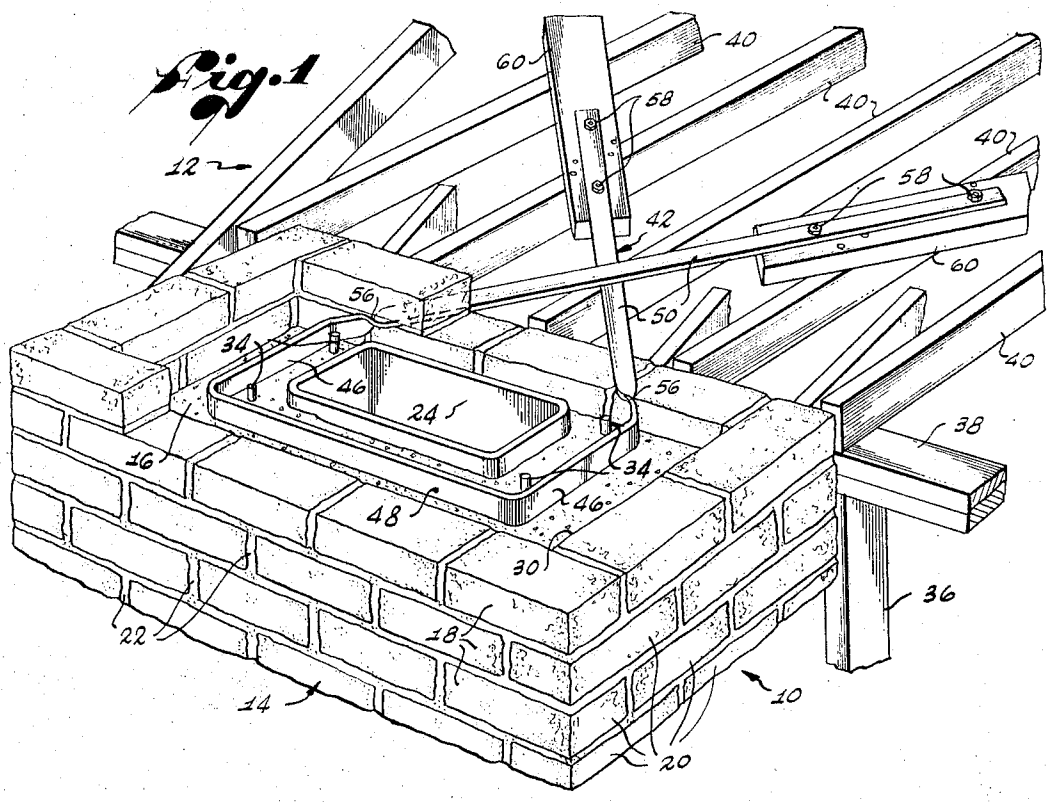
Jan. 24, 1967 J. AVILA 3,299,593

CHIMNEY ANCHOR STRAP

Filed March 23, 1964

Fig. 1



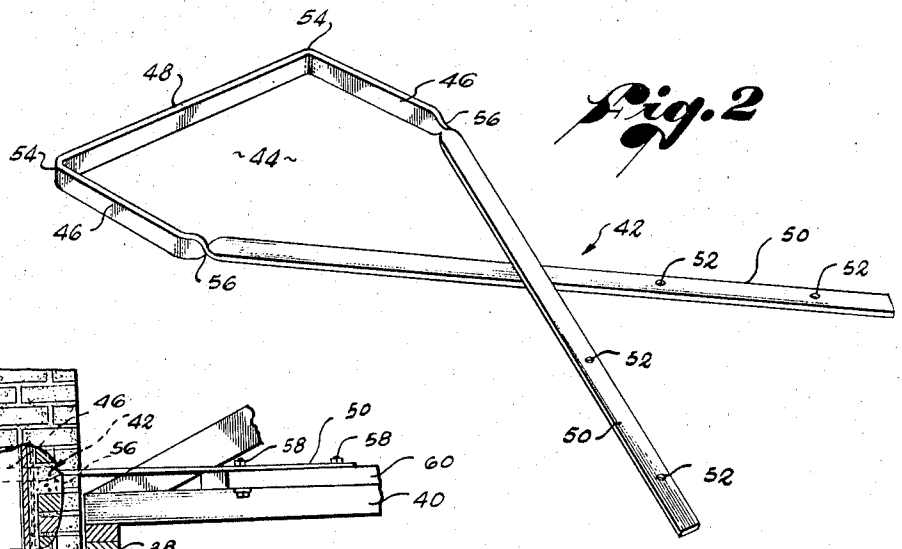


Fig. 2

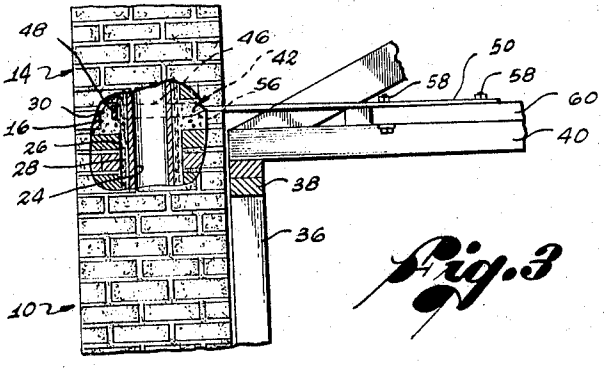


Fig. 3

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CHIMNEY ANCHOR STRAP

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This invention relates generally to so-called bond beam anchorages for chimneys, and more particularly to an improved chimney anchor strap.

The construction of chimneys for family dwellings and the like is relatively standardized and regulated in most, if not all, areas, by local building codes. A typical brick chimney, for example, is supported at its base on a reinforced concrete footing or foundation. The bricks of the chimney are arranged in horizontal rows, or "courses" as they are commonly called, placed one on top of the other with mortar joints between the bricks to bond the latter into a rigid chimney structure. The base of the chimney is enlarged and shaped to form a firebox or fireplace which opens to the interior of the dwelling. The portion of the chimney above the firebox is generally of uniform rectangular cross-section and rises to a point above the roof to form a stack. Extending centrally through the stack is a flue. The lower end of the flue terminates just above the firebox and communicates with the latter through a narrow throat. This throat extends at an angle from the top of the firebox through one sidewall of the flue, a short distance above the lower end wall of the flue, to prevent rain from falling through the flue into the firebox. A pivoted damper is usually placed in the throat to permit the latter to be closed when the fireplace is not in use.

Chimneys of this type may be lined or unlined. In an unlined chimney, the walls of the chimney stack are two bricks, or more, in thickness, and the bricks themselves define and form the walls of the flue. In a lined chimney, on the other hand, the walls of the stack are generally but one brick in thickness and the flue consists of a separate tube or sleeve of fire-resistant material, such as terra cotta, which extends vertically through the stack in spaced relation to its brick walls. The space between the flue and the stack is filled with mortar or concrete.

According to most building code requirements, each chimney, whether lined or unlined, must include two or more so-called bond beams. The chimney of a one-story dwelling, for example, must have a first bond beam in its stack at the level of the ceiling joists of the wooden frame structure of the dwelling and a second bond beam at the upper end of the stack. Each such bond beam consists simply of a concrete collar or ring about the flue. In an unlined chimney, the collar of each bond beam is contained in a cavity within the brick walls of the stack and is separated from the flue opening by an inner layer of bricks. In a lined chimney, the concrete collar of each bond beam is contained in a cavity within the brick walls of the stack which opens inwardly to the space between these walls and the flue sleeve. Accordingly, each bond beam of a lined chimney is integrally joined to the mortar or concrete which fills the space between the brick walls of the stack and the flue.

Some chimneys, of course, have more than one flue. The construction of multiple-flue chimneys, however, is essentially identical to that of single-flue chimneys.

Chimneys commonly referred to as inside chimneys, are contained entirely within the wooden frame structure of a dwelling. Most chimneys, however, and those with which this invention is concerned, are outside chimneys which are located almost entirely exteriorly of the frame structure, contiguous to an outer wall thereof. One of the major causes of damage to chimneys, particularly to outside chimneys, is ground vibration due to earth tremors and movement of vehicles, particularly heavy vehicles

such as trucks and busses, along adjoining streets or roads. In many localities, of course, earth tremors are relatively rare, or never occur. On the other hand, while it is not commonly known to the layman, ground vibration due to vehicular traffic is a frequent cause of chimney damage.

Earth vibration, whatever the cause, tends to create two types of damage in outside chimneys, to wit, cracks in the chimney structure itself and cracks between the chimney structure and the contiguous dwelling wall. The reasons why earth vibration tends to create cracks in a relatively tall, slender masonry structure, such as a chimney, are obvious. The reasons why such earth vibration tends to create cracks between the chimney structure and its contiguous wall, however, may not be so obvious. Accordingly, a brief explanation of the way in which these latter cracks tend to form, is deemed to be in order. Vibrations in the earth, of course, are transmitted to, and tend to vibrate or rock, both the chimney structure and the wooden frame structure of the dwelling. Because of the differences in the physical constants of a chimney structure and a wooden frame structure, such as mass, size, stiffness, and method of construction, however, the natural frequency of vibration of the chimney structure and the natural frequency of vibration of the frame structure are considerably different. When subjected to earth vibration, of course, the chimney structure and the frame structure tend to vibrate at their own respective natural frequencies rather than at the frequency of the earth vibration. As a result, the chimney structure and the frame structure undergo relative vibrational movement, and it is this relative motion which produces vertical cracks between the chimney and its contiguous dwelling wall.

In order to minimize, or entrely eliminate these two types of chimney damage, most building codes require first, reinforcement of the masonry structure itself against the formation of cracks therein, and second, attachment of the chimney structure to the frame structure of the dwelling to minimize relative movement between the chimney structure and the frame structure. The chimney reinforcement dictated by building codes generally consists of vertical steel reinforcing rods within the chimney walls and horizontal steel reinforcing rods within and extending around the bond beams. The chimney-frame structure attachment dictated by building codes is commonly referred to as a bond beam anchorage, and typically consists of metal straps, called chimney anchor straps, which are firmly attached at one end to the ceiling joists of the frame structure and embedded at their other ends in the concrete of the adjacent chimney bond beam.

The existing chimney anchor straps of this type are deficient in several respects. First, the existing anchor straps are arranged on edge; that is to say, they extend laterally from the chimney to the frame structure with their narrow edge faces horizontal and their wide side faces vertical. As a result, the anchor straps possess very little horizontal bending strength and thus offer little resistance to relative horizontal movement between the chimney and the frame structure. Secondly, because the anchor straps extend on edge through the brick wall of the chimney, it is necessary to cut and shape the bricks at the points where the straps emerge from the chimney, to provide clearance spaces for the straps. This is a difficult and time-consuming operation. Thirdly, a typical existing bond beam anchorage consists of two separate anchor straps. As a result, while these straps serve to reinforce the bond beam in one horizontal direction, that is in the longitudinal direction of the straps, the latter do not reinforce the bond beams in the other horizontal direction. Accordingly, the existing building codes require the bond beam in which the chimney anchor straps are embedded to be additionally reinforced

by the conventional horizontal steel reinforcing rods. This requirement of both anchor straps and horizontal reinforcing rods in the bond beam, of course increases the complexity and cost of the chimney. Moreover, it is not apparent from mere visual inspection of the completed chimney, whether or not the bond beam contains the required horizontal reinforcing rods. Finally, the existing chimney anchor straps are generally bent around certain of the vertical reinforcing rods in the chimney and hooked to other vertical rods in such manner that during earth vibration, the straps exert horizontal tension forces on the masonry structure of the chimney which tend to, and often do, produce cracks in the chimney.

It is the general object of the present invention to provide an improved chimney anchor strap for the purpose described.

An other object of the invention is to provide an improved chimney anchor strap which forms a much more rigid attachment between a chimney and an adjoining wooden frame structure than existing chimney anchor straps.

Yet another object of the invention is to provide an improved chimney anchor strap which is uniquely constructed to extend through the mortar joint between adjacent courses of bricks in a chimney, thereby eliminating the necessity of cutting brick to accommodate the anchor strap.

Yet another object of the invention is to provide an improved chimney anchor strap which reinforces the bond beam in which it is embedded in such manner as to permit the conventional horizontal reinforcing rods in the bond beam to be omitted, whereby the cost of the chimney is reduced and the existence of proper reinforcement in the bond beam can be visually determined after completion of the chimney.

Yet a further object of the invention is to provide an improved chimney anchor strap which does not tend to produce any strain on the masonry structure of the chimney which would produce cracks in the chimney.

Still a further object of the invention is to provide an improved chimney anchor strap which is relatively simple in construction, economical to fabricate, easy to install, and otherwise ideally suited to its intended purposes.

Other objects, advantages and features of the invention will become readily apparent as the description proceeds.

Briefly the objects of the invention are attained by providing a chimney anchor strap having a generally U-shaped strap formation including two opposing, and preferably parallel, sides integrally joined at one end by a third side. The two free end portions of the strap converge inwardly toward one another from the other ends of the parallel sides of the U-formation at approximately equal obtuse angles relative to the respective parallel sides. These free end portions cross one another intermediate their ends. The anchor strap is thus generally symmetrical about an axis passing through the intersection of the free end portions of the strap and through the midpoint of the connecting side of the U-formation.

The portions of the strap which define the three sides of the U-formation are disposed in planes normal to the plane of the formation, while the two crossing end portions of the strap are disposed in planes parallel to the plane of the U-formation. According to the preferred practice of the invention, the anchor strap is simply fabricated by bending and twisting a steel strap in such a manner as to form the described anchor strap shape.

The anchor strap is installed by embedding the U-formation of the strap in the concrete of the proper chimney bond beam in such manner that the three sides of the formation are arranged on edge, that is in vertical planes. The two end portions of the strap are disposed in horizontal planes, and extend between two adjacent courses of bricks in the chimney and over the ceiling joists of the adjoining wooden frame structure.

These end portions are bolted or otherwise rigdly attached to the joists. Since the end portions of the strap lie flat between adjacent courses of brick and are entirely contained within the mortar bed, there is no need to cut brick as in the case of existing anchor straps. Also, the U-formation reinforces the bond beam in which it is embedded in such manner that the conventional horizontal reinforcing rods may be omitted from the bond beam. Proper reinforcement of the bond beam may thus be visually determined after completion of the chimney, by simply observing the presence of the anchor strap. The primary advantage of the anchor strap is that relative horizontal movement of the chimney and the frame structure in any direction places one or both of the crossed end portions of the anchor strap under tension, whereby the strap strongly resists relative vibrational movement of the chimney and frame structure in any direction.

A better understanding of the invention may be had from the following detailed description of the presently preferred illustrative embodiment thereof, taken in connection with the annexed drawings, wherein:

FIGURE 1 is a perspective view of a partially completed brick chimney and an adjoining wooden frame structure, illustrating the improved chimney anchor strap in positon in the bond beam cavity of the chimney, prior to pouring concrete into the cavity to form the bond beam;

FIGURE 2 is a perspective view of the improved anchor strap; and

FIGURE 3 is a side elevation, on a reduced scale, and partly broken away, of the portion of the completed chimney containing the anchor strap.

In these drawings, the numeral **10** designates a conventional outside, lined brick chimney and numeral **12** denotes an adjoining wooden frame structure to which the chimney is to be anchored. In the interest of simplicity of illustration, only the portion of the chimney stack **14** containing the bond beam **16** to be anchored to the frame structure **12** has been shown in the drawings.

In line with the earlier discussion of conventional chimney construction, the chimney stack **14** illustrated in the drawings is made up of horizontal rows, or courses **18** of bricks **20**. The courses are arranged one on top of the other, with mortar joints **22** between adjacent courses and between the bricks of each course to bond the bricks into an integral and rigid chimney structure. Extending centrally through the stack **14**, in spaced relation to the brick walls thereof, is a flue **24** composed of fire resistant material, such as terra cotta. The space **26** between the brick wall of the chimney stack **14** and the flue **24** is filled with mortar or concrete **28**, which serves to bond the brick wall of the stack and the flue to one another and to provide the stack with an overall wall thickness of the magnitude required by modern building codes. At the level of the bond beam **16**, the bricks **20** in the stack **14** are laid in such a way as to form an enlarged cavity **30** in the stack **14** about the flue **24** and opening inwardly to the space **26** between the flue and the stack wall. This cavity is filled with concrete which, when it hardens, forms a horizontally enlarged, reinforcing collar or ring about the flue **24**. This concrete collar or ring constitutes the bond beam **16**. Extending vertically through the chimney, between the brick wall of the stack **14** and the flue **24**, are vertical reinforcing rods **34**, as required by modern building codes.

Frame structure **12** includes vertical studs **36** nailed at their upper ends to a top plate **38** to form an outer wall. Nailed at their ends to this top plate are horizontal ceiling joists **40**. As noted earlier, and shown in the drawings, the chimney bond beam **16** is located at the level of the ceiling joists **40**.

This invention provides an improved anchor or anchor strap **42** for anchoring the chimney **10** to the frame struc-

ture 12. A typical chimney anchor according to the invention is fabricated from a steel strap on the order of ¼ inch in thickness and 1¼ inches in width, whereby the strap has relatively narrow edge faces and relatively wide side faces. Referring to FIGURE 2, the anchor strap of the invention will be seen to include a generally U-shaped formation 44 having two opposing, and preferably parallel, sides 46 integrally joined at one end by a third side 48. The portions of the strap which make up these three sides are disposed with their wide side faces in planes normal to the plane of the U-formation itself. The free end portions 50 of the anchor strap 42 converge toward one another from the other ends of the sides 46, and at substantially equal obtuse angles relative to the respective sides. End portions 50 are disposed in planes parallel to the plane of the U-formation 44 and cross one another approximately at their center points. Holes 52 are drilled through these free end portions. According to the preferred practice of the invention, the anchor strap is fabricated by simply bending the steel strap in the regions 54 to form the sides 46 and 48 of the U-formation, and then twistng the strap, in the regions 56, about its longitudinal axis and simultaneously bending the strap in such regions to form the crossing end portions 50. An anchor strap having the illustrated shape could, of course, be fabricated in other ways.

When using the present anchor strap to ancho a chimney 10 to the wooden frame structure 12 of a building, the bricks 20 of the chimney are laid in courses 18 to the approximate level of the ceiling joists 40 of the frame structure. At this level, the bricks are laid in such a way as to form the cavity for the bond beam 16. When the upper surface of the top course of bricks of the partially completed chimney is substantially flush with the upper surfaces of the ceiling joist 40, and prior to filling of the bond beam cavity 30 with concrete, the anchor strap 40 is placed in position with its U-formation 44 located in the caviety 30, about the flue 24 and reinforcing rods 34, in the manner shown. The crossed end portions 50 of the anchor strap extend laterally from the cavity over the uppermost course of bricks in the chimney and over the ceiling joists 40. The end portions of the strap are firmly attached to the ceiling joists, as by bolts 58, which extend through the apertures 52 in the anchor strap and aligned holes in the wooden members 60 nailed to the joists 40. Typically, ½ inch bolts are used for this purpose, and the members 60 may be lengths of two-by-six lumber which are nailed on top of the ceiling joists.

Construction of the chimney is now continued in the usual way until the desired chimney stack height is attained. When thus completing the chimney, a course of bricks 20 is laid directly over the end portions 50 of the anchor strap 42. As the anchor strap and portions 50 are thinner than the mortar joint, the strap is contained entirely within the mortar bed where it passes through the chimney wall, and it is not necessary to cut any of the bricks to provide clearance. Finally, the concrete of the bond beam 16 is poured about the U-formation 44 of the anchor strap. In the completed chimney, therefore, the end portions 50 of the anchor strap extend through the mortar joint 22 between adjacent courses 18 of brick in the chimney, and the U-formation 44 is embedded in the bond beam 16.

At this point, two advantages of the anchor strap become apparent. First, since the end portions 50 of the strap are disposed in planes parallel to and extend through the mortar joint 22 of the chimney, it is unnecessary to cut bricks to accommodate the anchor strap, as is required with conventional chimney anchor straps. Secondly, since the U-formation 44 of the anchor strap surrounds the flue 24 within the concrete of bond beam 16, this portion of the anchor strap effectively reinforces the bond

beam horizontally, in much the same manner as do the horizontal reinforcing rods in a conventional bond beam. Accordingly, when using the present anchor strap, it is possible to eliminate the horizontal reinforcing rods from the bond beam. A chimney constructed with the present anchor strap is therefore easier and less costly to construct. In addition, the existence of adequate horizontal reinforcement in the bond beam 16 can obviously be visually determined after completion of the chimney, by simply observing the presence of the anchor strap. This is in contrast to a chimney constructed with a conventional anchor strap, wherein it is impossible to visually determine whether or not the bond beam is properly reinforced by horizontal reinforcing rods.

A third advantage of the present chimney anchor strap is that it provides a much more rigid and solid attachment between the chimney and the frame structure than do existing chimney anchor straps. Thus, it is apparent that relative lateral movement between the chimney stack 14 and the frame structure 12, either to the left or the right, or away from the frame structure in FIGURE 1, places the end portions 50 of the anchor strap under tension. Since the anchor strap possesses maximum strength in tension, it provides an exceedingly strong and rigid bond beam anchorage between the chimney stack and the frame structure, which resists, to a high degree, relative lateral vibrational movements therebetween. It is also apparent that when the anchor strap is thus stressed, the portion of the strap within the bond beam 16 creates only compressive forces on the concrete of the bond beam, whereby the latter is not prone to fracture by stressing of the anchor strap, as is a bond beam with a conventional anchor strap.

The invention herein disclosed, therefore, is fully capable of achieving the objects and advantages preliminarily set forth. Various modifications of the invention are, of course, possible within the spirit and scope of the following claim.

I claim:

In a building structure having a frame including exterior walls and ceiling joists, and an exterior masonry chimney located contiguous to said outer wall and including a concrete bond beam and a mortar joint at the approximate level of said ceiling joists, a bond beam anchor comprising, in combination:

a metal anchor strap having wide side faces and narrower edge faces, said anchor strap being bent to provide an intermediate, generally U-shaped portion and converging end portions which cross one another intermediate their ends;

said U-shaped portion being adapted to be embedded in said bond beam, and said end portions being adapted to extend through said mortar joint and over said ceiling joists;

said U-shaped portion being disposed with said side faces vertical, and said end portions being twisted 90 degrees at the point where they join the sides of said U-shaped portion, whereby said end portions have their side faces horizontal so as to pass freely through said mortar joint; and

means for securing said end portions to said ceiling joists.

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