

Sept. 22, 1964

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3,149,704

CEILING SUSPENSION SYSTEM

Filed Nov. 14, 1960

3 Sheets-Sheet 1

Fig. 1

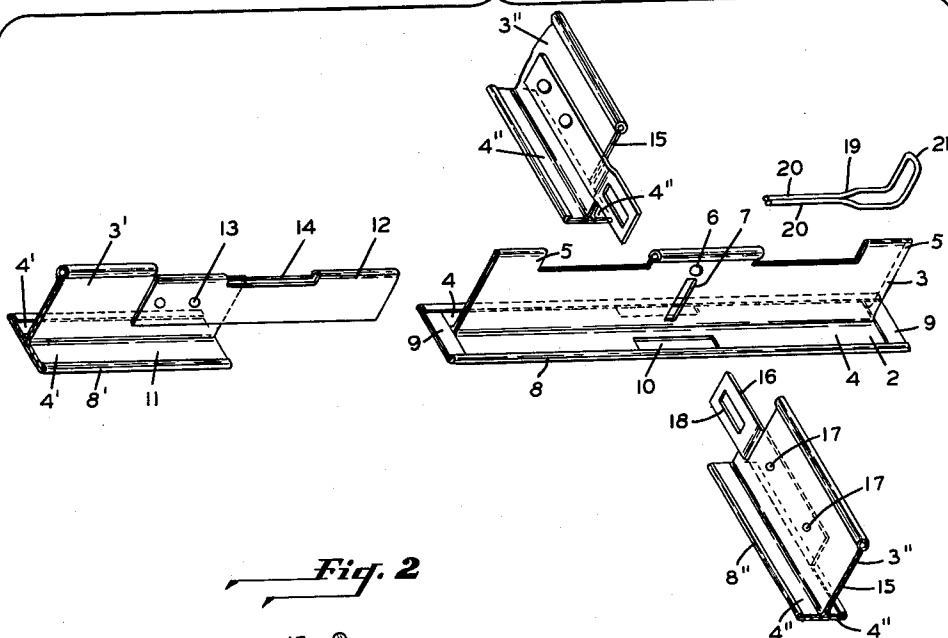


Fig. 2

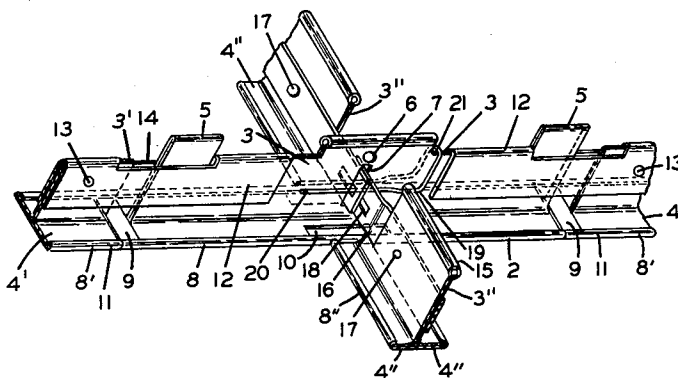
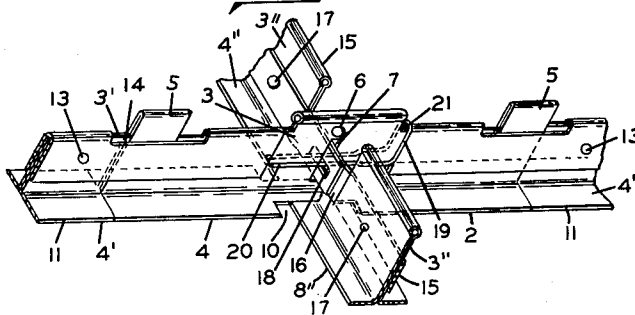


Fig. 3



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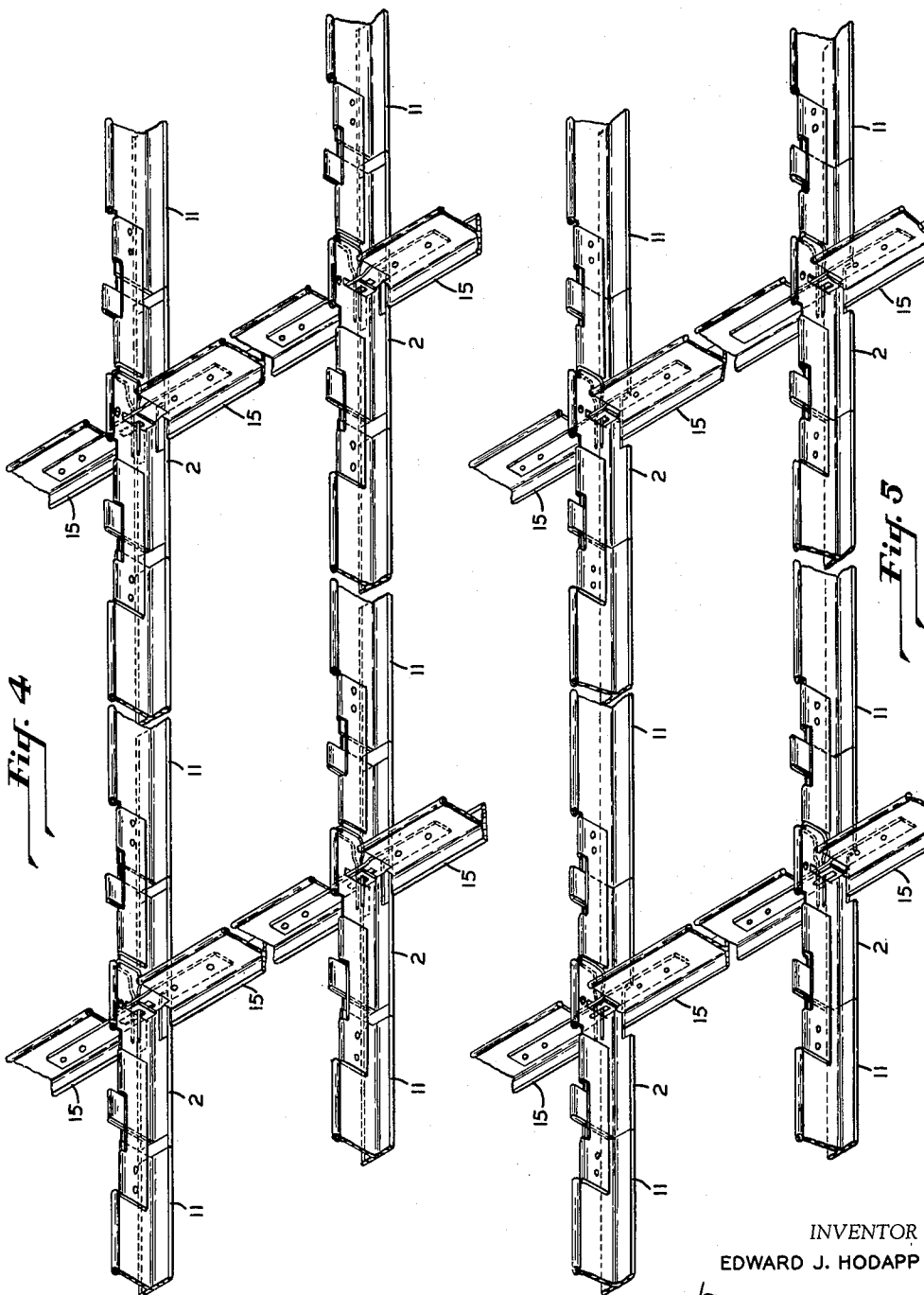
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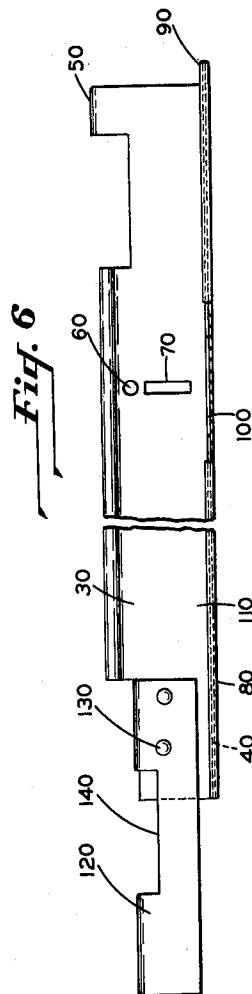
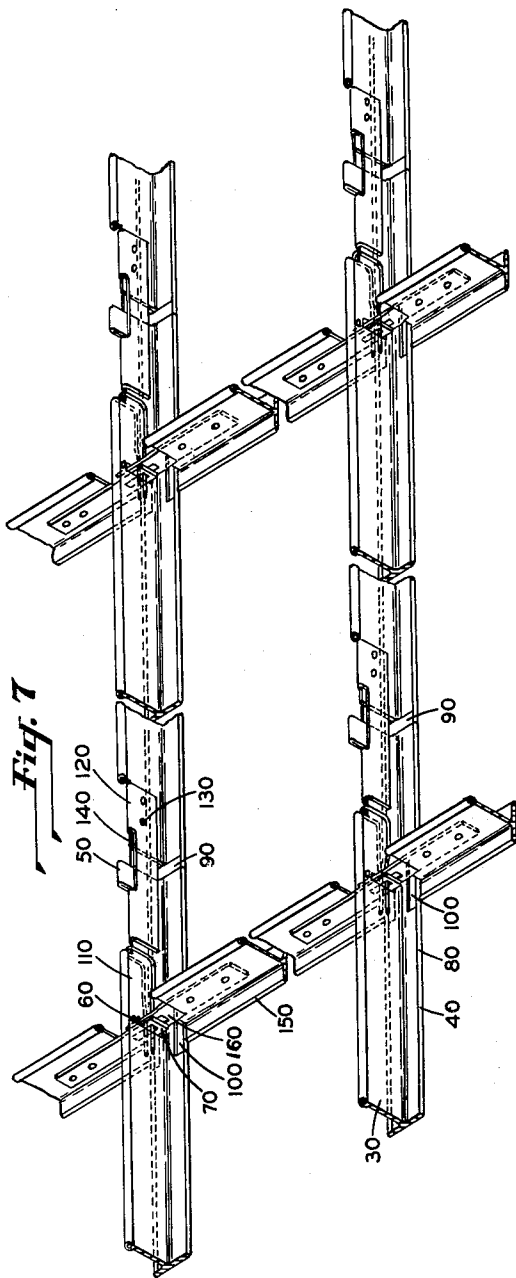
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3 Sheets-Sheet 3



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CEILING SUSPENSION SYSTEM

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This invention relates to a ceiling suspension system and more particularly to a suspension system which will resist high temperatures resulting from fire occurring in the room in which the ceiling is installed. The system here under consideration prevents the ceiling units from dropping from the suspension system and avoiding exposure of the structure thereof to the fire.

In the installation of ceilings in which fireproof units such as mineral fiber acoustical tile are installed in the suspended runner system, it is necessary that the ceiling tile itself meet certain requirements as to fire resistance. The purpose of these requirements is to prevent a fire in the room beneath the ceiling from burning through the ceiling to the building structure thereabove. Substantial fire losses could occur by reason of the fact that the ceiling material, even though fireproof in itself, falls from the suspension system because the elements comprising the suspension system expand when exposed to high temperatures. Normally during such expansion the openings in the structure are increased to the point where the members supporting the dimensionally stable ceiling units no longer engage them, and they fall from the system, thereby exposing the superstructure thereabove.

The invention can be used with suspension systems in which the edge areas of the face of the ceiling units are supported on a bottom flange of the suspension system as well as in those systems in which the ceiling units are supported by flanges which fit into a kerf in the edge of the ceiling unit. In this latter system no part of the suspension system is visible from the room area in which the system is installed. In systems of the type where the supporting flange is visible from the room, it is desirable from an aesthetic standpoint that the exposed surfaces be continuous in both directions at all times.

In the preferred embodiment of the invention here under consideration, the suspension system is designed for the runners to be positioned on a four-foot modulus. This accommodates the various sizes of ceiling units available. In this system each four-foot section of the suspension system, both main runners and cross runners, can expand lengthwise into an open space provided at each end of the runner. By this arrangement there is provided a reticulated structure in which the open areas are defined by the main runners and cross runners extending over the entire ceiling area. These open areas are maintained at the same size and shape during expansion or contraction of the runners. The ceiling units are positioned in these open areas of the reticulated system with the main runners engaging one edge of the rectangular unit and the cross runners engaging an edge at 90° with respect to the edge engaged by the main runner.

The spaces at the end of each runner are not necessarily open at all times, but for ease for installation are usually occupied during normal room temperatures by material having a low fusion temperature so that it will fuse during the early stages of a fire, making available the open space into which the runners can expand. In those installations where the bottom of the runner system is exposed, it is desirable that this visible bottom surface be covered with a material which will fuse at a low temperature. When this bottom surface melts and the metal inserts at the end of each main runner section and at the end of each cross runner section melt, these

runner elements are free to expand lengthwise. In the areas where the main runners abut either one another or a suitable connection member, and where the cross runners engage the main runners or their connecting members, there is provided a space for expansion of the runners. With this system the main runners and cross runners maintain the same relationship to one another, thereby defining an open ceiling unit receiving area of the same dimensions and shape when the metallic suspension system has expanded to its fullest extent as when the system is exposed to normal temperature conditions. It has been found that with an arrangement of this type a fire rating of three hours is possible.

An object of this invention is to provide a suspension system which will retain the ceiling elements in position, protecting the superstructure thereabove during the occurrence of a fire in the room below.

Another object of this invention is to provide a suspension system which permits endwise expansion of the individual runner elements but in which the relationship between the various elements remains the same during such expansion.

A still further object of the present invention is to provide a suspension system in which elements are employed so that certain portions will fuse at relatively low temperatures to permit the elements to expand into the areas previously occupied by these fusible portions.

In order that the invention may be more readily understood, it will be described in connection with the attached drawing in which—

FIG. 1 shows the five elements utilized in the construction of the system;

FIG. 2 shows the relative position of the elements under normal conditions;

FIG. 3 shows the relative position of the elements after the fusible portions have been removed by high temperature;

FIG. 4 shows the suspension system in position under normal conditions, showing the area for reception of the ceiling unit;

FIG. 5 shows a suspension system with the fusible portions removed, showing the arrangement for holding the ceiling unit in position;

FIG. 6 is a modification of a main runner which requires no individual hanger splice for connecting it to adjacent runners; and

FIG. 7 shows a reticulated structure using the modified main runner of FIG. 6.

Referring to the preferred embodiment illustrated in FIG. 1, there is shown a hanger splice 2 in the form of an inverted T. This hanger splice comprises an upstanding web 3 corresponding to the leg of the inverted T and a ceiling unit supporting flange 4 extending on either side of the web 3. This flange 4 corresponds to the cross-bar of the inverted T. These flanges 4 extend at right angles to the web 3 and can engage the bottom of the edge portion of a ceiling unit in such materials as lay-in units, or it can be received in a kerf in the edge of the tile in those cases where the suspension system is not exposed. The web 3 is provided at its ends with upstanding members 5 which extend above the normal height of the web 3. These members 5 are for engagement with the main runners, as will be described more fully herein. Close to the upper edge of the web 3 and centrally located is an opening 6 for the reception of a suspending member such as a wire or other suitable means (not shown) connected to the building structure for holding the hanger splice 2 in its proper suspended position. Immediately below the opening 6 and in alignment therewith is an elongated vertical opening 7 in the web 3. The purpose of this elongated vertical opening 7 is to receive projections on the ends of the cross runners to be described more fully later.

In those installations where the ceiling units are lay-in units and the bottom surface of the suspension system is exposed, this surface may be covered with a metallic wrap 8 which is curled or beaded over the edges of the flanges 4 to hold the wrap securely in position by a crimping action. It will be noted that the wrap 8 is longer than the web 3 and the flanges 4 and that this area of extension is filled by an insert 9 which serves as a continuation of the flanges 4 beyond the ends of the hanger splice 2. The area of the flanges 4 located centrally of the hanger splice 2 is cut out as indicated at 10. Inasmuch as these cut-out areas 10 are positioned centrally, they are also centered on the elongated opening 7 in the web 3 and are so positioned that they are in alignment with the flanges on the cross runners when in position. These cut-out areas 10 are in the flanges 4 only and not in the wrap 8. This arrangement will be described later. The wrap 8 and the inserts 9 are of a material having a fusing point substantially lower than the fusing point of the material employed in making the hanger splice 2.

To the left in FIG. 1 there is shown the end of a main runner 11 having the same cross-sectional design as the hanger splice 2 in that it has a central upstanding web 3' and ceiling unit supporting flanges 4' extending at right angles to the web 3' at the bottom thereof. In an area adjacent the end of the main runner 11 the central web 3' is cut down and a connecting member 12 is riveted to the end of the web 3 by means of rivets 13. This connecting member 12 in the preferred embodiment here disclosed is made of a folded piece of metal which fits over the web 3' of the main runner 11. Inasmuch as the connecting member 12 extends beyond the end of the web 3' of the main runner 11, this folded arrangement provides a space for the reception of the web 3 of the hanger splice 2 when the two elements are brought into cooperative relationship. The top portion of the inverted U-shaped fold of the connecting member 12 is removed in the central area to provide a slot 14 through which projection 5 may extend when the connecting member 12 is placed over the web 3 of hanger splice 2 in the area of projection 5. This will bring the flanges 4' of main runner 11 in alignment with the flanges 4 of hanger splice 2. In the exposed system the metallic wrap 8' of main runner 11 will also be in alignment with metallic wrap 8 of hanger splice 2 so that when viewed from the bottom the two elements will appear to be continuous except for a fine line where the two units abut. When in this position the ends of flanges 4' of main runner 11 abut the fusible insert 9 on the hanger splice 2. It will be understood that a similar main runner 11 is also in position to be secured to the opposite end of the hanger splice 2 onto the projection 5 at the right-hand end of hanger splice 2 as viewed in FIG. 1.

It will be noticed in FIGS. 2 and 3 the slot 14 in the folded U-shaped portion of the connecting member 12 is of sufficient length that when the upstanding projection 5 is positioned therein the connecting member 12 may move longitudinally while the projection 5 is still in a slot 14. This is brought about when the insert 9 melts or fuses and the main runner 11 expands into the area formerly occupied by this fusible insert 9.

The cross runners are shown in FIG. 1, one above and one below the hanger splice 2 in the position approaching the elongated opening 7. The cross runners 15 are of the same general cross-sectional design as the hanger splice 2 and the main runners 11. This means that the web 3'' of the cross runners assumes the same position as the web 3 of the hanger splice and the web 3' of the main runner. The same is true of the ceiling unit supporting flanges 4'' and the wrap 8'' which covers the bottom surface of the flanges 4'' in exposed systems. Instead of the folded connecting member 12 as shown on the main runners, the cross runners 15 are provided with a projecting tab 16 which is riveted to the web 3'' by means of rivets 17. This projecting tab 16 has an elongated opening 18 therein which is so positioned that when the projecting tab 16 is inserted in the elongated opening 7 of the hanger splice 2 in such manner that the end of the flanges 4'' abut the flanges 4 of the hanger splice, the opening 18 is bisected vertically by the hanger splice. The elongated opening 7 in hanger splice 2 is of sufficient width to accommodate two of the projecting tabs 16, one for each of the cross runners on each side of the hanger splice. When the cross runners are in position with their flanges in abutting relationship to the flanges on the hanger splice, the opening 18 in each of the cross runners will be in alignment. These cross runners are secured to the hanger splice by means of a wire clip or locking device 19. This clip is sprung apart so that one of its legs 20 will be positioned on one side of the hanger splice 2 and the other leg 20 will be on the other side of the hanger splice 2. These legs pass through the opening 18 in the projecting tab 16 of the cross runners 15. The clip 19 has a pressure spring effect by means of its curved top 21 and is held in engagement with the sides of the web 3 of the hanger splice 2 by this spring effect. When in position the clip will be held firmly in engagement with each side of the web 3 and the legs 20 will pass through the openings 18 in the projecting tabs 16 on the cross runners 15.

When in this position the flanges 4'' of the cross runners 15 will be in alignment with the cut-out areas 10 in the flanges 4 of the hanger splice 2. The length of the opening 18 in the projecting tabs 16 are of sufficient length that the cross runner 15 may expand into the open area 10 in hanger splice 2 and the projecting tabs 16 will be free to move on into the opening 7 by reason of the clearance provided by the opening 18.

FIG. 2 shows the four members in position with the clip 19 holding the cross runners 15 in position. This view shows the relative position of the various units during normal conditions.

Referring now to FIG. 3 the units are shown in their relative positions after the fusible material has been removed by reason of a temperature of sufficient intensity to fuse the inserts 9 leaving the main runners and cross runners free to expand to the fullest extent permitted by the arrangement. It will be seen from this that the cross runners 15 have moved into the cut-out areas 10 and that the flanges 4' of the main runner 11 are in abutting relationship with the flanges 4 of the hanger splice 2. It will be seen also that the upstanding projection 5 is now extending through the opening 14 in an area more centrally located in this opening than that shown in FIG. 2. This occurs by reason of the fact that the connector 12 has moved inwardly on the hanger splice during the expansion of the main runner 11.

In this embodiment of the invention the hanger splices 2 are positioned on four-foot centers throughout the suspended ceiling area. This means that the main runners and cross runners are of a length to fit between this four-foot center arrangement. This accommodates slabs of ceiling material four feet square or any division of a four-foot square arrangement. In those instances where the slabs are four feet in one dimension and any division of four feet in the other dimension, such as one foot or two feet, this can very easily be accommodated by having cut-out areas in the main channel 11 similar to the cut-out areas 10 in the hanger splice 2. These cut-out areas may be positioned midway on the main runner 11 or may be positioned on one-foot centers on the main runner 11 with cross runners positioned to abut the main runner 11 at these locations. It will be understood, of course, that where the cut-out areas are provided there are also provided slots similar to the slot 7 in the web 3' of the main runner 11. The same type clip 19 is used for attaching these cross runners to the main runner 11 in these areas.

The size of the fusible element 9 and the size of the cut-out areas 10 are dependent upon the length of the runner

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units in alignment therewith. For example, in the specific embodiment here illustrated where the hanger splices are positioned on four-foot centers, the fusible element and the cut-out area are approximately one-quarter of an inch at each end. This allows one-eighth of an inch expansion per foot of the runner elements. It will be understood that where the hanger splices are placed on less than four-foot centers, the size of these fusible areas can be diminished accordingly.

The specific figures included herein are for metal alloys of the type used during the experimental work with the suspension system in order to get a satisfactory laboratory rating of three hours under fire. Where different alloys are used, their expansion rate at a given temperature is easily determined, and the size of the elements 9 and the cut-out areas 10 can be determined accordingly. This same modification can be borne in mind when determining the amount of clearance to be provided for the other member in designing systems which operate on the four-foot center arrangement here disclosed or on lesser or greater spanning systems.

The fusible inserts may be metal or plastic or any material which will insure proper spanning of the runners in abutting relationship during normal conditions and will readily fuse under high temperatures to provide space for expansion of the runner elements. Aluminum is suitable as well as some of the well-known soft alloys of lead and zinc, etc. The invention can also be carried out with plastic materials such as styrene, etc.

In the modification shown in FIGS. 6 and 7 the hanger splice has been eliminated and instead the system is suspended in much the same manner as that already described except that the wires or other suspending members engage the main runners 110 directly through holes 60 positioned therein immediately above the elongated, vertical openings 70 for the reception of the cross runners 150 in the web 30. When this arrangement is used, the main runner is modified in the manner shown in FIG. 6 in which one end of the main runner carries the connecting element 120 which is of the same design as the connecting element 12 shown in FIG. 1, and the other end of the main runner has the upstanding projection 50 for engagement with the opening 140 in the connecting element 120. The connecting element 120 is secured to the main runner 110 by means of rivets 130. The manner of attaching the cross-runner members to the main runners is similar to that shown in FIGS. 1, 2, and 3; however, in this modification the cross runners are attached directly to the main runners, using the same vertical slot and clip arrangement passing through the horizontal slot in the ends of the projections 160 on the cross runners 150.

In the modification shown in FIG. 7, the cross runners engage the main runners at four-foot intervals. It will be understood, of course, that the main runners may be punched with vertical slots to maintain the modular arrangement on two-foot or one-foot centers.

The same system of providing fusible inserts at the zones of junction where the main runners abut one another and where the cross runners abut the main runners, is carried out in this modification in exactly the same manner as described earlier. Also, the fusible wrap 80 on the bottom flanges 40 for those installations where the lay-in ceiling units are used are also present in this modification. The fusible inserts between adjacent main runner elements are designated by the numeral 90, while the inserts where the cross runners engage the main runners are designated at 100.

It will be understood that the modification shown in FIGS. 6 and 7 shows another form of suspending the supporting grid system; however, other means of suspension such as having the cross runners suspended instead of the main runners are also usable. The important feature of the invention resides in providing means for each four-foot section or each section on a modulus of four

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feet to expand in both directions longitudinally without pushing the cross member engaged by it out of position. With this arrangement the opening in the grid system remains the same dimension, and inasmuch as the acoustical ceiling unit is dimensionally stable, it will be retained in the grid system when the grid system is fully extended in as secure a manner as it was retained before the grid system expanded.

In conventional suspension systems in which no take-up is provided other than at the edges, as soon as any expansion takes place the entire grid system shifts toward the edges, increasing the size of the openings and permitting the ceiling units to drop therefrom, exposing the entire upper area. In systems of this type if no space is provided for expansion at the edges, the suspension system will buckle and twist to such an extent that the ceiling units drop from the system. Instead of the fusible inserts, the same effect can be attained by merely extending the wrap 8 beyond the extremity of the hanger splice or the runner a distance equivalent to that provided by the fusible inserts. It will be obvious also that the flanges 4" on the cross runners can be terminated short of the end of the wrap 8" on the bottom thereof to accommodate the expansion of the cross runners without the necessity of the cut-out portions shown in the preferred embodiments.

I claim:

1. In a reticulated ceiling suspension system for holding a plurality of rectangular ceiling units, said suspension system comprising main runners for supporting at least one edge of said rectangular ceiling unit and cross runners for supporting at least one edge at right angles to the edge supported by said main runners, said main runners and cross runners being made in sections to fit a predetermined modular arrangement, fusible inserts positioned between said main runner section and at the points where said cross runners abut said main runner, said inserts having a melting point substantially less than the melting point of the main runners and cross runners.

2. In a reticulated ceiling suspension system, the elements comprising a hanger splice, a main runner for engagement with the end of said hanger splice, a cross runner for engagement with said hanger splice at right angles to the main runner, and fusible inserts positioned at the points where said main runner and cross runner abut the hanger splice, said inserts having a melting point substantially less than the melting point of the main runner, cross runner and hanger splice.

3. In a reticulated ceiling suspension system, the elements comprising a plurality of equally spaced hanger splices, main runner channels for engagement with the ends of said hanger splices, cross runners for engagement with said hanger splices at right angles to the main runners, and fusible inserts provided at the points where the main runners and cross runners abut the hanger splices, said inserts having a melting point substantially less than the melting point of the main runners, cross runners and hanger splices.

4. In a reticulated ceiling suspension system, the elements comprising a plurality of hanger splices, main runners for engagement with the ends of said hanger splices, cross runners for engagement with said hanger splices at right angles to the main runners, means provided on said hanger splices, main runners and cross runners for cooperating to form a rectangular grid system, and fusible inserts located at the points where the main runners and cross runners abut the hanger splices, said inserts having a melting point substantially less than the melting point of the main runners, cross runners and hanger splices.

5. In a reticulated ceiling suspension system, the elements comprising a plurality of hanger splices, main runners for engagement with the ends of said hanger splices, cross runners for engagement with said hanger splices at right angles to the main runners, said hanger splices, main runners, and cross runners being provided with supporting flanges at their lower extremities, means for connecting

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said main runners and cross runners to said hanger splices in such manner that said supporting flanges are on the same plane, and fusible inserts located at the points where the main runners and cross runners abut the hanger splices, said inserts having a melting point substantially less than the melting point of the main runners, cross runners and hange splices.

6. In a reticulated ceiling suspension system, the elements comprising a hanger splice, a main runner for engagement with the end of said hanger splice, a cross runner for engagement with said hanger splice at right angles to the main runner, means for connecting said main runner to said hanger splice and said cross runner to said hanger splice, said connecting means being adapted to permit longitudinal movement of the main runner and cross runner without moving said hanger splice, and fusible inserts located at the points where the main runner and cross runner abut the hanger splice, said inserts having a melting point substantially less than the melting point of the main runner, cross runner, and hanger splice.

7. In a reticulated ceiling suspension system, the elements comprising a hanger splice, a main runner for engagement with the end of said hanger splice, a cross runner for engagement with the hanger splice at right angles to the main runner, a fusible metallic insert located at the points where the main runner and cross runner abut the hanger splice, said fusible metallic insert having a melting point substantially less than the melting point of the main runner, cross runner and hanger splice.

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8. In a reticulated ceiling suspension system, the elements comprising a hanger splice, a main runner for engagement with said hanger splice, a cross runner for engagement with the hanger splice at right angles to the main runner, a fusible aluminum insert located at the points where the main runner and cross runner abut the hanger splice, said fusible aluminum insert having a melting point substantially lower than the melting point of the main runner, cross runner and hanger splice.

9. In a reticulated ceiling suspension system, the elements comprising a hanger splice, a main runner for engagement with said hanger splice, a cross runner for engagement with said hanger splice at right angles to the main runner, a fusible insert located at the points where the main runner and cross runner abut the hanger splice, said fusible insert having a melting point substantially lower than the melting point of the main runner, cross runner and hanger splice.

References Cited in the file of this patent

UNITED STATES PATENTS

1,079,862	Kinnear	Nov. 25, 1913
1,704,826	Forbes	Mar. 12, 1929
2,718,290	Segil	Sept. 20, 1955
2,829,743	Strauss et al.	Apr. 8, 1958
2,840,200	Wong	June 24, 1958
3,015,375	Lickliter	Jan. 2, 1962
3,089,570	O'Neil	May 14, 1963