

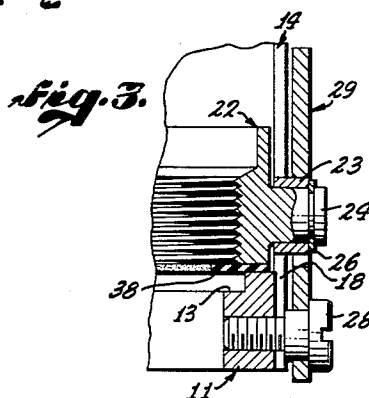
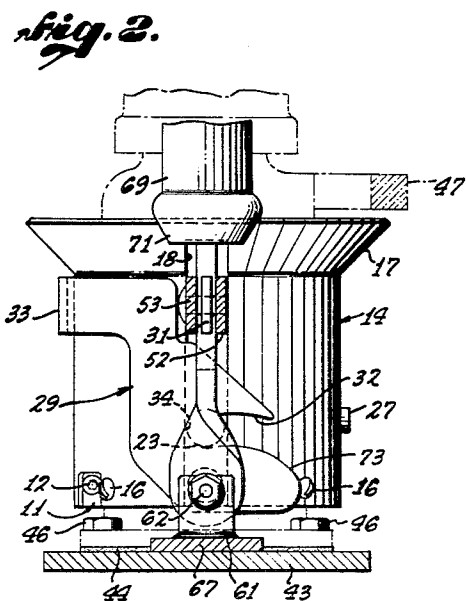
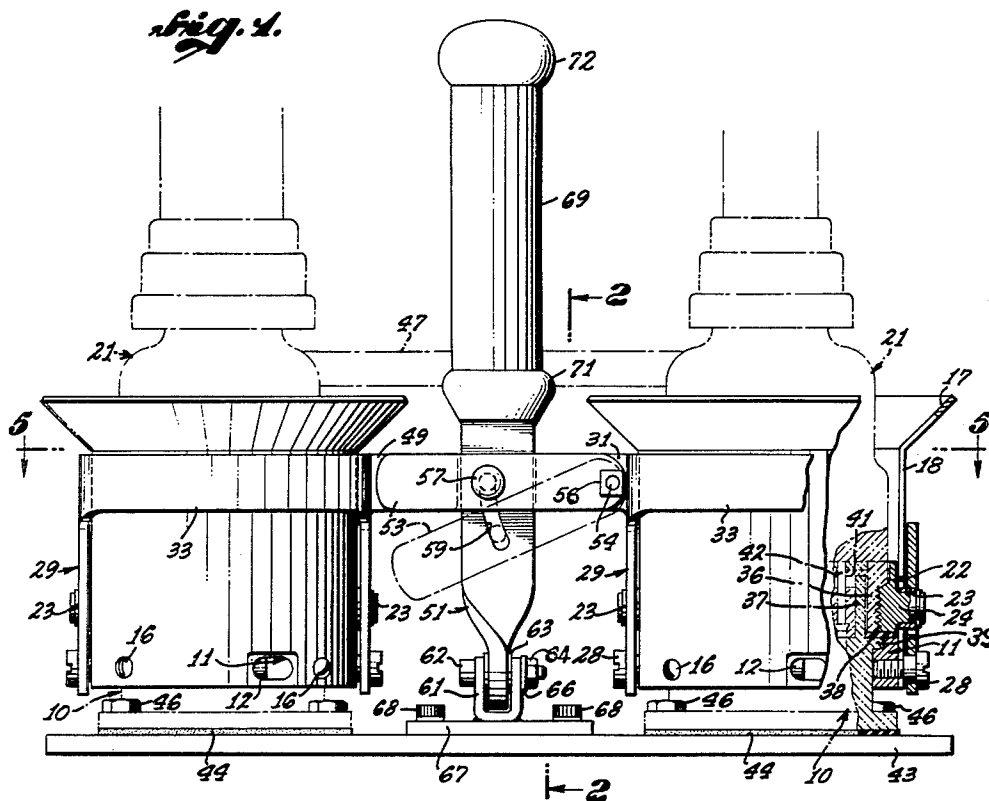
May 31, 1960

A. AGRON ET AL
QUICK PLUG DISCONNECT

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3 Sheets-Sheet 1



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fig. 4.

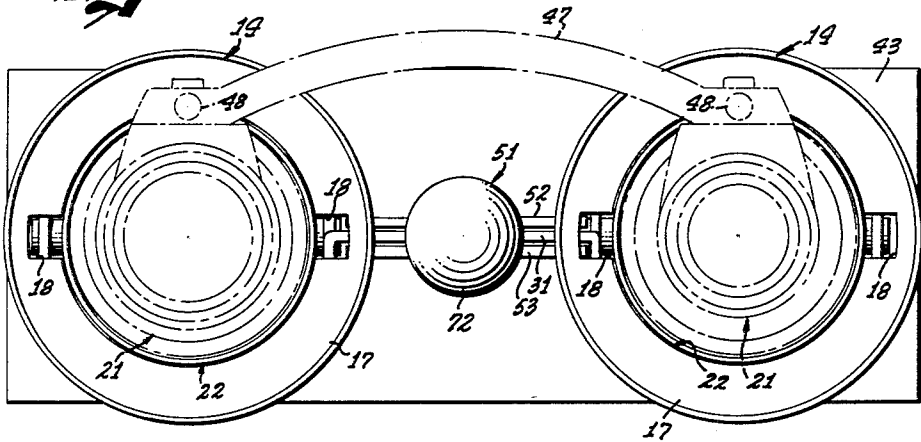


fig. 5.

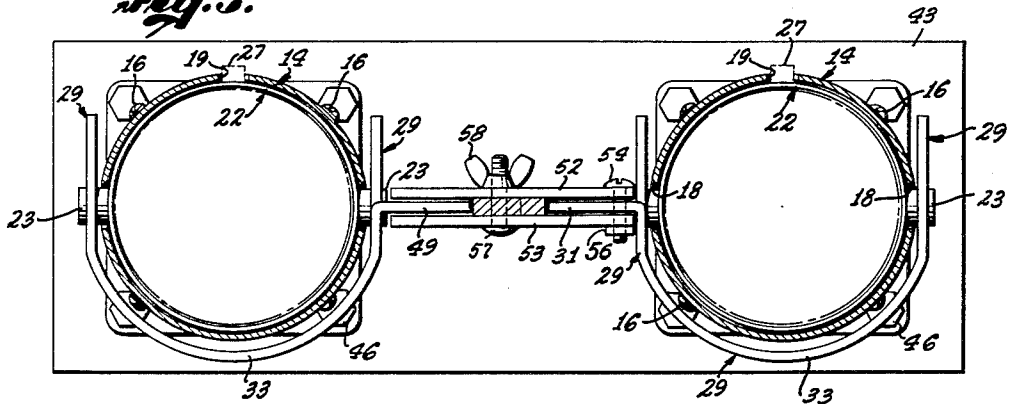
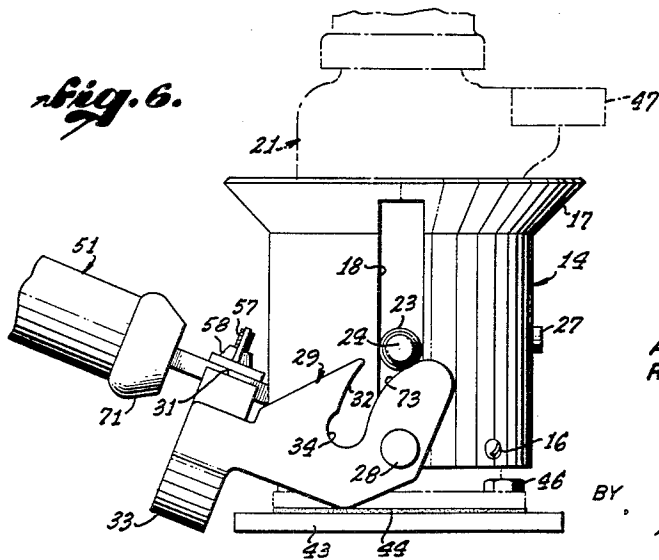


fig. 6.



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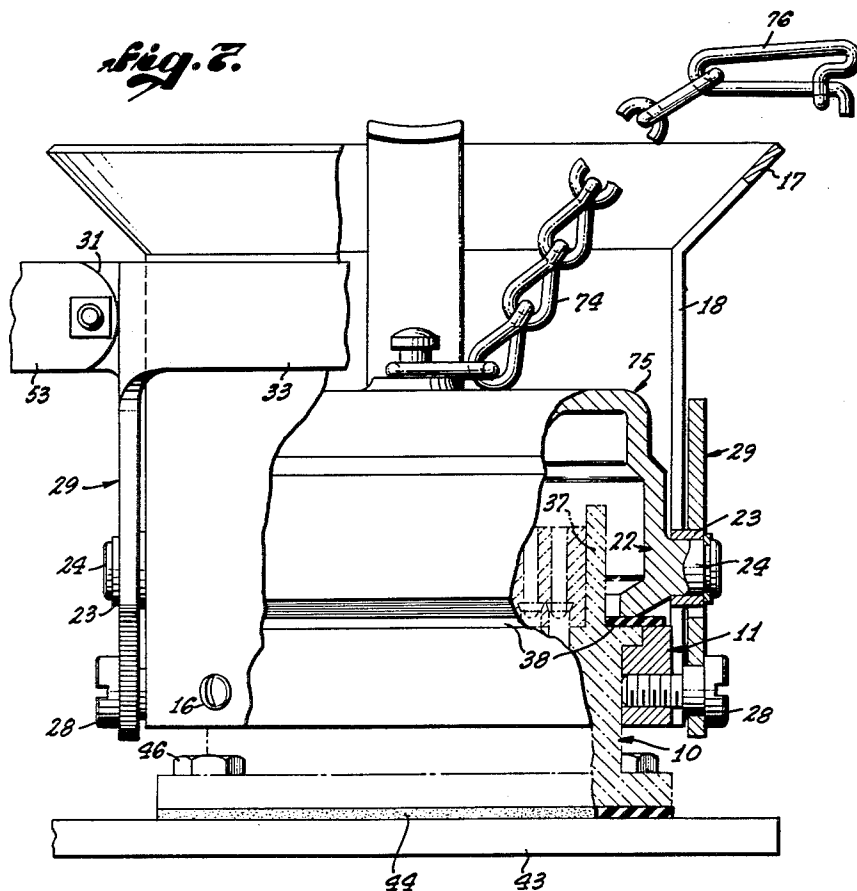
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2,939,103

QUICK PLUG DISCONNECT

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2 Claims. (Cl. 339-75)

This invention relates to an electrical plug and receptacle connecting and disconnecting mechanism and particularly to such a mechanism for clamping the plug and receptacle securely in operative relationship with respect to each other and in a manner wherein the plug and receptacle may be quickly disconnected from each other.

This is a continuation-in-part of our application Serial No. 518,272, filed June 27, 1955, now abandoned.

Electrical plug and receptacle connections present a problem in that it is necessary that the connection between the plug and receptacle to secure and safe and free from any danger of short circuiting. At the same time, it is desirable that the plug and receptacle connection, in certain applications, such as in ordnance work, be capable of being rapidly made and broken. In certain plug and receptacle connections, a secure connection is achieved by screwing the plug and receptacle together. However, in such types of connections, an appreciable amount of time is consumed in threading one of the members into the other. Also, in such connections, an objectionable amount of time is required to unthread one member from the other, especially in emergency situations and in ordnance work where it is absolutely necessary to produce a rapid disconnection of the plug and receptacle. On the other hand, in certain plug and receptacle connections not employing threading connection between the members, the members are not securely joined to each other and there is danger of open circuiting.

Accordingly, it is an important object of the invention to provide a positive rapid and convenient connecting and disconnecting mechanism for plug and receptacle connections.

Another object is to provide a plug and receptacle connecting and disconnecting mechanism, wherein a tight seal is achieved between the plug and receptacle and the connection is capable of being quickly and safely broken.

A further object is to provide a rapid connecting and disconnecting plug and receptacle arrangement, wherein there is a minimum of danger of short circuiting.

Additional objects will become apparent from the following description:

Stated in general terms, the present invention comprehends the provision of an electrical plug and receptacle connecting and disconnecting mechanism including a housing and alignment means for orienting the plug and receptacle in operative engagement relationship with each other. A clamping means is included for securely holding the plug and receptacle in operative engagement relationship. The clamping means is adapted for rapid release of the clamped plug from the receptacle and preferably is pivotally mounted. Also, the clamping means preferably is adapted for connection in pairs, or other multiples, to make it convenient to release two, or more, plugs simultaneously.

A more detailed description of a specific embodiment

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of the invention is given with reference to the drawings, wherein:

Figure 1 is a side elevational view partially in section showing two plugs and receptacles clamped in engagement relationship with each other respectively;

Figure 2 is a sectional elevational view taken on line 2-2 of Figure 1;

Figure 3 is a partial view in sectional elevation to a somewhat enlarged scale showing details of a roller on a plug adapter and of a pivotal mounting of a clamping and release mechanism;

Figure 4 is a plan view of the apparatus shown in Figure 1;

Figure 5 is a cross-sectional view taken on the line 5-5 of Figure 1;

Figure 6 is an end view showing the clamping means pivoted to release the plugs from the receptacles; and

Figure 7 is a side elevational view partially in section showing a cap mounted in the housing.

In the embodiment shown in the drawing, one plug and receptacle of the two pairs of plugs and receptacles shown will be described first. The female receptacle 10, shown in partial sectional elevation in Figure 1, is connected to a split lock ring 11. The split lock ring 11 consists of two identical semi-circumferential halves tightly held together by socket head screws 12 (Figure 2). The screws 12 also serve to clamp the locking ring 11 tightly around the flanged end of the female receptacle 10. The lock ring 11 is provided with an internal flange 13 (Figure 3) adapted to receive therein the flanged end of the female receptacle 10.

Lock ring 11 is in turn tightly mounted within the rear end of a housing 14 by a series of spaced screws 16 threaded into the wall of the lock ring through the wall of the housing. It will be seen that the female receptacle 10 is tightly connected to the rear end of the housing 14, as by the clamping screws 12 in lock ring 11, which then becomes an integral part of the housing 14.

The housing 14 is of generally cylindrical shape with a flared portion 17 on the front end thereof. Two slots 18 are formed longitudinally on opposite walls of the housing 14 and are made to extend through the cylindrical portion of the housing and through part of the flared portion 17 of the housing. A third slot 19 (Figure 5) spaced approximately midway between the two slots 18 extends longitudinally through most of the cylindrical portion of the housing and through a part of the flared portion 17.

A male plug 21, shown in phantom, is threaded at its front end into an internally threaded plug adapter 22. The plug adapter 22 is provided with two coaxial rollers 23 mounted on externally grooved axles 24 by means of retaining rings 26. The rollers 23 slide through slots 18 when plug 21 is inserted into housing 14 through the flared opening 17. A guide projection 27 is integral with the wall of plug adapter 22 about midway between the axis of rollers 23. The projection 27 is positioned on plug adapter 22 so that it will slide through slot 19 and orient plug 21 with respect to receptacle 10 when the plug is inserted to the housing 14 for operative engagement with the receptacle.

Two stud screws 28, positioned coaxially with respect to each other and in the same plane as the axis of axles 24, are threaded into lock ring 11 to pivotally mount a clamping means in the form of a cam locking lever 29 on housing 14. Cam locking lever 29 is bifurcated and is provided with an inwardly extending handle 31, by means of which it is pivoted about the axis of studs 28. The cam locking lever is provided with two cam portions 32 adapted to engage rollers 23 as the cam locking lever

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is urged, by means of handle 31, around the axis of studs 28 into locking position.

As the cam locking lever is progressively urged into locking position, the cam portions 32 progressively urge plug adapter 22 and plug 21 toward the receptacle 10. Just before cam locking lever 29 is completely pivoted with connecting arch 33 in engagement with housing 14, the rollers 23 are tightly engaged by a latching undercut portion 34, as best shown in Figures 2 and 6. This action securely retains plug 21 in locked, operative engagement with receptacle 10.

The plug 21 is provided at the end thereof with an outer cylindrical portion 36 (Fig. 1) which telescopes around a similar outer cylindrical portion 37 provided at the end of the receptacle 10 and having a somewhat smaller outside diameter than the inside diameter of cylindrical portion 36. As the plug 21 and the receptacle 10 are urged together in locked relationship, the lip of cylindrical portion 36 of the plug is urged tightly against a resilient gasket 38 (see also Fig. 3) positioned around the receptacle 10 and supported against a flanged portion 39 in Figure 3 of the receptacle 10. The plug 21 is provided with a disc-shaped gasket 41 supported against the front wall of the plug as shown. The gasket 41 is perforated to permit pins 42 to protrude therethrough and to extend into sockets in receptacle 10 to establish electrical connection between the engaged plug and receptacle.

In the locked position of cam locking lever 29, the cylindrical portion 37 of receptacle 10 is tightly pressed at its lip against the exposed surface of gasket 41 adjacent its periphery. It will be seen that a water-tight seal and a secure electrical connection are made between the plug 21 and the receptacle 10 when locking lever 29 is rotated into contact with housing 14 against the resilience of the gaskets 38 and 41 and by virtue of the locking action of the latching undercut 34.

Two plug 21 and receptacle 10 assemblies are shown, in the specific embodiment of the drawings, mounted in spaced relationship on a panel 43 above a gasket 44 by screws 46. The two plug and receptacle assemblies are shown to have similar dimensions and structural features but it will be understood that the two assemblies can be different in size or construction from each other. The plugs 21 of the two assemblies are connected by a connecting link 47 shown in phantom. The link 47 rigidly maintains the plugs in spaced relationship. It is detachably mounted on the plugs by screws 48 (Fig. 4).

The inwardly extending handle 31 of one assembly, and a similar handle 49 of the adjacent assembly, are connected to a pivotally mounted control handle 51. The connection is made by two flat bars 52 and 53 attached at adjacent ends to handle 31 by a bolt 54 and a nut 56, and at their mid-portions to handle 51 by a bolt 57 and wing nut 58. The bolt 57 passes through a downwardly extending, curved slot 59 cut through handle 51.

The double bar assembly 52 and 53 may be released and pivoted downward by releasing wing nut 58 as shown in phantom drawing in Figure 1. In this case handle 51 will only operate on the inwardly extending handle 31 of the corresponding plug and receptacle assembly. This gives the user option of operating one or both plugs 21 and receptacles 10 as the need may arise.

Handle 51 is pivotally mounted at its lower end on a clevis 61 by a bolt 62 passing through a bearing 63. A nut 64 and washer 66 retain the bolt in position. The clevis 61 is attached to a base plate 67, as indicated, which in turn is fastened to panel 43 by screws 68. For convenience and comfort in grasping and pivoting handle 51, an upper portion thereof is provided with a molded rubber grip 69. The grip preferably is knurled and provided with enlarged portions 71 and 72 at the respective ends thereof to provide a more certain and secure gripping section.

When it is desired to quickly disconnect plugs or plug 21 from receptacles or receptacle 10, the cam locking lever

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29 is actuated at points 31, and 49, or optionally only at point 31 by handle 51 and pivoted in a direction away from connecting link 47, as shown in Figure 1. During this pivotal action, a second cam portion 73 of the cam locking lever 29 engages the rollers 23 and urges plug adapter 22 away from and out of engagement with receptacle adapter 11. To accomplish this disengagement, pins 42 must be rapidly withdrawn from frictional contact in their sockets in receptacle 10. A relatively large frictional force must be rapidly and certainly overcome to break the multiple connections between the pins and their sockets and to snap rollers 23 out of latching undercut portions 34 of the cam surfaces 32 and 73.

Plugs or plug 21 are then grasped by grasping connecting link 47 and are completely removed from housing 14 by sliding rollers 23 and projection 27 through slots 18 and 19, respectively. This is readily accomplished by virtue of the fact that the slots 18 and 19 extend into and through the flared portion 17 of the housing.

When it is desired to reconnect receptacles 10 and plugs 21, the operations just described are reversed. Namely, the plugs are urged into the housings 14 by sliding rollers 23 through slots 18 and projections 27 through slots 19. In this manner, the pins 42 in plugs 21 are automatically aligned with the sockets in receptacles 10 so that electrical contact is always assured without the danger of short circuiting. The frictional force between the pins 42 and their sockets is readily overcome by the mechanical advantage gained through the leverage resulting in using handle 51 and the cam action of surfaces 32 and 73 when making and breaking contact. This is an advantage over grasping the handles 31 or 49 and manually operating each plug and receptacle individually with the force applied to locking lever 29 directly from one's fingers. A strain is placed on the fingers in overcoming the frictional forces acting on the pins 42 and the rollers 23 seated in undercut portions 34.

The flared portion 17 of the housing is made of an outside diameter sufficiently large so that there is no danger of the lip of the flared portion coming in contact with the tips of any of the pins 42, especially the outside row thereof, and thus causing short circuits. If the diameter of the outer lip of flared portion 17 of the housing is made too small, the lip of the flared portion will dip sufficiently into the depression in plug 21 so that the lip may contact pins 42 during careless or inaccurate insertion of the plug into the flared mouth of the housing and cause short circuits.

When it is desired to maintain plugs 21 disconnected from receptacles 10, a cap consisting of a plug adapter 22, as described above, and a cap 75 of the type shown in our co-pending application, Serial No. 518,272, instead of a plug 21, is inserted in housing 14 so that rollers 23 slide through slots 18 and screw 27 slides through slot 19, as previously described. The cap is locked into position in engagement with receptacle 10 by means of cam locking lever 29, also as previously described. Similarly, the cap is disengaged from receptacle 10 by rotating cam locking lever 29 in a clockwise direction using handle 51 as previously described. The cap is attached to one end of a chain 74 having the other end thereof connected to a receptacle. Two chain sections may be joined together for increased length by a chain joining link 76.

It will be observed that the embodiment of the socket and receptacle connecting and disconnecting mechanism described above is adapted for rapid engagement and disengagement and for secure engagement of the male plug and female receptacle. The embodiment shown also is provided with safety features, as pointed out above, to keep contact pins from short circuiting on parts and surfaces of the mechanism, to keep water and moisture from getting into the electrical contact parts of the mechanism, and to assure against incorrect and incomplete contacting of these parts. The embodiment described also contains a double cam latching mechanism which latches

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the plug and receptacle together when the handle of the latching mechanism is urged against the housing of the mechanism and forces them apart when the handle of the latching mechanism is pivoted away from the housing of the assembly.

The foregoing description, given in connection with a particular embodiment of the mechanism is, of course, given primarily to illustrate that particular embodiment of the invention. It is understood that many variations, changes or modifications in structure, design, and details of the illustrated mechanism will occur to one skilled in the art, and that the invention can be applied to a variety of plugs and receptacles other than the ordnance plug and receptacle illustrated. Accordingly, it is understood that such applications of the invention and such variations, changes or modifications in the structure, design, and details of the specific embodiment of the invention illustrated and described above may be made within the scope of the appended claims without departing from the spirit of invention.

Accordingly, while we have herein shown and described our invention in what we have conceived to be the most practical and preferred embodiment, it is recognized that departures can be made therefrom within the scope of our invention, which is not to be limited to the details disclosed herein, but is to be accorded the full scope of the claims so as to embrace any and all equivalent structure or construction.

What is claimed is:

1. An electrical plug and receptacle mechanism comprising; a generally cylindrical housing, a receptacle in one end of said housing, longitudinal slots in said housing, a plug having an end portion engageable in said receptacle and having lateral projections slidable in said slots and of a length to project therethrough and outside said hous-

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ing, and a clamping member pivoted to said housing on a transverse pivot axis and having cam portions adjacent said axis selectively engageable with said projections outside said housing to clamp said plug in said receptacle, said housing being provided with an outwardly flared open end portion at the end opposite said receptacle, said slots extending through only the inner portion of said flared end whereby the outer portion thereof defines a circumferentially continuous edge.

2. An electrical plug and receptacle mechanism comprising; a generally cylindrical housing, a receptacle in one end of said housing, longitudinal slots in said housing, a plug having an end portion engageable in said receptacle and having lateral projections slidable in said slots and of a length to project therethrough and outside said housing, and a clamping member pivoted to said housing on a transverse pivot axis and having cam portions adjacent said axis selectively engageable with said projections outside said housing to clamp said plug in said receptacle, a cam portion of said clamping member being provided with a depression in its cam surface engageable with a projection to lock said plug in said socket and resilient means for forcing said projection into said depression.

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