# United States Patent

[11] 3,559,914


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[45] Patented **Feb. 2, 1971**


[54] **APPARATUS FOR LAYING ROLL ROOFING**
**9 Claims, 8 Drawing Figs.**


[52] **U.S. Cl.** ..... **242/86.52**
[51] **Int. Cl.** ..... **B65h 17/46**
[50] **Field of Search** ..... 242/86.52; 52/273



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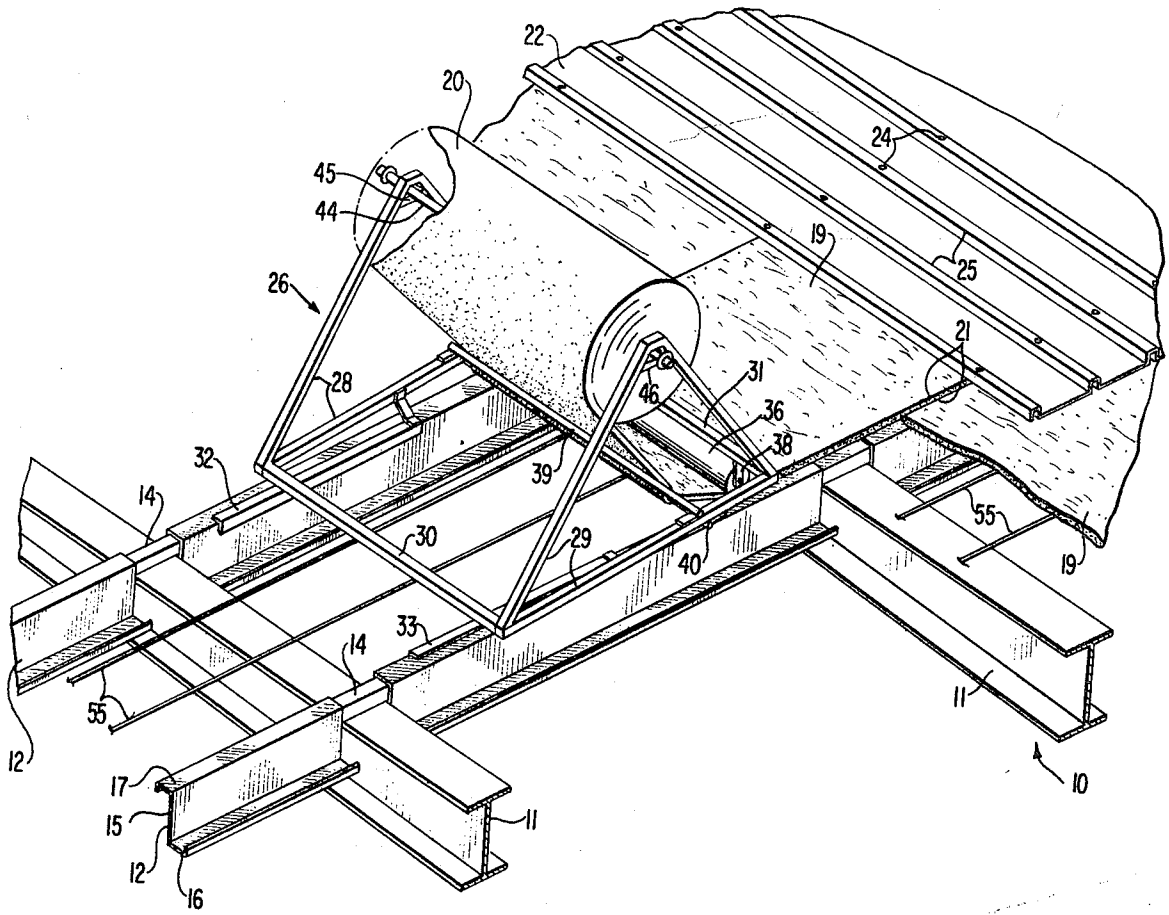
**ABSTRACT:** A roof structure is fabricated by supporting a reel of insulating material above adjacent pairs of roof purlins with the width of the material spanning the space between the purlins, moving the reel along the length of the purlins and simultaneously unreeling the insulating material from the reel as the reel is moved along the purlins, and connecting the insulating material at its edges to the purlins. A reel support frame is supported by adjacent ones of the purlins and is movable along the lengths of the purlins. The reel of insulating material is unreeled as the support frame is pushed along the purlins, and workmen follow the support frame and connect hard roofing material to the purlins to complete the roof structure.

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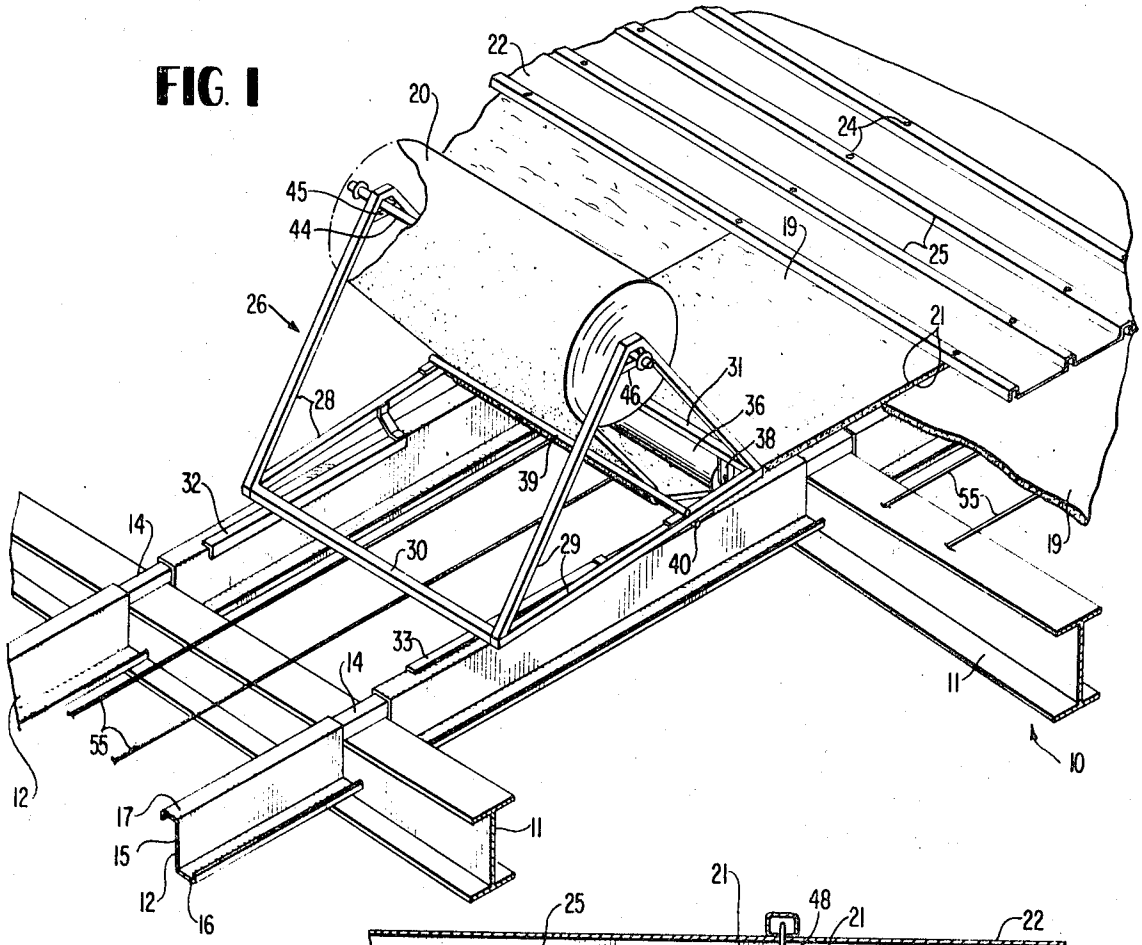
SHEET 1 OF 3

FIG. 1



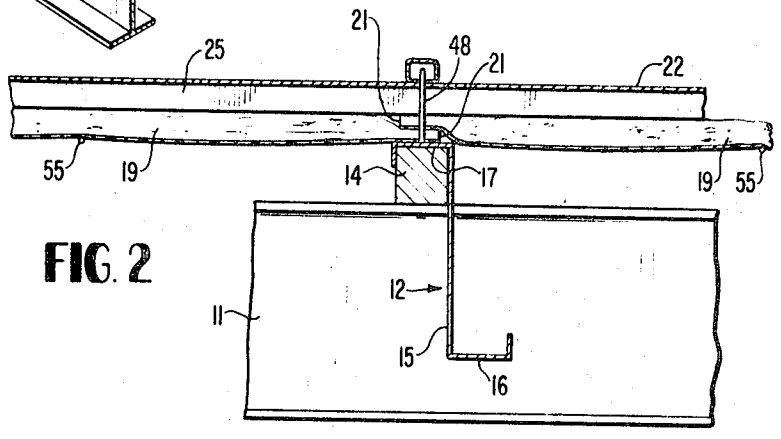




FIG. 2

FIG. 3

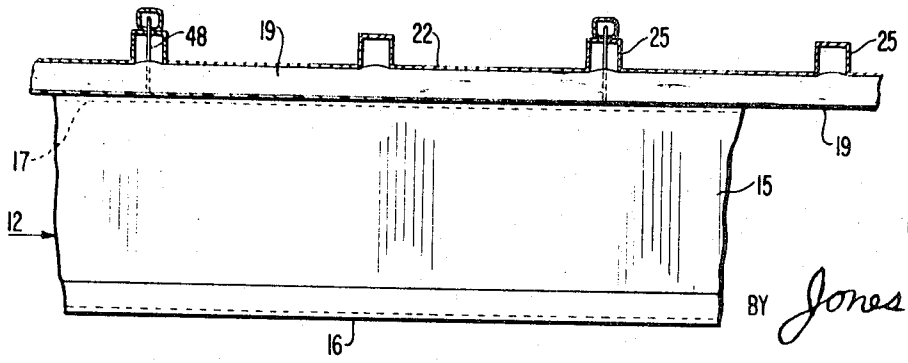



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FIG. 5

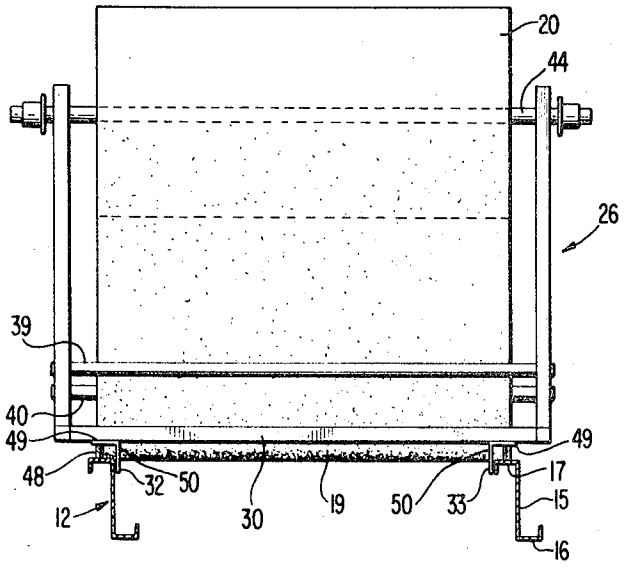



FIG. 6

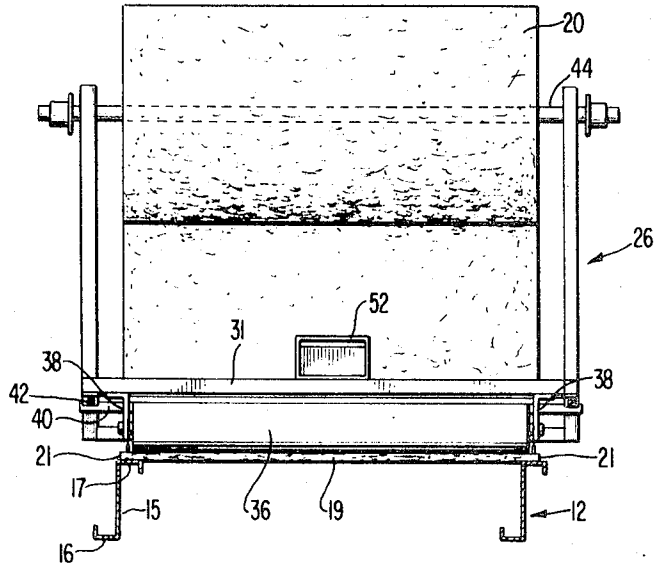



FIG. 4

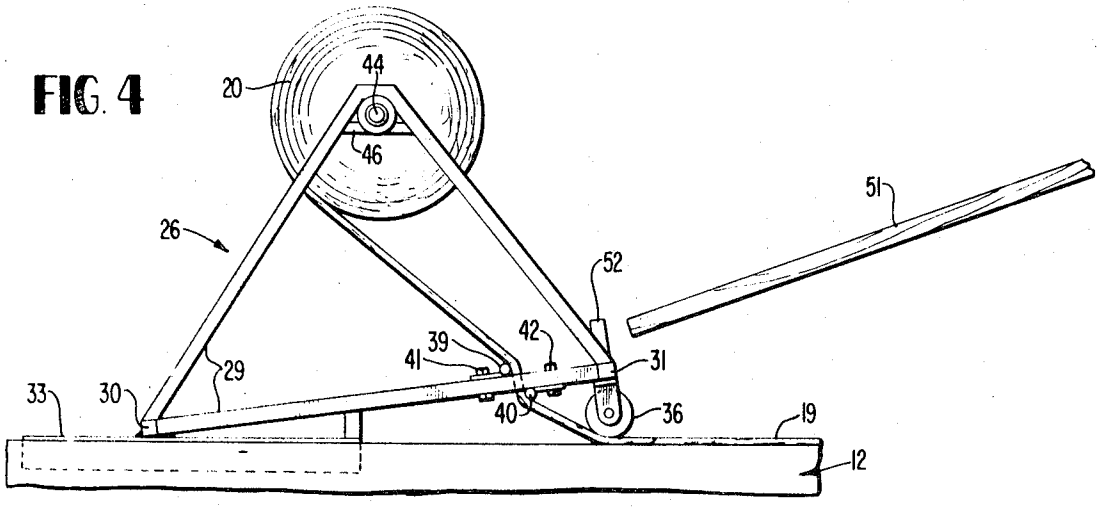


FIG. 7

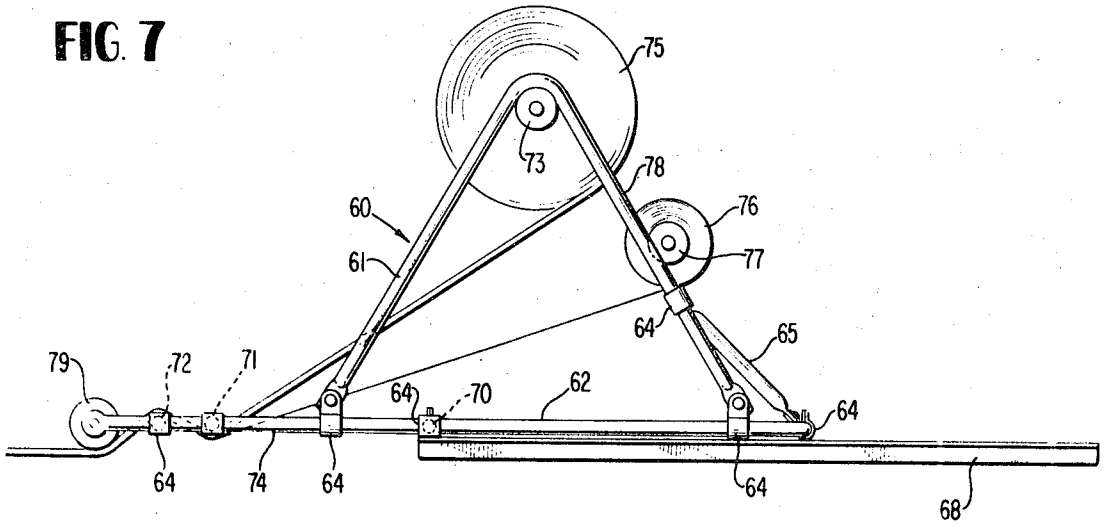
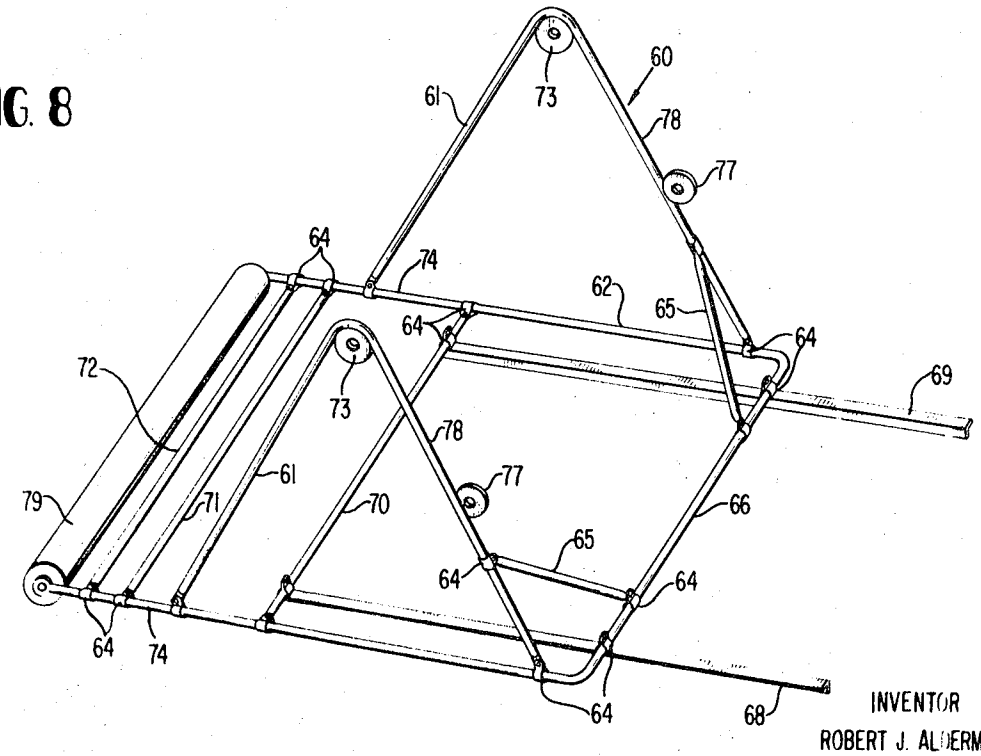



FIG. 8

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# APPARATUS FOR LAYING ROLL ROOFING

## BACKGROUND OF THE INVENTION

The roof structure of an industrial building typically comprises roof or rafter beams which extend parallel to each other across the building in one direction and purlins which extend parallel to each other in a direction normal to the rafter beams. The purlins are supported from the rafter beams, insulating material is spread in long sheets or strips over the purlins with the lengths of the sheets extending normal to the lengths of the purlins, and hard roofing material is attached to the purlins through the insulating material. In the past, roof structures of this type have been difficult to assemble, and since the seams of abutting sheets of insulating material are usually exposed to the inside of the building structure, any gaps appearing in the seams are exposed within the building structure and air within the building contacts the hard roofing material, causing heat loss and vapor condensation.

The typical construction process for a roof structure includes the steps of unreeling sheets of insulating material from large reels of insulating material and placing the sheets of material with their lengths extending across the lengths of the purlins. The sheets of material are stretched to prevent sagging between the purlins, and the hard roofing material is then placed over the insulating material and connected to the purlins. The hard roofing material is used as the working surface for the workmen and the reels of insulating material are unwound on this working surface and moved by hand over to the exposed purlins adjacent the hard roofing material. With this procedure, poor alignment of the sheets of insulating material is likely to occur and gaps between adjacent sheets of insulation material are likely to be formed.

Because of the likelihood of gaps occurring between the adjacent sheets of insulating material, some manufacturers have produced insulating material with tapes that overhang the edges of the insulating material and which normally overlap an adjacent sheet of insulating material. Also, rolls of tape, glue, and other devices have been developed for connecting together the abutting edges of insulating material in a roof structure to prevent gaps from appearing between adjacent strips of material. However, it is expensive and onerous for the workmen to seal the gaps with the use of these devices. Furthermore, since the strips of insulating material must be stretched to prevent sagging between the purlins, the workmen usually extend the strips of insulating material beyond the edges of the building structure so as to leave enough material available for the workmen to pull and stretch the material. Of course, after the strip of insulating material has been stretched, the overhanging portion thereof must be cut away and discarded as waste.

As the typical roof structure is formed, it is customary to form the entire width of the roof structure at one time, proceeding along the length of the structure from one end to the other. This method of construction has been desirable since the insulating material comes in strips or long sheets and it has been convenient for the workmen to place the long sheets across the lengths of the purlins and immediately place the hard roofing material over the insulating material in their progression along the length of the building structure; however, the workmen are required to move back and forth across the width of the building and carry and retrieve their various manual and electrically actuated tools with them. Furthermore, the long length of insulating material is difficult to handle as it is being unreeled from its reel and moved onto the purlins from the hard roofing surface. While the long sheets of insulating material are difficult to handle on a still day, they are extremely difficult to handle on a windy day—so much so that it is virtually impossible to handle the material. Of course, the wind factor also affects the neatness of the job, the number of gaps in the seams of the insulating material, the warping or stretching of the material, the number of workmen required to lay the material and the safety of the workmen.



## SUMMARY OF THE INVENTION

Briefly described, the present invention comprises a roof structure, a method of forming a roof structure, and apparatus for forming a roof structure. The roof structure comprises strips of insulating material extending parallel to the lengths of the purlins of the roof structure, with the insulating material spanning the spaces between adjacent ones of the purlins. The edges of adjacent strips of insulating material overlap each other on the top surfaces of the purlins, and the hard roofing material is laid over the strips of insulating material and connected to the purlins by spikes, screws, or the like, which compress the overlapped edges of the insulating material into engagement with each other and between the purlins and hard roofing material. Support frames are provided for holding reels of insulating material. Each support frame rests on and uses adjacent ones of the purlins as guides. The support frames are pushed along the lengths of the purlins, and the reels of insulating material unwind as the support frames are moved, which functions to apply the strip of insulating material to the top surfaces of adjacent purlins. The workmen merely push the support frames far enough ahead along the lengths of the purlins to accommodate the next sheet of hard roofing material which is to be applied to the roof structure, so that only short lengths of the sheets of insulating material are actually unreeled ahead of the hard roofing surface.

Thus, it is an object of this invention to provide a roof structure which is neat in appearance, which shows no seams or connections in its insulating material from inside the building structure, and which has no gaps or spaces in its insulating material for the circulation of air.

Another object of this invention is to provide a method of forming a roof structure which is economical, safe, capable of being performed on windy days, and which provides an improved roof structure.

Another object of this invention is to provide an apparatus for forming a roof structure which conveniently supports and moves a reel of insulating material across a roof framework ahead of the workmen that are applying the hard roofing surface to the structure.

Other objects, features and advantages of the present invention will become apparent upon reading the following specification, when taken in conjunction with the accompanying drawing.

## BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a partial perspective view of a roof structure and reel support framework, showing the manner in which the insulating material is applied to the roof structure.

FIG. 2 is a detail showing of a completed roof structure, showing the rafter beam, purlin, insulating strips, and hard roofing surface.

FIG. 3 is a detail illustration of a roof structure, normal to FIG. 2.

FIG. 4 is a partial side elevational view of a reel support framework.

FIG. 5 is an end view of the reel support framework.

FIG. 6 is an end view, opposite from that shown in FIG. 5, of a reel support framework.

FIG. 7 is a side elevational view of a modified form of the reel support framework.

FIG. 8 is a perspective view of the reel support framework of FIG. 7.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in more detail to the drawing in which like numerals indicate like parts throughout the several views, FIG. 1 shows a partially completed roof structure **10** which includes rafter beams **11** extending parallel to each other across the width of the building and which are peaked (not shown) at the center of the building. Purlins **12** extend along the length of the building and extend between adjacent ones of the rafter

beams 11. Purlins 12 are supported between rafter beams 11 by clips 14. Purlins 12 are generally Z-shaped in configuration and include central web 15, bottom flange 16, and top flange 17 (FIGS. 5 and 6). Purlins 12 are placed along rafter beams 11 in substantially parallel disposition, and are spaced apart a prescribed distance.

Strips or sheets of insulating material 19 are unrolled from a reel 20 and applied to the top surface of top flange 17 of purlins 12. The sheets of insulating material 19 are of a width greater than the spacing between adjacent ones of purlins 12 and are overlapped at their edges 21 on the top flanges 17 of purlins 12. Hard roofing material 22 is positioned on top of the sheets of insulating material and connected to purlins 12 by screws, rivets, pins, or the like. Hard roofing material 22 is fabricated of corrugated sheet metal, and the screws 24 normally extend through the raised corrugations. A single sheet of hard roofing material will normally span over several purlins 12, and the corrugations 25 of the hard roofing material extend normal to purlins 12 and generally parallel to rafter beams 11 down the slope of the roof for drainage purposes.

Reel support frameworks 26 are provided for supporting each of the reels 20 of insulating material. Each reel support framework 26 comprises triangular side frames 28 and 29, laterally extending front and rear support bars 30 and 31, and framework guides 32 and 33. Framework guides 32 and 33 are connected to front support bar 30 intermediate its ends and to the lower bar of triangular side frames 28 and 29, respectively. Framework guides 32 and 33 are L-shaped in cross section and face outwardly and downwardly with respect to framework 26. Framework guides 32 and 33 are spaced apart a distance corresponding to the spacing of purlins 12, and arranged to engage the upper surfaces and inwardly facing surfaces of adjacent purlins 12.

Guide roller 36 is of a width only slightly larger than the spacing between purlins 12. Guide roller 36 is connected by L-shaped support straps 38 to rear support bar 31 of framework 26. Guide roller 36 normally engages either the top surfaces of adjacent purlins 12 or the insulation applied to the purlins. Tension bars 39 and 40 are connected at their ends to lower bars of triangular side frames 28 and in an offset relationship by means of bolts 41 and 42. A series of holes (not shown) are present in the lower bars of triangular side frames 28 and 29 so that bolts 41 and 42 can be inserted at various locations along the lower bars and tension bars 39 and 40 can be moved toward and away from each other along the lengths of the lower support bars.

Reel support bar 44 is supported by braces 45 and 46 at the apex of each triangular side frame 28 and 29, respectively, and reel support bar 44 is inserted through the center of reel 20. With this arrangement, reel 20 is free to rotate about reel support bar 44.

The workmen place a plurality of reel support frameworks 26 across the width of the building structure, with a reel support framework 26 resting on adjacent ones of purlins 12. A reel of insulating material 20 is placed on a reel support bar 44 and supported by a framework 26. The insulating material is unreeled from reel 20 and fed down between tension bars 39 and 40 (FIG. 4) and beneath guide roller 36 and onto the top surfaces of purlins 12. Framework guides 32 and 33 engage the top surfaces and facing surfaces of adjacent purlins 12, to support framework 26 from the purlins and guide the framework along the length of the purlins. As is shown in FIG. 5, if the purlins 12 are of the type that include spikes 48 which extend in an upward direction from the upper flanges 17, the lateral leg 49 of each of the L-shaped framework guides 32 and 33 will engage the top surfaces of spikes 48. The vertical leg 50 of each framework guide 32 and 33 extends in a downward direction a distance sufficient to engage the facing surfaces of the purlins. Of course, if no spikes 48 are present on the purlins, the lateral legs 49 of framework guides 32 and 33 will rest on and slide across the top flange 17 of the purlins.

When the sheet of insulating material 19 is fed from reel 20 behind tension bar 39 and in front of tension bar 40 and beneath roller 36 onto the top surfaces of adjacent purlins 12 and the workmen push framework 26 along the lengths of the purlins, the sheet 19 of insulating material will be applied to the purlins and span the space between adjacent purlins. When a plurality of reel support frameworks 26 are used in this manner over the roof structure, a surface of insulating material will be formed, with the edges 21 of the sheets of insulating material overlapping each other on the top flanges 17 of the purlins. The workmen then apply hard roofing material 22 to the roof structure, by laying sheets of the hard roofing material on the purlins and insulating material and connecting the hard roofing material to the purlins with screws 24. When an additional length of insulating material is needed from one of the reels 20 of insulating material to make room for more hard roofing material, the workmen can move reel support framework 25 along the length of the purlins by applying a pole 51 to a box or socket 52 attached to rear support bar 31 of framework 26 and pushing framework 26. In this manner, the workmen can stand on the hard roofing material 22 and move framework 26 a distance sufficient to apply enough insulating material to the purlins to accommodate another sheet of hard roofing material. Of course, the workmen can also walk on the exposed roof beams and purlins and pull framework 26 to apply the insulating material.

Since only relatively short lengths of the sheets 19 of insulating material need be spread over the purlins to provide enough insulating material to accommodate a sheet of hard roofing material, only small lengths of the sheets 19 of insulating material will be exposed to the wind at one time, with the major portion of the insulating material either being present on reels 2o or beneath hard roofing material 22. Furthermore, framework 26 and reel 20 are of sufficient weight to resist any movement under the influence of normal wind velocities and function to anchor the exposed lengths of insulating material at both of their ends. Moreover, tension bars 39 and 40 maintain the exposed portion of the sheets 19 of insulating material extending between framework 26 and hard roofing material under sufficient tension to resist most movements under the influence of wind. The tension applied to the sheets of insulating material extending from frameworks 26 toward roofing material 22 prevents any sagging of the insulating material between the purlins. After the hard roofing material 22 is attached to the purlins, the sheets 19 of insulating material are securely held by screws 24 to the purlins at their edges 21 and there is virtually no possibility of any sagging occurring in the insulating material after the roof structure has been completed. As is shown in FIG. 2, when hard roofing material 22 is applied to purlins 12, the overlapping edges 21 of the sheets 19 of insulating material will be compressed against the top flange 17 of the purlins. This further prevents the sheets of insulating material from pulling apart and sagging. Moreover, the overlapped edges 21 of the insulating material create a seal between adjacent sheets 19 of the insulating material, which obviates the necessity of supplemental sealing means. Thus, the sheets 19 of insulating material form a virtually continuous insulating surface when viewed from the interior portion of the building, which is eye appealing and functional in that both a vapor and heat seal is obtained.

In order to minimize the possibility of the sheets 19 of insulating material from sagging between purlins, wires 55 can be stretched along the length of the building structure between adjacent ones of purlins 12, and the sheets 19 of insulating material will lightly rest upon wires 55. Wires 55 are not only desirable from a functional standpoint but form eye appealing lines across the inside of the roof structure. With the use of wires 55, if any of the insulating material should be damaged after the roof structure has been completed by the inadvertent or necessary tearing away of a portion of the insulating material, wires 55 would help isolate the tearing of the insulating material. Of course, the sheets 19 of insulating material comprise a loose material laminated to a sheet of plastic material, with the plastic material usually being applied to the purlins and oriented toward the inside of the building. The plastic

material tends to rigidify the insulating laminate and form a vapor barrier.

As is shown in FIGS. 7 and 8, a modified form of the invention is provided in order that a nonlaminated insulating material can be applied to the roof structure, and a foldable reel support framework can be utilized in its application. Framework **60** has its basic elements connected together by means of sliding clamps so that its various elements are adjustable with respect to each other. For instance, the upright triangular frames **61** are connected to base frame **62** by clamps **64** which allows the clamps to pivot with respect to base frame **62** and assume a generally flat configuration. Brace bars **65** are connected between front leg **66** of base frame **62** and triangular frames **61** by clamps **64** to maintain triangular frame **61** in an upright attitude when supporting a reel of insulating material.

In a similar manner, framework guides **68** and **69** are supported from front leg **66** of base frame **62** and from crossbar **70** by clamps **64**. Thus, the spacing of framework guides **68** and **69** can be adjusted, as desired.

Tension bars **71** and **72** are also slidably connected to side legs **74** of base frame **62**. Thus, a completely adjustable framework is provided so that it can be stored in a substantially flat configuration and adjusted as desired to fit varying purlin spacing.

As is best shown in FIG. 7, nonlaminated insulating material can be applied with the use of framework **60**. A reel of fiberglass insulation **75** is mounted at the apex of triangular frames **61** in sockets **73**, and a reel of vinyl, aluminum foil, or other air impervious backing **76** is mounted on the front legs **78** of triangular frames **61** in sockets **77**. The backing material is fed from its reel together with the insulating material through tensioning bars **71** and **72** and below guide roller **79**. Of course, as framework **60** is moved along the purlins of the roof structure, the insulation material and backing material will pay out together and a laminate is formed over the purlins. Since both the insulation sheet and backing sheet pass through the same tensioning bars, substantially identical tension will be applied to the spans of the sheets extending from framework **60** back toward the hard roofing surface previously applied to the laminate.

It will be understood by those skilled in the art that the laminate formed by framework **60** of FIGS. 7 and 8 requires no bonding substance to hold the backing sheet and insulation sheet together as is required in the laminated reel **20** of FIG. **1**. This substantially reduces any fire hazard that might possibly be present with the presence of the bonding material. Moreover, the individual reels **75** and **76** of insulation material and backing material are substantially less expensive than the laminated reel **20** which reduces the cost of the roof structure.

While this invention has been described in detail, with particular reference to preferred embodiments thereof, it will be understood that variations and modifications can be effected within the spirit and scope of the invention as described hereinbefore and as defined in the appended claims.

I claim:

**1**. Apparatus for laying a sheet of insulating material or the like on a pair of spaced apart support members in a roof support structure comprising a framework including support means for rotatably supporting a reel of insulating material, a pair of spaced apart guide means at one end of said framework for engaging and guiding the framework along the spaced apart support members in the roof structure, roller means at the other end of said framework for bearing against the spaced apart support members, whereby a reel of insulating material is placed on said support means and the free end thereof passed between said roller means and the spaced apart support members as the framework is moved along the spaced apart support members.

**2**. The invention of claim **1** and wherein said pair of spaced apart guide means comprise a pair of bars of L-shaped cross section with each bar oriented with one of its flanges extending in a downward direction and its other flange extending away from said framework, whereby the downwardly extending flanges of the L-shaped bars extend between adjacent ones of the spaced apart support members of the roof structure and the other flanges of the L-shaped bars rest on the top surfaces of the adjacent spaced apart support members.

**3**. The invention of claim **1** and wherein said support means for rotatably supporting a reel of insulating material comprises a rectilinear bar removably supported in a horizontal attitude by said framework.

**4**. The invention of claim **1** and wherein said framework comprises a normally horizontal base frame and normally upright side frame members connected to the sides of said base frame, and means for folding the side frame members over and adjacent to said base frame for storage purposes.

**5**. Apparatus for applying a sheet of material to spaced apart substantially parallel purlins or the like in a building structure comprising reel support means constructed and arranged to support a reel of the sheet material above a pair of adjacent ones of the purlins with the width of the sheet material spanning the space between the purlins, guide means connected to one end of said reel support means and constructed and arranged to engage the pair of purlins for moving the reel support means along the length of the purlins, and roller means for receiving the sheet material from the reel of the sheet material and applying the sheet material to the purlins.

**6**. Apparatus for applying a sheet of material to spaced apart substantially parallel purlins or the like in a building structure comprising a framework and of a width wider than the spacing of adjacent ones of the purlins, framework guide means positioned at one end of said framework and constructed and arranged to engage a pair of adjacent ones of the purlins and guide the framework along the length of the purlins, said framework including upstanding side frames and a support bar supported at its ends by said side frames arranged to rotatably support a reel of sheet insulating material or the like above the space between the purlins engaged by said framework guide means with the width of the sheet insulating material spanning the space between the purlins, and insulation guide means arranged to receive the sheet insulating material from the reel and apply the sheet insulating material to the purlins as the framework is guided along the purlins by said guide means.

**7**. The apparatus of claim **6** and wherein said framework guide means comprises means for engaging the upper surfaces and facing surfaces of adjacent purlins.

**8**. The apparatus of claim **6** and wherein said framework guide means comprises a pair of rectilinear guides L-shaped in cross section facing outwardly and downwardly with respect to said framework and spaced apart a distance corresponding to the spacing adjacent ones of the purlins and arranged to extend along and engage the inner upper edges of adjacent ones of the purlins.

**9**. The invention of Claim **6** and wherein said insulation guide means comprises a roller rotatably connected at its ends to said framework and arranged to bear against the top surfaces of adjacent ones of the purlins or the sheet insulating material passing from the reel of sheet insulating material to the purlins.