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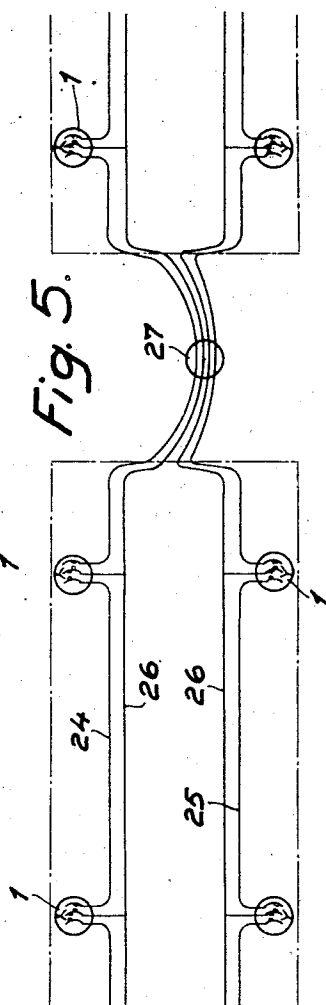
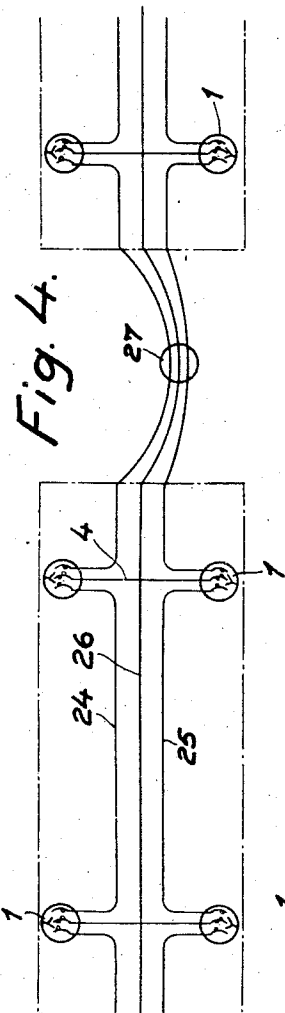
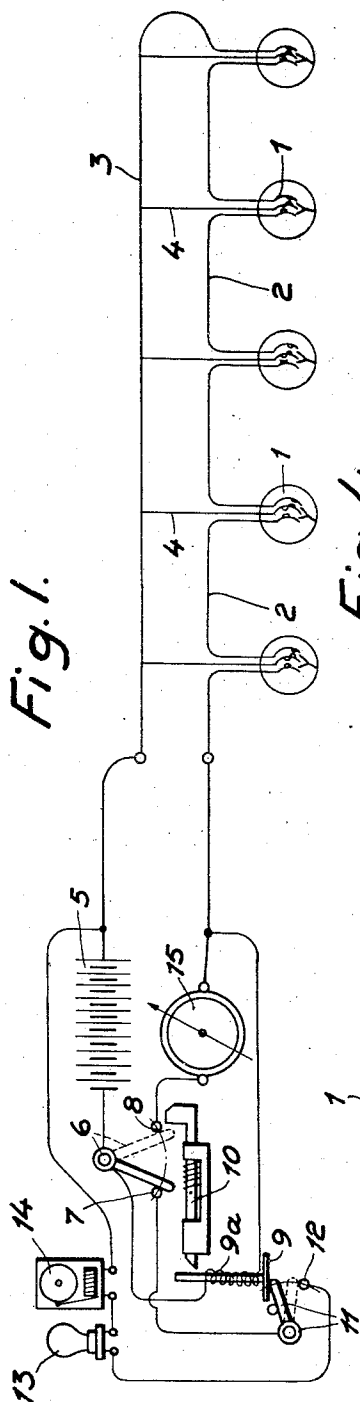
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2,408,660

REMOTE INDICATION SYSTEM

Filed May 25, 1943

3 Sheets-Sheet 1



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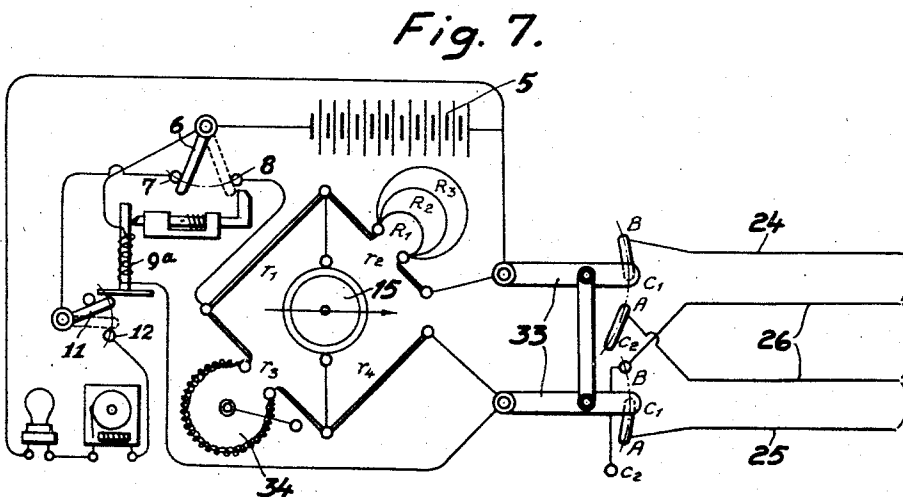
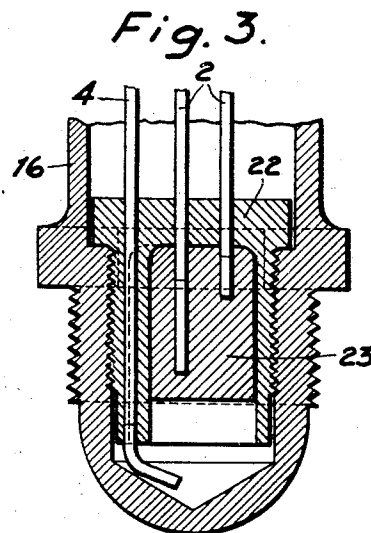
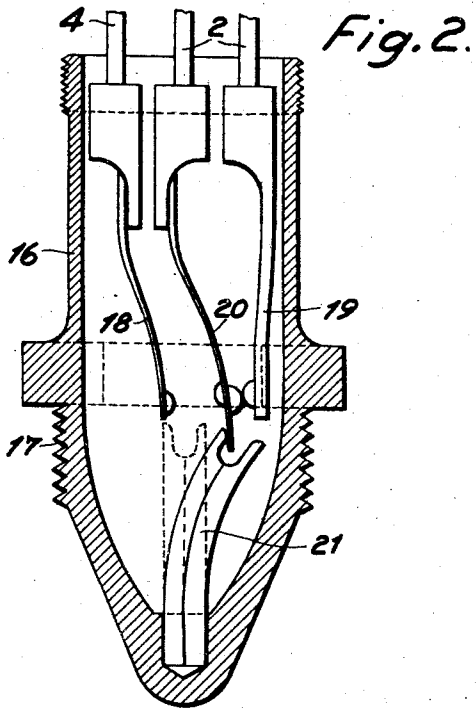
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2,408,660

REMOTE INDICATION SYSTEM

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3 Sheets-Sheet 2



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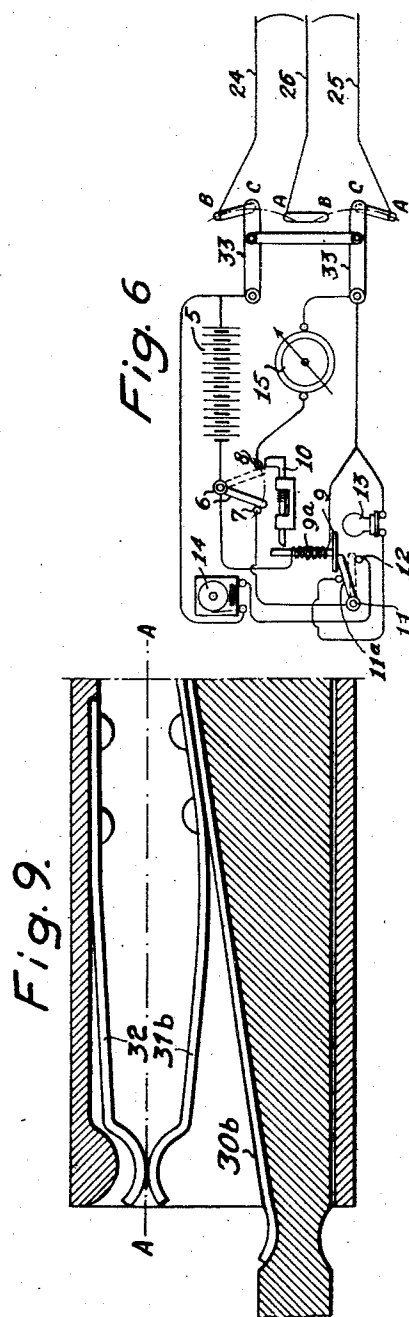
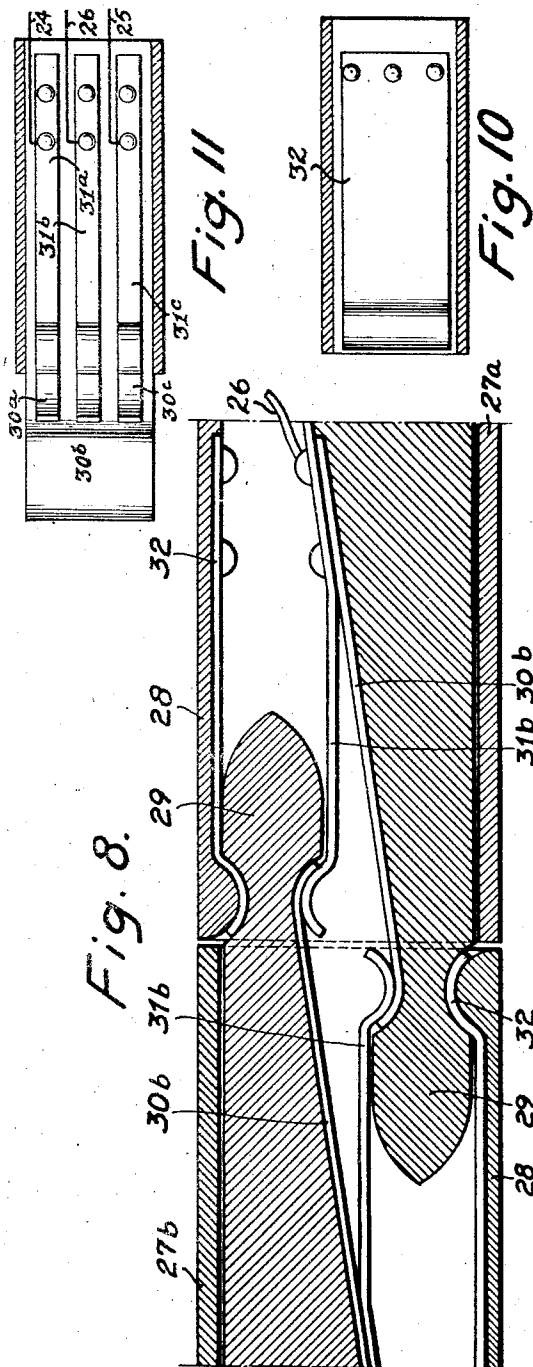
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REMOTE INDICATION SYSTEM

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,408,660

REMOTE INDICATION SYSTEM

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5 Claims. (Cl. 177—311)

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The present invention relates to remote indication systems and more particularly to a circuit arrangement for indicating at a control station the occurrence, at any of a plurality of remote locations, of a predetermined physical condition.

One object of the invention is to provide a circuit arrangement of this type for use on railroad trains to operate an alarm in the engineer's cab as soon as a bearing begins to run hot and also to indicate the location of the hot bearing.

Another object of the invention is to provide a remote indication system of simple construction which is reliable in its operation and comparatively simple to install.

A still further object of the invention is to provide an electrical alarm and indication system, in which the alarm mechanism is operated when a normally established circuit is broken, whereas the indicator is normally disconnected, but can be connected into an indicating circuit established upon the occurrence of a predetermined condition at a remote location.

These and other objects which will appear more fully as the specification proceeds are accomplished, according to the present invention, by the arrangement and combination of elements, set forth in the following detailed description, defined in the appended claims and illustratively exemplified in the accompanying drawings, in which:

Fig. 1 is a circuit diagram of one arrangement according to the invention.

Figs. 2 and 3 are sectional views of a bimetal make after break contact device and of a fuse make after break contact device, respectively, which may be used in the arrangement according to Fig. 1.

Figs. 4 and 5 are partial diagrams of modified circuit arrangements intended particularly for railroad trains.

Figs. 6 and 7 are partial diagrams of circuit arrangements with modified control stations.

Fig. 8 is a central sectional view of a line coupling comprising two coupling members in their connected positions.

Fig. 9 shows the right hand coupling member after it has been disconnected from the left hand member.

Figs. 10 and 11 are two sectional views taken on line A—A in Fig. 9 and viewed in opposite directions, respectively.

In the arrangement shown in Fig. 1 which is particularly intended for stationary machinery, a number of thermally operated make after break

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contact devices 1, described in more detail later on, are connected in series in a bus line 2 which, at its right hand end, is connected with a zero conductor 3. Shunt lines 4 extend from the zero conductor 3 in parallel to each of the contact devices 1. The left hand end of the zero conductor 3 is connected to one terminal of a battery 5. The other terminal of the battery 5 is connected in parallel to a changeover switch 6 and, through the winding 9a of a relay 9, to the left hand end of the bus line 2. The change over switch 6 has two contacts 7 and 8. Contact 7 is connected with a back contact 11 of the relay 9. The back contact 11 cooperates with a stationary contact 12 connected through a lamp 13 and a bell 14 with the first mentioned terminal of the battery 5. The contact 8 of switch 6 is connected through an indicating instrument 15 with the bus line 2. The circuit through coil 9a of the relay 9 is normally closed but will be broken in a manner explained later on when any one of the bearings reaches a critical temperature. When this happens, the relay 9 is released and closes the contacts 11, 12 to complete a circuit from battery 5 through the lamp 13 and bell 14 back to battery whereby the lamp is lighted and the bell is operated. Simultaneously, a spring actuated latch 10 is released and assumes a position in which it prevents the armature of relay 9 from returning to its initial position even after the flow of current through its coil 9a has been resumed.

In order to liberate the armature of relay 9, the latch 10 must be withdrawn by means of the lower end of the manually controlled switch lever 6 cooperating with a projection on the latch 10 when the switch 6 is changed over to close the contact 8. Thus, the latch 10, insures continuation of the alarm signal until the engineer operates switch 6 to change over from contact 7 to contact 8. As a result of this operation, the relay 9 is liberated and the signal circuit through 13 and 14 is interrupted so that the engineer is no longer troubled by the ringing of the bell 14. Simultaneously, the instrument 15 is connected into the line circuit to indicate the location of the hot bearing as explained below.

The contact devices 1, two embodiments of which are illustrated in Figs. 2 and 3, are constructed in such a way that each device at a location where a critical condition occurs, e. g. where the associated bearing reaches a critical temperature, first interrupts the bus line 2 at such location, and, immediately thereafter, connects the associated shunt line 4 with that part

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of the bus line 2, which in Fig. 1 is disposed to the left of the location in question. As a result, the circuit including the instrument 15 is closed through all the contact devices 1 which, in Fig. 1, are to the left of the hot bearing. The bus line 2 may consist of wire of relatively high resistance and may be so arranged that the resistances between successive contact devices 1 are equal. Alternatively, the line may consist of low resistance wire and have equal ohmic resistances connected therein between successive contact devices 1. In either case, the instrument 15 will operate in function of the magnitude of the resistance of the part of the bus line 2 disposed in Fig. 1 to the left of the hot bearing. As will be clear, the instrument may be graduated to indicate directly the location of the hot bearing.

Each contact device 1 may be formed and connected, for example as shown in Fig. 2. The contact device shown in this figure comprises a casing 16 provided with an external screw thread 17 to be screwed into a threaded bore in the bearing to be controlled. The associated shunt line 4 and the part of bus line 2 to the right of each contact device 1 (as shown in Fig. 1) are connected to two contacts 18 and 19, respectively, while the part of bus line 2 to the left of each contact device 1 as shown in Fig. 1 is connected to a contact spring 20. The contact spring 20 is controlled by a bimetal bar 21 fixed in the casing 16. In cold condition, the bimetal bar 16 assumes a bent position, as shown in full lines in Fig. 2, thus keeping the contact spring 20 in touch with the contact 19 so that the two parts of bus line 2 are normally series connected with each other. However, when the bearing reaches its critical temperature, the bimetal bar straightens, as shown in dotted lines in Fig. 2 and the contact 19, 20 is broken so that the line current is interrupted and the relay 9 is released. Shortly thereafter, the contact spring is caused to touch the contact 18 so that the zero conductor is connected through the associated shunt line 4 with the part of bus line 2 which extends to the left of the operating contact device 1 in Fig. 1. The instrument 15 may now be connected into this circuit to indicate the location of the bearing which is running hot.

In the modified contact device shown in Fig. 3, a hollow plug 22, made for example of ceramic or Bakelite, is screwed into the casing 16. The terminals of lines 2 and 4 pass through bores provided in the plug 22. An easily fusible metal 23 is cast into the plug 22 and surrounds both terminals of the bus line 2 without reaching the exposed terminal of the shunt line 4. When the bearing becomes hot, the metal 23 fuses and breaks the contact between the two terminals of the bus line 2. Shortly thereafter, the molten metal established contact between the terminal leading to the part of the bus line 2 extending to the left of the contact device 1 in Fig. 1 and the terminal of the shunt 4 leading to the zero conductor 3.

Figs. 4 and 5 show circuits which are particularly intended for railroad trains. These circuits comprise two bus lines 24, 25 into which the contact devices 1 are connected in series and either one (Fig. 4) or two (Fig. 5) zero conductors 26. The shunt lines 4 extend from said zero conductor or conductors 26 to the contact devices 1 in the bus lines 24, 25. The two pairs of contact devices 1 shown in the left hand part of each of Figs. 4 and 5 belong to the bearings of one carriage. All the lines 24, 25 and 26 pass-

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ing through this carriage are connected to the corresponding lines in an adjacent carriage, indicated in the right hand part of Figs. 4 and 5, by means of diagrammatically shown couplings 27. The arrangement may comprise three wires (Fig. 4) or four wires (Fig. 5). In the case of a three line arrangement, the wires are, preferably, disposed approximately centrally under the carriage and follow, for example, the compressed air brake line. The shunt lines 4 run along the axles to the respective bearing bushes on both sides of the carriage. The zero conductor 26 runs without interruption throughout the length of the carriage and is connected by the shunt lines 4 to the individual contact devices 1, respectively.

In an arrangement comprising two bus lines 24, 25 and two zero conductors 26, the four wire line may either run centrally under the carriage or, as shown in Fig. 5, it may be branched in such a way that one bus line 24 or 25 and one zero conductor 26 extend along each carriage side immediately above the bearing bushes. The lines 24, 25 and 26 are combined into a common flexible cable at each carriage end where they terminate in a suitable coupling piece.

One embodiment of a coupling which may be used in connecting the circuits of successive railroad carriages in a system according to the present invention is shown in Figs. 8 to 11. The coupling illustrated in Fig. 8 comprises two similar coupling members 27a and 27b. Each coupling member consists of an insulating casing 28 having mounted therein and projecting therefrom an insulating plug 29 on which a plurality of contact bars 30a, 30b, and 30c are located side by side but insulated from one another, as shown in Fig. 11. Each contact bar 30a, 30b, 30c is connected with a contact spring 31a, 31b, and 31c, respectively, and each contact bar with its appertaining contact spring is connected to one of the lines running through the train. As exemplified in Fig. 11, bar 30a and spring 31a are connected to the bus line 24 (see Fig. 3), contact bar 30b and spring 31b are connected to the zero conductor 26, and bar 30c and spring 31c are connected to the bus line 25. Within each casing 28 there is further provided a metal spring plate 32 with which, in disconnected condition of the member 27a or 27b all the contact springs 31a, 31b and 31c make contact (see Fig. 9). When coupling is to be effected, the insulating plug 29 of each coupling member 27a and 27b is inserted between the contact springs 31a, 31b, 31c and the spring plate 32 of the other members 27b and 27a, so that, in each member, the connection between the spring 31a, 31b and 31c by means of the spring plate 32 is broken and each contact bar 30a, 30b and 30c of each coupling member 27a and 27b is separately connected with the corresponding contact springs 31a, 31b and 31c of the other coupling members 27b and 27a. Thus a through connection between the corresponding bus lines and zero conductors from carriage to carriage is established.

Figs. 6 and 7 show diagrammatically different embodiments of the instruments at the control station of the device and also modified connections of the lines to said control station.

According to Fig. 6, the line system corresponds to that shown in Fig. 3, i. e. it comprises three wires including two bus lines 24, 25 and a common zero conductor 26. Contact devices 1 are connected serially into the bus lines 24 and 25 in the manner shown in Figs. 1 to 3. Each wire is connected with two terminal contacts arranged

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for cooperation with a change over switch 33 having its two arms connected to two terminals of the control station, respectively. The control station comprises a resistance measuring instrument, such as a galvanometer, 15, which is so graduated that each line represents a certain bearing on the train. Thus, when the switch 33 is set to its proper position, the engineer can directly see which bearing is running hot.

In the circuit connection of the control station according to Fig. 6, the lamp 13 is normally lighted, but becomes extinguished when a bearing begins to run hot, as the circuit through the lamp includes both bus lines 24, 25, normally connected in series by the change over switch 33 set to the position C, as shown in the drawings. When this circuit is broken in one of the contact devices 1, the relay 9 connected in parallel with lamp 13 across the battery 5 through the serially connected bus lines 24, 25 releases and the bell mechanism 14 is energized over the back contact 11 of relay 9, as in Fig. 1. Normally, the switch 6 is set to the position shown and the change over switch 33 is set to the position C. Current then flows from one terminal of the battery 5 through the relay winding 9a, and parallel, therefore, over switch 6, contact 7 and front contact 11a of relay 9 through lamp 13 to the lower contact arm of switch 33, thence over contacts C, A through bus line 25 to the end of the train, and back through bus line 24 over contacts B, C and the upper contact arm of switch 33 to the second terminal of the battery 5. When a bearing begins to run hot and break contact (e. g. 19, 20 in Fig. 2) is caused to operate, the lamp 13 is extinguished and the relay 9 releases and connects the bell mechanism 14 into a circuit extending from the first terminal of battery 5 over switch 6, contact 7, back contact 11 of relay 9 and through the bell mechanism 14 to the other terminal of battery 5.

The engineer, then, operates the switch 6 to connect the first terminal of the battery 5 through switch 6 and contact 8 to one terminal of the galvanometer 15. Simultaneously, the lamp and bell circuits are both broken at contact 7 of switch 6. Next, the change-over switch 33 is set to the position A to test the left side of the train and subsequently to position B to test the right side of the train. When the switch 33 is in position A the circuit through the galvanometer 15 is closed through the lower arm of 33, contact A, bus line 25, zero conductor 26 connected to the bus line 25 either at the end of the train or at the location of the hot bearing, contact A and upper arm of the switch 33 to the second terminal of battery 5. With switch 33 in position B the circuit through the galvanometer 15 is closed through the lower arm of switch 33, contacts B, A, zero conductor 26, bus line 24 connected to the zero conductor 26 either at the end of the train or at the location of the hot bearing, contact B and upper arm of switch 33 to the second terminal of the battery 5. The hot bearing is found in the line for which the galvanometer 15 displays the smaller deflection, and the magnitude of such smaller deflection indicates which bearing is running hot counted from the locomotive. If, in the arrangement according to Fig. 6, the switch 33 is set to either its position A or its position B while the switch 6 is in its position closing its contact 7, the circuit through the winding 9a of relay 9 would immediately be closed over the zero conductor 26, but due to the latch 10, the relay 9 would be prevented from

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attracting its armature so that the circuit through the bell 14 would not be broken and the circuit through the lamp 13 which includes a front contact 11a of the relay 9 could not be re-established until after the switch 6 has first been moved to its right hand position and has, then, been returned to its original position.

Fig. 7 shows a four wire system corresponding to that illustrated in Fig. 4, with two bus lines 24, 25 and two zero conductors 26. A resistance measuring apparatus constructed in the form of a Wheatstone bridge is provided at the control station. Normally, the current flows from the battery 5 through the relay winding 9a and the change-over switch 33 in the illustrated position C₁ and hence, through the two bus lines 25, 26 in series back to the battery.

After an alarm has been given due to the operation of a contact device 1, and the switch 6 has been operated, the change-over switch 33 is set successively from its normal position C₁ to the test positions A and B. In either test position of the switch 33, the rheostat 34 is turned until the galvanometer 15 indicates 0, whereby, as known, the bridge branch resistances r_1 , r_2 , r_3 and r_4 are related to one another as follows: $r_1/r_2 = r_3/r_4$. r_4 represents the resistance of the train line. The pointer of the rheostat 34 now indicates which bearing is running hot. Three or more ohmic resistances R_1 , R_2 , R_3 having different values are adapted to be connected into the bridge branch r_2 in order to limit the size of the rheostat, said resistances being dimensioned in such a way that the same rheostat can be used for trains of different lengths. R_1 may be connected in the case of short trains, R_2 in the case of longer trains and R_3 in the case of particularly long trains, such as long freight trains. The rheostat 34 is provided with three different scales, corresponding to R_1 , R_2 , and R_3 to permit proper readings whichever resistance R may be connected in the circuit.

By line wires which have a certain known self-resistance per bearing distance, or by providing a wire system with small self-resistance and properly dimensioned ohmic resistances connected at each bearing, the indication can be made very reliable and easily readable so that the engineer can ascertain immediately the location of any hot bearing.

If due to a hot bearing one bus line has been broken, it is possible to maintain the other bus line in operative condition by means of an emergency switching. Thus, if for instance, the left bus line 25 has been interrupted due to the hot running of a bearing along this line, the change-over switch 33 may be set to the position B so that an alarm signal may be received from any contact device 1 in bus line 24 and the location of any hot bearing on the right side of the train may then be ascertained as soon as the switch 6 has been set to its right hand position. Similar emergency switching can be used in arrangements comprising three instead of four wire lines.

If, with the change-over switch 33 in the position C₁, the connection between two cars of the train breaks so that the coupling members 27a, 27b (see Figs. 8 to 11) are disconnected from each other, the circuit through bus lines 24, 25 is first broken and, immediately thereafter, the bus lines 24, 25 and the zero conductor or conductors 26 at the end of the last carriage left on the train are automatically connected together in the terminal coupling member 27a or 27b as explained above in connection with Figs. 8 to 11. Due to

momentary line interruption thus caused, the relay 9 is released and the alarm is started. When the engineer tests the lines, he will find that the deflection of the galvanometer needle is the same in position A and in position B of the change-over switch 33, thus indicating that the alarm is due to the loss of a part of the train and not to a hot bearing.

In the device according to Fig. 7, the change-over switch 33 may also be set to a fourth position C₂ to connect the two zero conductors 26 in series across the alarm starting relay 9. This makes it possible to provide for an operation of the alarm devices upon loss of any part of the train even after both bus lines 24 and 25 have been broken by hot running bearings.

It is possible to substitute ground for the zero conductor in the systems according to the invention. In such a case, only the bus lines run underneath the carriages, and when a bearing runs hot the contact device at the location of such bearing breaks the bus line and connects either only that part of the bus line which runs forward to the engine or both parts of the bus line to ground. One terminal of the control station in the engine is also connected to ground so that either one or two measurable circuits are obtained, which inform the engineer on which side of the train a bearing is running hot and where such bearing is located. However, since ground is not a reliable conductor and has a rather high resistance, the bus lines must, in this case, be given an extraordinarily high self-resistance in order to obtain a reliable deflection.

The alarm system according to the invention can also be used in stationary plants. For instance in a plant in which a number of bearings are disposed in positions which are difficult to control, lines may be connected to said bearings in a predetermined succession with predetermined resistances interposed between the serially arranged contact devices associated with the individual bearings, respectively.

The lines end in a control station located at the place of the plant guard, from which place the whole plant can be supervised and controlled.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In an arrangement for indicating at a control station the occurrence, at any one of a plurality of remote locations, of a predetermined physical condition, the combination of an alarm mechanism at said control station including a relay, an alarm device, an energizing circuit for said alarm device including a back contact of said relay, and means operative upon release of

said relay for locking said back contact in closed position, a source of current connected in series with said relay, a contact device at each location including a normally closed contact adapted to open upon occurrence of said predetermined physical condition at its location and a normally open contact adapted to close shortly after the opening of the associated normally closed contact, said normally closed contacts being connected in series across said source of current and relay to keep the latter normally energized, circuits connecting said normally open contacts parallel to each other across said relay and source of current, each of said circuits having a predetermined resistance different from those of all the other parallel circuits, a normally open shunt across said relay, an electrical measuring instrument in said shunt, and an operator controlled switch to close said shunt.

2. A combination, as claimed in claim 1, including coupling means between said operator controlled switch and said back contact locking means to effect unlocking of said back contact when said switch is changed over to close said shunt.

3. A combination, as claimed in claim 1, including a normally closed contact in the energizing circuit of said alarm device said contact being opened when said switch is changed over to close said shunt.

4. A combination, as claimed in claim 1, in which the circuits connecting said contact devices across said relay and source of current include at last one bus line connecting a number of said normally closed contacts in series to one terminal of the source of current and at least one zero conductor leading from the last closed contact of said series to the other terminal of said source, each normally open contact having one contact element connected to the part of the bus line extending between the location of this contact and said first terminal of the source of current and a second contact element shunt connected to said zero conductor.

5. A combination, as claimed in claim 1, in which the normally closed contacts are series connected into two bus lines and at least one common zero conductor is connected to the last normally closed contact of each series, each normally open contact including one contact element which is shunt connected to a zero conductor, and a change over switch for connecting said source of current and relay alternatively across both bus lines or across either bus line and a zero conductor.

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