

[54] **HIDDEN SHEET SECURING ASSEMBLY**
[75] Inventor: Ian Scrivener, Beecroft, New South Wales, Australia
[73] Assignee: Comalco Limited, Melbourne, Australia
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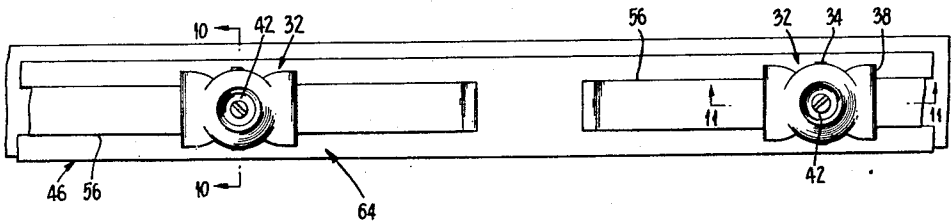
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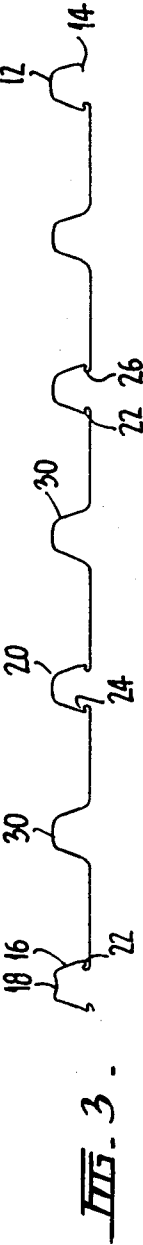
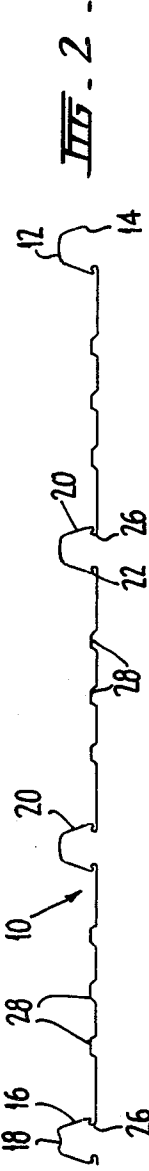
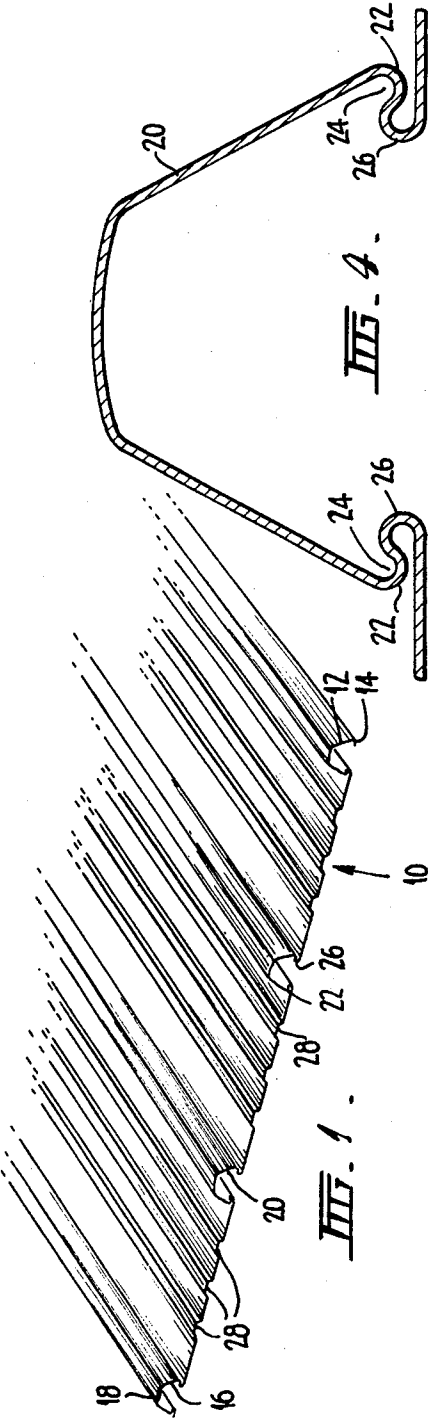
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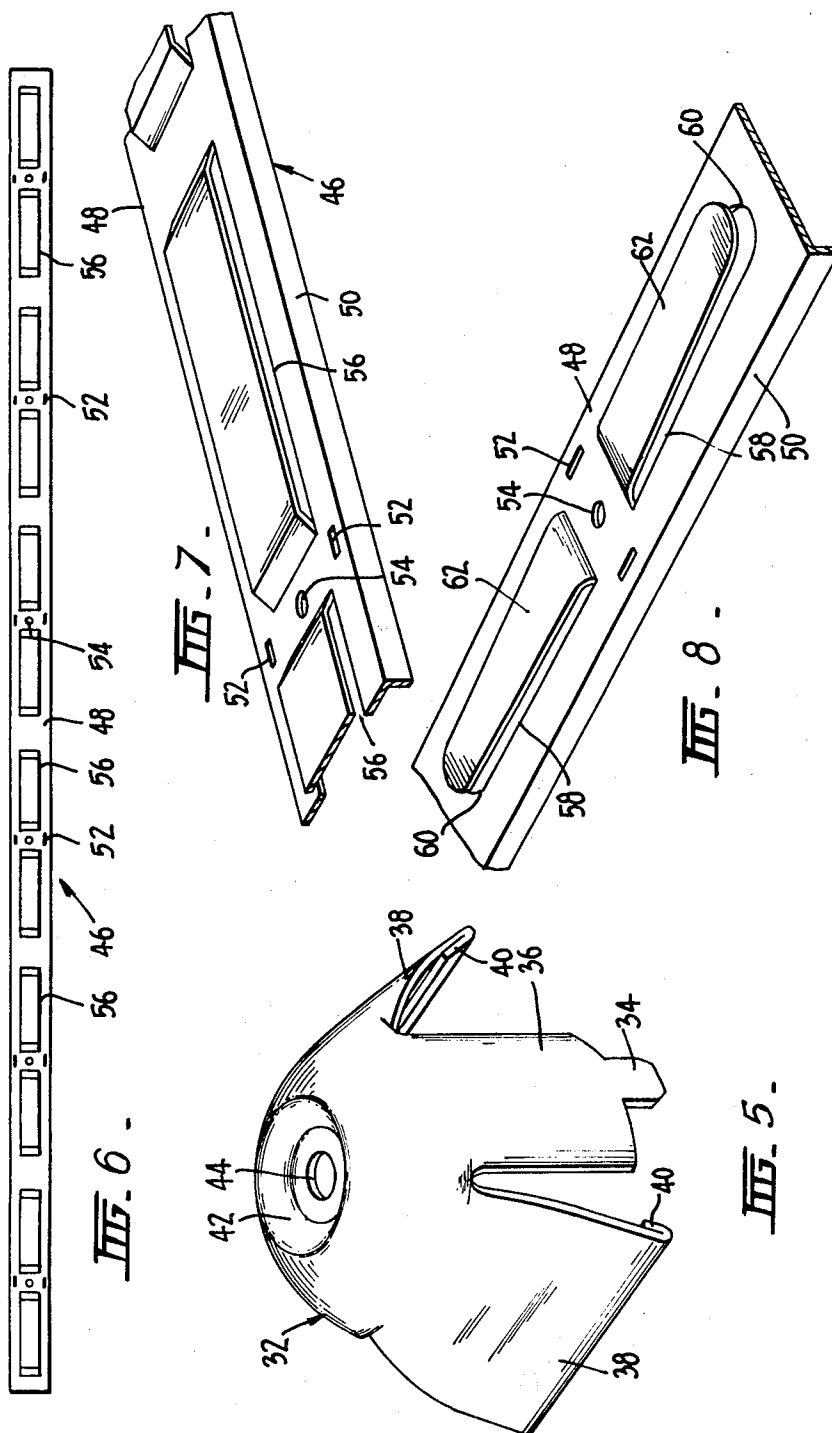
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Attorney—Dennison, Dennison, Townshend & Meserole

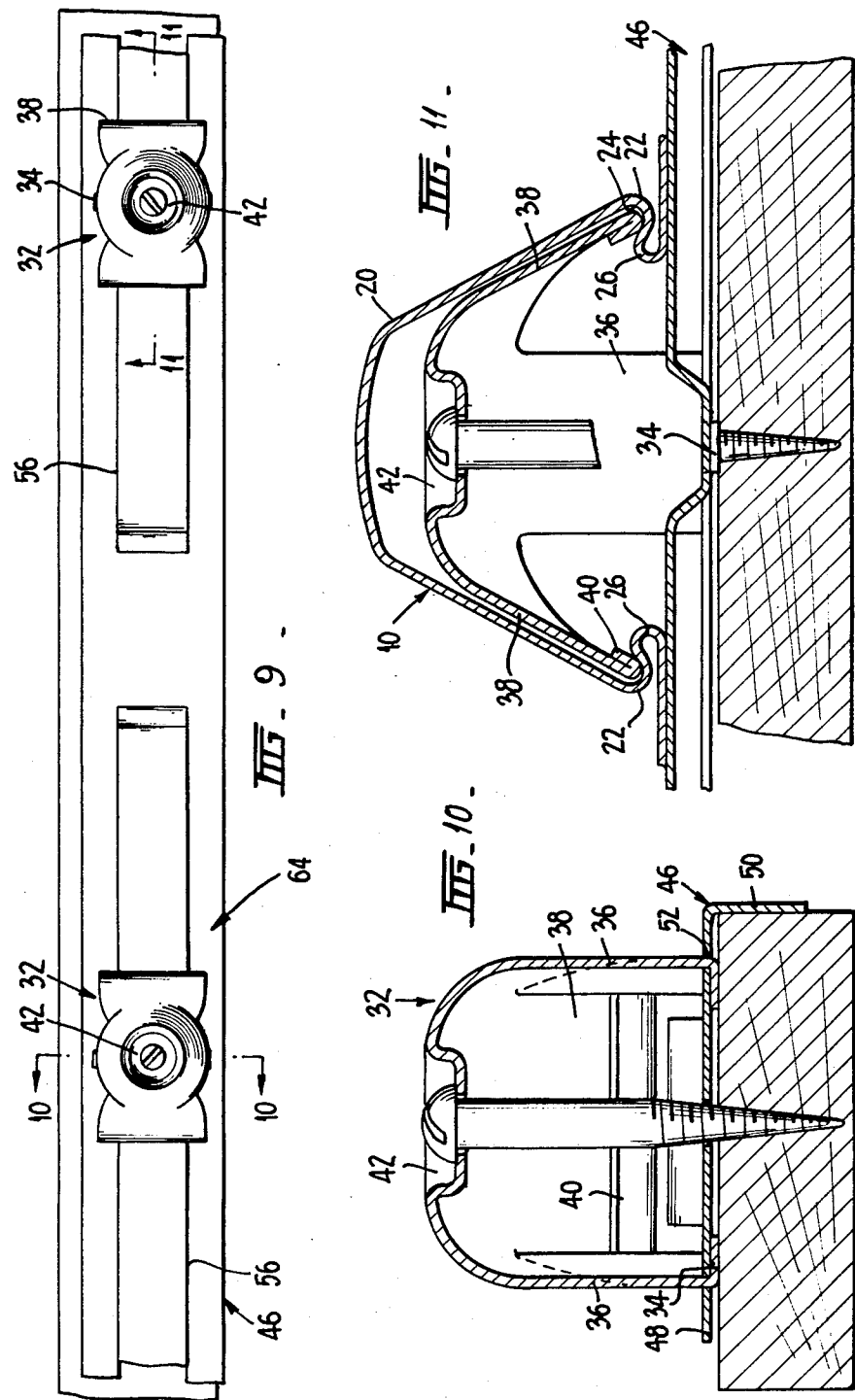
[57] **ABSTRACT**
The invention relates to an improved roofing or wall covering sheet having a rib formation which permits more effective connection to a roof or wall frame. The sheet is provided with one or more ribs, each of which has a groove on each of its sides, the mouth of the groove facing away from the roof or wall frame. The sheet is held in position by means of clips which have arms projecting towards the roof or wall frame and into the grooves. To facilitate installation the clips may be connected to a mounting plate which automatically locates them at the correct spacing.

3 Claims, 11 Drawing Figures









HIDDEN SHEET SECURING ASSEMBLY

This invention relates to sheet metal roofing, decking and siding sheets, (hereinafter referred to, for the sake of convenience, as roofing sheets) and means for fixing them to a structure.

More particularly the invention relates to arrangements whereby a sheet metal roof or the like may be fixed to a structure without the necessity to pierce holes in the sheets for this purpose and without the fixing means being visible from the exterior of the building.

Many types of secret-fix roofing or concealed-fix roofing are already available and many of them have advantages over prior art roof fixing systems. Nevertheless, the clips used for fixing concealed fix roofings in many cases are unsatisfactory. In particular they do not hold the sheeting effectively against the negative loads imposed by varying wind conditions.

In addition the passage of wind forces in even strength (velocity) or in gusts upon and along the surface of roof sheets induces wave motions in the sheets. These wave motions may be of such period or height as to cause the concealed-fix clips or fastenings or grooves in the ribs to fail or unfasten.

The fixing of concealed fix roofs or walls requires the attachment of clips to the roof purlins or battens or to wall girts and subsequent forcing of the sheets over the clips to lock and secure the sheets. The clips must be accurately positioned and this involves a careful measurement by the workman fixing the clips.

It is an object of the present invention to provide an improved form of concealed fix roofing or wall covering.

A further object of the invention is to provide an improved roofing sheet of a form adapted to co-operate with fixing clips to give a very secure covering.

Another object of the invention is to provide an improved fixing clip.

A roofing or wall covering sheet according to the invention may comprise a sheet formed with at least one upstanding generally U-shaped rib characterized in that a groove adapted to cooperate with an arm of a fixing clip is formed in each side of said rib adjacent its junction with the general plane of the sheet, the form of the grooves being such as to resist movement towards each other of the portions of said arms engaged in said grooves, and to resist opening of the mouth of said rib when the arms of a fixing clip are engaged in said grooves.

Further according to the invention there may be provided a roofing or wall covering sheet comprising a sheet formed with an upstanding generally U-shaped female rib along one edge and an upstanding generally U-shaped male rib along the other edge, characterized in that a groove adapted to co-operate with an arm of a fixing clip is formed in each side of each male rib adjacent its junction with the general plane of the sheet, the form of the grooves being such as to resist movement towards each other of the portions of said arms engaged in said grooves and to resist opening of the mouth of said rib when the arms of a fixing clip are engaged in said grooves.

A fixing clip according to the invention may comprise a pressed metal cup having a pair of legs adapted to support the cup from a mounting plate or the like, and a pair of arms extending outwardly at an angle to

engage in a groove in a rib of a roofing sheet to retain said sheet in position.

Preferably the mounting plate is provided with spring means adapted to hold said roofing sheet firmly in contact with the free ends of said arms.

The invention may also provide a strip of fixing clips comprising: a mounting plate or the like formed with a plurality of spaced pairs of slots; and a plurality of clips as above defined each held to said mounting plate by means of a tag on each of its legs engaging with one pair of said slots.

Preferably the length of the mounting plate is equal to a multiple of the spacing between adjacent clips.

In order that the invention may be more readily understood it will now be described by way of example with reference to a particular embodiment illustrated in the accompanying drawings wherein:

FIG. 1 is a fragmentary perspective view of one end of a roofing or wall covering sheet according to the invention.

FIG. 2 is an end view of the sheet of FIG. 1.

FIG. 3 is an end view of a slightly modified form of sheet.

FIG. 4 is an enlarged fragmentary end view illustrating a rib of a sheet of any one of FIGS. 1 to 3.

FIG. 5 is a perspective view of a clip according to the invention.

FIG. 6 is a plan view of a mounting plate for the clip of FIG. 5.

FIG. 7 is a perspective view illustrating portions of the mounting plate of FIG. 5 in greater detail.

FIG. 8 is a perspective view similar to FIG. 7 but illustrating an alternative form of mounting plate.

FIG. 9 is an enlarged plan view illustrating the attachment of clips to a mounting plate.

FIG. 10 is a cross-sectional view on line 10—10 of FIG. 9.

FIG. 11 is a cross-sectional view on line 11—11 of FIG. 9.

The preferred sheet for use in the practice of the invention has an effective covering width of either 2 feet or 3 feet and may be of any suitable length. The sheet illustrated in FIG. 1 is intended to have a width of 3 feet. Along one edge of the sheet 10 there is formed a female rib 12 which is of generally U-shaped cross-section and upstanding from the plane of the sheet. The free edge of the rib 12 is turned over in the form of a hook 14. Along its other edge the sheet is formed with a male rib 16, again of generally U-shaped configuration in cross-section, but having a depression 18 in its upper surface to separate it from the upper surface of a female rib with which it will be engaged in use, thereby preventing capillary action which would lead to leakage during rainy weather. The centers of these ribs 12, 16, in the preferred form of the invention, are 36 inches apart.

Between the edge 12, 16 ribs referred to above, there are two further ribs 20 at 12 inch centers from each other and from the edge ribs, each of the ribs 20 have a cross-section generally in the shape of a U. Adjacent its junction with the general plane of the sheet 10, each side wall of the male rib 16 and each side wall of each intermediate rib 20 is curved inwardly of the rib at 22 at a small radius through an angle of approximately 180°. The actual angle is not critical, the aim being to

provide an internal groove 24 in which a limb of a fixing clip to be described below can satisfactorily engage.

The inner wall of the groove (having regard to the rib) is blended with the general plane of the sheet through a further small radius curve 26. It will be realized that the configuration of the ribs thus described results in a rib which has a mouth of width somewhat less than the maximum width of the rib.

If so desired there may be formed in the space between adjacent ribs, one or more shallow longitudinal grooves 28 to increase the rigidity of the sheet 10 and to inhibit buckling of the sheet between the ribs. In the preferred form of the invention there are three such grooves 28 between each adjacent pair of ribs.

In another form of the invention illustrated in FIG. 3 there may be formed, between each adjacent pair of ribs, a further rib 30 generally of the same configuration as the ribs described, but not formed with grooves to engage fixing clips.

The form of fixing clip 32 (see FIG. 5) preferably used to hold the sheets above described onto the framework of a structure is made from sheet metal and preferably sheet aluminum.

It is cut initially to a generally cruciform shape with a small tag 34 on the end of each of two opposite legs 36. The blank is then placed in a press and formed to a generally cup shaped configuration with the two legs 36 having the tags substantially parallel to each other and the other two opposite arms 38 directed outwardly at an angle.

The free ends of the arms 38 are turned over inwardly so that their extremities lie parallel to the main length of the arms as seen at 40 in FIG. 5.

The base of the cup (which will be the upper surface in use) is formed with a central recess 42, and a hole 44 to accommodate a screw, bolt or the like for holding the clip in position.

The clips described may be used for individual attachments to purlins at appropriate spacing, but are preferably assembled on a mounting plate which may take any one of several forms. One suitable form of mounting plate illustrated in FIGS. 6 and 7 consists of a strip 46 of sheet metal, preferably aluminum, having one of its edges bent at right angles to form an angle section having a longer leg 48 and a flange which provides a shorter leg 50.

At appropriate spacing, leg 48 of the strip is formed with pairs of longitudinal slots 52, each of which is adapted to receive one of the tags on a fixing clip. As indicated above the ribs on the roofing sheet with which the clips are to be used are preferably arranged at 12 inch centers and the spacing between adjacent fixing clips must be the same as that between adjacent ribs. Hence, for the purpose of this description, it will be assumed that the spacing between adjacent pairs of slots 52 is 12 inches. Preferably the strip has a length of 6 feet, each of the end pairs of slots being arranged at 6 inches from the associated end of the strip. The spacing between the slots 52 of each pair is equal to the spacing between the free ends of the legs 36 carrying the tags 34 so that a clip may be assembled to the mounting plate simply by entering its tags 34 in a pair of slots and bending the tags.

Between the slots 52 of each pair, a hole 54 is drilled or punched in the mounting plate in alignment with the

central hole in the fixing clip. From a point close to the line joining the centers of the slots of each pair of slots, a pair of parallel longitudinal slits 56 is made in leg 48 of the mounting plate extending to each side of the center line of the slots for a distance of, for example, $4\frac{1}{4}$ inches.

The material between each pair of slits 56 is displaced upwardly from the surface of the mounting plate for a purpose which will hereinafter appear.

An alternative form of mounting plate illustrated in FIG. 8 has pairs of slots 52 and drilled holes 54 as described in connection with the first form of mounting plate, but the pairs of parallel slits 56 are replaced by pairs of slits 58 which converge towards each other and are joined by a radiused slit 60 at their outer ends. This enables the material defined by the slits to be displaced upwardly in the form of a cantilever leaf spring 62.

A strip of fixing clips 64 (see FIG. 9) is made by attaching the appropriate number of clips by means of the tag and slot connections to either of the forms of mounting plate above described.

The strips of clips, in conjunction with roofing sheets as above described permit quick, accurate and efficient laying of a roof.

If the strips of fixing clips are made exactly 6 feet long (or some other multiple of 1 foot) and the clips are accurately spaced along the strip at 1 foot intervals, strip of clips can be placed in abutting relationship along a purlin and affixed thereto without the necessity for measuring and marking off. The saving in time thus effected more than offsets the cost of any additional metal used in the construction of these clips as compared with prior art clips.

After the clips have been placed in position, covering sheets 10 are placed over the clips with the ribs in alignment with clips, and with suitable end lap where required. The weight of a workman applied to the top of the sheets is sufficient to force the male rib and intermediate ribs into engagement with the clips.

Where the sheets are to be fixed as wall cladding (and if so desired in the fixing of a roof) engagement between the sheets and the clips may be effected by striking the ribs over the clips with a rubber hammer.

The upwardly displaced material between the slits described hereinabove acts, in either form of mounting plate, as a spring to urge the sheets upwardly, bringing their grooves into firm contact with the free ends of the arms of the clips.

In another form of mounting plate, the turned-over edge and the slits may be dispensed with. The full width of the material on each side of each clip may then be displaced upwardly to bring the grooves 24 in the sheets into contact with the ends of the arms 38 of the clips.

Subsequent sheets are laid with the female rib on the edge of each sheet overlapping the male rib on the edge of an adjacent sheet. The relative dimensions of the male and female ribs are such that the male rib fits neatly within the female rib and the hook 14 on the female rib engages with the shoulder formed externally of the groove in the inner wall of the male rib. The weight of a workman is sufficient to force the female rib into engagement with the male rib.

The assembly described gives a very firm and stable roof-fixing. The removal of the sheets from the clips by

natural forces is strongly resisted because the mounting plates exert a resilient force to urge the sheets into contact with the clips. The form of the grooves prevents the lower ends of the rib-engaging arms moving towards each other and to prevent the ribs opening when the arms of the clips are engaged in the grooves 5 28, and any force which tends to lift the sheets from the purlins is resisted by the arms of the clips. These arms have substantial strength because of the domed shape of the clips, resulting in a curved cross-section in the arms. The curvature gradually diminishes from the upper ends of the arms to the free ends, the free ends being substantially straight to enable them to enter the grooves in the sheets without difficulty.

I claim:

1. For use in securing roofing or wall covering sheets with formed ribs therein to a support,
an elongated strip-like mounting plate positionable in underlying relation to said sheets transversely across the sheet ribs,
a plurality of spaced clips attached to said mounting plate, each of said clips being generally in the shape of an inverted cup having at least one leg

with the end thereof secured to said plate to mount the cup on the plate in overlying relation thereto, a pair of arms on the cup extending generally toward said mounting plate for engagement with grooves in a rib of said roofing or wall covering sheet, said arms terminating in downwardly directed free ends, and

spring means on said mounting plate in generally underlying relation to said free ends and adapted to hold said sheets firmly in contact with the free ends of the arms.

2. The structure as claimed in claim 1, in which said spring means consists of a section of said mounting plate displaced upwardly in the form of a cantilever leaf spring.

3. The structure as claimed in claim 1, in which the mounting plate has a plurality of spaced pairs of slots defined therein,

each of said cups having two legs with the end of each leg including a tag thereon, the tags on the legs of each cup being engaged within one pair of said slots.

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