United States Patent [19]

McQuiston

[11] **3,830,441**

[45] **Aug. 20, 1974**

[54] **METHOD OF INSTALLATION OF THERMAL BUILDING INSULATION AND STRETCHERS THEREFOR**

[76] Inventor: **H. Robert McQuiston,** R. D. 2, Sharpsville, Pa. 16150

[22] Filed: **Feb. 8, 1972**

[21] Appl. No.: **224,445**

[52] **U.S. Cl.** ..... **242/67.1 R**

[51] **Int. Cl.** **B65h 17/02**

[58] **Field of Search** ..... 242/67.1, 74.1, 75, 68, 242/67.1 D, 67.3 F

[56] **References Cited**

UNITED STATES PATENTS

825,799	7/1906	Berglund	242/67.3 F
1,163,401	12/1915	Gerrish	242/74.1 X
2,015,368	9/1935	Ryan	242/67.1 D
3,510,081	5/1970	Anderson	242/67.1 D

Primary Examiner—John W. Huckert
Assistant Examiner—Edward J. McCarthy
Attorney, Agent, or Firm—Ely & Golrick

[57] **ABSTRACT**

Method and equipment for tensioning blankets of thermal insulation in building. Equipment comprises a stretcher having a self-securing windlass element supported adjustably in means for mounting the windlass member on structural members of a building; ratchet drive means for windlass element hold insulation under tension during its installation in a building.

8 Claims, 5 Drawing Figures

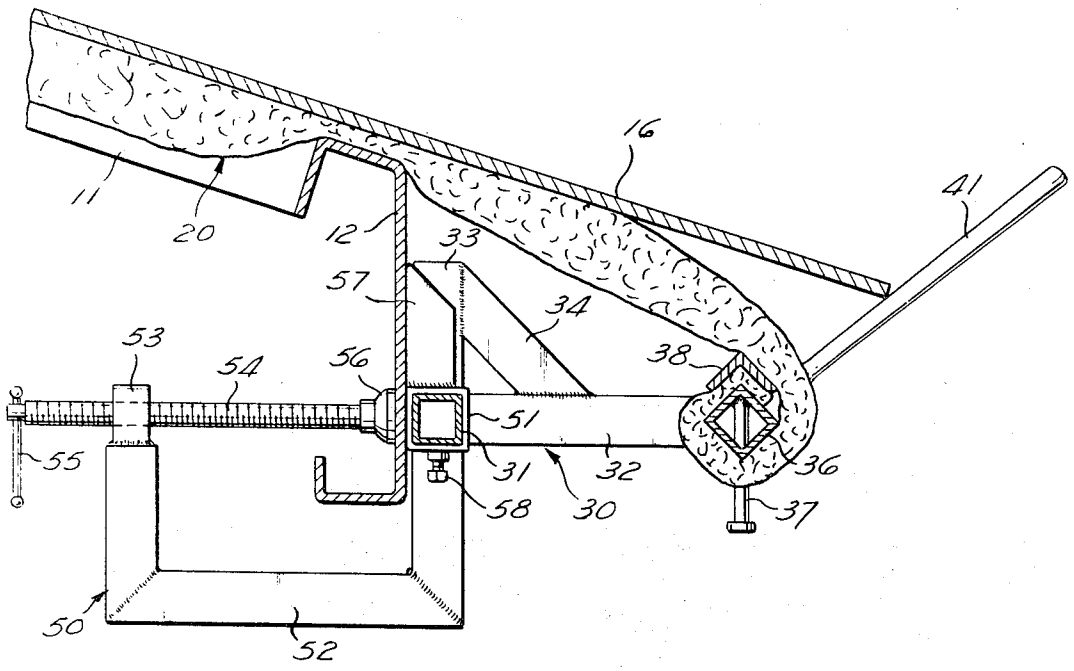
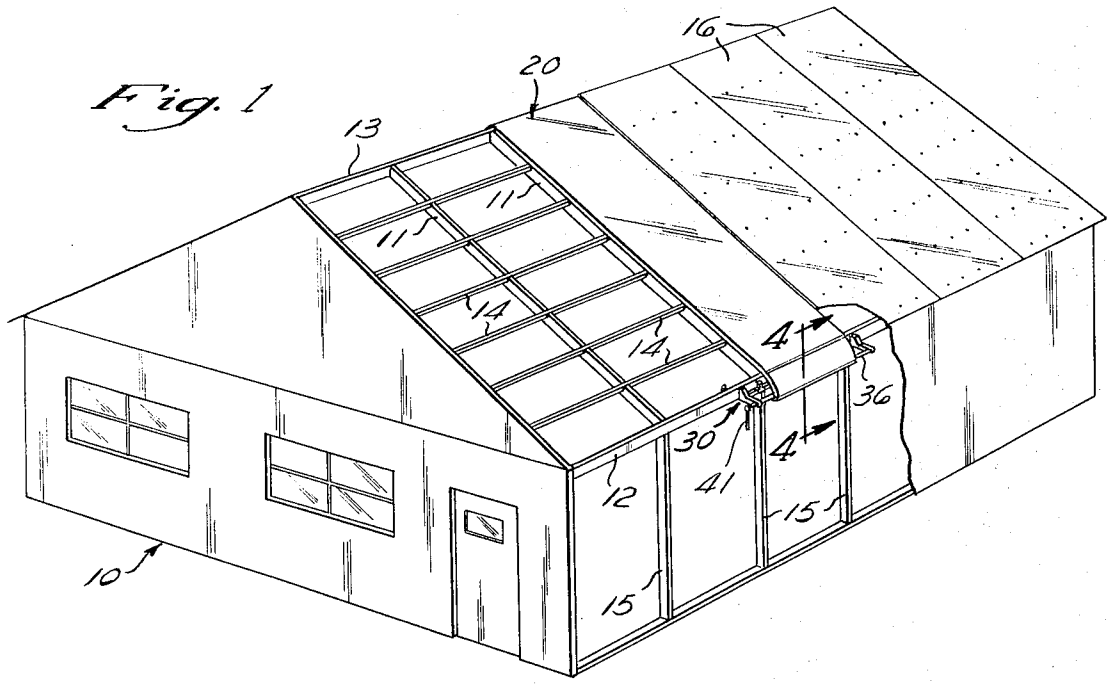


Fig. 1


16
20
13
11
11
14
14
4
4
36
30
41
12
15
15
10

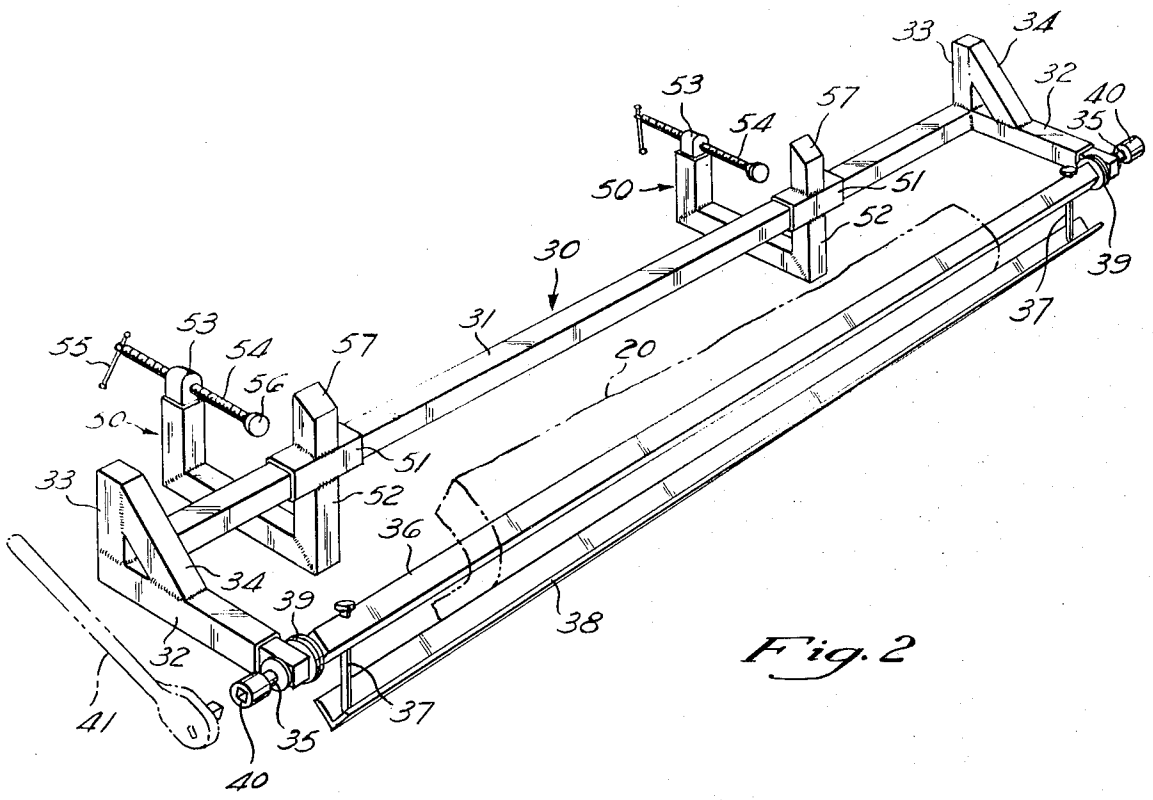
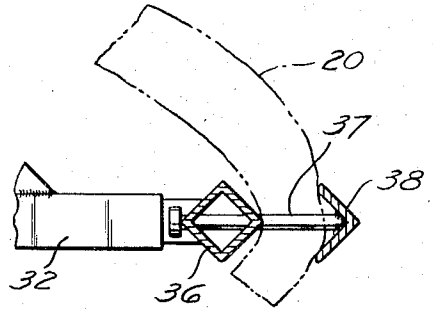

33
34
32
40
35
53
54
57
50
51
52
30
39
37
31
20
55
53
54
56
57
50
51
52
33
34
36
39
38
32
41
35
37
40

Fig. 2

Fig. 3



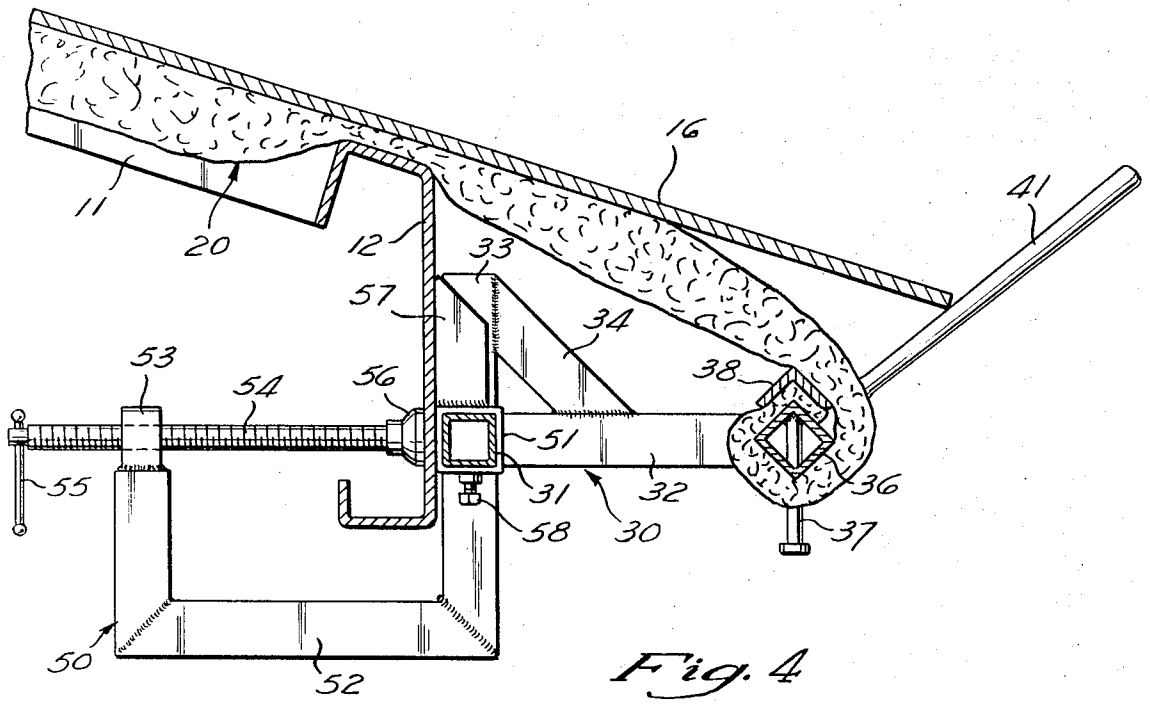


Fig. 4

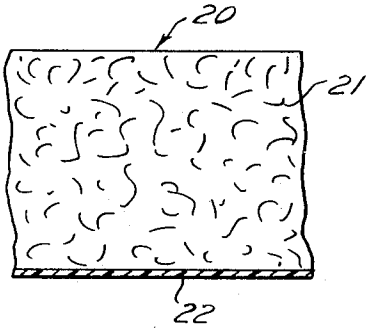


Fig. 5

METHOD OF INSTALLATION OF THERMAL BUILDING INSULATION AND STRETCHERS THEREFOR

This invention relates to means for applying tension to thermal insulation and holding it under such tension while the insulation is secured in place in a building. More particularly, the invention is designed for the installation of blankets or semi-rigid sheets of thermal insulation which are also intended to serve as an interior ceiling or wall surface in buildings constructed to provide internally exposed rafters, beams, and purlins.

Various systems of building construction, particularly metal buildings for plants, warehouses, and like industrial and/or storage purposes, leave the framing members internally expoxed, particularly the roof rafters and their connecting purlins. The necessary thermal insulation of such buildings is ordinarily obtained with flexible blankets (usually supplied in roll lengths) or long semi-rigid sheets. Such insulation is usually a laminate comprised of a relatively thick air-entrapping porous or fibrous layer (usually glass fibers, mineral wool and the like) of low heat conductivity and a layer which serves as a moisture vapor barrier. Unless the vapor barrier completely encases the porous layer, the insulation is installed so that the vapor barrier is located interiorly to inhibit absorption of moisture vapor from inside the building and thereby minimizes the numerous problems which result from the subsepuent escape of any such absorbed moisture from the porous layer. Early in the art, such barrier layers were simply kraft papers having an asphalt or other coating reducing the transmission of moisture vapor; the vapor-barrier function is improved by the addition to or replacement of such coated papers by metal foils, films, and laminates of such films and foils and/or paper. Vinyl or like flexible plastic films, laminated or unlaminated, are now generally preferred for the outer surface of such barrier layers intended to be exposed to the interior of a building. Such films may be pigmented to provide an attractive visual appearance and good light reflectance; their toughness enables them to withstand abrasion during installation and (if and when the building occupant desires it) subsequent cleaning to remove accumulated dust and soil.

The above described internally exposed insulation is most effectively installed by securing appropriate lengths of it between frame members of the building and the sheathing which is bolted, nailed, or otherwise secured to and/or supported by such frame members, the insulation material usually being supplied in widths equal to the distance between the centers of the principal parallel building frame members and multiples of such widths. However, in practice, such installation has heretofore required a substantial and often unpredictable amount of time and manpower. The insulation is compressed between the frame members and the sheathing, causing it to "pillow" inwardly of the building in order to provide the desired depth of thermal insulation in the open areas between the frame members. But unless the insulation is held firmly in place and under a relatively light but substantially equal tension over all such open areas while the insulation is being secured by application and fastening of the sheathing to the frame members, the appearance of twists and wrinkles in the interiorly exposed barrier layer of the insulation or unequal pillowing in open areas both reduces the functional effectiveness of such thermal insulation and, from an appearance standpoint, may make the building less acceptable to the owner or occupant for which the building was constructed.

It is an object of this invention to provide a method and equipment by which such insulation may be properly installed with less manpower and in less time than heretofore required. It is an advantage of this invention that such installations may be made under wind conditions which have heretofore made it extremely difficult, if not impossible, to effect proper installations. This advantage is particularly significant in roofs, for example, where a length of insulation extends from eave to eave over the ridge pole and should be held in place while the roof sheathing is being secured; in such cases even a very slight breeze would heretofore cause the unsecured insulation to flutter or lift as an uncontrollable sail.

Another object and advantage of this invention is that it is adaptable to substantially all commercially extant metal building systems, irrespective of the widely varying configurations of frame members in the different makes and systems.

Other objects and advantages of this invention will be apparent from the following specification, claims, and the accompanying drawings, in which:

FIG. **1** is a perspective ov a partly completed metal building illustrating the insulation installation method of this invention and showing an embodiment of a novel insulation stretcher made according to this invention mounted for use.

FIG. **2** is a perspective of the entire stretcher partly shown in FIG. **1.**

FIG. **3** is an enlarged cross-sectional detail of the windlass and locking member of the stretcher shown in FIG. **2,** but showing these elements rotated to a position in which an insulation blanket may be more readily inserted.

FIG. **4** is a cross-section taken along the line **4—4** of FIG. **1.**

FIG. **5** is an enlarged fragmentary section of a blanket type of insulation adapted to be installed according to this invention.

Referring to the drawings, the building **10** is a metal building construction which illustrates a general type of building, and particularly its roof structure, for which my invention is adapted. This roof structure comprises equally spaced rafters **11,** each extending in parallel vertical planes from an eave strut **12** to the ridge pole **13;** relatively closely spaced horizontal purlins **14,** parallel to the eave strut **12,** extend between adjacent rafters. This roof framing is duplicated on the opposite side of the roof not shown in FIG. **1** and is supported at the desired wall height by suitable studding members or poles **15.**

The blanket of thermal insulation **20** to be installed comprises, in this instance (as shown in FIG. **5**), a thick layer of fibrous material **21** and a vapor barrier **22** of vinyl film (usually pigmented white) which will become the inner surface of the insulation exposed to the interior of the building. To install this insulation, a blanket is cut from a roll of the material which is provided in a width equal to the spacing between the centers of adjacent rafters **11** or an even multiple of such spacing. The length of the blanket is preferably enough to extend over the ridge pole **13** from the eave strut **12** to the opposite eave strut (not shown) plus enough addi-

tional material to allow each end to be secured in a stretcher mounted on the opposite eave struts and positioned so that, in the particular embodiment shown, the edges of the blanket over-lie the centers of a pair of adjacent rafters **11.** Although the width of this spacing between rafters may vary between different makes or systems of metal buildings, for any one make or building system the spacing between the rafter is normally a standard modular width. Within limits, labor time may be saved if the blanket is wide enough to span more than one pair of adjacent rafters and it is an advantage of the method and equipment of this invention that not only may it be readily adapted to handle such wider widths but the availability of such equipment may make it economical for the insulation to be produced in such wider widths. Also, provided it is fixed squarely to the blanket's length, one end of a blanket may be fixed by a suitable clamping batten to a frame member, such as a ridge pole or the corresponding member of a "lean-to" style roof and the other end mounted in a stretcher at a lower eave strut. Further, if the structural system of a roof employs sheathing extending lengthwise of the building and transversely of the rafters, one or more stretchers may be mounted to receive a blanket also extending transversely of the rafters.

To achieve the installation of thermal insulation in a roof shown partly completed in FIG. **1,** the installation is commenced by mounting a stretcher **30** on each eave strut **12** so that the operative length of each windlass bar **36** in a stretcher **30** spans one pair or a larger modular number of rafters. A blanket **20** is then laid over the ridge pole of the roof so that its lengthwise edges fall on the center lines of a pair of rafters and the blanket ends are then secured on the windlass bars in a manner to be described below. Because the construction of the stretcher **30** is such that its windlass bar **36** will be parallel to the eave strut **12** on which it is mounted and each eave strut, in turn, is perpendicular to the rafters **11,** the lining-up of the edge of a blanket with the refter which it overlies makes it simple to fix the ends of the blanket to the windlass bar so that the length of the blanket will be "square" to the axis of the windlass bar. With the ends of the blanket **20** so secured in stretchers **30,** the windlass bars are turned to apply just enough tension to the blanket and maintain that tension to hold the blanket in place while a panel of roof sheathing **16** is laid over the blanket on each side of the roof. Each panel **16** is then fastened through the blanket to the purlins and/or rafters by suitable means, such as bolts, self-tapping screws or (if the rafters and/or purlins are of the type adapted to receive and hold them), metal nails. With one blanket of insulation thus secured, the operation is repeated for adjacent blankets until the entire roof is insulated and sheathed. The roof is then completed in the usual manner by installing a ridge cap, flashing (where necessary), rain gutters, and external roofing material.

CONSTRUCTION OF INSULATION STRETCHER

A preferred embodiment of an insulation stretcher **30** by which the above described tensioning of an insulation blanket is obtained is shown more fully in FIGS. **2–4.** It comprises a base bar **31** having a length greater than any modular width of insulation it is intended to handle. Each end of the base bar **31** carries a perpendicularly extending bracket structure comprised of an outwardly extending arm **32,** an upwardly extending bearing foot **33,** and a suitable diagonal brace **34.** The outboard end of each arm **32** is provided with a bearing for the end shafts **35** of the windlass bar **36.** The windlass bar **36** is a length of tubing having a square or other polygonal cross-section; it is drilled transversely at each end to receive a pair of freely slidable headed pins **37** carrying a locking bar **38.** The locking bar **38** in this instance is a length of angle iron positioned to mate with a corner of the windlass bar. The spacing between the pins **37** is at least as great as the widest insulation blanket **20** the stretcher is intended to handle and constitutes the operative length of the stretcher. The end shafts **35** are rotatable clockwise ro counterclockwise in their bearings but preferably not too freely; that is, torque applied by hand to the windlass bar **36** by pressure on the locking bar **38** will readily rotate the windlass bar **36** but the windlass bar **36** will then remain in the position to which it is rotated when the pressure on the bar **38** is released. This allows the windlass bar **36** and its locking bar **38** to be indexed and then "stay put" at a position which is the most convenient for inserting the end of a blanket between the bars, such as shown in FIG. **3,** for example. To aid such indexability of the windlass bar, the washers **39** between the ends of the square sections of the windlass bar **36** and the outboard bearings carried by the arms **32** are preferably under some axial pressure so that they serve both as spacers and as friction means to hold the windlass bar in any indexed position when it is under no torque load.

The washers **39,** above described, may be replaced by a suitable ratchet and releasable pawl mechanism so that the windlass bar will also stay at its indexed position when it is subject to the torque of the tension applied to a blanket of insulation **20** being held in place while a panel of roof sheathing **16** is secured, as described above. However, a far simpler means of holding the windlass bar in selected indexed position while it is subject to the torque of the tension it applies to an insulation blanket is to simply provide each outer end of the shafts **35** with a socket **40** adapted to receive the drive of a ratchet wrench **41.** The ratchet wrench **41** is usually a conventional ½ inch drive reversible ratchet-wrench for a socket-wrench set, which an installer is almost certain to have in his own tool kit or which the building contractor employing him should be readily able to supply. Interference between the shank of the wrench **41** and some portion of the building structure will usually function as a stop whereby, so long as a wrench **41** is carried in a socket **40,** the windlass bar **36** cannot back off from the position to which it has been torqued. If the bar **36** is torqued from the end of a stretcher which lies under an edge of a panel **16,** the shank of the wrench will interfere, as shown in FIG. **4.** If the wrench **41** is connected at the open end of the stretcher, as shown in FIG. **1,** it will strike the eave strut **12,** the handle length of a standard ½ inch drive ratchet wrench, for example, normally being greater than the distance from the axis of the windlass bar **36** to an eave strut on which the stretcher is mounted.

The stretcher structure described thus far is removably attachable to an eave strut **12** by means of a pair of mounting means **50** carried by the base bar **31.** Each such clamping means **50** is comprised of a sleeve **51** mounted slidably but non-rotatably on the base bar **31,** the sleeve **51** in this embodiment comprising a length of square tubing whose inside surface can receive and

slide on the square tubing of which the base bar **31** is made. Each sleeve **51** carries a depending C-structure **52,** on which is carried a suitable clamping means. For simplicity of illustration, the clamping means in the illustrated embodiment is comprised of a threaded boss **53** receiving a clamping screw **54** (including a drive rod **55** and bearing foot **56**) as employed in a conventional C-clamp, whereby the web of a typical eave strut **12** may be engaged between the clamp foot **56** and the sleeve **51.** In commercial embodiments of this invention, the conventional C-clamp clamping means comprised of the elements **53, 54, 55,** and **56** is preferably replaced by a quick-acting (and release) clamp, usually a lever actuated toggle linkage. The depth and width of the C-structure **52** should, of course, be sufficient to accommodate the various sizes and configurations of the wide range of eave struts and like frame members upon which the stretcher mechanism **30** is likely to be mounted for installation of thermal insulation.

It is to be noted that the sleeve **51** of the mounting means **50** carries an upstanding pressure foot **57,** which may serve two functions. Bearing as it does on the web of the particular eave strut **12** shown in FIG. **4,** the foot **57** resists the torque on the base bar **31** imposed by tension on the insulation **20.** Rather than opening inwardly, as in the case of the roughly C-section channel shown in FIG. **4** for the eave strut **12,** the eave struts of some commercial metal building systems are formed with a longitudinal slot opening outwardly from the building; in this latter style of framing, the foot **57** may bridge such a slot or it may receive a suitable adapter permitting the stretcher to be securely mounted by the clamping means of the mounting means **50.** After the mountings **50** have been secured to an eave strut or other building frame member and the base bar **31** has been slid in the sleeves **51** to the desired position, some operators may wish to lock the stretcher in its adjusted position. For this purpose, the sleeve **50** may be provided with a set-screw **58;** to minimize the tools required by the operator, instead of employing a heading machine screw, as shown in FIG. **4,** the set screw **58** may carry a permanently attached wrench socket, similar to the socket **40,** whereby the ratchet wrench **41** may be used to lock the stretcher in place before it is used to drive the winch bar **36.**

OPERATION OF INSULATION STRETCHERS

With the stretcher **30** mounted on an eave strut **12,** as shown in FIGS. **1** and **4,** the end of a blanket of insulation **20** overhanging an eave strut **12** is fed between the winch bar **36** and its depending locking bar **38,** as indicated in FIG. **2,** or the assembly is backed up until the pins **37** are horizontal and the end of the blanket may be more readily inserted between the bars **36** and **38,** as shown in FIG. **3.** The operator then squeezes the bars **36** and **38** together while lining up one edge of a blanket with the centerline of a rafter and smoothing out the blanket so that it is "square" to the winch bar **36.** Then, with the blanket continuing to be squeezed between the bars **36** and **38,** the winch bar is turned by a wrench or by hand until substantially one full wrap is wound around the winch bar **36** so that the locking bar **38** commences to be included between the first and second wrap of the insulation blanket **20,** as shown in FIG. **4.** With the blanket thus secured on the winch bar **36,** the ratchet wrench **41** is then backed until it interferes with a building member, such as the roof panel **16,** as shown in FIG. **4.** Assuming the blanket **20** extends over the ridge pole **13** to a second stretcher mounted on the eave strut on the opposite side of the building, as indicated in FIG. **1,** the operation is then repeated on the second stretcher. The winch bar of either stretcher or both may then be torqued by a wrench **41** until the desired tension is applied to the blanket to hold it in position without wrinkling or rucking while a panel of roof sheathing **16** is secured. If the torque imposed on the winch bar by the tension on the blanket is such that the bar **36** cannot be held by hand from backing off while the ratchet wrench **41** is backed for either an additional turn forward or to a locking interference with a building member, the winch bar can be readily held during such operation of a ratchet wrench **41** by a second wrench having adjustable or open jaws of suitable size to fit opposite faces of the bars **36** and **38.**

The more tightly a blanket **20** is tensioned by torquing a winch bar after one wrap of the blanket on it, the more securely a blanket is held by the bars **36** and **38** without imposing on either the porous layer **21** or barrier layer **22** any localized load which might otherwise tend to start tears in the blanket **20.** After the insulation is secured in place by the roof sheathing **16,** the blanket end held on a winch bar **36** may be trimmed off.

The entire operation of the stretchers as above described may often be handled by one operator in less time than heretofore required by a crew to position and maintain an insulation blanket similarly in position while it was being secured between the roof sheathing and the supporting rafters and purlins. The time and labor saving is greatest under wind conditions which have heretofore made the insulation particularly difficult to install. When the blanket is exceptionally wide, or if the availability of stretchers made according to this invention makes it economic for insulation to be available in multiples of the modular widths now produced, it may be advisable to employ two operators, one at each end of a stretcher, to apply tension to such a wide blanket; the time and labor should be still less than that of the crew required to install such exceptionally wide insulation by the techniques and equipment heretofore available.

As indicated above, this invention is not limited to the specific embodiment and technique of application as shown and described above but may be modified and varied by those skilled in the art without departing from the spirit and scope of this invention as set forth in the following claims:

What is claimed is:

1. Means for applying tension to a length of a flexible thermal insulation blanket comprising a pair of bracket members, means permitting said bracket members to be mounted on and dismounted from a building frame member, a windlass shaft journaled at each end in said bracket means, means to secure an end of a blanket of insulation on said windlass shaft, and means to permit said windlass shaft to be turned to wind said insulation on said shaft and to be held at the angular position to which it is turned to tension said blanket longitudinally.

2. Thermal insulation tensioning means as defined in claim **1** in which said means to secure said insulation to said windlass shaft comprises a locking bar extending substantially parallel to said shaft between said bracket means, means to support said locking bar on said shaft

at a freely variable spacing of the locking bar with respect to said windlass shaft sufficient to allow an end of a blanket to be inserted therebetween, whereby, when said end is held on said windlass shaft by compression of said blocking bar and the shaft is turned to wrap said blanket on said shaft and over said locking bar, tnesion on the unwrapped portion of said blanket actuates the compression of said end between said shaft and said locking bar.

3. Thermal insulation tension means as defined in claim **2** in which said means for mounting said bracket members to a building frame member comprises (a) a base member extending between and maintaining outwardly extending arms of said bracket members parallel to each other and (b) clamping means carried by said base member for securing said base member to a building frame member.

4. Thermal insulation tension means as defined in claim **3** in which at least one end of said windlass shaft extends outboard of a bracket arm in which it is journaled to receive a wrench for applying torque to said shaft and for holding said shaft at the angular position to which it is torqued.

5. hermal insulation tension means as defined in claim **3** including means carried by said windlass shaft to hold the same at an angular position to which it is turned.

6. Thermal insulation tension means as defined in claim **3** including means for slidably mounting said clamping means on said base member for movement in a longitudinal direction only with respect to said base member, whereby the operative length of said windlass shaft may be adjusted longitudinally with respect to the location on a building frame member on which the base member may be clamped.

7. Thermal insulation tension means as defined in claim **6** in which said mounting means for said clamping means includes a slide member connecting said clamping means to said base member, means for releasably locking said slide member in an adjusted position, and bearing foot means for resisting the moment imposed on said base member through said bracket members by tension on said insulation blanket.

8. Thermal insulation tension means as defined in claim **6** in which said bracket means include a pressure foot adapted to bear against a building frame member on which said base member is mounted, said pressure foot being oriented with respect to the arms of said bracket, means to resist the moment imposed on a bracket arm through the windlass shaft journaled therein by the tension of an insulation blanket wrapped on said shaft.

* * * * *