

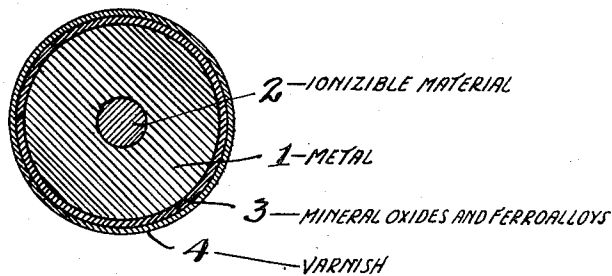
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W. HUMMITZSCH

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ELECTRODE FOR CUTTING AND WELDING UNDER WATER

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INVENTOR

W. Hummitchsch

BY *Charles C. Downing & Sebold*
ATTORNEYS

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ELECTRODE FOR CUTTING AND WELDING
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Electrodes for welding and cutting purposes under water consisting of a soft iron core-wire, having a coating of oxides and a water resistant varnished coating are well known.

It is desirable to use an electrode having a waterproofed coating with a burn-off and a rate of breaking away adjusted to maintain a clearance between the work piece and rod. This is to enable the diver to weld with the electrode put onto the work.

Such electrodes can be used for flat welding under water and for under-water-cutting, however, use of these electrodes for a vertical and overhead welding is substantially impossible.

This invention includes the use of a cored wire as a rod core having a wick and coating selected to meet the special requirement of use under water for vertical and overhead welding. The coating is protected by a water-resistant varnish to prevent the coating from dissolving in water. By properly adapting the wick, wire, and coating it is possible to ensure the specific properties required for use under water.

An under-water-cutting-electrode has to be suitable for use in all positions with efficient performance. It is required to display a minimum burn-off, deep penetration and high cutting rate.

All these 4 requirements can be met by suitable combining of wire and coating material. In the case of a comparatively great proportion of wick being used in the cored wire, amounting e. g. to 5-10% of the wire cross-section, strong ionization occurs in the arc, resulting in a high depth and force of penetration.

The invention is clearly illustrated in the accompanying drawing in which the single figure illustrates a cross sectional view through an electrode in accordance with the invention.

Referring more particularly to the drawing the numeral 1 designates a hollow wire provided with a filling or core 2, constituting a wick, the outer surface of the wire being provided with a coating 3 of a mixture of mineral oxides and ferro alloys as set forth hereinafter and being further protected by an outer coating or skin 4 of a water resistant and electrically insulating varnish.

The ingredients making up the wick consist of oxides of the alkali earth metals with possible additions of metals, ferro alloys and salts of the alkali metals. Other requirements, such as low electrode consumption, is met by alloying metals contained in the wire, the wire being alloyed with manganese, silicon and certain additions of zirconium and titanium. It is zirconium combined

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with silicon that effects a retarding of the burn-off. The composition of the core wire is in the range of the following limits:

	Per cent
5 C -----	0.05-0.30
Si -----	0.30-1.00
Mn -----	0.50-2.00
Zr -----	0.10-0.50
resp. Ti -----	0.10-0.50

10 The coating serves the purpose of supplying the oxygen required for the burning process. Mixtures of the following components have proved to be applicable:

15 (1) Titanium ore, quartz, Kaolin and ferro-manganese.

(2) Iron-mica, serpentine and ferro-manganese.

Kaolin or serpentine may be substituted by aluminum, silicates and partly by talcum.

20 The main component of all coatings is an ore consisting of the oxides of iron and titanium or iron alone. The silicates are to form the slag.

The ferro-manganese supplies additional heat resulting from the heat of its reaction with the ore.

A cutting performance permitting the use of the electrodes in any position is obtained by combining a cored wire with the suitable coating. The surfaces cut are smooth. It is possible to perform vertical cuts in a downward direction. The resistance of the arc is reduced by the wick.

30 The voltage drop between workpiece and electrode amounts to 28 to 40 volts if a coated cored wire is used whereas rods without coating have a voltage drop of 35 to 50 volts under identical conditions.

35 The consumption of energy of under-water-cutting electrodes is accordingly decreased when cored wire is used instead of normal wire.

40 The cutting rate of a coated cored wire electrode 350 mm. long, is 29-35 cm. p. min. in the case of a 5 mm. gauge sheet and vertical downward cut. A similar electrode without wick having a cutting speed of but 24-30 cm. p. min. the quality of the cut being much inferior. The waterproof varnish is to protect the coating, celluloseacetate-base varnish dissolved in acetone or any air-drying insulating varnish as used in usual electrical practice, being suitable. Under water paints are equally applicable providing strong adhesion of coating and varnish are secured. No considerable effect of the varnish on the cutting performing has been observed.

55 It is essential that the electrodes allow weld-

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ing in all positions without causing deep under-cutting. The under-water electrodes for welding purposes as distinguished from cutting electrodes are required to have a fast melting wire and to yield sufficient depth of penetration. This demand is met by a cored electrode containing but a small proportion of wick consisting of easily ionizing components and having a cross section percentage of 1 to 3% or a larger proportion of wick may be used e. g. 5-7% of the cross section using ingredients more difficult to ionize, as e. g. the oxide of iron or titanium or their mixtures. A wire of the following composition may be used:

	Per cent
C -----	0.5-0.20
Si -----	0.10-0.50
Mn -----	0.30-1.00

Copper, nickel, molybdenum and aluminium may be added. Equally small amounts of titanium and zirconium.

To provide for easier guidance of the electrode in all positions the cored wire is covered with a coating consisting of mineral components. A suitable coating is indispensable for reliable and steady welding. The following mixtures have provide suitable for coatings:

(1) Mixtures of feldspar, carbonates of the alkali earth metals, titanium ores and ferromanganese.

(2) Mixtures of limestone, fluorspar and ferromanganese.

The coatings may contain organic ingredients as further additions. The varnish not only prevents the coating from dissolving in water but provides stability of the arc. It supplies carbon-monoxide additional to the gas evolved by the burning of the organic matter contained in the coating, preventing the water from coming into contact with the arc. A moisture-proof insulating varnish as it is used in the electrical practice has proved suitable. The under-water welding electrodes described above secure steady welding in all positions. They can successfully be applied for vertical welding in a downward direction. The welds made are sound and free of notches.

The under-water cutting electrode initially described may equally be used for welding under water if an amperage suitable for cutting is applied. Their performance is however inferior as compared to welding electrodes.

It is possible to combine both properties in an electrode by accordingly adapting the properties of the wire.

I claim:

1. An electrode useful for both welding and cutting under water by merely varying the ap-

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plied current thereto for either purpose, comprising a cored wire having compounds ionizable in the electric arc as said core material, said core comprising 1 to 10% of the cross section of the combined wire and core, said cored wire being coated with a mixture of mineral oxides and ferroalloys and being further protected by an outer coating of a water resistant and an electrically insulating varnish.

2. The electrode as defined in claim 1 wherein the wire has a composition in the range of the following limits:

	Per cent
C -----	0.05 to 0.30
Si -----	0.30 to 1.00
Mn -----	0.50 to 2.00

and .10 to 0.50% of an element selected from the group consisting of zirconium and titanium, the balance being substantially iron.

3. The electrode as defined in claim 1 wherein the outer coating comprises a mixture of substantial quantities of the mineral oxides, ilmenite, quartz, kaoline, feldspar and the ferroalloy, ferromanganese.

4. The electrode as defined in claim 1 wherein the outer coating consists of a mixture in substantial quantities of iron-mica, serpentine and ferromanganese.

5. The electrode as defined in claim 1 wherein the varnish consists of a cellulose derivative applied as a solution in acetone.

WERNER HUMMITZSCH.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,321,309	Holslag -----	Nov. 11, 1919
1,324,227	Carpenter -----	Dec. 9, 1919
1,451,392	Holslag -----	Apr. 10, 1923
1,501,266	Brace -----	July 15, 1924
1,898,933	Biers -----	Feb. 21, 1933
1,972,067	Pennington -----	Aug. 28, 1934
2,000,861	Miller -----	May 7, 1935
2,141,995	Leitner -----	Dec. 27, 1938
2,141,996	Leitner -----	Dec. 27, 1938
2,394,550	Jensen -----	Feb. 12, 1946
2,410,461	Ronay -----	Nov. 5, 1946

FOREIGN PATENTS

Number	Country	Date
409,293	Great Britain -----	Apr. 24, 1934
417,195	Great Britain -----	Oct. 1, 1934
459,715	Great Britain -----	Jan. 8, 1937
534,744	Great Britain -----	Mar. 17, 1941