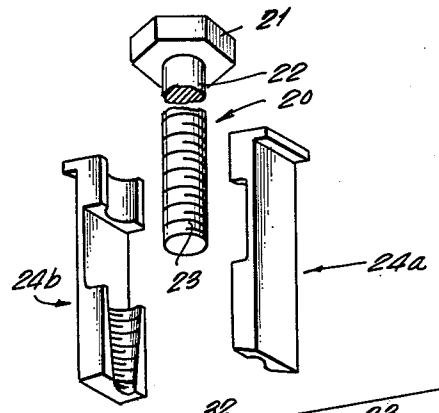
March 9, 1965 W. BELL ETAL 3,172,603

ANCHORING DEVICE

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FIG. 1



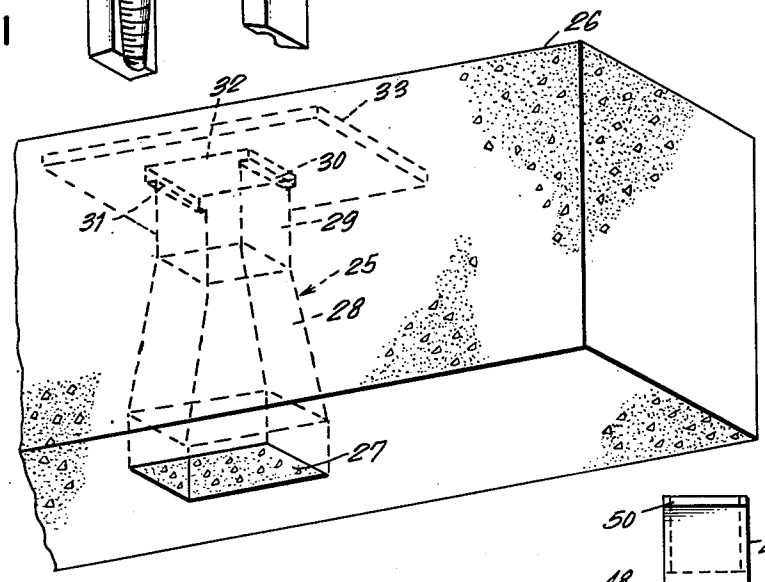
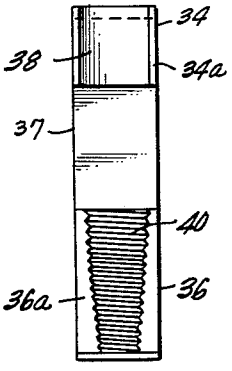


FIG. 3

FIG. 2



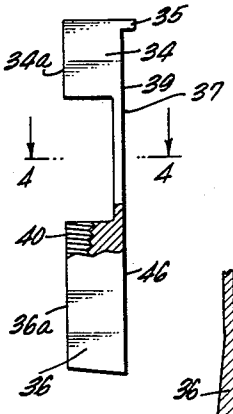
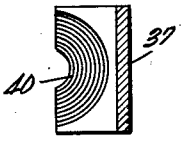


FIG. 4



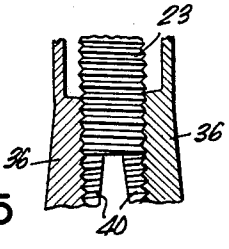


FIG. 5

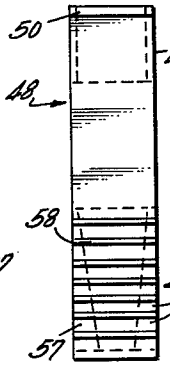


FIG. 9

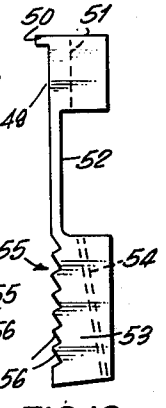


FIG. 10

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FIG. 6

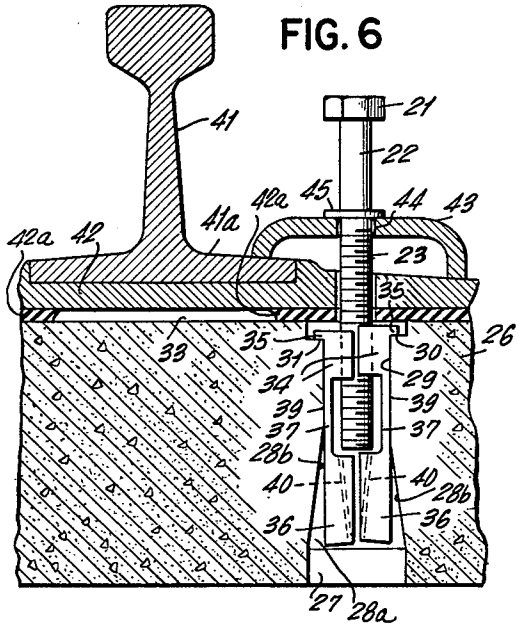
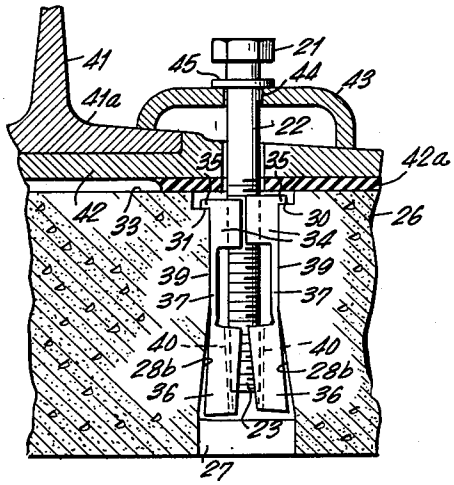


FIG. 7



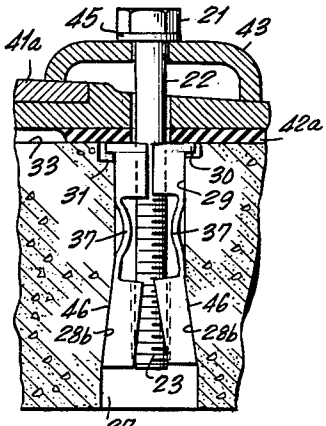


FIG. 8

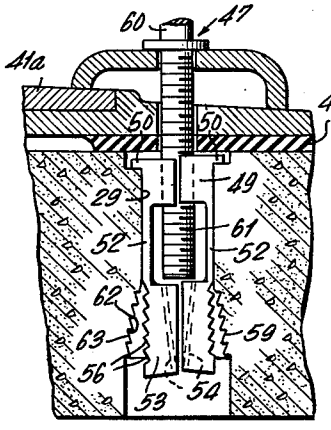


FIG. 11

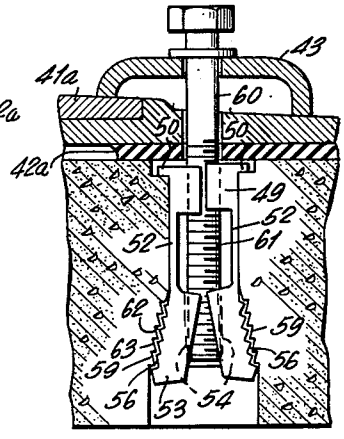


FIG. 12

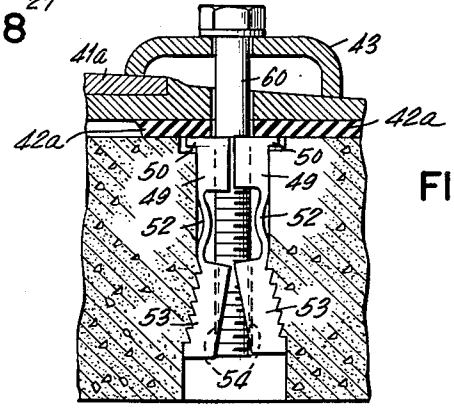


FIG. 13

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3,172,603

ANCHORING DEVICE

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Filed Nov. 16, 1960, Ser. No. 69,592
8 Claims. (Cl. 238—79)

This invention relates generally to devices commonly known as anchor or expansion bolts, which are adapted to be inserted in an opening, previously prepared, in a material such as concrete or masonry and to be subsequently expanded into intimate contact with the walls of such recesses. The invention is particularly related to anchor or expansion bolts which are adapted to be employed to secure rails upon pre-stressed concrete railroad crossties.

The use of pre-stressed concrete crossties in railroad track super-structure has assumed substantial interest as an economical and safe replacement for conventional wooden ties. Such a crosstie comprises a concrete casting which encases pre-stressed reinforcing members extending longitudinally of the casting. The introductioin of an anchoring member into a crosstie of this character may cause cracking of the tie unless the direction of stress induced by the anchoring member is oriented in alignment with the direction of stress created by the pre-stressed reinforcing member. It has therefore become a problem to provide anchoring means adequate for securing rails to the pre-stressed concrete ties and capable of exerting sufficient pressure against the walls of the aperture in which it is inserted so as to insure its retention therein without incurring the risk of rupture or breakage of the concrete material defining said aperture.

It is an object of the present invention to provide an anchor or expansion bolt which is particularly adapted for use with a pre-stressed concrete crosstie.

Another object of the invention is to provide an anchor or expansion bolt of the character indicated which applies a stress parallel to the major axis of the tie.

Another object of the invention is to provide an anchor or expansion bolt of the character indicated which is equipped with improved interchangeable expansion shields of identical construction.

Another object of the invention is to provide an anchor or expansion bolt of the character indicated wherein the expansion shields employed therewith have improved means for assuring their engagement with the sides of the aperture into which said bolt is inserted.

A further object of the invention is to provide an anchor or expansion bolt of the character indicated wherein the expansion shields employed therewith are adapted to exert upon a pre-stressed concrete crosstie a unidirectional compressive stress compatible with the ability of said crosstie to resist such compression and with an efficient anchoring of a rail thereto.

A further object of the invention is to provide an anchor or expansion bolt of the character indicated wherein the expansion shields employed therewith may be subjected to an unusually great amount of distortion during installation without substantial interference with their anchoring functions.

A still further object of the invention is to provide an improved means for seating the aforesaid expansion shields.

Yet a further object of the invention is to provide an improved means for seating the aforesaid expansion shields which will accomplish anchoring thereof by means of compressive pressures directed both laterally and axially parallel to the anchor or expansion bolt.

Other and further objects of the invention will become

apparent from the following description as read in connection with the accompanying drawings.

In the drawings:

FIGURE 1 is an exploded perspective view of one embodiment of the invention, depicting the anchor bolt, a pair of expansion shields employed therewith and an aperture in a pre-stressed concrete crosstie which may receive said anchor bolt and expansion shields;

FIGURE 2 is a front elevational view of one of the expansion shields depicted in FIGURE 1;

FIGURE 3 is a right end view, partially in section of the expansion shield depicted in FIGURE 2;

FIGURE 4 is a cross-sectional view taken about line 4—4 of FIGURE 3 and looking in the direction of the arrows located in the vicinity of the ends of said line 4—4;

FIGURE 5 is a fragmentary cross-sectional elevational view depicting the relative vertical positions of the threaded portions of the expansion shields and the engagement of the threaded member facilitated thereby;

FIGURE 6 is a cross-sectional elevational view depicting the aforesaid anchor bolt and expansion shields disposed in the aperture depicted in FIGURE 1 and employed for anchoring a rail, the said anchor bolt being depicted as about to engage the threaded portions of the expansion shields, the said expansion shields being shown in an unexpanded position;

FIGURE 7 is a fragmentary cross-sectional elevational view depicting the said anchor bolt and expansion shields within the aperture, the expansion shields being shown in a partially expanded position.

FIGURE 8 is a fragmentary cross-sectional elevational view similar to that of FIGURE 7 but depicting the said expansion shields in a fully expanded position;

FIGURE 9 is a rear elevational view of a modified form of expansion shield which may be employed for anchoring purposes in a pre-stressed concrete crosstie;

FIGURE 10 is a right end view of the form of expansion shield depicted in FIGURE 9;

FIGURE 11 is a fragmentary cross-sectional elevational view depicting an anchor bolt and a pair of the expansion shields formed according to the structure shown in FIGURES 9 and 10 installed in a modified form of aperture in a pre-stressed concrete crosstie, the said aperture being adapted to cooperate with the said expansion shields by providing an improved seating means therefor, the said anchor bolt being about to engage the threaded portion of said expansion shields, the said expansion shields being in an unexpanded position;

FIGURE 12 is a cross-sectional elevational view similar to that shown in FIGURE 11 but depicting the said anchor bolt partially engaged with the threaded portions of the said expansion shields and the said expansion shields in a partially expanded position.

FIGURE 13 is a cross-sectional elevational view depicting the said anchor bolt fully engaged with the threaded portions of the said expansion shields and the said expansion shields in a fully expanded position.

The instant invention comprises a bolt and bolt anchor particularly adapted for use in anchoring a railroad track rail to a crosstie. In such application, a bolt or longitudinal member is provided with means for engaging an anchor within the crosstie which is deflectable to exert a compressive stress upon the crosstie in a direction parallel to the stress induced therein by conventional pre-stressing members, thereby enabling the crosstie to be subjected to extremely high stresses by the anchor and permitting the latter to retain the longitudinal member against correspondingly high disruptive forces which the rail may exert upon the longitudinal member.

Thus, as shown in FIGURE 1 of the accompanying drawings, one embodiment of the invention comprises a longitudinal member such as a bolt generally designated

by the numeral 20 and including a head 21 and a shank 22 provided with a thread 23. In this embodiment of the invention, the anchor is of generally rectangular conformation and split into two parts disposed in face-to-face confrontation. These two parts are in the form of a pair of expansion shields, generally designated by the numerals 24*a*, 24*b*.

The aforesaid anchor and bolt are intended for reception within a bore, generally designated by the numeral 25 and formed in a concrete crosstie 26 which has been pre-stressed by conventional means in a longitudinal direction. There are three essential characteristics which this bore must possess. In the first instance, it must be capable of receivig the bolt and anchor. Secondly, it must make provision for receiving the anchor in its expanded condition. And lastly, the bore must be capable of transmitting any stress exerted upon it by the anchor in a direction parallel to the stresses induced in the crosstie by the pre-stressing member. Thus, if the pre-stressing member is disposed so as to exert an initial longitudinal compressive stress upon the crosstie, the sides of the bore must be capable of transmitting a compressive stress exerted by the anchor in a direction longitudinal of the crosstie and opposite to that of the aforesaid initial stress thereon. In this way, the initial stress upon the crosstie is relieved and the overall effect is that the crosstie can withstand a stress from the anchor to a much greater extent than it could in an unpre-stressed direction.

As indicated in FIGURES 1, 6 and 7, the bore may include three chambers. The first or lower chamber 27 is characterized by vertical walls arranged in rectangular conformation and communicating between the lower face of the crosstie and the second or intermedaite chamber 28. The lower chamber 27 of the three chambers and its upper perimeter coincides with the perimeter of the base of the intermediate chamber 28. The latter is defined by a pair of vertical opposing walls, typical of which is the wall designated 28*a*, and a pair of sloping opposing walls 28*b* disposed at right angles to the said vertical walls 28*a*.

It is important to note that the sloping walls 28*b* are inclined in a direction longitudinal of the crosstie, thereby providing a seat for the deflectable portions of the anchor, which seat will transmit any stresses imposed thereon in a correspodingly longitudinal direction.

The upper perimeter of the intermediate chamber 28 also coincides with the perimeter of the base of the third or upper chamber 29. The latter is characterized by vertical walls arranged in rectangular conformation and communicating between the intermediate chamber 28 and a pair of shoulders 30, 31 disposed laterally of the upper chamber 29 and in vertically offset relation with respect to each other. These shoulders 30, 31 are formed within a rectangular aperture 32 provided in a rectangular seat 33 located on the upper face of the crosstie, the said aperture 32 communicating with the upper chamber 29.

It will be noted that the depression 32, as well as the three chambers 27, 28 and 29, are of rectangular cross-section (when intersected by a horizontal plane), the longitudinal axis of which is parallel to or coincident with the longitudinal axis of the crosstie. Moreover, the overall length of the generally rectangular anchor is greater than the width of the depression 32 and chambers 27, 28 and 29, and may be received therein only in a position wherein the longitudinal axis of the rectangular characteristic of the anchor is parallel to the longitudinal axis of the rectangular characteristic of said depression 32 and chambers 27, 28 and 29. Such a disposition of the anchor serves to insure that its expansion will follow a path parallel to the longitudinal pre-stresses of the crosstie rather than in a direction transverse thereto where the crosstie could not support as great a compressive stress.

The expansion shields 24*a*, 24*b* are an important feature of the invention and are identical in form. One of such expansion shields is depicted in detail in FIGURES 2, 3 and 4. As shown in these figures, this expansion shield comprises a collar 34 provided with a horizontal flange 35, a deflectable element 36 and a web 37 of reduced cross-section connecting the collar 34 and the deflectable element 36. The external periphery of the said collar 34, web 37 and deflectable element 36 is of generally rectangular conformation defined by planar surfaces, interrupted and distortable as hereinafter described.

Thus, on one side of the collar 34, hereinafter called the face 34*a* thereof, there is provided a semi-cylindrical depression 38. Since each of the expansion shields is of identical form, when they are disposed in face-to-face confronting relation, the collars of each such shield present a generally cylindrical, split throat wherein the shank 22 of the bolt 20 may be received.

The side of the expansion shield opposite to the face 34*a* hereinafter called the rearward surface 39 is a planar surface communicating between the collar 34, the web 37 and the deflectable element 36. As may be seen in FIGURES 2, 3 and 4, the deflectable element 36 is provided with an inclined thread 40 formed upon the face 36*a* thereof. Since each of the expansion shields is identical in form, the thread in each of said shields is identical. It is the function of these threads to provide a female engagement with the thread 23 of the bolt shank 22. Hence, to accomplish the vertical displacement between the threads in each of the shields, so as to accord with the pitch of the thread 23, it is necessary to provide a corresponding vertical displacement between the shields. To attain this end, the flange 35 of one of the expansion shields 24*a* rests upon the upper shoulder 30 formed at the base of the depression 32. The corresponding flange of the other expansion shield 24*b* rests upon the lower shoulder 31 formed at the base of said depression 32. Since the shoulders 30, 31 are vertically offset to an extent equal to ½ the pitch of the thread 23, it follows that the thread 40 on each deflectable element 36 of the expansion shields will be similarly offset with respect to each other. A similar offset is advantageously provided on surfaces 28*b*, thereby permitting engagement of the thread 23 as depicted in FIGURE 5. Thus, unlike the situation so frequently encountered with conventional expansion shields wherein the threaded portions intended for engagement with the bolt are offset in accordance with the pitch of the bolt thread, thereby necessitating the employment of expansion shields which are not identical in form, the present invention makes use of expansion shields which include identically formed threads, thereby permitting interchangeability of any of said shields.

It will also be noted that the web 37 is offset with respect to the face 34*a* of the collar 34 and the face 36*a* of the deflectable element 36, thereby permitting the shank 22 of the bolt to extend between the throat formed by the collars when they are assembled within the bore of the crosstie and the thread 40. Moreover, the web is of reduced cross-section and since the expansion shield is preferably composed of a bendable metallic material, the web facilitates the inclination of the deflectable elements of the expansion shields when they are engaged by the bolt so as to produce a lateral pressure upon said deflectable elements.

The operation of the present invention can be clearly understood from a consideration of FIGURES 5, 6 and 7. Thus, as appears in FIGURE 5, the invention may be used to secure a rail or track 41, such as is customarily encountered in current railroad practice. Such rail or track 41 is customarily mounted upon a suitable support, such as a tieplate 42 and pad 42*a*, which may be received within the rectangular seat 33 provided in the upper surface of the concrete crosstie. So also, the said rail or track 41 is secured by a rail clip 43 which abuts against the lower flange 41*a* of the rail or track and against the tieplate 42. The rail clip 43 is provided with an aperture 44 through which the shank 22 of the bolt may project. The head

21 of the bolt is seatable upon suitable washers 45 disposed upon the upper surface of the rail clip 43.

The bolt and expansion shields may be assembled within the bore in the various stages of installation depicted in FIGURES 6, 7 and 8. Thus, in the stage of installation of the anchor depicted in FIGURE 6, the bolt is disposed through the throat formed by the collars 34 and its thread 23 is about to engage the threads 40 of the deflectable elements 36 of the expansion shields. Upon such engagement, the shank 22 of said bolt will descend as depicted in FIGURE 7, thereby forcing the deflectable elements 36 outwardly so as to bring that portion of the rearward surface 39 which is opposite the thread 40 formed on each deflectable element 36, hereinafter referred to as the gripping face 46 into confrontation with the sloping walls of the intermediate chamber 28 of the bore. This disposition of the deflectable eelements 36 occurs upon partial engagement of their threads 40 by the thread 23 of said bolt, said engagement being accomplished by suitable turning of its head 21. Upon further rotation of said bolt head 21, full engagement of the threads 40 of the deflectable elements 36 may be accomplished so as to dispose the expansion shields in the position depicted in FIGURE 8, wherein their gripping faces 46 will be in substantial contact with the sloping walls of the intermediate chamber 28 of the bore. It will be noted that since the web 37 of each expansion shield is of a reduced thickness, it will buckle upon the exertion of axial pressure by the bolt induced by its rotation in engagement with the deflectable elements 36 of said expansion shields, thereby displacing the gripping faces 46 thereof upwardly and permitting them to fully engage the said sloping walls. Said webs 37 also afford a certain amount of resilience to the contact between said gripping faces 46 and the said sloping walls, so as to minimize the possibility of breaking that contact during the operative use of the anchoring means, as might otherwise occur by reason of rail vibration, for example.

A modified form of the invention makes use of a bolt 47 and expansion shields, such as are illustrated in FIGURES 9 and 10 of the drawings. These expansion shields, generally designated by the numeral 48, include a collar 49 provided with a flange 50, a semicylindrical depression 51 and an offset web 52, all of which are of construction similar to that described in connection with the expansion shield illustrated in FIGURES 2, 3 and 4. The modified form of expansion shield is also provided with deflectable element 58 having an inclined thread 54 similar to that described in connection with the originally described type of expansion shield. However, the gripping face 55 of said deflectable element 53 is characterized by a series of serrations or teeth 56. In the unexpanded position of the expansion shield 48, each of these teeth 56 is formed by two inclined surfaces 57 and 58.

The function of these teeth 56 may be best understood from a consideration of FIGURES 11, 12 and 13. As shown in FIGURE 11, the expansion shields 48 may be inserted in a bore similar to that previously described, the said bore being formed in a pre-stressed concrete crosstie. The aforementioned similarity of the bore must be qualified by the fact that its sloping walls which are advantageously offset from each other in the manner heretofore indicated, are also provided with a series of seats or serrations 59 intended for engagement with the teeth 56 of the expansion shields 48. These shields, as in the case of those originally described, are disposed within said aperture in face-to-face confrontation and are vertically offset by the shoulders provided above the upper chamber of said bore in a manner similar to that of the expansion shields depicted in FIGURES 6, 7 and 8. FIGURE 11 shows the shank 60 of the bolt 47 about to engage the threads 54 of the expansion shields 48. FIGURE 12 depicts the thread 61 of said bolt 48 in partial engagement with the threads 54 of said expansion shields and the consequent expansion of their deflectable elements

into the close vicinity of the serrations or seats 57. It will be noted that each of the serrations or seats 59 is defined by a horizontal and a vertical surface, respectively designated by the numerals 62 and 63. Since the teeth are formed by inclined surfaces 57 and 58, their intimate engagement with the serrations or seats 59 is necessary before the horizontal surface 62 of each of said seats 59 will bear fully upon the upper surface 58 forming each of said teeth 56. To accomplish said intimate engagement, further tightening of the bolt 47 is necessary so as to cause it to fully engage the threads 54 of the expansion shields 48. Such a disposition appears in FIGURE 13 of the drawings wherein the teeth 56 are fully engaged with the seats or serrations 59. It wil be noted that as in the case of the originally described form of expansion shield, the web 52 thereof will buckle upon the exertion of a sufficient axial pressure by the bolt 47. Here again, this buckling serves to insure a resilient contact between the teeth 56 and the seats or serrations 59, thereby resisting the breaking of such engagement due to rail vibration or other causes.

It will be understood, however, that to accomplish contact between any of the forms of expansion shields described above, and the sloping walls of the bores in which they are received, it is not absolutely necessary that the webs of said expansion shields be buckled and that in many instances such contact will be sufficient without the necessity of the aforesaid buckling. However, it is felt that the forms of the invention described above present a distinct advantage over conventional equipment by reason of the resilience of the contact afforded by the buckled condition of the necks.

It will also be observed that in the modified form of the invention described above, the seats or serrations provided by the aperture permit the expansion shield to take advantage of a vertical as well as a lateral resistance to compressive pressures, thereby permitting extremely secure anchoring of the rail or track engaged by the anchor bolt and rail clip and reducing the total longitudinal loading in the pre-stress tendons.

It will be apparent from the foregoing that the instant invention, in addition to having the advantages heretofore pointed out, is capable of being readily installed by insertion from the top of the tie and furthermore, that in the event of damage to any portion of the anchor, it may be readily removed and replaced in the same manner without disturbing the tie itself.

The embodiment of the invention illustrated and described hereinabove has been selected for the purpose of clearly setting forth the principles involved. It will be apparent, however, that the present invention is susceptible to being modified in respect to details of construction, combination and arrangement of parts which may be resorted to without departure from the spirit and scope of the invention as claimed.

We claim:

1. A bolt anchor formed by a pair of mutually unsecured expansion shielsd of similar conformation, each of said expansion shields comprising an elongated body of generally rectangular cross-section, the said elongated body including a deflectable element characterized by at least two oppositely disposed planar faces, one of said planar faces being provided with an inclined thread, the inclined threads of said shields being identical.

2. A bolt anchor formed by a pair of expansion shields of similar conformation, each of said expansion shields comprising an elongated body of generally rectangular cross-section, the said elongated body including a deflectable element formed integrally with a web of reduced thickness, the said web being bendable outwardly and upwardly upon the exertion of a lateral pressure upon the said deflectable element, each of said bodies having an identical thread on its inner surface.

3. A bolt anchor formed by a pair of expansion shields of similar conformation, each of said expansion shields having an identical thread engageable with a bolt, the said

expansion shields being disposed in vertically offset relation when engaged with said bolt.

4. A bolt anchor formed by a pair of expansion shields of similar conformation, each of said expansion shields comprising an elongated body of generally rectangular cross-section, the said elongated body including a deflectable element characterized by a pair of oppositely disposed planar faces, one of said planar faces being provided with an inclined thread, the inclined threads of said shields being identical, the said elongated body being provided with a collar formed with a semi-cylindrical depression, the said collar being connected to the said deflectable element by a web of reduced thickness, the semi-cylindrical depressions of each of said collars defining a generally cylindrical aperture for receipt of a bolt engageable with the inclined thread of each of said deflectable elements, the said deflectable elements being displaced outwardly of the axis of the said bolt anchor upon engagement by the said bolt with the said inclined thread of each of said deflectable elements, each of said webs being bendable in a first direction to permit the outward displacement of each of said deflectable elements and in a second direction to permit the upward displacement of each of said deflectable elements.

5. An improved anchor bolt comprising in combination, a bolt, a pair of mutually unsecured expansion shields engageable with said bolt and deflectable upon said engagement to contact the sides of a bore provided in a pre-stressed concrete crosstie, the said expansion shields being characterized by planar faces adapted to be disposed transversely of the said pre-stressed concrete crosstie whereby the said planar faces exert upon the sides of said bore a compressive stress parallel to the direction of pre-stress in the said concrete crosstie, said shields having identical threads for threaded engagement with said bolt.

6. In combination with a solid pre-stressed concrete crosstie, an anchor bolt comprising in combination, a bolt, a pair of expansion shields engageable with said bolt and deflectable upon said engagement to contact the sides of a bore provided in said pre-stressed concrete crosstie, the said expansion shields being characterized by planar faces disposed transversely of the said pre-stressed concrete crosstie, the said planar faces exerting upon the sides of said bore a compressive stress parallel to the direction of pre-stress in the said concrete crosstie, the said anchor bolt being engaged with means for securing a railroad track rail to said concrete crosstie, the said expansion shields being provided with identically threaded faces for engagement with the said bolt, the said expansion shields being seated upon a pair of vertically offset shoulders, whereby the said threaded faces are offset to accommodate the pitch of the thread of said bolt.

7. A device according to claim 6, the said expansion shields being provided with a pair of flanges seatable upon the said shoulders.

8. In combination with an elongated bore disposed transversely of a longitudinally pre-stressed solid concrete crosstie and characterized by at least one generally rectangular chamber provided with vertical side walls and a second chamber provided with a pair of opposing vertical side walls and a pair of opposing inclined side walls, the said inclined side walls being disposed transversely of the said concrete crosstie, an anchor bolt comprising in combination, a bolt, a pair of expansion shields engageable with said bolt and deflectable upon said engagement to bring a planar face on each of said expansion shields into compressive contact with the said inclined side walls, the said anchor bolt being engaged with clamping means for securing a railroad track rail to said crosstie, the said expansion shields being provided with a pair of flanges seatable upon a pair of vertically offset shoulders located laterally of the mouth of the said generally rectangular chamber, the said expansion shields being provided with identically threaded faces for engagement with said bolt, the said threaded faces being offset by said shoulders to accommodate the pitch of the thread of the bolt.

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