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PATENT SPECIFICATION

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(54) PLASTICS ANCHORS

(71) We, ILLINOIS TOOL WORKS INC., a corporation organised under the laws of the State of Delaware, United States of America, of 8501, West Higgins Road, Chicago, Illinois 60631, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

In the field of fastening technology, a common problem has confronted designers where a fastening is applied to thin sheet material and a heavy load is placed on the fastening system. Normally, this has resulted in a deformation of the sheet. This is particularly true in the hard goods trade for products such as vacuum formed plastic refrigerator liners, television cabinets, dishwasher shelf support rollers and other various applications where it is desired to provide an anchor which is capable of being disposed on the blind side of a panel through an aperture and to provide an anchoring means available through the front side of the panel. Unless the load on the support is spread over a wide area, the plastic liner of a refrigerator may crack, or, in the case of sheet metal, buckle or deform. Early attempts have been directed primarily to the disposition of an anchor from the front side of the panel and related art covering similar devices can be found in the patents to E. Schlueter, U.S. Patent No. 2,940,558 and J.V. Fisher, U.S. Patent No. 3,443,783. Both of these patents are directed to anchors which are applied from the front side of a panel and after telescopic association with an aperture in said panel, are rotated approximately 45° to engage shoulder means on the remote side of the panel. While both of these patents disclose devices which are functional for light loads, they do not serve as the ultimate solution nor do they suggest the usage of such an anchor from the remote side of the panel to provide means for acceptance of a secondary anchoring system on the front side of the panel.

An object of the present invention is to provide a one-eighth turn anchor for fastening in plastics and metal sheet which will accept a screw or other secondary fastening means from the opposite side of the panel. The anchor must be able to be used as a screw fastening of variable styles of shelf supports to vacuum-formed plastics refrigerator liners. The wide flange of the anchor must spread the load over a wide area and substantially eliminate the problem of stress cracking.

According to this invention a one piece plastics anchor for application to a generally polygonal aperture in a panel includes a first head of generally polygonal cross-section, the first head being resilient and having a thin-wall cup-like configuration defining a cavity, the first head diverging towards its free end and presenting cam-like radially outer clamping surfaces at its corners, the anchor also including a rigid element of similar cross-section to the first head and extending axially from the clamping surfaces thereof, the rigid element adapted to lie, in use, within the aperture and prevent relative rotation of the anchor and the panel, the cross-section of the rigid element being angularly offset from the cross-section of the first head, the anchor further including a second head lying adjacent to the rigid element and having a clamping surface of substantial area disposed in a plane transverse to the axis of the anchor and axially spaced from the clamping surfaces of the first head, the anchor being also formed with a blind axial bore communicating with the interior of the cup-like configuration of the first head.

Plastics anchors according to this invention are described below with reference to the accompanying drawings, in which:—

Figure 1 is a perspective view of an anchor;

Figure 2 is a further perspective view in partial section of the anchor installed in a panel with a screw threaded member engaged therein;

Figure 3 is an expanded side elevation in

partial section of an anchor in installed position, ready to accept a secondary fastening means, the section of the anchor being taken along line 3—3 of Figure 4;

5 Figure 4 is an end elevational view taken along the line 4—4 of Figure 3;

Figure 5 is an elevational view in section showing the secondary fastening means of Figure 3 in final, installed position;

10 Figure 6 is a fragmentary enlarged view of one corner of the fastener shown in Figure 4;

Figure 7 is a side elevational view in section of a second anchor shown in attached position with the secondary fastening means;

15 Figures 8 and 9 are a side elevational view in partial section and an end view of a hole plug which can be used with the anchors shown;

20 Figure 10 is a partial view in perspective of a modified anchor, and;

Figures 11 and 12 are illustrative examples of the anchors utilized as a shelf support in a refrigerator, and as a roller shelf support in a dishwasher.

25 An anchor or fastener 10 includes a polygonal or generally square shaped head 12, which has walls 14 of substantially uniform thickness which taper outwards from the base to their free extremities to form a cup-like configuration. The head 12 is attached to a relatively rigid element 16 having at least portions thereof 30 corresponding to and capable of co-operating with an aperture 18 in a panel 20. The rigid element 16 is four-sided and generally square in configuration for co-operation with the aperture in the panel. 35 Sides 22 of the rigid member 16 are flat, but with slightly rounded corners, for convenience in manufacture, and can conform generally to and co-operate with the sides of the aperture 18 to prevent rotation of the anchor in the mounted position. It should be 40 noted, however, that the sides 22 do not have to be continuous in configuration, as shown in the drawing, but may be constituted by spaced protuberances generally disposed along one or more lines generally complementary to at least one side in the aperture for purposes of rotation prevention, as described below.

50 Each corner of the head 12 is truncated by a surface 24 which falls in an oblique angled plane that substantially includes the adjacent flat side of the rigid element and a point adjacent the outer extremity of the corner. Since each surface 24 tapers outwards from its juxtaposition to the rigid 55 element 16 to its free extremity, it forms a cammed clamping surface for engagement with the edge of the aperture 18 in panel 20. As will be apparent from the drawing, the 60 rigid element 16 is angularly rotated about

its axis from the head 12 so that it is disposed at approximately 45° relative to the disposition of the head 12.

70 Spaced from the clamping surfaces of head 12 is a second head 30 having a broad clamping surface 32, an upstanding body portion 34, and one or more laterally extending wing elements 36. The head 30 is of substantial size and is generally circular in configuration to provide a broad 75 engagement with one side of the panel 20. The head 30 can alternatively have any desired configuration such as oval, trapezoidal, triangular, but preferably has a substantial extent so as to distribute the load 80 over a broad area. The clamping surface 32 may be slightly dished to present a line engagement seal at its outer edge, as well as to give a slight resilience to the head 30 and thereby afford some take up for panel 85 variation and thickness. The body 34 has a central bore 40 closed at its outer end, but open and communicating with the interior of first-mentioned head 12. A portion 42 of the body 34 extends inwards within the 90 cavity of the cup-like head 12 and has a chamfered lead-in surface 44 to assist in locating the secondary fastening means within the bore 40. The bore 40 is generally dimensioned to accept such a secondary 95 fastening means as the screw 50.

To install an anchor fastener of the type described, the head 12 is telescoped into the hole 18 and the entire fastener 10 rotated approximately a one-eighth turn. The head 100 12 being thin-walled and resilient in nature, deforms along the cam surface 24 until the rigid element 16 is aligned with the aperture 18 at which time it snaps axially into position, with the corner surfaces 24 105 overlying the edges of the aperture 18 and the back side of panel 20. The resilience of the head 12 and its corner surfaces 24 pulls the second-mentioned head 30 into snug engagement with the opposite side of the 110 panel 20.

This positive locking of the fastener in the aperture means the anchor can be installed at any convenient point along an assembly 115 line with all secondary operations being carried out, and ensures the position of a means for selectively applying a secondary fastening means at any later point along the assembly line. Many manufacturers utilize a 120 single body shell and provide several models utilizing the basic body shell by the variation in style and quality of hardware applied to the interior of the basic body shell. As an illustrative example shown in Figures 3 and 5, it is possible for the manufacturer to apply 125 a shelf support, in the case of a refrigerator or other appliance, such as that designated by the numeral 60. The screw 50 is telescoped within a central bore 62, introduced into the bore 40, and, by suitable 130

thread cutting or thread forming means carried by the screw 50, a thread is impressed in the bore 40 and the shelf support 60 having a wide bearing flange 64 with a sealing edge 66 is brought into mounted position relative to the inside face of the panel 20. The screw 50 could also be an integral part of the support 60 or alternatively could be an insert moulded part, not shown, and thereby, in either instance, provide a part that has no exposed metal portions when installed.

In many instances, for aesthetic reasons, it is desirable to keep the flange 64 with a minimum axial height so that shelving 68, shown in phantom in Figure 5, which is to be mounted on the support 60, will be positioned relatively close to the interior of panel 20. To accommodate such a situation, the present anchor fastener 10, and particularly its head 12, has grooves or relieved portions 70 in each of its corners, thereby creating a weakened portion in the wall 14. By the application of an axial pressure against the free end of the head 12, it is possible to rupture or split the head 12 in each of its corners, causing the wall 14 to bend as petals over the opposite surface of the panel 20, as shown in Figure 5. The sealing portion 66 is of an axial length shorter than the axial projection of head 12 beyond the side of panel 20. Thus, the clamping forces created by the introduction of the screw 50 into the bore 40 and the pull up of its head against the end of the support 60 causes the clamping face 67, which is the wall facing the open end, to force the tapered head 12 radially outwards from its initial position, rupturing or splitting the walls 14 at their thinned portion 72 resulting in the petalling of the wall 14 outwards over the panel 20 in the fashion shown in Figure 5. The sealing means 66 forms a cavity for retention of the petals wholly internally of the cavity to thereby promote the total aesthetic appearance within the appliance.

A modification to the embodiment shown in Figure 4 can be seen in Figure 10, wherein similar parts are designated by similar numerals with the addition of the suffix "b". To further enhance the petalling action of the walls 14b after the corners have been split, the walls 14b may be circumferentially relieved, as by groove 76, to provide a bend or hinge line disposed intermediate the axial extent of walls 14b.

At a previous stage in manufacturing, prior to the addition of hardware such as the support 60, most manufacturers of refrigerators are today using a foamed-in-place insulating material. The present fastener may, if desired, and in those instances where extreme pressures are involved, include a resilient deformable sealing ring, not shown, within the cavity of

the dished clamping surface 32 for additional sealing of the aperture 18. Generally, however, such additional sealing is not required. The application of foamed-in-place material to the back side of panel 20 results in an encasement of the wings 36 and the sealed body 34. When the foam rigidifies, in its chemical process, this encasement of the lateral wings 36 serves to assist the rigid element 16 as a rotation preventing means during the driving of the screw 50 into the bore 40.

A modification of the present invention is seen in Figure 7, wherein similar numerals are utilized to indicate similar parts with the addition of the suffix "a". The fastener 10a has an increase in the axial length of the extension 42a whereby it axially extends a distance equal to or greater than the extent of head 12a. The support 60a includes a laterally extending flange 64a and a downwardly depending sealing element 66a for contacting the panel 20a. The sealing element 66 has a substantial axial extent with its free end spaced from the clamping wall 67a a distance in excess of the axial penetration of head 12a beyond the front side of panel 20a. Thus, the head 12a is totally accepted within the cavity formed by sealing element 66a and the clamping wall 67a without deformation, as opposed to the splitting, petal-shaped deformed manner shown in the first embodiment. Additionally, the support 60a has a tubular extension 80 extending into the cavity and embracing in complementary fashion the extension 42a. Thus, the wide distribution of load on the surfaces of panel 20a is further enhanced in shear by the combined functions of the inter-nesting extensions 42a and 80.

The support 60a has been utilized as a spacer to mount a secondary member or panel 82, such as an evaporator pan. In spaced relation to the supporting panel 20a.

In many instances as various models of appliances proceed down the assembly line, the less expensive models are not provided with certain features, even though the basic box liner is designed to accommodate all models. Fastening means such as the anchor fastener 10 have been installed in all available apertures in the liner. Where a certain piece of hardware is to be omitted, a suitable hole plug 90 is provided. Such a plug 90 would include a shank 92 having a bifurcation or slot 94 and a connecting web 96 to provide a pair of lateral legs 98 movable towards one another in a resilient fashion to be acceptable within the bore 40. The head 100 is preferably recessed to provide a cavity 102 capable of accepting the cup-like head 12. When the shank 92 is telescoped within the bore 40, the leg portions 98 will spring towards one another

against the inner surface of the bore 40 until the sealing edge 104 of head 100 is brought into contact with the surface of panel 20. Thus, a smooth, decorative cover is provided for those anchors which are not used

The secondary fastening means, although shown as a screw threaded element, may take many configurations. For example, the bore 40 could be provided with stepped shoulder means, not shown, which could co-operate with resilient friction or a ratchet-type engaging mechanism to ensure retention of the secondary fastening means. Thus, the invention is not intended to be limited to screw-threaded fasteners per se.

Figures 11 and 12 show typical applications of the anchor fastener 10 with Figure 10 showing its use as a shelf support in a refrigerator or freezer unit while Figure 11 shows the anchor fastener in association with a dishwasher shelf support roller.

Thus, the invention contemplates a simple, one-piece plastic device which is self-retaining and capable of accepting secondary fastening means from the opposite side of the panel. It can be injection moulded in an economical die from suitable materials, such as nylon, which exhibit the necessary resilient qualities in thin sections while providing substantial rigidity in heavier cross sections.

The wide flange serves as a second head to grasp the opposite side of the panel and to spread the load over a wide area, as mentioned hereinabove. Additionally, the anchor includes rotation-inducing means of a non-circular configuration and a body portion for acceptance of a closed bore communicating through the first mentioned head. Where a screw is utilised with the anchor, it is completely enclosed, thereby preventing abrasion of wires or insulation by its point. The second head or wide flange seals the hole in the panel allowing trouble-free installation of pressurised foam insulation on the backside of the panel with the non-circular rotation inducing means co-operating with the foam, in that particular example, to assist the rigid means in preventing rotation of the anchor when a screw is driven into the bore from the front side of the panel.

An additional advantage is that the anchor may be telescoped into the hole and a one-eighth turn will firmly lock it in place. This positive locking means that the anchor can be installed at the most convenient point along the assembly line and will not fall out before the screw or other fastening means is driven.

An additional advantage is the fact that this anchor with its tapered first head will accommodate a wide variation in panel thickness and additionally, can be

economically fabricated in simple injection moulds.

WHAT WE CLAIM IS:—

1. A one piece plastics anchor for application to a generally polygonal aperture in a panel, the anchor including a first head of generally polygonal cross-section, the first head being resilient and having a thin-wall cup-like configuration defining a cavity, the first head diverging towards its free end and presenting cam-like radially outer clamping surfaces at its corners, the anchor also including a rigid element of similar cross-section to the first head and extending axially from the clamping surfaces thereof, the rigid element adapted to lie, in use, within the aperture and prevent relative rotation of the anchor and the panel, the cross-section of the rigid element being angularly offset from the cross-section of the first head the anchor further including a second head lying adjacent to the rigid element and having a clamping surface of substantial area disposed in a plane transverse to the axis of the anchor and axially spaced from the clamping surfaces of the first head, the anchor being also formed with a blind axial bore communicating with the interior of the cup-like configuration of the first head.
2. An anchor according to claim 1 in which a guide means surrounds the open end of the axial bore.
3. An anchor according to claim 2 in which the guide means comprises an annular ridge defining a continuation of the bore and projecting into the cavity defined by the first head.
4. An anchor according to any of claims 1 to 3, in which the rigid element includes at least two flat side surfaces, the planes of which intersect at a sharp angle.
5. An anchor according to any preceding claim, in which the first head and the rigid element are generally square in cross-section.
6. An anchor according to any of claims 1 to 5, in which the rigid element has four substantially flat side surfaces, the walls of the first head being of substantially uniform thickness, and the corners of the first head being truncated by surfaces each of which falls in a plane inclined to the axis of the anchor, and substantially including the adjacent flat side of the rigid element and also a point adjacent to the outer extremity of the corner, to form the tapered cam-like outer surfaces for clamping co-operation with the apertured panel.
7. An anchor according to any of claims 1 to 6, in which the first head is relieved at its corners, whereby axial pressure against the free extremity of the first head causes the corners to separate to form petals which

against the inner surface of the bore 40 until the sealing edge 104 of head 100 is brought into contact with the surface of panel 20. Thus, a smooth, decorative cover is provided for those anchors which are not used

The secondary fastening means, although shown as a screw threaded element, may take many configurations. For example, the bore 40 could be provided with stepped shoulder means, not shown, which could co-operate with resilient friction or a ratchet-type engaging mechanism to ensure retention of the secondary fastening means. Thus, the invention is not intended to be limited to screw-threaded fasteners per se.

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The wide flange serves as a second head to grasp the opposite side of the panel and to spread the load over a wide area, as mentioned hereinabove. Additionally, the anchor includes rotation-inducing means of a non-circular configuration and a body portion for acceptance of a closed bore communicating through the first mentioned head. Where a screw is utilised with the anchor, it is completely enclosed, thereby preventing abrasion of wires or insulation by its point. The second head or wide flange seals the hole in the panel allowing trouble-free installation of pressurised foam insulation on the backside of the panel with the non-circular rotation inducing means co-operating with the foam, in that particular example, to assist the rigid means in preventing rotation of the anchor when a screw is driven into the bore from the front side of the panel.

An additional advantage is that the anchor may be telescoped into the hole and a one-eighth turn will firmly lock it in place. This positive locking means that the anchor can be installed at the most convenient point along the assembly line and will not fall out before the screw or other fastening means is driven.

An additional advantage is the fact that this anchor with its tapered first head will accommodate a wide variation in panel thickness and additionally, can be

economically fabricated in simple injection moulds.

WHAT WE CLAIM IS:—

1. A one piece plastics anchor for application to a generally polygonal aperture in a panel, the anchor including a first head of generally polygonal cross-section, the first head being resilient and having a thin-wall cup-like configuration defining a cavity, the first head diverging towards its free end and presenting cam-like radially outer clamping surfaces at its corners, the anchor also including a rigid element of similar cross-section to the first head and extending axially from the clamping surfaces thereof, the rigid element adapted to lie, in use, within the aperture and prevent relative rotation of the anchor and the panel, the cross-section of the rigid element being angularly offset from the cross-section of the first head the anchor further including a second head lying adjacent to the rigid element and having a clamping surface of substantial area disposed in a plane transverse to the axis of the anchor and axially spaced from the clamping surfaces of the first head, the anchor being also formed with a blind axial bore communicating with the interior of the cup-like configuration of the first head.

2. An anchor according to claim 1 in which a guide means surrounds the open end of the axial bore.

3. An anchor according to claim 2 in which the guide means comprises an annular ridge defining a continuation of the bore and projecting into the cavity defined by the first head.

4. An anchor according to any of claims 1 to 3, in which the rigid element includes at least two flat side surfaces, the planes of which intersect at a sharp angle.

5. An anchor according to any preceding claim, in which the first head and the rigid element are generally square in cross-section.

6. An anchor according to any of claims 1 to 5, in which the rigid element has four substantially flat side surfaces, the walls of the first head being of substantially uniform thickness, and the corners of the first head being truncated by surfaces each of which falls in a plane inclined to the axis of the anchor, and substantially including the adjacent flat side of the rigid element and also a point adjacent to the outer extremity of the corner, to form the tapered cam-like outer surfaces for clamping co-operation with the apertured panel.

7. An anchor according to any of claims 1 to 6, in which the first head is relieved at its corners, whereby axial pressure against the free extremity of the first head causes the corners to separate to form petals which



overlie the panel on its side remote from the second head.

5 8. An anchor according to any of claims 1 to 7, in which the first head has a tapered groove at each truncated corner, thereby reducing the corner wall thickness so that the application of an axial pressure on the free end of the head causes the corners of the cup-like configuration to split and
10 further pressure causes the sides to petal into overlying relation to the panel.

9. An anchor according to any of claims 1 to 8, in which projecting outwards from the second head are a body portion defining the
15 axial bore, and a non-circular gripping means to assist manual gripping of the anchor during insertion into the panel.

10. An anchor according to claim 9, in which the body portion is a closed-end
20 tubular member, and the gripping means is a wing element which extends substantially radially outwards from the tubular member towards the margin of the second head.

11. An anchor according to any of claims 1 to 10, in which the clamping surface of the second head is dishd to provide a sealing engagement with the panel.

12. An anchor according to any of claims 1 to 11, in which the second head has a
30 diameter at least twice as great as the first head.

13. An anchor according to any of claims 1 to 12, in which the walls of the first head are radially relieved along a substantial
35 portion of a circumferential line disposed intermediate the axial extremities of the walls, to assist in petaling of the walls.

14. The combination of an anchor according to any of claims 1 to 13, and a
40 fastener which can be associated with the anchor from the side of the panel adjacent the first head.

15. A combination according to claim 14, in which the fastener includes a screw.

45 16. A combination according to claim 14 or claim 15, in which the fastener includes

supporting means overlying the aperture on the side of the panel adjacent to the first head and includes means for supporting a second component.

17. A combination according to any of claims 14 to 16, in which the fastener includes supporting means and a screw which can threadedly engage the bore of the anchor, the supporting means having a base
55 with an outer peripheral margin which can engage the panel, and having an open-ended central cavity defined by a wall facing the open end, and the outer peripheral margin defining the side wall of the cavity, the
60 cavity being able to accept the first head of the anchor within its confines, and there being a passage penetrating the fastener and communicating with the cavity to accept the screw.

18. A combination according to claim 17, in which the axial extent of the first head of the anchor is greater than the axial extent of the cavity in the fastener.

19. A combination of a panel having a non-circular aperture, and an anchor according to any preceding claim, the anchor being of appropriate size to be secured in the aperture.

20. A combination according to claim 19, in which the aperture is substantially square and the angle of offset between the first head and the rigid element of the anchor is
75 45°.

21. An anchor substantially as described with reference to Figures 1 to 6, Figure 7 or Figure 10 of the accompanying drawings.

22. A combination of an anchor according to claim 2 and a fastener substantially as described with reference to Figures 2, 3 and
85 5, or Figure 7 of the accompanying drawings.

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