Feb. 11, 1964 H. HUBBELL 3,120,985

ELECTRICAL CONNECTOR HAVING SELECTIVE KEY MEANS FOR DIFFERENT VOLTAGES

Filed April 19, 1961 2 Sheets-Sheet 1

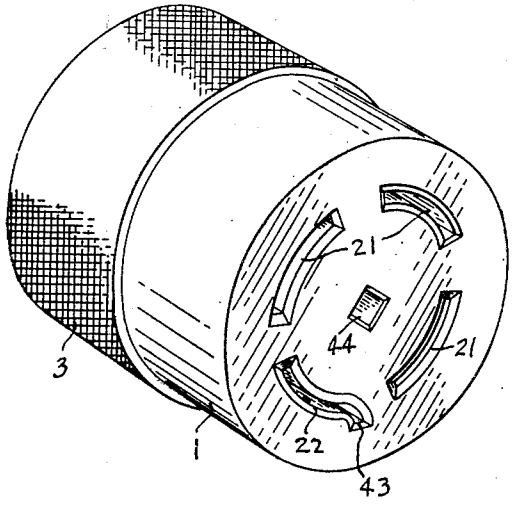


Fig. 1.

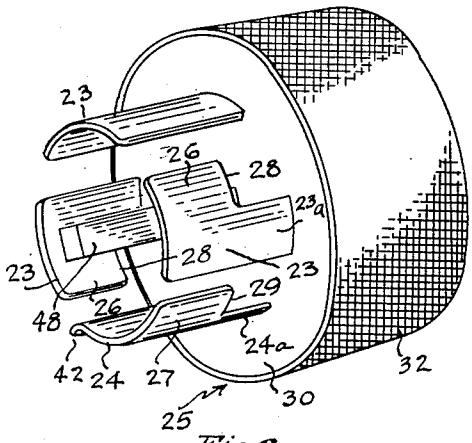


Fig. 2.

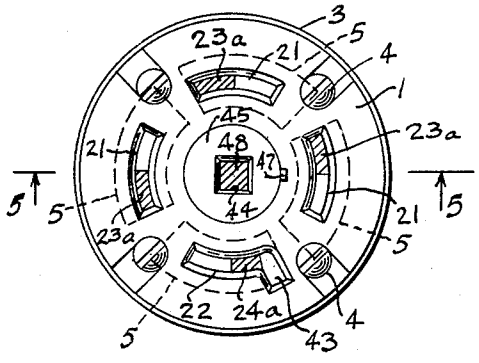


Fig. 3.

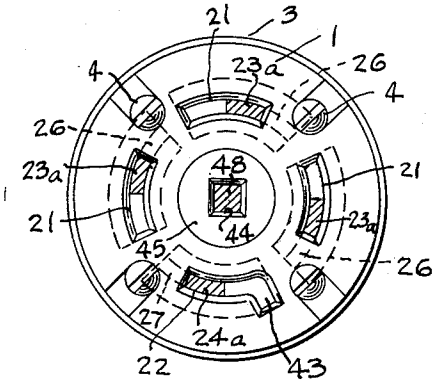


Fig. 4.

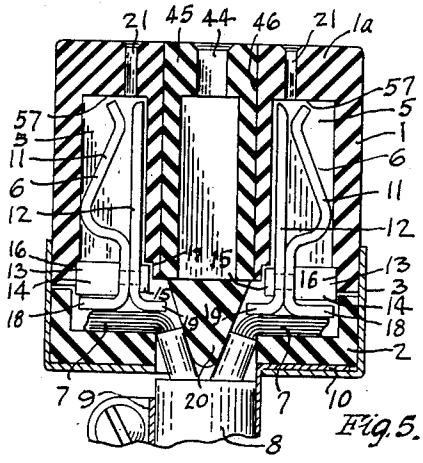


Fig. 5.

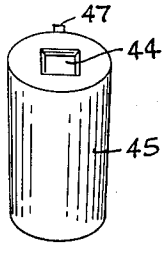


Fig. 6.

INVENTOR
Harvey Hubbell
BY
Wooster, Davis & Cifelli
ATTORNEYS.

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ELECTRICAL CONNECTOR HAVING SELECTIVE KEY MEANS FOR DIFFERENT VOLTAGES

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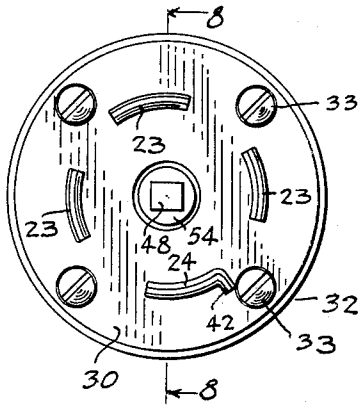


Fig. 7.

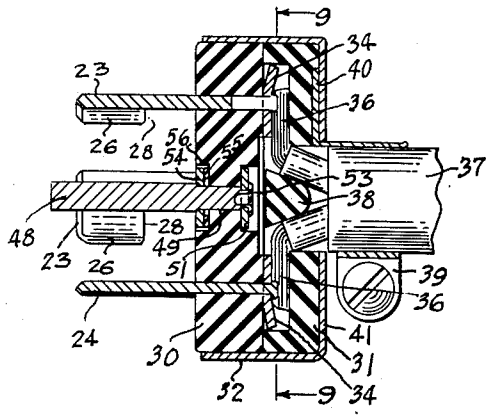


Fig. 8.

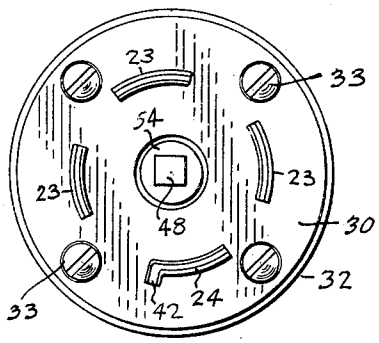


Fig. 10.

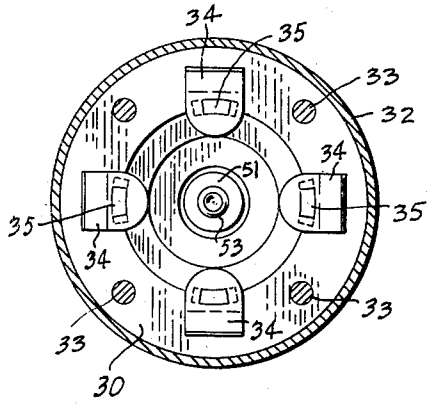


Fig. 9.

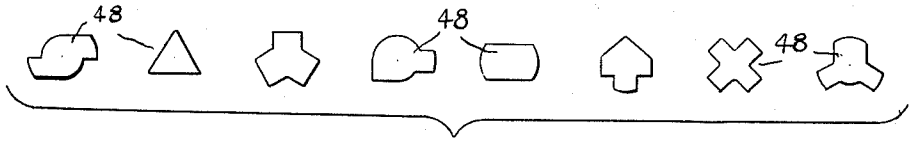


Fig. 12.

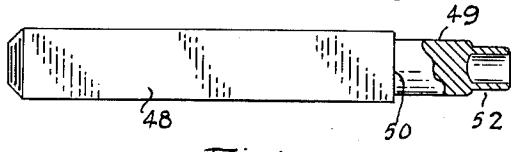


Fig. 11.

INVENTOR
Harvey Hubbell
BY
Wooster, Davis & Cifelli
ATTORNEYS.

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ELECTRICAL CONNECTOR HAVING SELECTIVE KEY MEANS FOR DIFFERENT VOLTAGES

Harvey Hubbell, Southport, Conn., assignor to Harvey Hubbell, Incorporated, Bridgeport, Conn., a corporation of Connecticut

Filed Apr. 19, 1961, Ser. No. 104,032
9 Claims. (Cl. 339—31)

This invention relates to electrical connectors and cooperating plugs, and has for an object to provide a wire connector and plug having selective key means for different voltages.

Another object is to provide a device of this character with a selective key means adapted for use with a locking type of connection whereby the connector and plug may be locked by relative turning movement against inadvertent separation.

Another object is to provide a device of this character which will identify the connectors and plugs for different polarities and voltages for special applications.

Still another object is to provide this type of connector and plug with means which will prevent the use of either the plug or connector designed for one voltage or polarity with a plug or connector designed for another voltage or polarity.

With the foregoing and other objects in view, I have devised the construction illustrated in the accompanying drawings forming a part of this specification. It is, however, to be understood the invention is not limited to the specific details of construction and arrangement shown, but may embody various changes and modifications within the scope of the invention.

In these drawings:

FIG. 1 is a perspective view of a connector involving this invention;

FIG. 2 is a similar view of a plug which may be used with this connector;

FIG. 3 is an end view of the connector of FIG. 1 showing the plug contacts inserted therein in section and in the unlocked position;

FIG. 4 is a similar view showing the plug contacts in the locked position;

FIG. 5 is a longitudinal section of the connector substantially on line 5—5 of FIG. 3 but with the plug contacts omitted;

FIG. 6 is a perspective view of an insert forming part of the selective means and showing it removed from the connector;

FIG. 7 is an end view of the plug of FIG. 2;

FIG. 8 is a longitudinal section thereof substantially on line 8—8 of FIG. 7;

FIG. 9 is a transverse section substantially on line 9—9 of FIG. 8;

FIG. 10 is an end view similar to FIG. 7 but showing a slight modification;

FIG. 11 is a partial elevation and partial section of the key member used in the plug showing it removed from the plug, and

FIG. 12 are views showing examples of a number of shapes of openings and cooperating keys which may be used in this plug and connector.

The connector is shown in FIGS. 1, 3, 4 and 5, and comprises a body member 1 of any suitable insulating material and an end member 2, also of insulating material, located at the end of member 1, and enclosed by a suitable metal protective cap 3, all of which are connected together by suitable screws 4 passing longitudinally through the members 1 and 2 and threaded into the end wall of the cap 3. The member 1 is provided with suitable chambers or compartments 5 in which are located suitable receptacle contacts 6. The number of these contacts may vary depending on the circuit with which the connector is to be used, but in the arrangement shown there are four equally spaced about the longitudinal axis of the connector. These are adapted for connection to suitable lead wires 7 from an insulated conductor cable 8, and a suitable strain-relief clamp 9 may be clamped about the cable with feet 10 slidable under the end wall of cap 3. One of these contacts may be a grounded contact, and they may also be polarized. They may be of any suitable construction, but they are shown as each comprising two blade members 11 and 12 placed side by side and connected by a transverse securing means in the form of a rivet 13. In the arrangement shown these rivets are flat members passing through the members 11 and 12, with flattened outer ends 14 and 15 seating respectively in the longitudinal channels 16 and 17 extending from the end wall of the member 1 on the opposite sides of the chambers 5. The inner ends of the members 11 and 12 are flared outwardly in opposite directions, as indicated at 18 and 19, and the wires 7 are clamped against them by the end member 2 to make electrical connection from the lead wires to these contacts. These wires may be separated by an intermediate transverse member 20 to prevent short-circuiting.

In the upper or outer end wall of the member 1 are curved elongated slots 21 and 22 leading to the chambers 5 and the receptacle contacts mounted therein. These slots are adapted for insertion of the contact blades 23 and 24 of the plug or cap 25. As this is a locking type of connector, these blade contacts are widened at their free ends to provide overhanging portions 26 and 27 to thus provide overhanging inwardly facing locking shoulders 28 and 29 spaced from the top or outer surface of the insulating body member 30 in which these blades are mounted. The body of the cap or plug includes a second insulating member 31 at the inner side of the member 30, and both are enclosed in a protective metal cup-shaped cap 32, and all three of these members are connected together by suitable screws 33 passing through the members 30 and 31 and threaded into the end wall of the member 32. Shanks of the blades 23 and 24 are passed through suitable openings in the member 30 and secured therein by contact plates 34 riveted to the inner ends of these shanks as indicated at 35, and resting against the inner surface of the member 30.

Conductor wires 36 in the insulated conductor cable 37 may be connected to these plate contacts by any suitable means, that shown comprising laying the stripped ends of conductors 36 across plates 34 between the insulating members 30 and 31, and then drawing these members together by means of the screws 33 to clamp these conductors 36 against the plates 34. The conductors may be kept separated by a transverse dividing member 38 forming a part of the member 31, and there may be a strain-relief 39 clamped about the cable 37 and having feet 40 slidable radially under the end wall 41 of the cap 32.

One of the contacts, in this case the contact **24**, may be a grounding contact with a laterally bent portion **42** forming a longitudinal rib at one edge of the widened end portion **27** of this contact and adapted to enter a similarly arranged laterally extending portion **43** at one end of the slot **22** in the end wall of the connector body **1**, to insure that the plug is inserted in the connector in position to engage the grounded contact in the connector which is located in the chamber **5** to which the slot **22** leads.

To insure that only the proper plug and connector are used together, the connector and plug are provided with cooperating key means; that is, the outer end wall **1***a* of the body member **1** may be provided with a central fixed non-circular opening **44** extending longitudinally inwardly from the outer surface of this wall. It may be formed directly in the end wall of the body, as shown in FIG. 1, or it could be formed in an insert **45** mounted in a fixed position in the body **1**, as shown in FIGS. 3, 4 and 5. In this form the insert is shown as a cylindrical plug inserted in a similarly shaped recess **46** in the body **1** in a fixed position therein. This may be effected by making the insert a press-fit in the recess, or cemented in place, or secured by longitudinal key means, as indicated at **47**.

Cooperating with this key opening **44** is a longitudinally extending key **48** mounted in the member **30** of the cap or plug **25** on the central longitudinal axis of this plug and projecting therefrom in the same direction as the contact blades **23** and **24**. It is of the same shape and substantially the same size as the opening **44** so as to be insertable into this opening when the contacts of the cap or plug are inserted in the slots **21** and **22** of the connector. In this case it is square in cross section to correspond with the shape of the opening **44**, but it is mounted for limited turning movement in the cap or plug **25** about the longitudinal axis of the key and plug, to permit relative turning movement between the plug and connector after the contact blades of the plug have been inserted in the slots of the connector. Thus the inner end portion of the key **48** is reduced in diameter, providing a cylindrical portion **49** leading from a shoulder **50**. This portion **49** may have a bearing in a similar opening in the member **30** of the plug and retained therein by a washer **51** on the reduced end **52** of the key and riveted over as shown at **53**. Means is provided to provide friction yieldingly holding the key in different angular positions, comprising a washer **54** seated against the shoulder **50** and a compressed O-ring **55** in a countersunk recess **56** in the outer surface of the member **30** between the washer **54** and the bottom of this countersunk recess. This friction means therefore retains the key in proper position to pass into the opening **44** in the connector when the blades of the plug are inserted in the connector and properly aligned with the correct slots to receive the respective plug contacts.

To double the possible combinations of plug and connector contacts which may be used with any given opening **44** and key **48**, one of the slots and contacts is provided with the offset portions **42** and **43**, in this case the grounded contact **24** and slot **22**. As shown in FIG. 7, this offset **42** is on one edge of the contact **24** and the offset **43** in the slot is in the corresponding end of this slot, while in FIG. 10 this offset is on the opposite edge of the contact **24** and the offset **43** in the slot would be correspondingly located in the opposite end of the slot **22**. Therefore, two different sets of contacts and their specific relation may be used with one determining key locating means, thus doubling the different connector and plug which may be used with any given form of key and cooperating opening. Thus connectors designed for two different voltages or different polarizations could be used with the same controlling key arrangement of a given form without danger of one being used in place of the other.

Various noncircular shapes could be used for the opening **44** and key **48**. A number are shown by way of example in FIG. 12.

As previously described, the curved slots **21** and **22** lead to the chambers **5** containing the stationary receptacle contacts **6**. These slots are of a length to permit insertion of the widened end portions **26** and **27** of the plug contacts. The chambers **5** are wider than these slots, as indicated in dotted lines in FIGS. 3 and 4, to provide overhanging inwardly facing walls or shoulders **57** at these ends and at the inner ends of the slots. As the plug contacts are inserted in these slots by a relative longitudinal movement between the plug and the receptacle, they engage the receptacle contacts **6** and establish electrical connection between the receptacle and plug contacts. This position is shown in FIG. 3 with the shanks **23***a* and **24***a*, or narrower portions of the blade contacts in the counterclockwise ends of the slots **21** and **22**. These slots are long enough to now permit relative turning movement between the connector and plug, usually by turning the plug clockwise, to shift these contacts from the counterclockwise end of the slots as shown in FIG. 3, to the clockwise end of these slots as shown in FIG. 4. This carries the overhanging portions **26** and **27** of the plug contacts, together with the locking shoulders **28** and **29**, under the overhanging walls **57** at the inner ends of the slots **21** and **22**, thus locking the plug against withdrawal from the connector by longitudinal pull on the cord **37**. By relative turning movement in the opposite direction these overhanging portions of the blade contacts may be shifted back to alignment with the slots **21** and **22**, and the plug may be withdrawn from the connector. The connector or receptacle contacts are of sufficient width so that the electrical contact and connection between the blade contacts of the plug and receptacle contacts established by relative longitudinal movement of the plug and connector as the blade contacts are inserted in the connector, is maintained by the plug and connector contacts remaining in engagement during turning movements of the plug to and from the locked position. In the connector contact to be engaged by the plug contact **24** the outer member **11** would be narrowed to provide clearance for the rib **42**. It will be seen from the above that with this construction only the connector and plug having the same arrangement of contacts and the proper key and keyhole shapes can be connected by inserting the plug contacts into the connector, and therefore, different combinations can be designed for different voltages and polarities without danger of the wrong plug being used with any given connector or the wrong connector being used with a certain plug.

The invention disclosed herein is an improvement on the invention disclosed and claimed in my copending application, Serial No. 721,856, filed March 17, 1958, entitled Multi-Wire Connector and Plug With Selective Central Key Means for Different Voltages, now Patent No. 3,023,394. In the invention disclosed and claimed in my copending application, selective central key means for controlling connection of connectors and plugs of different voltages or polarity is provided in the form of a key that is rigidly mounted on the plug and a cooperating insert having an opening of the same shape as that of the key mounted in the connector body for limited turning movement. Although the invention covered by my copending application is entirely satisfactory for its intended purposes, it has been found in practice that the invention covered by the instant application is superior thereto in several respects. In the first place, it is more economical to manufacture a connector body and plug embodying the invention of the instant application with available manufacturing equipment, because it is less costly to provide a rotatable key on the plug than a rotatable insert on the connector body. Secondly, having the rotatable key on the plug provides a simple means for adjusting the key if it has inadvertently been moved out of phase and does not properly align with the opening in the connector for initial longitudinal insertion, whereas it is difficult to correct the position of a rotatable insert in the connector in

the event of its being inadvertently moved out of phase. The former may be simply effected by utilizing the fingers to grip the key and turn it, whereas the latter requires an implement of some sort, such as a screw driver, to be inserted into the key insert opening to turn the insert. Thirdly, it is an advantage to have the key on the plug rotatably mounted because this precludes its use as a wrench to force its way into a key insert opening having a similar but slightly different cross sectional configuration. This obtains because the rigid key mounting lends itself to such use, whereas the rotatable key mounting inherently slips if it is used as a wrench and prevents its being forced into an improperly shaped insert opening in a connector. Fourthly, the movable key mounting on the plug adapts itself more readily to utilization with three-wire and two-wire connector and plug assemblies, because in such applications there is not sufficient room in the center of the connector to mount a rotatably mounted key insert, as this requires considerable room as opposed to rotatably mounting the key on the plug, which requires relatively little room. For the foregoing reasons, the invention covered by this application constitutes a distinct improvement over that of my copending application.

Having thus set forth the nature of my invention, I claim:

1. A multi-wire connector and plug, said connector comprising an insulating body provided with chambers for receptacle contacts and a series of contact blade entrance slots in the front wall of said body leading to said chambers and a central fixed noncircular key opening leading longitudinally inward from said end wall, receptacle contacts in said chambers, said plug including an insulating body and contact blades mounted on said body for insertion in the slots in the connector to engage the receptacle contacts therein, interlocking means on the plug and connector to prevent their separation mounted to become effective and ineffective by relative turning movement between the plug and connector after the contact blades have been inserted in the slots, a key member projecting longitudinally from the plug body of the same noncircular shape as the key opening in the connector and positioned in the same angular position relative to the axis of the plug and the blade contacts as the key opening is to the axis of the connector and the blade entrance slots therein, and means mounting the key to turn in the plug to permit turning movements of the plug after the key is inserted in the noncircular opening including friction means to yieldably retain the key in any different angular position in the plug to which it is turned.

2. A multi-wire connector and plug, said connector comprising an insulating body member provided with chambers for receptacle contacts and a series of contact blade entrance slots leading to said chambers, receptacle contacts in the chambers, said plug including an insulating body and contact blades mounted on said body for insertion in the slots in the connector to engage the contacts therein, interlocking means to prevent separation of the plug and connector mounted to become effective and ineffective by relative turning movement between the plug and connector only after the contact blades have been inserted in the slots in the connector and are in engagement with the receptacle contacts, said connector body provided with a central noncircular opening leading inwardly from the surface having the entrance slots, and a key of the same size and shape as said opening projecting from the plug body in the same direction as the blade contacts and positioned to enter said opening only when the contact blades of the plug are in position to enter predetermined slots of the connector, and means mounting the key to turn about its longitudinal axis as the inserted plug is turned to and from the interlocked position including friction means to yieldingly retain the key in any different angular position.

3. A multi-wire connector and plug according to claim 2 in which one of the entrance slots in the connector includes a laterally extending portion at one end and the contact blade on the plug positioned to enter this slot has a similar longitudinal rib at one edge to enter this laterally extending portion and prevent insertion of the plug in the connector in more than one position.

4. A multi-wire connector and plug comprising an insulating body member, spaced stationary contacts mounted therein, a plug, spaced contacts mounted in the plug adapted to engage those of the body member by a relative longitudinal movement of the plug and body member, interlocking means to prevent separation of the plug and body member mounted to become effective by a relative turning movement between the plug and body member while the contacts of the plug and body member are continuously in engagement, a fixed insert in the connector body member provided with a noncircular opening, a key projecting from the plug of the same shape as the opening in the insert and positioned in the same position relative to the axis of the plug body and the contacts thereon as is the opening in the insert in relation to the axis of the connector body and the stationary contacts so as to enter said opening only when the plug contacts are in position to engage predetermined contacts of the body member, and means mounting the key in the plug to turn about its axis in the plug during relative turning movements of the body member and plug to and from the interlocked position including friction means to yieldingly retain the key in any different angular position in the plug to which it is turned.

5. A multi-wire connector and plug comprising an insulating body member provided with chambers for receptacle contacts, receptacle contacts in said chambers, said body provided with a series of contact blade entrance slots in its front wall leading to said chambers and contacts and a fixed noncircular central opening, a plug, spaced contact blades mounted in the plug adapted for insertion in said slots to engage the receptacle contacts by a relative longitudinal movement of the plug and body member, one of said slots having a lateral extension at one end thereof and the plug contact positioned to enter said slot having a laterally extending rib along the corresponding edge thereof, interlocking means to prevent separation of the plug and body member mounted to become effective by a relative turning movement between the plug and body member while the contacts of the plug and body member are continuously in engagement, a key projecting from the plug of the same shape as the noncircular opening in the insulating body member and positioned in the same position relative to the axis of the plug and the contacts thereon as is the opening in the body member in relation to the axis of said body member and the entrance slots so as to enter said opening when the plug contacts are in position to enter said slots to engage predetermined contacts of the body member, and means mounting the key in the plug to turn about its axis in the plug during relative turning movements of the body member and plug to and from the interlocked position including friction means to yieldingly retain the key in any different angular position in the plug to which it is turned.

6. A plug for a multi-wire connector comprising an insulating body, contact blades on said body projecting longitudinally from the front surface thereof adapted for insertion in similarly located entrance slots in a connector to engage receptacle contacts therein, a key noncircular in cross section extending longitudinally from said front surface of the body on the central axis thereof adapted for insertion in a similarly shaped and located key opening in the container, and means mounting the key to turn in the body to different angular positions about said axis including friction means to yieldably retain the key in any different angular position.

7. A plug according to claim 6 in which one of the contact blades is provided with a laterally extending longitudinal rib along one edge adapted to enter a similarly

shaped entrance slot in a connector to determine the angular position of the plug with relation to the connector.

8. A plug according to claim 6 wherein the means for mounting the key in the body includes a stressed resilient member.

9. A multi-wire connector and plug according to claim 1 wherein the means for mounting the key in the body includes a stressed resilient member.

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