United States Patent [19]

Dinse

[11] **3,847,287**

[45] **Nov. 12, 1974**

[54] **SINGLE-POLE ELECTRICAL PLUG CONNECTION FOR SHIELDED ARC WELDING APPARATUS**

[76] Inventor: **Wilhelm Dinse,** Konigsreihe 12, 2000 Hamburg 70, Germany

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[21] Appl. No.: **366,183**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 277,086, Aug. 1, 1972, abandoned, Continuation-in-part of Ser. No. 277,087, Aug. 1, 1972, abandoned.

[30] **Foreign Application Priority Data**

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June 3, 1972 Germany 7220918

[52] **U.S. Cl.** **219/130,** 219/136
[51] **Int. Cl.** **B23k 9/00**
[58] **Field of Search** ..... 219/130, 136, 138, 74, 219/75; 174/15 C; 337/177, 272

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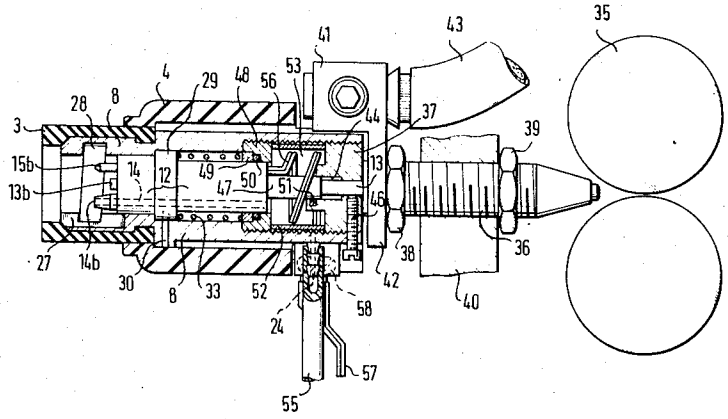
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Primary Examiner—J. V. Truhe
Assistant Examiner—G. R. Peterson
Attorney, Agent, or Firm—H. Dale Palmatier; James R. Haller

[57] **ABSTRACT**

A single-pole electrical plug connection for shielded arc welding apparatus including plug and socket bodies telescopically interfitting and relatively rotatable to produce interlocking, the socket bodies having interconnectible and coaxial tubes carrying the electrode wire, and additional connectors for other utilities such as gas and electrical control signals; and a centrally bored adapter pin mountable on the wire feed mechanism and carrying one of said bodies in stationary position and supplying the electrode wire therethrough; additional utility supply tubes for coolant and the like having connectors mounted on said plug and socket bodies in an arrangement whereby one of the bodies has a rotatable sleeve carrying such coolant tube connectors.

11 Claims, 8 Drawing Figures



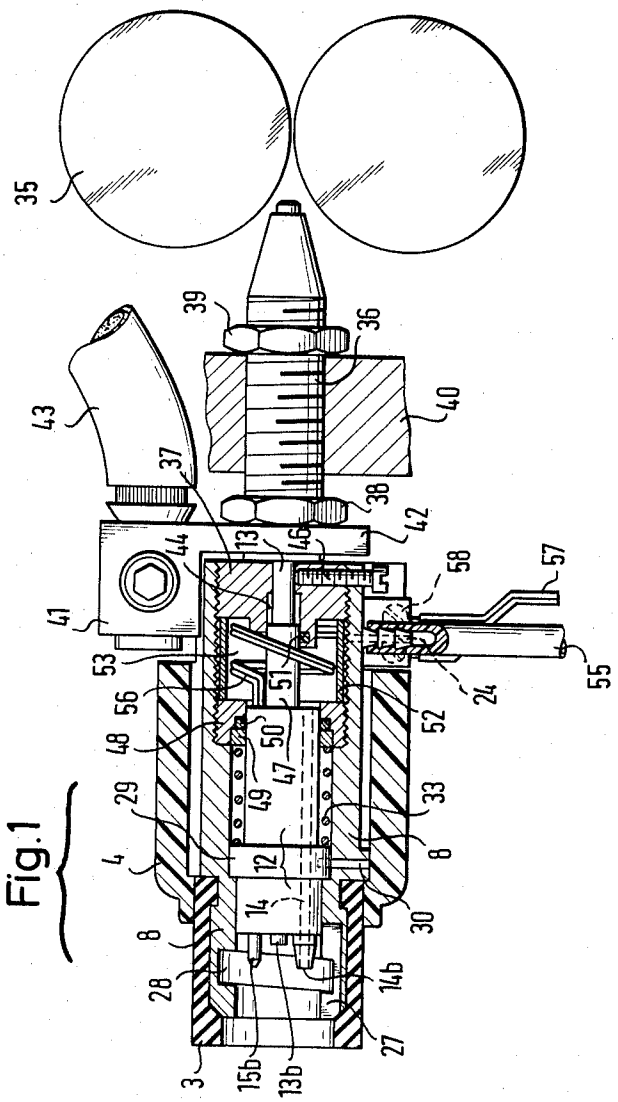

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52
47
49
29
33
4
12
8
14
30
8
28
14b
27
3
15b
13b

Fig.1

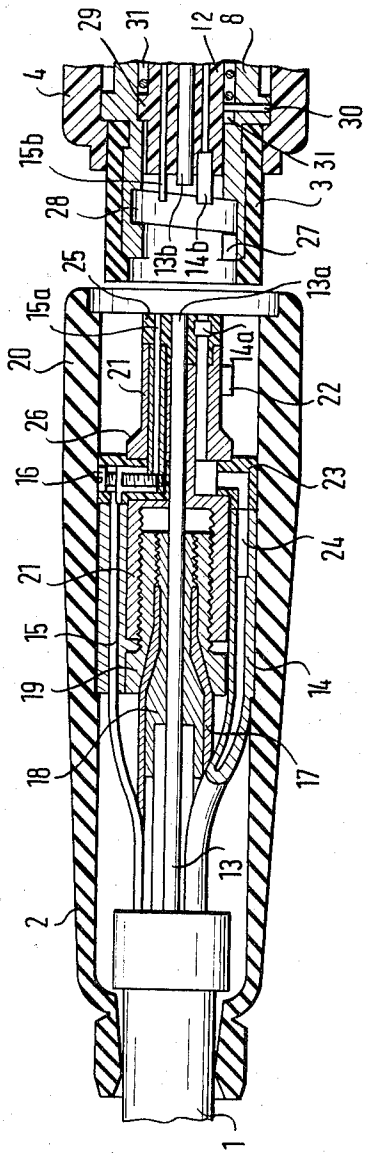

29
31
12
8
4
30
15b
31
3
28
27
13b
14b
25
13a
15a
20
21
14a
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1

Fig.2

Fig. 3

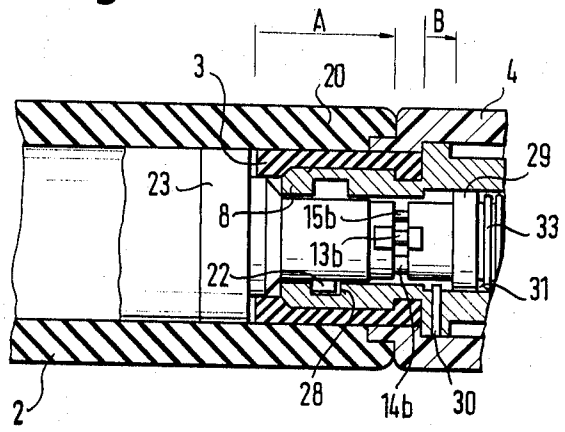

A
B
3
20
4
29
23
8
15b
33
13b
22
31
2
28
14b
30

Fig. 4

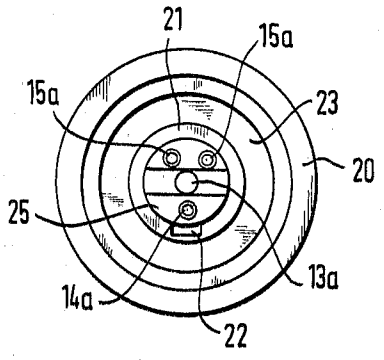

21
15a
15a
23
20
25
13a
14a
22

Fig. 5

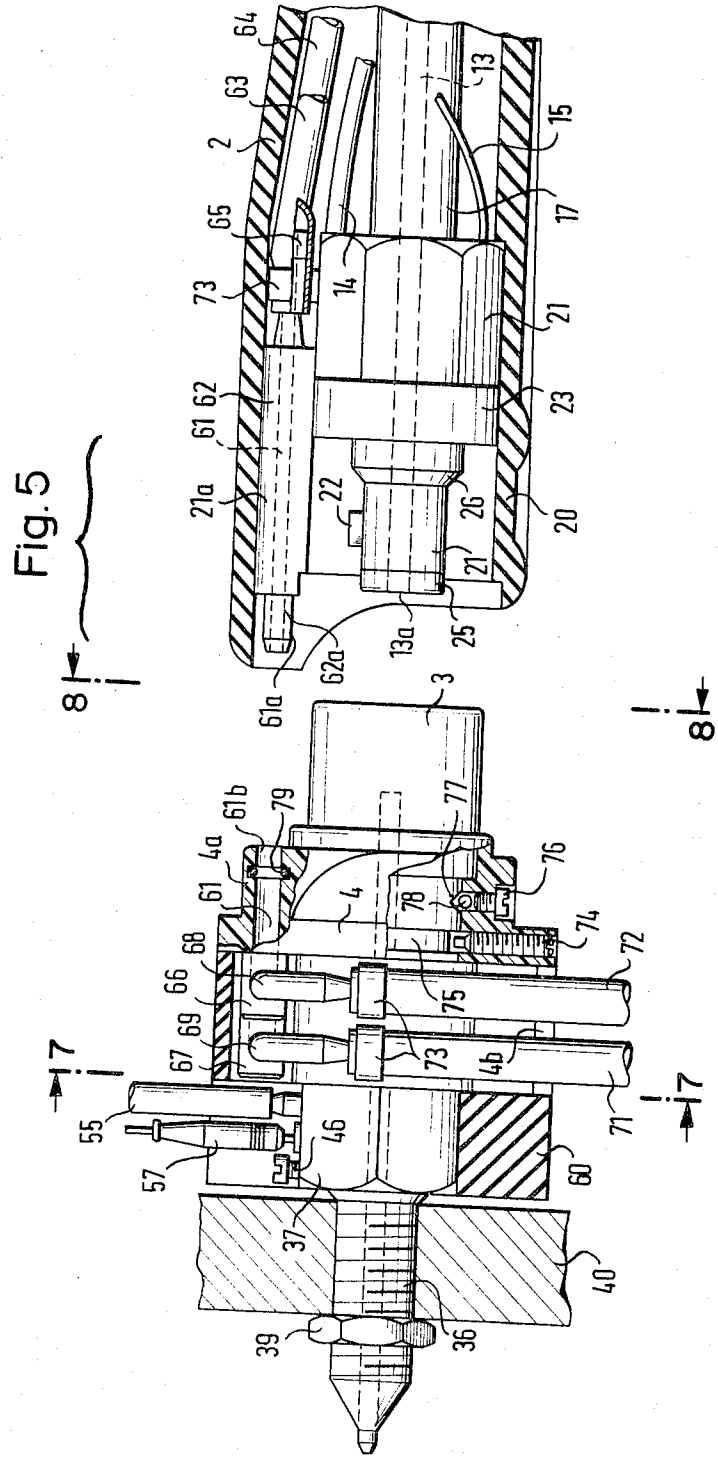

64
63
2
65
73
62
61
21a
61a
62a
13a
25
27
26
22
21
23
20
17
15
13
14
3
77
61b
79
4a
61
4
76
78
74
72
68
66
69
67
75
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4b
71
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36
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7
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Fig.6

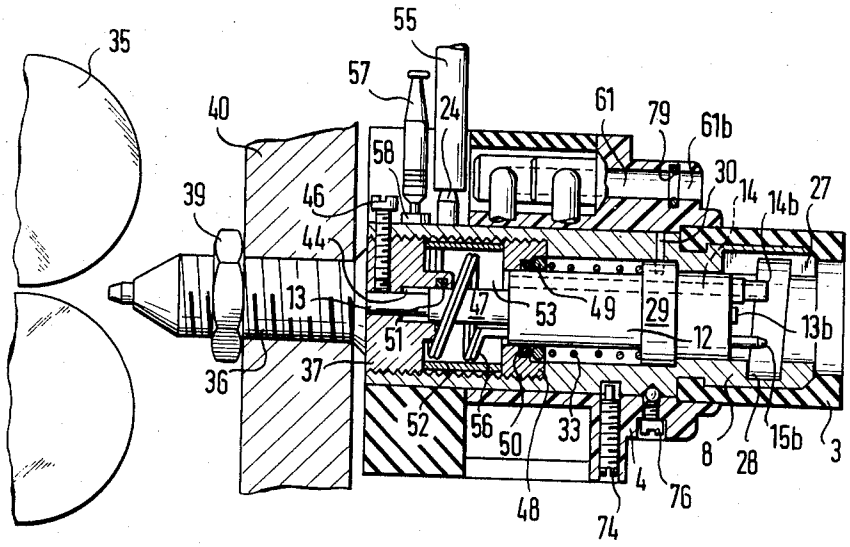


Fig.7

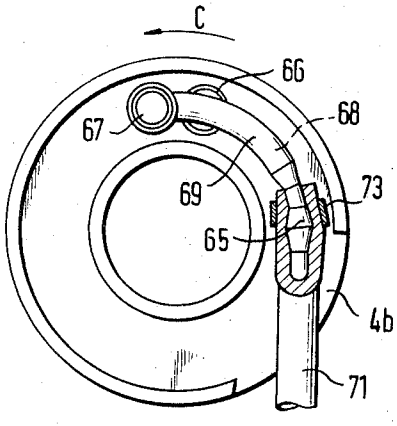
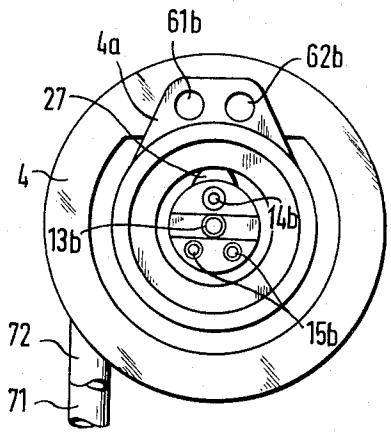


Fig.8



SINGLE-POLE ELECTRICAL PLUG CONNECTION FOR SHIELDED ARC WELDING APPARATUS

RELATED APPLICATIONS

This application is a continuation-in-part of U.S. applications Ser. No. 277,086 and 277,087, both filed on Aug. 1, 1972, now both abandoned.

BRIEF SUMMARY OF THE INVENTION

This invention relates to a single-pole electrical plug connection for shielded arc welding apparatus and comprises coaxially disposed plug and socket bodies adapted to be interlocked by a relative rotational movement.

Heretofore, a great variety of electrical plug connections are known in which a retainer pin is provided and adapted to engage in a groove, when fitting plug and socket bodies into one another, and to establish an electrical contact upon rotation. In one prior art plug connection of this type the retainer plug is provided at the periphery of the plug body. When fitting plug and socket bodies into one another this retainer pin slides along a longitudinal groove in the socket body. This longitudinal groove opens into a helical groove, and retainer pin and helical groove are mutually disposed in a manner so that when rotating the two bodies relatively to each other the plug body will be urged into the socket body and a bias pressure assuring good electrical connection is achieved (German Utility Model 1,971,103).

It is an object of the present invention to provide a plug connection of the above mentioned type which connection allows, in addition to the main current connection, the connection of the electrode guide tube and of further control and supply lines and comprising plug or socket bodies adapted to be mounted with a minimum of effort on already existing electrode wires feed mechanisms.

This object is achieved in accordance with the present invention in that a pair of connectors serving to connect the guide tube for the fusible endless electrode wire is arranged centrally in a manner known per se, in addition to further supply connectors in the plug and socket bodies, and that the plug or socket body is connected to an adaptor pin having a longitudinal bore in alignment with the guide tube.

By virtue of the specific design and arrangement of the adapter pin the plug body or the socket body may be incorporated directly into the electrode wire feed mechanism, instead of the conventional wire feed guide. Advantageously, the mounting may consist of a thread on the exposed adapter pin end. This permits the mounting on any electrode wire feed mechanism of the various and different manufacturers.

The further supply connections which may be connections for a control current for activating and deactivating the welding current, connections for the shielding gas or for a coolant may be arranged either on the outside of or within the plug or socket bodies.

By the expedient of mounting the adapter pin on the socket body a simple design has been achieved. The adapter pin may not only serve as a supporting element for the socket but concurrently as a connecting element for a cable lug terminal or the like for the welding current supply.

By the expedient of arranging the further supply connectors, particularly the connectors for the coolant, externally of the interconnection range of the further supply connectors including particularly those for the shielding gas it is assured that particularly when releasing the connection any possible coolant leakage can never enter the shielding gas feed region which is sensitive to such leakage. Due to the rotatable mounting of the sleeve plug and socket bodies conducting the main or welding current may be joined by means of a rotational movement so that a good conduction of the relatively high welding current is assured. The present invention therefore allows to fit further supply connectors on the known single-pole electrical plug connection without abandoning the interlocking connection by a relative rotational movement.

When the socket body is provided with a rotatable insert and a rotatable sleeve and interconnection with a simple plug body may be effected such as when for example only the welding current and no other supplies are to be taken off from the available apparatus.

In the following, further advantages and the various features will be explained in more detail with reference to an exemplary embodiment shown in the appended drawing wherein:

FIG. **1** is a lateral cross-sectional view of a socket body with an adapter pin, prior to effecting the plug connection with a plug body;

FIG. **2** is a cross-sectional view of a plug body and the forwardly facing part of a socket body, prior to being plug-connected;

FIG. **3** is a fragmentary cross-sectional view corresponding to FIG. **2**, after the plug connection has been joined;

FIG. **4** is a front end view of the front face of the plug body;

FIG. **5** is a fragmentary lateral cross-sectional view of another embodiment of plug and socket bodies, prior to interconnecting these two bodies;

FIG. **6** is a cross-sectional view of the socket body shown in FIG. **5** to illustrate the rotatable insert mounted in this embodiment within the socket body;

FIG. **7** is a detail end elevational view of the rotatable sleeve seen from line **7—7** of FIG. **5**; and

FIG. **8** is an end elevational view seen from line **8—8** of FIG. **5.**

The plug connector shown in the drawing consists of a plug and a socket designed to interconnect, in addition to the contacts for a relatively high welding current, several other supply lines. A hose assembly **1** connects the various supply lines to the plug. The actual plug body **21** is arranged in a housing **2** projecting at **20** in order to protect the exposed portion of the plug body. The housing is made of rubber or any similar material.

The socket body **8** shown in a position opposite the plug body is likewise protected by a rubber sleeve **3.** An insulating sleeve **4** is applied over the socket body.

The lead carrying the welding current in the plug is arranged as a tubular conductor **17** which is clamped between a conical screw **18** and a mating conical check nut **19.** The check nut **19** is in turn threadedly engaged into the plug body **21.**

A longitudinally displaceable and rotatable body or insert **12** is confined within the conductive socket body **8** and has a peripheral flange **29** projecting slightly radially to abut against a shoulder of the socket body **8.** The

insert 12 is normally restrained against rotation by a pin 30 affixed in the socket body 8 and projecting into an endwise open groove 31 extending through the flange 29; however, when the insert 12 is longitudinally displaced so that the flange 29 clears the pin 30, the insert 12 may be rotated. The longitudinal displacement of the insulated insert 12 is restrained by a coil spring 33 which surrounds the insert and bears against the flange 29 and against a rigid ring 49 also surrounding the insulating insert 12 and retained by the threaded nut 48 which is threadedly secured in the socket body 8.

A guide tube 13 for the welding rod extends essentially through the plug connection and through both the plug body 21 and the socket body 8. The guide tube 13 has a two part construction, with one part being affixed in the plug body 21 and the other part being affixed in the insulating insert 12. The guide tube will, when joined together, slidably carry the welding rod or wire therethrough. In the plug body 21, the guide tube terminates at a sleeve or socket connector 13a which is internally flared or tapered divergently toward the end of the guide tube at the end face of the plug body, at the insulating cover plate 25. The guide tube 13 in the insulated insert 12 of the socket body terminates in a tapered insert or plug connector 13b which will fit within the socket connector 13a and make an efficient electrical and physical connection.

Other auxiliary utilities such as shield gas and electrical control signals are also supplied through the plug connection. Accordingly, a utility line or duct or gas passage 14 for shielding gas extends through the plug connection in two parts and the ends of this gas transmitting passage or line 14 are connected through hose fittings 24 and through socket and plug connectors 14*a* and 14*b*, respectively. The socket connector 14*a* is arranged in the face cover plate 25 and the insert or plug fitting 14*b* is affixed in the end of the duct or passage 14 on the insulating insert 12 so as to be joined to the socket connector 14*a* in a simple endwise thrust movement. Although only one such fluid passage 14 is shown, an additional utility connection, a water pipe and/or a compressed air pipe may be additionally added in the plug connector, through the plug body 21 and through the rotatable insert 12.

Additionally, a pair of electrical control leads 15 extend through the plug connection. These leads are in two parts, one part in the plug body 21 and the other part in the insulated insert 12. The external control leads 15 are clamped by screws 16 to a split insulating plate 23 and to the connectors 15*a* and 15*b*, respectively disposed in the plug body 21 and in the rotatable insert 12. The connector 15*a* is a sleeve or socket type flared connector to telescopically receive and electrically join the plug or insert connector 15*b* in the rotatable insert 12. The connector 15*a* is insulated from the plug body by a sleeve extending from the cover plate 25 to the split insulating plate 23.

A seal 50 is confined between the spring retaining ring 49 and the nut 48 and seals against the external periphery of the longitudinally displaceable and rotatable insulating insert 12.

The space 53 defined in the socket body 8 adjacent the nut 48 is closed at its end remote from the plug body by a likewise threaded portion 37 of the adapter pin 36. The smaller diameter portion of the adapter pin 36 protrudes endwise beyond the socket body 8 and is likewise threaded, and two nuts 38 and 39 are engaged on this thread. The nuts 38 and 39 serve for the connection with the electrode wire feed mechanism of which a bored mounting plate 40 and wire supply rollers 35 are shown. The adapter pin 36 is mounted in the bore of the mounting plate 40, for the purpose of mounting the socket body 8 on the plate, instead of the conventional wire feed guide. If the main current is not supplied directly through the mounting plate 40 then a cable lug terminal 41 with a bored portion 42 is provided, as illustrated in FIG. 1. The cable lug terminal is connected to a welding current feed cable 43, and its bored mounting portion 42 is clamped between the larger diameter portion 37 of the adapter pin 36 and the nut 38. When employing an additional cable lug for supplying the welding current the bore of the mounting plate 40 may be provided with an insulating sleeve.

The adapter pin 36 is provided with a central bore through which the guide tube 13 extends and is secured by a screw 46. The bore end located within the portion 37 is of a larger diameter as shown at 44. This bore portion 44 defines in conjunction with the smaller diameter sleeve portion 47 formed integrally of the rotatable insulating insert 12 a telescopic guide for the insert 12. The sleeve portion 47 is rotatable in the bore portion 44 and may be moved axially. A seal 51 is provided in an annular groove of the bore portion 44.

The space 53 within the socket body 8 is sealed in a gas-tight manner by means of the seals 50 and 51 and a sleeve 52. The shielding gas supplied by a hose 55 passes through the hose fitting 24 into the sealed space 53. From the sealed space 53 the shielding gas enters the feed line or passage 14 in the insert 12.

Within the space 53 are furthermore disposed a pair of electrical leads 56 for the control current connected to the terminals 58 in the socket body and compensating the rotational movements of the insert 12. The control current is supplied to these terminals.

The plug connection is effected by moving the plug body into the socket body. During this movement, the protective portion 20 of the housing 2 is pushed over the rubber sleeve 3. The retainer pin 22 is guided in the longitudinal groove 27 and at the same time the respective connectors 13*a*, 13*b*, 14*a*, 14*b*, 15*a* and 15*b* are joined. Insulated insert 12 is displaced against spring 33. When a sufficient plug connection has been achieved the insert 12 has been moved sufficiently far so that rotation thereof is no longer prevented by the detent pin 30 since in this position the detent pin is disengaged from the longitudinal detent groove 31. When then rotating the plug body relative to the socket body to achieve tightening in the region of the conical surface 26 whereby the retainer pin 22 engages the helical groove 28 the connectors 14*a*, 14*b*, 15*a*, 15*b* act as entrainment members so that the rotatable insert 12 is positively rotated and the plug connections previously established at the connectors are jointly rotated. Due to the conical or cone-shaped configuration of the connectors 13*a* and 13 *b* a good centering is assured. When the plug connection has been made, the position will correspond to the one depicted in FIG. 3. Thus the plug has been moved in the direction of its longitudinal axis as indicated by the arrow A. The insert has simultaneously been displaced in its longitudinal direction by a smaller amount as illustrated by the arrow B. In the illustration of FIG. 3 the plug body (refer to retainer pin 22) occupies the same position as in the illustration of FIG. 2.

As may be seen from FIG. 4. in the present embodiment there are provided three further supply lines, in addition to the welding current line. These lines comprise the pair of electrical control leads **15** the connectors **15***a* of which are shown in FIG. **2.** These leads form a part of an electrical control circuitry for activating and deactivating the welding current. The figure furthermore shows the connector **13***a* for the guide tube **13** and the connector **14***a* for the shielding gas feed line **14.**

In the form illustrated in FIGS. **5 – 8,** the plug body mounts an insulating attachment **21***a* in which a pair of flow passages or conduits **61** and **62** for a coolant supply and return flow are provided. These conduits terminate in tubular connectors or fittings **61***a* and **62***a* respectively. Coolant hoses **63** and **64** forming part of the hose assembly are connected by means of nipples **65** and clamping rings **73** to the conduits **61** and **62** respectively.

In this form of the invention, the sleeve **4** of insulating material is rotatably mounted externally on the socket body **8.** A pair of socket connectors **61***b* and **62***b* adapted to be interconnected with the insert connectors **61***a* and **62***a* respectively are mounted on the projecting portion **4***a* of the sleeve **4** which projecting portion **4***a* is opposite the attachment **21***a* of the plug body when fitting plug and socket bodies into one another. Seals **79** prevent any coolant leakage in the interlocked position. The conduits **61** and **62** in the sleeve **4** terminate in closed tubes **66** and **67** respectively. From these tubes **66** and **67** extend lateral curved tube portions **68** and **69** at right angles to the pivot axis of the sleeve. Hoses **71** and **72** are slipped over the nipples **65** and held thereon by clamping rings **73.** In the normal operational position, the hoses **71** and **72** extend downwardly from the sleeve. By means of these lateral curved tube portions **68** and **69** arranged laterally of and at right angles to the pivot axis of the sleeve these members may be freely rotatably entrained when rotating the sleeve.

A set screw **74** in the sleeve engages an annular groove **75** on the socket body **8** and prevents axial movements of the sleeve. Another screw **76** forms in conjunction with a ball **78** and a recess **77** in the socket body a detent means (in the initial or normal operational position) for the sleeve **4,** this detent means assuring that all connectors which are to be interconnected are in mutual alignment, based upon the alignment of retainer pin **22** and longitudinal groove **27.**

When plug and socket bodies have been fitted into one another from the position shown in FIG. **5** the retainer pin **22** engages the helical groove **28.** All of the pairs of supply connectors **13***a*, **13***b;* **14***a*, **14***b;* **15***a*, **15***b;* **61***a*, **61***b;* **62***a*, **62***b*, are then mutually joined. Additional endwise movement of the plug body **21** causes endwise displacement of insulated insert **12,** and causes pin **22** to pass along groove **27** until groove **31** clears pin **30.** When the plug body **21** is rotated relative to the socket body **8,** plug and socket bodies are mutually tightened, due to movement of pin **22** along the helical groove **28,** and the conical surface **26** will be urged against the associated part of the socket body. The sleeve **4** rotates with plug body **21** and insert **12** due to the interconnected connectors **61***a*, **61***b;* **62***a*, **62***b* on the sleeve. As sleeve **4** is turned during assembly, the fluid supply tubes **66, 67** turn with the sleeve, causing limited movement of hoses **71, 72.** At the end of this rotational movement of approximately a quarter turn all of the connector pairs are tightly engaged.

For releasing the plug connection the plug is rotated in the opposite direction. Thus insert **12** and sleeve **4** return into their initial position shown in FIG. **1.** The sleeve is stopped and retained in its initial position by the ball **78.** The initial position of the insert **12** is defined by the detent pin **30.**

When rotating the sleeve **4** in the direction of the arrow C (FIG. **7**) or in the opposite direction the curved tube portions **68** and **69** are rotated in the same direction as sleeve **4.** The vertical position of the curved tubes **68, 69** with respect to the direction of rotation does not present any significant obstruction to the rotational movement. The hoses **71** and **72** normally extend downwardly.

What is claimed is:

1. A single-pole electrical plug connection for mounting in the base of a mounting plate and through which a fusible endless electrode wire from a feed mechanism, and auxiliary utilities, are supplied for shielded arc welding apparatus, the connection comprising coaxially disposed plug and socket bodies assembled and interlocked by a relative endwise displacement and rotational movement, the plug and socket bodies having interfitting means permitting relative rotation between the plug body and the socket body and about a longitudinally extending axis and said interfitting means drawing said bodies tightly together by reason of such rotation, said plug and socket connection having a pair of guide tubes for the fusible endless electrode wire and arranged centrally in said bodies with connector means for releasably joining the tubes together, an endwise displaceable and rotatable insulated insert in the socket body and having the guide tube of the socket body affixed therein, a spring urging the insulated insert and guide tube toward the plug body to maintain said connector means together, additional connector means in the plug body and in the insulated insert through which auxiliary utilities are supplied, the socket body having an adapter pin secured therein, said pin having a longitudinal wire-carrying bore therethrough in alignment with said guide tubes and also having means for attachment to such a mounting plate and electrode wire feed mechanism.

2. A single-pole electrical plug connection according to claim **1** wherein said adapter pin is externally threaded for attachment to the mounting plate.

3. A single-pole electrical plug connection according to claim **1** wherein one of said connector means is disposed eccentrically of the rotatable insert to produce rotation thereof.

4. A single-pole electrical plug connection according to claim **1** wherein the adapter pin has a central enlarged bore confronting the insulating insert, and said rotatable insert having an integral sleeve extending into said bore and axially and slidably guided and rotatable in the bore of said adapter pin.

5. A single-pole electrical plug connection according to claim **4,** characterized in that a sealed space is defined within the socket body and between the insert and the adapter pin, duct means conveying shielding gas to and from said sealed space, said sealed space serving as a conduit for the shielding gas.

6. A single-pole electrical plug connection according to claim **4,** and electrical conductor means permissive of rotation of the insert relative to said socket body and

extending to and through said insert for continuity through the plug connection.

7. The single-pole electrical plug connection of claim 1 including additional utility plug-in connectors disposed externally of the plug and socket bodies, one of the additional plug-in connectors being affixed on the plug body to be rotated therewith in assembly and interlocked with the socket body, a rotatable sleeve mounted on the socket body and having the mating additional plug-in connector mounted thereon, the plug-in connectors being assembled and rotated with the sleeve and relative to the socket body as the plug and socket bodies are rotated for interlocking.

8. A single-pole electrical plug connection through which a fusible endless electrode wire and auxiliary utilities including coolant are supplied for shielded arc welding apparatus, the plug connection comprising coaxially disposed plug and socket bodies assembled and interlocked by relative endwise displacement and rotational movement, the plug and socket bodies having interfitting means permitting relative rotation therebetween and about a longitudinally extending axis and said interfitting means drawing said bodies tightly together by reason of such rotation, said plug connection having a pair of guide tubes for the fusible endless electrode wire disposed centrally in said bodies and having endwise interfitting connector means releasably joining the tubes together, an insulated rotatable insert in the elongate socket body and movable both longitudinally and rotatably relative to the longitudinal axis, and spring means restraining endwise movement of the rotatable insert in the socket body away from the plug body, and urging the rotatable insert toward the socket body, additional utility plug-in connectors disposed externally of said plug and socket bodies and being affixed on the plug body to be rotated therewith in assembly and interlocked with the socket body, a rotatable sleeve mounted on the socket body and having mating ends of said additional plug-in connectors mounted thereon, the additional plug-in connectors being assembled and rotated with the sleeve and relative to the socket body as the plug and socket bodies are rotated for interlocking, and said plug-in connectors on the plug body and rotatable sleeve being secured together by the interlocked plug and socket body.

9. The single-pole plug connection according to claim 8 wherein said additional utility plug-in connectors include conduit fittings providing open flow connection therethrough for supplying coolant through the single-pole plug connection, said conduit fittings producing rotation of the rotatable sleeve in response to rotation of the plug body during assembly and interlock of the plug and socket bodies.

10. The single-pole electrical plug connection according to claim 7 wherein said socket body includes a spring bearing against the socket body and against said insulated insert and urging the insert toward the plug body to maintain endwise pressure on the interfitting connecting means of said guide tubes, detent means normally retaining the insulated insert in predetermined rotational orientation in the socket body and releasing the insulated insert for rotation with the plug body after the insulated insert has been longitudinally displaced by the plug body during assembly of the plug connection, and said plug body and insulated insert having an additional pair of plug-in utility connectors disposed eccentrically of the plug body and rotatable insert and joined together to produce rotation of the insert with the plug body upon assembly and disassembly of the single-pole plug connection.

11. The single-pole electrical plug connection according to claim 10 wherein said socket body has an endwise open and interior threaded rear portion, an adapter pin threaded into said rear portion of the socket body and protruding from the socket body, said adapter pin having a central bore receiving one of the guide tubes therethrough, the central bore in the adapter pin being enlarged adjacent the insulated insert, and a rigid sleeve formed integrally of the insulated insert and being longitudinally slidably assembled and rotatable within the enlarged central bore of the adapter pin for movement with the insulated insert longitudinally and rotationally during assembly and disassembly of the plug connection, and sealing means sealing the open space endwise between the insulated insert and the adapter pin and encompassed by the rear portion of the socket body, and fluid flow passages in the insulated insert and plug body supplying flow connection to the sealed space adjacent the adapter pin and through the insulated insert and plug body, whereby multiple utility connections are assembled and disassembled upon longitudinal and rotational displacement of the plug body in the socket body for supplying the utilities needed for the shielded arc welding apparatus.

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