United States Patent

Paulve

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[54] **ELECTROMECHANICAL APPARATUS FOR CHECKING AND SIGNALLING THE POSITION OF A RAILWAY-TRACK SWITCH OR THE LIKE**

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[51] **Int. Cl.** **B61l 5/00**

[58] **Field of Search** 200/61.41; 246/253

[56] **References Cited**

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1,035,113	4/1953	France	200/61.41
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Assistant Examiner—M. Ginsburg
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[57] **ABSTRACT**

An electromechanical apparatus for checking and signalling the position of a railway-track switch comprising an electric switch actuated by a cam solid with a cam-carrying shaft forming the crank-pin of a crank whose arm is pivoted to one end of a transmission rod, the other end of which is pivoted to a switch blade, said crank and rod being connected by a ball joint comprising a connecting member mounted on and displaceable along said rod for being fixed in a selectively adjustable relative position.

10 Claims, 5 Drawing Figures

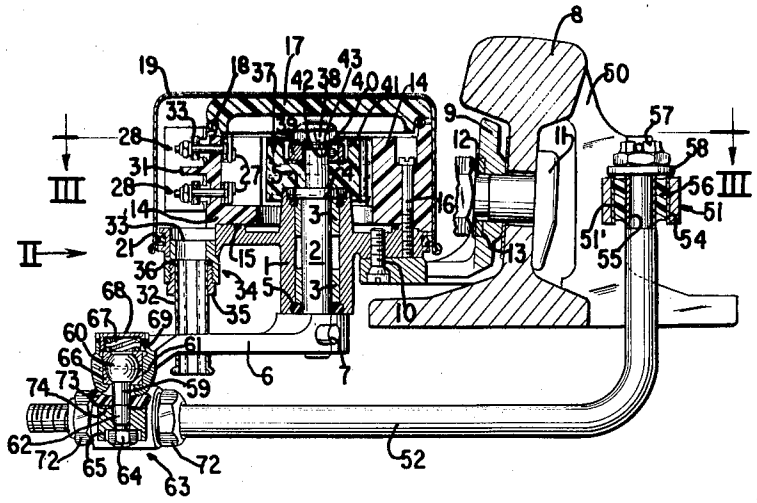


FIG. 1

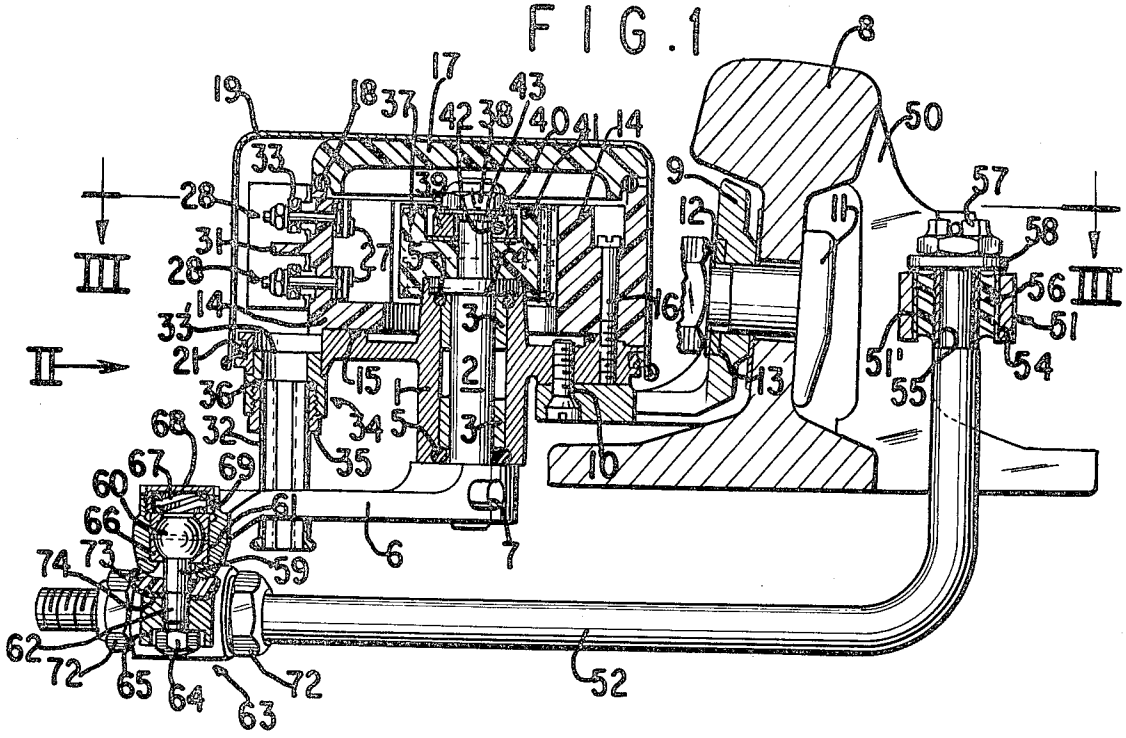

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FIG. 3

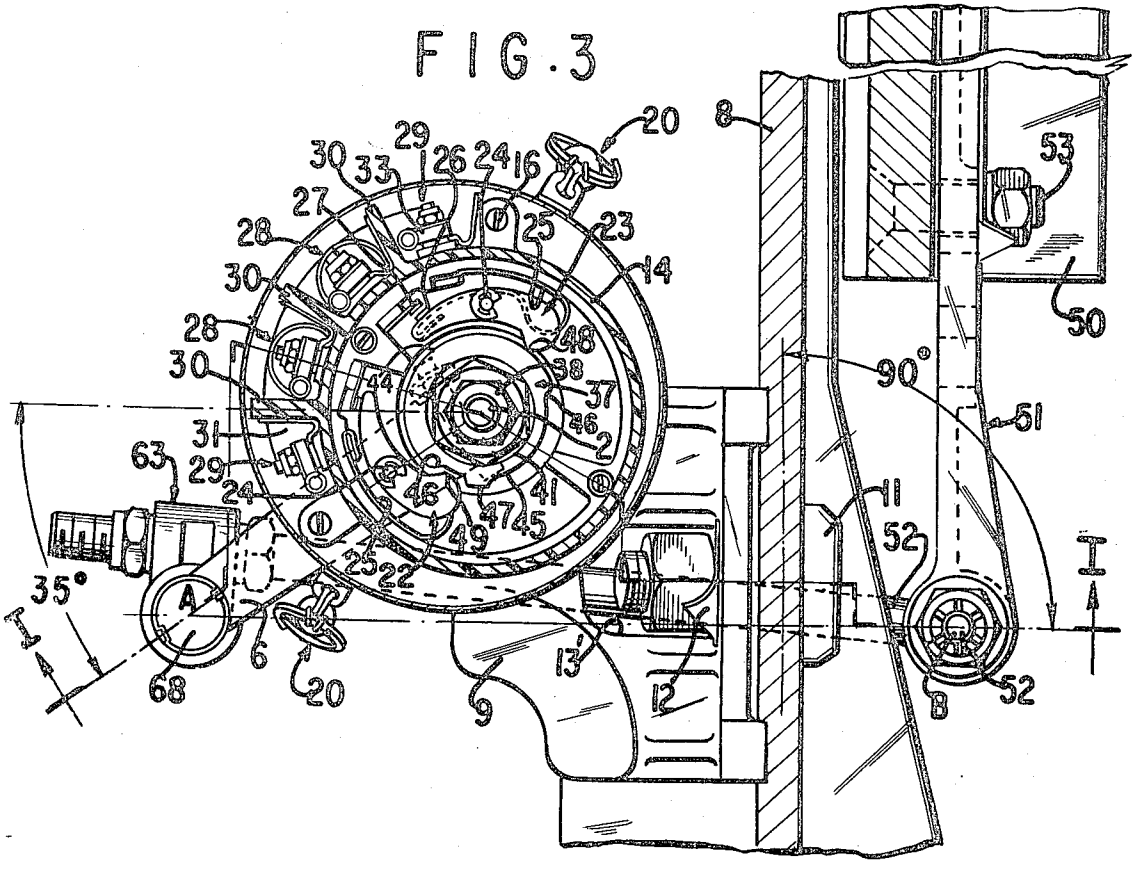
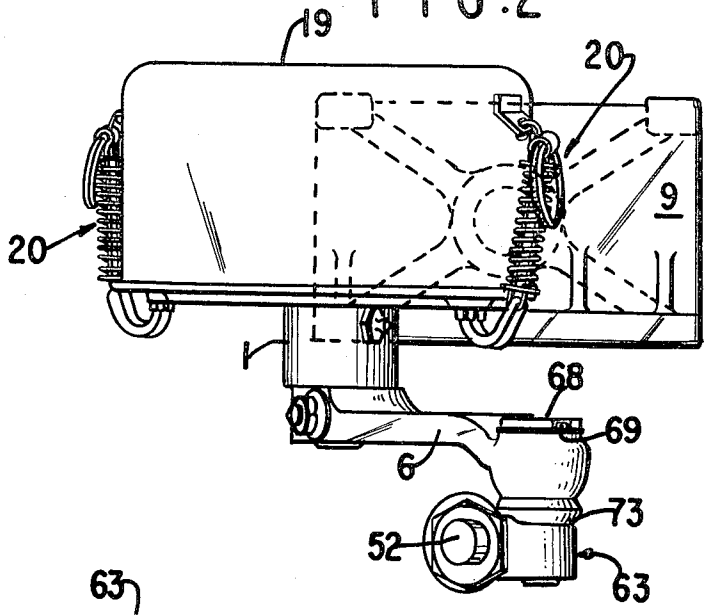

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FIG. 2



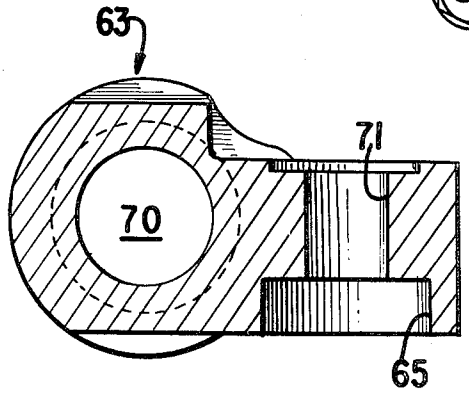


FIG. 5

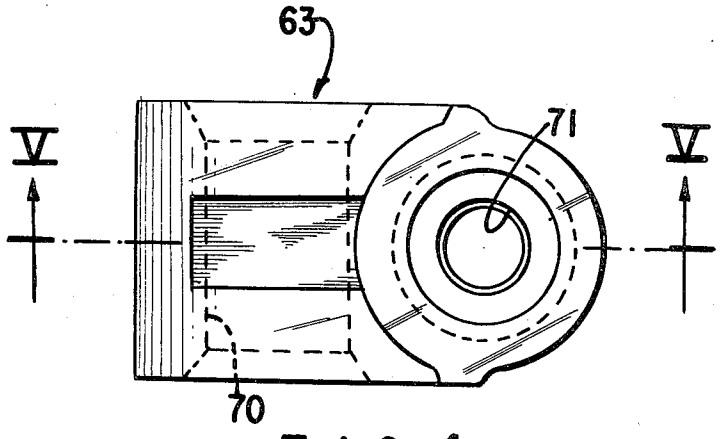


FIG. 4

ELECTROMECHANICAL APPARATUS FOR CHECKING AND SIGNALLING THE POSITION OF A RAILWAY-TRACK SWITCH OR THE LIKE

The present invention relates generally to and has essentially for its object improvements to electromechanical apparatus for checking and signalling the state of a rail-track point or the like, in particular for detecting an disclosing the present relative position of a point and remote transmission, in particular electrically, of such information concerning the applied or the open state of the point to a control cabin or box, various interlocks ensuring, for instance, the actuation of signals being controlled by the said information. The invention also relates to the various applications and uses resulting from the working of the said apparatus, the use of which may be extended for instance to the checking of various locks, as well as to the systems, assemblies, devices, equipments and plants provided with such apparatus.

There is already known, in particular from French Pat. No. 1.035.113, an apparatus of this kind provided with an electric switch of the type described in said patent or of the type disclosed in French Pat. Nos. 1.153.127 and 1.252.608 and actuated by a rotary cam solid in rotation with a cam-carrying shaft forming the pin of a control crank, the arm of which is hinged on one end of a transmission rod whose other end is hinged on the movable switch tongue adapted to be respectively applied against and moved away from the stock-rail of a switch. The said electric switch is placed with its actuating cam in a casing closed sealingly by a cover and supported by a base or stand covered with a hood, whereas the cam is rendered solid through friction with its driving shaft by being clamped against a collar or shoulder of the said shaft by means of a nut screwed on the end of the latter and an interposed, resiliently deformable friction washer.

Such an arrangement is disadvantageous in that in case of longitudinal sliding displacement of the rail-track apparatus constituted by the point, owing in particular to the rail creep phenomenon caused by the braking of trains whose inertial force is thus transmitted to the rails, the apparatus becomes misadjusted with respect to the reference position of the movable switch blade as a result of a slight rotation of the cam displaced by the creep. As a result, in order to compensate for or at least reduce the said misadjustment, it is necessary to remove the said protecting hood and the cover, loosen the cam clamping nut and rotate the cam, for instance by means of a special tool or key, in the appropriate direction of rotation and by the appropriate angle in order to do away with or at least reduce the misadjustment, and then retighten the nut and replace the said cover and hood. This is a rather difficult operation owing to the accuracy and the time required.

The invention has mainly for its purpose to avoid the aforesaid drawbacks and difficulties by eliminating the necessity of acting upon the cam and by enabling to effect the aforementioned compensating adjustment by acting upon a given portion of the system of transmission rods connecting the movable switch blade with the said cam. To this end, the apparatus according to the invention is characterized in that the joint between the said crank and the said rod is preferably of the spherical type forming a ball joint or the like and comprising a connecting member mounted on the said rod so as to be displaceable along the latter and adapted to be fixed in a selectively adjustable relative position. Such an arrangement is advantageous in that in case of casual variation of the distance between the axis of the cam-carrying shaft and the axis of the point connecting the said rod with the said switch blade, the concomitant misadjustment of the cam in its relative angular position may be readily corrected by displacing the said connecting member along the rod by an appropriate amount. Under such conditions, it is not necessary that the cam be displaceable through rotation with respect to its cam-carrying shaft, so that, according to another feature of the invention, said cam is rigidly and positively solid with its driving shaft, in a manner known per se. This offers the advantage of simplifying the design by doing away with the frictional drive, and therefore of reducing costs.

The invention will be better understood and other objects, characteristics and advantages thereof will appear as the following description proceeds, with reference to the appended drawing given solely by way of example illustrating one form of embodiment of the invention and wherein :

FIG. 1 is an elevational, vertical sectional view along the broke line I-I of FIG. 3, of an apparatus according to the invention, in the position wherein the switch blade is applied against the stock-rail of a switch ;

FIG. 2 is an external side view of the direction of the arrow II of FIG. 1 ;

FIG. 3 is a horizontal sectional view along the line III—III of FIG. 1 ;

FIG. 4 is a detailed top view, to a larger scale, of the aforesaid connecting member ;

FIG. 5 is a sectional view along the line V—V of FIG. 4.

According to the form of embodiment illustrated in FIGS. 1 to 3, the apparatus comprises a stand or base 1 in the shape of a substantially horizontal plate provided with a central bored boss forming a sleeve or the like, the axis of which is substantially vertical and which serves as a bearing for the cam-carrying shaft 2. The lower portion of the latter passes through the central bore of the base 1 in which it is mounted through the medium of two bushings or the like 3 consisting advantageously of self-lubricating porous rings in which the shaft is mounted with a turning fit. In its intermediate portion the cam-carrying shaft is provided with a collar or the like 4 forming a stop by which it bears upon the upper end of its bearing. The fluid-tightness of the turning assembly of the cam-carrying shaft in its bearing is ensured at each end by an annular seal or like packing or gasket means 5 set in a suitable groove of the said bearing. The lower projecting end of the cam-carrying shaft is fitted in one end of a radial crank arm 6 with which it is rendered solid by means of a pin or the like 7. The base 1 is advantageously made from steel and is preferably removably fixed to the stock-rail of a switch 8 by means of a support 9 made for instance from moulded steel and consisting of a ribbed or suitably strengthen-ed or stiffened bracket whose vertical arm, in particular, comprises a surface by which it bears upon the stock-rail of a switch and the shape of which is adapted to the profile and inclination of the web, the head and the base of the said rail against which it is adapted to be applied. The said bracket 9 is secured by means of its horizontal arm, laterally and underneath the stand 1 by means of screws or the like 10. The fastening of the bracket to the rail 8 is ensured by a bolt 11, for instance of the type provided with a hammer-shaped head serving to prevent its rotation. The said bolt passes through the web of the rail 8 and the vertical arm of the bracket 9 by passing through suitable aligned holes and its nut is locked or prevented from loosening by means of an interposed small braking plate 12 bent against a side of the nut and a split resilient washer, for instance of the Grower type 13, interposed between the braking plate 12 and the vertical arm of the support 9 by being sunk in a recess or the like provided in the said arm and serving, in case of breakage of the Grower washer, to prevent the washer fragments from falling, the latter thus continuing to exert a pressure upon the nut. The access to the nut of the bolt 11, in particular for a suitable tool or key, is facilitated by the presence of an appropriate recess or hole 13' provided in the horizontal arm of the support 9 below the location of the said nut.

On the stand 1 is mounted the casing 14 of the electromechanical switch, made from an insulating material, for instance from moulded monolithic synthetic material. The bottom of said casing is traversed by a central orifice allowing for the passage of the cam-carrying shaft and the upper end of the bearing of the latter. The said bottom is advantageously provided at its outer periphery with a descending flange by which it may be set in a mating slot or groove of the stand 1, an annular seal or gasket being preferably interposed by being mounted in a corresponding circular slot of the plate of the base 1 in the upper surface of the latter (see FIG. 1). The casing 14 is secured to the stand 1 by means of screws or the like,

for instance four in number. The casing is closed at its top by a removable cover **17** which is also made from an insulating material, for instance moulded plastics, with an annular seal or gasket **18** interposed between the said cover and the upper edge of the casing. The cover is retained simply as a result of the pressure exerted by a hood **19** made preferably from plastics and secured to the stand **1** by means of two resilient fastening devices **20**, and the fluid-tightness of the stand is ensured by an annular seal or gasket **21** mounted in a corresponding peripheral slot of the stand. In the mounted and assembled state, the casing **14** therefore forms a sealingly closed container capable of containing a reserve of oil introduced once and for all during the mounting and ensuring permanent lubrication of the apparatus.

In the casing **14** are mounted four contact pawls arranged in two superposed pairs **22, 23** allowing to switch off or to switch over two separate electric circuits. Both pawls of each pair are pivotally mounted on two fixed vertical pins **24** solid with the casing **14** (see FIG. 3). The four pawls, which are thus associated in twos, respectively form two superposed contact sets and are advantageously made from nylon. They are respectively subjected to the permanent action of a return leaf-spring **25** made from instance from beryllium bronze. The contact element **26**, made for instance from non-corroding alloy, of each pawl is adapted to co-operate with a corresponding fixed contact element **27** carried by the free end of a substantially fork-shaped member secured and connected respectively to a terminal **28** passing through the side wall of the casing **14** and extending into the free space between the said casing and the protecting hood **19**. Each leaf-spring **25** serves as an electric conductor and is connected at one end to a terminal **29** and at the other end to the contact element **26** of the pawl which is constantly so urged by its spring as to remain applied against the associated fixed contact element **27**. The various terminals **28, 29** are advantageously separated or isolated from one another by radial partitions **30** and circumferential partitions **31**. The connecting cables (not shown) penetrate into the casing **14** through a connection tube **32**. The said cables are attached to the corresponding terminals by means of lugs or like electric connection means **33**. The tube **32** is sealingly secured to the base **1** by means of a sealing device. To this end, the inlet for the cables **33** is constituted by a sleeve **34** provided with an internal shoulder and sealingly solid with the base **1**. The tube **32** terminates at its inner end with a collar forming a flange or the like and abutting against the internal shoulder of the sleeve **34** forming a sealing body against which it is clamped by means of a nut **35** and an interposed seal ring **36**. When the tube **32** is removed the inlet **33** is sufficiently wide to allow the cable lugs **33'** to be passed therethrough.

Both pairs of pawls **22, 23** are both opened or closed by a common actuating cam **37** made from an insulating material, for instance moulded plastics. This cam is provided with a central bore by which it is mounted on the upper portion of the cam-carrying shaft **2** above the collar **4** of the latter, which collar is located in a corresponding recess of the cam. The cam **37** is rendered solid with its cam-carrying shaft through frictional connection by way of clamping by means of a self-locking nut **38** screwed on the upper threaded end of the cam-carrying shaft and by means of an interposed clamping washer **39** and a spring washer **40** located in a corresponding recess **41** on the upper face of the cam **37**. The recess **41** is advantageously in the shape of a polygonal, for instance hexagonal orifice allowing a special key or the like tool to be introduced therein to cause the cam **37** to turn with respect to its shaft in order to vary and adjust its angular position. To prevent the rotation of the clamping nut, when the latter is being screwed, from driving the washer **39** and therefore the cam **37** in rotation, the cam-carrying shaft is provided with a lateral radial pin **42** (FIG. 1) located in a corresponding longitudinal groove **43** of the internal bore of the washer **39**. Besides, this possibility of adjusting the angular position of the cam by rotating the same becomes useless owing to the new system of transmission which will be described later, so that the cam may be rendered directly solid with its shaft as by sticking or by keying or by any other suitable positive fixing means.

The working peripheral surface of the cam **37**, consisting of a substantially cylindrical surface, is composed in plan by two arcs of circle of different radii, namely a large radius arc **44** and a smaller radius arc **45**, the said two arcs or convex cylindrical surface portions being interconnected respectively by curve or oblique surface portions **46** at each end (see FIG. 3). The smaller radius arc **45** is provided with an intermediate convex boss **47** projecting radially outwardly and interrupting the arc **47** or subdividing it into two portions. The cam **37** is adapted to co-operate simultaneously with the corresponding noses **48, 49** of the pairs of pawls **22, 23**, so that when the longer radius working profile **44** of the cam is in contact with the noses **48** or **49** of the pawls, the contacts of the latter are closed, whereas they are opened when the longest radius profile **44** does not engage the noses of the pawls considered. The smaller radius profile **45** has a sufficiently small radius to prevent the profile **45** from coming into contact with the noses **48, 49** of the pawls when the latter are in contact closing position. In the configuration illustrated in FIG. 3, the pair of pawls **23**, the noses of which are in contact with the longer radius working profile of the cam **44** has its contacts in the open position, whereas the pair of pawls **22**, the noses of which are opposite the smaller radius profile **45**, has its contacts closed by the action of the return springs **25**.

Both said pairs of contacts comprise respectively two contacts for checking the application of the switch and two contacts for checking the opening of the switch. The contact for checking the application, such as for instance **22**, are closed when the switch blade is applied on the stock-rail of a switch, and remain closed during a pre-determined travel of, for instance, **5** mm measured at the tip of the switch blade. They must be opened when the opening or spacing of the switch blade is, for instance, **6** mm measured at the tip of the switch blade. The contacts for checking the opening of the switch blade, for instance the contacts **23**, are closed when the travel of the switch blade is equal to or exceeds for instance about **80** mm measured at the tip of the switch blade.

Thus, the movable contact or contact-carrying members constituted by the pawls are moved and in particular resiliently returned to closed position during the approaching motion and the application of the movable switch blade **50** within a predetermined spacing of the latter from the stock-rail of a blade **8** and are actuated so as to be opened by the rotary cam **37** operated by the said switch blade through the medium of a positive transmission beyond the said predetermined spacing. The function of the additional safety boss **47** of the cam **37** is to again open the said contact in case of untimely closing thereof when the spacing of the switch blade **50** exceeds the said predetermined spacing.

The transmission mechanism connecting the movable switch blade **50** of the cam-carrying shaft **2** comprises an end fitting or like element **51** connected by a bent rod **52** to the crank arm **6**. The end fitting **51** is provided with several longitudinally spaced holes allowing it to be adjusted longitudinally with respect to the switch blade **50** against which it is secured by at least two, for instance countersunk-head bolts **53**, the nuts of which are respectively locked by means of Grower washers and braking plates. The free end of the end fitting **51**, which extends substantially horizontally and projects beyond the switch blade **50**, is provided with an eye or the like by which it is hingedly mounted at the corresponding end of the bent rod **52**. This hinged connection is constituted by a resilient joint of the type commercially known as "silent-bloc" which is composed of an outer ring **54** fitted in the eye **51'**, and inner ring **55** passed on a shoulder surface at the upper end of the rod **52** and an annulus **56** made from rubber or a like elastomer product mounted with a tight fit between the two rings. This joint is clamped by means of a slotted or castle nut **57** screwed on the threaded end of the rod **52** with

an interposed bearing washer 58 the dimensions of which, as well as those of the nut, are sufficient to prevent the rod 52 from becoming detached or separating from the end fitting 51 in case of breakage of the said resilient joint. Such a resilient joint allows for angular displacement of the rod 52 and crank 6 assembly in a horizontal plane. The bent rod 52 which thus comprises a substantially vertical portion and a substantially horizontal portion is hingedly connected by the end of the latter to the crank 6 by means of a joint comprising a hinge pin 59 provided with a spherical head forming a ball 60 located in a mating cavity 61 provided at the corresponding end of the arm of the crank 6, the said hinge pin having its opposite end preferably provided with a substantially conical surface 62 fitted in a mating conical orifice of an adjusting connection member 63. This lower end of the pin 59 receives suitable removable locking means such as, for instance, a nut or the like 64 screwed on the threaded end of the said lower end of the pin and sunk in a suitable recess 65 provided on the said connecting member. Means are advantageously provided for automatically taking up the play resulting from the wear in the bearing 61 of the said joint, the said means consisting preferably of a bushing or the like 66 made in two pieces separated by a substantially horizontal jointing plane extending approximately at the level of the equatorial plane of the ball 60. The bushing 66 is so located in the cavity 61 as to surround and support the spherical head 60 and it is resiliently retained in contact with the said head by a helical spring 67 bearing respectively upon the bushing 66 and against a stop 68, the relative position of which may be selectively adjustable and which consists for instance of a threaded cap or the like screwed on the end of the crank 6 and locked by suitable locking means 69. As appears from FIGS. 4 and 5 the adjusting member 63 consists of a single-piece element comprising a smooth cylindrical bore 70 allowing it to be slidingly and rotatably mounted on a cylindrical or round portion of the rod 52 and a preferably conical bore 71 receiving the mating surface of the hinge pin 59, the respective longitudinal axes of the said bores being arranged in spaced and substantially orthogonal relationship to one another. Locking means are provided to fix the adjusting member 63 in a selected position on the horizontal portion of the rod 52, the said means consisting advantageously of two self-locking nuts 72 screwed on a corresponding threaded portion of the rod 52, respectively on either side of the member 63 so as to clamp the latter. The said self-locking nuts are for instance of the type provided with a locking ring.

A yieldable or resilient annular sealing ring or gasket 73 is pressed between the member 63 and the end of the arm of the crank 6 forming a ball box, the said ring being preferably set in a rigid, for instance metal cup or dish 74, and receiving a bulging portion provided on the said crank arm end being applied on the said ring.

It should be noted that the resilient hinged connection 54-56 between the rod 52 and the end fitting 51 ensures the damping of vibrations and has sufficient mobility to withstand the vertical oscillations of the switch blade 50 as well as a sufficient angle of torsion during the operation of the apparatus. The device connecting the rod 52 with the crank 6 enables to readily adjust the connection point of the rod 52 with the end fitting 51, i.e. with the switch blade 50. Such adjustment must correspond to such a relative position that for optimum adjustment of the rotary cam 37 and in the closed or applied position of the switch, the vertical plane AB passing through the vertical axis of the ball 60 and through the resilient hinged connection 54–56 be substantially perpendicular to the stock-rail of a switch 8 when the switch blade is applied (see FIG. 3). In view of such adjustment, the arm of the crank 6 is inclined for instance by 35° to the normal vertical plane of the stock-rail of a switch 8. The device for connection by means of the said connecting member 63 offers the advantage of enabling to compensate for or reduce any misadjustment caused by the creep of the switch resulting in particular from the braking of trains. The necessity of adjustment of the cam 37 proper is thus avoided.

The presence of the additional boss 47 on the cam 37 enables to avoid that a deformation of the system of actuating rods, for instance an opening of the angle of the elbow of the rod 52, may increase the safety figure corresponding to an opening of the switch blade lower than or equal to, for instance, 6 mm. The boss 47 thus enables to open the contact again in case this figure should be exceeded and to indicate or signal the presence of a defect (deformation of the rod 52), so that the interlocks serving for instance for the actuation of signals cannot be operated.

Of course, the invention is by no means limited to the form of embodiment described and illustrated, which has been given by way of example only. In particular, it comprises all the means constituting technical equivalents to the means described as well as their combinations, should the latter be carried out according to the spirit of the invention.

What is claimed is :

1. In an electromechanical apparatus for checking and signalling the state of a railway-track switch including a stock-rail and a switch blade and comprising: an enclosure formed of a casing and a base connected to said stock rail; an electrical switch provided in said enclosure; a rotary cam actuating said electrical switch; a rotating driving shaft carrying said rotary cam solid in rotation with said driving shaft; a crank actuating said driving shaft forming the crank pin of said crank; and a rod, one end of said rod being assembled by a hinged connection to said crank, the other end of said rod being hingedly connected to said switch blade, wherein the improvement consists in that said hinged connection between said crank and said rod is of a spherical type forming a ball-joint and comprising a connecting member movably mounted for adjustment along said rod and locking means fixing said connecting member on said rod in a selected position, in that said casing and said base comprise means so as to form a fluid-tight mechanical unit and in that the connection between the said cam and its driving shaft is of rigid and of positively solid character.

2. Apparatus according to claim 1, wherein said ball-joint comprises a joint pin, one end of said joint pin being provided with a spherical head forming a ball, the opposite end of said joint pin being provided with a substantially conical surface, a mating cavity provided in the end of said crank and with said ball located therein, a mating conical orifice in said connecting member in which said conical surface is fitted, said opposite end of the joint pin receiving a removable locking means consisting of a nut screwed on a threaded portion of said opposite end.

3. Apparatus according to claim 2, including a bearing for said ball-joint and additionally comprising means for automatically taking up the play resulting from wear in the bearing of said joint, said means including a two-piece bushing located in said cavity, said bushing surrounding and supporting said spherical head, an adjustable stop comprising a threaded cap, and a spring bearing upon said stop and bearing upon said bushing and resiliently retaining said bushing in pressure contact with said head.

4. Apparatus according to claim 2, wherein said connecting member consists of an integral element comprising a smooth cylindrical bore slidingly and rotatably mounted on a round portion of said rod, and a conical bore receiving said joint pin, both said bores having their respective longitudinal axes in spaced and substantially orthogonal relationship.

5. Apparatus according to claim 4, wherein said means for fixing the connecting member comprises at least two self-locking nuts screwed on a threaded portion of said rod respectively on either side of said connecting member, and locking rings associated respectively with said locking nuts.

6. Apparatus according to claim 2, further including a resilient sealing ring interposed in pressure contact between said connecting member and the end of said crank containing said ball, and a rigid cup in which said ring is set, said crank end having a bulging portion applied on said sealing ring.

7. Apparatus according to claim 1, further including a fastening lug for removably securing said base to a stock rail of

a switch, a separate fixing bracket having a plurality of recesses, and fastening means located therein for removably connecting said bracket to said base, wherein said fastening lug additionally forms a flange of said bracket.

8. Apparatus according to claim 1, further including end-fitting means for hingedly connecting said switch blade to said rod, said end-fitting means being so constructed and arranged as to be removably secured to and selectively adjustable on said switch blade.

9. Apparatus according to claim 1, further including means for friction driving said cam, said friction driving means comprising a collar located on one side of said cam on said cam driving and carrying shaft, a frictional resilient washer having a longitudinal slot in the bore thereof and being located on the other side of said cam, a nut adjacent said washer and screwed on the end of said shaft, and at least one radial pin solid with said shaft and penetrating into said slot.

10. Apparatus according to claim 1, wherein the casing of said switch enclosure incorporates an orifice through which said cam-carrying shaft passes, and further including a hood (19) for protecting said enclosure, a plurality of annular gaskets for sealing said casing, tube means (32) for allowing entry of electrical cable means into said casing and means (34, 35, 36) for sealing said tube means.

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