F. F. BOURDIL.

AUTOMATIC SAFETY DEVICE.

APPLICATION FILED SEPT. 6, 1907.

930,141.

Patented Aug. 3, 1909.

3 SHEETS—SHEET 1.

Fig. 1.

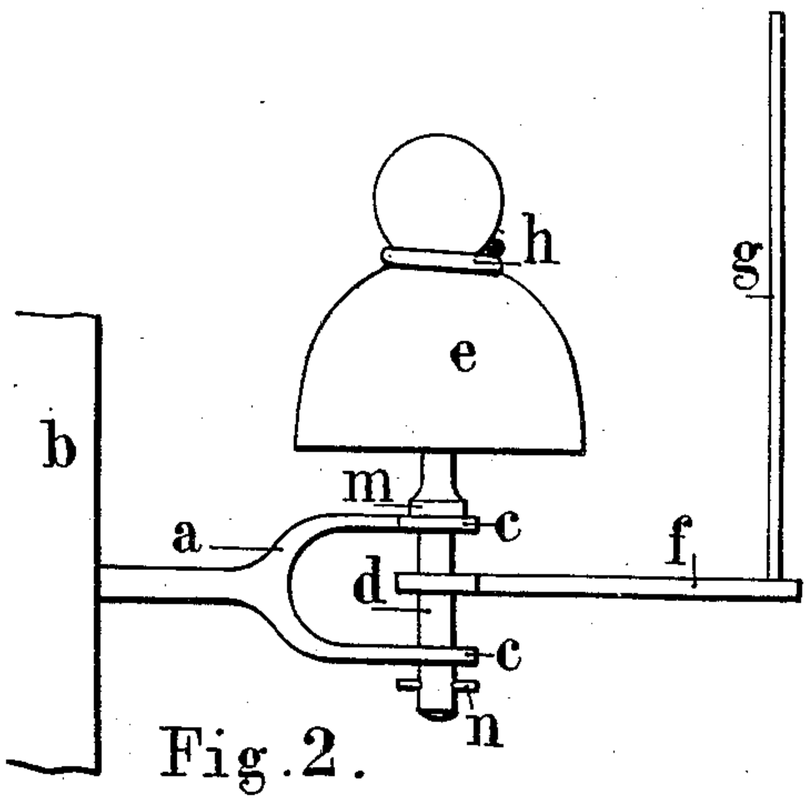



Fig. 2.

Fig. 3.

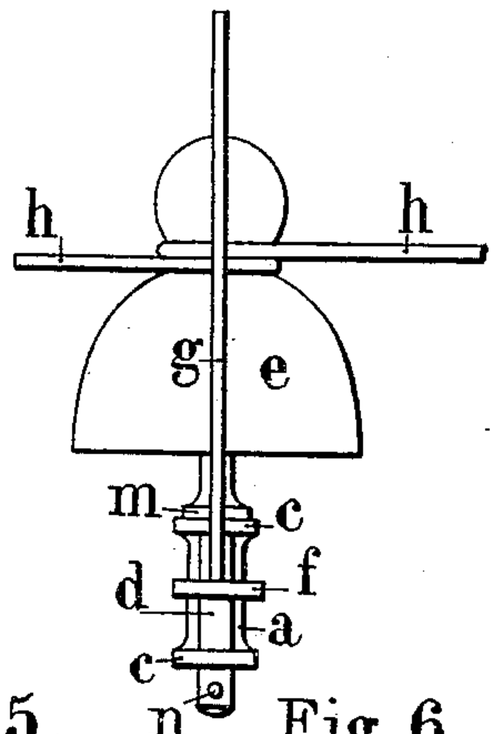



Fig. 5. Fig. 6.

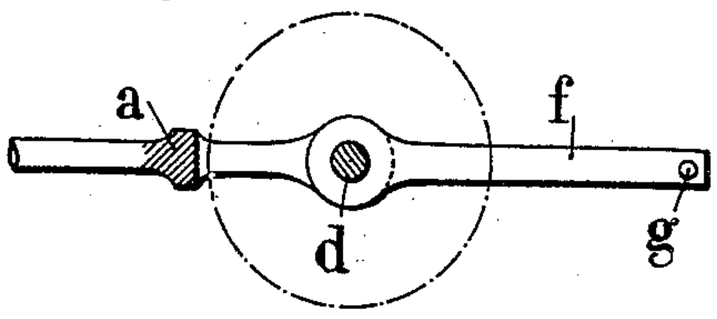



Fig. 4.

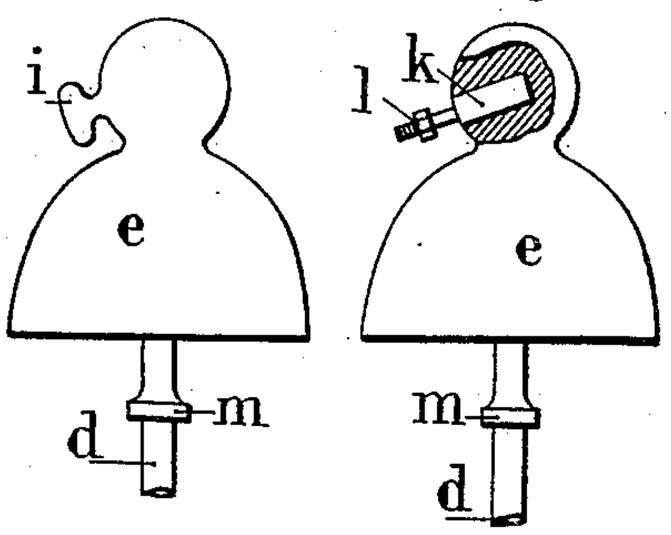



Fig. 7.

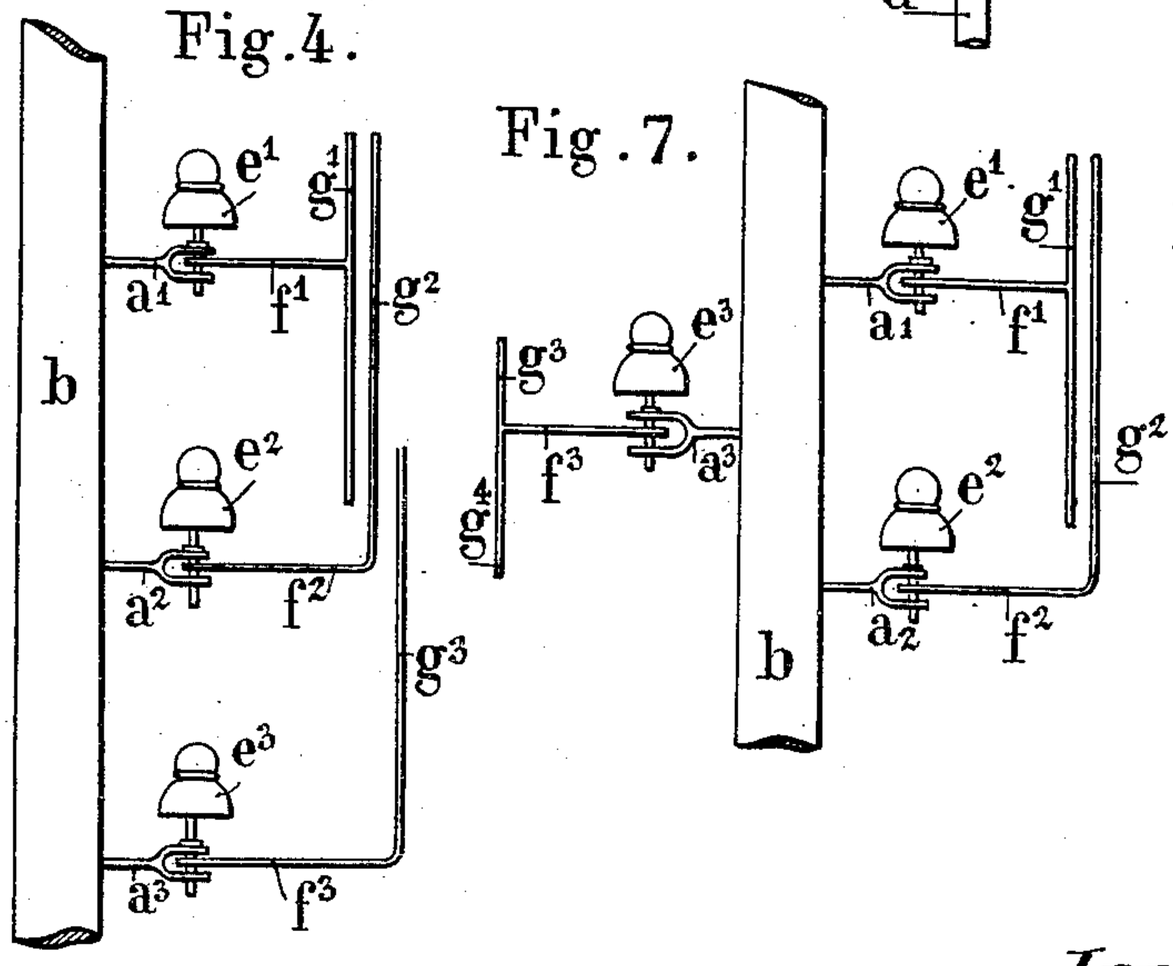
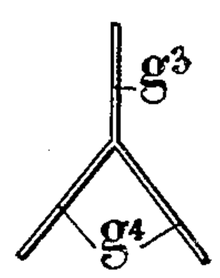



Fig. 8.

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3 SHEETS—SHEET 2.

Fig. 9.

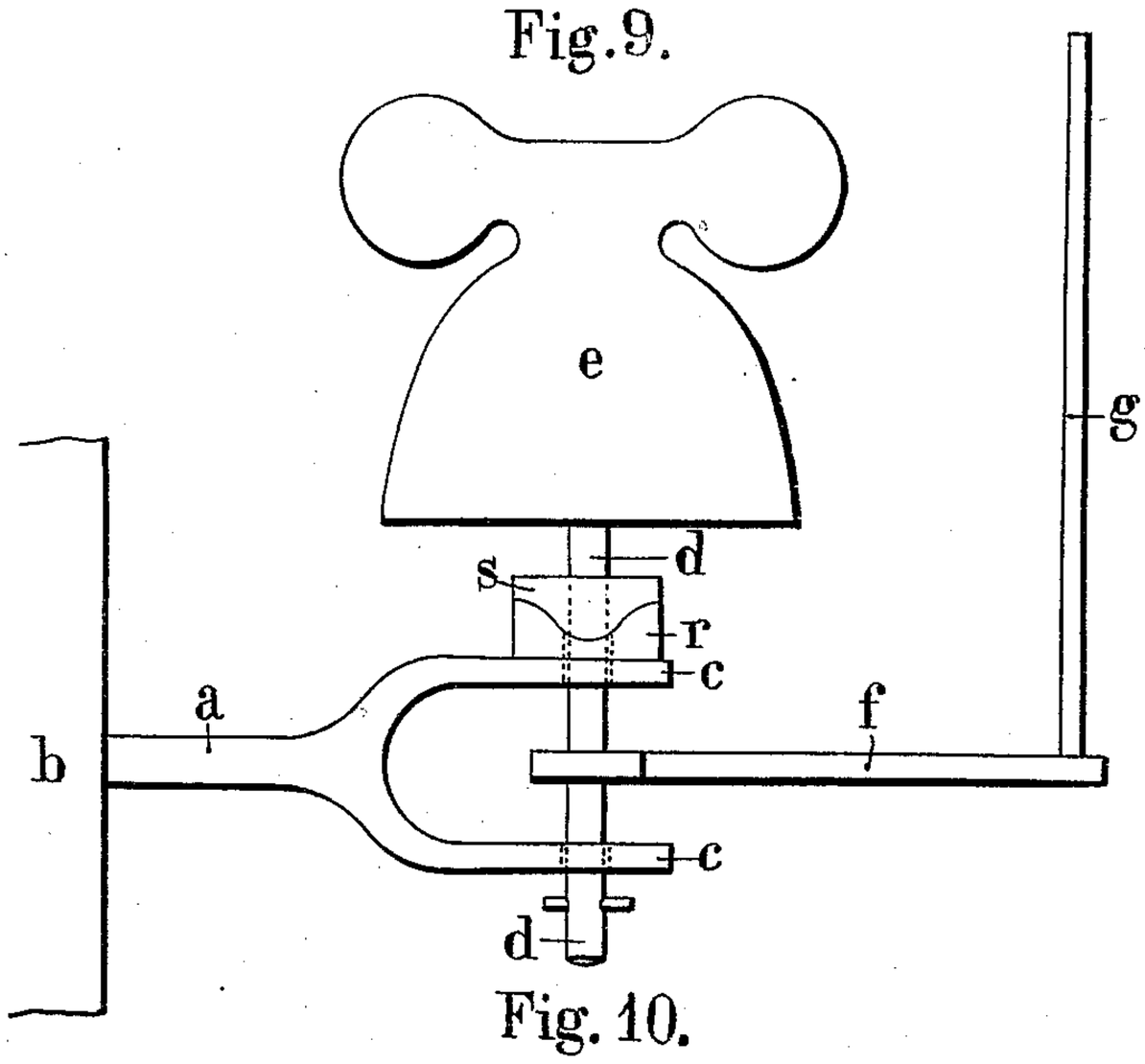



Fig. 10.

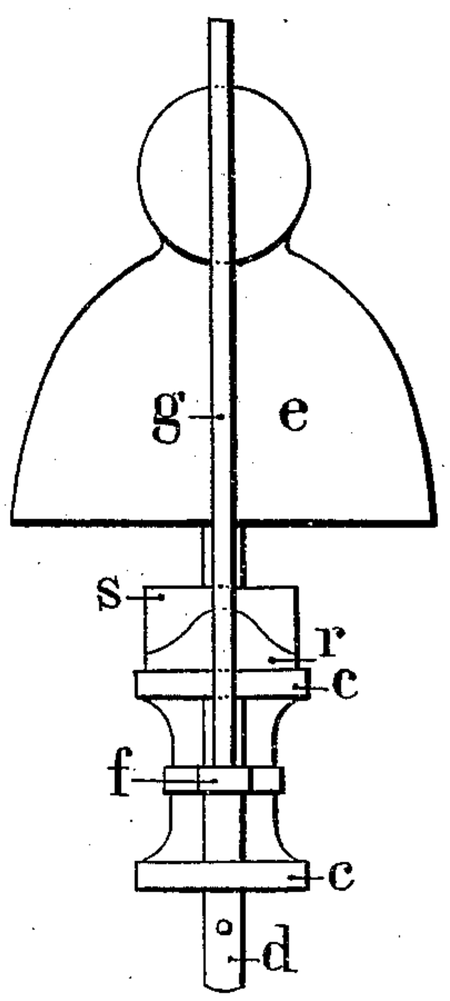



Fig. 11.

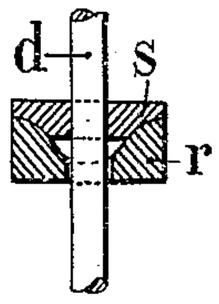



Fig. 12.

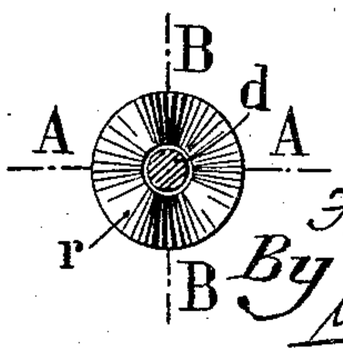



Fig. 13.

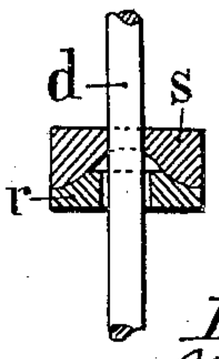
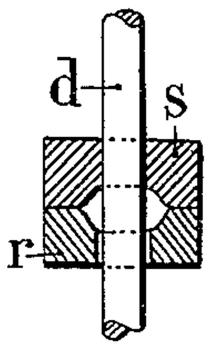



Fig. 14.

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3 SHEETS—SHEET 3.

Fig. 15.

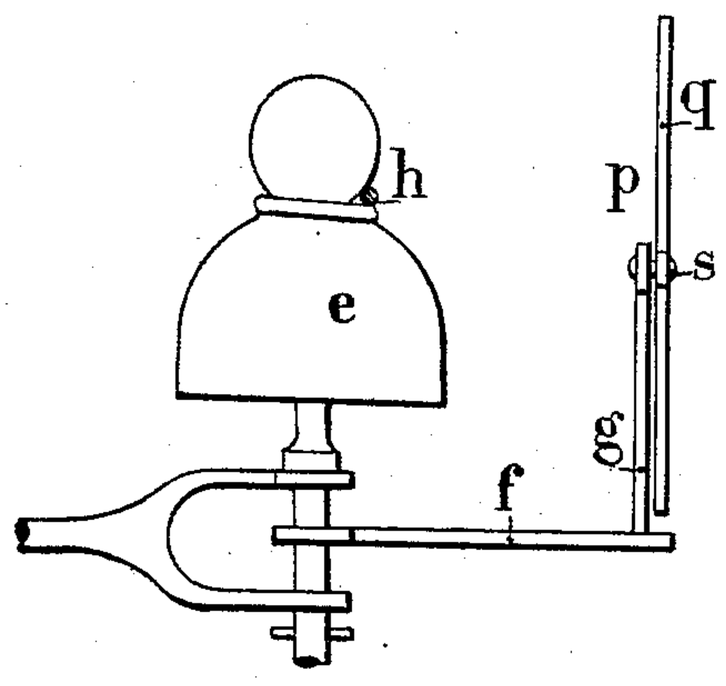



Fig. 16.

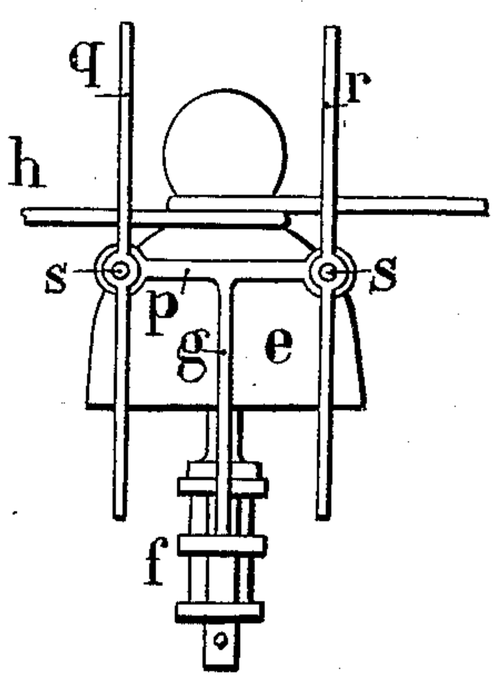
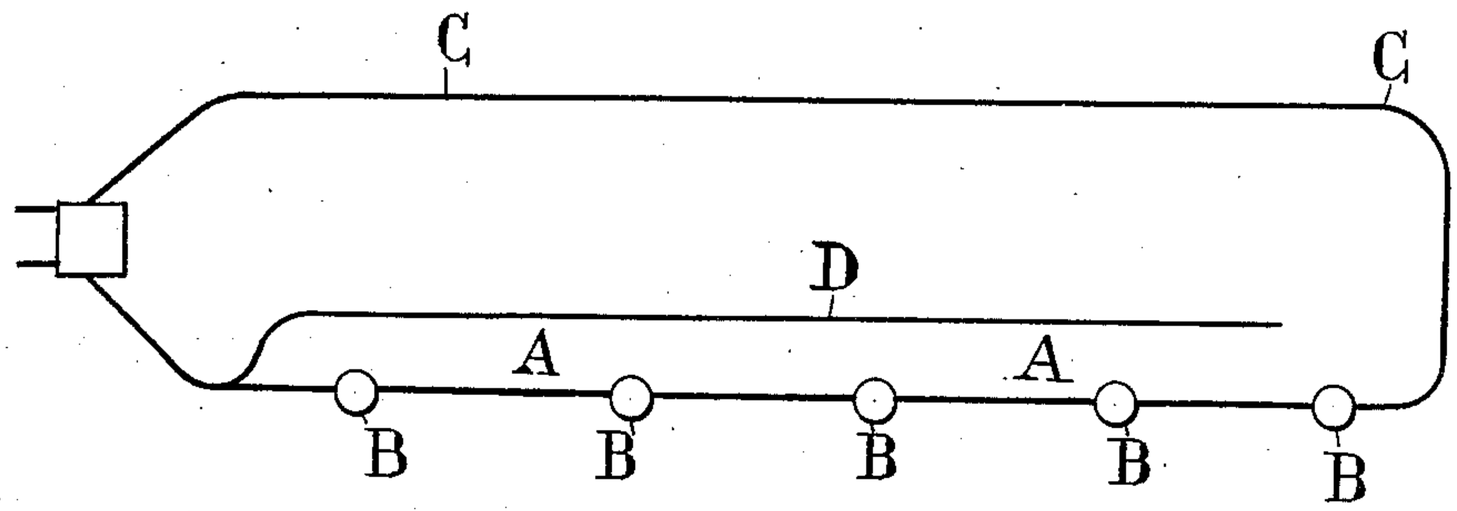



Fig. 17.

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# UNITED STATES PATENT OFFICE.

FRANCOIS FERNAND BOURDIL, OF PARIS, FRANCE.

## AUTOMATIC SAFETY DEVICE.

No. 930,141. Specification of Letters Patent. Patented Aug. 3, 1909.

Application filed September 6, 1907. Serial No. 391,584.

*To all whom it may concern:*

Be it known that I, FRANCOIS FERNAND BOURDIL, a citizen of the Republic of France, residing at 56 Avenue d'Iena, Paris, in the French Republic, have invented certain new and useful Improvements in Automatic Safety Devices, of which the following is a specification.

The invention relates to an automatic safety device rendering it possible in the case of the rupture of a wire carrying a high tension current, to render the end of this wire which may fall to the ground harmless.

This apparatus is based upon the application of an insulator capable of assuming a movement of rotation around its axis when the wire that it is supporting breaks without experiencing any displacement in space.

It is possible that under an accidental strain, such for example as the action of the wind, the device, which should remain fixed becomes displaced momentarily by a certain angle, the system would then become disarranged, if there were no means tending to cause the device to resume its initial position. In order to obviate this inconvenience, the apparatus may comprise, between the axis of the insulator and its support, a part intended to permit of the rotation of the support in either direction through an angle of a certain amplitude, say a maximum angle of 90°, and of returning the axis to its initial position automatically, as soon as the accidental strain which displaced it ceases to act.

The object of the invention is illustrated by way of example in the accompanying drawing, in which:—

Figure 1 represents in side elevation an insulator and the safety device belonging thereto. Fig. 2 is an upper plan view of the same parts with the insulator removed. Fig. 3 is a front elevation of the device illustrated in Fig. 1. Fig. 4 represents the invention applied to an assemblage of three superposed lines. Figs. 5 and 6 show by way of example, various modifications of the means for fixing the line on the insulators. Fig. 7 illustrates the case of three lines which are not superposed. Fig. 8 is a detail view of one of the parts shown in the above figure. Figs. 9 to 14 illustrate an improved modification of the counter or returning device. Fig. 9 is an elevation of the improved insulator. Fig. 10 is an end elevation of the same. Fig. 11 is a vertical section through the counter device referred to above on the line A—A of Fig. 12. Fig. 12 is a top view of the lower cup of this counter device. Fig. 13 is a section on the line B—B of Fig. 12. Fig. 14 is a similar section showing the position of the two parts of the counter device at the moment at which the accidental rotation of the axis has reached its maximum. Figs. 15 and 16 show in front and side elevation, another improved modification. Fig. 17 shows by way of example, a diagrammatic view of an arrangement of lines in which in case one of the line wires should break, short-circuiting is set up between another line and a special line mounted in shunt on the broken line.

In the device represented in Figs. 1 to 8, *a* is a support which is fixed on the one hand to a pole *b* and carrying say two sockets or forks *c* in which the rod *d* of the insulator *e* is able to rotate freely. It is supported in the vertical direction by a bearing *m* and a pin *n*.

The spindle *d* of the insulator carries a horizontal lever *f* at the extremity of which there is fixed a light rod or a conducting tube *g*.

The wire *h* constituting the line is supported in the ordinary manner, but adheres sufficiently in the groove or neck of the insulator. This adherence may be obtained in different ways, for instance by using a cement or by winding the wire not only in the groove in the insulator but around one or more studs *i* cast in the body of porcelain (Fig. 5). As shown in Fig. 6 the wire might be held in a sort of clip constituted by a fitted part *k* fixed in the porcelain and presenting a screw threaded portion upon which a nut *l* is capable of displacement.

The line wire *h*, instead of being itself wound upon the insulator may be connected with the latter by any suitable means.

Whatever method may be employed for causing the line wire *h* to adhere to the insulator and fix it firmly thereon, it will be understood that if the line wire should break at one of its points as there would no longer be equilibrium of the tensions, the insulator *e* under the influence of the unbroken length will rotate upon itself carrying with it the arm *f* and the rod *g*. In this movement the rod *g* comes into contact with the line itself

and at the same time in contact with one of the adjacent lines or of a special "earth" thereby causing a short circuit which will cut off all current from the lines. For example in Fig. 4, there are three lines carried by three superposed insulators $e^1$ $e^2$ $e^3$; these insulators are arranged in the manner described above and the different levers $f^1$ $f^2$ $f^3$ carry the contact tubes or rods $g^1$ $g^2$ $g^3$. With this arrangement, if the line wire corresponding to the insulator $e^1$ should break, the insulator will turn and the lever $f^1$ applies the tube $g^1$ against the lines corresponding to the insulators $e^1$ $e^2$. If it is the wire of the insulator $e^2$ that breaks, the bar $g^2$ comes into contact with the lines corresponding to the insulators $e^1$ $e^2$ and so on in succession.

In Fig. 7 the three lines are not in the same plane and the insulators $e^1$ $e^2$ $e^3$ are preferably arranged at the apexes of an equilateral triangle. In this case, as shown in the front elevation, Fig. 8, the bar $g^3$ presents a vertical branch $g^3$ and two extensions $g^4$ forming a fork. This arrangement is necessary in order that, if the line corresponding to the insulator $e^3$ should break, one of the extensions $g^4$ should come into contact with the line $e^2$ for example, while the vertical part $g^3$ comes into contact with the line $e^3$.

It will of course be understood that the arrangement of the insulator and also of the other constituent parts of the system may vary without thereby in any way affecting the nature of the invention. Similarly the insulators may be of any convenient form and nature; they may be mounted either upright or inverted and their axes may be placed vertically, horizontally or in any inclined position. Finally instead of effecting the short circuiting directly in the manner described above, the movement of rotation of the various insulators might be transmitted to a distance by variable mechanical means for closing the earths of any other safety device.

The advantages of the above apparatus as compared with those hitherto constructed with similar objects, result from the application of an insular rotating about its axis, and the chief of these advantages are as follows:—1. The lines are mounted substantially in the ordinary manner. 2. In the condition of repose the safety device is out of circuit. 3. The system may be utilized in angles or along inclines or declines of any nature, while still operating in both directions. 4. The intermediate poles, that is to say those not provided with safety devices, may be mounted by means of the same rotating insulators, thereby enabling the number of the safety poles to be reduced. 5. There is no displacement of the point of attachment of the line in the direction of this line, as the axis of the insulator remains fixed. 6. The point of attachment is independent of the contacts which may consequently be slight.

In the apparatus as described above, the axis of the insulator is mobile in its support in such a manner that it is able to rotate when the line is broken. Now it may happen that under the influence of an accidental strain such for example as the action of the wind, the apparatus which should remain fixed, is momentarily displaced through a certain angle. If there is no means tending to cause it to return to its initial position, the system becomes deranged. In order to obviate this defect, there may be interposed between the spindle of the insulator and its support, a part intended to permit of the rotation of the support, in either direction through an angle of a certain amplitude (say 90° at the most) and to return the spindle automatically to its initial position as soon as the accidental strain which has displaced it ceases to operate. Figs. 9 to 14 illustrate a method of carrying this improved arrangement into practice. In these several figures $a$ represents as before the support fixed to the pole $b$ and comprising the two sockets or forks $c$, in which the spindle $d$ of the insulator $e$ is able to rotate freely. The spindle $d$ carries a horizontal lever $f$ ending in a conductor $g$ the action of which has been explained.

The special arrangement consists in fixing on the upper fork $c$ of the support $a$ a cup or sleeve $r$ provided with a central hole for the passage of the spindle $d$. This latter carries another cup or sleeve $s$ which rests on the sleeve $r$. As shown in the drawing, the adjacent faces of the two sleeves $r$ and $s$ are not plane but sinuous or helicoidal so that each of them presents two depressions and two reliefs.

When the apparatus occupies its normal position Figs. 9 to 14, the reliefs on the upper sleeve $s$ rest in the hollows or depressions of the lower sleeve $r$; if, however, any strain should cause the spindle $d$ to rotate through a certain angle in its support, the projections of the sleeve $s$ mount upon those of the sleeve $r$ in such a manner that as soon as the effort which has displaced the spindle ceases to act, the entire system constituted by the spindle, the sleeve $s$ and the insulator tends to resume its initial position, the projections of the sleeve $s$ sliding over the inclined faces on the sleeve $r$ and resuming their position.

In case the line should break, the amplitude of displacement exceeding 90°, the projections on the sleeve $s$ first of all ride up on those on the sleeve $r$ as shown in Fig. 14 which shows the position of the parts for a displacement of 90°. Then, the movement continuing, the sleeves $r$ and $s$ facilitate it

as soon as the projections on the sleeve *s* have passed over those on the sleeve *r* and slide on the inclined faces on this latter.

It will of course be understood that the form of the sleeves may vary without in any way altering the nature of the improvement described above and that these sleeves might be replaced by any other equivalent parts, that is to say parts capable of sliding one upon the other through a certain angle and returning to their original position, or on the other hand, continue this sliding when their relative displacement exceeds a certain angle.

As already specified, the contact between the lines that it is desired to cause to communicate one with the other, if one of them should break, is effected by means of a vertical rod *g;* now it may happen that, owing to defective verticality of this rod or by reason of a displacement of the lines, the rod *g* may not bear exactly on the two wires to be connected. In order to avoid this defect it is preferable to employ the arrangement illustrated in Figs. 15 and 16. As shown in these figures, the rod *g* carries a cross piece *p*, straight or bent, upon which there are pivoted on either side of the rod *g*, two rods or beams *q* and *r*. These beams are thus capable of displacement in the plane of the cross piece. In these conditions, when the line *h* breaks, the bell *e* in rotating in the manner explained above, carries with it the arm *f*, and rod *g* and according to the direction of its rotation, the beam *q* or the beam *r* bears against the lines to be placed in communication. Owing to the joint *s* the contact between this beam and the lines is certain, even if the lines are not situated in the same plane. Further, it has already been explained that when one of the lines breaks, the device places this line in communication with one of the adjacent lines, or with the earth. In place of this, the mechanical action of the device in question might be utilized for establishing any other communications than those referred to above, for the purpose of rendering the broken line harmless. For example if one of the lines should break, the safety device might place in communication two other adjacent lines, forming the short circuit necessary for the operation of the safety device; or again the device might put to earth one or more of the lines adjacent to that the breakage of which has caused the device to act.

As already stated above, the invention is absolutely independent of the method of mounting and connecting or utilizing the various electric circuits connected with the safety device. The same is true as regards the various examples of operation which have been described.

Fig. 17 shows diagrammatically an arrangement of lines in which in case one of the line wires should break, a short circuit is established between another line and a special line mounted in shunt on the broken line. In this figure, A designates a line on which appliances B are mounted in tension, and C the return wire of this line. In a circuit of this kind, the rupture of the line A and its short circuiting with the line C may not be sufficient to cause the switch or other safety devices provided at the works to act, owing to the resistance of the appliances arranged on the line A, especially if the rupture takes place at a point of the line distant from the works. In order to obviate this defect, a line D branches in shunt from the line A and constitutes an open auxiliary circuit. In case A should break, the device establishes a short circuit between C and D.

What I claim and desire to secure by Letters Patent of the United States is:—

1. In an automatic safety device for high tension lines, a rotatably mounted insulator, and a contact member movable therewith.

2. In an automatic safety device for high tension lines, a rotatably mounted insulator, a contact member movable therewith, and means for returning the parts to normal position by rotation.

3. In an automatic safety device for high tension lines, an insulator mounted for rotation by the unbroken line in case of breakage of a line wire, and means movable rotatably with said insulator for making contact to cut off the current.

4. In an automatic safety device for high tension lines, an insulator mounted for rotation by the unbroken line in case of breakage of a line wire, means movable rotatably with said insulator for making contact to cut off the current, and means for returning the parts to their normal position.

5. In an automatic safety device for high tension lines, an insulator mounted for rotation by the unbroken line in case of breakage of a line wire, means movable rotatably with said insulator for making contact to cut off the current, and helicoidal sleeves for returning the insulator to normal position.

In testimony whereof I affix my signature in presence of two witnesses.

FRANCOIS FERNAND BOURDIL.

Witnesses:
F. K. THORSEN,
M. ALGER.