

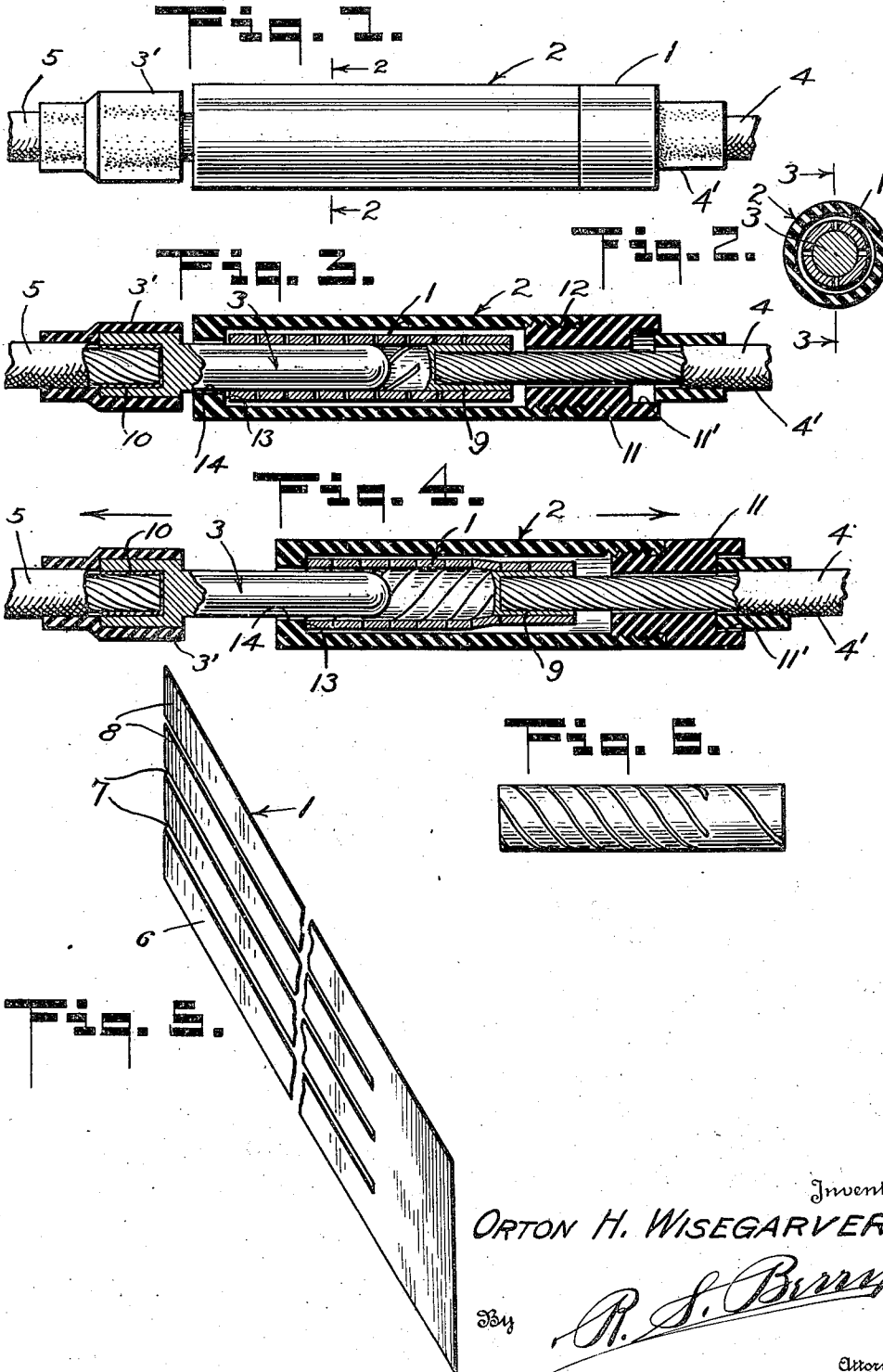
Jan. 15, 1946.

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2,393,083

WIRE CONNECTOR

Filed Oct. 11, 1943



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## UNITED STATES PATENT OFFICE

2,393,083

## WIRE CONNECTOR

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Application October 11, 1943, Serial No. 505,871

6 Claims. (Cl. 173-383)

This invention relates to detachable connectors for mechanically and electrically connecting electrical wires, particularly in aircraft.

An object of this invention is to provide a plug and socket type of connector of the character described wherein the socket will be axially expanded and diametrically constricted to increasingly grip and hold the plug therein when a force tending to separate the socket and plug is accidentally applied thereto but will be diametrically expanded and release its grip on the plug when compressed during the application of an intentional separating force thereto.

Another object of my invention is to provide a connector of the character described in which a member is provided in association with the socket as a means for effecting the compression of the socket while pulling on the socket and plug to intentionally disconnect them, said member in the present embodiment being in the form of a housing in which said socket is mounted so that the housing and socket are relatively movable.

Another object is to provide a connector such as described wherein the socket is provided with a plurality of integral helically coiled gripping fingers or members the free or outer ends of which are subject to being engaged by the socket housing so that the socket may be compressed and diametrically expanded to release the plug by holding the housing and pulling thereon in a direction away from the plug or while pulling in the opposite direction on the plug.

A further object is to provide a connector such as described wherein a good electrical contact is effected and maintained by reason of the construction of the socket and the gripping action thereof on the plug, and particularly in that the helically coiled fingers embrace and frictionally grip the plug and wipe the latter clean with each connection and disconnection of the connector.

With the foregoing objects in view, together with such other objects and advantages as may subsequently appear, the invention resides in the parts and in the combination, construction and arrangement of parts hereinafter described and claimed, and illustrated by way of example in the accompanying drawing, in which:

Fig. 1 is a side elevation of a connector embodying the present invention shown in wire connecting position;

Fig. 2 is a cross sectional view taken on the line 2-2 of Fig. 1;

Fig. 3 is a longitudinal sectional view taken on the line 3-3 of Fig. 2;

Fig. 4 is a longitudinal sectional view of the connector showing the relation of the plug and socket during the act of disconnecting them;

Fig. 5 is a fragmentary top plan view of the rhomboidal blank or strip as prepared preliminary to rolling it to form the tubular socket;

Fig. 6 is a side elevation of the tubular socket contact removed from its housing.

Referring to the drawing more specifically, it is seen that one embodiment of my invention generally includes a tubular socket contact 1 made of somewhat resilient metal, a cylindrical rigid housing 2 of insulation material enclosing socket 1, and a metal plug contact 3 adapted to be extended through an end of the housing 2 into the socket so as to be frictionally gripped and held therein.

Electrical wires 4 and 5 are fixed to the socket and plug respectively in electrical contact therewith so that when said members are telescopically engaged as above noted a reliable electrical and mechanical connection of said wires is provided for.

In accordance with this invention the tubular socket 1 is constructed so that it will be expanded axially and diametrically constricted to tighten its grip on the plug 3 when a force for pulling them apart is applied through the wires 4 and 5 and while the socket is free, thereby preventing accidental uncoupling of the connector. However, the housing 2 and socket 1 are constructed and relatively arranged so that when the operator grips the housing and the plug or the wire 5 adjacent thereto, and exerts a force for pulling them apart, the housing will engage and axially compress the socket 1 which will then expand diametrically and release its grip on the plug 3 thereby providing for a quick and easy disconnection of the connector with a comparatively light pull.

As shown in Fig. 5, the socket 1 is made from rhomboidal strip 6 of somewhat resilient sheet metal having good conducting qualities and provided with a plurality of narrow parallel slots 7 extending longitudinally from a point near one end of the strip through the other end thereof to form separate fingers or gripping members 8. This rhomboidal strip is rolled to form the tubular socket 1 shown in Fig. 6 with the fingers 8 helically convolved similarly to a coiled spring and the free ends of said fingers flush with one another and forming the open or outer end of the socket. Due to the rhomboidal shape of the

strip and the manner in which the fingers 8 are formed and helically wound in normally axially spaced relation, to form the tubular socket 1, it is seen that when a force tending to pull the plug 3 and socket 1 apart is transmitted thereto through the wires, while the housing 2 is not held, the socket is axially expanded and the helical fingers 8 will be constricted and tightened around the plug and effect a tight grip thereon preventing accidental uncoupling of the connector.

When the socket 1 is compressed axially as by pushing inwardly against the outer ends of the finger 8 thereof while pulling on plug 3 as though to remove it, the socket will be diametrically expanded and the fingers 8 will unwind somewhat and release their grip on the plug 3.

As here provided the wire 4 is soldered as at 9 in the inner end of the socket 1, and wire 5 is soldered as at 10 to the plug 3.

The cylindrical housing 2 has a greater internal diameter than the outside diameter of the socket 1 whereby the latter may be freely diametrically expanded therein. Moreover, the housing is of greater length than the socket member whereby these two members are relatively movable axially thereof and the housing becomes a means for effecting the compression of the socket to release the plug.

The wire 4 is inserted through an apertured screw threaded stop member 11 before being soldered as at 9 to the socket 1 and following the soldering of the wire to the socket the latter and the wire are inserted through internally screw threaded end 12 of the socket 2 and the stop member 11 is then screwed into said threaded end and acts to hold the socket in the housing. The wire 4 is freely slidable in opposite directions in the stop 11 in the same manner that the socket 1 is freely movable in the housing 2.

The outer end of the housing 2 is provided with an annular internal stop flange 13 forming an opening 14 for reception of plug 3, said opening registering with the bore of the socket 1. The flange 13 will engage the outer ends of the fingers 8 of the socket 1 and, if forcibly held against said fingers, will compress the socket axially whereby the socket will expand diametrically when the operator while gripping the housing 2 without pulling on the wire 4, and while gripping the plug 3 or the wire 5 adjacent thereto, exerts a force for pulling the socket and plug apart. When the socket is diametrically expanded in this manner the helical fingers 8 unwind somewhat and release their grip on the plug thereby permitting of an easy intentional separation of the plug and socket. Fig. 4 shows the socket as when diametrically expanded to release its grip on the plug member.

Any accidental pulling part force transmitted through the wires themselves to the two connector members 1 and 3 while the housing 2 is free and the flange 13 thereof is not caused to engage and compress the socket axially, will cause the socket to be extended axially diametrically constricted whereby the fingers 8 will likewise be constricted and tightly grip plug member to prevent disconnection thereof, the gripping action increasing with the increase of the pulling-apart force, thereby safeguarding against inadvertent disconnection of the socket and plug. That part of the socket 1 in which the wire 4 is soldered is not diametrically expanded and contracted as will be seen with reference to Fig. 4.

It should be noted that in addition to a reli-

able yet quick detachable mechanical connection afforded by the helical fingers 8 of the socket 1 when the plug is unseated, a most effective electrical connection is provided due to the contact of the integral fingers 8 with the plug. These fingers present sharp edges which closely and somewhat angularly bind against the plug to insure a good electrical and holding contact when the plug is inserted and to act as wipers to keep the contacting surfaces clean.

The stop member 11 is counterbored as at 11' to receive the insulation 4' of the wire 4 whereby the bared portion of the wire is freely slidable therein when the socket and housing are relatively moved. The extended part of the plug is preferably of the same diameter as the housing to make a smooth and flush joint.

The part of the plug 3 which is exposed when the plug is in the socket is preferably insulated by means of a suitable insulation jacket 3'.

It is now seen that I have provided an improved wire connector which of simple, inexpensive, small and compact construction ideally suited for use in aircraft where quick connection and disconnection of such wires are most desirable to meet the installation, replacement and inspection requirements and a reliable safeguard against accidental disconnection must be provided.

While I have shown and described specific embodiments of my invention I do not limit myself to the exact details of construction set forth, and the invention embraces such changes, modifications and equivalents of the parts and their formation and arrangement as come within the purview of the appended claims.

I claim:

1. In a wire connector, a tubular socket contact adapted to be fixed at one end to an electric wire and having its other end open for reception of a plug contact, a tubular housing of greater length than and enclosing said socket and being movable axially relative thereto, and stop members in the housing for limiting the movement thereof relative to the socket, said socket including a plurality of helically coiled gripping members adapted to surround the plug contact and which will be constricted diametrically and grip the plug contact when the socket is free and a force tending to pull the socket and plug apart is applied thereto, but will be diametrically expanded and release the plug when the housing is intentionally held with one of its stop members pressing forcibly against the open end of the socket in opposition to a force exerted on the plug and socket to intentionally pull them apart.

2. In a wire connector, a tubular socket contact adapted to be fixed at one end to an electric wire and having its other end open for reception of a plug contact, a tubular housing of greater length than and enclosing said socket and being movable axially relative thereto, and stop members in the housing for limiting the movement thereof relative to the socket, said socket including a plurality of helically coiled gripping members adapted to surround the plug contact and which will be constricted diametrically and grip the plug contact when the socket is free and a force tending to pull the socket and plug apart is applied thereto, but will be diametrically expanded and release the plug when the housing is intentionally held with one of its stop members pressing forcibly against the open end of the socket in opposition to a force exerted on

the plug and socket to intentionally pull them apart, said socket being formed of a strip of resilient sheet metal of rhomboidal outline having a plurality of slots extending parallel to the longitudinal edges thereof forming said helically coiled gripping members when said strip is rolled into tubular form.

3. In a wire connector, a tubular socket contact adapted to be fixed at one end to an electric wire and having its other end open, a plug contact insertable into said socket contact through its open end to be frictionally held therein, a tubular housing in which said socket is mounted so that the housing and socket may be relatively moved axially, stop members in said housing limiting relative movement of the housing and socket, said housing having one end open sufficiently to allow a wire attached to the socket to be freely movable therein, the other end of the housing being open to permit of insertion of the plug contact into the socket, and means embodied in the socket for frictionally gripping and holding the plug therein, operating to increasingly grip and hold the plug when a force tending to pull the plug and socket apart is applied thereto while the socket is free, said means releasing its grip on the plug when the housing is intentionally held by the operator with one of said stop members pressing forcibly against the open end of the socket member in opposition to a force exerted on the plug and the socket to pull them apart.

4. In a wire connector, a tubular socket contact adapted to be fixed at one end to an electric wire and having its other end open, a plug contact insertable into said socket contact through its open end to be frictionally held therein, a tubular housing in which said socket is mounted so that the housing and socket may be relatively moved axially, stop members in said housing limiting relative movement of the housing and socket, said housing having one end open sufficiently to allow a wire attached to the socket to be freely movable therein, the other end of the housing being open to permit of insertion of the aforesaid plug contact into the socket, said socket including integral helically coiled gripping members adapted to embrace the plug contact and which render the socket subject to axial expansion and compression, with incident diametrical restriction and expansion respectively, whereby said helical members while operating to tighten around the plug when the socket is axially expanded, and loosening their grip on the plug when the socket is axially compressed, said axial expansion of the socket member occurring when a separating pull is communicated to the plug member and socket member without holding the housing, the axial compression of the socket occurring when the operator holds the housing with one of the stop members forcibly

pressing against the open end of the socket in opposition to a force tending to pull the socket and plug apart.

5. In a wire connector, a tubular socket contact adapted to be fixed to one end of an electric wire and having its other end open, a plug contact which is adapted to be connected to another electric wire, said plug contact being insertable into said socket contact through its said open end, said socket including a plurality of helically coiled gripping members having their free ends disposed at the open end of the socket, said gripping members frictionally gripping and holding the plug when the latter is in the socket and operating when a force is applied to separate the plug and socket to effect axial expansion and diametrical constriction of the socket to increase the gripping action on the plug, and means associated with said socket and adapted to be forcibly pressed against the free ends of said gripping members in opposition to a force tending to separate the plug and socket, whereby the socket will be axially compressed and diametrically expanded to release the gripping action on the plug.

6. In a wire connector, a tubular socket contact adapted to be fixed to one end of an electric wire and having its other end open, a plug contact insertable into said open end and adapted to be connected to another electric wire, said socket including a plurality of helically coiled gripping members having their free ends disposed at the open end of the socket, said gripping members frictionally gripping and holding the plug when the latter is in the socket and operating when a force is applied to separate the plug and socket to effect axial expansion and diametrical constriction of the socket to increase the gripping action on the plug, means associated with said socket and adapted to be held against the free ends of said gripping members in opposition to a force tending to separate the plug and socket, whereby the socket will be axially compressed and diametrically expanded to release the gripping action on the plug, said means including a tubular housing enclosing the socket and having greater internal diameter than the diameter of the socket and a greater length than the socket so that the socket may be diametrically expanded therein and the housing and socket may be relatively axially moved, an apertured member in one end of the housing through which a wire connected to the socket is freely slidable, and an annular stop flange on the other end of the housing permitting of free movement of the plug into and out of the socket and operating to engage said free ends of the helical gripping members and compress the socket when the socket is held in opposition to a force tending to separate the plug and socket.

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