

UNITED STATES PATENT OFFICE.

PERCY A. E. ARMSTRONG, OF NEW YORK, N. Y., ASSIGNOR TO WALTER L. CLARK AND ARTHUR H. ADAMS, A COPARTNERSHIP UNDER THE NAME OF THE QUASI-ARC COMPANY, OF NEW YORK, N. Y.

WELDING-ELECTRODE AND PROCESS OF WELDING.

1,241,899.

Specification of Letters Patent.

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No Drawing.

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To all whom it may concern:

Be it known that I, PERCY A. E. ARMSTRONG, of New York city, in the county of New York, and in the State of New York, have invented a certain new and useful Improvement in Welding-Electrodes and Processes of Welding, and do hereby declare that the following is a full, clear, and exact description thereof.

My invention relates to welding electrodes and processes in which an electric current is employed to fuse a metal electrode, so that the fused metal is deposited upon a metal surface or surfaces which are to be thereby welded or patched.

Objects of my invention are to provide electrodes by which metal may be deposited solid and free from blow holes, a spongy condition or impurities, and by which the deposited metal can readily and conveniently be made to have any desired composition.

My invention is capable of embodiment in and of being practised by the use of various electrodes and with many variations of details, and the embodiments thereof by which I shall illustrate it are therefore to be regarded as typical only of many possible embodiments, and my invention is not to be confined to the details of such embodiments.

According to my invention, a metal rod of any desired shape and composition is coated with an inner and an outer coating, preferably of an essentially insulating nature, and preferably essentially non-metallic and adapted to act as a slag when fused. The rod may be of any material desired to be deposited, such as cast iron, iron, steel, alloyed steels, brass, copper or aluminum. In the present instance, it may be of manganese steel. The inner coating, according to my invention, has a lower melting or fusing point than the outer coating, but such fusing point may be either higher or lower than that of the metal core of the electrode, according to the class of work to be welded, patched or reinforced. For overhead and vertical work, the inner slag is preferably made equal to or of a slightly higher melting point than the metal core. But the metal will work with an inner slag of a lower fusing point than that of the metal core. For horizontal work, I preferably make the in-

ner coating of a lower fusing point than that of the metal core, but it is quite possible to obtain excellent results with the inner slag of a higher melting or fusing point than the metal core.

The inner coating may consist of any suitable material or combination of materials such as blue asbestos, which may be in the form of yarn and smeared with a suitable composition, such as sodium silicate, aluminum silicate, or any other suitable, well-known composition, that will either raise or lower the fusing point of the asbestos as desired, according to the circumstances. This coating, when in the form of a yarn, may be twisted around or braided on the metal core, or squeezed or cast on to it.

The outer coating may consist of any suitable refractory material or combination of refractory materials, such as refractory clays or a commercial white asbestos, the composition of which is found to be silicon, aluminum oxid, magnesia, calcium, carbon, etc., and I preferably use it in the form of yarn, twisted around or braided or squeezed or cast on the electrode.

The thickness of the wall of the outer slag I preferably make such that a crucible is maintained at the end of the electrode by reason of the fusion of the metal rod, and the inner coating or slag taking place at a lower temperature than that of the outer coating or slag. I prefer to have the wall of the crucible not thinner than 5% of the diameter of the average cross-section of the metal core of the electrode. The outer coating should be such that on being in contact with the fused deposited metal, it will just fuse and combine with the slag of the inner coating or form a separate slag on top of the already deposited inner slag and deposited molten metal.

While I may use the inner coating as consisting only of materials adapted essentially to form a slag, as before described, and which are essentially non-metallic, the inner slag may have compounded with it various metals or alloys, separate or combined, such as ferro-manganese, ferro-titanium, ferro chromium, ferro tantalum, ferro-tungsten, ferro-vanadium, carbon, etc., so that the inner slag, besides acting as a blanket, so to speak, to cover the deposited

metal and prevent its oxidation from the atmosphere, may serve as a medium for carrying the alloying substances.

For instance, where it is desired to deposit manganese steel, I may use a steel rod or core for the electrode having no manganese therein, or less manganese than or equal to that desired in the deposited metal, and may supply manganese from a ferro-manganese in the inner coating. I find that in this way I can obtain a higher percentage of manganese in the deposited metal than is possible by depending alone upon manganese in the rod or core, because the latter is so readily oxidized.

In the practice of my process by means of my electrode in any of its above described forms, the electrode is connected with the pole of a source of either direct or alternating current, and the circuit is completed through the work. The metallic core of the electrode is brought into contact with the metal on which it is to be fused by direct contact or some interposed conductive body. The metal core then starts to fuse and the inner coating is fused leaving the outer coating to form a shell or crucible-like structure, and in the crucible-like cup or tube thus formed, the metal core or inner slag is fused, the atmosphere being excluded by the crucible so that the fused metal is protected therefrom. There is an expulsive effect due probably to an arc throwing the molten metal away from the metal core, and the crucible or tube acts as a conductor or pipe by which the fused material is directed on the metal to be welded, patched or reinforced. The electrode is held perpendicular to the work or otherwise, according to whatever angle is best suited to accomplishing the operation, and the nearest edge of the crucible is advantageously held touching the work or the deposited metal or slag, but this latter condition is not essential. The current will determine the greatest distance from the work at which the electrode may be held.

The outer coating should just fuse at such a rate as to maintain a sufficient crucible and yet flow on to the work sufficiently rapidly so that the arc if there be one, will not become too long.

That feature of my invention by which I provide the inner coating with the alloying elements, when it is used, is very advantageous because it has been found that when a bare metallic electrode is used to deposit metal upon a body, it has, during the process of fusion, lost much of the alloying elements and absorbed oxygen, and it is to overcome this defect and give a better deposited metal that slag has been heretofore melted down with the metallic electrode, but even this has not prevented a loss of alloy in the deposited metal nor

the formation of oxid in the latter, and it has been necessary to provide the metal core with an excess of the alloying elements so that the loss could, to some extent, be compensated. By my invention I obviate this defect to a large degree, and I not only have a control over the composition of the metal deposited but I can obtain depositions of a large variety of compositions by the use of cores of a standard composition, and inner coatings with various alloys mixed therewith. The intimate and complete mixing taking place in the crucible at the end of the electrode insures a good mixture of the various elements. The metallic core is deposited and the molten metal core is covered with slag during the whole time it is being deposited and until it cools. The metal thus deposited will be free from occluded gas holes and contain the required alloys.

I claim:

1. An electrode, comprising a metal core having an inner coating adapted to form a slag which will protect the deposited molten metal from gaseous attack, and an outer slag adapted to form a crucible that shall protect both said molten metal and slag, said outer coating being fusible but at a higher temperature than said inner coating.
2. An electrode comprising a core of manganese steel and inner and outer coatings of insulating material adapted to act as a slag when fused, the outer coating being of a higher melting point than the inner one.
3. An electrode comprising a metal core having inner and outer coatings of insulating material that is adapted to act as a slag, said coatings having different melting points.
4. An electrode comprising a metal core having inner and outer coatings of insulating material that is adapted to act as a slag, said coatings having different melting points, the melting point of the inner coating being lower than that of the outer coating.
5. An electrode comprising a metal core having inner and outer coatings of insulating material that is adapted to act as a slag, said coatings having different melting points, the melting point of the outer coating being higher than that of the metal and of inner coating.
6. An electrode comprising a metal core having inner and outer coatings of insulating material adapted to act as a slag when fused, the inner coating comprising blue asbestos.
7. An electrode comprising a metal core having inner and outer coatings of insulating material adapted to act as a slag when fused, the inner coating comprising blue asbestos combined with a silicate.

8. An electrode comprising a metal core having inner and outer coatings of insulating material adapted to act as a slag when fused, the inner coating comprising blue
5 asbestos combined with sodium silicate.

9. An electrode comprising a metal core having inner and outer coatings of insulating material adapted to act as a slag when fused, the outer coating comprising white
10 asbestos.

10. An electrode comprising a metal core having inner and outer coatings of insulating material adapted to act as a slag when fused, the inner coating comprising blue
15 asbestos and the outer coating comprising white asbestos.

11. An electrode comprising a slag forming sleeve, a second slag forming element, and a metal-depositing element.

20 12. An electrode comprising a slag forming sleeve, a second slag forming element, and a metal-depositing element, said sleeve having a higher fusing point than said second slag forming element.

25 13. An electrode comprising a slag forming sleeve, a second slag forming element, and a metal-depositing element, said sleeve having a higher fusing point than said second slag forming element, and providing a
30 crucible for containing and protecting both of said elements.

14. An electrode comprising a metal rod or core, and a coating of insulating material adapted to act as a slag when fused, said
35 coating comprising elements to be combined with the deposited metal, and an outer coating of insulating material adapted to act as a slag when fused, said outer coating having a higher melting point than said inner
40 coating.

15. An electrode comprising a metal rod or core and a coating of insulating material adapted to act as a slag when fused, said
45 coating comprising alloys adapted to be combined in depositing with the metal of the core, and an outer coating of insulating material adapted to act as a slag when fused, said outer coating having a higher melting point than said inner coating.

16. An electrode comprising a metal rod 50 or core, and a coating of insulating material adapted to act as a slag when fused, said coating comprising alloys adapted to be combined in depositing with the metal of the core, such as a ferro-manganese, and an 55 outer coating of insulating material adapted to act as a slag when fused, said outer coating having a higher melting point than such inner coating.

17. The process of depositing metal by 60 an electric current which comprises coating a metallic electrode with an insulating material adapted to act as a slag when fused, and so maintaining said coating in contact with the work, and melting it by means of 65 an electric current, that such coating forms a crucible for the molten metal.

18. The process of depositing metal by means of an electric arc consisting in coating a metallic electrode with inner and outer 70 coatings of insulating material adapted to act as a slag when fused, the outer coating having a higher melting point than the inner coating, and melting said electrode by means of an electric current, and so main- 75 taining the electrode near the work that such outer coating forms a protecting crucible about the metal being deposited.

19. The process of depositing metal by means of an electric current comprising 80 coating a metallic electrode with inner and outer coatings of insulating material adapted to act as a slag when fused, said outer coating being of a higher melting point than said inner coating, and combining with said 85 inner coating alloying materials desired to be combined with the metal of said rod, melting said rod by means of the electric current, and so maintaining said rod near said work that said outer coating shall form a crucible 90 protecting the molten metal.

In testimony that I claim the foregoing I have hereunto set my hand.

PERCY A. E. ARMSTRONG.

Witnesses:

EDWIN J. PRINDLE,
MARIAN I. DEMPSEY.