Deck Fire Barrier
WITh Spray Foam

US007454876B2

(12) **United States Patent**
Kelly Spray Foam Fire Barrier

(10) **Patent No.: US 7,454,876 B2**
(45) **Date of Patent: *Nov. 25, 2008**

(54) **FIRE RETARDANT ROOF STRUCTURE FOR STYRENE INSULATED ROOFS AND METHOD FOR MAKING THE SAME**

(76) Inventor: **Thomas L. Kelly**, 31 Sands St., Waterbury, CT (US) 06710

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 716 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **10/923,929**

(22) Filed: **Aug. 23, 2004**

(65) **Prior Publication Data**

US 2006/0053717 A1 Mar. 16, 2006

(51) **Int. Cl.**
E04B 1/00 (2006.01)
E04G 21/00 (2006.01)
E04G 23/00 (2006.01)

(52) **U.S. Cl.** **52/746.11**; 52/309.4; 52/783.11; 52/784.15; 52/DIG. 15

(58) **Field of Classification Search** .... 52/746.11, 52/309.4, 410, 783.11, 783.14, 309.8, 784.15, 52/676, DIG. 15, 450, 785.15
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,245,689 A * 6/1941 Krueger 52/88
2,484,695 A * 10/1949 Dickey et al. 52/450
3,300,912 A * 1/1967 Shumaker 52/39
3,397,497 A * 8/1968 Shea et al. 52/334
3,956,864 A * 5/1976 Fung 52/414
4,106,249 A * 8/1978 Morton 52/336
4,450,663 A * 5/1984 Watkins 52/309.4
4,558,550 A * 12/1985 Marchais et al. 52/309.7
4,707,961 A * 11/1987 Nunley et al. 52/408
5,259,157 A * 11/1993 Ault 52/145
5,561,953 A * 10/1996 Rotter 52/198
5,600,929 A * 2/1997 Morris 52/309.8
5,842,315 A * 12/1998 Lin 52/309.9
6,418,678 B2 * 7/2002 Rotter 52/199
6,944,997 B2 * 9/2005 Verkamp 52/309.4

* cited by examiner

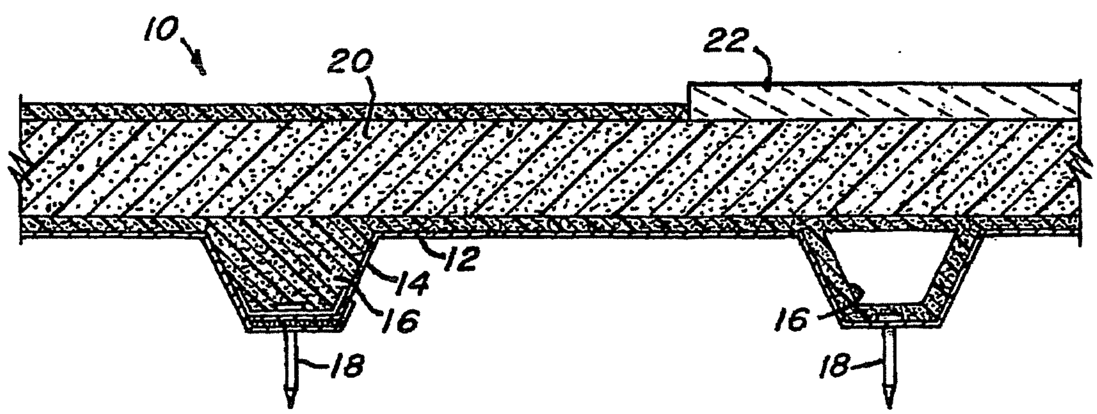
Primary Examiner—Richard E. Chilcot, Jr.
Assistant Examiner—Chi Q Nguyen
(74) *Attorney, Agent, or Firm*—Cantor Colburn LLP

(57) **ABSTRACT**

Disclosed is a fire retardant roof system with a roof deck, a sealant material applied to the roof deck to prevent fluid migration, a polystyrene insulation board upwardly adjacent the sealant material and a sealing material upwardly adjacent the polystyrene material.

Further disclosed is a method for making a fire retardant roof structure. The method includes sealing all fluid passageways in a roof deck with a sealing material, applying a polystyrene material upwardly adjacent the roof deck and the sealing material and applying a further sealing material or cover board upwardly adjacent the polystyrene material.

9 Claims, 3 Drawing Sheets



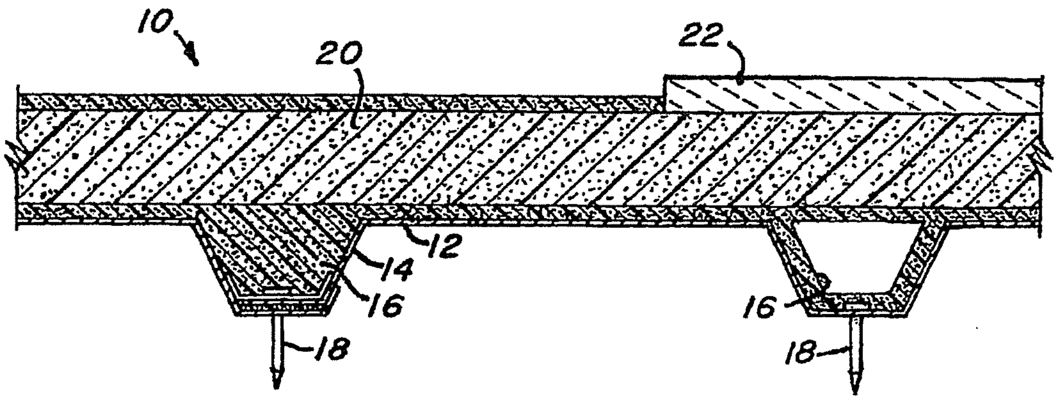


FIG. 1

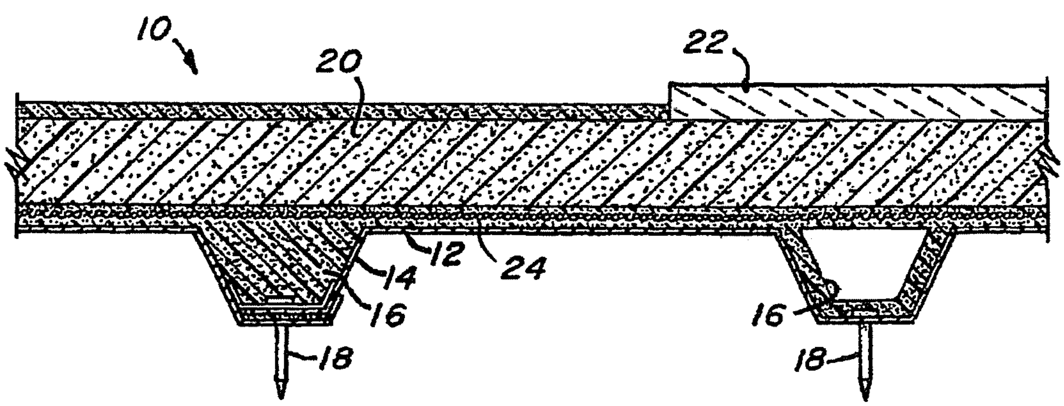


FIG. 2

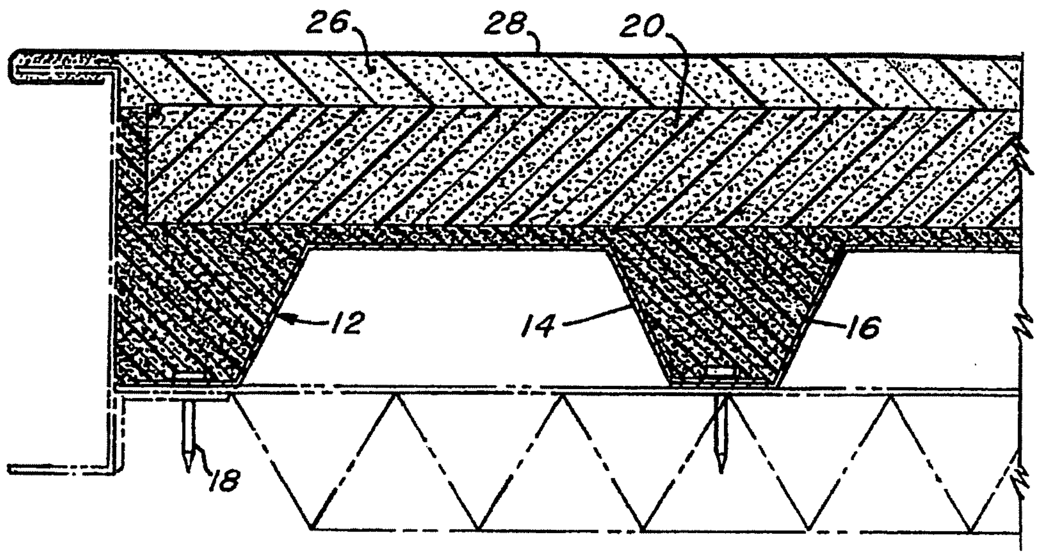


FIG. 3

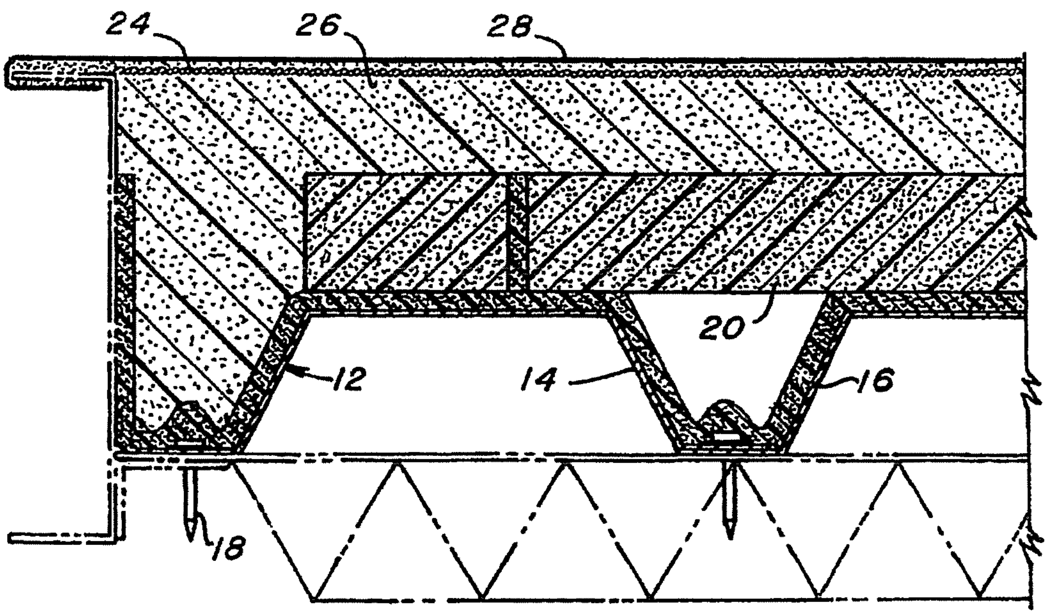


FIG. 4

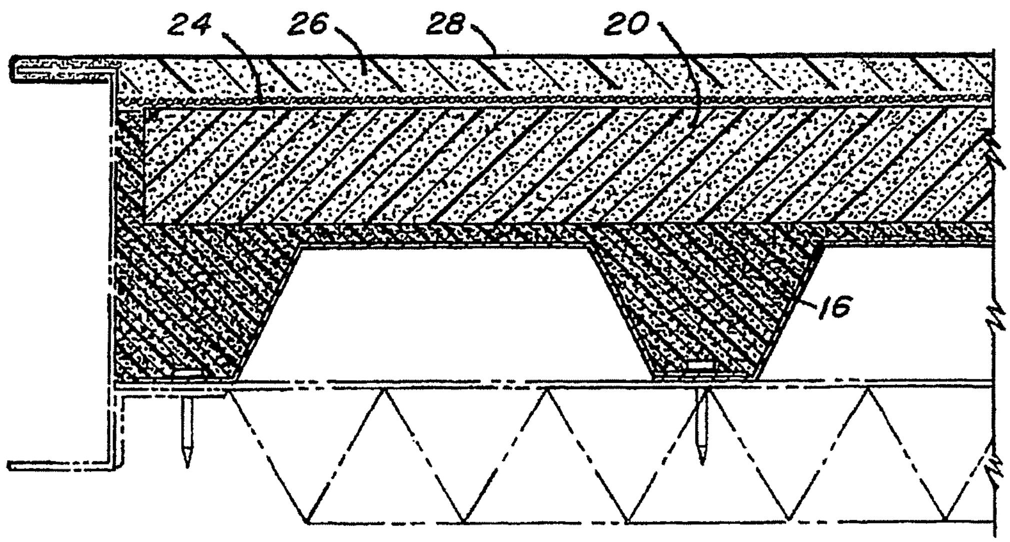


FIG. 5

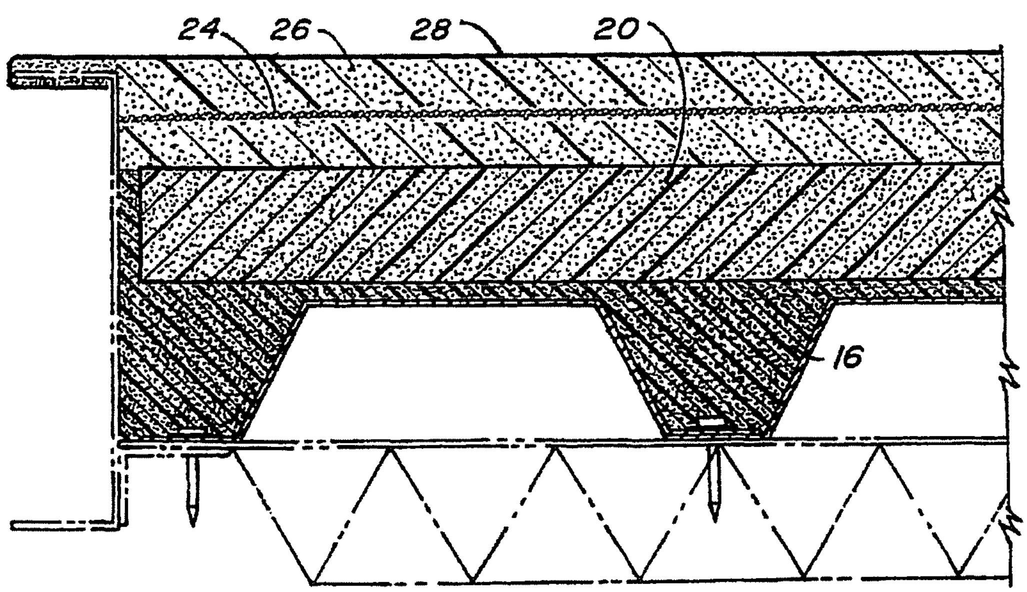


FIG. 6

Slow rise fire retardant adhesive foam application technique for installing styrene insulation and air sealing a roof assembly on a metal panel roof deck T. L. Kelly patent 7,454,876

New T Kelly Patent 7,454, 876 for metal deck and insulation. This patented application technique using fire retardant slow rise urethane spray foam adhesive increases low-slope roof insulation performance 30 to 70 % compared to Conventional Mechanically Attached Insulation. Fire retardant rating of spray foam allows use of inexpensive Polystyrene Insulation for Cost Effective High R-value Roof Assemblies.

How is this accomplished?

Our completed assembly stops:

1. the bottom-up free flow of internal building air up through the roof deck. Without an air barrier installed on the metal deck or without sealing the metal deck joints, up to 30% energy loss can occur from heat loss.

2. convection air currents within roof assembly insulation layer. If air can circulate around rigid roof insulation board joints up to 23% energy deficit can occur as hot air from the roof deck migrates up and is cooled on the underside of a roof membrane.

3. the top-down free flow of air under roof membrane flowing downward into the insulation. In summer, heat load from sunshine generates hot air under the roof membrane. This hot air can flow downward through the insulation from under the roof membrane. This is a especially prevalent on mechanically attached and ballasted roofs. 30% energy deficit from insulation failure can occur.

4. the horizontal or lateral Flow of air into a roof assembly from open perimeter edge detailing. Outside building air can flow into a building from the nailer and gravel stop perimeter edge. Up to 43% energy deficit heat loss/gain can occur.

2010_05_11 UC Rewrite 7,454,876

5. air exchange in a roof assembly from unsealed through roof penetrations. These unsealed openings in B deck act as interior exposure ports. If internal building air can travel horizontally in or under a roof assembly on the metal deck from non-air sealed penetrations, up to 20% energy deficit heat loss/gain can occur.

6. thermal transmission of screws and fasteners from the cool topside to the warm deck. Installation screws and fastening plates and seem fastening plates act as a thermal bridge, conducting heat towards a cool surface. This transfer occurs in winter and summer equally. Up to 13% energy deficit heat loss/gain has been observed.

7. wind uplift pressure inducing bellowing of mechanically fastened membranes. Like a fireplace bellows, the negative pressure fills the area between the mechanically fastened membrane and membrane seems with internal building heated or cooled air. If air barriers and deck air seals are omitted flattering of mechanically attached membranes constantly brings air exchange from interior to Exterior under roof membrane. The heat loss can be up to 70% of the insulation efficiency.

8. condensation buildup in a roof assembly in winter climates. Internal building hot air convecting up and condensing at cooled dew point in the roof assembly. Over winter moisture continues to accumulate accelerating effect. Intra-roof moisture in a roof assembly can cause a 70% or greater reduction in the insulation thermal efficiency.

9. extreme heat and cold roof surface temperature fluctuations. Installation of gypsum cover board lowers convection air currents in the roof assembly by having a gypsum board on the top surface to act as a heat cold storage against extreme membrane temperature fluctuations. This can save an additional 10% to 15% thermal efficiency.

10. By eliminating moisture in the roof assembly occurring from a leak or condensation. 2001 company equalizer valve technology uses wind uplift low-pressure transfer and controlled air exchange in a roof assembly to cause liquid water to vaporize and be drawn out of the roof assembly. Keeping insulation dry will maintain maximum thermal efficiency of the insulation boards.

05292009 UC