A cover assembly for a floor joint utilizes the combination of a bowed leaf spring spanning the joint and a coiled compression spring extending vertically in the joint to maintain an essentially stable holding bias on the cover plate of the assembly during relative shifting of the floor members of the joint caused by normal thermal effects on the members. The leaf spring is designed to break upon excessive movement of the floor members such as by earthquakes, thus releasing the cover plate before the latter can be permanently damaged.

12 Claims, 8 Drawing Figures
1 FLOOR JOINT COVER ASSEMBLY

This invention relates to an improved cover assembly for expansion joints, particularly floor joints.

The cover plate of a floor joint cover assembly is exposed to constant daily traffic over the floor. Accordingly, it is extremely important that the plate be held tightly against the floor over the joint so that the plate does not present a hazard to the moving traffic. Moreover, a tight seal is important in preventing moisture and refuse from entering the joint.

Such a seal is difficult to maintain during relative shifting of the floor members which define the joint, especially when the shifting occurs in irregular combinations of directions, commonly referred to as four-way shifting. In the past many attempts have been made to provide cover assemblies which perform in the desired manner, yet most have resulted in assemblies which were less than satisfactory. For example, one concept was to use a yieldable leaf spring within the joint which extended across the latter and was rigidly connected to the overlying cover plate. In theory, the spring was to provide a yieldable holding bias on the cover plate, even during expansion and contraction of the floor member. In practice, the relatively thin aluminum cover plate could become deformed during expansion of the floor members because of an excessive buildup of holding bias through the rigid connection between the plate and leaf spring, thereby necessitating replacement or repair of the damaged plate, both of which were undesirable from an economical standpoint. Similarly, upon contraction of the members to widen the joint, the holding bias on the cover plate was directly reduced by a proportionate amount, thereby loosening the plate and increasing the chances of accidents and moisture accumulation.

An additional problem inherent in prior assemblies was their lack of safeguards for major shifting of the floor members such as encountered during earthquakes as opposed to normal thermal expansion and contraction. Because of the structural design of previous assemblies and the positive manner in which the cover plates thereof were held in overlying relationship to the joints, damage to the cover plates was almost certain to occur during such large-scale tremors, necessitating costly replacement of the cover plate and other components of the assembly as well.

In view of the above problems, it is an important object of the present invention to provide a floor joint assembly having opposed carrier sections supporting a cover plate thereon which is held in position by the yieldable interaction of a leaf spring spanning the joint and a coil spring extending vertically in the joint, such interaction resulting in the maintenance of an essentially stable holding bias on the plate over the normal range of thermally caused expansion and contraction of the structural floor members of the joint.

Another important object of the invention is the provision of a leaf spring as aforesaid which is designed to break along lines of bend thereof upon excessive relative shifting of the floor members, such as during an earthquake, before the cover plate can be structurally damaged, thereby releasing the plate.

A further important object of the present invention is to provide a cover assembly as aforesaid having a vertical stabilizing post which passes through the leaf spring and permits canting of the latter relative to the post during irregular, four-way shifting of the floor members.

Still another important object of the instant invention is the provision of means for precluding rotation of the post when the latter is connected to the cover plate during installation of the assembly.

In the drawings:

FIG. 1 is a perspective, cross-sectional view of a floor joint installation utilizing a cover assembly constructed in accordance with the principles of the present invention;

FIG. 2 is a fragmentary, top plan view of the installation of FIG. 1 on a reduced scale, portions of the cover plate thereof being broken away to reveal components of the assembly therebelow;

FIG. 3 is a vertical, cross-sectional view of an installation utilizing a second embodiment of the present invention especially adapted for installations having joints smaller that that shown in FIG. 1;

FIG. 4 is a vertical cross-sectional view of the installation of FIG. 3 illustrating the canting action of the assembly during four-way shifting of the floor members;

FIG. 5 is an enlarged elevational view of components of the first embodiment illustrating the relationship of the components in both the normal and unstressed condition thereof;

FIG. 6 is a top plan view of the components of FIG. 5;

FIG. 7 is a view similar to FIG. 5 of components of the second embodiment of the invention; and

FIG. 8 is a top plan view of the components of FIG. 7 similar to FIG. 6.

Referring initially to FIG. 1, a pair of solid structural members 10 are shown which comprise, for example, sections of the floor of a building. The members 10 are illustrated as being constructed from cementitious material, although it is to be understood that the principles of the present invention are not limited to structural members of this particular construction. Members 10 are spaced apart to present an open joint 12 therebetween, and each has an elongated, right-angle carrier section 14 of the cover assembly integral therewith covering portions of the interior wall of the member 10 and the top margin of the latter. Sections 14 are identical in configuration and may be conveniently constructed of an extrudable material such as aluminum or the like, such that the somewhat irregular projections and channels on each section 14 may be easily formed. Sections 14 are preferably embedded in the respective floor members 10 during construction of the latter, and a cavity 16 on each section 14 between the vertical wall 18 and horizontal shelf 20 thereof extends longitudinally of section 14 to capture a number of longitudinally spaced nuts 22 for corresponding anchor bolts 24 embedded deeply within the corresponding floor member 10. A pair of opposed grooves 26 in the walls 18 on opposite sides of joint 12 extend longitudinally of the latter for supporting an optional, downwardly looped, conventional drip strip (not shown) within joint 12. Each shelf 20 is disposed a short distance below the upper surface of the corresponding floor member 10 and is provided with a short, upstanding hook-shaped wall 28. A pair of vinyl or rubber sealing strips 30 are disposed on respective shelves 20 interlocked with walls 28 and flush with the top surface of members 10.

The cover assembly also includes a flat, elongated cover plate 32 of extruded aluminum or other suitable
material which overlies joint 12 and has a pair of downwardly extending ribs 34 along opposite side margins thereof which are received within upwardly opening channels 36 in the sealing strips 30. The recessed nature of shelves 20 permit plate 32 to lie flush with the upper surfaces of the sealing strips 30, walls 28 and groove members 10. A series of bowed, generally U-shaped, resilient leaf springs 38 of spring steel are disposed below plate 32 within joint 12 at approximately 18 inch intervals, and each cooperates with a coil compression spring 40 to exert holding bias on plate 32 through a post 42 during relative shifting of the floor members 10. Spring 38 has a pair of legs 44 interconnected by a bight 46 which, as shown clearly in FIG. 5, are capable of flexing toward and away from each other in response to inwardly directed pressure applied to the outside of the legs 44. Legs 44 converge as the bight 46 is approached and lie against opposed, sloping upper faces 48 of walls 18 when installed with the upper inner-turned tips 50 of legs 44 bearing against the underside of an overhanging portion of each shelf 20. A pair of upturned stiffening flanges 52 on opposite longitudinal sides of the bight 46 prevent the latter from flexing during movement of the legs 44 toward or away from one another.

The rigid, rectangular or hexagonal post 42 for each set of springs 38 and 40 presents a plurality of flat sides 54 and has its upper interior end threaded to receive a flathead bolt 56 projecting through the cover plate 32, whereby to firmly secure the post 42 to the plate 32. Post 42 passes through a polygonal opening 58 in bight 46 having the same number of sides as post 42 to preclude rotation of the latter relative to spring 38, yet permit linear movement of bight 46 along post 42.

The coil spring 40 is carried by the lower portion of post 42 extending beyond bight 46 and is trapped between a lower washer 60 affixed to post 42 and the underside of bight 46. An upper washer 62 affixed to post 42 above bight 46 limits the travel of bight 46 in an upward direction along post 42.

The installation shown in FIGS. 3, 4, 7 and 8 is identical to that previously described, except in certain respects which adapt the second embodiment for joints which are narrower than joint 12 of FIG. 1. Accordingly, components of the installation in FIGS. 3, 4, 7 and 8 are identified by the same numerals used for the first embodiment with the addition of the letter a. In view of the fact that the joint 12a is narrower than joint 12, cover plate 32a is correspondingly narrower, post 42a is shorter than post 42, and springs 38a and 40a are smaller. Further, spring 38a has legs 44a and bight 46a which are rectilinear in configuration as opposed to the arcuate configuration of legs 44 and bight 46. In other structural and operational respects the two installations are identical.

Prior to installation of the cover assembly, each leaf spring thereof is in its unstressed condition as illustrated by the widely extended legs 44 of spring 38 in FIG. 5. However, when the apparatus of FIG. 5 is placed within the joint 12, the legs 44 are forced to flex toward one another a sufficient extent to allow spring 38 to be snapped in place as tips 50 pass over the overhanging portion of the shelves 20 into disposition therebeneath. After the cover plate 32 has been placed over joint 12 with ribs 34 inserted into the channels 36 of sealing strips 30, the bolt 56 for each post 42 is threaded into the latter, causing the post 42 to be drawn upwardly toward plate 32 against the biasing action of springs 38 and 40. Rotation of post 42 is prevented at this time because of the flat-sided configuration of post 42 and the similar configuration of opening 58. Once tightening of bolt 56 is completed, the assembly assumes the normal, stressed condition illustrated in FIG. 1 and in phantom in FIG. 5.

Under the effects of normal thermally caused expansion and contraction, the floor members 10 move relatively upward or away from one another within a total range of approximately three-eighths inches. In the event that such movement is simply toward one another in linear fashion to constrict joint 12, legs 44 flex inwardly toward another to urge bight 46 downwardly further into joint 12. If post 42 were rigidly secured to spring 38, it is apparent that such action would cause a buildup of biasing energy in spring 38 directly proportional to the movement of members 10, such buildup, in turn, being transmitted directly to plate 32. Without release of the progressively accumulating energy, it is likely that plate 32 could be permanently deformed, necessitating repair or replacement. However, since bight 46 is movable along post 42, such buildup is prevented from occurring as the springs 38 and 40 interact to establish an equilibrium point. The resultant force transmitted to post 42 and hence plate 32, is substantially less than that which would otherwise be applied to plate 32 if spring 38 and post 42 were directly joined. Accordingly, over the normal displacement range of three-eighths inches, the holding bias on plate 32 is maintained in an essentially stable condition such that damage to plate 32 is prevented.

Similarly, in the event that four members 10 shift away from each other to expand joint 12, the legs 44 are allowed to flex outwardly from their normal flexed condition of FIG. 1, tending to move bight 46 upwardly toward plate 32. Once again, if post 42 and spring 38 were rigidly interconnected, such outward movement of legs 44 would substantially reduce the holding bias on plate 32. However, due to the shiftability of spring 38 along post 42 and its interaction with spring 40, the bias actually released is substantially less than would otherwise take place, and essentially stable force is applied against plate 32.

In many situations, the members 10 are likely to move in a combination of several different directions as illustrated in FIG. 4 wherein members 10 are shifted in both horizontal and vertical planes relative to one another. This four-way shifting of members 10 has presented certain problems in the past because of the inability of spring-retaining structure within the joint to function properly under such distorted conditions. However, as illustrated by the spring 38, the enlarged dimensions of opening 58a with respect to post 42a, permit spring 38a to cant relative to post 42a, thus relieving shear stress between post 42a, bolt 56a and cover plate 32a. Moreover, the inclined faces 48a facilitate such canting of the spring 38a at this time, and the springs 38a and 40a interact to maintain essentially stable holding bias on plate 32a.

While the leaf spring 38 cooperates with spring 40 to maintain stable, yieldable biasing pressure against plate 32, it also provides a means for releasing plate 32 under earthquake conditions before plate 32 can be damaged. To this end, both embodiments of the springs 38 are tempered to a predetermined degree of brittleness sufficient to cause the legs 44 to break along the lines of
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weakness presented by the bending junction of legs 44 with bight 46 prior to a point at which excessive bias could be applied to plate 32. Once breakage has occurred, the plate 32 is released and can be easily salvaged when the quake has subsided. Since the spring 38 is relatively inexpensive compared to the plate 32, this breakability feature affords a distinct economic advantage.

It is to be understood that various combinations of spring strengths could be used to reach the desired interaction of springs 38 and 40 during shifting of members 10. Regardless of which combination is chosen as best suited for the situation at hand, the fact that leaf spring 38 is yieldably movable along post 42 instead of being rigidly affixed thereto, assures that substantially less energy buildup or release thereof occurs than would otherwise be the case. Accordingly, over the normal range of relative shifting of members 10, the holding bias on plate 32 is maintained in an essentially stable condition.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A cover assembly for a joint defined by a pair of spaced-apart, relatively shiftable structural members, said assembly comprising:
   - a plate-like cover;
   - means supporting said cover in overlying relationship to said joint;
   - first yieldable biasing means disposed in spanning relationship within the joint having a pair of resilient legs on opposite sides of the joint and a shiftable portion between said legs, said first biasing means being responsive to relative shifting of said members toward and away from one another to flex said legs and move said shiftable portion toward and away from said cover, to thereby vary the biasing energy of said first biasing means,
   - second yieldable biasing means within said joint disposed for operation by said shiftable portion of said first biasing means during movement thereof, said second biasing means being coupled with said cover for biasing the latter toward the joint, and said first and second biasing means interacting with one another during relative shifting of said members to dissipate biasing energy otherwise accumulating in said first biasing means, thereby stabilizing the bias applied to said cover.

2. The assembly as claimed in claim 1, wherein is provided an elongated, rigid element on the cover projecting into said joint and supporting said second biasing means, said shiftable portion shifting relative to said element during movement toward and away from said cover to relax and compress said second biasing means.

3. The assembly as claimed in claim 2, wherein said portion of the first biasing means is provided with an opening receiving said element for movement of the portion therealong, said opening being enlarged with respect to said element a sufficient extent to permit canting of said first biasing means relative to the element.

4. The assembly as claimed in claim 2, wherein said portion of the first biasing means is provided with an opening receiving said element, said element and said portion being provided with mutually interengageable means for precluding rotation of said element within said opening.

5. The assembly as claimed in claim 4, wherein said element has a plurality of flat sides, said opening corresponding in configuration to the element.

6. The assembly as claimed in claim 1, wherein said first biasing means includes a generally U-shaped, resilient component presenting a pair of legs bendable toward and away from one another from opposite sides of the joint in response to corresponding shifting of said members and a bight interconnecting said legs, and wherein is provided a rigid post on said cover, projecting into said joint through said bight, said post being shiftable received by said bight for movement of the latter along the post in response to bending of said legs.

7. The assembly as claimed in claim 6, wherein is provided an abutment on said post below said bight, said second biasing means being interposed between said abutment and said bight.

8. The assembly as claimed in claim 7, wherein said second biasing means includes a coil compression spring surrounding said post.

9. The assembly as claimed in claim 6, wherein is provided an opening in said bight for the post, said opening being enlarged with respect to said post a sufficient extent to permit canting of said component relative to the post.

10. The assembly as claimed in claim 6, wherein said post has a plurality of flat sides, and wherein is provided an opening in said bight for the post conforming in configuration to said post whereby to preclude relative rotation between the component and the post.

11. The assembly as claimed in claim 6, wherein is provided an elongated flange integral with said bight and projecting outwardly therefrom, said flange extending generally in the direction of bending movement of said legs to preclude corresponding bending of said bight to a sufficient extent to prevent binding of the bight on the post during movement of the bight thereof.

12. The assembly as claimed in claim 6, wherein said component is constructed of material capable of breaking along the lines of bend of said legs upon excessive relative shifting of said members, thereby releasing said cover.

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