



- (51) **International Patent Classification:**
B23K 7/08 (2006.01)
- (21) **International Application Number:**
PCT/HR2016/000013
- (22) **International Filing Date:**
12 April 2016 (12.04.2016)
- (25) **Filing Language:** Croatian
- (26) **Publication Language:** English
- (30) **Priority Data:**
P20150415A 13 April 2015 (13.04.2015) HR
P20150727A 4 July 2015 (04.07.2015) HR
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- (81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,

BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— of inventorship (Rule 4.17(iv))

Published:

— without international search report and to be republished upon receipt of that report (Rule 48.2(g))

(54) **Title:** DEVICE FOR DRILLING AND CUTTING WITH IMPROVED ELECTRODE AND TUBULAR ELECTRODE FOR CUTTING AND DRILLING USING BURNING METHOD IN THE OXYGEN MIXTURE

(57) **Abstract:** Device for drilling and cutting with improved electrode enables simpler construction and easier handling and can therefore be constructed as the portable handheld device, i.e. it can be used for cutting and drilling under the water. It consists at least of the following parts: tank for oxygen under pressure, oxygen inlet hose, coupling, holding fixture, body of the device, valve, tubular electrode holding shank and tubular electrode, provided that the tubular electrode is made of iron tube, into which are inserted the alloy and non-alloy rods which burn down in the oxygen mixture during the drilling/cutting procedure. Essential part of the present invention is a tubular electrode for cutting and drilling using burning method in the oxygen mixture which is made of iron tube, inside of which there are non-alloy metal rods and alloy rods with content of aluminium and magnesium.



INVENTION DESCRIPTION: DEVICE FOR DRILLING AND CUTTING WITH IMPROVED ELECTRODE AND TUBULAR ELECTRODE FOR CUTTING AND DRILLING USING BURNING METHOD IN THE OXYGEN MIXTURE

FIELD OF THE INVENTION

This invention relates to the field of devices for cutting and drilling with a tubular electrode which burns down in the oxygen mixture, and to appurtenant electrodes.

TECHNICAL PROBLEM

Inventor wanted to improve existing devices for cutting and drilling by burning off electrode in the oxygen mixture in such a way as to achieve a higher cutting and drilling speed, as well as to make the simpler structure of the device itself at the same time.

Furthermore, the problem of existing devices is the replacement of electrode used for cutting and drilling, which is why the inventor found the solution how to replace an electrode in the shortest possible time and also how to provide a high level of safety in the handling of device, given that the device is hazardous, since it is driven by the oxygen under pressure of 3-7 bar and also operates at working temperatures of up to 10.000 °C.

Also, the inventor had a goal to construct a device for cutting and drilling of the hardest materials, which could also be used under the water.

Furthermore, the inventor had a goal to construct a device for cutting and drilling of the hardest materials which is also easy to transfer and handle, which would enable its use in various industries, for military applications, firefighting, civil protection and various rescue services, with the aim to make the device accessible to consumers in specialized stores where people could buy it for personal use; a device which wouldn't need large oxygen tanks since its oxygen consumption needed for the burn-down of electrodes is low, because this device uses electrodes of small dimensions concerning both - length and diameter, which are almost half the size comparing to those used with the existing devices, while being safe to work with.

Another goal was to find the electrode of simplest possible construction which could be produced in technologically simple manufacturing process, but with ability to achieve the temperature of 10.000 °C when burning down.

PRIOR ART

The inventor is familiar with devices for cutting and drilling developed on the principle of metal electrode or metal alloy burning down in the oxygen mixture.

The existing devices for cutting and drilling of the hardest materials using burning method in the oxygen mixture are very robust and almost impossible to apply for use under water, i.e. to use as the portable devices to fit the needs of firefighters and rescue services. This becomes particularly evident in severe rail accidents, when it is necessary to cut through thick steel plates, chassis and shells in a shortest possible time in order to rescue people and animals, while a portable version is also very useful for interventions in other types of accidents or destruction such as an earthquake, when it comes to prompt rescue of victims who remain buried in the rubble and need to be rescued as soon as possible from rubble consisting of concrete, iron or stone, and this device is able to quickly and efficiently cut or drill any of the mentioned materials. Also, the flame temperatures produced by such devices are in the range from 3500 to 5000 ° C.

The inventors are familiar with different constructions of electrodes, but the point is that they are complex constructions generally consisting of two tubes, while the solution revealed in the present invention comprises only one tube. Inventors have carried out a search of patent applications and patents of other inventors by searching patent databases PATENTSCOPE, USPTO Patent Database and ESPACENET, but search did not reveal inventions as presented here.

BRIEF SUMMARY OF THE PRESENT INVENTION:

The primary objective of the invention is to construct a device for cutting and drilling with tubular electrode which achieves higher cutting and drilling temperatures, and consequently, higher cutting and drilling speed.

The invention is based on a special composition and ratio of alloy or non-alloy bars inside the tubular electrode, which composition enables achievement of the very high

temperatures, over 10.000 °C as the tubular electrode burns down in the oxygen mixture.

Device for cutting and drilling with improved electrode enables simpler construction and easier handling and can therefore be constructed as the portable handheld device, i.e. it can be used for cutting and drilling under the water.

It consists at least of the following parts: tank for oxygen under pressure, oxygen inlet hose, coupling, holding fixture, body of the device, valve, tubular electrode holding shank and tubular electrode, provided that the tubular electrode is made of iron tube into which are inserted the alloy and non-alloy rods in a given composition and ratio.

Electrode holding shank (20) consists at least of a body of the holding shank (2), core (3) for clamping a tubular electrode (330) and a ring (4), wherein a tubular electrode (330) is during use inserted into a tubular electrode clamping core (3), which core (3) is inserted into a body of the holding shank, wherein the side of the holding shank into which an electrode enters a clamping core is equipped with threads in such a way that a tubular electrode clamping core and the electrode are firmly tightened by means of threads provided on the ring (4) which is screwed on corresponding thread on the body of the holding shank.

As the ring (4) tightens more, a slope of the core (206) enters the interior of the body of the holding shank (2), wherein every feather (204) is being pushed towards the tubular electrode (330), clamping it and pressing it more and more until a tubular electrode (330) is completely fixed inside the body of the holding shank (2).

Tubular electrode clamping core (3) has at least two feathers (204), wherein these feathers (204) tighten around the tubular electrode (330) end which enters the core (3).

A tubular electrode clamping core (3) is cylindrical in shape and has a core base (202) and a core top (214), wherein on the core base there is a bottom (200) whose inner side is also a depth limiter and into which a tubular electrode is inserted, which bottom is equipped with opening of the core base (216) for the oxygen flow, wherein the core base (202) is followed by the constriction extending in the direction toward the core top (214) which is a starting point for at least two feathers (204), so that the constriction diameter (212) is at least 1 millimetre narrower than the core base

diameter (202), where each individual feather (204) is separated from another feather (204) by a slot (208) which starts in the feather opening (210) and extends laterally along a tubular electrode clamping core until it reaches the opening of the core top (216), where the feather opening (210) is positioned inside the constriction (212) with a slope (206) positioned on the upper end of the pen (204), next to the core top (214).

A tubular electrode is performed as a round iron tube inside of which are placed non-alloy metal rods and alloy rods with content of aluminum and magnesium in a specific ratio, and such electrode is typically made of iron tubes with a diameter of 8 mm to 50 mm, wherein the thickness of the tube wall is 1 mm to 3 mm, and the typical ratio of non-alloy metal rods and alloy metal rods inside a tubular electrode is greater than 3 to 1.

Individual non-alloy rods are made of iron with content of 0,50% nickel, less than 0.15% carbon, less than 0.25% silicon, approximately 1.10% magnesium, wherein the diameter of the non-alloy rod is from 1 mm to 3.2 mm, while the alloy rod inside the tubular electrode contains from 5% to 6% magnesium and 94% to 95% aluminium, wherein the diameter of the alloy rod is from 1 mm to 3.2 mm.

Typically, the tubular electrode is manufactured in a manner that the alloy and non-alloy rods are installed circularly in a concentric arrangement around the rim of the inner wall of the iron tube.

During the operation of the device for cutting and drilling with a tubular electrode, through the interior of the tubular electrode flows oxygen from the oxygen tank (300), wherein the electrode is manufactured in a manner that the alloy and non-alloy rods are installed circularly in a concentric arrangement around the rim of the inner wall of the iron tube.

The tests showed the purposefulness of the different dimension combinations for tubular electrode and combinations of alloy and non-alloy rods, so it is possible into an iron tube with 10 mm of diameter and 1 mm of wall thickness to concentrically arrange 7 non-alloy metal rods 7 and one alloy rod, wherein the diameter of each rod is 2 mm.

High-quality cutting results are also achieved by a solution according to which a tubular electrode is performed in such a way that the iron tube containing rods is

drawn into another iron tube with a greater diameter, wherein the iron tubes are so dimensioned that the outer diameter of the inner iron tube is at least 1 mm smaller than the inner diameter of the outer iron tube.

A tubular electrode may also be made in such a way that the rods inside the electrode are arranged in three concentric circles, wherein the first circle in the center of the tubular electrode contains four rods, two of which are alloy and the other two are non-alloy rods; in the second circle, which is formed around the rim of the first circle, there are 11 concentrically distributed non-alloy rods, while the rim of the third circle has concentrically arranged total of 17 alloy and non-alloy rods, the four of which are alloy rods, and the other 13 are non-alloy rods, wherein the alloy rods are arranged on the rim of the circle in a way that between the alloy bars there are at least three and the most 4 non-alloy rods.

Electrode for cutting and drilling using burning method in the oxygen mixture may also be used with other devices for cutting and drilling provided that they work on the same principle, and the characteristic of such electrode is at least one iron tube inside of which there are alloy or non-alloy bars with content of aluminium and magnesium, in a special ratio.

Thereby the diameter of the iron tube is from 8 mm to 50 mm, while the wall thickness of the tube is from 1 mm to 3 mm. The ratio of non-alloy metal bars and alloy bars is greater than 3 to 1. Typically, individual non-alloy rod is made of iron with content of 0.50% nickel, less than 0.15% carbon, less than 0.25% of silicon, approximately 1.10% magnesium, wherein the diameter of the rod of 1 mm to 3.2 mm, while the typical individual alloy rod contains from 5.00% to 6.00% magnesium and from 94.00% to 95.00% aluminium, wherein the diameter of the rod is 1 mm to 3 mm. Individual alloy rod made of magnesium also contains from 5.80% to 7.20% aluminium, from 0.40% to 1.50% zinc, from 0.15 to 0.50% manganese, up to 0.05% silicon, up to 0.05% copper, 0.005% nickel, up to 0.005% iron, and other elements up to 0.30%, wherein the diameter of said rod of 1 mm to 3.2 mm.

Best results are achieved when oxygen flows evenly through the electrode interior, and the alloy and non-alloy rods are arranged in a circle and concentrically distributed around the rim of the inner wall of the iron tube. Typical quality solutions comprise 7 non-alloy metal rods and one alloy rod which are concentrically

distributed around the rim of the iron tube, wherein each rod has a diameter of 2 mm.

While testing the quality and speed of cutting and drilling, inventor found that the great results are achieved when one iron tube containing rods is drawn into another iron tube with a greater diameter, wherein the iron tubes are so dimensioned that the outer diameter of the inner iron tube is at least 1 mm smaller than the inner diameter of the outer iron tube. It was also found that the results are good when the rods inside the electrode are arranged in three concentric circles, wherein the first circle in the center of the tubular electrode contains four rods, two of which are alloy and the other two are non-alloy rods; in the second circle, which is formed around the rim of the first circle, there are 11 concentrically distributed non-alloy rods, while the rim of the third circle has concentrically arranged total of 17 alloy and non-alloy rods, the four of which are alloy rods, and the other 13 are non-alloy rods, wherein the alloy rods are arranged on the rim of the circle in a way that between the alloy bars there are at least three and the most 4 non-alloy rods.

Thereby the possible dimensions of the outer iron tube are 17 mm for the tube diameter and 2 mm for the tube wall thickness, while the inner iron tube has 12 mm diameter and the wall thickness of 1.5 mm. In possible combination the inner tube contains 7 non-alloy rods with diameter of 2 mm and three alloy rods with diameter of 2,4 mm.

In general, the advantage of this device is that it is very simple and easy to handle and, if necessary, it can be connected to a smaller oxygen tank (cca 5-10 kg), which can be put in a backpack and carry, and as such it can be delivered (along with the device and a couple of rods, which all together doesn't represent a challenge for a single person regarding the weight and size) to very inaccessible places where there is a need for carrying out a demanding cutting or drilling work, especially during emergencies, for the needs of military, police, civil protection and mountain rescue, but also for the civil sector, particularly for construction companies which need to remove large metal object (eg, transmission lines etc).

Furthermore, it must be taken into consideration that in these cases and the places mentioned above it is not possible to use standard methods of cutting by autogenous

cutting machine which requires a lot of resources, manpower and expensive machinery.

Essential part of the present invention is the electrode for cutting and drilling using burning method in the oxygen mixture which is made of iron tube, inside of which there are alloy and non-alloy rods with content of aluminium and magnesium.

The advantage of this device concerning underwater use, compared to the above mentioned conventional cutting method using autogenous cutting machine is such that much higher cutting and drilling temperatures are achieved, which significantly increases the efficiency and speed of work.

There are electrodes in use today suitable for underwater cutting, but their length is short, usually from 45 to 90 centimetres, which means that, when cutting, it is necessary to replace electrodes very frequently comparing to electrodes revealed by the present invention, whose length vary from 100 to 200 cm, wherein their diameter is from 10 to 17 mm. It is obvious that the time needed for the replacement of electrodes is significantly saved, which ultimately results with higher performance through more work done per unit time, which for technical diver in harsh environments means a lot.

BRIEF DESCRIPTION OF THE DRAWINGS

The enclosed images, which are referred to in the description and which form a part of the description, illustrate the best invention embodiment and help explain the basic principles of the invention.

Figure 1. Schematic view of the device for drilling and cutting with improved electrode

Figure 2. Overview of the components of the device for drilling and cutting with improved electrode

Figure 3. The view of the core

Figure 4. View of the characteristic appearance of the core

Figure 5. Sectional view of the joint between the core and electrode - hatching

Figure 6. Sectional view of the joint between the core and electrode

Figure 7. Sectional view of the electrodes

Figure 8. Sectional view of the electrodes with outer iron tube

A LIST OF REFERENCE SIGNS USED IN THE DRAWINGS

- 1- body of the device
- 2- body of the holding shank
- 3- core
- 4- ring
- 5- coupling of the fixture
- 6- coupling
- 7- valve
- 8- seal of the device body
- 9- valve seal
- 10- core seal (10)
- 11- ring seal
- 20 - electrode holding shank
- 200 - bottom of the core
- 202 - core base
- 204 -feather

- 206 –slope of the core
- 208 –feather slot
- 210 – otvor pera feather opening
- 212 –constriction of the feather
- 214 – core top
- 216 –opening of the core base
- 218 –opening of the core top
- 300 –tank for oxygen under pressure
- 310 –safety valve
- 320 –oxygen inlet hose
- 330 –tubular electrode
- 332 –iron tube
- 334 –alloy / non-alloy rod
- 336 –iron tube with rods
- 338 –outer iron tube

DETAILED DESCRIPTION OF AT LEAST ONE WAY OF CARRYING OUT THE INVENTION

In a typical embodiment the present invention is carried out in a way that at least the following parts are connected into one functional unit: tank for oxygen under pressure (300), oxygen inlet hose (320), coupling (6), holding fixture (5), valve (7), tubular electrode holding shank (20) and tubular electrode (330), provided that the contact points between elements are equipped with rubber seals resistant to oxygen in order to prevent leakage of oxygen during operation. Typically, the following seals are used: seal of the device body (8), the valve seal (9), the core seal (10) and the ring seal (11). In one embodiment there is safety valve (310) built-in between the tank for oxygen under pressure (300) and an oxygen inlet hose (320).

In a typical embodiment a tubular electrode (330) is made of iron tube with a diameter of 17 mm and wall thickness of 2 mm, into which are inserted alloy and non-alloy rods with a diameter of 2 mm. The electrode holding shank consists at

least of a body of the holding shank (2), tubular electrode clamping core (3) and a ring (4).

During use, a tubular electrode (330) is inserted into a tubular electrode clamping core (3), which core (3) is inserted into a body of the holding shank (2), wherein the side of the holding shank into which an electrode enters a clamping core is equipped with threads in such a way that a tubular electrode clamping core and the electrode are firmly tightened by means of threads provided on the ring (4) which is screwed on corresponding thread on the body of the holding shank.

A tubular electrode clamping core (3) is made of solid hardened steel round bar in turning and milling process, which in typical embodiment has four equal feathers (204). The core (3) must be separately made of the above mentioned material, and improved by the thermal treatment-quenching. Other components of the device: holding fixture (5), body of the device (1), body of the holding shank (2) and ring are made of brass in turning process, while some components like a coupling (6) and valve (7) for a typical embodiment can be purchased at specialized dealers, wherein seals (8, 9, 10, 11) are manufactured of special rubber resistant to oxygen in specialized workshops.

In one embodiment a tubular electrode (330) is carried out as an iron tube (332) with a diameter of 50, while the wall thickness is 3 mm. In another embodiment, a tubular electrode (330) is carried out in a way that the ratio of non-alloy metal rods (334) and alloy metal rods (334) inside the tubular electrode is greater than 3 to 1, so four alloy rods and 15 non-alloy rods with diameter of 2 mm can be inserted there.

In a typical embodiment a tubular electrode (330) is carried out in a way that oxygen flows through it during operation. With respect to arrangement of rods inside the tubular electrode, in one possible embodiment, the alloy and non-alloy rods are installed circularly in a concentric arrangement around the rim of the inner wall of the iron tube.

In another embodiment a tubular electrode (330) is carried out in a way that the iron tube into which the electrodes are inserted has a diameter of 10 mm, wherein the wall thickness is 1 mm, and where 7 non-alloy metal rods and one alloy rod are concentrically arranged around the rim of the iron tube, wherein the diameter of

each rod is 2 mm. Typically, the length of the tubular electrode in all the embodiments is 2 meters, so the length of the rods is the same. In some embodiments, particularly those for underwater work, for easier manipulation, more suitable are shorter tubular electrodes of approximately 120 cm.

In another possible embodiment of a tubular electrode, inside of an iron tube with diameter of 50 mm and a wall thickness of 2 mm the rods are arranged in three concentric circles, wherein the first circle in the center of the tubular electrode contains four rods with diameter of 2 mm, two of which are alloy and the other two are non-alloy rods; in the second circle, which is formed around the rim of the first circle, there are 11 concentrically distributed non-alloy rods with diameter of 2 mm, while the rim of the third circle has concentrically arranged total of 17 rods, the four of which are alloy rods, and the other 13 are non-alloy rods, wherein the alloy rods are arranged on the rim of the circle in a way that between the alloy bars there are at least three and the most 4 non-alloy rods. In another possible embodiment a tubular electrode is made of the outer iron tube (338) with diameter of 17 mm, wherein the tube wall thickness is 2 mm, while the inner iron tube inside of the iron tube with rods (336) has diameter of 12 mm and the wall thickness of 1.5 mm, wherein the inner tube contains 7 non-alloy rods with diameter of 2 mm and three alloy rods with diameter of 2,4 mm.

In another possible embodiment, an electrode for cutting and drilling using burning method in the oxygen mixture is performed as an iron tube with outer diameter of 50 mm and a wall thickness of 2 mm, into which are drawn 12 non-alloy metal rods with diameter of 2 mm and 4 alloy rods with diameter of 2 mm and with content of aluminium and magnesium.

In one embodiment of the device, as well as the electrode, the ratio of non-alloy metal rods and alloy metal rods inside a tubular electrode is greater than 3 to 1.

Typically, individual non-alloy rod is made of iron with content of 0.50% nickel, less than 0.15% carbon, less than 0.25% of silicon, approximately 1.10% magnesium, wherein the diameter of the rod of 1 mm to 3.2 mm. Another possible embodiment of the alloy rod contains from 5% to 6% magnesium and from 94% to 95% aluminium, wherein the diameter of the rod is 1 mm to 3,2 mm.

PATENT CLAIMS

1. Device for drilling and cutting with improved electrode, characterized in that it comprises at least following parts: a tank for oxygen under pressure (300), an oxygen inlet hose (320), a coupling (6), a holding fixture (5), a body of the device (1), a valve (7), a tubular electrode holding shank (20) and a tubular electrode (330) arranged so when in function, tubular electrode (330) burns in oxygen mixture .
2. Device for drilling and cutting with improved electrode, as claimed in claim 1, characterized in that the tubular electrode (330) is made of an iron tube (332), into which are inserted alloy and non-alloy rods (334).
3. Device for drilling and cutting with improved electrode, as claimed in claims 1 or 2, characterized in that the electrode holding shank (20) comprises at least of a body of the holding shank (2), a core (3) for clamping a tubular electrode (330) and a ring (4), wherein the tubular electrode (330) is inserted into the core (3) for clamping the tubular electrode (330) during use, which core (3) is inserted into the body of the holding shank (2), wherein the side of the holding shank into which an electrode enters the core (3) for clamping the tubular electrode (330) is equipped with threads in such a way that the core (3) for clamping the tubular electrode (330) and the electrode are firmly tightened by means of threads provided on the ring (4) which is screwed on corresponding thread on the body of the holding shank.
4. Device for drilling and cutting with improved electrode, as claimed in claim 3, characterized in that the core (3) for clamping the tubular electrode (330) has at least two feathers (204), wherein these feathers (204) tighten around the tubular electrode (330) end which enters the core (3).
5. Device for drilling and cutting with improved electrode, as claimed in claims 3 or 4, characterized in that the core (3) for clamping a tubular electrode (330) is cylindrical in shape and has a core base (202) and a core top (214), wherein on the core base there is a bottom (200) whose inner side is also a depth limiter and into which the tubular electrode is inserted, which bottom is equipped with an opening of the core base (216) for the oxygen flow, wherein the core base (202) is followed by a

constriction (212) extending in the direction toward the core top (214) which is a starting point for at least two feathers (204), so that the constriction diameter (212) is at least 1 millimetre narrower than the core base diameter (202), where each individual feather (204) is separated from another feather (204) by a slot (208) which starts in a feather opening (210) and extends laterally along the tubular electrode clamping core until it reaches the opening of the core base (216), where the feather opening (210) is positioned inside the constriction (212) with a slope (206) positioned on an upper end of the feather (204), next to the core top (214).

6. Device for drilling and cutting with improved electrode, as claimed in any claim from 1 to 5, characterized in that the tubular electrode (330) is made of iron tube (332) inside of which are placed non-alloy metal rods and alloy rods with content of aluminum and magnesium in a specific ratio.
7. Device for drilling and cutting with improved electrode, as claimed in any claim from 1 to 6, characterized in that the tubular electrode (330) is made of iron tube (332) with an outer diameter of 8 mm to 50 mm, wherein the thickness of the tube wall is 1 mm to 3 mm.
8. Device for drilling and cutting with improved electrode, as claimed in any claim from 1 to 7, characterized in that the ratio of non-alloy metal rods and alloy metal rods inside a tubular electrode is greater than 3 to 1.
9. Device for drilling and cutting with improved electrode, as claimed in any claim from 1 to 8, characterized in that individual non-alloy rod is made of iron with content of 0,50% nickel, less than 0.15% carbon, less than 0.25% silicon, approximately 1.10% magnesium, wherein the diameter of the rod is from 1 mm to 3.2 mm.
10. Device for drilling and cutting with improved electrode, as claimed in any claim from 1 to 8, characterized in that the alloy rod inside the tubular electrode contains from 5% to 6% magnesium and 94% to 95% aluminium, wherein the diameter of the rod is from 1 mm to 3.2 mm.

11. Device for drilling and cutting with improved electrode, as claimed in any claim from 1 to 9, characterized in that during its operation, through the interior of the tubular electrode flows oxygen from the oxygen tank (300).
12. Device for drilling and cutting with improved electrode, as claimed in any claim from 1 to 10, characterized in that the tubular electrode is manufactured in a manner that the alloy and non-alloy rods (334) are installed circularly in a concentric arrangement around the rim of the inner wall of the iron tube.
13. Device for drilling and cutting with improved electrode, as claimed in any claim from 1 to 11, characterized in that the tubular electrode is carried out as an iron tube into which are inserted the electrodes with 10 mm of diameter, wherein the tube wall thickness is 1 mm, and there are 7 non-alloy metal rods and one alloy rod are concentrically arranged on the rim of an iron tube, wherein the diameter of each rod is 2 mm.
14. Device for drilling and cutting with improved electrode, as claimed in any claim from 1 to 12, characterized in that tubular electrode is performed in such a way that an iron tube with rods (336) is drawn into another, outer iron tube (338) with a greater diameter, wherein the iron tubes are so dimensioned that the outer diameter of the inner iron tube (336) is at least 1 mm smaller than the inner diameter of the outer iron tube (338).
15. Device for drilling and cutting with improved electrode, as claimed in any claim from 1 to 13, characterized in that the tubular electrode is made in such a way that the rods inside the electrode are arranged in three concentric circles, wherein the first circle in the center of the tubular electrode contains four rods, two of which are alloy and the other two are non-alloy rods; in the second circle, which is formed around the rim of the first circle, there are 11 concentrically distributed non-alloy rods, while the rim of the third circle has concentrically arranged total of 17 alloy and non-alloy rods, the four of which are alloy rods, and the other 13 are non-alloy rods, wherein

the alloy rods are arranged on the rim of the circle in a way that between the alloy bars there are at least three and the most 4 non-alloy rods.

16. Device for drilling and cutting with improved electrode, as claimed in any claim from 1 to 14, characterized in that the outer iron tube (338) has a diameter of 17 mm, wherein the tube wall thickness is 2 mm, while the outer diameter of the iron tube inside of the iron tube with rods (336) is 12 mm, with a wall thickness of 1.5 mm.
17. Device for drilling and cutting with improved electrode, as claimed in any claim from 1 to 15, characterized in that the iron tube with rods (336) contains 7 non-alloy rods with diameter of 2 mm and three alloy rods with diameter of 2,4 mm.
18. A tubular electrode for cutting and drilling using burning method in the oxygen mixture, characterized in that the electrode is made at least of one round iron tube inside of which there is a combination of non-alloy metal bars and alloy bars with content of aluminium and magnesium.
19. A tubular electrode, as claimed in claim 18, characterized in that at least one iron tube has a diameter from 8 mm to 50 mm, while the wall thickness of the tube is from 1 mm to 3 mm.
20. A tubular electrode, as claimed in claim 18 or 19, characterized in that the ratio of non-alloy metal bars and the alloy metal bars is greater than 3 to 1.
21. A tubular electrode, as claimed in any claim from 18 to 20, characterized in that individual non-alloy rod is made of iron with content of 0.50% nickel, less than 0.15% carbon, less than 0.25% of silicon, approximately 1.10% magnesium, wherein the diameter of the rod of 1 mm to 3.2 mm

22. A tubular electrode, as claimed in any claim from 18 to 21, characterized in that the individual alloy rod contains from 5.00% to 6.00% magnesium and from 94.00% to 95.00% aluminium, wherein the diameter of the rod is from 1 mm to 3 mm.
23. A tubular electrode, as claimed in any claim from 18 to 22, characterized in that individual alloy rod made of magnesium also contains from 5.80% to 7.20% aluminium, from 0.40% to 1.50% zinc, from 0.15 to 0.50% manganese, up to 0.05% silicon, up to 0.05% copper, up to 0.005% nickel, up to 0.005% iron, and other elements up to 0.30%, wherein the diameter of the rod of 1 mm to 3.2 mm.
24. A tubular electrode, as claimed in any of claim from 18 to 23, characterized in that the oxygen flows through the electrode interior.
25. A tubular electrode, as claimed in any of claim from 18 to 24, characterized in that the alloy and non-alloy rods are arranged in a circle and concentrically distributed around the rim of the inner wall of the iron tube.
26. A tubular electrode, as claimed in any of claim from 18 to 25, characterized in that the iron tube, into which the electrodes are inserted, has a diameter of 10 mm and a wall thickness of 1 mm, wherein there are 7 non-alloy metal rods and one alloy rod which are concentrically distributed around the rim of the iron tube, wherein each rod has a diameter of 2 mm.
27. A tubular electrode, as claimed in any of claim from 18 to 26, characterized in that the iron tube containing rods is drawn into another iron tube with a greater diameter, wherein the iron tubes are so dimensioned that the outer diameter of the inner iron tube is at least 1 mm smaller than the inner diameter of the outer iron tube.
28. A tubular electrode, as claimed in any of claim from 18 to 25 or claim 27, characterized in that the rods inside the electrode are arranged in three concentric circles, wherein the first circle in the center of the tubular electrode contains four rods, two of which are alloy and the other two are non-alloy rods; in the second

circle, which is formed around the rim of the first circle, there are 11 concentrically distributed non-alloy rods, while the rim of the third circle has concentrically arranged total of 17 alloy and non-alloy rods, the four of which are alloy rods, and the other 13 are non-alloy rods, wherein the alloy rods are arranged on the rim of the circle in a way that between the alloy bars there are at least three and the most 4 non-alloy rods.

29. A tubular electrode, as claimed in claim 26, characterized in that the outer iron tube has a diameter of 17 mm and a wall thickness of 2 mm, while the iron tube inside of the iron tube with rods has a diameter of 12 mm and the wall thickness of 1.5 mm.
30. A tubular electrode, as claimed in claim 26, characterized in that the iron tube inside of the iron tube with rods (336) contains 7 non-alloy rods with diameter of 2 mm and three alloy rods with diameter of 2,4 mm.

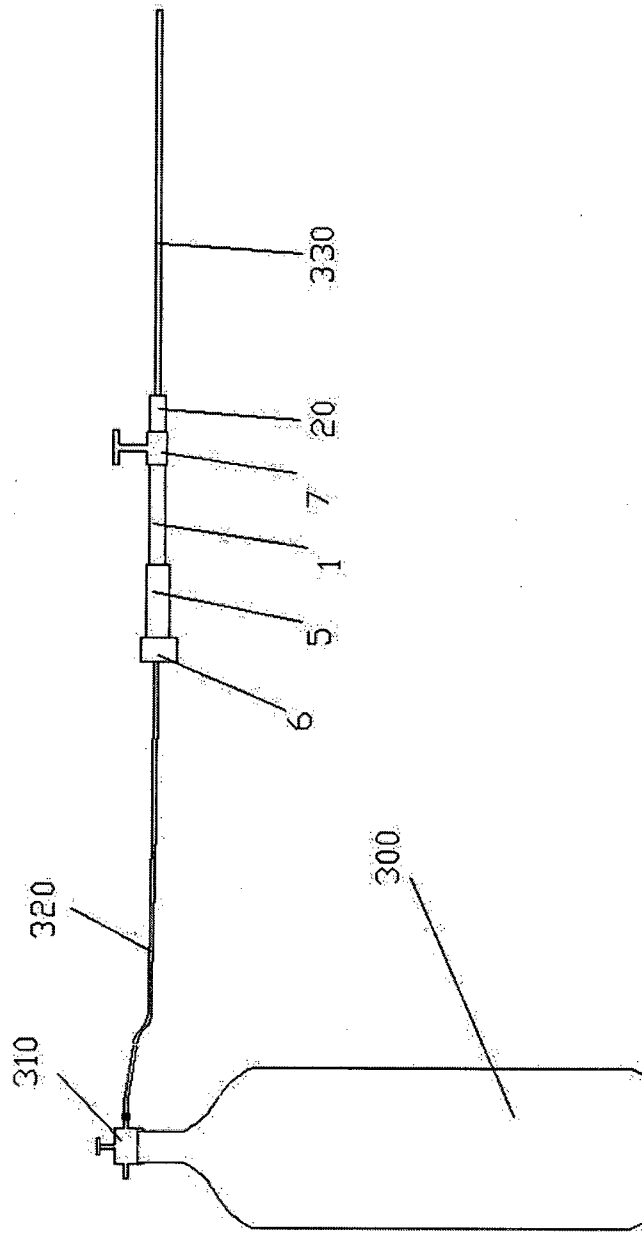


Figure 1.

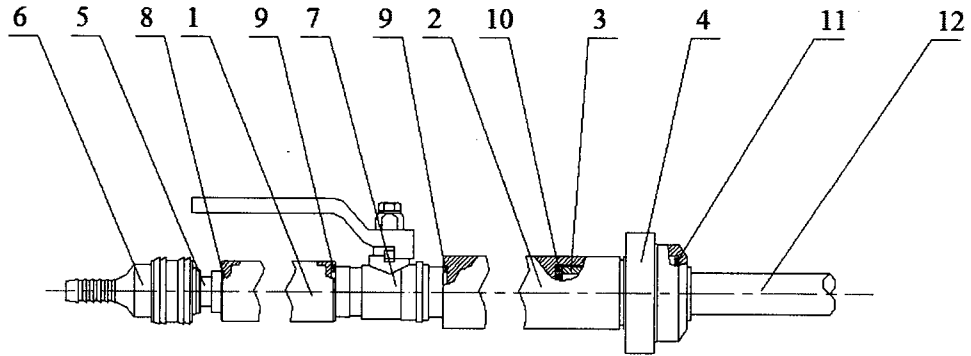


Figure 2.

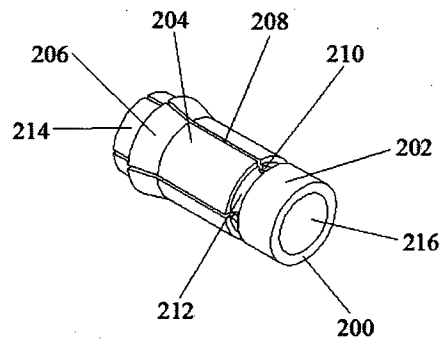


Figure 3.

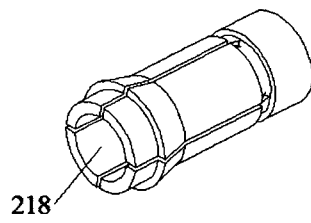


Figure 4.

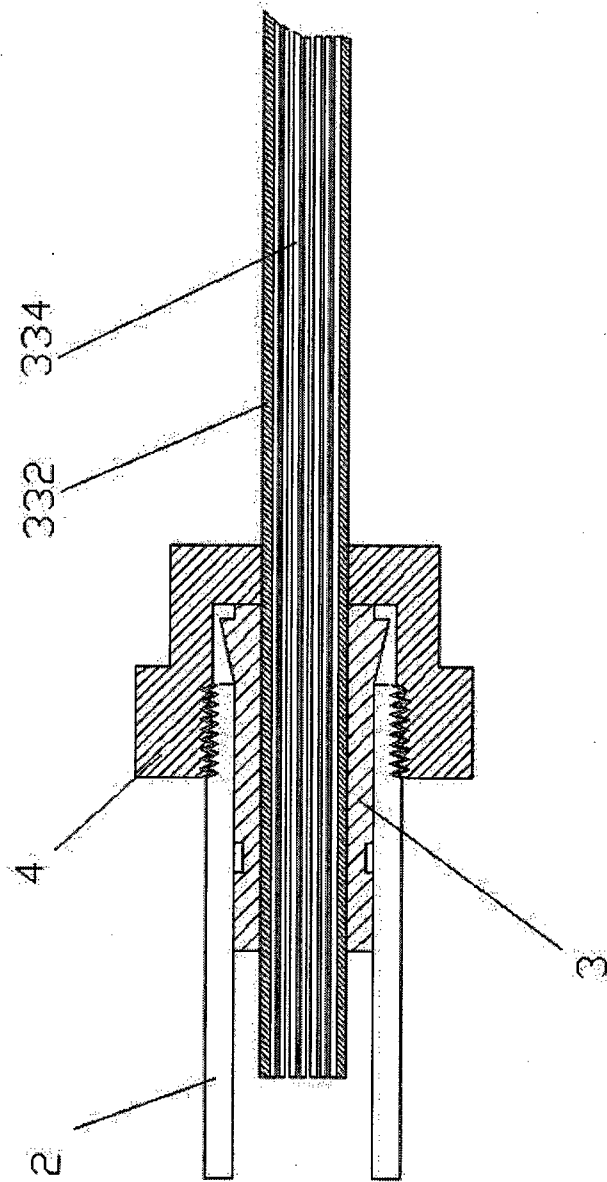


Figure 5.

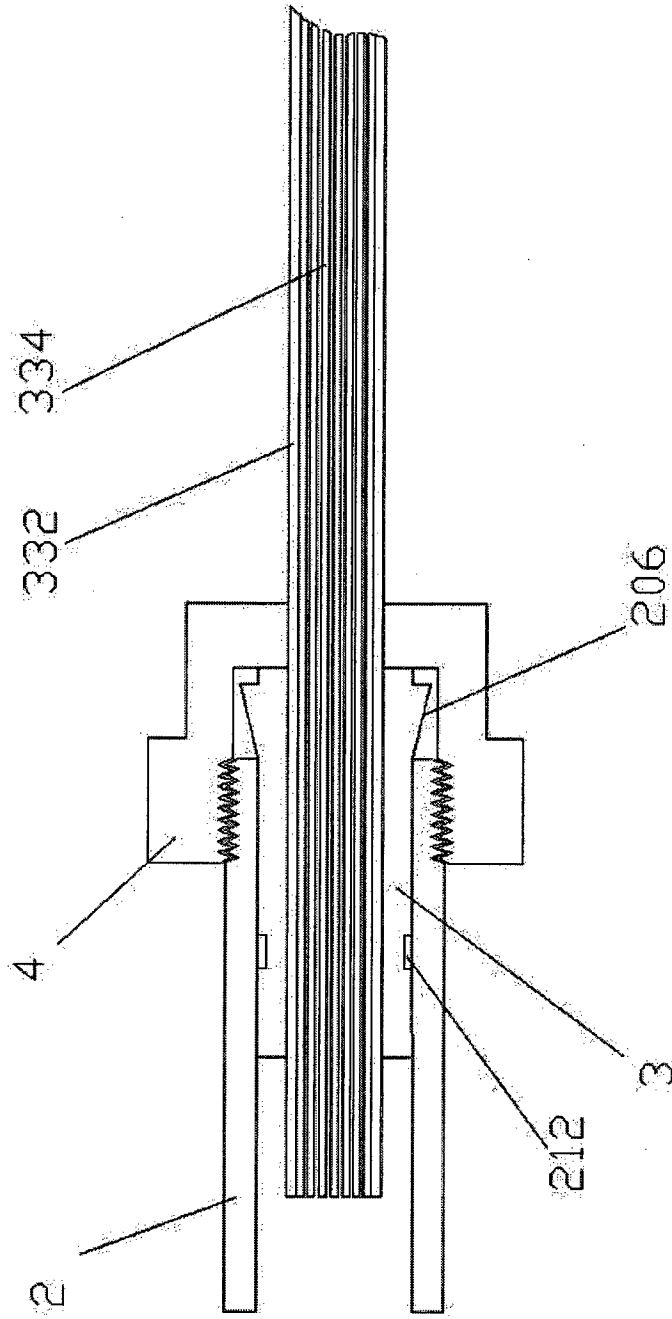


Figure 6.

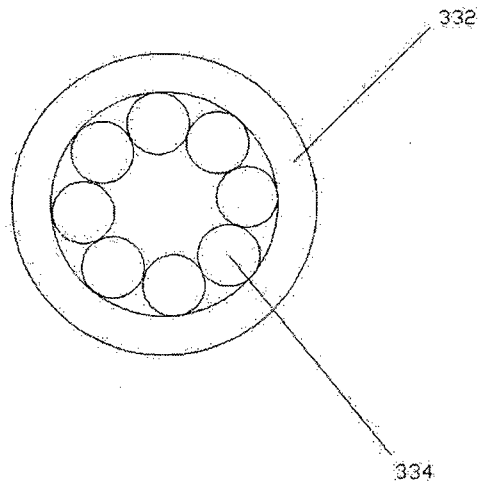


Figure 7.

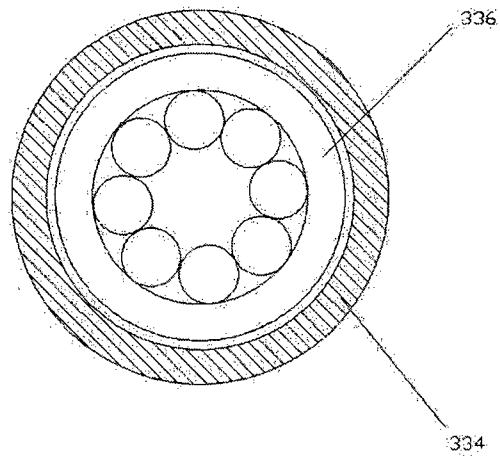


Figure 8.