Sept. 5, 1944. W. S. BOYCE ET AL 2,357,499

RAIL FASTENING

Filed May 4, 1942

Fig. 1.

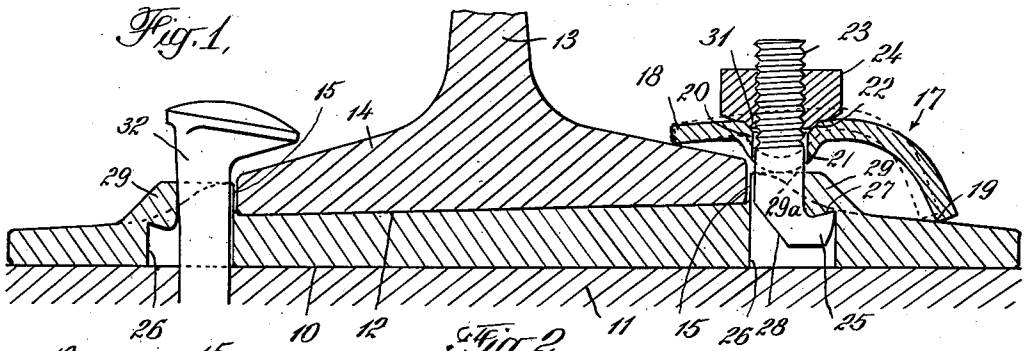


Fig. 2.

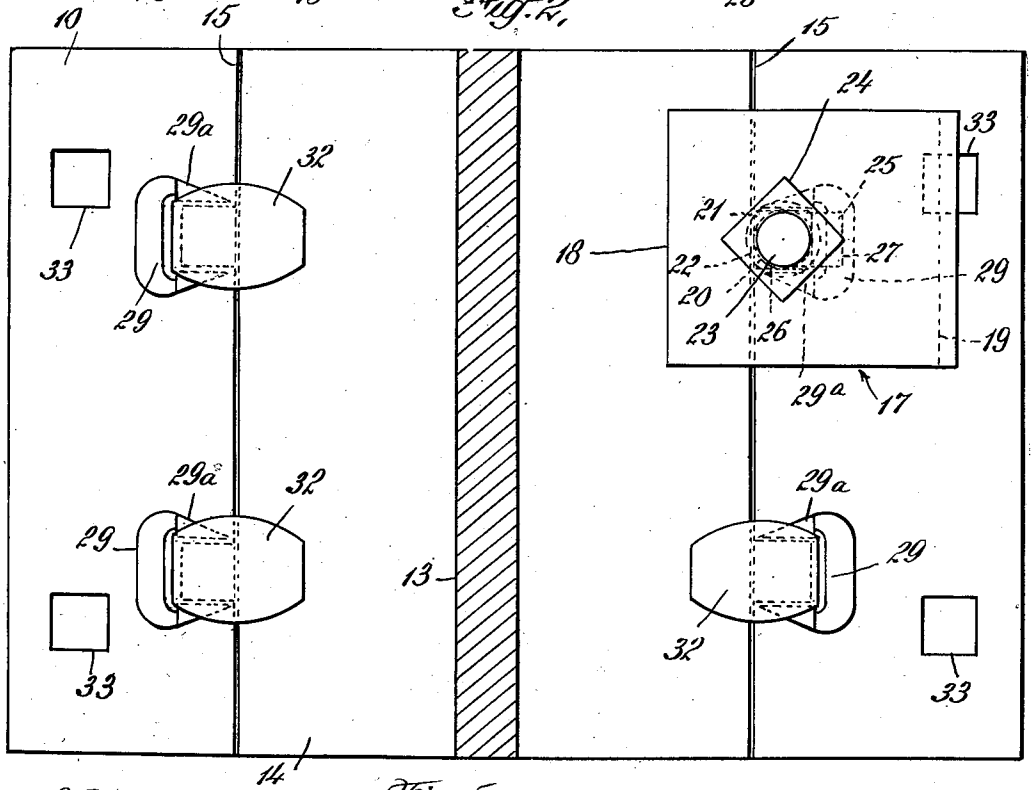


Fig. 4.

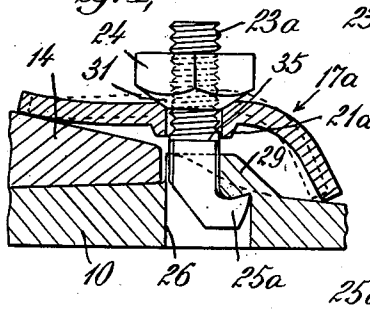


Fig. 5.

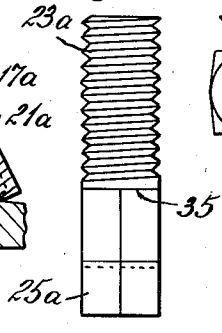


Fig. 6.

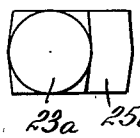
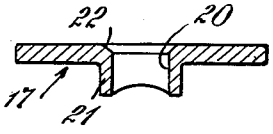


Fig. 3.



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RAIL FASTENING

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Application May 4, 1942, Serial No. 441,642

15 Claims. (Cl. 238—349)

This invention relates to rail fastenings of the type including adjustable means for urging a spring lock against the rail base to hold the rail yieldingly on its seat, and has particular reference to a novel fastening of this type wherein the stress to which the spring lock is subjected by the adjustable means is limited to an amount determined by a stress control element which may be integral with the lock and formed so as to provide increased strength in the area of maximum stress of the lock to insure a greater factor of safety in the operation of the fastening. The new fastening locks the rail and its tie plate together yieldingly and provides a hold-down force of a magnitude comparable to the lifting force against the spring lock, in order to minimize the abrasive movement of the plate on the tie. Also, the fastening is of a simple and durable construction, may be easily installed, is readily adaptable to conventional double shoulder tie plates in use, and effectively resists accidental loosening due to vibration or other causes.

Rail fastenings have been devised heretofore in which the rail is held against its seat by a locking member clamped against the rail base by a nut and bolt secured to the tie plate, the bolt having a plate-gripping head extending below the plate bottom. This downwardly projecting head requires pre-indenting of the tie to permit insertion of the bolt and proper seating of the plate. The nut is tightened against the lock to cause it to exert a downward pressure on the rail base, the amount which the nut is tightened being determined generally by its resistance to tightening which, in the prior fastenings, increases relatively gradually and uniformly because it is affected only by the increasing reactive force of the lock itself throughout the range of adjustment. With this construction, the installation or maintenance worker must rely on his own judgment to determine when the nut has been tightened sufficiently to provide the desired pressure on the rail, and, accordingly, the pressure exerted by the locks is not uniform and frequently exceeds or falls short of the desired pressure by a substantial amount. Moreover, it happens not infrequently that the worker tightens the nut too much and thereby subjects the locking member to stresses exceeding its elastic limit so that breakage or failure of the lock occurs. Also, in punching the lock to provide an opening for entry of the bolt or a bolt backing means, or both, the metal around the opening is frequently ruptured and incipient cracks develop which, under excessive and unrestricted tension of the bolt, result in complete fracture of the lock.

In our copending application Ser. No. 403,138, filed July 19, 1941, of which this application is a continuation-in-part, we have disclosed a rail fastening of the spring lock type which may be readily adjusted to provide a predetermined spring pressure on the rail by reason of its inclusion of a separate stress control member coacting with the spring lock to prevent overtightening of the nut and bolt or other adjustable means for the lock. One feature of the present invention resides in the provision of a novel fastening of this type in which it is unnecessary to employ a separate stress control member for the spring lock, the spring lock itself having an integral part for limiting its normal distortion by the adjustable means.

A rail fastening made in accordance with our invention comprises a tie plate having the rail seated on it, and a spring lock having one end seated on the tie plate outwardly of the rail and the other end engaging the rail base with a spring action. The ends of the lock are urged downwardly against the rail base and the tie-plate by a nut and bolt or other adjustable means, the threaded portion of the bolt being disposed in an opening in the tie-plate adjacent the rail and having its head underlying a portion of the plate for resisting upward movement of the bolt. The bolt extends upwardly through an opening in the lock intermediate its ends, and the nut is threaded on the bolt above the lock. Downward movement of the intermediate portion of the lock due to tightening of the nut is limited by a stress control means integral with one of the fastening elements and extending at least partly around the bolt below the lock. Preferably, the stress control means is integral with the spring lock and engages abutments adjacent the plate opening which receives the bolt, the initial space between the stress control means and abutments limiting the downward flexure of the spring and the pressure transmitted to the rail and tie plate as the nut is tightened, the maximum pressure occurring when the stress control means engages the plate abutments.

Another feature of the invention resides in the provision of a novel rail fastening of the type described in which the spring lock is provided on the lower face with a protrusion for engaging the plate abutments to limit distortion of the lock by the nut. The protrusion may take the form of a boss formed around the lock opening and having its maximum depth at the side edges of the opening, the boss thus serving to strengthen the intermediate portion of the lock where it would otherwise be weakened by the opening and also acting to space the main body of the lock above the plate abutments so that the lock may flex more readily in response to the usual wave motion of the rail. Preferably, the upper face of the lock is provided around its opening with a depression, which may be made in the formation of the boss, and the nut has on its lower face a chamfered portion adapted to fit in the

depression so as to lend stability to the lock and center it relative to the bolt when the nut is tightened. The boss or protrusion may, if desired, have a rounded portion where it engages the plate abutments whereby the lock may tilt on the protrusion as a pivot to accommodate lateral movement of the bolt due to tightening of the nut or movement of the rail, or both.

In the installation of the new fastening, the nut may be tightened varying degrees until the lock protrusion or stress control means is clamped firmly against the plate abutments, whereupon further tightening is prevented. By locating the stress control means at the sides of the bolt, the spring lock cannot yield appreciably under the action of the nut after the latter forces the lock against the plate abutments, with the result that the final degree of tightening of the nut is indicated by a sudden marked increase in its resistance to tightening. Since the stress control means positively limits the tightening of the nut or other adjustable means and therefore the pressure of the lock against the rail, there is no danger of overstressing the lock and breaking it or otherwise preventing fulfillment of its intended function. The spring pressure against the rail base, which is thus determined by the stress control means, insures uniformity of holding power of the fastenings, the cumulative force of which serves effectively to resist upward and lateral movement of the rail and longitudinal creeping thereof. Due to its distortion and reactive force, the spring lock acts to prevent accidental loosening of the nut and automatically takes up any looseness which might otherwise develop in the nut and bolt due to wear, corrosion, etc. Preferably, the tie-plate is provided with openings each formed so as to accommodate interchangeably the bolt of the fastening or a spike which is adapted to engage the tie plate in the manner of a wedge, the cumulative action of the spikes acting to develop sufficient holding power for retaining the plate in contact with the tie and resisting the lifting force against the spring incident to passing wheel loads.

These and other features of the invention may be better understood by reference to the following detailed description and the accompanying drawing, in which

Figs. 1 and 2 are longitudinal sectional and plan views, respectively, of one form of the new rail fastening;

Fig. 3 is a cross-sectional view of the spring lock;

Fig. 4 is a longitudinal sectional view of part of another form of the new fastening; and

Figs. 5 and 6 are side and plan views, respectively, of the bolt shown in Fig. 4.

The new rail fastening comprises a rail support in the form of a tie plate **10** mounted on a cross tie **11** and preferably having a canted seat **12** for the rail **13**. The base **14** of the rail is held in its operative position on the plate by rail abutting shoulders **15** extending transversely of the plate along the margins of the rail seat.

The rail is held yieldingly on its seat by a spring lock **17** which, as shown, comprises a strip of relatively heavy spring metal having one end **18** engaging the top of the rail base, the opposite end being bent downwardly and engaging the top of the tie plate a substantial distance outwardly from the rail seat, as shown at **19**. Intermediate its ends, the spring lock is provided with an opening **20** and a boss **21** projecting from the lower face of the lock around the opening, the upper face of the lock being formed with a depression **22** around the opening.

The spring lock is clamped down against the tie plate and the rail base by an adjustable means which preferably comprises a bolt **23** and a nut **24** threaded on the upper end of the bolt. The bolt extends through the opening **20** in the lock and has at its lower end or head a laterally extending hooked projection **25** underlying a part of the tie plate so as to secure the bolt against upward movement relative to the plate. As shown, the bolt is disposed in an opening **26** in the tie plate, and the lateral projection **25** is located above the bottom surface of the plate and extends outwardly under a shoulder **27** formed by under-cutting the opening **26**. The shoulder **27** is arched upwardly and outwardly from the main portion of the opening **26** and is engaged by a similarly arched surface of the bolt projection **25**, so that lateral movement of the lower portion of the bolt is prevented although the bolt may pivot toward and away from the rail, as will be described hereinafter in greater detail. At its lower end portion, the side of the bolt remote from the lateral projection **25** is beveled, as shown at **28**, for a purpose to be described.

Above the shoulder **27**, the tie plate is provided with a raised abutment **29** extending transversely of the plate along the outer edge of the opening **26**, the abutment serving to brace the bolt. The top surface of the plate is also provided with longitudinal abutments **29a** extending along the opposite sides of the plate opening to the adjacent shoulder **15** so as to form in effect lateral continuations of the shoulder **15** for reinforcing the transverse abutment **29** and affording additional lateral support for the bolt.

The boss **21** on the lower face of the spring lock provides a stress control means in the form of a downwardly extending rounded protrusion underlying the body of the lock **17**. Preferably, the bolt is made of round stock and has its head upset to form the lateral projection **25**, its upper portion being threaded to accommodate the nut **24**.

In assembling the new fastening, the rail is mounted on the tie plate, and the bolt **23** is inserted in the plate opening **26** so that the lateral projection **25** extends into the under-cut part of the opening. The beveled portion **28** allows the bolt to be inserted readily in the opening by initially tilting it outwardly from the rail, hooking the projection **25** under the shoulder **27** and straightening the bolt to its vertical position, as shown. The spring lock **17** is then placed in position with the threaded portion of the bolt extending through the lock opening **20**, and the nut **24** is screwed on the bolt to clamp the lock down against the rail base and the tie plate. Before the nut is tightened, the spring lock assumes its normal unstressed position shown in dotted lines in Fig. 1, but as the nut is tightened the part of the lock directly beneath the nut is forced downwardly, and, due to the shape of the lock and its relation to the tie plate and rail base, this downward force causes it to move inwardly toward the rail on its outer end **19** as a pivot. The pivotal engagement of the bolt projection **25** with the overhanging shoulder **27** of the tie plate permits the bolt to tilt slightly and adjust itself so as to accommodate this longitudinal movement of the lock.

The nut **24** is preferably provided at its lower end with a chamfered portion **31** forming a cam surface which fits into the depression **22** in the

upper face of the lock. Accordingly, as the nut is tightened, its chamfered portion exerts a cam action on the spring lock around the opening and acts to center the lock relative to the bolt. This centering of the lock is a desirable feature of the new fastening because, when the lock is in its final position, it insures accurate and uniform engagement of the lower end of boss **21** with the spaced shoulder abutments **29***a* at the sides of the bolt. Also, the centering of the lock insures a uniform spacing of the sides of the lock opening from the adjacent sides of the bolt, whereby the intermediate portion of the lock may flex more readily and with less interference from the bolt when vibration or wave motion of the rail occurs. Additionally, since only a small area of the nut engages the lock at the cam surface **31**, the nut does not interfere appreciably with the flexing of the lock.

The resistance of the nut **24** to tightening increases initially at a relatively gradual and uniform rate due to the increased resistance of the spring lock to distortion as it moves away from its normal position. However, the resistance of the nut to tightening increases suddenly to a very high value when the protrusion **21** on the spring lock is forced down against the top of abutments **29***a*, thus preventing further tightening of the nut. Accordingly, when this point in the tightening operation is reached, the worker is informed by the sudden and inordinate increase in the resistance of the nut to turning that the lock has been distorted sufficiently to provide the desired pressure on the top of the rail base, the lock then assuming the position shown in full lines in Fig. 1.

By properly forming the spring lock **17** and positioning the stress control element **21** on the lock, it is possible to control accurately the distance through which the lock is forced before it contacts the plate abutments **29***a* and, therefore, its ultimate pressure on the rail base. It will be understood that a plurality of spring locks **17** may be spaced along the rail, and by making the boss **21** of uniform depth the pressure of the locks on the rail will be uniform. Each lock in its final position is caused to exert on the rail base a downward pressure of the desired magnitude determined by the stress control means **21**, so that upward or lateral movement of the rail is resisted yieldingly and longitudinal movement or vibration of the rail is effectively reduced or prevented. Since the boss **21** on the lock is rounded at the bottom where it engages the raised abutments **29***a*, the lock may tilt or rock transversely of the rail on the boss **21** as a pivot, in unison with the tilting action of the bolt, and thereby adjust itself. Because of the stress control means **21**, **29***a*, the stress applied to the lock by the nut is determined independently of the bolt.

Due to the distortion of the lock by the nut in its final position, the lock exerts on the nut an upwardly directed reactive force which maintains the nut under considerable stress and thereby resists loosening thereof. The reactive force of the lock also has a horizontal component directed outwardly from the rail due to the tendency of the distorted lock to return to its normal position on its outer end **19** as a pivot. Accordingly, the resultant reactive force of the lock acts not only to urge the nut and bolt upwardly but also to tilt the bolt outwardly in the plate opening. The upper part of the bolt, therefore, is urged outwardly against the shoulder abutment **29** on the tie plate, and the lower part of the bolt is urged inwardly so that the arched portion of its lateral projection **25** is forced against and held by the correspondingly arched surface of the shoulder **27** in the plate opening. The eccentric reactive force on the nut and bolt thus maintains the parts in tightly wedged relation and automatically takes up any looseness which might otherwise develop between the parts due to wear, corrosion, etc.

It will be apparent that with the new fastening it is impossible to tighten the nut **24** to the point where the elastic limit of the spring lock is exceeded, because the stress control element **21** provides a positive limit to the distortion of the lock by the nut.

The plate opening **26**, as shown, is rectangular at the lower portion of the plate to accommodate the bolt head **25**, while at the upper portion of the plate it is square so that it may receive either the shank of the bolt **23** or the shank of a spike **32**. Thus, the spring lock and the spike are interchangeable, as conditions may require. Preferably, the sides of the spike **32** are tapered downwardly to the normal cross section of the shank so that they provide in effect a wedge action against the abutments **29***a* which precludes the full driving of the spike, whereby the spike head is held in the desired spaced relation to the rail base, as shown at the left in Fig. 1. The abutments **29** and **29***a* facilitate the insertion of the bolt **23** and provide a substantially horizontal surface for engagement with the stress control boss **21**. Also, when a spike is driven through the plate opening **26** into the tie, the vertical inner surfaces of the abutments engage the tapered sides of the spike and retain the plate **10** firmly against the tie. Additionally, the abutments act as guide means impelling vertical driving of the spike, which is an important factor in securing the greatest possible holding power of the spike in the tie.

If desired, additional spikes (not shown) may be driven into the tie through openings **33** in the tie plate outwardly from the openings **26**. The accumulative holding power of the spikes is sufficient to resist the reactive force encountered by the lock **17** incident to the usual wave motion of the rail under load, whereby vertical and lateral movement of the plate relative to the tie are prevented.

The rail fastening shown in Fig. 4 is similar to that illustrated in Figs. 1 and 2, except that the spring lock and bolt are of somewhat different form. As shown, the spring lock **17***a* is provided with a stress control boss **21***a* of slightly different shape around the opening in the lock, the boss being substantially flat on the bottom instead of rounded. The bolt **23***a* has a laterally extending head or projection **25***a* disposed in an undercut portion of the plate opening **26**, and below the threaded portion it is provided with an upwardly facing shoulder **35**. Preferably, the bolt is made of round stock, and the corners below the threaded portion, which form the spaced shoulders **35**, are produced in the upsetting or heading operation used in forming the head and projection **25***a*.

The lock **17***a* is installed in the same manner as the lock **17**, but when the nut **24** is tightened it forces the boss **21***a* downwardly against the bolt shoulder **35**. Thus, the stress to which the spring lock is subjected by the nut is determined by the point at which the boss **21***a* moves into contact with shoulder **35**.

The rail fastening of our invention includes relatively few parts and is adapted for manufacture at low cost. The spring lock may be made easily by punching an opening in the strip of spring metal intermediate its ends and somewhat smaller than the final opening **20**, and then depressing the metal around the opening on the upper face of the lock so that the displaced metal is utilized in forming the boss on the lower face.

We claim:

1. In a rail-fastening assembly, the improvement comprising a tie-plate provided with a rail-seat, a rail-abutting shoulder and a plate-opening adjacent the seat, a rail on the seat, a spring-lock having an inner end and an outer end, the inner end being adapted to engage the rail-base to resist upward movement thereof, the outer end being bent downwardly to engage the tie-plate, an opening in the spring-lock intermediate its ends, a depending integral boss at the bolt-opening on the lower face of the spring-lock, said boss being of sufficient size materially to strengthen the spring-lock adjacent the bolt-opening while permitting the spring-lock to flex when a load passes over the rail, a bolt in said plate-opening and spring-lock opening secured to the tie-plate normally maintaining the inner end of the spring-lock in engagement with the rail base and the outer end of the spring-lock in engagement with the tie-plate, and means cooperating with said boss for stopping downward movement of the spring-lock when it is secured to the rail-base and tie-plate so that the elastic limit of the spring-lock cannot be exceeded by tightening the bolt.

2. In a rail-fastening assembly, the improvement comprising a tie-plate provided with a rail-seat, a rail-abutting shoulder and a plate-opening adjacent the seat, a rail on the seat, a spring-lock having an inner end and an outer end, the inner end being adapted to engage the rail-base to resist upward movement thereof, the outer end being bent downwardly to engage the tie-plate, a bolt-opening in the spring-lock intermediate its ends, a depending integral boss at the bolt-opening on the lower face of the spring-lock, said boss being of sufficient depth and thickness materially to strengthen the spring-lock adjacent the bolt-opening while permitting the spring-lock to flex when a load passes over the rail, a bolt fitting freely in the plate-opening with the lower end thereof terminating in a laterally extending hooked projection underlying a portion of the plate for resisting upward movement of the bolt, said bolt projecting upwardly through the opening in the spring-lock, a nut threaded on the bolt above the spring-lock normally maintaining the inner end of the spring-lock in engagement with the rail-base and the outer end of the spring-lock in engagement with the tie-plate, and means cooperating with said boss for stopping downward movement of the spring-lock when it is secured to the rail-base and tie-plate so that the elastic limit of the spring-lock cannot be exceeded by tightening the bolt.

3. A rail-fastening assembly according to the preceding claim, in which the lower portion of the plate-opening below the rail-seat is defined by four walls; the upper portion of the plate-opening is provided outwardly with an upwardly extending abutment to form a three-walled plate-opening above the rail-seat; the tie-plate is provided outwardly of the plate-opening with an undercut portion forming a shoulder arched outwardly and upwardly from the main portion of the plate-opening; the top of the laterally extending hooked projection of the bolt is similarly arched to permit hinged and locked engagement of the projection with the undercut portion of the tie-plate so that lateral movement of the lower portion of the bolt is prevented while the upper portion of the bolt may be moved toward and away from the rail resting on the tie-plate.

4. In a rail-fastening assembly, the improvement comprising a tie-plate provided with a rail seat, a rail-abutting shoulder and a plate-opening adjacent the seat, the tie-plate being provided with a raised abutment along the outer edge of the plate-opening, a rail on the seat, a spring-lock having an inner end and an outer end, the inner end being adapted to engage the rail base inwardly of the plate-opening to resist upward movement of the rail relative to the tie-plate, the outer end being bent downwardly to engage the top of the tie-plate a substantial distance outwardly of the plate-opening, said spring-lock having a bolt-opening intermediate its ends, a depending integral boss at the bolt-opening on the lower face of the spring-lock, said boss being of sufficient depth and thickness materially to strengthen the spring-lock adjacent the bolt-opening while permitting the spring-lock to flex when a load passes over the rail, said boss also being of predetermined depth so that it is adapted to act as a stress-control element to control accurately the distance through which the spring-lock may be forced and hence its ultimate pressure on the rail-base, a bolt fitting freely in the plate-opening with the lower end thereof terminating in a laterally extending hooked projection underlying and in hinged and hooked engagement with an undercut portion of the plate outwardly adjacent the plate-opening for resisting upward movement of the bolt and to permit movement of the upper end of the bolt toward and away from the rail, the side of the bolt removed from the laterally extending hooked projection being drawn in to permit ready insertion of the bolt in the plate-opening, said bolt projecting upardly through said opening in the spring-lock, stop-means extending at least partly around the bolt below the spring-lock for stopping downward movement of the boss to limit downward movement of the spring-lock, and a nut threaded on the bolt above the spring-lock normally maintaining the inner end of the spring-lock in engagement with the rail base and the outer end of the spring-lock in engagement with the tie-plate.

5. A rail-fastening assembly according to the preceding claim, in which the boss is integrally formed of material depressed from the bolt-opening in the spring-lock.

6. A rail-fastening assembly according to claim 4, in which the upper face of the spring-lock is formed with a depression around the bolt-opening adapted to receive a chamfered portion of the nut so that the nut lends stability to the spring-lock and to center the spring-lock relative to the bolt when the nut is tightened to insure accurate and uniform engagement of the spring-lock with the rail-base and the tie-plate.

7. A rail-fastening assembly according to claim 4, in which the boss is rounded on the bottom so that when the rounded bottom is placed in engagement with the stop-means for stopping downward movement of the boss and hence of the spring-lock, the spring-lock may rock transversely of the rail on the boss in unison

with the tilting action of the bolt in the bolt-opening and thereby adjust itself after a load has passed over the rail.

8. A rail-fastening assembly according to claim 4, in which said stop-means for the boss on the spring-lock comprises said raised abutment along the outer edge of the plate-opening in the tie-plate.

9. A rail-fastening assembly according to claim 4, in which said bolt is provided with an upwardly facing shoulder below the spring-lock, and the shoulder forms said stop-means for stopping downward movement of the boss and hence of the spring-lock.

10. A rail-fastening assembly according to claim 4, in which said boss is substantially flat on the bottom, the flat bottom of the boss being engageable with said stop-means for stopping downward movement of the boss and hence the spring-lock.

11. A rail fastening assembly according to claim 4, in which said bolt is provided with an upwardly facing shoulder below the spring-lock, the shoulder forms said stop-means for stopping downward movement of the boss and said boss is substantially flat on the bottom, the flat bottom of the boss being engageable with the stop-means.

12. For use in a rail fastening assembly, the improvement comprising a spring-lock having an inner end and an outer end, the inner end being adapted to engage a rail-base to resist upward movement thereof, the outer end being bent downwardly so as pivotally to engage a tie-plate, the spring-lock having a bolt-opening intermediate its ends, the upper face of the spring-lock being formed with a depression around the bolt opening, a boss around the bolt-opening on the lower face of the spring-lock, said boss being of predetermined depth so that it is adapted to act as a stress control element to control accurately the distance through which the spring-lock is forced and hence its ultimate pressure on the rail-base.

13. A spring-lock according to the preceding claim, in which the boss is rounded so that the spring-lock may rock transversely of the rail on the boss as a pivot in unison with the tilting action of the bolt and thereby adjust itself after a load has passed over the rail.

14. A spring-lock according to claim 12, in which said boss is substantially flat on the bottom so that the flat bottom may be placed in engagement with stop-means for stopping downward movement of the boss and hence the spring-lock.

15. A spring-lock according to claim 12, in which the thickness of the spring-lock surrounding the opening is substantially greater than the normal thickness of the spring-lock to provide through the area of maximum stress increased strength of the spring-lock around the periphery of the opening.

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