INTEGRATED LOCKING CONTROL AND STATUS INDICATOR FOR MANUALLY OPERATED RAILWAY SWITCH STAND

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ABSTRACT
The invention relates to a device to be integrated with a manual switch stand, particularly for use in dark territory. The device secures the spindle of the switch stand against rotation, thereby preventing authorized throwing of the switches. The device also contains sensors that will clearly indicate to an external observer both the position of the switch points and the locked or unlocked status of the switch stand. A particular sequence of steps must be taken before an operator will be able to unlock the switch stand and throw the switch, and further steps are required before he can secure the switch stand and remove his key. The switch stand must therefore be left in a locked state, and it continuously indicates the status of the switch stand to a remote monitor.
INTEGRATED LOCKING CONTROL AND STATUS INDICATOR FOR MANUALLY OPERATED RAILWAY SWITCH STAND

FIELD OF THE INVENTION

This invention relates to a mechanism to provide a definite indication of the position of the switch controlled by a switch stand and to secure the stand against unauthorized switching, and is particularly applicable for stands used in dark territory.

BACKGROUND OF THE INVENTION

A railroad switch includes moveable switch points (sometimes called blades) that direct the wheels onto the appropriate track. The switch points are driven from a first position, to direct the train onto one track, to a second position, to direct the train onto another track, by a power operated switch machine, or by a manually operated switch stand. The points are locked in one position until required to be switched back to the other position. Rail terminology commonly refers to the switch point position for the track most frequently used as the "normal" position, and the position for the track less frequently used as the "reverse" position.

A power operated switch machine is typically used in areas of high rail traffic or in other areas where the expense of a centrally controlled signal system can be justified. The switch machine monitors whether the switch points have been locked and, if so, in what position they are locked, and notifies the signal system of this status. The signal system uses this information to regulate approaching trains and to ensure safe operation given the status of the switch points.

At locations where the cost of a power operated switch machine is uneconomical, a manual switch stand may be used to control the operation of the switch points. The manual switch stand is operated by a railway employee standing adjacent to the track. To prevent tampering, most manual switch stands located outside of classification yards are locked with a padlock. To operate the switch stand, the employee must unlock the padlock, disengage the locking mechanism holding the switch points, and lift or rotate the hand throw lever to move the points to the new position. The locking mechanism must then be engaged and the employee must visually confirm that the points are held in the intended position before allowing a train to pass over the switch. Before leaving the switch, the employee must leave the switch points locked in a specified position, and reattach and relock the padlock. Safe operation of this type of system is ensured only if all employees are familiar with, and follow, a detailed set of rules in order to secure the switch stand.

However, a single human error can result in a manual switch stand being left unattended in an incorrect position. If the switch stand is left unlocked, vandals may tamper with the hand throw lever, leaving the switch points in an unexpected position, or in a position in which the points are not locked in either of the expected positions. Numerous train accidents have been documented as a result of employee failure to properly secure a manual switch stand. U.S. Pat. No. 5,642,870 to Sargsis describes a switch stand having a locking device to clamp a throw lever within a cradle, but no means to secure that locking device against unauthorized operation.

The simplest way to lock a manually operated switch stand is to immobilize the throw lever. A switch stand system including a padlock to secure the hand throw lever is shown in U.S. Pat. No. 6,164,601 to Schenck and McCord. U.S. Pat. No. 383,965 to Manning shows a spring-biased bolt extending into a recess in a throw lever, securing the lever until a key is inserted to retract the bolt. U.S. Pat. No. 1,092,259 to Ham shows an integral key-based lock to secure the throw lever. U.S. Pat. No. 379,708 to Manning shows a lock on the throw lever which slides to secure the lever within a guide on the switch stand. A series of patents issued to Torpay (U.S. Pat. Nos. 952,022; 949,098; 900,131; and 968,505) show a locking bolt in a casing integral with the switch stand housing, which engages notches provided in the hub of the throw lever, immobilizing the hub and lever until the bolt is raised.

A switch stand may also be secured by locking other parts of the switch stand. A system including multiple padlocks to secure various parts of the switch stand is shown in U.S. Pat. No. 7,267,304 to Scheer. Generally, padlock-based security systems rely heavily on the competence and attention of the operator, as discussed above.

In most situations, if a key is to be used to lock and unlock the switch stand, it is preferable that the locking mechanism physically retain the key in the lock until the points are confirmed to be fully locked in the normal or reverse position, and the stand is secured against further movement. This prevents a switch operator from leaving a switch open without also leaving his key behind, and also prevent a key from being lost during switch operation. Further, if a key is left behind, it may be traced to a particular operator. U.S. Pat. No. 525,678 to Dedel describes a specialized key that is retained within a lock once the lock is opened to release the throw lever, and further includes a belt worn by the operator, to which the key is attached, rendering it very difficult to leave a switch open accidentally.

In addition to properly securing the switch points controlled by a manual switch stand, it is important to monitor the position of the switch points and to clearly communicate that information to an oncoming train before it passes over the switch. If the switch point status can be visually displayed to an oncoming train, this allows the train to stop for an incorrectly positioned switch. Status display may be done through a flag-based system, such as that shown in U.S. Pat. No. 7,267,304 to Scheer, which shows a multi-colored flag-based system, wherein the colour of the flag displayed to a train operator indicates the position of the switch. U.S. Pat. No. 2,740,041 to Marcum describes a status indicator which uses appropriately colored lights to indicate the switch position. U.S. Pat. No. 5,470,035 to Sigis shows an electrical switch stand having lights to indicate switch position.

In order to monitor the position of the associated switch points, several systems have been used. U.S. Pat. No. 5,348,257 to Ocampo shows a detection system located near the stock rail, along with a heating element to prevent adverse weather conditions from affecting the efficiency of the detector. U.S. Pat. No. 2,740,041 to Marcum describes a status indicator having electrical contacts located between the rails in the switch, which respond to movements of the rod connecting the points to illuminate appropriately colored signal lights. U.S. Pat. No. 6,427,949 to Hager et al. describes a point detection system based on a linear variable differential transformer. Many other systems use proximity sensors. For example, U.S. Pat. No. 6,149,106 to McQuistian describes a point position indicator having proximity sensors located on the stock rails at a switch. In U.S. Pat. No. 5,806,809 to Danner, proximity sensors are located near the switch points,
with other proximity sensors being located within the switch machine to monitor the position of various lock rods and lock bars. U.S. Pat. Nos. 6,186,448 to Wydots et al., 6,688,559 to Brushwood and 6,296,208 to Franke all incorporate proximity sensors near a sleeved point detection bar.

[0011] A common monitoring system is a switch circuit controller, such as that shown in U.S. Pat. No. 5,598,992 to Chew. This type of controller is typically mounted to the railroad ties and is connected to the operating rod or to one or more switch rods. Any movement of a rod causes a crank arm associated with the controller to rotate, in turn rotating a cam shaft, and causing the appropriate electrical contacts to be made within the controller housing. However, a switch circuit controller must be regularly adjusted to compensate for lost motion between the cams of the cam shaft, the crank arm and the operating rod, as well as to ensure that all internal movable contacts are properly aligned. This is time-consuming, expensive and can be difficult to do correctly. U.S. Pat. No. 6,484,974 to Franke discloses a switch machine controller using Namur sensors to detect point positions. U.S. Pat. No. 6,062,514 to McQuistan also discloses a switch circuit controller based on proximity sensors.

[0012] It is therefore an object of the invention to provide a locking mechanism and a point position indicator that overcomes the foregoing deficiencies.

[0013] In particular, it is an object of the invention to provide a simple means to secure a switch stand and to obtain constant indications of the status of the switch stand and of the associated switch.

[0014] It is a further object of the invention to provide a device which will secure a switch and will provide constant indications of the status of the switch, without the need for ongoing adjustment of the internal components of the device.

[0015] These and other objects of the invention will be appreciated by reference to the summary of the invention and to the detailed description of the preferred embodiment that follow.

SUMMARY OF THE INVENTION

[0016] Generally speaking, the invention employs two main mechanisms: an integrated locking system and an arrangement of sensors that can continuously notify an external monitor or monitoring device as to the status of the switch points.

[0017] The integrated lock system is designed to require the operator to insert a key before throwing the switch point lock handle. The lock handle must be physically disengaged (unlocked) before the switch points can be moved, but the handle cannot be disengaged until the key is turned. Further, once the key is inserted properly it is retained within the device and can only be removed once the locking handle has been returned to an engaged (locked) position, presumably after the switch points have been moved to the desired position.

[0018] To ensure proper and safe operation of the switch, the locking handle cannot be engaged unless the switch points are either in the “normal” position or the “reverse” position. The locking handle will not lock (and the key therefore cannot be removed) if the switch points are at any position between normal and reverse. The operator cannot leave the switch points unlocked in a mid-throw position without leaving the key behind.

[0019] Sensors are used to continuously monitor the location and status of the switch stand, whether it is unlocked, locked in the normal position, or locked in the reverse position. An external device or monitor receives information obtained from these sensors and broadcasts the status of the switch points so that approaching trains can be handled accordingly.

[0020] The locking control and status indicator prevents human error from compromising the safety of manually operated railway switches. It requires employees operating a switch stand to leave the stand in a locked state, and it continuously indicates the status of the switch stand (unlocked, locked in normal, or locked in reverse) through an external notification device to a remote monitor.

[0021] In one aspect, the invention comprises a rail switch stand comprising an elongated spindle mounted for rotation about a vertical axis, wherein rotation of the spindle is adapted to cause actuation of a throw rod; a lever for manually actuating rotation of the spindle, the plane of motion of the lever being spatially offset from the axis; a plate lying substantially in a horizontal plane and being coupled to an intermediate portion of the spindle for co-axial rotation therewith, the plate comprising at least one engagement surface for engaging a locking bar, wherein engagement of the locking bar in the engagement surface locks the spindle against rotation; and a lock sensor for sensing when the locking bar is engaged in the engagement surface. The engagement surface may be a notch in the plate. The locking bar may be vertically elongated and replaceable into and out of engagement with the engagement surface by lateral movement, which may be effected by movement of a handle member.

[0022] In a further aspect, the invention comprises an enclosure mounted about an intermediate portion of the spindle, and the plate is disposed in the enclosure.

[0023] In yet a further aspect, the rail switch stand of the invention may comprise a second engagement surface, each of the engagement surfaces corresponding to first and second positions of the throw rod. The engagement surfaces may be disposed about the plate at 90 degrees of angular separation.

[0024] In another aspect, the invention comprises a rail switch stand having a switch position sensor for sensing a rotational position of the plate, the rotational position corresponding to the position of the throw rod. In a more particular aspect, the switch position sensor may comprise two contacts corresponding to two angularly displaced other contacts on the plate.

[0025] In yet another aspect, the invention comprises a retractable stop member for retaining the locking bar in a first position corresponding to engagement with the engagement surface when a key is in a locking state.

[0026] In another aspect, the invention comprises a switch stand having retention means to retain a key within the switch stand when the key is in a non-locking state.

[0027] In a more particular aspect, the invention comprises a rail switch stand having a second engagement surface disposed about the plate at 90 degrees of angular separation from a first engagement surface; and a switch position sensor for sensing the rotational position of the plate, the rotational position corresponding to the position of the throw rod; the switch position sensor comprising two contacts corresponding to two angularly displaced other contacts on the plate.

[0028] In another aspect, the invention comprises an integrated lock control and status indication device for a manually operated railway switch stand, comprising a plate; a locking member engageable with at least one engagement surface in the plate to prevent rotation of the plate; a handle member to control engagement and disengagement of the
locking member with the at least one engagement surface; a lock means to maintain the locking member in engagement with the engagement surface until a matching key has been inserted; and a first sensor to sense the engagement and disengagement status of the locking member. In a further aspect, the engagement surface corresponds to a rail switch position of normal or reverse, and the locking member prevents rotation of the plate only if the rail switch is fully in a normal or reverse position. In yet a further aspect, the handle member can move into a locked position only when the locking member is engaged with the engagement surface, and the lock means may retain the key unless the locking member is engaged in the engagement surface.

[0029] In another aspect of the invention, the engagement or disengagement status of the switch and the switch stand may be communicated to an external notification device.

[0030] In another aspect of the invention, the device may comprise a second sensor to sense the position of the plate and to provide an indication of a rail switch position of normal or reverse. The indication of a rail switch position may be communicated to an external notification device.

[0031] In yet another aspect, the invention comprises a manually operated railway switch stand comprising a throw handle rotatably connected to a spindle, by which switch points may be controlled; an plate through which the spindle passes, such that the plate and the spindle rotate in a coordinated manner; a locking member that may engage at least one engagement surface in the plate to prevent rotation of the plate and the spindle; a handle member to manually control engagement and disengagement of the locking member with the at least one engagement surface; a lock means that maintains the locking member in engagement with the plate until a matching key has been inserted; and a first sensor to monitor engagement and disengagement status of the locking member. The invention may further comprise a second sensor to monitor the position of the plate and to provide an indication of a position of the switch points.

[0032] The engagement or disengagement status and/or the indication of a rail switch position may be communicated to an external notification device.

[0033] In another aspect, the invention comprises a method of operating a rail switch stand, comprising the sequential steps of inserting a key to move a retractable stop member out of abutment with a locking member; turning a handle member to disengage said locking member from a first engagement surface on a plate; actuating a lever to rotate a spindle on which said plate is coaxially mounted, thereby rotating said plate and wherein rotation of said spindle causes rotation of a throw rod operatively connected to said lever; and sensing when said locking member is disengaged from said first engagement surface through a first sensor means in operative communication with said locking member and thereby determining a status of said switch stand. The status sensed may be signaled to an external notification device. The method may include the further step of sensing a position of said throw rod through a second sensor means in operative communication with said plate. The position sensed may also be signaled to an external notification device.

[0034] In another aspect, the invention comprises a method of securing a rail switch stand, comprising the sequential steps of moving a lever operatively connected to a throw rod and to an elongated spindle, such that said throw rod is in a reverse or normal position; actuating a handle member to engage a locking member with an engagement surface on a plate mounted on an intermediate portion of said spindle; sensing that said locking member is engaged with said first engagement surface with a sensor means; applying a retractable stop member to a lateral portion of said locking member; and removing a key from a lock means controlling said retractable stop member. The method may comprise the further step of locking said lever in place, when said throw rod is in said normal or reverse position. A signal that said locking member is engaged with said first engagement surface may be sent to an external notification device. The method may comprise the further step of sensing a position of said throw rod through a second sensor means in operative communication with said plate. The position of said throw rod may also be signaled to an external notification device.

[0035] The foregoing was intended as a broad summary only and of only some of the aspects of the invention. It was not intended to define the limits or requirements of the invention. Other aspects of the invention will be appreciated by reference to the detailed description of the preferred embodiment and to the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036] The preferred embodiment of the invention will be described by reference to the drawings in which:

[0037] FIG. 1 is a perspective view of a switch stand incorporating the locking control and status indicator of the invention;

[0038] FIG. 2 is a top perspective view of the switch stand of FIG. 1, with the top cover of the locking control and status indicator of the invention removed; and

[0039] FIG. 3 is a sectional view of the locking control and status indicator of the invention, taken along line 3-3 of FIG. 2;

[0040] FIG. 4 is an enlarged sectional view of the locking control and status indicator of the invention, taken along line 4-4 of FIG. 2.

DETAILED DESCRIPTION OF THE INVENTION

[0041] Referring to FIG. 1, the switch stand 10 is preferably a manual stand comprising a base 12 supporting a lever or throw handle 14 which moves between normal and reverse positions and may be secured in those positions by foot latches 16. FIG. 1 illustrates the throw handle 14 having a yoke 17 to interact with the foot latch 16, but it will be understood that any throw handle 14 of suitable configuration may be used, and in particular that the throw handle 14 need not have any yoke 17, but if a yoke is present, it may be of any suitable configuration. In addition, a secondary locking method, such as a padlock (not shown) may be used to secure the throw handle 14 to one of the foot latches 16, as is known in the art. The actuation of the throw handle 14 causes a vertical, elongated spindle 18 to rotate, moving the appropriate rods, such as throw rods, and throwing the associated switch points (not shown). Rotation of the spindle 18 also moves the mounted flag or target 22 to an appropriate position to visually indicate the position of the switch points.

[0042] Switch stand 10 is further fitted with an extended support 24 terminating in an enclosure 26 designed to house the locking control and status indicating apparatus. As best shown in FIGS. 2 and 3, the spindle 18 passes through the enclosure 26 and is fitted within a plate, such as index plate 28, inside the enclosure 26. The spindle 18 is preferably fitted within index plate 28 such that rotation of the spindle 18
causes index plate 28 to rotate in a coordinated, preferably essentially coaxial, manner. Index plate 28 comprises one or more engagement surfaces, which may be of any appropriate configuration, such as notches 30, and preferably comprises two notches, one corresponding to a normal switch position, and the other corresponding to a reverse switch position.

[0043] A locking member, such as lock bar 32, is positioned to engage the index plate 28, and may be spring biased to remain engaged with the index plate 28, or to force the lock bar 32 out of engagement with the index plate 28. When the lock bar 32 engages either of two notches 30, the index plate 28 cannot rotate. This also prevents the spindle 18 from rotating, and therefore prevents the throw handle 14 from being rotated, preventing the throw rod from being actuated and the switch points from being thrown.

[0044] Lock bar 32 is moved in and out of engagement with the index plate 28 by operation of a handle member, such as lock handle 34 (see Fig. 1), which protrudes from the enclosure 26. Lock handle 34 (see Fig. 1) is coupled to the lock bar 32 by any suitable means, such as a screw or bolt. As an additional safety feature, one or more shear bolts 36 may be used to couple the two assemblies. Shear bolt 36 is designed to fail if excessive force is applied to the lock handle 34, as might be done in an attempt to defeat the locking mechanism of the switch stand 10. Lock handle 34 is preferably made readily visible in order to allow an operator to easily determine the position of the lock. For example, the lock handle 34 may be somewhat large, or it may be painted a highly visible or luminous colour. In addition, the lock handle 34 preferably has at least two distinct positions, such as vertical and horizontal, so that an operator can easily visually verify whether it is locked or unlocked.

[0045] As best seen in Fig. 4, a lock mechanism, such as lock core 38, is preferably located near the lock handle 34, and may be operated by a regular mechanical key or an electronic key (not shown). Lock core 38 is preferably located under an overhang 40 of the enclosure 26, or under some other type of protective hood, in order to protect it from the elements and tampering. The lock core 38 preferably retains an inserted key, by mechanical or electrical retention, as appropriate, at all times when the switch stand 10 is unlocked or when the switch points are in a mid-throw position. The lock core 38 preferably is in a locked state by default, such as by spring-bias means or magnetic means, such that the key can only be inserted or removed when the lock core 38 is locked. When the lock core 38 is in a locked state, a retractable stop member, such as lock core cam 42, abuts the lock bar 32, pressing it into the notch 30 and preventing it from moving out of contact with the index plate 28 unless lock core 38 is opened. This prevents unauthorized tampering with the switch points, and also prevents an operator from accidentally leaving the switch unlocked, unless he also leaves his key behind.

[0046] Enclosure 26 further houses one or more sensors, which sense and provide information regarding the status of the switch and switch stand. In the preferred embodiment, a lock sensor, which may be a lock bar switch 44 (Fig. 2), is in contact with the lock bar 32 via one or more contacts 46, which provides an indication of whether the lock bar 32 is engaged or disengaged with the notch 30 in the index plate 28. If the lock bar 32 is not engaged with one of the notches 30, the contact 46 on the lock bar switch 44 will open, indicating that the switch is unlocked.

[0047] A second sensor, such as directional switch 48 which determines the switch position, is also located in the enclosure 26, in order to monitor the position of the index plate 28 as it rotates between the normal and reverse positions. The rotational position of the index plate 28 corresponds to the position of the railroad switch. Preferably, the directional switch 48 comprises at least two contacts 50, 52 (Fig. 3), one of which is closed only when the railroad switch is in the normal position and the other of which is closed only when the railroad switch is in the reverse position. The pair of contacts provides two distinct signals, each of which can be correlated to a specific switch position. The contacts 50, 52 may be actuated by any suitable engagement with the index plate 28, such as fitting into notches in the circumference of the index plate 28 or by coming into contact with teeth or other specifically selected contact areas on the index plate 28. The signals produced by each of the lock bar switch 44 and the directional switch 48 are preferably provided to a remote monitor by an external notification system 54. The external notification system may be of any type known in the art, including but not limited to, fixed wayside signals; analogue radio broadcasts to the crew on an oncoming train, which may be triggered by DTMF; or automatically as the train crosses sensors along the track; digital radio broadcasts to special devices in an oncoming train; and analogue or digital messages to a remote rail traffic control office.

[0048] Because of the self-contained nature of the locking control and status indicator, and the relatively simple binary nature of the signals received from the lock bar switch 44 and the directional switch 48, the invention is simple to operate and maintain. In particular, the invention is not subject to serious impact or vibrations from passing trains or otherwise during operation, and therefore does not require continuous adjustment throughout the lifetime of the device.

[0049] The enclosure 26 can also be designed to accommodate additional equipment to enhance the functionality of the switch stand 10. For example, a remote locking mechanism may be used in addition to the lock core cam 42, to further secure the lock bar 32. The remote locking mechanism, which may comprise a second lock bolt or any other means to immobilize the lock bar 32, would preferably normally be engaged, preventing any manual actuation of the switch stand 10. Upon receiving a command from a remote or local source, the remote locking mechanism would disengage from the lock bar 32, allowing the switch stand 10 to be operated as described above. Upon completion of the switching operation, the remote locking mechanism would return to its normal default locked condition.

[0050] The enclosure 26 may also be fitted with miniature communication equipment to allow two-way communications with the switch stand 10. These communications may take any suitable form, such as conventional radio frequencies currently used by railways, commercial cellular phone systems or private satellite communications.

[0051] A Global Positioning System receiver may also be incorporated into the enclosure 26. This device would allow the switch stand 10 to distinguish its unique position in an area where several similarly fitted switch stands are operating.

Operation

[0052] In operation, the switch stand 10 is initially locked and aligned to position the railway switch points to allow travel along a selected railroad route, in either the reverse or
normal direction. An operator would insert his electronic or mechanical key into the lock core 38, releasing the lock core cam 42 from its abutment with the lock bar 32, thereby unlocking the switch stand 10. A mechanical key would likely release the lock core cam 42 by rotating the key, while an electronic key could be rotated, or may send a signal to the lock core cam 42, instructing it to release. At this stage, the lock bar switch 44 is open, indicating that the switch stand 10 is unlocked. Because the index plate is still in contact with one of the contacts 50, 52 in the directional switch 48, the directional switch 48 will indicate that the switch is in the appropriate position, either reverse or normal. The external notification system 54 will consider these two readings in combination and will indicate that the turnout is unsafe for transit at track speed.

[0053] The key is preferably retained by the lock core 38, such as by mechanical, electrical magnetic or any other suitable means, and cannot be removed until the switch stand 10 is relocked.

[0054] The operator actuates the lock handle 34, which in turn frees the lock bar 32 from the notch 30 in the index plate 28. This allows the index plate 28 to rotate freely. Upon pressing the foot latch 16, the operator can move the throw handle 14 from its current position to the opposite position, e.g., clockwise, in FIG. 1. The spindle 18 rotates, moving the switch points and causing the index plate 28 to rotate. As the index plate 28 rotates, it breaks contact with the contact in the directional switch 48, causing the directional switch 48 to indicate that the switch points are out of position, i.e. not in the reverse or normal position. The lock bar switch 44 is still open, indicating that the switch is unlocked. When these two readings are combined, the external notification system 54 will indicate that the turnout is unsafe for transit at track speed.

[0055] If a secondary locking mechanism, such as a padlock on the foot latch 16, is used, the operator would typically unlock and remove the padlock at any point prior to depressing the foot latch 16.

[0056] As the rotation of the throw handle 14 is completed, it will engage the opposite foot latch 16, and the index plate 28 will complete its rotation, allowing the notch 30 to engage with lock bar 32. The index plate 28 will also close the appropriate contact 50 or 52 in the directional switch 48. The external notification system 54 will therefore signal that the switch is in the normal or reverse position, and that the switch is still unlocked, rendering the switch unsafe for transit at track speed.

[0057] The operator then returns the lock handle 34 to its original position, engaging the lock bar 32 with notch 30. The operator can then rotate his key to the original insertion position, if necessary, re-engaging the lock core cam 42 with the lock bar 32, and forcing the lock bar 32 to remain within the notch 30. The lock bar 32 then completes the circuit with the contacts 46 of the lock bar switch 44, so the lock bar switch 44 can indicate that the switch is locked. The external notification system 54 can therefore signal the remote monitor that the switch is in the normal or reverse position and that the switch is locked, so that it is safe for transit. These indications reassure the operator and the remote monitor that the switch is in a proper position and is secure against tampering or operator negligence.

[0058] If a secondary locking mechanism, such as a padlock on the foot latch 16, is used, the operator would preferably reattach and lock the padlock on to the foot latch 16 holding the throw handle 14. The switch is then further secured against tampering.

[0059] It will be appreciated by those skilled in the art that other variations to the preferred embodiment described herein may be practised without departing from the scope of the invention, such scope being properly defined by the following claims.

What is claimed is:

1. A rail switch stand comprising:
   an elongated spindle mounted for rotation about a vertical axis and wherein rotation of said spindle is adapted to cause actuation of a throw rod;
   a lever for manually actuating rotation of said spindle, the plane of motion of said lever being spatially offset from said axis;
   a plate lying substantially in a horizontal plane and being coupled to an intermediate portion of said spindle for co-axial rotation therewith, said plate comprising at least one engagement surface for engaging a locking bar, wherein engagement of said locking bar in said at least one engagement surface locks said spindle against rotation;
   and
   a lock sensor for sensing when said locking bar is engaged in said engagement surface.

2. The rail switch stand of claim 1 further comprising an enclosure mounted about said intermediate portion of said spindle, said plate being disposed in said enclosure.

3. The rail switch stand of claim 1 wherein said at least one engagement surface comprises a notch in said plate.

4. The rail switch stand of claim 1 wherein said plate further comprises a second engagement surface, said at least one engagement surface corresponding to a first position of said throw rod and said second engagement surface corresponding to a second position of said throw rod.

5. The rail switch stand of claim 4 wherein each of said engagement surfaces comprises a notch.

6. The rail switch stand of claim 4 wherein said at least one engagement surface and said second engagement surface are disposed about said plate at 90 degrees of angular separation.

7. The rail switch stand of claim 1 further comprising a switch position sensor for sensing the rotational position of said plate, said rotational position corresponding to the position of said throw rod.

8. The rail switch stand of claim 7 further comprising an enclosure mounted about said intermediate portion of said spindle, said plate, said lock sensor and said switch position sensor all being disposed in said enclosure.

9. The rail switch stand of claim 8 wherein said switch position sensor comprises two contacts corresponding to angularly displaced other contacts on said plate.

10. The rail switch stand of claim 7 wherein said switch position sensor comprises two contacts corresponding to two angularly displaced other contacts on said plate.

11. The rail switch stand of claim 1 further comprising a retractable stop member for retaining said locking bar in a first position corresponding to engagement with said engagement surface when a key is in a locking state.

12. The switch stand of claim 11 further comprising retention means to retain said key within said switch stand when said key is in a non-locking state.
13. The rail switch stand of claim 1 wherein said locking bar is vertically elongated and is displaceable into and out of engagement with said engagement surface by lateral movement.

14. The rail switch stand of claim 13 wherein said lateral movement of said locking bar is actuated by movement of a handle member.

15. The rail switch stand of claim 1, further comprising: a second engagement surface disposed about said plate at 90 degrees of angular separation from said first engagement surface; a switch position sensor for sensing the rotational position of said plate, said rotational position corresponding to the position of said throw rod; said switch position sensor comprising two contacts corresponding to two angularly displaced other contacts on said plate.

16. An integrated lock control and status indication device for a manually operated railway switch stand, comprising: a plate; a locking member engageable with at least one engagement surface in said plate to prevent rotation of said plate; a handle member to control engagement and disengagement of said locking member with said at least one engagement surface; a lock means to maintain said locking member in engagement with said engagement surface until a matching key has been inserted; and a sensor to sense the engagement and disengagement status of said locking member.

17. The device of claim 16, wherein said at least one engagement surface corresponds to a rail switch position of normal or reverse, and said locking member prevents rotation of said plate only if the rail switch is fully in a normal or reverse position.

18. The device of claim 17, wherein said handle member can move into a locked position only when said locking member is engaged with said at least one engagement surface.

19. The device of claim 17, wherein said lock means remains said key unless said locking member is engaged in said at least one engagement surface.

20. The device of claim 16, wherein said engagement or disengagement status is communicated to an external notification device.

21. The device of claim 16, further comprising a second sensor to sense the position of said plate and to provide an indication of a rail switch position of normal or reverse.

22. The device of claim 21 wherein said indication of a rail switch position is communicated to an external notification device.

23. A manually operated railway switch stand comprising: a throw handle rotatably connected to a spindle, by which switch points may be controlled; a plate through which said spindle passes, such that said plate and said spindle rotate in a coordinated manner; a locking member that may engage at least one engagement surface in said plate to prevent rotation of said plate and said spindle; a handle member to manually control engagement and disengagement of said locking member with said at least one engagement surface; a lock means that maintains said locking member in engagement with said plate until a matching key has been inserted; and a first sensor to monitor engagement and disengagement status of said locking member.

24. The switch stand of claim 23, further comprising a second sensor to monitor the position of said plate and to provide an indication of a position of said switch points.

25. The switch stand of claim 23, wherein said engagement or disengagement status is communicated to an external notification device.

26. The switch stand of claim 24 wherein said indication of a rail switch position is communicated to an external notification device.

27. A method of operating a railway switch stand, comprising the sequential steps of: inserting a key to move a retractable stop member out of abutment with a locking member; turning a handle member to disengage said locking member from a first engagement surface on a plate; actuating a lever to rotate a spindle on which said plate is coaxially mounted, thereby rotating said plate and wherein rotation of said spindle causes rotation of a throw rod operatively connected to said lever; and sensing when said locking member is disengaged from said first engagement surface through a first sensor means in operative communication with said locking member and thereby determining a status of said switch stand.

28. The method of claim 27 comprising the further step of signaling said status to an external notification device.

29. The method of claim 27 comprising the further step of sensing a position of said throw rod through a second sensor means in operative communication with said plate.

30. The method of claim 29 comprising the further step of signaling the position of said throw rod to an external notification device.

31. A method of securing a railway switch stand, comprising the sequential steps of: moving a lever operatively connected to a throw rod and to an elongated spindle, such that said throw rod is in a reverse or normal position; actuating a handle member to engage a locking member with an engagement surface on a plate mounted on an intermediate portion of said spindle; sensing that said locking member is engaged with said first engagement surface with a sensor means; applying a retractable stop member to a lateral portion of said locking member; and removing a key from a lock means controlling said retractable stop member.

32. The method of claim 29 comprising the further step of locking said lever in place, when said throw rod is in said normal or reverse position.

33. The method of claim 31 comprising the further step of signaling that said locking member is engaged with said first engagement surface to an external notification device.

34. The method of claim 27 comprising the further step of sensing a position of said throw rod through a second sensor means in operative communication with said plate.

35. The method of claim 29 comprising the further step of signaling the position of said throw rod to an external notification device.