Nov. 3, 1964 W. S. BOOTH 3,155,206

FASTENING MEANS FOR FLANGES

Filed Nov. 18, 1959

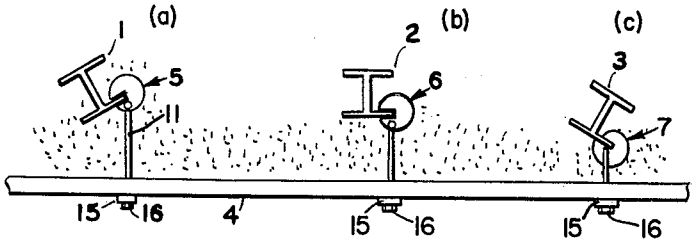


FIG 1

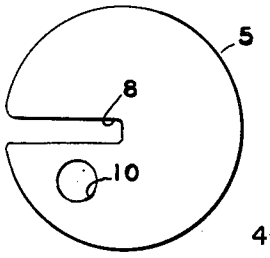
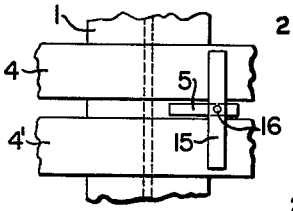


FIG 2

FIG 1A



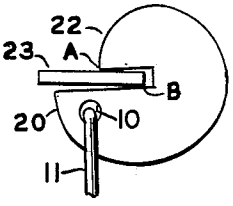


FIG 4

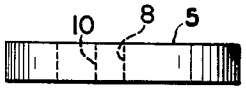


FIG 2A

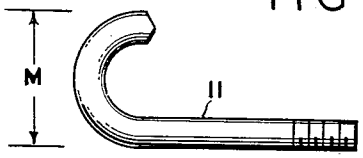


FIG 3

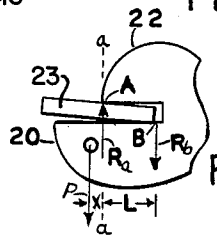


FIG 5

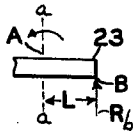


FIG 6A

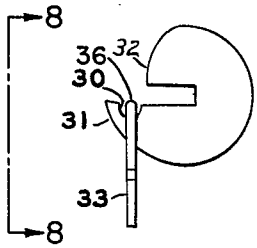


FIG 7

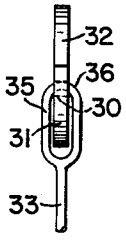


FIG 8

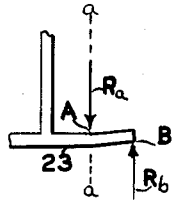


FIG 6

INVENTOR.

WELDON S. BOOTH

BY

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FASTENING MEANS FOR FLANGES

Weldon S. Booth, 117 Villard Ave.,
Hastings on Hudson, N.Y.

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9 Claims. (Cl. 189—88)

This invention relates to construction of retaining walls for excavations and more particularly to clip means for holding the retaining wall sheeting to vertical H beams.

This application is directed to the invention described in my copending prior application, Serial No. 768,388, filed October 20, 1958, now abandoned, and in the continuation application, Ser. No. 21,973 filed April 13, 1960, and to improvements thereon, and is a continuation-in-part of the prior application Ser. No. 768,388.

Clip means of the types which constitute the subject matter of the present and of the prior application are employed in constructing retaining walls as described in United States application Ser. No. 704,550, filed December 23, 1957, jointly by Weldon S. Booth and Alfred J. Coakley. The joint application, now abandoned, has been replaced by continuation application Ser. No. 21,973 filed April 13, 1960. The joint application describes the general method of sinking vertical H beams along the line of the proposed excavation, then excavating close to the beams, and fastening planks known as sheeting, to the beams in order to retain the ground in place and to protect the workers in the excavation.

Prior excavating methods required excavating between the vertical beams in order to insert the sheeting behind the flanges of the beams. As described in the mentioned joint applications, in the old method it was impossible to excavate between the vertical beams with machinery which resulted in handwork which was quite expensive. The method disclosed in the joint applications eliminates all digging between the supports. The sheeting is fixed in front of the vertical beams by means of clip members which clip onto the flanges of the beams and which then clamp the sheeting planks in place. The term "vertical" is used here in only a general identifying sense, as it is well known that such beams are seldom, if ever, actually vertical. Similarly, sheeting planks are frequently not actually horizontal, even though so called.

The clip shown in the joint applications comprised a U-shaped member which was adapted to fit over the flange of the vertical beam. A bolt was then inserted through a hole in the member and through a cross-piece at the other end for the purpose of clamping the sheeting planks.

The present invention provides improvements of the clip and bolt arrangements described in the joint applications and in my prior application by which the clip is more readily attached to the beam and remains locked to the flange of the beam even under especially adverse conditions.

In one embodiment of the present invention the clip comprises a rounded steel plate having a radial slot which is adapted to fit loosely over the flange of the vertical beam, or pile. A mounting hole is made in the plate adjacent the slot for the purpose of receiving the curved end of a J-shaped bolt. In inserting the clip, the ground is removed sufficiently to permit the clip to be slid onto the flange of a vertical beam. The rounded shape of the clip permits easy insertion with a minimum of digging as well as tending to resist cracking. If the earth is not too hard or rocky the rounded clip may be hammered into place with little or no digging.

A J-bolt or shackle of proper length is then hooked through the hole in the clip and the sheeting is clamped in conventional manner by placing a cross-piece over the

bolt and a nut on the bolt, and tightening the nut to place the bolt under tension. The J-bolt is easily inserted in the hole of the clip and is free to rotate so as to compensate for angular misalignment of the beam with respect to the line of sheeting, as also described in the mentioned prior application Ser. No. 768,388 and in the continuation application Ser. No. 21,973.

In another embodiment of the invention the clip has a long jaw and a short jaw, the mounting hole being adjacent the long jaw. In this embodiment the locking feature of the invention enhanced.

In an alternative embodiment of the invention employing the unequal length or offset jaws, an attachment groove is provided in the surface of the extending jaw instead of the mentioned hole. In this arrangement an eye bolt is used to slip over the extending jaw and into the groove.

Accordingly, a principal object of the invention is to provide new and improved clip means for holding structural members, and especially for holding underground sheeting to vertical H-beams.

The invention will be better understood from the following specification and from the drawings, of which

FIG. 1 is a plan view illustrating use of the invention under various conditions.

FIG. 1A is a front elevational view of the assembly (*a*) of FIG. 1.

FIG. 2 is a plan view of one embodiment of the invention.

FIG. 2A is a side view of an embodiment of FIG. 2.

FIG. 3 is a side view of a J-bolt used with the invention.

FIG. 4 is a plan view of another embodiment of the invention.

FIGS. 5, 6 and 6A are diagrams illustrating the locking forces causing crimping in a flange.

FIG. 7 is a plan view of a modification of the invention.

FIG. 8 is a side view of FIG. 7.

Referring to the figures, FIG. 1 illustrates the use of the invention under various conditions. The beams or piles 1, 2 and 3 are steel H-beams which are driven or otherwise sunk into the ground behind the line of the proposed excavation. Due to the force required under different ground conditions it is generally impossible to drive these beams in a straight line so that the line, is usually irregular and some of the beams become rotated or twisted. Of course, once the beams have been driven in place in the earth they no longer can rotate. The sheeting 4 must run in a straight line, but also must be fastened to these irregular beams in order to maintain good contact with the wall of the excavation. This is done by means of the clip members 5, 6 and 7 which are anchored to the sheeting by bolts and cross-pieces later described.

From FIG. 1, the universality of application of the clip will be appreciated. In FIG. 1(*b*), the clip is shown applied to a beam flange which is substantially parallel to the line of sheeting. FIG. 1(*a*) shows the clip attached to a beam which has rotated counterclockwise, the clip being attached to the flange which has turned away from the sheeting. FIG. 1(*c*) shows a similar clip attached to a beam which has rotated clockwise, the clip being locked to the flange which has turned toward the sheeting. Since this condition is usually the most difficult to meet in practice, the merits of the present invention are the most striking in this case because, for the reasons explained below, my clip will lock itself to the flange and will not slip off in use as will other clips heretofore proprosed.

The new means for anchoring the sheeting to the vertical beams illustrated in FIG. 1 will be better understood by reference to FIG. 1A which is a front elevation view of the clip assembly (*a*) at the left-hand end of FIG. 1.

As here shown, crosspiece 15 is retained on bolt 11 by a nut 16, which, when tightened, draws the crosspiece against the faces of two sheeting members 4, 4'; holding them by virtue of tension in the bolt, in position against the dirt (represented by dots). This tension force also tends to rotate the clip 5 into locking engagement with the flange of beam 1, as described below in connection with FIGS. 4 to 6A.

One such clip is illustrated in FIGS. 2 and 2A. The slot 8 is shown as equal to the radius of the disc shaped clip 5. However, it is not required to be equal to a full radius but may be somewhat less in length if desired. The slot is wide enough to fit over the flange of the beam being used. The edges of the slot may be rounded off, if desired, although the locking grip below explained may be greater if the edges of the slot are not rounded off. The inside corners of the slot are preferably rounded for greater strength. An aperture such as hole 10 is provided through the disc, and in this embodiment approximately in the center point of one quadrant of the disc adjacent to slot 8. The purpose of the hole 10 is to receive the curved end of the J-shaped bolt 11 (FIG. 3).

A clip is inserted on either or both flanges of the beam by slipping the slot of the disc over the flange of the beam. Although the clip may be of any shape, the rounded shape is preferable to avoid snags since it is desired to do as little digging as possible. In soft ground the disc may be hammered into place with little or no digging. The curved end of the J-bolt is then inserted through the hole 10 (see FIG. 4) and the sheeting plank 4 is held in place and then clamped by the clip by means of a crosspiece 15 having a bolt hole and a nut 16 which is screwed on the threaded portion of the bolt 11. The crosspiece is long enough to span at least two adjacent planks. This arrangement provides that the bolt is rotatable with respect to the clip which permits the bolt to come out straight perpendicular to the sheeting and permits fastening without any twisting or bending of the members regardless of angular misalignment.

FIG. 3 illustrates a typical J-bolt 11 for use with the clip of FIG. 2. For typical applications the J-bolt may be made of ¾" rod of any length required to compensate for the beam setback as illustrated in FIG. 1.

FIG. 4 shows a modified clip comprising a rounded plate or disc-like member having one portion or jaw 20, to which the bolt 21 is attached, longer than the other portion or jaw 22. This type clip enhances and makes more effective the locking feature of the clip, as the clip will bear on the flange 23 at the points A and B and will tend to rotate so that if sufficient force is applied, the end of the flange 23 will be actually crimped as shown in FIG. 6. The clip of FIG. 2 operates in similar manner, because in both cases, the slot is wider than the flange as shown in FIG. 4.

FIGS. 5, 6, and 6A are force diagrams illustrating the forces and moments involved. FIG. 5 shows a diagram of forces acting on the clip and FIGS. 6 and 6A show external forces acting on the flange, as follows:

A and B are points (or lines) of contact of the flange and clip.
P=Applied bolt force.
X=Distance between line of force P and line a—a.
R_a and R_b=Forces acting at points A and B.
L=Distance between line a—a and line of force R_b.
ΣM_a=Sum of moments about axis through A.
$\Sigma F=P+R_b-R_a$
$\Sigma M_a=PX-R_bL=0$ (equilibrium).

Therefore

$$R_b=\frac{PX}{L}$$

Permissible values of R_a and R_b are limited by the strength of the flange so that when tested to yielding by increasing P, or X, or both, the flange will be ultimately

crimped as in FIG. 6. This is due to the moment R_bL shown by the arrow FIG. 6A about the axis a—a in the counterclockwise direction. Due to the resulting locking action the clip may even be placed on a flange extending toward the sheeting if desired, as shown on the right in FIG. 1(c).

Since only a small moment in the direction shown in FIG. 6A is required to produce locking pressure at points A and B, FIGS. 4, 5, the distance X can be reduced to a minimum.

FIGS. 7 and 8 show another modification of the invention wherein the hole is replaced by another form of aperture viz., a deep groove 30, on the long leg 31 of the clip beyond the end of the short leg 32. With this type of aperture it is preferable to use an eye or slot type bolt 33. This type bolt 33 comprises a forked portion 35 with a connecting piece 36 across the end, the forked portion being adapted to slip over the open end of the clip and the connecting piece 36 being adapted to pivot in the open groove 30 of the clip.

The clips are preferably of a good grade of steel and may be made in conventional manner by forging, machining, flame cutting, or punching.

The clip dimensions are not critical. The following is typical for disc 5 of FIG. 2:

	Inches
Radius	2½
Thickness	⅝
Slot width	7/16
Radius of hole 10	33/64

The J-bolt 11 (FIG. 3) may have the following typical dimensions:

	Inches
Shank diameter	¾
Inside radius of hook	⅜
Dimension M	2

Overall bolt length may be chosen as required. The other clips preferably have comparable dimensions.

Clips of the above specifications have sufficient strength for their intended use. It has been found that the normally used sheeting will fail before the clips and bolts when tested to destruction.

I claim:

1. Clip means for fastening sheeting to a support having a flange, comprising a disc-like member, a radial slot in said member defining two jaws, one jaw being longer than the other, said slot being adapted to fit loosely over said flange, and an aperture in said member adjacent said longer jaw adapted to receive a bolt hooked into said aperture.

2. Clip means for fastening sheeting to a support having a flange, comprising a disc-like member, a radial slot in said member defining two jaws, one jaw being longer than the other, said slot being adapted to fit loosely over said flange, and a groove in the surface of said longer jaw adapted to receive the eye of a tension member said groove being located outside the edge of the shorter jaw.

3. Clip means for fastening structural members to a beam having a flange, comprising a plate having a slot extending inwardly from the edge and defining two jaws, said slot being adapted to fit over said flange, one jaw being longer than the other, and aperture in the longer jaw outside the edge of the shorter jaw, a crosspiece adapted to span at least part of at least one structural member, and a tension member disposed in said aperture and linked to said crosspiece.

4. Clip means fastening sheeting to a support having a flange, one end of said flange being inclined away from said sheeting, comprising a rounded plate member, a slot in said member along a radius thereof, said slot being fitted on said end of said flange and a mounting hole substantially in the center of a quadrant of said plate member adjacent said slot being adapted to receive a J-bolt mounted substantially perpendicular to the plane of said sheeting.

5. Clip means fastening sheeting to a support having a flange, comprising a rounded plate member having a radial slot with substantially parallel sides said slot fitting over one end of said flange, a mounting hole in said plate member in a quadrant of said rounded plate adjacent said slot, a J-bolt connected to said mounting hole, said J-bolt being connected perpendicular to said sheeting to cause a pulling force on said flange, the angle between said force and the working surface of said flange in contact with said clip being such that said force has a substantially zero component in the direction to pull said clip off said flange.

6. A clip assembly for fastening sheeting to an H-beam having a flange which is subject to angular misalignment with respect to the plane of the sheeting, comprising: a plate having a slot extending inwardly from the edge thereof, said slot being proportioned to slide over said flange from the edge thereof, the width of said slot being slightly greater than the thickness of the flange so as to be rotatable to a limited degree in a plane perpendicular to the plane of said flange, and a tension member pivoted in said plate on an axis substantial normal to the plate at a position adjacent and intermediate the ends of the lower side of said slot thereby to create a turning moment in said plate relative to said flange so that said clip grips said flange when said member is under tension by a force having an effective component in the plane of said plate and in a direction away from and generally perpendicular to the lower side of said slot.

7. Clip means for fastening horizontal sheeting to a single flange of a vertical beam secured against rotation and comprising a longitudinal web and at least one longitudinal flange secured thereto at an angle, said clip means comprising: a metal plate having a slot therein, said slot extending inwardly from the edge of said plate and having two sides, the width of said slot between said sides being slightly greater than the thickness of said single flange, and said plate being so proportioned that, when the plate is in position on the flange with the flange in said slot, said plate is free of contact with the remaining flanges, if any, and is rotatable on said flange to a limited degree in a plane perpendicular to the plane of said one flange and is also free of contact with said web, and an aperture in said plate disposed in a portion of said plate of which one side of said slot forms one side of said portion, said aperture being adapted to receive a tension link member therein.

8. Clip means for fastening horizontal sheeting to a single flange of a vertical beam secured against rotation and comprising a longitudinal web and at least one longitudinal flange secured thereto at an angle, said clip means comprising: a metal plate having a slot therein, said slot extending inwardly from the edge of said plate and having two sides, the width of said slot between said sides being slightly greater than the thickness of said single flange so that when the plate is in position on said flange it is rotatable to a limited degree in a plane perpendicular to the plane of said flange, the edge of said plate being cut back adjacent at least one side of said slot to permit said rotation free of contact with said web, and an aperture in said plate disposed in a portion of said plate of which the other side of said slot forms one side of said portion, said aperture being adapted to receive a tension member rotatable therein, the length and width of said slot and the position of said aperture in said portion being such as to produce a turning moment in said plate tending to twist said flange with respect to said web as a result of tension in said member, whereby both sides of said flange are gripped in locking engagement with said plate.

9. Means for fastening longitudinally extending sheeting in spaced relation to a flanged supporting beam which is secured against rotation but is subject to angular misalignment with respect to the plane of said sheeting, said means comprising: a plate of such material and thickness as to be substantially undeformable under the conditions of use, said plate having a slot therein, said slot extending inwardly from the edge of said plate and having two sides so formed as to be substantially parallel to the respective sides of a certain flange of said beam and being spaced apart slightly more than the thickness of said certain flange such that said plate slides loosely over said flange from the edge thereof and is thereby rotatable to a limited degree in a plane perpendicular to the plane of said flange, an aperture in said plate disposed in a portion of said plate of which one side of said slot forms one side of the portion, said aperture being proportioned to receive a link member, and a tension-link member at one end pivotally engaged in said aperture and at the other end disposed to engage said sheeting, whereby to comprise an angularly self-compensating attachment between said sheeting and said flange, said aperture being spaced inwardly from the edge of said plate by a distance such that when said link member is under tension sufficient to support said sheeting said plate tends to rotate and to contact the flange in gripping engagement at its edge on one side and inwardly of its edge on the other side, thus tending to twist said flange and increase said gripping engagement with increase of tension in said member, whereby to retain the flange in gripping engagement irrespective of said angular misalignment.

References Cited in the file of this patent

UNITED STATES PATENTS

1,878,812	Berger	Sept. 20, 1932
2,426,237	Pfeifer	Aug. 26, 1947
2,611,459	Hammitt et al.	Sept. 23, 1952

FOREIGN PATENTS

9,913	France	of 1853
26,048	Great Britain	of 1913
576,628	France	May 16, 1924
602,489	Great Britain	May 27, 1948
543,422	Italy	of 1958

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,155,206 November 3, 1964

Weldon S. Booth

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 56, after "member" insert a comma; line 62, for "and" read -- an --; column 5, line 22, for "substantial" read -- substantially --.

Signed and sealed this 20th day of April 1965.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents