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Franke

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(54) **RAILWAY SWITCH MACHINE POINT DETECTION SYSTEM**

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Related U.S. Application Data

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(51) **Int. Cl.**[7] **B61L 5/00**
(52) **U.S. Cl.** **246/476**; 246/220
(58) **Field of Search** 246/217, 260, 246/220, 223, 225, 253, 476, 448, 219, 263

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,740,041 A 3/1956 Marcum
5,669,587 A 9/1997 Van Alstine et al.
5,806,809 A 9/1998 Danner
6,149,106 A 11/2000 McQuistian

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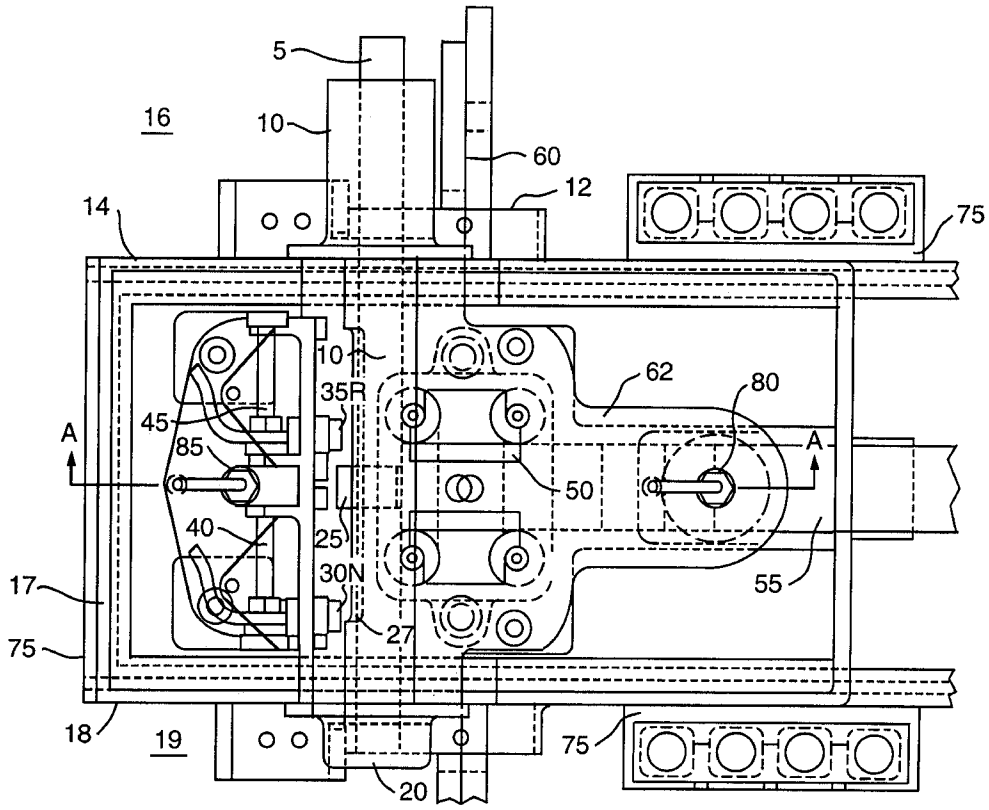
(57) **ABSTRACT**

A method of point detection is for use with a railway switch machine including a housing, a point detector bar positionable in a normal point position and a reverse point position, and a slide lock bar positionable in a normal locked position and a reverse locked position. The method includes providing point detecting sensors in the housing adjacent the point detector bar; detecting with the point detecting sensors the position of the point detector bar; generating by the point detecting sensors a point detection signal representative of the position of the point detector bar; and delivering the point detection signal to a processing device for determining if the point detector bar is in the normal point position, the reverse point position, or in neither the normal point position nor the reverse point position.

21 Claims, 3 Drawing Sheets



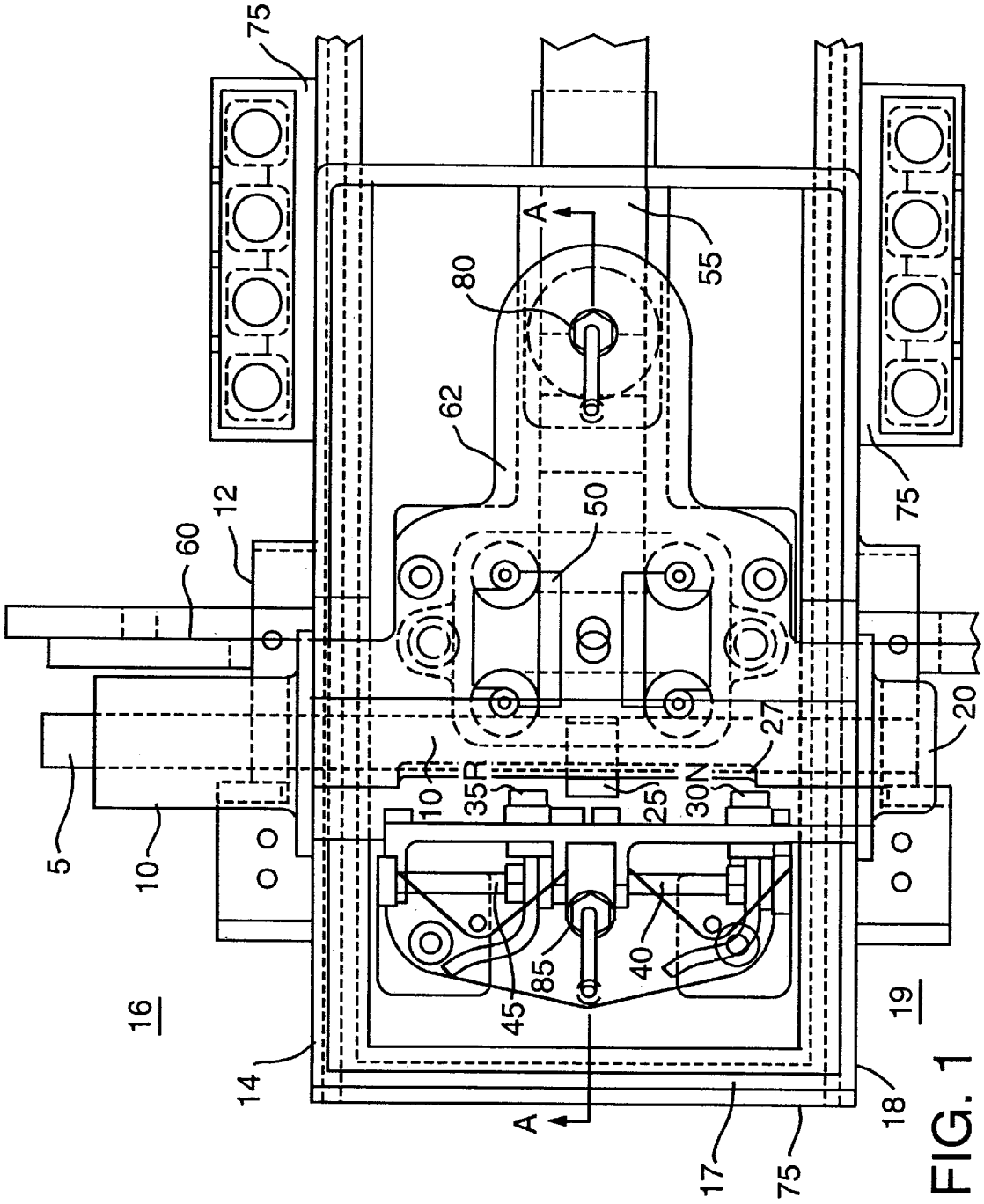

75
A
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FIG. 1

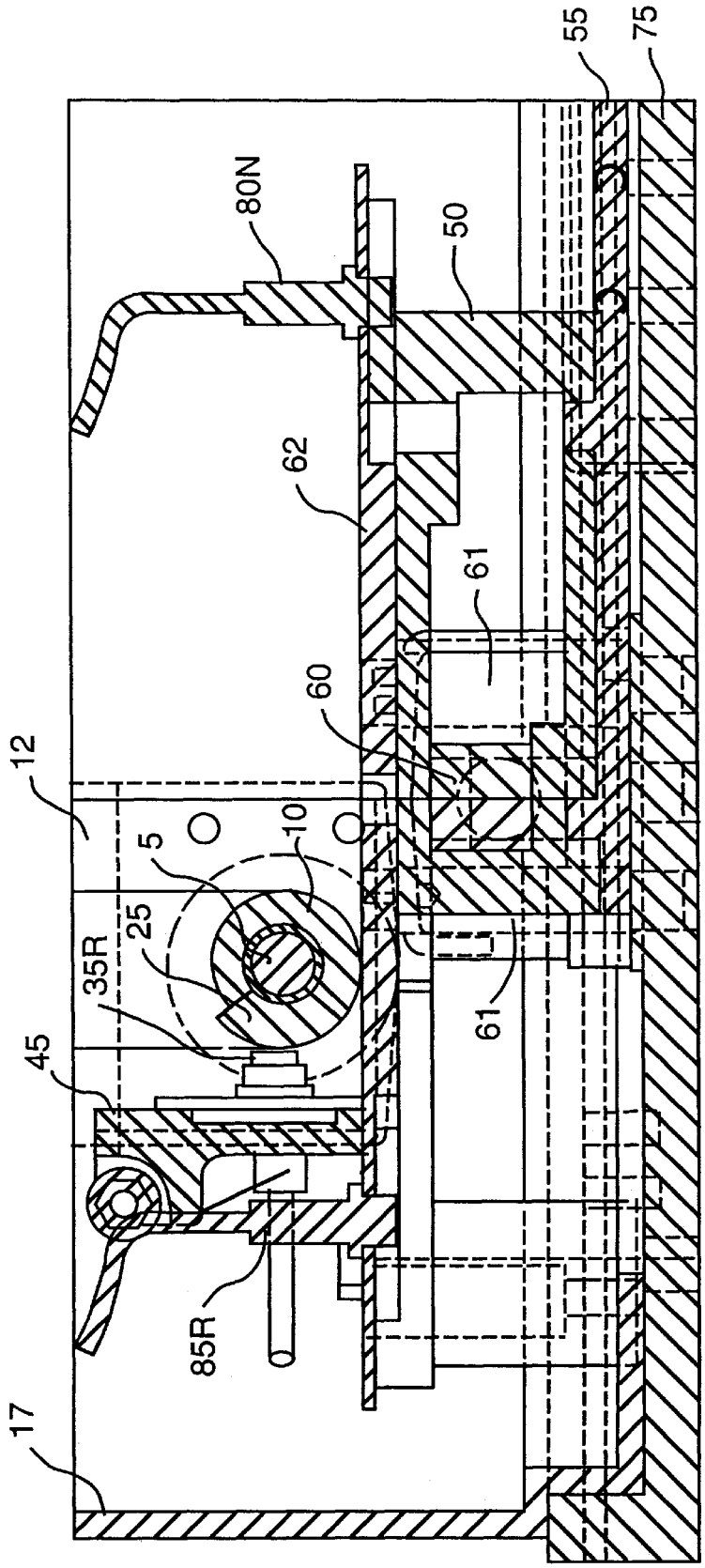

FIG. 2

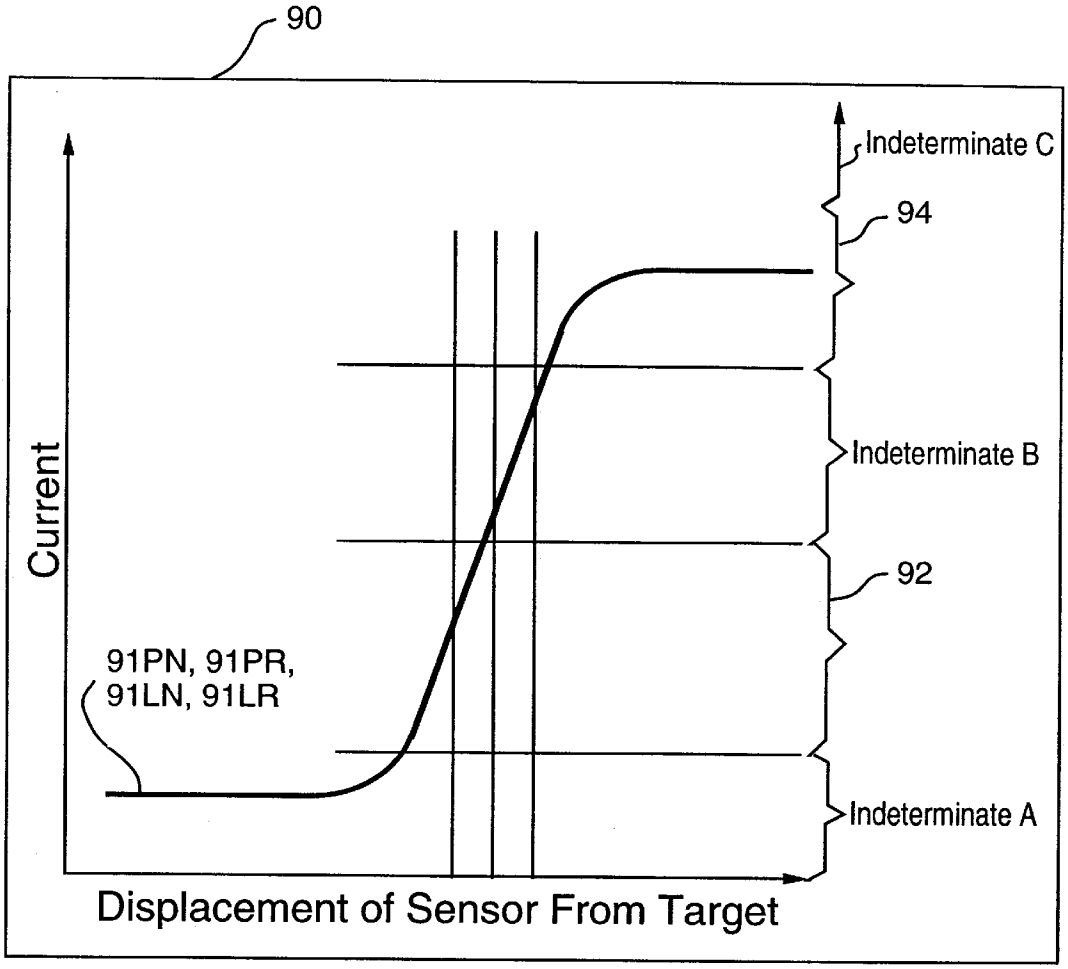
90
Indeterminate C
94
Indeterminate B
92
Indeterminate A
Current
91PN, 91PR,
91LN, 91LR
Displacement of Sensor From Target

FIG. 3

RAILWAY SWITCH MACHINE POINT DETECTION SYSTEM

This application is a divisional of application Ser. No. 09/382,439, filed Aug. 25, 1999, now U.S. Pat. No. 6,296,208.

BACKGROUND OF THE INVENTION

This invention relates to a point detection system for a railway switch machine and an associated method of point detection for a railway switch machine.

As is known in the art, a common method for switching a train from one railroad track to another is to install an electric motor driven switch machine next to the switching point of the track. Current versions of these switch machines are typically operated from a remote location, therefore it is essential that a remote operator be able to determine the position of the switch. In addition, because switch point closure is imperative to safe railroad train operation, Federal Railroad Administration (FRA) rules and regulations mandate not only that the position of the switch points be mechanically locked to prevent the points from opening during train traffic but also that the locked position of the switch points be continuously monitored to detect any undesirable movement.

Prior art switch machines relied on mechanical devices to perform the point and lock detections. However, such mechanical arrangements were subject to degradation over time as a result of wear. In addition, other factors, such as weather, directly affected the reliability of such systems.

U.S. Pat. No. 5,806,809 discloses a railroad switch point position detecting system employing a plurality of proximity detectors positioned proximate to the switch point or points of a railroad switch. These proximity detectors for detecting switch point position are physically located on the switch points or corresponding stock rail. While the use of proximity detectors in general are an improvement over the previous mechanical systems, there are still noted shortcomings of the use thereof. For example, the proximity sensors employed by the '809 patent provides no means to distinguish ON from shorted and OFF from open. Therefore, in a static situation, an ON sensor that shorts will go undetected. If the switch points were subsequently forced open, as would occur with a train running through in the wrong direction, it would go undetected. With the switch points forced open and not reflected in the indication circuit, a safety hazard is created.

There remains a need, therefore, for a point detection system for a railway switch machine that overcomes the disadvantages and shortcomings of the prior art and provides a safe and reliable means for detecting point position.

SUMMARY OF THE INVENTION

The invention has met or exceeded the above-mentioned needs, as well as other needs. The invention includes a point detection system for a railway switch machine having a housing where the point detection system comprises a point detector bar positionable in a normal point position and a reverse point position, and point detecting means positioned within the housing for detecting when the point detector bar is in the normal point position and when the point detector bar is in the reverse point position. Preferably, the point detecting means comprises a first inductive proximity sensor and a second inductive proximity sensor.

In addition, the invention includes a point detection system for a railway switch machine having a housing

defining a first sidewall and an opposing second sidewall, a point detector bar with a first and a second end positionable in normal point position and a reverse point position, a slide bar positionable in a normal locked position and a reverse locked position, and an indication system for indicating switching and locking data wherein the point detection system comprises a support sleeve affixed within the housing to the first sidewall and the opposing second sidewall for receiving and slidably supporting the first end of the point detector bar therewithin. The point detection system further comprises an orifice defined in the first sidewall of the housing through which the point detector bar is slidably retained by the first sidewall such that the first end of the point detector bar is slidably captivated within the support sleeve within the housing and the second end of the point detector bar is positioned outside of the housing. The point detection system also comprises a point detector target integrally engaged with the first end of the point detector bar within the housing and a point detecting means positioned within the housing and coupled to the indication system for detecting the point detector target when the point detector bar is positioned in the normal point position and the reverse point position. Furthermore, the point detecting means generates a normal point detection signal that is transmitted to the indication system when the point detecting means detects the point detector target with the point detector bar in the normal point position and the point detector means generates a reverse point detection signal that is transmitted to the indication system when the point detecting means detects the point detector target with the point detector bar in the reverse point position. Preferably, the point detecting means includes at least one inductive proximity sensor.

The invention also includes a method of point detection for a railway switch machine having a housing, a point detector bar positionable in a normal point position and a reverse point position, and a slide lock bar positionable in a normal locked position in a reverse locked position, wherein the method comprises the steps of: providing point detecting means in the housing adjacent to point detector bar; detecting with the point detecting means the position of the point detector bar; generating by the point detecting means a point detection signal representative of the position of the point detector bar; and delivering the point detection signal to means for processing and determining if said point detector bar is in the normal point position, the reverse point position, or in neither the normal point position nor the reverse point position. The method may also include the steps of employing as said point detecting means a first proximity sensor for detecting when the point detector bar is in the normal point position and a second proximity sensor for detecting when the point detector bar is in the reverse point position, and employing as said first proximity sensor and said second proximity sensor inductive proximity sensors.

BRIEF DESCRIPTION OF THE DRAWINGS

A full understanding of the invention can be gained from the following description of the preferred embodiment when read in conjunction with the accompanying drawings in which:

FIG. **1** is a top view of a point detection system positioned within a railway switch machine according to the present invention.

FIG. **2** is a sectional view taken along line A—A of FIG. **1**.

FIG. **3** is a graphical representation of current versus displacement using an inductive proximity sensor in accordance with the invention.

DETAILED DESCRIPTION

Referring to FIGS. **1** and **2**, there is shown a point detection system **10** of the present invention as positioned in a railway switch machine. The railway switch machine may be, for example, Union Switch & Signal, Inc., switch machine model number M23E.

A point detector bar **5** (shown partially in phantom in FIG. **1**) may be held slidably captive within a point detector sleeve **10** and within a track side bearing **12** mounted to a wall **14** on a track side **16** of a housing **17** of the railway switch machine, so as to support the point detector sleeve **10** and the point detector bar **5**. Preferably, the point detector sleeve **10** may extend the internal width of the housing **17** between the wall **14** and a wall **18** on a field side **19** of the housing **17**. A field side bearing **20** may be mounted to the wall **18** and may support the point detector sleeve **10**. A point detector target **25** may be affixed to the point detector bar **5** and may be exposed to be detected or sensed through a slot **27** defined in the captive point detector sleeve **10**.

The point detector bar **5** may be positioned in a normal point position and a reverse point position, as is generally known in the art. The normal point position may be indicated when the point detector bar **5** extends into the point detector sleeve **10** such that the point detector target **25** is more toward the bottom of the slot **27** as shown in FIG. **1**. Similarly, the reverse point position may be indicated when the point detector bar **5** extends partially into the point detector sleeve **10** such that the point detector target **25** is more toward the top of the slot **27** as shown in FIG. **1**.

In accordance with the present invention, point detecting means are positioned within the housing **17** for detecting when the point detector bar **5** is in the normal point position and for detecting when the point detector bar **5** is in the reverse point position. More specifically, the point detecting means includes a first proximity sensor **30** for detecting the point detector target **25** when the point detector **5** is in the normal point position. Similarly, the point detecting means includes a second proximity sensor **35** for detecting the point detector target **25** when the point detector bar **5** is in the reverse point position. FIG. **1** shows the point detector target **25** and the affixed point detector bar **5** positioned between the normal point position and the reverse point position, but closer to the reverse point position due to the proximity of the point detector target **25** to the second proximity sensor **35**.

Preferably, the first proximity sensor **30** and the second proximity sensor **35** are inductive proximity sensors. The use of inductive proximity sensors for determining the position of the point detector bar **5** is advantageous over other types of proximity sensors that have been used for similar purposes, as will be described in more detail herein. An example of an inductive proximity sensor suitable for use with the present invention is a NAMUR inductive proximity sensor TURCK Part No. Bi10-M30-YOX-H1141 or Pepper1+Fuchs Part No. NCB5-18GM40-N0.

To provide for linear adjustment of the first proximity sensor **30** and the second proximity sensor **35** due to a range of possibilities for the normal point position and reverse point position between the slot **27** for a variety of point detector bar **5** connections to various types of switch points (not shown), the invention also provides for first point mounting means for mounting the first proximity sensor **30** in slidable proximity to the point detector target **25** such that the first proximity sensor **30** is slidably adjustable relative to the point detector target **25**. In addition, second point mounting means are provided for mounting the second proximity sensor **35** in proximity to the point detector target **25** such that the second proximity sensor **35** is slidably adjustable relative to the point detector target **25**. More specifically, the first proximity sensor **30** may be held by a normal linear slide **40**, thereby to permit a linear position adjustment of the first proximity sensor **30** with respect to the point detector target **25** in the normal point position. Similarly, the second proximity sensor **35** may be held by a reverse linear slide **45**, thereby to permit a linear position adjustment of the second proximity sensor **35** with respect to the point detector target **25** in the reverse point position. Linear slides **40** and **45** may be a commonly known, commercially available linear slide mechanism. Preferably, linear slides **40** and **45** are adapted to mount and adjust an inductive proximity sensor for use with the present invention.

Still referring to FIGS. **1** and **2**, there is shown a commonly known lock box **50** that is fixedly mounted to a slide lock or slide bar **55** that mechanically cooperates with a commonly known lock rod assembly **60** to mechanically lock the switch points (not shown). The lock rod assembly **60** rides between and is guided by typical lock rod rollers **61**, as shown in FIG. **2**. The slide bar **55** rides atop and is guided by a switch machine base **75** through the housing **17** and beneath a frog plate **62** within the housing **17**. Preferably, the track side bearing **12** and the field side bearing **20** are mounted directly to the frog plate **62**. The slide bar **55**, as is generally known, moves linearly along the length of the switch machine base **75** as the switch machine operates, thereby moving the lock box **50**, which is fixedly mounted to the slide bar **55**, in the same linear fashion. The lock box **50**, as is known, is in locking engagement with the lock rod assembly **60** to mechanically prevent the lock rod assembly **60** from moving linearly in a motion perpendicular to the switch machine and the stock rail. This commonly known locking arrangement is typically safety critical. Accordingly, it becomes necessary to detect the linear position of the lock box **50** in order to ensure it is adequately locking the lock rod assembly **60**.

The invention also provides for lock detecting means for detecting the lock box **50** that is fixedly mounted to the slide bar **55** to detect when the slide bar **55** is positioned in the normal locked position or the reverse locked position. Of course, it will be appreciated that the lock box **50** acts as a slide bar target and that other types of targets, such as for example, a target similar to the point detector target **25** which is preferably made of a metallic material, may be utilized in conjunction with the invention.

The lock detecting means preferably includes a first proximity sensor **80** for detecting the lock box **50** when the slide bar **55** is positioned in the normal locked position and a second proximity sensor **85** for detecting the lock box **50** when the slide bar **55** is positioned in the reverse locked position. Preferably, the first proximity sensor **80** and the second proximity sensor **85** are inductive proximity sensors. Furthermore, the invention provides for mounting the first proximity sensor **80** and the second proximity sensor **85** in similar linear slides and in a similar manner to the manner in which first proximity sensor **30** and the second proximity sensor **35** are respectively mounted to the linear slides **40** and **45**. It will be understood that this permits a linear position adjustment of the first proximity sensor **80** and the second proximity sensor **85** with respect to the lock box **50** or other target positioned on the slide bar **55**.

During operation of the railway switch machine and application of the invention, the point detector bar **5** is fixedly connected, typically external to the switch machine, to a commonly known point detector connecting rod (not

shown) that is directly connected to the track near the ends of the track switch points (not shown). As the switch machine moves the switch points from the normal position to the reverse position, or vice versa, usually a distance of approximately 4 to 5 inches, the point detector connecting rod and fixedly connected point detector bar **5** are moved the same distance. The point detector bar **5** slides within the track side bearing **12** and within the point detector sleeve **10** where the sleeve **10** captivates the point detector bar **5**. Preferably, the point detector sleeve **10** is supported by the track side bearing **10** and the field side bearing **20**, each of which may be mounted to the frog plate **62** with a plurality of bolts or similar fasteners (not shown).

As the track switch points move a given distance, the point detector bar **5** moves the same linear distance and in turn moves point detector target **25** the same linear distance. In order to detect and ensure track switch point closure, the linear position of the point detector target **25** is sensed by either the first proximity sensor **30** or the second proximity sensor **35** through the slot **27** defined in the point detector sleeve **10**. The first proximity sensor **30** is capable of generating a normal point detection signal in response to detection of the point detector target **25** and, similarly, the second proximity sensor **35** is capable of generating a reverse point detection signal in response to detection of the point detector target **25**.

The lock rod assembly **60** is fixedly connected, typically external to the switch machine, near ends of the track switch points. After the switch machine has moved the track switch points from the normal position to the reverse position, or vice versa, the lock box **50** mechanically cooperates with the lock rod assembly **60**, as is known in the art, to mechanically lock the switch points. In order to detect and ensure locking of the track switch point closure, the linear position of the lock box **50** is sensed by either the first proximity sensor **80** or the second proximity sensor **85**. The first proximity sensor **80** is capable of generating a normal locked detection signal in response to detection of the lock box **50** and the second proximity sensor **85** is capable of generating a reverse locked detection signal in response to detection of the lock box **50**.

The first proximity sensor **30** and second proximity sensor **35** (for normal point position and reverse point position) and first proximity sensor **80** and second proximity sensor **85** (for normal locked position and reverse locked position) are coupled with means for processing point detection information and status and lock detection information and status, including an indication system for indicating switching and locking data. Specifically, the proximity sensors may be coupled with a microprocessor **90**, or logic controller or similar device that integrates with the railroad's train control signalling systems, as is known in the switch circuit controller art for switch machines. Preferably, these devices may be monitored by a vital microprocessor designed to provide failsafe operation.

The respective normal and reverse point detection signals may be transmitted to typical indication means such as a circuit controller, for example, for indication to railroad personnel or devices. The respective normal locked and reverse locked detection signals may be transmitted to typical indication means, such as a circuit controller, for example, for indication to railway personnel or devices.

Referring to FIG. **3**, there is shown a graphical representation of current versus displacement characteristics of an inductive proximity sensor generated signal for use with the invention. As shown, the graphical representation is produced by the proximity sensors **30** and **35** and communicated to microprocessor **90** which is used for processing and determining point and lock detection status and information. It will be understood that the curve **91** is typical and representative of the normal point detection signal generated by the first proximity sensor **30**, the reverse point detection signal generated by the second proximity sensor **35**, the normal locked detection signal generated by the first proximity sensor **80** and the reverse locked detection signal generated by the second proximity sensor **85**. More specifically, the normal point detection signal, generally designated by **91**PN, is in a first predetermined range **92** to indicate that the point detector bar **5** is in the normal point position. Similarly, the normal point detection signal **91**PN is in a second predetermined range **94** to indicate that said point detector bar is not in the normal point position. In addition, the normal point detection signal **91**PN is indeterminate of the position of the point detector bar **5** when the normal point detection signal **91**PN is less than the first predetermined range and located in the indeterminate A region. Similarly, the normal point detection signal **91**PN is indeterminate of the position of the point detector bar **5** when the normal point detection signal **91**PN is greater than said first predetermined range **92** but less than said second predetermined range **94** (i.e., within indeterminate B region), or greater than said second predetermined range **94** (i.e., within indeterminate C region). Therefore, it will be appreciated that the use of an inductive proximity sensor to produce the normal point detection signal **91**PN provides a safe and reliable means for determining whether the point detector bar **5** is in the normal point position, not in the normal point position or indeterminate of whether the point detector bar **5** is in the normal point position.

Reverse point detection signal **91**PR operates in a similar manner as described herein for the normal point detection signal **91**PN. Specifically, the reverse point detection signal **91**PR is in the first predetermined range **92** to indicate that the point detector bar **5** is in the reverse point position and is in the second predetermined range **94** to indicate that the point detector bar **5** is not in the reverse point position. In addition, the reverse point detection signal **91**PR is indeterminate of whether the point detector bar **5** is in the reverse point position when the reverse point detection signal **91**PR is in the indeterminate A, indeterminate B, or indeterminate C regions, as described.

The normal point detection signal **91**PN and the reverse point detection signal **91**PR are a result of utilizing inductive proximity sensors for the first proximity sensor **30** and the second proximity sensor **35**, respectively. As is known, inductive proximity sensors externally act much like a variable resistor. They are fed from a voltage source and separated from a metal target such as the point detector target **25** out of its sensing range such that the resulting current is significantly greater than the current with the target in the sensing range. For a NAMUR inductive proximity sensor having a nominal sensing range of 5 mm, the current changes from near the maximum value to the minimum value over a distance of approximately 1 mm. As is also known, such an inductive proximity sensor includes an oscillator having a coil wound on a ferrite core and concentrating an electromagnetic field near the sensing end. When a metal target, such as the point detector target **25**, is brought into the sensing field, induced eddy currents act to dampen the oscillations which in turn decreases the current demand from the source. Accordingly, with the sensor very close to the target, current is reduced to that demanded by transistor biasing.

Accordingly, employment of inductive proximity sensors for use with the point detection system of a railway switch machine is advantageous over previously known detection systems. Specifically, inductive proximity sensors in general are of greater complexity than the type of inductive proximity sensors, such as the NAMUR sensor, having trigger circuitry to turn ON an included transistor when the sensor is within the sensing range of a metal target. In addition, inductive proximity sensors in general are three-wire devices with two of the wires serving as power supply connection and the third wire providing access to the included transistor switch which is in common with the positive or negative side of the power supply. The type of inductive proximity sensor, such as the NAMUR sensor, is the simplest form of an inductive proximity sensor having the fewest parts and therefore being the most reliable. Specifically, the inductive proximity sensor employed with the present invention is a two-wire device. It will be appreciated that other types of generally known inductive proximity sensors contain the internal threshold and switching circuitry described herein. With sensors of this type, it is not practical to make the distinction between ON and shorted or OFF and open.

As previously discussed, the first proximity sensor **30** and second proximity sensor **35** are positioned in the housing **17** adjacent the point detector bar **5**. There are advantages to placing the proximity sensors **30** and **35** within the housing **17**. For example, when proximity sensors are placed at trackside, special brackets are required to mount the sensors and external wiring must be trenched to the machine and it is difficult to protect the wiring from dragging equipment and it is therefore more subject to damage. Also, employing proximity sensors at trackside and not in the housing **17** requires that the installation be done with more precision and often under conditions of bad weather and bad lighting. Installation cost is thus greater than it otherwise would be if the proximity sensors were installed in the housing at the point of manufacture. By mounting the proximity sensors in the housing **17**, these difficulties as well as others are overcome.

The first proximity sensor **80** and the second proximity sensor **85** for detecting the lock box **50** when the slide bar **55** is positioned in the normal locked position or the reverse locked position, respectively, operate in a similar manner to the first proximity sensor **30** and second proximity sensor **35**, as described herein. For example, the first proximity sensor **80** generates the normal locked detection signal **91**LN that is in the first predetermined range **92** to indicate that the slide bar **55** is in the normal locked position or in the second predetermined range **94** to indicate that the slide bar **55** is not in the normal locked position. In addition, the normal locked detection signal **91**LN is indeterminate of whether the slide bar **55** is in the normal locked position when the normal locked detection signal **91**LN is less than the first predetermined range **92**, greater than the first predetermined range **92** but less than the second predetermined range **94**, or greater than the second predetermined range **94**. In other words, the normal locked detection signal **91**LN is indeterminate of the position of the slide bar **55** when located in indeterminate A, indeterminate B, or indeterminate C regions.

Likewise, the second proximity sensor **85** generates the reverse locked detection signal **91**LR that is in the first predetermined range **92** to indicate that the slide bar **55** is in the reverse locked position or is in the second predetermined range **94** to indicate that the slide bar **55** is not in the reverse locked position. As previously described for other signal determinations, the reverse locked detection signal **91**LR is indeterminate of whether the slide bar **55** is in the reverse locked position when the reverse locked detection signal **91**LR is less than the first predetermined range **92**, greater than the first predetermined range **92** but less than the second predetermined range **94**, or greater than the second predetermined range **94**.

It will be appreciated that the various detection signals **91**PN, **91**PR, **91**LN, **91**LR have, for simplicity, been described as essentially representing the same curve or graphical representation as determined by the microprocessor **90** upon receipt of the respective signalling information. However, it will be appreciated and understood by one skilled in the art that the detection signals may be individually different and positioned within the same or other incremental values of the ranges **92** and **94** and the indeterminate A, indeterminate B and indeterminate C regions. The common aspect of all the detection signals and the processing thereof for purposes of determining point detector bar and slide bar position and status is that the ranges **92** and **94** and the indeterminate A, indeterminate B and indeterminate C regions allow for a more safe and reliable determination of normal point position, reverse point position, normal locked position and reverse locked position status at essentially all times.

While specific embodiments of the invention have been disclosed, it will be appreciated by those skilled in the art that various modifications and alterations to those details could be developed in light of the overall teachings of the disclosure. Accordingly, the particular arrangements disclosed are meant to be illustrative only and not limiting as to the scope of the invention which is to be given the full breadth of the appended claims and any and all equivalents thereof.

What is claimed is:

1. A method of point detection for a railway switch machine having a housing, a point detector bar positionable in a normal point position and a reverse point position, and a slide lock bar positionable in a normal locked position and a reverse locked position, the method comprising the steps of:

providing point detecting means in the housing adjacent the point detector bar;

detecting with said point detecting means the position of the point detector bar;

generating by said point detecting means a normal point detection signal having a first predetermined range of values when said point detector bar is in said normal point position and having a second predetermined range of values, which is different from said first predetermined range of values, when said point detector bar is not in said normal point position;

generating by said point detecting means a reverse point detection signal having a third predetermined range of values when said point detector bar is in said reverse point position and having a fourth predetermined range of values, which is different from said third predetermined range of values, when said point detector bar is not in said reverse point position; and

delivering said normal and reverse point detection signals to processing means for determining if said point detector bar is in the normal point position, the reverse point position, or in neither the normal point position nor the reverse point position.

2. The method of claim **1** further including

employing as said point detecting means a first proximity sensor for detecting when the point detector bar is in the

normal point position and a second proximity sensor for detecting when the point detector bar is in the reverse point position.

3. The method of claim 2 further including

employing as said first proximity sensor and said second proximity sensor inductive proximity sensors.

4. The method of claim 2 further including

generating said normal point detection signal by said first proximity sensor and said reverse point detection signal by said second proximity sensor.

5. The method of claim 4 further including

determining if said normal point detection signal is in said first predetermined range to indicate that said point detector bar is in said normal point position.

6. The method of claim 5 further including

determining if said normal point detection signal is in said second predetermined range to indicate that said point detector bar is not in said normal point position.

7. The method of claim 6 further including

determining if said normal point detection signal is indeterminate of the position of said point detector bar due to said normal point detection signal being less than said first predetermined range, greater than said first predetermined range but less than said second predetermined range, or greater than said second predetermined range.

8. The method of claim 4 further including

determining if said reverse point detection signal is in said third predetermined range to indicate that said point detector bar is in said reverse point position.

9. The method of claim 8 further including

determining if said reverse point detection signal is in said fourth predetermined range to indicate that said point detector bar is not in said reverse point position.

10. The method of claim 9 further including

determining if said reverse point detection signal is indeterminate of the position of said point detector bar when said reverse point detection signal is less than said third predetermined range, greater than said third predetermined range but less than said fourth predetermined range, or greater than said fourth predetermined range.

11. The method of claim 1 further including

providing lock detecting means in the housing adjacent the slide lock bar;

detecting with said lock detecting means the position of the slide lock bar;

generating by said lock detecting means a normal locked detection signal having a fifth predetermined range of values when said slide lock bar is in said normal locked position and having a sixth predetermined range of values, which is different from said fifth predetermined range of values, when said slide lock bar is not in said normal locked position;

generating by said lock detecting means a reverse locked detection signal having a seventh predetermined range of values when said slide lock bar is in said reverse locked position and having an eighth predetermined range of values, which is different from said seventh predetermined range of values, when said slide lock bar is not in said reverse locked position; and

delivering said normal and reverse locked detection signals to said processing means for determining if said slide lock bar is in the normal locked position, the reverse locked position or in neither the normal locked position nor the reverse locked position.

12. The method of claim 11 further including

employing as said lock detecting means a first proximity sensor for detecting when the slide lock bar is in the normal locked position and a second proximity sensor for detecting when the slide lock bar is in the reverse locked position.

13. The method of claim 12 further including

employing as said first proximity sensor and said second proximity sensor inductive proximity sensors.

14. The method of claim 12 further including

generating said normal locked detection signal by said first proximity sensor and said reverse locked detection signal by said second proximity sensor.

15. The method of claim 14 further including

determining if said normal locked detection signal is in said fifth predetermined range to indicate that said slide lock bar is in said normal locked position.

16. The method of claim 15 further including

determining if said normal locked detection signal is in said sixth predetermined range to indicate that said slide lock bar is not in said normal point position.

17. The method of claim 16 further including

determining if said normal locked detection signal is indeterminate of the position of said slide lock bar due to said normal locked detection signal being less than said fifth predetermined range, greater than said fifth predetermined range but less than said sixth predetermined range, or greater than said sixth predetermined range.

18. The method of claim 14 further including

determining if said reverse locked detection signal is in said seventh predetermined range to indicate that said slide lock bar is in said reverse locked position.

19. The method of claim 18 further including

determining if said reverse locked detection signal is in said eighth predetermined range to indicate that said slide lock bar is not in said reverse point position.

20. The method of claim 19 further including

determining if said reverse locked detection signal is indeterminate of the position of said slide lock bar when said reverse locked detection signal is less than said seventh predetermined range, greater than said seventh predetermined range but less than said eighth predetermined range, or greater than said eighth predetermined range.

21. A method of point detection for a railway switch machine having a point detector bar positionable in a normal point position and a reverse point position, the method comprising the steps of:

detecting the position of the point detection bar;

generating a normal point detection signal having a first predetermined range of values when said point detector bar is in said normal point position and having a second predetermined range of values, which is different from said first predetermined range of values, when said point detector bar is not in said normal point position;

generating a reverse point detection signal having a third predetermined range of values when said point detector bar is in said reverse point position and having a fourth predetermined range of values, which is different from said third predetermined range of values, when said point detector bar is not in said reverse point position; and

determining if said point detector bar is in the normal point position, the reverse point position, or in neither the normal point position nor the reverse point position responsive to said normal and reverse point detection signals.

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