

Dec. 24, 1957

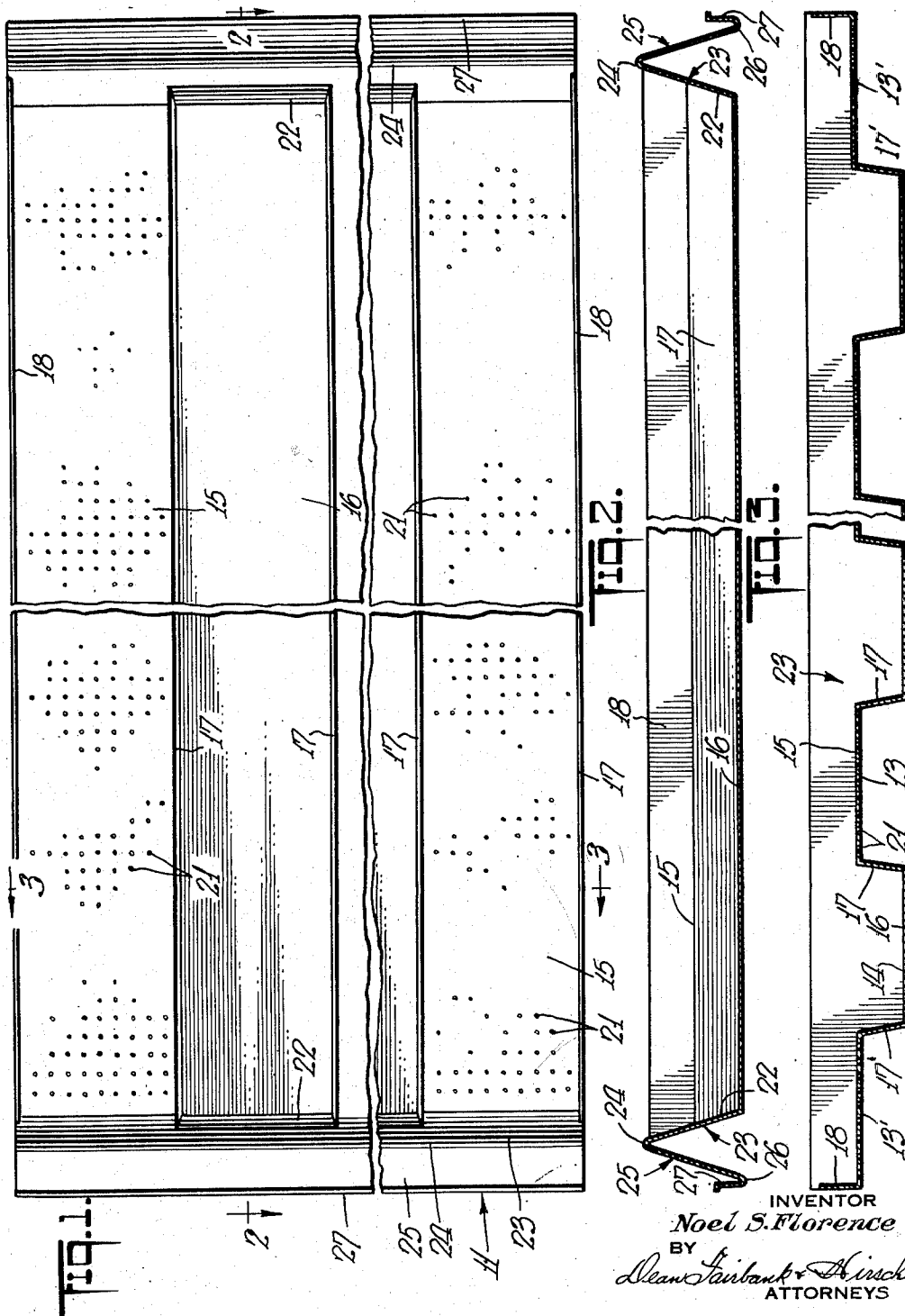
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LIGHTING SYSTEM AND CEILING PANEL

Filed Jan. 30, 1956

2 Sheets-Sheet 1



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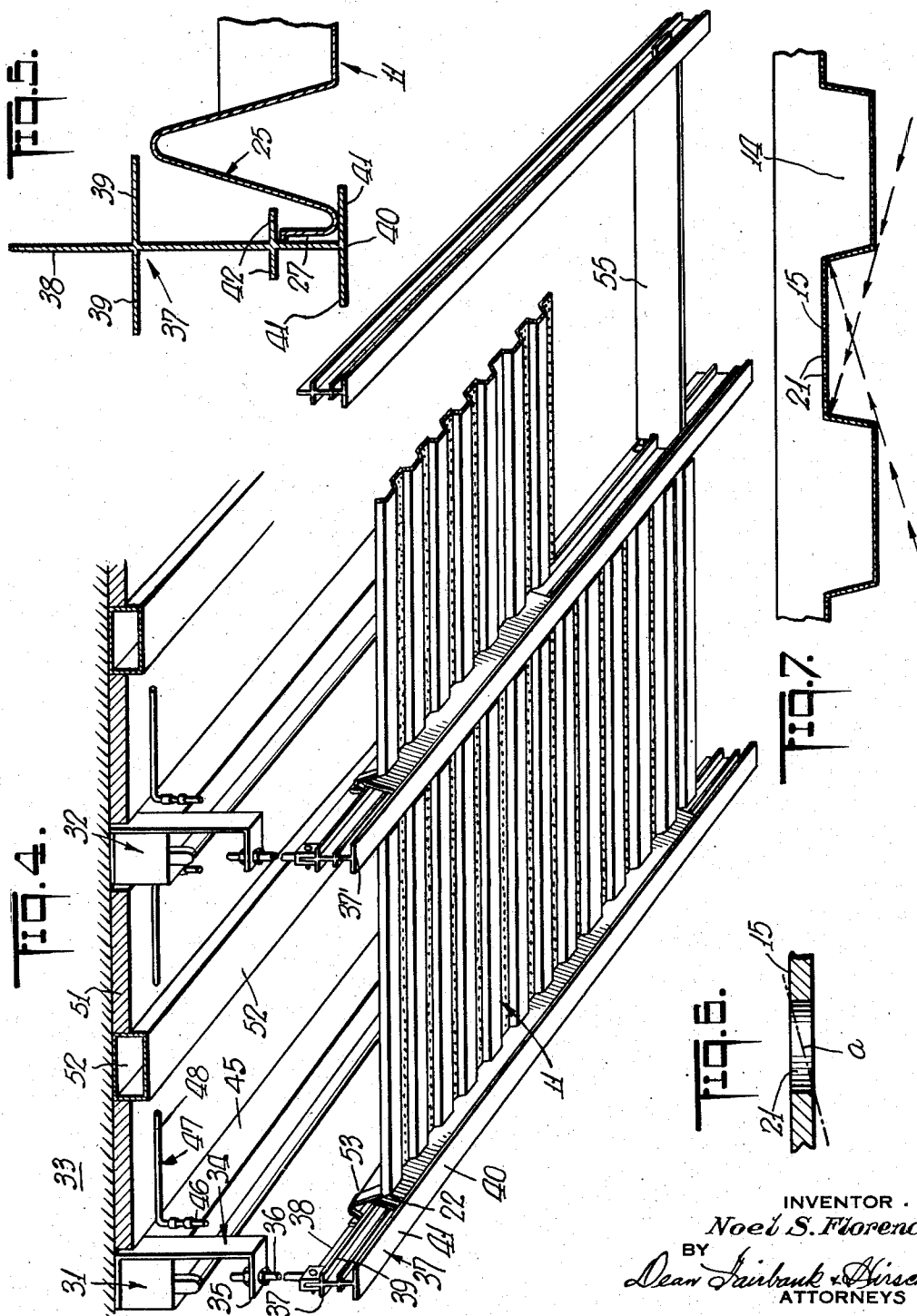
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LIGHTING SYSTEM AND CEILING PANEL

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Application January 30, 1956, Serial No. 562,221

7 Claims. (Cl. 240—9)

This invention relates to the art of luminous ceilings and more particularly to the translucent diffuser panels and mount therefor.

Where conventional diffuser panels of translucent materials, which are positioned beneath sources of light, require a hinged frame for mounting, the resultant structure may be costly, cumbersome and heavy and where the panels form part of a luminous ceiling, the frames of such panels may cause light discontinuity with resultant detracting from the decorative effect of the luminous ceiling.

Where the frames are dispensed with and supporting means are provided for two opposed edges of such panels which are spaced sufficiently to permit lateral movement of the panels therebetween for removal, and which require accurate positioning of the panels to prevent their accidental dislodgment, such positioning is relatively difficult to accomplish and even if the panels are initially properly positioned, any air drafts or vibrations may cause lateral movement of the panels with possible dislodgment from the supporting means so that they may drop to the floor with possibility of breakage or injury to occupants of the room in which the panels are mounted.

Where the panels have a continuous surface and form a luminous ceiling spaced from the main ceiling of the room or chamber, the need for grille work in the ceiling to permit passage of conditioned air from the air conditioning conduits in the space above the panels results in the interruption of the continuous luminous surface afforded by the panels which detracts from the decorative effect thereof.

Where the diffuser panels used in a luminous ceiling have a continuous unperforated surface and sound absorptive material is mounted in the space above the panels, to absorb sound transmitted thereto from the panels, due to the vibration thereof caused by sounds in the chamber, certain sound frequencies may cause little or no vibration of the panels, with consequent reflection therefrom back into the room with corresponding inefficiency of the installation in its sound absorption characteristics.

It is accordingly among the objects of the invention to provide a diffuser panel that may readily be fabricated from relatively inexpensive materials at low cost, which may readily be installed without the need of frames, requiring but a pair of spaced rails for mounting and which, when mounted will dependably remain in position without likelihood of accidental dislodgment from or vertical movement with respect to the support rails, yet may readily be removed therefrom when necessary, with a simple manipulation and without the use of tools of any sort.

Another object is to provide a diffuser panel of the above type which permits the ready passage therethrough of sound vibrations and air, yet in normal use will prevent unobstructed vision therethrough so that a source of light positioned above the panel will not be visible at the normal angle of vision of the occupant of the room in which the panel is located.

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Another object is to provide a ceiling installation in which diffuser panels of the above type may readily be mounted and removed to provide access to the space thereabove and in which installation the diffuser panels will be inherently maintained in position with substantially no vertical movement thereof.

According to the invention, the diffuser panels are formed from relatively thin substantially rectangular sheets of plastic material and have resilient means at two opposed edges thereof preferably formed integral therewith which are adapted to react in a direction substantially parallel to the plane of the panels.

More specifically the panels are corrugated at right angles to said opposed edges and the corrugations define troughs and crests, each with a flat face, the face of the crests being perforated for passage of air and sound therethrough.

The panels in a preferred embodiment shown, are supported by a pair of spaced parallel rails each having a pair of spaced flanges between which an upstanding member at each opposed edge of the panel is positioned to restrain vertical movement of the panel.

In the accompanying drawings in which are shown one or more of various possible embodiments of the several features of the invention,

Fig. 1 is a bottom plan view of the diffuser panel, Fig. 2 is a sectional view taken along line 2—2 of Fig. 1,

Fig. 3 is a view similar to Fig. 2 taken along line 3—3 of Fig. 1,

Fig. 4 is a fragmentary perspective view of a luminous ceiling installation incorporating the diffusing panels.

Fig. 5 is a transverse sectional view of the mounting rail for the panel,

Fig. 6 is a fragmentary detail view on a greatly enlarged scale showing a perforation in the panel, and

Fig. 7 is a fragmentary view similar to Fig. 3 illustrating the function of the troughs of the panel.

Referring now to Figs. 1, 2 and 3 of the drawings, the diffuser panel 11 comprises a substantially rectangular sheet of translucent plastic such as vinyl, acrylic or styrene which is transversely corrugated to define alternate crests and troughs 13 and 14 (Fig. 3) each having a flat face 15 and 16 respectively, the side walls 17 of the corrugations being inclined outwardly from the faces 15 so that each trough and crest is substantially the shorter base and two legs of a trapezoid. The corrugations of the panel enhance the rigidity of the plastic sheet so that the panels may be relatively thin and light in weight. Each end of the panel 11 terminates in a crest 13' having a single inclined wall 17' and a substantially vertical wall 18 of height approximately equal to the depth of the trough 14.

Each of the faces 15 of the crests 13 desirably has a multiplicity of perforations 21 therethrough (Fig. 6) of diameter approximately four times the thickness of the plastic sheet and the total area defined by all the perforations is approximately one to five percent of the total area of the face 15.

Each of the side walls 17 of the troughs 14 is inclined outwardly at each end 22 as shown in Figs. 2 and 4 and an elongated strip 23 extends across such ends 22 and rises from the faces 15 and 16. The strips 23 are inclined outwardly as shown in Fig. 4 and extend the length of the panel 11 preferably being an integral part thereof. The height of strip 23 is substantially equal to twice the height of the trough 14, for example, and extending downwardly from the upper edge 24 of strip 23 is a substantially rectangular strip 25 which is also an integral part of the sheet and extends the length thereof. The strip 25 is inclined outwardly and its lower

edge 26 which is substantially aligned with faces 16, is reversely bent to define a rim 27 of height less than that of strip 25. The strips 23, 25 thus define an accordion pleat and by reason of the resilience of the plastic material from which the panel is formed, the strip 25 is readily displaceable laterally toward and away from the strip 23 to provide a spring action.

Although the panels above described may be supported in any suitable manner as the diffusing element of an individual fixture, which, for example, may be suspended below the ceiling or recessed into the ceiling, in the illustrative embodiment shown in Fig. 4 they form part of a luminous ceiling.

To this end as shown in Fig. 4, a plurality of pairs of parallel lighting fixtures 31, 32, preferably of the fluorescent type, are affixed to the ceiling 33. Each of the lighting fixtures has a plurality of substantially L-shaped brackets 34 depending therefrom, the horizontal leg 35 of which carries a vertically adjustable hang rod 36. Mounted on the lower ends of the hang rods 36 of each lighting fixture is a support rail 37, 37' which may comprise an elongated substantially rectangular strip 38 (Fig. 5) supported in a vertical plane and having a laterally extending strengthening web 39 on each side thereof below the upper edge of the strip 38. The lower edge 40 of strip 38 has a laterally extending supporting flange 41 on each side thereof as shown and a laterally extending restraining flange 42 is positioned on each side of strip 38 between flange 41 and web 39, said flange 42 extending parallel to web 39. The space between flange 42 and the lower edge 40 of strip 38 is slightly greater than the width of rim 27 readily to accommodate the latter therebetween with substantially little vertical play between flanges 41 and 42.

Pivotally mounted to the opposed inner faces 45 of lighting fixtures 31 and 32 is the vertical leg 46 of a substantially L-shaped retaining member 47, the horizontal leg 48 of which extends parallel to the ceiling 33 and is spaced therefrom. The legs 48 of the retaining member 47 when extending outwardly from the associated lighting fixtures 31, 32 serve to support rectangular panels 51 of acoustic absorptive material and such panels 51 may have openings therethrough to accommodate air conditioning conduits 52 affixed to the ceiling 33.

To mount the panel 11, the rim 27 on one end thereof is positioned between flanges 41, 42 of the support rail 37 suspended from fixture 31, for example, as shown in Fig. 5. With the panel 11 in substantially horizontal position, pressure is exerted thereagainst in direction toward said support rail 37 and by reason of the spring action afforded by the strip 25, the panel 11 will move toward said rail 37. The rim 27 on the other end of the panel 11 is aligned with the space between flanges 41, 42 of rail 37' and the pressure on the panel released. As a result of the spring action of strip 25, the panel will move toward rail 37' positioning the adjacent rim 27 between the flanges 41, 42 thereof. Thus, the panel will be securely yet releasably retained between the parallel rails 37, 37' and by reason of the flanges 41, 42 and the interposed rims 27, vertical movement of the ends of the panels is substantially restrained so that any air drafts in the room in which the panels are installed will not cause jiggling of the panels with resultant disagreeable noise.

To remove the panel 11 to permit cleaning of the inside surface thereof and to provide access to the space above the panel for replacement of the lamps in the lighting fixtures, it is merely necessary to exert pressure against strips 23 of the panel adjacent rail 37' in direction toward rail 37. As a result of the spring action afforded by strip 25 adjacent rail 37, the panel will move toward said rail and the rim 27 will be moved clear of the flanges 41, 42 of rail 37' so that the panel may then be dropped for removal.

As the person removing the panel would have to stand on a ladder, for example, to reach the same and would have to use both hands to clean the inside surface of the panel or to re-lamp the lighting fixture, in order to avoid the need for a cumbersome holder for the panel at the top of the ladder, or for the person removing the panel to climb down the ladder to deposit the panel on the floor or for an additional person to hold the panel after it is removed, a pair of flexible plastic tapes 53 are desirably provided, one end of which is bonded to one side of the panel 11 and the other end of which is affixed to the rail 37. Thus, when the panel is removed and dropped, as above described, it will be supported at one edge by the tapes affixed to rail 37.

If desired, in order to retain the rails in parallel relationship, a plurality of cross-beams 55 may be provided, each preferably a substantially rectangular panel positioned in a vertical plane between the rails 37, 37' and secured thereto at each end. The cross-beams 55 are positioned between the longitudinal walls 18 of adjacent panels 11 and are desirably of the same color as the panels to avoid any light discontinuity.

By reason of the perforations or openings 21 in the panel, passageways are provided for the conditioned air from the conduits 52 to the interior of the room in which the panels are mounted. The perforations also permit passage of sound therethrough to be absorbed by the acoustic panels 51, thereby preventing undesirable reflection of such sounds.

By reason of the dimensions of the openings in the faces 15 with respect to the thickness of the sheet from which the panel is formed, i. e., the diameter of the holes is illustratively approximately four times the thickness of the sheet, each hole has a cut off angle "a" whose tangent as shown in Fig. 6 is approximately 0.25. Consequently, when the occupant of a room having the luminous ceiling, above described, is seated at a desk, his normal angle of view of the ceiling is such that he would not be able to see through the perforations. Hence there would be no direct glare from the lamps into the eyes of the viewer and the fluorescent lamps would not be visible. Concealment of direct view of the perforations is caused by the troughs in the panels as shown in Fig. 7 when they are positioned to extend at right angles to the observer for they will obstruct the view by the observer of at least a portion of the perforated faces 15 when he views the panels at his normal upward angle of vision.

Although the acoustic material or panels 51 are shown flush with the structural ceiling 33, it is to be understood that they could be suspended some distance below such ceiling such as by lowering the lighting fixtures so that they would form an intermediate layer between the panels 11 and the ceiling 33. By reducing the space between the luminous ceiling and the intermediate layer formed by the panels of acoustic material, loss of light in such space is diminished correspondingly.

With the use of plastic from which the panels are made, if they are heated to their heat distortion point, they will collapse and fall out of the support rails. Hence, if there should be a fire in a room with the luminous ceiling above described, the panels would fall out from between the rails, permitting sprinklers which might be concealed above the panels, to extinguish the fire.

The panels above described are relatively light in weight and may readily be formed and will afford excellent light diffusion while permitting air diffusion and sound absorption.

As many changes could be made in the above construction, and many apparently widely different embodiments of this invention could be made without departing from the scope of the claims, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. As an article of manufacture, a substantially rectangular translucent light diffusing panel of plastic material, said panel having a substantially rectangular strip along each of only two opposed edges thereof and integral therewith, said strips depending from an associated edge of the panel and extending the length of said edge, and being inclined outwardly from each of said edges, said strips when stressed reacting in direction substantially parallel to the plane of the panel, the lower edge of each of said strips being reversely bent outwardly to define an upstanding rim extending in a plane substantially at right angles to the plane of said panel.

2. The combination set forth in claim 1 in which said panel has a plurality of corrugations extending at right angles to said rectangular strips and defining parallel troughs and crests, each having a continuous flat face, the faces of said crests having a multiplicity of perforations therethrough, and the faces of said troughs being imperforate.

3. The combination set forth in claim 1 in which said panel has an upstanding wall at each of its two opposed edges inwardly of said rectangular strips and an upstanding wall at each of the other two opposed edges, said walls being connected at their ends, the walls at said other two opposed edges extending at substantially right angles to the plane of the panel.

4. The combination set forth in claim 1 in which said panel has a plurality of corrugations defining parallel troughs and crests extending at right angles to said strips, a plastic member extends across the ends of each of said troughs to close the latter, said members rising above the panel, the upper edge of each of said strips being connected to the upper edge of the associated plastic member and being formed integral therewith, and said panel has an upstanding wall extending at substantially right angles to the plane of said panel at the other two opposed edges thereof, the adjacent ends of said walls and said plastic members being connected.

5. As an article of manufacture a translucent light diffusing panel of plastic material, said panel having a plurality of corrugations defining parallel troughs and crests, each having a continuous flat face, the faces of said crests having a multiplicity of perforations therethrough and the faces of said troughs being imperforate.

6. An installation of the character described comprising a pair of spaced parallel support rails each having a flange extending inwardly therefrom in substantially a horizontal plane, a substantially rectangular translucent

light diffusing panel of plastic material, said panel having a substantially rectangular strip along each of only two opposed edges thereof and integral therewith, said strips depending from an associated edge of the panel and extending the length of said edge and being inclined outwardly from each of said edges, the lower edge of each of said strips respectively resting on said flanges, each of said strips being resilient whereby when pressure is applied to the panel to move the latter laterally toward one of the support rails, the strip adjacent said last named support rail will yield to permit such movement of the panel to effect disengagement of the lower edge of the strip adjacent the other support rail from its associated flange.

7. An installation of the character described comprising a pair of spaced parallel support rails, each having a pair of spaced parallel flanges extending inwardly therefrom in a horizontal plane, a substantially rectangular translucent light diffusing panel of plastic material, said panel having a substantially rectangular strip along each of only two opposed edges thereof and integral therewith, said strips depending from an associated edge of the panel and extending the length of said edge and being inclined outwardly from each of said edges, the lower edge of each of said strips resting on the lower flange of the respective pairs of flanges, each of said strips being resilient whereby when pressure is applied to the panel to move the latter laterally toward one of the support rails, the strip adjacent said last named support rail will yield to permit such movement of the panel to effect disengagement of the lower edge of the strip adjacent the other support rail from its associated lower flange, the lower edge of each of said strips being reversely bent outwardly to define an upstanding rim of height substantially equal to the distance between the associated pair of flanges whereby the upper flange of each pair will prevent upward movement of said panel at its opposed edges.

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