

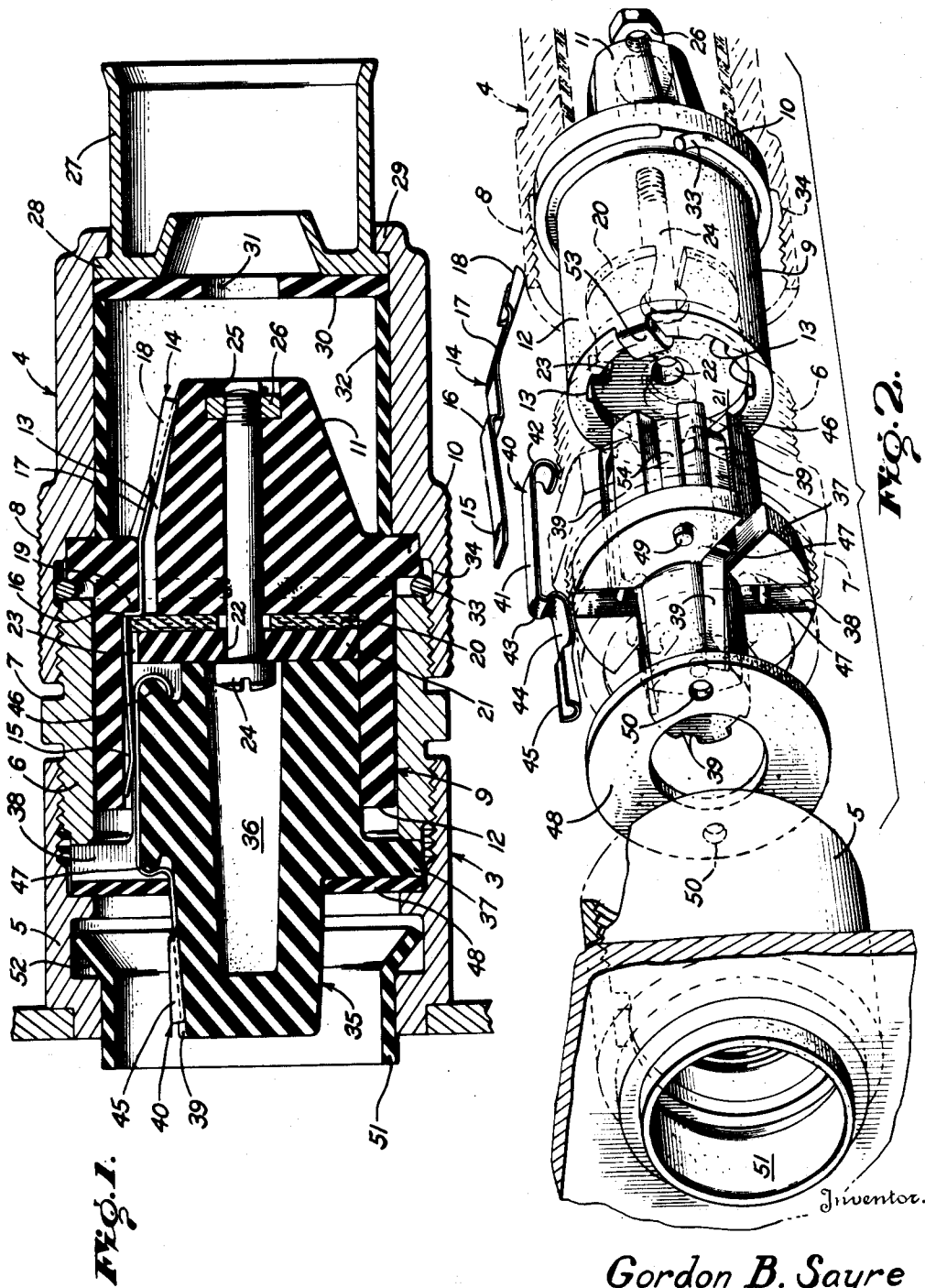
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G. B. SAYRE

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CONNECTING DEVICE

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Gordon B. Sayre
Stephen Berstrik
Attorney.

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CONNECTING DEVICE

Gordon B. Sayre, Brooklyn, N. Y., assigner to
Bendix Aviation Corporation, South Bend, Ind.,
a corporation of Delaware

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The present invention relates to electrical connectors and more particularly to a shielded electrical connector for simultaneously connecting and/or disconnecting a plurality of electrical circuits or devices.

The novel connector embodying the invention is adaptable for use in various fields where it is desired to connect and/or disconnect a plurality of electrical circuits or devices simultaneously. For example, it may be used to connect a radio receiving set to the various sources of potential required for its operation, or it may be used to connect the spark plugs of an internal combustion engine to its distributor, or it may be used with an electrical remote indicating system for connecting the transmitting instrument to the remote indicating instrument. Various other uses in other fields will readily suggest themselves to those skilled in the art to which the invention appertains.

One of the objects of the invention is to provide a novel multiple-circuit connector in which motion between the inter-engaging contacts thereof due to vibration is prevented, thereby making the connector adaptable for use on aircraft where vibration cannot be completely eliminated.

Another object is to provide a novel multiple-circuit connector which is effectively shielded against radio interference.

Another object of the invention is to provide a novel multiple-circuit connector in which the contacts per se may be readily and easily removed and/or replaced at any time, and also may be readily assembled during manufacture, especially when manufactured in large quantities.

A further object is to provide a novel multiple-circuit connector in which it is possible to solder or otherwise connect the contacts thereof to the ends of the wires of the circuits before the contacts are assembled in the housing of the connector, thereby greatly facilitating this operation.

Another object of the invention is to provide a novel structure in a multiple-circuit connector, whereby the connector is made rain-proof and substantially vapor-proof, whereby corrosion and deterioration of the contact elements are substantially prevented and particularly when the connector is used with a metal shield.

A still further object of the invention is to provide a novel combination of elements in an electrical connector, comprising a pair of complementary shell members, one containing a plug member of insulating material and having a plurality of contacts extending in parallel rela-

tion longitudinally of the plug member on the exterior surface thereof and peripherally spaced thereon, and the other of said shell members containing a socket comprising an insulating member having a recess therein for receiving the aforesaid plug member and having a plurality of spaced contacts arranged in said recess in parallel relation longitudinally of said insulating socket member, cooperating means on said plug and socket members for guiding said plug member into said socket member, means for coaxially securing said shell members together upon insertion of the plug member into the socket member, and means providing relative rotation between one of said shell members and the insulating contact-carrying member contained therein.

Still another object is to provide a novel connector comprising a pair of complementary shell members, one of which contains a socket comprising an insulating member having an axial opening therein and provided with a plurality of longitudinally extending channels in the interior wall thereof, an interior shoulder in said insulating member, means retaining said insulating socket member within said one shell member while permitting relative rotation between said members, a contact element in each of said channels and having a bowed portion and a knee portion, with the knee portion resting against said shoulder, and means maintaining the knee portions of said contact elements firmly in contact with said shoulder; the other of said shell members containing a plug comprising an insulating member adapted to be inserted into the opening of the insulating member of the socket and having a plurality of channels extending longitudinally on the exterior surface thereof, a contact element in each of said exterior channels adapted to engage the contact elements of the socket upon insertion of the insulating plug member into the opening of the insulating socket member, means retaining said second contact elements in said exterior channels, means retaining said insulating plug member within said second shell member, means for preventing insertion of said insulating plug member into said insulating socket member in other than a predetermined relation of the one set of contacts with respect to the other set of contacts and for preventing relative rotation between said insulating members after insertion of the one into the other, and means for connecting said shell members together.

A still further object of the invention is to provide a novel multiple-circuit connector in which

the contact-carrying members can be made standard for accommodating a predetermined maximum number of circuits but in which the actual number of circuits to be employed may be reduced without altering the structure of the connector, this being done by merely removing the required number of contacts from the contact-carrying members.

Still another object is to provide a novel multiple-circuit connector having low resistance between the inter-engaging contacts thereof.

The foregoing and other objects and advantages of the invention will appear more fully hereinafter from a consideration of the detailed description which follows, taken together with the accompanying single sheet of drawings wherein one embodiment of the invention is illustrated by way of example. It is to be expressly understood, however, that the drawing is for purposes of illustration and description only, and is not to be construed as defining the limits of the invention, reference being had for this purpose to the appended claims.

In the single sheet of drawings, wherein like reference characters refer to like parts in the two views:

Fig. 1 is a longitudinal section of one form of connector embodying the invention; and

Fig. 2 is a longitudinally exploded perspective view of the connector shown in Fig. 1.

Referring to the drawing, and more particularly to Fig. 1 thereof, the novel connector, in the form illustrated comprises a pair of complementary shell members 3 and 4 of any suitable material which, in the present embodiment, is shown as metal such as aluminum for lightness of weight and in order to provide electrical shielding.

For the purpose of facilitating assembly, the shell member 3 is made of two separable parts 5 and 6 which, after they are connected together during assembly, are not taken apart except for inspection or replacement of parts contained therein, i. e. the parts 5 and 6 are not separated during circuit-connecting or -disconnecting manipulations of the assembled connector.

The part 6 of shell member 3 is externally threaded at both ends thereof, as shown, and is provided with an external polygonal flange 7 intermediate said ends so that a wrench may be used to tightly screw the part 6 into the part 5, the latter part being internally threaded, as shown, to receive part 6.

The shell member 4 is also internally threaded at one end thereof to receive the other threaded end of part 6 of the shell member 3 and is provided with a knurled finger-operable portion 8 on the exterior thereof so that said shell member 4 may be easily screwed over the shell member 3 with the fingers of the hand and without the use of a wrench.

Contained within the shell member 4 is a socket comprising a moulded or otherwise formed insulating member 9 having an external flange 10 intermediate its ends, as shown, the portion 11 beyond said flange being tapered into frusto-conical form and the portion 12 on the other side of the flange 10 being cylindrical and hollow.

In the interior surface of the hollow cylindrical portion 12 are provided a plurality of circumferentially spaced longitudinal channels or slots 13, there being as many channels or slots as the maximum number of contacts it is desired to provide in the connector. In the present embodiment there are five of these channels or slots 13. These channels extend through the flange 10 and con-

tinue on the exterior surface of the tapered portion 11.

A contact element 14 is now provided in these channels or slots. Each contact element comprises a strip of conducting spring material having a bowed portion 15, a knee portion 16 and a terminal end portion 17 at the end of which is provided a terminal lug 18 for connecting a wire thereto (not shown) in any suitable manner as by soldering or brazing, for example.

The wires may be connected to the lugs 18 of the several contacts 14 prior to their being assembled with the socket member 9 and shell member 4. Then the bowed portions 15 are inserted from the tapered end 11 of the socket member 9 through the openings in the flange 10 formed by the channels 13, and are placed so that the knee portion 16 of each contact element rests against a shoulder 19 provided on the inside of the hollow cylindrical portion 12 of the insulating member 9.

After all the contact elements 14 are thus inserted and placed in their respective channels, they are held firmly in place by means of a resilient insulating split disc 20 and a rigid insulating disc 21 provided with a central opening 22 and radial slots 23 on its periphery to accommodate the bowed portions 15 of the contact elements 14. A bolt 24 is passed through the opening 22 of the disc 21, through the resilient disc 20 and extends through an opening in the tapered portion 11 of the member 9 until the end of the bolt comes out at a recess 25 provided at the end of the portion 11, where a nut 26 is screwed onto the bolt to hold the elements in assembled relation.

In assembling the insulating socket member 9, after the contacts have been provided therein, a cylindrical member 27 having an external flange 28 is inserted into the shell member 4 from the left end thereof, as viewed in Figs. 1 and 2, so that the flange 28 abuts the spun over end 29 of the shell member 4 on the inside thereof. Then an insulating disc 30 having a central opening 31 is placed into the shell 4 to bear against the flange 28 of the member 27, and then a cylindrical insulating shell 32 is placed inside the shell 4 so as to bear against the disc 30.

After all the above-described parts are placed into the shell 4, the assembled socket member 9 is inserted into said shell 4 and then means are provided for holding the socket member 9 in the shell 4 while permitting relative rotation therebetween. In the form shown said means comprise a resilient open-ended spring member 33 arranged to encircle the cylindrical portion 12 and to be seated in an annular interior groove 34 provided in the shell 4, while bearing against the flange 10, the spring pressure of the member 33 being radial against the wall of the shell 4.

A cooperating plug member is now provided within the complementary shell member 3 for insertion into the socket member 9 and, as illustrated, said plug member comprises an insulating member 35 having an internal longitudinal recess 36 therein and provided with a flange 37 intermediate its ends, said flange having a plurality of radial slots 38 which extend down to the main body portion of said member 35.

On the exterior surface of the plug member 35 are provided a plurality of circumferentially spaced longitudinal channels or slots 39 which pass through the radial slots 38, there being as many of these channels or slot 39 as there are channels or slot 13 in the socket member 9, and

in each of these channels or slot 39 there is seated a spring contact element 40.

Each contact element 40 comprises a straight contact portion 41 bent over to form a hook 42 at one end, a curved knee portion 43 intermediate its ends, and a terminal portion 44 provided with a lug 45 to which a wire (not shown) may be connected in any suitable manner as by brazing or soldering, for example.

These contact elements 40, because of their form, are self-retaining in their respective channels or slot 39 and are placed therein by first placing the hook end 42 over a shoulder 46 provided on the member 35 at each channel at one end thereof and then forcing the knee portion 43 over a similar shoulder 47. In this manner, each contact element 40 is firmly locked in its respective channel 39 and presents its contact surface 41 for engagement with the bowed portion 15 of a contact element 14 in the socket member 9.

To further insure against dislodgment of the contact elements a collar 48 of insulating material is provided around said insulating member 35 adjacent the flange 37 and is secured to the latter by means of pins 49 on said flange 37, said pins entering openings 50 provided in the collar 48.

A shell 51 of insulating material is provided within the shell member 3 with one end thereof projecting out of the end of said shell member 3 and having its other end spun outwardly to form a flange 52 for holding said insulating shell member 51 in said shell member 3.

The assembled plug member is placed into the part 5 of shell member 3 and then part 6 of said shell member 3 is tightly screwed into the part 5 until the end of said part 6 bears against the flange 37 of the plug member 35, thereby firmly holding said plug member within the shell member 3.

As in the case of the socket member, the circuit wires may be connected to the lugs 45 of the respective contact element 40 before the contact elements are attached to the member 35 and seated in their channels 39 and before the plug member 35 is inserted into the shell member 3, thereby greatly facilitating the wire-connecting operation.

Means are also provided for preventing insertion of the insulating plug member 35 into the insulating socket member 9 except in a predetermined relation of the contact elements 40 with respect to the corresponding contact elements 14 so that only a certain one of the contacts 40 will engage a certain one of the contacts 14, the two contacts always closing the same circuit upon insertion of the plug member into the socket member. In the form shown, said means comprise a tongue 53, longer radially or wider circumferentially than channels 39, provided on the interior surface of the cylindrical portion 12 of the socket member 9 extending longitudinally thereof, and a cooperating groove or channel 54 deeper or wider than channels 39, provided on the exterior surface of the plug member 35 longitudinally thereof and terminating at the flange 37. The tongue is made to project slightly beyond the end of the cylindrical portion 12 so that the contact elements 14 cannot come into engagement with the contact elements 40 until the tongue 53 enters the groove 54.

From the foregoing description it will be seen that after the plug and socket members have been assembled into their respective complementary shell members 3 and 4 and the contacts

40 and 14 have been connected to their respective circuits, all that is necessary to close the circuits simultaneously is to insert the plug member 35 into the socket member 9, with the tongue 53 entering the groove 54, and then screwing the shell member 4 onto the part 6 of shell member 3 by means of the finger-operable knurled portion 8, relative rotation between shell member 4 and socket member 9 being permitted by virtue of the spring element 33 which only loosely engages the flange 10 but firmly engages the annular groove 34 of the shell member 4.

When the complementary shell members 3 and 4 are screwed together they form a shield for the connector as well as a waterproof housing 15 therefor in view of the fact that disc 48 in the shell member 3, and the flange 10 of the socket member 9 form effective seals between shell members 3 and 4, respectively.

The number of channels 13 and 39 may be made standard in both the plug and the socket but the number of contact elements 14 and 40 may be decreased or they may be increased up to the maximum number of channels available, thus making the connector adaptable for any number of circuits from one up to the maximum number of channels provided.

It will be noted that the right hand end of part 6 of shell member 3, as viewed in Fig. 1, projects beyond the plug member 35, thereby protecting the ends of contacts 40 from any mechanical abrasion when the plug is separated from the socket. The contacts 14, on the other hand, do not extend all the way to the end of the cylindrical portion 12, thereby also being protected from abrasion when the plug and socket are disconnected.

There is thus provided a novel structure in an electrical connector, particularly in a multiple-circuit connector, whereby the connector is rugged and provided with contact elements which assure positive contact and which may be easily removed, replaced and readily connected to circuit wires before the contact elements are assembled in their housings, and whereby vibration does not separate the interengaging contact elements. Also, the novel structure makes it possible to manufacture connectors of this type in large quantities on a production basis and the connectors may be modified, without a change of the structure which can be standardized, to accommodate from one to a predetermined maximum number of circuits, by merely increasing or decreasing the number of contact elements within the predetermined maximum number.

Although only one embodiment of the invention has been illustrated and described, various changes in the form, materials and relative arrangement of parts, which will now appear to those skilled in the art, may be made without departing from the scope of the invention. Reference is therefore to be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. In an electrical connector, the combination of a socket member of insulating material provided with a plurality of channels extending longitudinally of said member, an interior shoulder in said member, a contact element in each of said channels and having a bowed portion and a knee portion, with the knee portion resting against said shoulder, means maintaining the knee portions of said contact elements firmly in contact with said shoulder, a plug member of insulating

material for insertion into said socket member and having a plurality of channels extending longitudinally on the exterior surface thereof, a contact element in each of said channels having its contacting portion beneath the outer surface of said plug member adapted to engage the corresponding contact elements of the socket member upon insertion of the plug member into said socket member, means retaining said second contact elements in said exterior channels, and means including a member extending beyond the end of one member and cooperating with a groove in the other member for preventing insertion of said plug member into said socket member in other than a predetermined relation of the plug contacts with respect to the socket contacts and for preventing relative rotation between said plug and socket members after insertion of the one into the other.

2. In an electrical connector, the combination of a pair of complementary metallic shell members, one of which contains a socket comprising an insulating member having an axial opening therein and provided with a plurality of longitudinally extending channels in the interior wall thereof, means providing an interior shoulder in said insulating member, a contact element in each of said channels and having a bowed portion and a knee portion, with the knee portion resting against said shoulder, and means maintaining the knee portions of said contact elements firmly against said shoulder; the other of said metallic shell members containing a plug comprising an insulating member for insertion into the opening of the insulating socket member and having a plurality of channels extending longitudinally on the exterior surface thereof and peripherally spaced thereon, a contact element having its contacting portion in each of said exterior channels and beneath the exterior surface of said plug adapted to engage the contact elements of the socket upon insertion of the plug member into the axial opening of the insulating socket member, and means retaining said second contact elements in said exterior channels, means retaining said insulating plug member within said second shell member, cooperating means on said socket and plug members for preventing insertion of the plug member into said socket member in other than a predetermined relation of the plug contacts with respect to the socket contacts and for preventing relative rotation between said plug and socket members after insertion of the one into the other, and means for connecting said metallic shell members together after insertion of the plug member into the socket member.

3. In an electrical connector, the combination of a pair of complementary metallic shell members, one of which contains a socket comprising an insulating member having an axial opening therein and provided with a plurality of longitudinally extending channels in the interior wall thereof, means providing an interior shoulder in said insulating member, a contact element in each of said channels and having a bowed portion and a knee portion, with the knee portion resting against said shoulder, and means maintaining the knee portions of said contact elements firmly against said shoulder; the other of said metallic shell members containing a plug comprising an insulating member for insertion into the opening of the insulating socket member and having a plurality of channels extending longitudinally on the exterior surface thereof and peripherally spaced thereon, a contact element

having its contacting portion in each of said exterior channels and beneath the exterior surface of said plug adapted to engage the contact elements of the socket upon insertion of the plug member into the axial opening of the insulating socket member, and means retaining said second contact elements in said exterior channels, means retaining said insulating plug member within said second shell member, cooperating means on said socket and plug members for preventing insertion of the plug member into said socket member in other than a predetermined relation of the plug contacts with respect to the socket contacts and for preventing relative rotation between said plug and socket members after insertion of the one into the other, and means for connecting said metallic shell members together after insertion of the plug member into the socket member, and means providing relative rotation between one of said shell members and the insulating contact-carrying member contained therein so as to permit connection of the two shell members together after the plug member is inserted into the socket member.

4. In an electrical connector, the combination of a pair of complementary shell members each provided with a shoulder and adapted to be screwed together, a plug member of insulating material in one of said shell members and having a plurality of removable longitudinally extending flat contacts peripherally spaced on its exterior surface, detachable means for securing said contacts to said plug, said means comprising a portion firmly clamping said contacts to said plug member and providing a shoulder cooperating with the shoulder on its shell member, an insulating socket member in said other shell member and having a plurality of removable longitudinally extending flat contacts peripherally spaced on the interior surface thereof for cooperation with the contacts on said plug member, detachable means for firmly securing said contacts to said socket member, a shoulder formed on said socket member cooperating with said shoulder on its shell member, and means providing relative rotation between one of said shell members and the contact-carrying member contained therein, whereby said shells may be screwed together with the shoulders thereof in compressed relation with the respective shoulders on the plug and socket members whereby said contact members are effectively sealed throughout their contacting portions.

5. In an electrical connector, the combination of a pair of complementary shell members adapted to be screwed together, a plug member of insulating material in one of said shell members and having a plurality of removable longitudinally extending flat contacts peripherally spaced on its exterior surface, a shoulder formed on said plug, hooks formed on said contacts and cooperating with said shoulders to hold the contacts in position against movement in one axial direction and axially slidable means encircling said contacts whereby said contacts are locked in place on said plug, means projecting beyond said contacts to shield the same throughout their contacting areas, an insulating socket member in said other shell member and having a plurality of removable longitudinally extending flat contacts peripherally spaced on the interior surface thereof for cooperation with the contacts on said plug member, a shoulder on said socket, axially movable means cooperating with said contacts and shoulder to hold said contacts in place

against said shoulder, means on said socket extending beyond the ends of said contacts to shield the same, cooperating means on said plug and socket for preventing insertion of said plug member in said socket member in other than a predetermined relation and means providing relative rotation between one of said shell members and the insulating contact-carrying member contained therein so as to permit connection of the two shell members together after the plug member is inserted into the socket member.

6. In an electrical connector, the combination of a pair of complementary shell members adapted to be screwed together, a plug member of insulating material in one of said shell members and having a plurality of removable longitudinally extending flat contacts, a shoulder on said plug, means permitting insertion of said contacts, means on said contacts cooperating with said shoulder for holding said contacts against

axial movement in one direction after insertion thereof, means axially slidable over said contacts for locking said contacts in place, an insulating socket member in said other shell and having a plurality of removable longitudinally extending flat contacts, a shoulder on said socket, means permitting axial insertion only of said contacts, means axially movable for cooperating with said contacts and said shoulder for holding said contacts in place after said insertion, a shoulder in each of said shells, said plug member and said socket being held in position against said shoulders respectively, a groove in one of said shells and a resilient ring axially insertable only into said shell to loosely lock one of said contact-carrying members against one of said shoulders, whereby said shells may be rotatably connected while said contact-carrying members remain in position.

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