is fixed at or near to one of the vertical edges of the composite sheet which is parallel to the ribs. It is shown as being thus secured by being soldered to the adjacent flange 8 and by being bolted at 11 to the ridge 9 nearest the edge of the sheet. Said sheet 10 extends across the composite sheet more than half way to the opposite edge 8. 10a is a similar sheet similarly fixed at or near to the opposite edge 8 and also extending more than half-way across the composite sheet, so that the sheets 10 and 10a overlap.

Transverse rows of bolts 12 are fixed to the ridges 9 of the ribs 5, by soldering their heads 13 inside the corrugations. The sheets 10 and 10a are slotted at 14 to allow said bolts to pass through them and have transverse play relatively to them. At the back of the sheets 10, 10a the bolts are provided with washers 15 and thumb nuts 16 which even when loose hold said sheets 10, 10a approximately in contact with the ridges 9.

The ridges 4 are tied together by the flat sheet 2. Consequently transverse bending of the composite sheet causes the corrugations slightly to change their curvature and the opposite ridges 9 to close together or separate accordingly as the face 2 of the sheet is made convex or concave.

Since the outer edges of the sheets 10, 10a are fixed to the composite sheet, such movement of the ridges causes the bolts 12 to slide relatively to the sheets 10, 10a. Accordingly, when the composite sheet has been bent to the curvature desired, screwing down of the nuts 16 also ties together the ridges 9; and the front ridges and back ridges being thus simultaneously tied, the composite sheet is made rigid, at the curvature in question, against transverse bending.

The fully rigid sheet may then be assembled, with others if necessary to form for instance a mould for a curved concrete wall 17 as shown in Figure 4. After it has served its purpose, and been removed from the set concrete, loosening of the nuts 16 renders it free to be brought to some other form within its range; and used again.

Instead of the sheets 10, 10a being continuous from top to bottom of the composite sheet, they may be reduced to a series of transversely flexible straps 10, 10a and 11a, 11b as shown in Figure 3.

The edge flanges 7 which extend transversely to the ribs, are cut into small sections 7a to enable them to curve with the composite sheet. Both sets of flanges may be formed with interlocking formations such as the pressed-out channels 13.

The flat sheet 2 instead of presenting a wholly flat face may have ornamental formations 19, Figure 5, in the nature of flutes running parallel with the ribs; such formations not materially impairing the transverse flexibility of the composite sheet nor permitting transverse elongation or contraction of the flat sheet when the latter is curved.

I claim:

1. An adjustably curvable composite sheet comprising a flexible flat sheet and parallel ribs projecting from the back of the flat sheet so that the composite sheet so formed is rigid lengthwise of the ribs and flexible transversely to the ribs, flexible sheet means so attached to the back of the composite sheet as to curve therewith, and a plurality of devices to clamp said sheet means to the composite sheet at a number of points extending in a direction transversely to the direction of the ribs, each such clamping device being continuously available to clamp, to the composite sheet, any point of a continuous extent of the sheet means in its neighbourhood.

2. An adjustably curvable composite sheet comprising a flat sheet and parallel ribs projecting from the back of the flat sheet so that the composite sheet so formed is rigid lengthwise to the ribs and flexible transversely to the ribs, flexible sheet means so attached to the back of the composite sheet as to curve therewith, and a plurality of screw clamps for clamping said sheet means to the composite sheet, said screw clamps being arranged in series extending in a direction transverse to the direction of the ribs, and each engageable frictionally with the sheet means over a continuous range of the latter.

3. An adjustably curvable composite sheet comprising a flat sheet and parallel ribs projecting from the back of the flat sheet so that the composite sheet so formed is rigid lengthwise to the ribs and flexible transversely to the ribs, flexible sheet means so attached to the back of the composite sheet as to curve therewith, a plurality of screw threaded members fixed to the composite sheet at points spaced in the direction transverse to the direction of the ribs, and nuts on said screw threaded members, the sheet means lying between the nuts and the back of the

composite sheet and being available to be clamped frictionally to the composite sheet by the nuts; each of said nuts being engageable frictionally with the sheet means over a continuous range of the latter.

4. An adjustably curvable composite sheet comprising a flat sheet and parallel ribs projecting from the back of the flat sheet so that the composite sheet so formed is rigid lengthwise to the ribs and flexible transversely to the ribs, flexible sheet means so attached to the back of the composite sheet as to curve therewith, said sheet means being slotted in the direction transverse to the direction of the ribs, a plurality of members attached to the composite sheet and extending through the slotting of the sheet means and spaced at intervals in the direction of said slotting, and means engaged with each of said members and positioned at the back of the sheet means for clamping the sheet means to the composite sheet.

5. An adjustably curvable composite sheet comprising a flexible flat sheet and parallel ribs projecting from the back of the flat sheet so that the composite sheet so formed is rigid lengthwise of the ribs and flexible transversely to the ribs, flexible sheet means positioned at the back of the composite sheet and extending therealong transversely to the direction of the ribs and rigidly fixed to the composite sheet at one point of said extent, whereby upon flexure of the composite sheet other points of said extent slide relatively to the back of the composite sheet, and a plurality of devices each adapted to clamp any point of a continuous portion of such transverse extent of the sheet means to the composite sheet.

6. An adjustably curvable composite sheet comprising a flexible flat sheet and parallel ribs projecting from the back of the flat sheet so that the composite sheet so formed is rigid lengthwise of the ribs and flexible transversely to the ribs, two flexible sheet members lying at the back of the composite sheet and severally secured rigidly thereto adjacent to the respective edges of the composite sheet which are parallel with the ribs, said members extending across the composite sheet transversely to the ribs sufficiently to overlap one another, and adjustable clamping means whereby the extent of said members which is not rigidly secured to the composite sheet may be left free to slide relatively to the composite sheet as the latter is flexed or may be clamped immovably to the composite sheet.

7. An adjustable curvable sheet comprising a flexible flat sheet and a flexible corrugated sheet assembled face to face and permanently united at the ridges of the corrugations which contact with the flat sheet, the two sheets thereby forming a composite sheet which is rigid lengthwise of the corrugations and flexible transversely to the corrugations, flexible sheet means so attached to the back of the composite sheet as to curve therewith, and a plurality of devices to clamp said sheet means to the composite sheet at a number of points extending in a direction transversely to the direction of the ribs, each such clamping device being continuously available to clamp, to the composite sheet, any point of a continuous extent of the sheet means in its neighbourhood.

8. An adjustably curvable composite sheet comprising a flexible flat sheet and parallel ribs projecting from the back of the flat sheet so that the composite sheet so formed is rigid lengthwise of the ribs and flexible transversely to the

ribs, two flexible sheet members lying at the back of the composite sheet and severally secured rigidly thereto adjacent to the respective edges of the composite sheet which are parallel to the ribs, said members extending across the composite sheet transversely to the ribs sufficiently to overlap one another and being slotted in the direction transverse to the directions of the ribs, a plurality of members attached to the composite sheet and extending through the slotting of the

sheet members and spaced at intervals in the direction of said slotting, and means engaged with each of said members and positioned at the back of the flexible sheet members whereby the extent of said flexible sheet members which is not rigidly secured to the composite sheet may be left free to slide relatively to the composite sheet as the latter is flexed or may be clamped immovably to the composite sheet.

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