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Marechal

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[54] ELECTRIC CONNECTION DEVICES

[76] Inventor: **Gilles Adrien Georges Marechal**, 36 Quai de Bethune, Paris, France

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[52] **U.S. Cl.** ..... **339/41**, 339/91 R, 339/188 C

[51] **Int. Cl.** **H01r 13/54**

[58] **Field of Search** 339/41, 88, 187–190, 339/184–185

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Primary Examiner—Richard E. Moore

Attorney, Agent, or Firm—Edwin E. Greigg

[57] **ABSTRACT**

In a separable electric connection device, an attachment plug and plug receptacle each have an insulating contact support housed within a casing and provided with contacts uniformly spaced over a circumference with the exception of one contact in displaced relation. Associated rotational locking means and guiding means permit coupling only in a single relative angular position. At the time of locking, the plug subjects an insulating safety disc to a movement of rotation on the receptacle from an initial angular position corresponding to the combination of contacts to be uncovered. The angular position of each contact support is adjustable from ϕ degrees to ϕ degrees with respect to guiding means, the displaced contact being angularly displaced by K.ϕ degrees. Retractable locking means are provided for maintaining the safety disc in its initial position when the plug is disconnected from the receptacle.

8 Claims, 12 Drawing Figures

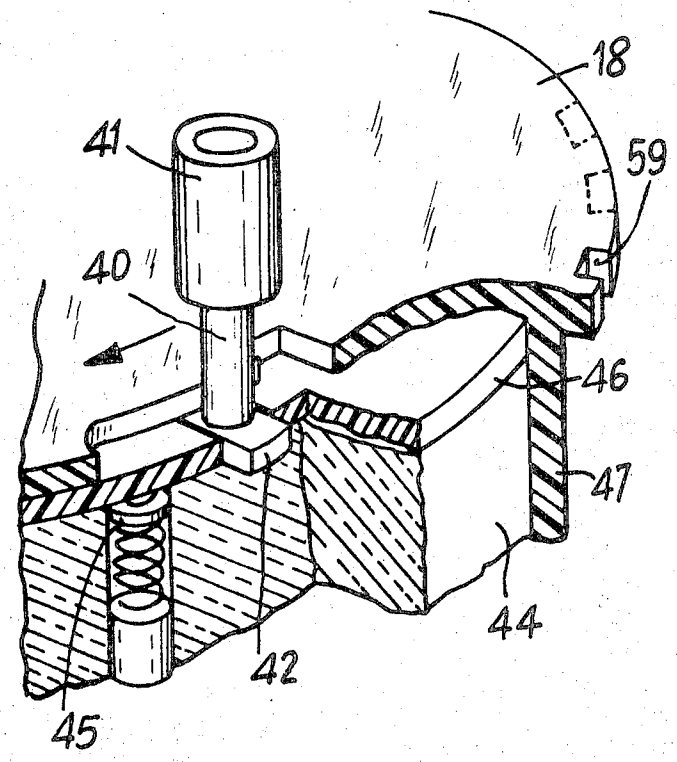


Fig. 1

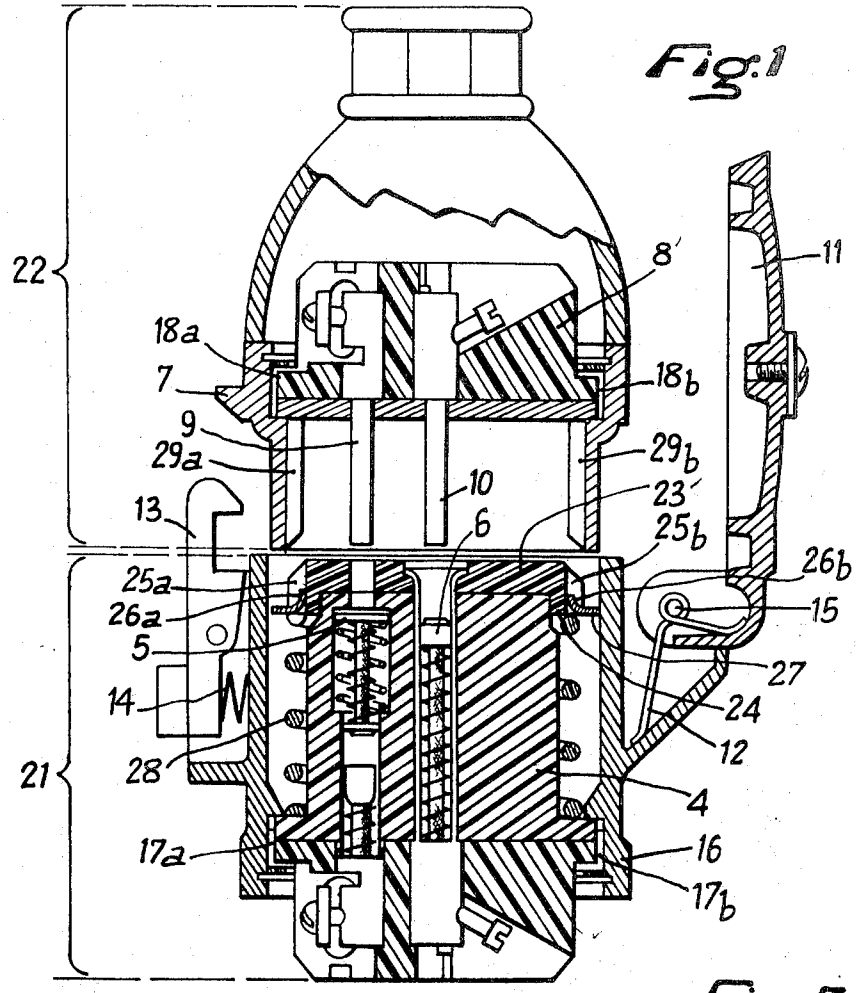


Fig. 2

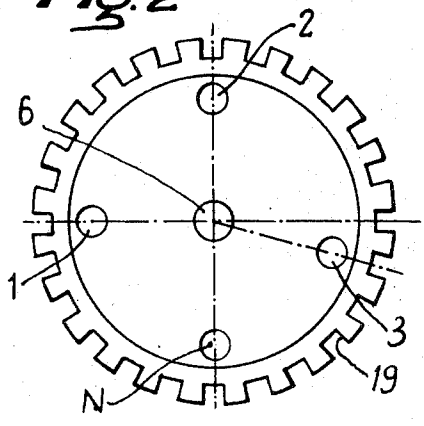


Fig. 3

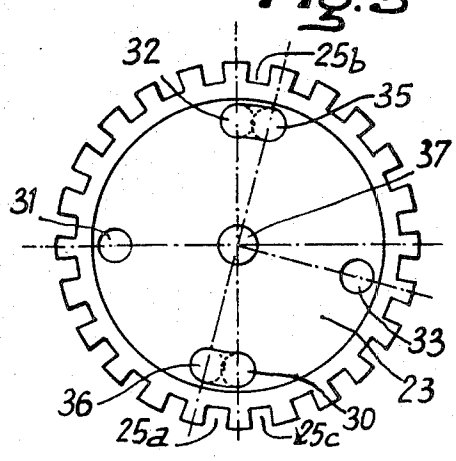


Fig: 4

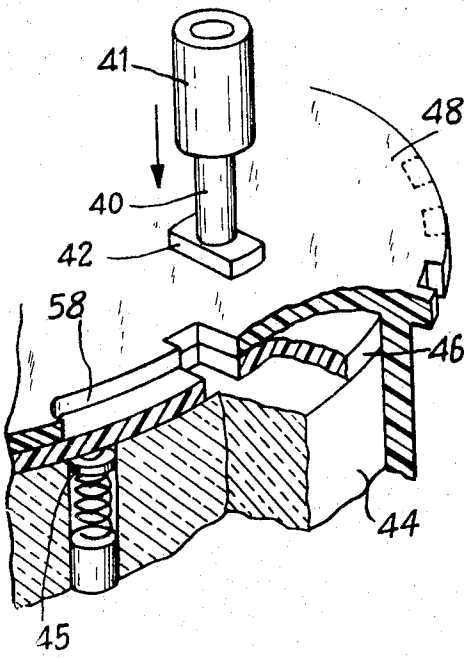


Fig: 5

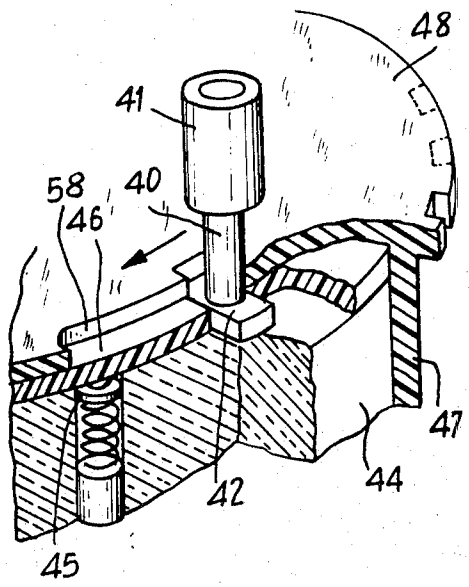


Fig: 6

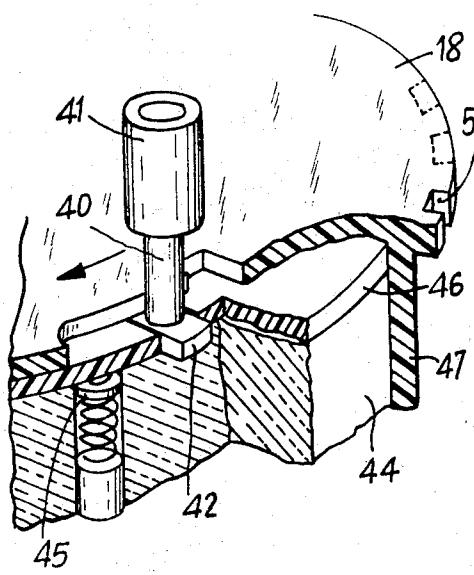


Fig: 7

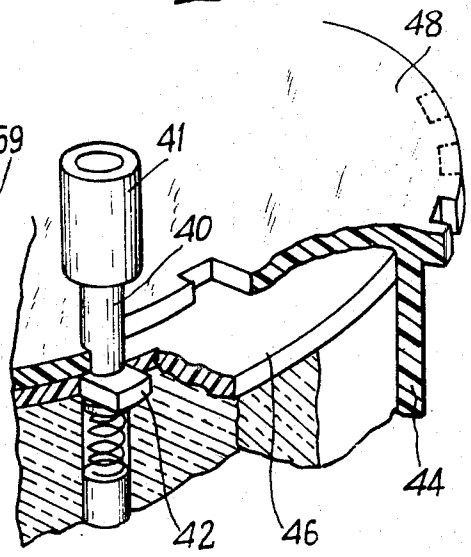


Fig: 8

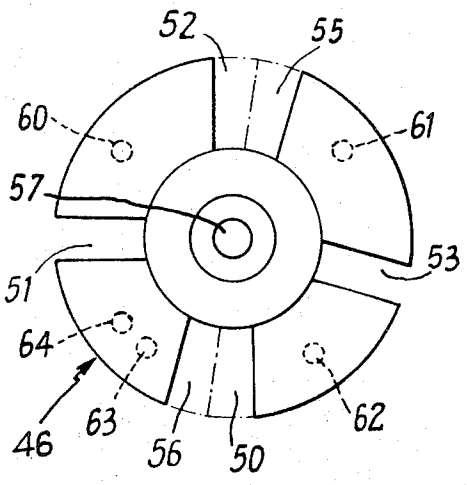


Fig: 9

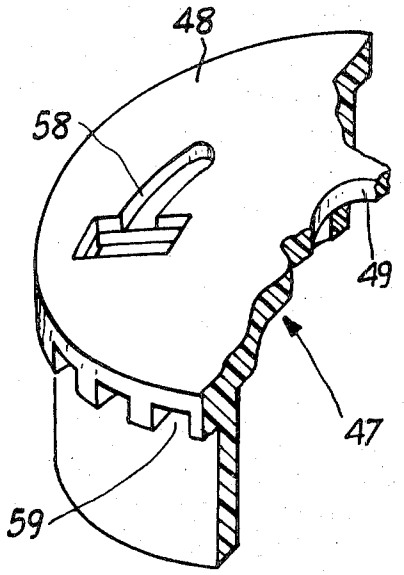


Fig: 10

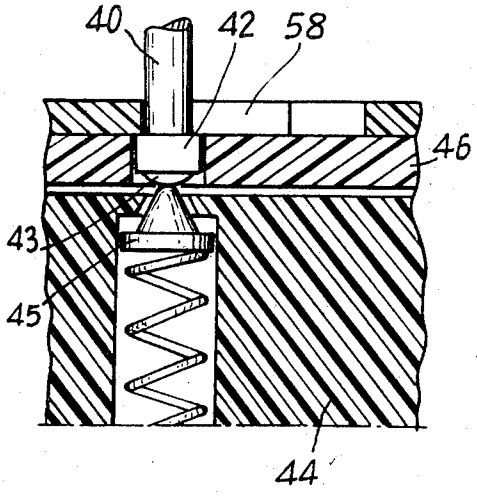


Fig: 11

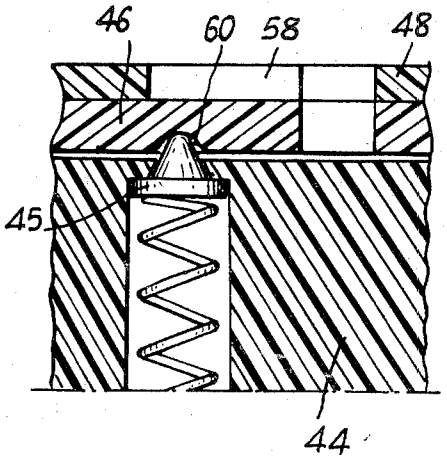
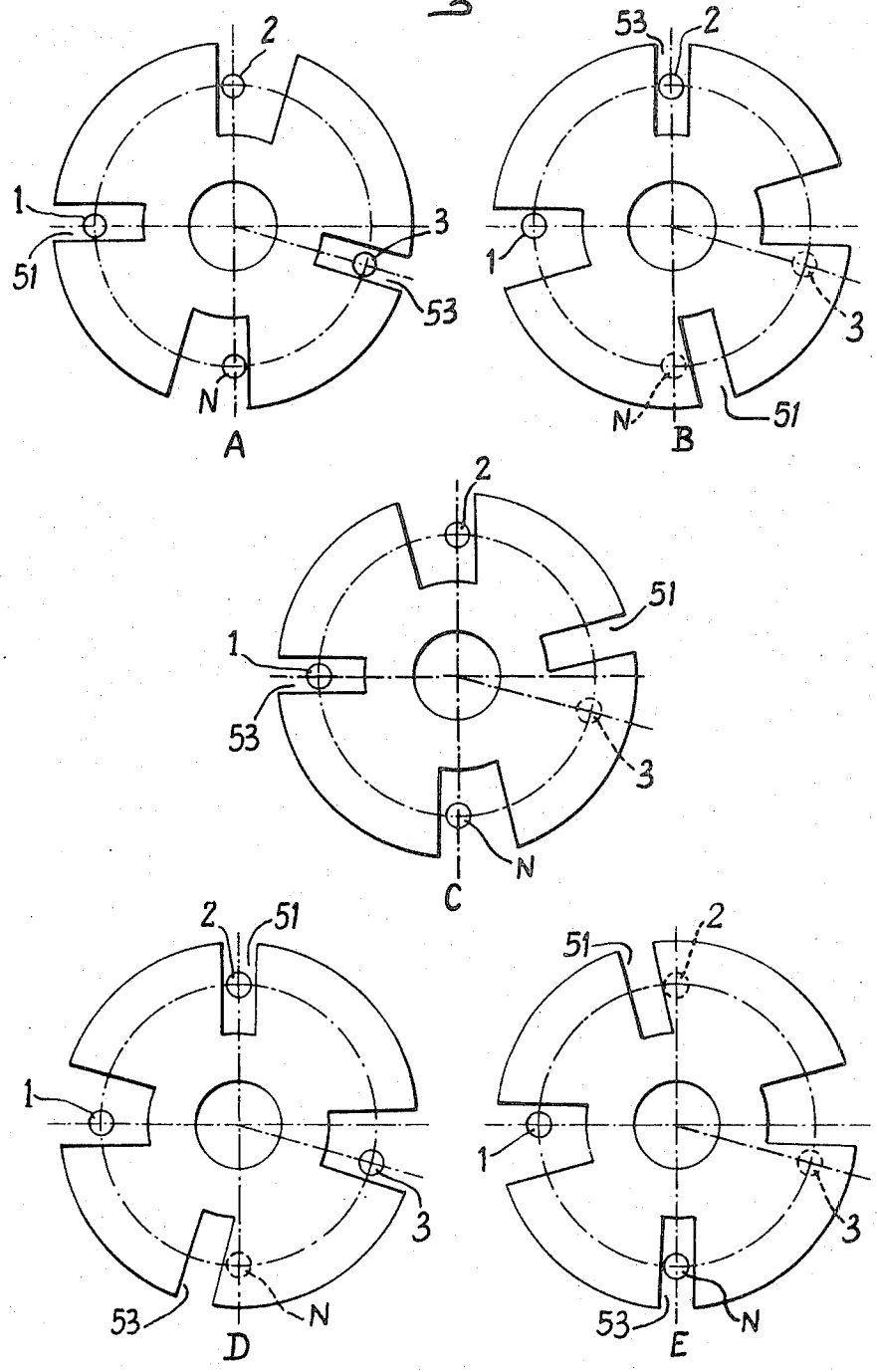


Fig: 12



ELECTRIC CONNECTION DEVICES

This invention relates to electric connection devices of the type comprising a multiple-contact attachment plug in which the contacts are intended to be brought into engagement with the corresponding contacts of a plug receptacle in order to convey electric power from a distribution circuit of variable type to a given utilization circuit such as three-phase, single-phase between phases or single-phase between phase and neutral, this being achieved by means of a single style of plug receptacle and attachment plug which are always connected in accordance with the same wiring layout.

It is also known on the one hand to dispose the contact elements on each of the two plug and receptacle components on a circumference which is concentric with the component as a whole by spacing said elements at uniform intervals along said circumference with the exception of one element which occupies a displaced position with respect to this spaced arrangement and, on the other hand, to design each component in the form of a casing and a contact support adjustably mounted in relative orientation with respect to said casing whilst the angular displacement of the displaced contact is different from the angular interval between two successive positions of a contact support within its casing or from a multiple of said angular interval.

This arrangement makes it possible within a single installation to differentiate plug receptacles which are supplied in a different manner, e.g. 500 volts three-phase, 380 volts three-phase, 110 volts single-phase, 24 volts single-phase, etc., and to prohibit certain interchangeable connections. These prohibitions result solely from the special position of the displaced contact.

Moreover, in an arrangement which is also known, the attachment plug can be inserted in the receptacle only in a single angular position with respect to this latter by virtue of a suitable guiding device. It is accordingly apparent that the connection of the attachment plug to the plug receptacle entails the need for correct coupling of the plug contacts corresponding to the utilization circuit with the receptacle contacts corresponding to the distribution circuit, provided that the number of equipped poles, or "polarity", of the plug receptacle is at least equal to the "polarity" of the attachment plug.

Finally, an appreciable improvement in a device of this type is known and consists in providing the plug receptacle with a safety disc of insulating material which is pivotally mounted coaxially with the circumference of the receptacle contacts, said disc being provided with openings through which the plug contacts are intended to pass and being accordingly displaced in rotational motion by said plug as and when this latter is locked to the receptacle. Said disc is so designed that, at the end of the locking movement of rotation, only the usable contacts of the receptacle are uncovered, whereas the initial position of the disc corresponding to separation of the plug from the receptacle is determined at the time of assembly according to the combination of contacts to be uncovered.

The invention is primarily but not exclusively directed to the case of a plug receptacle having four contacts or poles, as well as a grounding contact if necessary, in which the four poles are spaced on a single

circumference, any grounding contact which may be provided (but to which no further reference will be made in the following description) being placed at the center of the circumference.

It should be pointed out in the first place that the support for the contacts of each attachment-plug and plug-receptacle component must be adjustable in relative orientation, not necessarily with respect to its casing but essentially with respect to the associated means for guiding the plug and the receptacle.

Moreover, in order to obtain the greatest possible number of combinations and thus to have a well-defined and invariable wiring outlay from one installation to another, the angular difference between two successive relative positions must necessarily be as small as possible, the lower limit of this angular difference being imposed by allowances in assembly and by angular intervals arising from safety requirements.

As an advantageous feature, the safety disc can be protected by a fixed plate or "shield" traversed by openings corresponding to the attachment-plug contacts and each provided with an extended portion in the form of a circular arc having an angular length equal to the rotation produced by locking the attachment plug to the plug receptacle. In addition to its intended function of protection of the safety disc, the selected initial position of which can no longer be modified without disassembly of the plug receptacle, the shield can be adapted to carry one of the associated guiding means and the receptacle-contact support can then be stationary within its casing. The shield permits further simplifications which will become apparent from the detailed description of this form of construction.

A clearer understanding of the invention will be gained from the following description and from the accompanying drawings, wherein:

FIG. **1** is a longitudinal sectional view of a connection device in accordance with the invention;

FIG. **2** is a diagram illustrating a plug receptacle with its contacts in a predetermined relative angular position;

FIG. **3** is a diagrammatic top view of a safety disc corresponding to the plug receptacle of FIG. **2**;

FIGS. **4, 5, 6** and **7** are cutaway views in perspective and in another form of construction showing the relative positions of an attachment-plug contact, of the shield, of the safety disc and of the plug receptacle during the different steps of a connecting operation, namely: approach, insertion, rotation and end of operation;

FIG. **8** is a diagrammatic top view of the safety disc in this form of construction;

FIG. **9** is a perspective view of the shield cover;

FIG. **10** is a diagram showing the cooperation of an attachment-plug contact and of a plug-receptacle contact;

FIG. **11** is a diagram of the method of locking of the safety disc;

FIG. **12** shows diagrammatically the five final positions of the safety disc with respect to the plug receptacle, corresponding respectively to the five possible initial positions of said disc.

The electric connection device as shown in FIG. **1** is essentially composed of two assemblies, namely a stationary assembly designated by the reference numeral **21** and referred to hereinafter as the "receptacle" and

a movable assembly designated by the reference numeral **22** and referred to hereinafter as the "plug".

The receptacle itself comprises an outer casing **16** containing an insulating support **4**, there being mounted within said support four resilient contacts such as the contact **5** which will be referred to as receptacle contacts, and a central grounding contact **6**. The plug comprises an outer casing **7** containing an insulating support **8** in which are mounted electric contacts such as **9**, referred to below as plug contacts, and a central grounding contact **10**. When the plug is separated from the receptacle, a cover **11** can be rotated about its pivot-pin **15** so as to move downwards onto the receptacle **21** in opposition to the spring **12** and locked in the closed position by means of the catch **13** which is in turn retained by the spring **14**.

The four receptacle contacts are disposed in a standard manner on a single circumference which is concentric with the connector as a whole; these contacts consist of a neutral contact-pin N and three phase contact-pins designated respectively as **1**, **2** and **3** (as shown in FIG. **2**). The three first contact-pins N, **1** and **2** are separated along the circumference by equal arcs, the fourth contact-pin **3** being displaced with respect to this uniform division.

The locations of the plug contacts are made to correspond with the receptacle contacts but the only contacts equipped are those corresponding to the current which is necessary for the utilization circuit.

In accordance with a known arrangement, the insulating support **4** of the receptacle and the insulating support **8** of the plug are each provided with a plurality of peripheral grooves such as the groove **19** (shown in FIG. **2**) which are uniformly spaced and cooperate with two positioning lugs designated respectively by the references **17***a*, **17***b* and **18***a*, **18***b* which are secured to the corresponding casing. Thus, each insulating support is capable of taking-up a predetermined relative angular position with respect to its casing.

A predetermined relative position is associated with an electric current of predetermined type and effective voltage such as, for example, 380 volts A.C., 220 volts A.C., 110 volts D.C., 48 volts A.C., 24 volts D.C., and so forth.

The plug casing **7** can be inserted axially into the receptacle casing **16** only in a well-determined angular position by virtue of the presence, for example, of a lug (not shown) which is integral with one of the two casings and so arranged that complete positioning of the plug within the receptacle is carried out in three steps, namely a first step which consists in inserting the plug into the receptacle in an axial translational movement, a second step consisting in carrying out the relative rotation of the two casings through a given angle which brings the plug contacts into position opposite to the receptacle contacts and finally a third step in which the contacts are brought into effective engagement and which consists in a second axial displacement of the plug within the receptacle. This arrangement is obtained by means of a bayonet assembly of any suitable and conventional type.

There is mounted on the insulating support **4** of the receptacle a pivotal disc **23** which has a double safety function, namely: on the one hand to cover the receptacle contacts when the plug is disconnected from the receptacle and, on the other hand, to prevent errors of operation in the connections corresponding to different circuit layouts.

The pivotal disc **23** is maintained against the insulating support **4** of the receptacle by means of the head of the central grounding contact **6** which serves at the same time as a pivot for said disc.

The pivotal disc **23** is provided with a flange **24** forming a cup which is fitted over the insulating support **4**. The lateral face of the cylinder formed by the disc and its flange is provided with a plurality of longitudinal grooves such as the grooves **25***a* and **25***b* which are uniformly spaced around its periphery.

The pivotal disc **23** occupies, with respect to the receptacle, an initial position which in invariable from the moment of fitting of said disc during installation of the connection device, said initial position being chosen at the moment of assembly as a function of the polarity of the receptacle, as will be explained hereinafter.

This initial positioning is carried out by means of two noses **26***a* and **26***b* which project from the outer face of a safety washer **27**, said noses being intended to engage in two diametrically opposite grooves among grooves such as those designated by the references **25***a* and **25***b* and formed in the pivotal disc **23**. The safety washer **27** is secured with respect to the receptacle casing **16** and solely against relative rotation by means which are not illustrated but which can consist, for example, of longitudinal ribs carried by the casing and adapted to cooperate with peripheral recesses formed in said washer, this latter being urged towards the disc by a spring **28** which surrounds the body of the insulating support **4** of the receptacle.

During the period of rotation of the plug within the receptacle at the time of a connecting operation, the pivotal disc **23** must be displaced by the plug in the same movement of rotation. To this end, the plug casing **7** is provided with two internal longitudinal grooves **29***a*, **29***b* which are adapted to engage within two grooves such as **25***a* and **25***b* which are formed in the pivotal disc **23**. In the example illustrated, these grooves are the same as those already employed for locking the disc.

When the plug is inserted longitudinally in the first stage of positioning of the plug within the receptacle, the ribs **29***a* and **29***b* engage within the grooves of the disc, namely the grooves **25***a* and **25***b* respectively; at the same time, the extremity of the plug casing **7** thrusts back the safety washer **27** in opposition to the spring **28** and consequently releases the disc-locking noses **26***a* and **26***b*. From that time, the disc **23** is made fast for rotation with the plug and will therefore rotate with this latter during the period of rotation of the bayonet-coupling system.

FIG. **3** is a diagrammatic top view showing the pivotal disc **23** provided with its peripheral grooves such as those designated by the references **25***a*, **25***b* and **25***c*. The disc **23** is provided with a central opening and six openings **30**, **31**, **32**, **33**, **34**, **35** and **36** spaced over a circumference equal to the circumferences of distribution of the plug contacts and receptacle contacts, one opening **30** being located on the center-line of two adjacent grooves **25***a*, **25***c*.

The lugs **17***a* and **17***b* of the receptacle are located vertically beneath the noses **26***a* and **26***b* respectively of the washer **27** in the rest position, that is to say when the plug is not engaged within the receptacle. The piv-

otal disc 23 occupies within said receptacle an initial angular position in which its grooves such as 25*a* are located vertically above the receptacle grooves such as 19 whilst the plug contacts such as the contact 9 which are associated with the corresponding receptacle contacts after the positioning period of rotation are relatively displaced prior to said period of rotation so as to be exactly opposite to some of the openings of the pivotal disc.

The initial position of the disc 23 is chosen so as to ensure that the locking movement of rotation which is carried out during the positioning operation should uncover only the equipped receptacle contacts.

In its initial position, the pivotal disc covers all the receptacle contacts, thereby preventing any accidental contact and protecting the contact-pins from impacts and dust even if the receptacle cover has not been swung-back to the closed position. However, it is readily apparent that provision could be made for a disc which is stationary after assembly, that is to say a disc which is not displaced by the plug during the initial step of the insertion operation, in which case the opening 30 (shown in FIG. 3) would be centered on the radius which terminates in the groove 25*c* in the example shown, and that this would constitute a form of construction which remains within the scope of the invention.

Since the number of industrial current values normally employed is about twenty, it is necessary to have a large number of possible positions in order to establish valid standardization throughout the industry.

In order to define the spacing of contacts and the optimum ratios of the different angular values in such manner as to obtain the maximum number of possible positions, it is first necessary to take into account the dimensions imposed by requirements of manufacture, official standards and the necessary allowance both in assembly and in use which can be considered as being very close to 4°.

In all countries, standards define the different sizes of electric connectors and the maximum section of conductors which can be connected for each size. From the electrical point of view, the section of the contact components is related to the size of connector but for small sizes this section must also permit a sufficient degree of mechanical strength and rigidity.

In order to guarantee non-interchangeable connection between two positions of the contact support, it is necessary to ensure that the axis of a non-usable contact location is placed outside the corresponding opening of the safety disc in the final position. In an extreme case, this axis passes through one of the points of the periphery of said opening.

This is tantamount to starting that the difference γ between two consecutive angular positions of the contact support, namely one position in which a contact location is coaxial with the opening and the other position in which the axis of said location is secant with the periphery of the opening, is defined as a function of the diameter of an opening and of the radius of the circumference of position-location of the contacts.

Taking into account the allowance in assembly which has a maximum value of 4° as stated above, the angular difference ϕ between two consecutive positions of the contact supports must have a minimum value of $\gamma + 4°$.

A calculation shows that γ is approximately constant and equal to 11°. In consequence, the minimum angular difference of non-interchangeability is 15°. As is readily apparent, this angular difference ϕ must be such that $K\phi = 360°$, wherein K is a whole number and the value $\phi = 15°$ satisfies this condition.

Thus, by maintaining the minimum dimensions of connectors in order to reduce the cost price of these latter and be retaining a sufficient degree of safety in regard to non-interchangeability while taking into account allowances in assembly, the angular difference between two consecutive positions of a contact support is established at 15° and the number of possible positions is therefore 24. Since the number of industrial electric currents normally employed is approximately 20, this choice makes it possible to establish once and for all the position corresponding to a predetermined current value and thus to establish a system of general standardization which can be applied to the industry as a whole.

So far as concerns the spacing of the contacts on their position-location circumference, it should be pointed out that the minimum thickness *e* of insulator which is permitted between the central contact and any peripheral contact must also be maintained between two consecutive peripheral contacts. In other words, the minimum angle between these two consecutive contacts is 60°.

It is apparent that, among all the possible arrangements of contacts on the position-location circumference, it is preferable to choose the arrangement which provides the best distribution and in which the spacing is as far as possible from the minimum angle of 60°.

In the case of a contact support which comprises, in addition to the central grounding contact, four locations to be indicated as in the previous case by N for the neutral and by 1, 2 and 3 for the phases, which is a combination corresponding to practically all the industrial currents employed, the value of the angle between the contacts N and 1 and between the contacts 1 and 2 will be indicated by α, the value of the angle between the contact 2 and the displaced contact 3 will be indicated by β and, finally, the value of the angle between the contact 3 and N will be designated as β'.

As is readily apparent, we first have: $\alpha + \alpha + \beta + \beta' = 360°$, wherein α, β and β' are each a multiple of the angle ϕ whose value is fixed at 15° as stated earlier. It is also necessary to ensure that each of these angles is either greater than or equal to 60°; in addition, in order to ensure locking between the positions 2 and 3 and positions 3 and N, it is necessary to ensure that β and β' each differ from α by at least 15°.

The optimum values are in that case: $\alpha = 90°$, $\beta = 105°$, $\beta' = 75°$.

FIG. 2 shows an embodiment corresponding to the minimum value of ϕ, namely 15°. In this example, the four contacts other than the grounding contact 6 which is located at the center are disposed in standard manner on a circumference which is concentric with the connector as a whole. The three first contacts N, 1 and 2 are separated on the circumference by 90° arcs whilst the fourth contact 3 is displaced by 15° with respect to the uniform division, the arc of circumference between the contacts 2 and 3 being in that case 105°.

The insulating support of the receptacle comprises 24 peripheral grooves such as 19 which are uniformly spaced at intervals of 15°. The insulating support of the

plug also comprises 24 peripheral grooves and each insulating support can thus assume 24 relative angular positions with respect to its casing.

None of the 24 positions can be superposed on another so far as concerns all the locations of the three contacts other than the neutral N; and if one of the contacts **1, 2** or N of a given position corresponds to the location of the contact **3** of another position, neither of the two other contacts corresponds to a contact location of this second position.

It is thus possible to establish general standardization which is feasible for the entire industry by establishing once and for all the position corresponding to a predetermined current value.

The pivotal safety disc is so arranged that, starting from five well-determined initial positions in which none of the openings of the disc uncovers one of the contact locations of the receptacle-contact support, a rotation of the disc through a given angle θ causes the openings to uncover the locations.

	1 and 2
or	1, 2 and 3
or	1, 2, 3 and N
or	1, 2 and N
or	1 and N

It is apparent that the safety disc (shown in FIG. 3) must first be provided with four openings **30, 31, 32** and **33** having between them the same relative positions as the contact locations and consequently having successive angular intervals α, α, β and β', that is to say: 90°, 90°; 105°, 75°.

In order that only the contacts **1, 2** and **3** should be uncovered, said disc must be provided with three openings set at angular intervals α and β and generally different from the openings **31, 32** and **33.** The most simple solution consists in placing a fifth opening **35** at $-\beta$ from the opening **31.**

Similarly, in order to uncover only N, **1** and **2,** it is necessary to have three openings equidistant by α other than the openings **30, 31** and **32** considered together. It is accordingly necessary to have a sixth opening placed at $-\alpha$ from **33** or from **32** or even placed at $+\alpha$ from **35** or from **30.**

If we take into account the face that $\alpha = 90°$, the two solutions $-\alpha$ from **32** or $+\alpha$ from **30** are identical and in any case inapplicable. In fact, starting from the coincidence of N, **1, 2, 3** with **30, 31, 32, 33,** a rotation of the safety disc through $-\alpha$ would again uncover the four contact locations since the opening **30** would move to **1,** the opening **31** to **2,** the opening **35** to **3** and the sixth opening to **30.**

On the contrary, the two other solutions are possible. If the sixth opening is located at $-\alpha$ from **33,** then at **36** said opening is diametrically opposite to the opening **35;** and if said opening is located at $+\alpha$ from **35,** it is diametrically opposite to **33.**

In the first case, starting from the position of the disc which brings N, **1, 2, 3** into coincidence with **30, 31, 32, 33,** a rotation through $-\alpha$ uncovers **1, 2** and **3** and not N; a rotation through $\beta + 2\alpha$, or alternatively through $-\beta'$ inasmuch as $\alpha = 90°$, uncovers N and **1** and only these two locations; a rotation through $+\beta$ uncovers **1** and **2** and only these two locations; a rotation through $\beta + \alpha$ uncovers N, **1** and **2** and not **3.**

In the second case, the same positions are obtained respectively by rotations through $-\alpha$, $+\alpha$, $-\beta$, $-\alpha$, $-\beta$.

These two solutions therefore permit the five initial positions of the safety disc which ensure conditions of non-interchangeability. Taking into account the value of $\alpha = 90°$, the openings of the safety disc are therefore spaced from one of these latter which is taken as a point of origin at intervals of 15°, 90°, 180°, 195° and 270° in the reverse direction or else at 90°, 105°, 180°, 195° and 285° in the forward direction.

In both cases, the openings **32** and **35** only form an angular interval which is equal to 15° and the two openings are converted to an oblong slot. The same applies to the openings **30** and **36** in the first case and, in the second case, the sixth opening will be adjacent to the opening **31.** Thus, the safety disc is provided with only four openings, namely two circular openings and two oblong openings.

The safety disc must not only uncover at will the sets of locations which are defined in the foregoing but, in addition, it must not uncover any of the locations N, **1, 2** and **3** in each of the five initial positions.

Let θ be the angle through which the disc is caused to rotate from an initial position to the corresponding position of utilization, and let V be the minimum locking angle between an opening and a contact location. It is obvious that the most unfavorable conditions correspond to an initial position in which two adjacent openings are located together between the two nearest contact locations, that is to say within the angle β', whereas their final position is 0° and $360° - \phi$ or 0° and ϕ. It is both necessary and sufficient to have at the same time, at absolute value:

$$\theta + V \leq \beta' - \phi \text{ or } \theta + V \leq 90° - 2\phi$$

and $\theta - \phi \geq V$

from which it follows that $2\theta \leq 90° - \phi$

and $2V \leq 90° - 3°\phi$

Furthermore, the angle V is determined geometrically as was the case above with the angle γ of angular difference between two positions of the contact support. However, it is necessary in this case to ensure that the opening and the nearest contact location are tangent at an extreme value in order that the contact location should be entirely concealed or in other words that we should have: $V \geq 22°$.

We therefore have at the same time

$$22° \leq V \leq (90 - 3\phi)/2 \text{ namely } 22° \leq V \leq 22°30$$

For this value, we take $V = 22°30$ whereas $\theta = 37°30$ or, more precisely $\theta = -37°30$.

The disc is driven in rotation by the plug at the time of locking of the plug to the receptacle. Its initial position is chosen in such manner as to ensure that, after this rotation, said disc uncovers the receptacle contacts or be employed and these latter alone.

The locking rotation takes place through an angle of 37°30 and accordingly, as has been noted in the foregoing, the disc does not uncover any of the contact locations in its initial position even to a very partial extent. In other words, the angular interval between the center of any opening and the nearest contact location is greater than 22°. If the initial reference position taken for the disc is that in which the final position uncovers the four contacts N, **1, 2** and **3,** that is to say the initial

position in which the opening **30** is displaced by 37°30 in the forward direction with respect to the contact N, it is apparent that:

The initial position obtained as a result of rotation through −90° from the reference position makes it possible to uncover the contacts **1, 2, 3** and not N.

The position obtained as a result of rotation through −75° makes it possible to uncover the contacts N and **1** and only these two locations.

The position obtained as a result of a rotation through +105° makes it possible to uncover the contacts **1** and **2** and only these two locations.

Finally, the position obtained as a result of rotation through +195° makes it possible to uncover the contacts N, **1** and **2** and not **3.**

It is then only necessary to place the safety disc within one of these five initial positions which corresponds to the equipment of the receptacle.

As is readily understood, and taking into account the allowances in assembly and the clearances which are necessary for rational utilization of electric connection devices, all the angular values indicated in the characteristics set forth in the foregoing permit a variation of either plus or minus 2° approximately without thereby excluding the application from the broad purview of this invention.

Similarly, the arrangement of the plug and receptacle contacts as well as the safety-disc openings can be reversed provided that the direction of locking rotation is also reversed.

FIGS. 4 to 12 show another form of construction. In the example illustrated, the values of the angles γ, ϕ, θ, α, β and β' are the same as those corresponding to the example illustrated in FIGS. 1 to 3 and there are obviously obtained the same number of positions of assembly, the same number of initial positions of the safety disc and the same guarantee of non-interchangeability. The differences with the previous embodiment lies mainly in the various guiding and locking means; they permit a reduction in the number of component parts, a reduction in overall size by virtue of the possibility of reducing the length of resilient contacts and give rise to further advantages as will be explained hereinafter.

In this form of construction of the electric connection device, the plug (not shown) is similar to the plug employed in the previous embodiment and comprises an insulating support which is capable of assuming within a casing and with respect to a guide lug carried by said casing a relative position selected from twenty-four possible positions, depending on the characteristics of the utilization current. The fixed electric contacts are mounted in the insulating support, including a grounding contact corresponding to the current which is necessary for the utilization circuit. However, with the exception of the grounding contact, these plug contacts are of special design. Each contact comprises a cylindrical stem **40** which is adapted to carry a lead-clamp **41** at one end whilst the other end is enlarged so as to form a small, transverse and substantially rectangular plate **42** extending radially with respect to the contact-location circumference and adapted to carry on its free face a contact pastille **43** which is intended to cooperate with the resilient contacts of the receptacle.

The receptacle is also similar to the receptacle **21** of the previous example. It comprises an insulating support **44** in which are mounted a central grounding contact and four resilient contacts such as **45,** namely a neutral contact N and three phase contacts **1, 2** and **3** spaced along their position-location circumference as has been stated in connection with FIG. **2.** However, in this case the support **44** takes up a fixed relative position within its casing, the angular position of this support with respect to the guiding means for the plug and the receptacle being selected according to the characteristics of the supply current in the manner which will be explained below.

A pivotal safety disc **46** is mounted on the insulating support **44.** Said disc has a central opening **57** which is intended to be traversed by the grounding contact of the plug and has four peripheral slots for accommodating the small plates such as **42** of the plug contacts, namely two slots **51** and **53** having a width substantially equal to that of said small plates and two other slots having a width which is substantially double and defining two rectangular locations designated respectively by the references **50** and **56, 52** and **55,** these locations and the slots **51** and **53** being spaced over the circumference in the same manner as the openings of the safety disc **23** of the previous example (FIG. **8**).

The assembly which is formed by the support **44** and the safety disc **46** is fitted with a cylindrical cover **47** which is stationary with respect to the support **44** and has a slightly projecting end-wall **48** or so-called shield provided with five openings, namely a central circular opening **49** for the insertion of the grounding contact of the plug and four identical openings such as **58** (FIG. **9**) each constituted by a rectangular portion which is intended for the insertion of the small plates **42** of the plug contacts and provides an extension in the reverse direction in the form of a portion of circular arc having a width corresponding to the diameter of the stems **40** of said contacts and having an angular length θ of 37°30. These openings are disposed in such manner as to ensure that the ends of the portions in the form of circular arcs are located respectively in the line of extension of the receptacle contacts.

On that face which is directed towards the receptacle, the shield is provided on its projecting periphery with notches such as **59** (as shown in FIG. **9**), provision being made for twenty-four notches uniformly spaced at intervals of 15°. It is by opening one of these notches which is then intended to cooperate with the guide lug of the plug that the relative angular position of the support **44** with respect to said lug is chosen according to the characteristics of the supply current.

Locking of the safety disc **46** in its initial position is obtained as a result of cooperation of a contact of the receptacle, namely the contact of phase **1,** for example, with a recess such as **60** formed in the internal face of the disc (as shown in FIGS. **8** and **11**). In order to obtain the five initial positions corresponding to the various possibilities of polarity, it is therefore necessary to have five recesses **60, 61, 62, 63** and **64** (shown in FIG. **8**) which are suitably disposed as follows: the recess **60** located at 37°5 from the slot **51,** the recess **61** located at 105° from the recess **60,** the recess **62** located at 90° from the recess **61,** the recess **63** located at 75° from the recess **62** and the recess **64** located at 15° from the recess **63,** which produces an angular interval of 75° between the recesses **64** and **60.**

The operation is clear and is illustrated in FIGS. **4** to **7.** The plug is presented in front of the receptacle in such manner that the lug of its casing engages within

the opened notch **59** of the shield **48**. As in the case of the previous example, if the position of the plug support within its casing corresponds to a utilization current which is compatible with the supply current, each of the plug contacts is in that case located opposite to the rectangular portion of one of the openings **58** of the shield (as shown in FIG. **4**). The movement of insertion of the plug can then continue (as shown in FIG. **5**) so that the small plates **42** engage within the peripheral slots of the safety disc **46** after having passed through the openings **58** so as to come into abutment against the free face of the receptacle. A rotation is then carried out in the reverse direction, the small plates **42** cause the displacement of the disc **46** and the stems **40** of the contacts engage in the arcuate portions of the openings **58** (as shown in FIG. **6**). This movement of rotation continues until the stems **40** are abuttingly applied against the ends of said arcuate portions (as shown in FIG. **7**). This position corresponds to the "contacts established" position (FIG. **10**), wherein each pastille **43** is applied against a resilient contact **45** of the receptacle.

At the time of assembly, the initial position of the disc **46** is chosen as a function of the polarity as in the previous example, by bringing one of the recesses **60** to **64** opposite to the contact **45** of the pole **1** (as shown in FIG. **11**). In fact, since the angular interval between two recesses in the case of some of these latter is 75°, 90° and 105°, that is to say values equal to the angular interval of certain contacts of the receptacle, cooperation between a number of recesses and the contacts is accordingly possible.

More precisely, locking of the disc in its initial position is ensured by two or three contacts which cooperate with recesses, namely as follows:

Position A : **60** on **1**, **62** on **3** and **63** on N
Position B : **61** on **1** and **62** on **2**
Position C : **62** on **1**, **64** on **2** an **61** on N
Position D : **63** on **1**, **60** on **2** and **61** on **3**
Position E : **64** on **1** and **62** on N

Starting from each of these initial positions, a rotation through $\theta = 37°30$ in the reverse direction makes it possible to uncover the different combinations of contacts (see FIG. **12**).

Position A : **1**, **2**, **3** and N
Position B : **1** and **2**
Position C : **1**, **2** and N
Position D : **1**, **2** and **3**
Position E : **1** and N

This form of construction offers a certain number of advantages. In the first place, it permits simplification of the device: guiding by means of a simple lug, provision of a stationary receptacle support, locking of the plug onto the receptacle by means of the plug contacts themselves (small plates **42** cooperating with the internal face of the shield) and locking of the disc by means of the receptacle contacts, thereby making it possible in contrast to the previous example to suppress the catches for locking the plug to the receptacle as well as the disc-locking washer and its spring. In addition, the shield protects the safety disc after disconnection of the plug: the initial position of this disc cannot be changed without disassembling the receptacle and the plug cover no longer serves any useful purpose. It is also worthy of note that the plug contacts and receptacle contacts produce a self-cleaning action by sweeping over each other. Finally, and above all, this device makes it possible to reduce the elastic amplitude of the receptacle contacts to a considerable extent. In fact, this amplitude is reduced to the play which exists between the disc and the corresponding face of the receptacle as increased by the clearance which is necessary during rotation between the internal face of the shield and the corresponding face of the small plates (or alternatively as increased by the depth of the recesses in FIG. **11**). In contrast to the previous example in which the large number of components employed for locking the plug to the receptacle entailed the need for an elastic amplitude of the female contacts of the order of 7 millimeters in order to ensure a good contact, taking into account the manufacturing tolerances of each of these components, the device which has just been described makes it possible to reduce this amplitude to 2 millimeters. This in turn makes it possible to reduce the length of the braided cable for a connector of the same size (for example a braided cable of 6 millimeters instead of 20). In point of fact, as a contact is shorter, so its resistance is lower and its current-carrying capacity in amperes is higher. In consequence, it is possible for the same value of power to construct a smaller and consequently less costly apparatus.

What is claimed is:

1. An electric connection device of the type comprising, in combination: a plug and a receptacle each having contacts and constituted by an insulating contact support housed within a casing, said plug and said receptacle carrying associated relatively rotational locking means and associated guiding means arranged to couple these said means in a single relative angular position, locations for said contacts on each of said two supports being uniformly spaced over a circumference with exception of one contact which occupies a displaced position with respect to this spaced arrangement, and a safety disc of insulating material provided with openings adapted to be traversed by said contacts of said plug being pivotally mounted on said receptacle coaxially with said circumference defining said contact locations, said safety disc being rotationally displaced by said plug at the time of locking of said plug to said receptacle from an initial angular position corresponding to a given combination of contacts to be uncovered at finish of locking rotation movement, wherein said contact support of each said plug and said receptacle is adjustable in steps of ϕ degrees in relative angular position with respect to a respective one of said guiding means associated respectively with said plug and said receptacle, the angular displacement of that contact which is displaced with respect to the uniform spaced arrangement is $k \cdot \phi$ degrees, k being a whole number and retractable locking means provided for maintaining said safety disc in its initial position at a time of disconnection of said plug from said receptacle.

2. An electric connection device as claimed in claim **1**, wherein the means for locking the safety disc in its initial position are constituted by $360/\phi$ slots formed on a peripheral flange of said disc and adapted to cooperate with lugs carried by an annular washer urged in contact with said flange by elastic means and mounted in such manner as to be axially displaced by the plug in opposition to said elastic means during insertion of said plug.

3. An electric connection device as claimed in claim **1**, comprising resilient receptacle contacts, wherein the means for locking the safety disc in the initial angular

position selected is carried out by cooperation of at least one resilient receptacle contact with a recess formed in the internal face of said safety disc.

4. An electric connection device as claimed in claim **1** and comprising four poles in which the angular displacement ϕ between two consecutive angular positions of a contact support with respect to the guiding means is 15° whilst the three phase contacts are disposed at intervals along their positionlocation circumference starting from the neutral at locations of 90°, 180° and 285° in the reverse direction.

5. An electric connection device as claimed in claim **4**, wherein the safety disc is provided with six openings disposed from one of said openings taken as a point of origin at 15°, 90°, 180°, 195° and 285° in the reverse direction.

6. An electric connection device as claimed in claim **5**, wherein those of said openings in the safety-disc which are displaced by 15° are connected by a slot which surrounds these openings.

7. An electric connection device as claimed in claim **5**, wherein said safety disc is rotatable between each possible initial position thereof and the corresponding connection position through an arc having an amplitude of 37°30′ in the reverse direction.

8. An electric connection device as claimed in claim **1**, including a shield having a projecting annular flange, and wherein the guiding means for coupling the plug to the receptacle are constituted by a lug carried by the plug casing and cooperate with a slot formed in said projecting annular flange of said shield whilst the insulating support of the receptacle is stationarily fixed within its casing and the insulating support of the plug is adjustable for orientation with respect to said lug, the projecting annular flange of the shield is provided on the face directed towards the receptacle with a plurality of notches uniformly spaced at intervals of 15°, one of said notches being intended to be opened at the moment of assembly so as to constitute the guiding slot.

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