To all whom it may concern:

Be it known that I, VAN RENSELLAER
CHOATE KING, a citizen of the United States,
and resident of Radnor, in the county of
Montgomery and State of Pennsylvania,
have invented certain new and useful Im-
provements in Segmental Cross-tie and Rail-
Holding Structures, of which the following
is a specification.

This invention relates to segmental cross-
tie and rail holding structures. Generally
speaking, objects of the invention are to
produce at low cost, with a maximum of con-
crete and a minimum of metal, a practical,
efficient, segmental cross tie which may be
used for holding rails in place without the
use of heavy trenched rail chairs of the
type having a bottom and at least one in-
tegral side wall although my tie has seg-
mental, trenched; rail seats; and to make the
ties in such wise that the ties and therewith
tamped ballast will make a road bed in
which the track, including ties and rails, is
held against lateral movement. It quite fre-
quently happens with tracks as heretofore
constructed that long sections of many feet
of track are moved bodily in a lateral direc-
tion under ordinary tamping conditions,
the ties slipping endwise bodily on the road
bed. There is always a tendency in all track
construction of the rails to creep in the
direction in which the traffic moves. There is
also a positive tendency for the rails to
spring laterally out of their predetermined
center line when many rails have moved end-
wise into contact one with another due to
creeping induced by a sudden rise in tem-
perature. Serious accidents constantly occur
from this cause. Objects of the invention
are to minimize all such objectional occur-
rences.

Another object of the invention is to make
the ties reversible so that they may be used
either side up and another object is to pre-
vent shock and disintegration of the tie
heads by the simultaneous downward bow-
ing and endwise movement of rails under
traffic conditions.

In the accompanying drawings forming a
part hereof and illustrating the principle
of the invention and the best modes now
known to me of applying that principle,
Fig. 1 is a top plan view of the preferred
form of my new reversible, concrete and
metal cross tie with one rail in place.

Fig. 2 is a side elevation of what is shown
in Fig. 1.

Fig. 3 is an inner end view of one of the
two concrete and metal tie heads of identical
construction.

Fig. 4 is an end view of an anchorable,
tie corner armor block, detached.

Fig. 5 is a top plan view of what is shown
in Fig. 4.

Fig. 6 is top plan view of a rail clamp
socket block, detached.

Fig. 7 is a side elevation of what is shown
in Fig. 6.

Fig. 8 is a side view of my new anti-
creeping clamp, detached.

Fig. 9 is a bottom plan view of what is
shown in Fig. 8.

Fig. 10 is an enlarged view in section at
a part of line 10—10 of Fig. 1 and shows a
rail flange, an anti-creeping rail clamp
and a clamp bolt in homed position.

Fig. 11 is a diagrammatic end view of two
laterally opposed, spaced apart tie heads
with a rail clamped thereon, and indicates,
by a dotted line, that typical downward
bowing of a rail between two adjacent ties
which occurs when a locomotive or train
travels over track rails supported at inter-
vals by cross ties.

Fig. 13 is an enlarged sectional view at
lines 13—13 of Fig. 1 and shows the inward
end portions of the tie heads coupled by
transverse short-length, one piece coupling
rods exposed between their ends in a work
space between the heads and provided with
reversely turning screw threads; and with the
threads of the sockets homed in the 95
socket blocks and also exposed between the
heads.

Fig. 14 is a bottom plan view, enlarged,
of a portion of a toothed under surface of
the inner end portion of the anti-creeping
rail clamp shown in Figs. 8 and 9.

Fig. 15 is a plan view of two laterally
spaced apart ties shown in Fig. 1 with
ballast tamped in place.

Fig. 16 is a transverse section at line 105
16—16 of Fig. 15 looking towards the side.
of one of the tie heads and showing ballast more heavily tamped beneath the rail supporting portion of the tie heads than between the inward narrowed end portions of the heads.

Fig. 17 is a perspective view of a flat topped rail seat plate anchored in a concrete tie head and provided with clamp bolt receiving sockets. A portion of the plate is broken away for greater clearance and the concrete in which the plate is anchored is indicated by dotted lines.

Fig. 18 is a length-wise sectional view of one of my new reversible, sectionalized cross tie heads provided with a rail seat plate shown in Fig. 17.

In the two illustrated forms of the invention each cross tie comprises a pair of transversely aligned and adjustably coupled concrete, reversible tie heads of identical construction, dimensions and shape. Any suitable form of reinforcement for the concrete may be used. Reinforcement rods are shown. The heads are of a length sufficient to bring their inner opposed ends in each transversely coupled pair nearly up to the middle line between the rails, so that when laid their inner ends are spaced apart by a short distance, preferably of a maximum distance of about four inches, just sufficient to form a narrow working space 3 between the opposed end walls of the heads. This working space gives room for turning the short, stiff, one piece, coupling rods. A plurality of one piece coupling rods is shown, but in some cases a single coupling rod will suffice. However, a plurality of these rods one above the other and located in the axial plane of the transversely coupled heads is preferred. One end of each coupling rod is provided with right hand screw threads and the other end is provided with left hand screw threads. The inner end portions of the two tie heads are severally provided with one or more tie rod receiving socket blocks 7 anchored horizontally in a head. Each socket block is shown with an interiorly threaded socket 8 for reception of a threaded coupling rod end. The threads at the end portions of such tie rods extend for a length in excess of the depth of the socket threads. The threads weaken the ends of these short-length, one piece coupling rods and the inward threads at each end are extended so that when the rods are screwed into the sockets some threads at each end portion of a tie rod are exposed for breakage under some conditions of accident and for thereby, in such cases, preventing or minimizing the expense of rupture of the more expensive tie heads. By forming the coupling rod threads in reversed directions, it is possible to turn the rods by application of a suitable wrench to a rod in the working space and simultaneously to pull together or push apart the two coupled tie heads, not only to suit rail gage dimensions when the track is laid, but also to draw the tie heads and rails closer together when that is necessary to be done owing to the wearing away of the inner sides of the rail heads by the wheel flanges of locomotives and cars. The fact that the tie heads have long dimensions sufficient to bring their inner ends so closely together is favorable to the immobility of the track construction because of the length of the tie head inwardly from the rail and of the length of the tie head outwardly from the rail. The best practice is to tamp ballast most heavily beneath the rail supporting end portion of a tie, as from 9 to 10; and more lightly to tamp the ballast along the middle portion of the tie as at 10.

An additional advantage of making a segmental tie with such relatively long heads and with as short a coupling as will permit a good working space between their opposed ends lies in the fact that there is substantially less bending strain exerted on short length couplings than there is on long length couplings under the endwise, downwardly tipping strains to which the outer end portions of all cross ties are subjected, as is well-known to all skilled in the art. This is a matter of substantial practical importance in being desired to stiffen and keep stiff the mid-length portion of my new tie and it being recognized that the mid-length strength of all ties is important to the integrity of the track.

As above stated, I preferably use a plurality of coupling rods in the present case, two of which are shown one above the other.

In the working assemblage whenever one or both tie heads have their outer ends depressed so as to bring an upward tipping action on the inward ends of the heads, either or both, the under portion of each tie rod will be put in compression and the upper portion thereof in tension; and under such conditions also the under tie rod must act as a compression member forming (Fig. 2) a truss connection between the heads because of the upper and under location of the two rods and their anchorages in the sockets anchored one above the other in the inner ends of the tie heads.

It is a feature of this invention, for the sake of economy and of lightness in weight, to use as little metal as feasible and all the component parts of the structure herein described, with the exception of the concrete, are of suitable metal. Those parts which are held by a tie head are firmly anchored in concrete against endwise movement and also against axial movement and tipping movements; all these metal members which are components of the tie head...
and have exposed surfaces, have such surfaces substantially flush with the concrete so that the tie heads are easily stackable for transportation in railway maintenance cars. The tie heads are so formed that they can be easily stacked block-wise and are of a weight convenient to permit quick and efficient handling. The practice is in track maintenance to carry the supplies in a car and to dump them at intervals on the track under construction or repair with usually very limited time between train movements in which to work.

In the form shown, the rod socket blocks are polygonal in cross section throughout their length whereby they are prevented from axial turning movements; their corner portions are indicated by 11. To permit assemblage of any one head with any other head, either rail supporting side up, the axes of the coupling rod receiving sockets are at equal distances from the normal upper edge under corners 12 of each head. To secure firm anchorage of the socket blocks in the endwise direction, each body portion is provided with a polygonal butt-end head 13. The outer ends of the sockets are substantially flush with the inner ends of the tie heads. The sockets between their heads and butt-ends are reduced cross-sectionally for reduction of weight.

A very important feature and advantage of the invention, irrespective of the particular construction of the tie heads, in other respects, is that their inward end portions are narrower in width for a substantial distance than their outer portions. Thus in the form shown each side wall of each end portion of the tie head is formed with an incurred sloping shoulder 14 in a direction toward the long axis of the head, the incurving shoulders severally extending into opposed walls 14. When a series of cross ties having such width-wise dimensionally reduced end portions adjacent the central portion of the road bed are laid and connected thereto by detachably clamped rails, ballast between the rails is tamperable not only against the sides of the tie heads, but also between their opposed ends and into an inwardly convergent space at each side of two aligned heads, due to the inward convergence of the narrowed end portions of the heads. As shown in Figs. 15 and 16, that area of ballast which is indicated by B, in effective cooperation with the remainder of the ballast, forms a tie and track anchorage which tends enormously to prevent endwise slippage of the ties and lateral track movement under accident conditions. The area B of the tamped ballast comprises ballast between the two opposed ends of the tie heads and about the coupling rods; and at each side thereof ballast between the shoulders 14 along the walls 14. This area of ballast at each side of and between the tie heads engages with the usual ballast B' across the road bed between the ties. The width-wise reduced dimensions of the inner end portions of the aligned ties form a substantial distance and the ballast effect a new kind of railway track bed and is a safety factor of highest importance in track maintenance. Moreover, it results in a saving of much of the ballast now required, as shown, at opposite ends of ties. The ballast areas B and B' also assist in prevention of axial tie rocking movements.

It is recognized that tie and rail holding requirements not only vary in tangents, curves and switching tracks and while for tangents; that is, straight tracks, and perhaps for other than tangent tracks, a feature of the invention lies in the omission of rail chairs of the old type mentioned, I nevertheless show a flat topped rail seat forming cross-plate in Figs. 17 and 18. But I immediately describe the preferred form or condition of the invention wherein neither such a rail seat forming cross plate nor a chair of the old type is required, and the cost of construction and upkeep of a railway track is consequently very greatly diminished.

Outwardly of the mid-length of each tie head, about midway of that portion of the head which is outwards of the shoulders and walls of the reduced inner end portion, I anchor in the head a pair of spaced apart, vertical, interiorly threaded socket blocks having sockets wherein the threads are indicated by 15. Each block has a polygonal head 16; its body portion is shown polygonal and is cross-sectionally reduced for reduction of weight; and it has a butt-end polygonal head 17. Thus each of these upstanding socket blocks which are aligned with their axes in the axial plane of the head is anchored in the head against axial, endwise, and tipping movements. The polygonal heads 16 are shown square and the inward, opposed, spaced part margins 16' of the heads project towards each other sufficiently to bring these margins into rail base supporting positions. The square heads are properly dimensioned for this purpose. Each outward margin 16' of the head is made broad enough to become a clamp heel bearing, as described below.

A very important feature and object of the invention lies in a downward inclination of the opposed corner portions of the tie, immediately under the rail base; and in that form of my invention in which no supporting cross plate is used, Figs. 1; 2; 4; 5; 10 and 11, the opposed corners of each head are severally armored in the line of the rail by identical opposed, metal armor blocks 17, the corners of which adjacent the under side of the rail base R are inclined down-
wardly at 18. These corner armors, sever-
ally, in the form shown, comprise an ap-
proximately cross-sectionally square body
portion having a plurality of spaced apart,
flanged lugs 19 which are aligned and project
diagonally downwards and inwardly into
the concrete head. The diagonal direction of
the extension of each lug is away from an
upper curved or inclined corner 18. A
front wall of the body portion of the block
is flush with a vertical side wall of the head.
The flanged lugs are anchored in the con-
crete. The upper horizontal armor surface
20 of each block is flush with the upper sur-
face of a head and forms a rail base bear-
ing surface. These bearing surfaces 20 on a
side of the head are opposed and aligned
one being at one side portion and the other
at the other side portion of the vertical,
axial plane of the head. The rail base when
in place rests in part on the metal margins
16 of the upstanding clamp holding sock-
et, and in part on the opposed surfaces 20
of the armor blocks. By this construction
no railway supporting, trenched chair of
the old type is required and a very great
expense of metal per mile of track is ob-
viated. But a rail base seat is thus formed
on a tie head, and for such rail seat, metal
side walls are provided as described below,
for engagement with opposite edges of the
rail base flanges.

The purpose of beveling or inclining the
corners of the tie heads at 18 where such
corners are opposed to the base of the rail,
is due to the fact that track rails are tem-
porarily bowed down, between adjacent ties,
by the load and strains of locomotives and
cars, the downwardly bowed rails springing
upwardly when free of load. Every rail is
subjected to an upwardly and downwardly
flexing movement between the ties and
though this movement is slight, it is a rec-
ognized condition. The rails when thus
bowed down as also when level, tend to
travel in the direction of the travelling lo-
comotive or train and the downward bowing
and simultaneous endwise travelling move-
ments have a positive destructively disinte-
grating action of the opposed corners of con-
crete ties. In accordance with this inven-
tion, I downwardly incline each upper cor-
ner portion of the rail base supporting metal
member in whatever form it may be; in or-
der to relieve such corner portions from di-
rect disruptive strain incident to the simu-
taneous downward strain and endwise thrust
of the rails and to obviate repeated shocks
on the tie heads. By such practical elimi-
nation of the end thrust of bowed rails on
the tie seat corners, the axial rocking ten-
cencies of the tie heads, due to the end
thrust, is greatly reduced.

By my invention, the tie heads are prefer-
crably wider at their outer end portions,
where their exterior sides are parallel, than
they are high, and their bottom and top sur-
faces are also parallel. The rails are pre-
ferably firmly clamped at the mid-length
portion of each tie head outwardly of its
reduced inward end, and midway between
the tie sides. The means for clamping a
rail base to the tie are preferably trans-
versely aligned and located midway between
the upright sides of the head. This affords
a maximum area from each upper, long cor-
ner of a head horizontally outwards in
which each tie head may absorb the shock
of a downwardly deflected rail, ahead of an
engine wheel or car wheel, and thereby
greatly reduces or approximately eliminates,
the present side-wise or axially rocking
movement of each cross tie on its varying
tamped ballast support. The undisturbed
bearing of every cross tie on its carefully
tamped supporting material is one of the
most important problems now awaiting so-
lution in existing track maintenance meth-
ods. The ballast or supporting material
after tamping is, of course, subject to varia-
tions in consequence of shocks, wear and
tear, washing away by rains, etc., but said
preferred, cross-sectionally reduced shape of
the tie heads greatly helps in maintenance
of the tamped bearing, the intermediate
tamped material at B resisting inward
movement of the material at 9--9.

The rail base flanges, in the rail assem-
blage with the ties, bear on the opposed
margins 16 of the clamp holding socket
blocks, the anchor block surfaces 20 and
the concrete exposed between these metal
members.

The rails are detachably secured on the
flat seats thus formed by vertical clamp
bolts 21 and anti-creeping rail clamps. The
bolt shanks each have a sliding fit in a hole
22 through the outer end portion of each
anti-creeping rail clamp 23, the inward end
24 of which is upwardly inclined and heav-
ily toothed at 25 on its under surface. The
teeth are preferably of pyramidal, trans-
verse, cross section. When the clamp is
in working position, the teeth are heavily
engaged with the upper surface of a rail
base flange R. The inward toothed end 21
rises from a transverse, vertical, under
shoulder 26 of the clamp, inwardly of its
bolt hole. This shoulder 26 is engageable
with an outer edge of the rail base flange
120 when the bolt is home. The clamp shoul-
ders 28 constitute opposed side walls of the
rail seat above mentioned.

The rail base clamps are so dimensioned
that before an effective clamping pressure
125 can be put on a clamp by the screwing in of
the bolt, the points of the teeth 25 will rest
on the upper surface of the rail base flange
while its outward heel corner 27 (Fig. 10)
will be supported on an outward margin 16.130
of a clamp socket block 16, forming a triangular space 28 between the under side of the clamp outwardly of its shoulder and the edge of the rail base flange. Sufficient play is given to the bolt shanks in the clamp holes 22 to permit a clamp bolt to be initially turned into the threaded socket; whereupon, with the parts in such initial position, the threaded clamp bolt is turned home hard and powerfully to clamp the clamp teeth 25 on the rail base flange, actually springing the clamp downwardly between its ends. The two opposed clamps for the rail base flanges may be homed so as to impinge toothedly and with great force on the rail base flanges and to minimize if not wholly prevent rail creeping; and thereby to solve one of the important, heretofore unsolved problems of railway track maintenance.

In Fig. 12, the upper surface of the clamp is shown straight from end to end; and the triangular space 28 is slightly larger than it is shown in Fig. 10 where the clamp has been finally sprung downwardly by the homing of the bolt and the upper surface of the clamp is shown slightly deformed.

By using clamps of different lengths from head to shoulder, the tie heads with their bolt receiving socket blocks, anchored at a suitable uniform distance apart, may be used for rail bases of different widths.

In some cases it may be preferred to use a rail seat member extending wholly across the head; and in Figs. 17 and 18, I show, as an alternative form of one feature of the invention, a flat topped rail base seat formed of a metal plate 29 which has at each under side corner portion, a lengthwise extending flange 30 that projects horizontally outward and from which an edge 31 of the body of the plate extends upwardly. The upward rail bearing surface of the plate is flat. Between its ends, the plate has transversely ained, internally threaded clamp bolt receiving sockets 32. The outward margin of each socket 32 is sufficiently wide to afford a bearing 10° for the heel of a clamp, as in the first described form of the invention.

In Fig. 18 the plate 29 is shown embedded in the concrete which engages the upper surfaces of its flanges 30 and anchors the plate against upward displacement. The plate is anchored in lateral directions by engagement of the concrete with the edges 31; and is also anchored against endwise movement as well as side movement by upward projection of the concrete into a quadrangular recess 33 in the under side of the plate. The plate is thus anchored in place across the width of the head and has its upper continuously flat surface flush with the upper surface of the head. Its upper, end corner portions are sloped downwardly at 34 to prevent end-thrust of the rails against such corner portions when the rails are bowed downwardly and creep endwise, as above explained.

Concrete under the metal members on one side, or between metal members on opposite sides, of the tie heads, as the case may be, serves to prevent track currents from grounding. In the figures showing the reversible tie heads it will be noted that there is an insulating portion of the concrete at both sides of the line -- (Fig. 2) and that this body of concrete separates and insulates, one from another, the tie rod socket blocks and all the other metal members incorporated in each side portion of a tie head.

The vertical clamp holding socket blocks and the armor blocks at each side of a tie head are spaced apart from the lengthwise extending, reinforcement rods 2 and from one another.

The tie heads above described are preferably reversible but the metallic members in one of the two opposite side portions of each head may be omitted if desired. Due to their reversibility, the tie heads may be used either side up. This duplicated or reversible construction requires the coupling rod socket blocks to be spaced at equal distances from the tops and bottoms of each tie head, as illustrated, in order that either tie head or any tie head may be used either side up in a transversely coupled pair, the upper surfaces whereof are aligned.

It is practically necessary for the preservation of the threads in the under, vertical socket blocks, when the heads are installed on a road bed, to fill the sockets with some easily removable material, such as tar, for the prevention of rust and overspout of the socket threads and such a filling in the under, vertical socket blocks is indicated by F.

In Fig. 17, the vertical rail clamp bolt sockets are in effect transversely connected by the metal forming the plate seat and the clamp heel margins are indicated by 16° as in Fig. 1, while the inward margins 16° of these sockets extend one into the other width-wise of the plate.

The threads at each end of each coupling rod are of a length to leave them partially exposed, as at B, when the couplings are fully homed. Consequently, if a transverse breaking strain in the vertical direction is brought on either of the couplings by an endwise, tipping movement of the head, the break will in all probability occur in an exposed portion of the thread with little danger of breaking a head. The coupling rods are stiff and of a cross section intended to resist bending and breaking strains between the opposed ends of the heads, at the middle portion of the track. In this respect, the coupling rod or rods correspond to the mid-length portion of a wood tie. Another
point is that while one or more of these one piece, stiff coupling rods are quickly usable for adjusting rails to gauge in laying a track prior to ballasting, they are equally useful in pulling the heads one towards another in ballast, which may be loosened, if necessary, adjacent the ties, to facilitate endwise movement of the heads, when the rail gauge has to be narrowed because of the wearing away of the inward sides of the rail track heads. The horizontal, anchored socket blocks 7 have rigid walls whereby vertical strains on the bend resisting, coupling rods cannot effect a disintegrating action on the concrete surrounding the blocks; the coupling connections being made by metal thread against metal thread. The threads on the coupling rods do not project diametrically beyond the body of the coupling rod so that the threaded ends of a coupling rod are cross-sectionally weaker than the intermediate body portion.

It is noted that when any one of these cross ties is subjected to the loads and strains of use, all the parts are then in cooperative relations; and that my invention is intended so to resist all the loads and strains of use that its integrity will be maintained during its life except in the case of disruptive accidents; and that in case of such accidents, there will be minimum danger of destroying the tie heads.

It will be observed that in Figures 1; 2; 15 and 16 the inward ends of the tie-heads are narrowed laterally and are not narrowed in the vertical direction. Each tie-head is of uniform height throughout its length in the form shown and this uniformity or approximate uniformity of height is necessary to give adequate strength to the laterally narrowed, inward ends of the tie-heads for resistance to vertical strains exerted thereon. Some of the reinforcement rods 2, indicated by the dotted lines in Fig. 1, extend inwardly in the lengthwise direction into the laterally narrowed, inward ends of the heads so that these narrowed, inward ends are reinforced both vertically and laterally. But the reinforcement, though generally necessary in solid concrete structures like those herein described, is particularly necessary for giving suitable strength to the laterally narrowed ends of the heads in the vertical direction. In fact, the horizontal sockets 7 also in some measure act as reinforcements for the inward ends of the heads, but the main reinforcement is from the reinforcement rods 2, the intermediate pair of which, illustrated, extend from near the outer end to near the inner end of each head.

What I claim is:
1. A cross tie comprising a pair of concrete tie heads and a rigid metallic coupling therefor; each tie head having a rail seat portion comprising therein anchored and spaced apart metallic, rail clamp holding members held against axial endwise and tipping movements and severally formed with a threaded socket outwardly of and adjacent which the member has a clamp head bearing and inwardly of and adjacent which the member has a rail base bearing; and for the said seat, an opposed upper front corner, metallic armor formed at each end of the seat with a downwardly extending clearance for a downwardly bowed and endwise thrusting opposed portion of a rail base.

2. A cross tie comprising a pair of concrete tie heads and a rigid metallic coupling therefor; each tie head having a rail seat portion comprising therein anchored and spaced apart metallic, rail clamp holding members held against axial, endwise and tipping movements and severally formed with a threaded socket outwardly of and adjacent which the member has a clamp head bearing and inwardly of and adjacent which the member has a rail base bearing; and for said seat, an opposed upper front corner, metallic armor formed at each end of the seat with a downwardly extending clearance for a downwardly bowed and endwise thrusting, opposed portion of a rail base; and, for completion of the rail seat, bodily springable rail base flange clamps severally having a bolt hole in its outer end portion; inwardly thereof, on its under side, an upsetting shoulder for engagement with an edge of a rail base flange, and inwardly of the shoulder, an upwardly and inwardly extending end toothed on its under side; in combination with a rail having opposite base flanges; and a bolt through each clamp into a socket, the clamps being severally dimensioned initially to rest with its heel on a socket member and with its toothed surface on a rail flange, with a clear space under the outer end portion of the clamp; and to be bodily sprung downwards when the bolt is honed for gripping the flange against endwise creeping movement.

3. A concrete cross tie comprising a pair of elongated and aligned concrete tie heads and a short length metallic coupling between their inner ends; the coupling comprising in each head a horizontal, threaded socket block therein anchored against axial, lengthwise and tipping movements, together with a short length, one piece coupling rod reversely threaded at its end portions; each tie head comprising an inward portion substantially narrower in the widthwise direction than its outward portion, the inner ends of the tie heads being opposed one to another and spaced apart for the purpose stated; and each inward portion comprising lengthwise extending reinforcement.

4. A cross tie comprising a pair of aligned and elongated concrete tie heads the inner
portions of which are widthwise reduced for a substantial length on both sides; and a short length coupling; the reduction of the aligned, opposed end portions forming a recessant space along the length of each side of each tie in a series of ties, for the reception of tampered ballast between the heads and between the ties, and which ballast, in association with the ties, is effective to restrain endwise slipping movements of the ties and also sidewise and lengthwise movement of the track.

5. A cross tie comprising a pair of elongated and aligned concrete tie heads; in the inner end of each tie head, a plurality of interiorly threaded socket blocks anchored against endwise, axial and tipping movements and located one above the other; and for each transversely opposed pair of socket blocks, a stiff, one piece coupling rod reversely threaded at its ends; the plurality of coupling rods forming compression and tension truss members.

6. A cross tie comprising a pair of elongated and aligned concrete heads and a short length, stiff coupling; each head having a portion at the mid-length part of which the head is provided with rail seat forming members and also having an inwardly extending widthwise, reduced portion; the ends of the two width-wise reduced portions being spaced shortly apart to form a short length working space wherein to manipulate the coupling.

7. A cross tie comprising a pair of elongated and aligned concrete heads and a short length, stiff coupling; each head having a portion at the mid-length part of which the head is provided with rail seat forming members and also having an inwardly extending width-wise reduced portion, the ends of the two widthwise reduced portions being spaced shortly apart to form a short length working space wherein to manipulate the coupling; and the rail seat forming portion of each head having parallel sides and parallel top and bottom surfaces and being of a width greater than its height.

8. A cross tie comprising a pair of elongated and aligned concrete heads and a short length, stiff coupling; each head having a portion at the mid-length part of which the head is provided with rail seat forming members and also having an inwardly extending width-wise reduced portion, the ends of the two widthwise reduced portions being spaced shortly apart to form a short length working space wherein to manipulate the coupling; and the rail seat forming portion of each head having parallel sides and parallel top and bottom surfaces and being of a width greater than its height; and the rail seat forming members being located mid-way between the upstanding sides.

9. A concrete cross tie seat comprising a pair of upstanding, spaced apart socket blocks severally shaped for anchorage in the concrete against axial, endwise and tipping movements and severally provided with an interiorly threaded clamp bolt receiving socket; the upper ends of the blocks being approximately flush with the upper surface of the concrete and the upper end of each socket block extending inwardly to form opposed rail base bearings and extending outwardly to form a clamp heel bearing; the seat also comprising in its inner end portion a horizontal coupling rod receiving socket block shaped for anchorage in the concrete against axial, endwise and tipping movements, and provided each with an interiorly threaded socket; and the head also comprising at each of its upper side corner portions a fixedly anchored metal armor having a downwardly sloping corner for the purposes stated.

10. A concrete cross tie seat comprising a pair of upstanding, spaced apart socket blocks severally shaped for anchorage in the concrete against axial, endwise and tipping movements and severally provided with an interiorly threaded clamp bolt receiving socket; the upper ends of the blocks being approximately flush with the upper surface of the concrete and the upper end of each socket block extending inwardly to form opposed rail base bearings and extending outwardly severally to form a clamp heel bearing; the seat also comprising in its inner end portion a horizontal coupling rod receiving socket block shaped for anchorage in the concrete against axial, endwise and tipping movements and provided each with an interiorly threaded socket; and the seat also comprising at each of its upper side corner portions a fixedly anchored metal armor having a downwardly sloping corner for the purposes stated; each armor having a horizontal portion extending inwardly of the upper surface of the seat and approximately flush therewith to form rail base bearing surfaces.

11. A concrete cross tie structure comprising therein oppositely anchored corner armor blocks and therebetween, spaced apart in the direction of the length of the structure upstanding socket blocks, each corner armor block having an upper, outward inclined corner for the purpose stated.

12. A concrete cross tie structure comprising therein oppositely anchored corner armor blocks; each having an upper outward inclined corner for the purpose stated.

13. A concrete cross tie structure comprising a pair of corner anchor blocks having angularly projecting back legs anchored in the body-forming concrete and a horizontal, integral rail seat member.

14. A tie comprising a pair of transverse-
ly detachably coupled concrete heads having on each of its two sides, rail clamping mechanism comprising metallic members anchored in the concrete; metal rail-seat armor having inclined corner portions opposable to a rail base and anchored in the concrete; and a plurality of spaced apart coupling socket blocks anchored in the concrete; the rail clamping mechanism and armor at one side of the head being spaced apart from the corresponding parts at another side of the head by an intermediate portion of the concrete.

15. A tie comprising a pair of transverse ly detachably coupled concrete heads having on each of its two sides, rail clamping mechanism comprising metallic members anchored in the concrete; metal rail-seat armor having inclined corner portions opposable to a rail base and anchored in the concrete; and a plurality of spaced apart coupling socket blocks anchored in the concrete; the rail clamping mechanism and armor at one side of the head being spaced apart from the corresponding parts at another side of the head by an intermediate portion of the concrete; the heads also comprising reinforcement members out of contact with therein anchored metallic members subject to vertical thrust strains.

16. A concrete tie head comprising therein anchored interiorly threaded rail clamp bolt receiving sockets open in a plurality of sides of the head; the sockets being packed with a removable anti-rust material; each corner portion of said head being provided with a fixed corner armor block having an upper, outward inclined corner for the purpose stated; and the sockets and corner armor blocks for one side of the head being spaced apart from the sockets and corner armor blocks for the other side of the head by an intervening portion of the concrete.

17. A concrete cross tie having a lengthwise channeled rail seat comprising a flat metallic rail base seat approximately flush with the side and anchored in the concrete and having integral horizontal walls and vertical walls for rendering the bearing immovable in the concrete; the bearing being provided with interiorly threaded, clamp receiving sockets spaced apart in the direction of the length of the tie and located in opposite upper margins of the bearing inwardly of an outward edge of the bearing; in combination with a bodily springable rail base flange clamp at each socket, such clamps severally having a front end portion engageable with the upper surface of a rail base flange and shouldered to engage an upward standing side wall of the rail seat; and being dimensioned to rest in assemblage with a rail, on a rail base flange, and, at its heel, to rest on an outward margin of a socket with a triangular clearance beneath its body portion; and a clamp bolt entered in the socket and, when homed operative to spring the clamp bodily into rail clamping position.

18. The combination in a railway tie of a pair of endwise spaced apart tie heads severally comprising means for holding a track rail in place on the head; a track rail held in place by said means on each head; a threaded horizontal socket fixed in the inward end portion of each head and exposed at its mouth; and a one piece, stiff coupling having its ends formed with reverse threads; the socket threads so turning that by rotating the coupling rod axially, the heads are pulled one towards another when the rod is rotated in one direction and that the heads are spaced further apart when the rod is rotated in a reverse direction; and the stiff coupling serving to resist dipping movements of the heads.

19. The combination in a railway tie of a pair of endwise spaced apart tie heads severally comprising means for holding a track rail in place on the head; a track rail held in place by said means on each head; a threaded horizontal socket fixed in the inward end portion of each head and exposed at its mouth; and a one piece, stiff coupling having its ends formed with reverse threads; the socket threads so turning that by rotating the coupling rod axially the heads are pulled one towards another when the rod is rotated in one direction and that the heads are spaced further apart when the rod is rotated in a reverse direction; and the stiff coupling serving to resist dipping movements of the heads; and the heads at each end of the coupling rod inwardly of an end of the head being exposed for subjection to transverse strain in a vertical direction.

20. In railway track construction, a series of parallel cross ties each comprising a pair of endwise, spaced apart, solid concrete, lengthwise reinforced coupled heads severally provided with rail clamping devices severally provided with spaced apart, uprightly anchored, rigidly anchored sockets; the opposite long sides of the tie having reentrant portions for the reception between the heads of ballast entrant into the reentrant portions of the tie, for prevention of endwise movements and track slippage; and the opposed top and bottom sides of said heads being parallel and the heads being severally of approximately equal height throughout their length; and each head having fixedly anchored in its inner end portion a horizontal coupling member; all in combination with a stiff, short length, detachable coupling member.

21. In railway track construction, a series of parallel cross ties each comprising a pair of endwise, spaced apart coupled heads severally provided with rail clamping devices;
the opposed long sides of the ties having reentrant portions for the reception between the ties of ballast entrant into the reentrant portions of the ties, for prevention of endwise movements and track slippage; the heads also severally comprising metallic rail seat members one at one upper corner portion and the other at the opposite upper corner portion of the rail seat; the upper corner portion of each member being inclined downwardly.

22. In railway track construction, a series of parallel cross ties each comprising a pair of endwise, spaced apart coupled heads severally provided with rail clamping devices; the opposed long sides of the ties having reentrant portions for the reception between the ties of ballast entrant into the reentrant portions of the ties, for prevention of endwise movements and track slippage; the heads also severally comprising metallic rail seat members one at one upper corner portion and the other at the opposite upper corner portion of the rail seat; the upper corner portion of each member being inclined downwardly; each set of rail clamping devices comprising a bodily springable toothed rail base flange engaging ramp.

23. A railway cross tie comprising endwise, spaced apart and alined concrete heads, each head having therein embedded a horizontal, metallic, interiorly threaded, socket block exteriorly formed for anchorage in the concrete against axial, endwise and tipping movements and having the margin of its mouth exposed and approximately flush with the otherwise continuously flat, inner end wall of the head; for connecting the heads, a metallic coupling rod having a reversely turned, non-projecting thread at each end, each threaded end being in connection with the thread of one of said socket blocks, whereby both heads can be given simultaneous movement in a direction depending on the direction in which the rod is turned; the sockets being alined in assemblage and the coupling rod tying the heads together and also bracing them apart and being dimensioned normally to prevent vertical bending movements at the mid-length portion of the cross tie, and the socket blocks having rigid walls which prevent vertical strains on the coupling rod from effecting at its threaded ends a disintegrating action on the concrete enclosing the socket blocks.

24. In a railway cross tie comprising separable members, the combination with a pair of alined tie heads each having a therein rigidly fixed, threaded, metallic socket accessible exposed in the inward end wall of the head of a stiff coupling rod having reversely turned threads at each end, each thread being for connection with one of said sockets, whereby both heads can be given simultaneous movement in a direction depending on the direction in which the rod is turned; the coupling rod tying the heads together and also bracing them apart and forming a stiff connection exposed and accessible between the opposed ends of the heads; and each threaded end portion of the coupling rod having a thread exposed outwardly of the adjacent end wall of the head after the coupling rod and sockets have been fully homed.


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