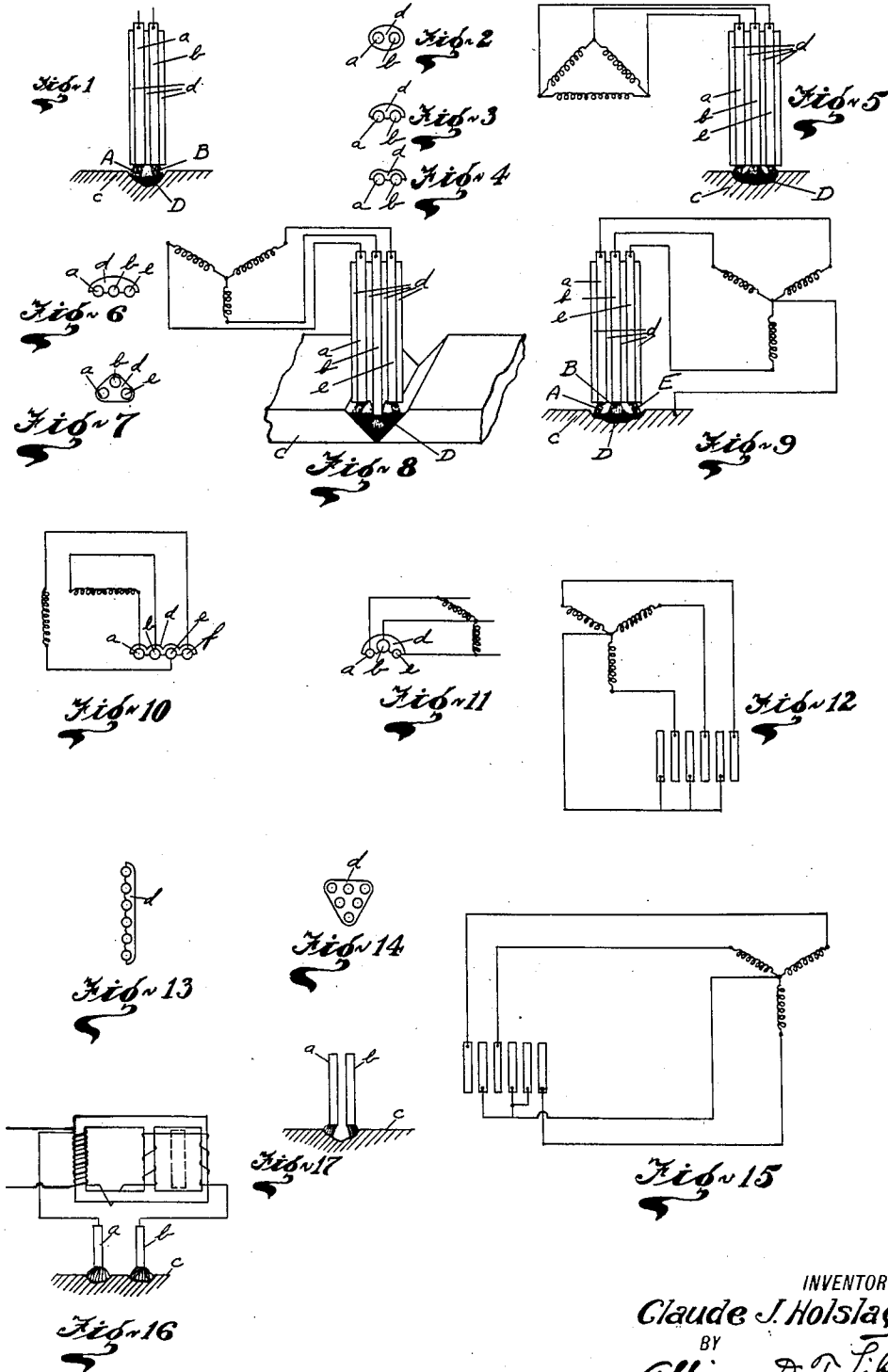


C. J. HOLSLAG.
 MEANS FOR ELECTRIC ARC WELDING, CUTTING, AND THE LIKE.
 APPLICATION FILED NOV. 16, 1920.

1,371,094.

Patented Mar. 8, 1921.



INVENTOR
 Claude J. Holslag
 BY
 Albion D. Libby
 ATTORNEY

UNITED STATES PATENT OFFICE.

CLAUDE J. HOLSLAG, OF SOUTH ORANGE, NEW JERSEY.

MEANS FOR ELECTRIC-ARC WELDING, CUTTING, AND THE LIKE.

1,371,094.

Specification of Letters Patent.

Patented Mar. 8, 1921.

Application filed November 18, 1920. Serial No. 424,443.

To all whom it may concern:

Be it known that I, CLAUDE J. HOLSLAG, a citizen of the United States, residing at South Orange, in the county of Essex, State of New Jersey, have invented certain new and useful Improvements in Means for Electric-Arc Welding, Cutting, and the like, of which the following is a description, reference being had to the accompanying drawing and to the figures of reference marked thereon.

This invention relates to improved means of electric arc welding, cutting and the like.

According to the present invention, the welding, cutting or like operation is effected by means of two or more series connected arcs, the electric path being through an electrode to the work to be welded or cut and thence back to the source of energy through another electrode or another series of electrodes and work.

The invention also consists in a twin or multiple electrode having two or more electrodes arranged adjacently to, but insulated from, each other, and intended to produce at least two closely adjacent arcs having a common puddle.

The invention further consists in the methods of connections and relative arrangements between the electrodes, supply of current, and work, as hereinafter more particularly referred to.

In the drawings:

Figure 1 is a diagrammatic view showing my multiple electrode in operation.

Figs. 2, 3 and 4 show different ways of binding the electrodes together.

Fig. 5 illustrates the application of the invention to a three-phase delta line.

Figs. 6 and 7 illustrate different ways of holding a triple multiple electrode together.

Fig. 8 illustrates the application of my invention to a three-phase star line.

Fig. 9 illustrates the application of my invention to a three-phase four wire system.

Fig. 10 illustrates my invention as applied to a four wire two-phase line, there being provided in this case four electrodes.

Fig. 11 shows the application of my invention to a two-phase three wire line.

Figs. 12, 13, 14 and 15 show different groupings of electrodes of which my invention is susceptible.

Fig. 16 is a diagrammatic view showing how the electrode may be connected to a transformer of the Holslag type with the

electrodes spaced apart to form two separate and distinct welds, and

Fig. 17 is a diagrammatic view disclosing the behavior of the series connected arcs 60 when they are close to one another.

Referring to Fig. 1, the two component metal electrodes *a* and *b* of a twin electrode are connected by means of wires attached thereto, to the two poles of a transformer, 65 as shown in Fig. 16, *e. g.*, the transformer described in my Patents 1305360, 1305361, 1305362 and 1305363 granted to me June 3, 1919, and a "twin arc" A B is drawn between the said component electrodes and the 70 work *c*, at the joint between the pieces of metal, the two adjacent arcs A and B being thus in series with each other, and their combined heat effect forming one puddle, by which welding is accomplished. As shown 75 in Figs. 1 and 9 and more particularly in Fig. 8, the electrodes are placed at the joint to be welded or at the juncture of the two pieces of metal to be joined together, and as the electrodes are consumed by the heat of 80 the arcs they melt into the joint to be welded. The fact that in the arrangement just referred to, two arcs are produced instead of one, which latter is the case with the two electrodes in Jablochhoff's candle, is proved 85 by the voltage drop across the two electrodes being equal to that of two arcs; furthermore visual inspection shows that there are two arcs as is shown in Figs. 17, which repel one another, and attempts made to cause 90 the two arcs to merge into one end in failure while the arcs are in striking distance of the work.

The two electrodes *a*, *b* of the twin electrode may be joined or held together in any 95 suitable way and the insulating and holding bond *d* used for this purpose may inclose the component electrodes wholly as shown in Fig. 2 or partly, as shown in Figs. 3 and 4, being made more or less thin, or more or less thick according to requirements. The 100 insulating and holding bond may be made of the same materials as the flux coatings described in my patent application 239,447 filed June 11, 1918, or be replaced by a 105 spacer or other mechanical means.

Figs. 5 and 8 illustrate the application of the invention to a three-phase delta and a star line respectively; in these cases use may be made of a multiple electrode comprising 110 three component electrodes *a b c* connected to the three corners of the delta (see

Fig. 5) or the three free ends of the star (see Fig. 8). The three electrodes, which may be held together by a holding bond *d* of the same character as described with reference to Fig. 1 may be arranged in the same or in different planes relatively to one another, as shown in Figs. 6 and 7 respectively and during use one electrode may be arranged to advance in front of the other, more especially when a conical or other depression *D* is formed between the parts to be welded together, in which case the electrode which is ahead of the other two is used for filling the deeper part of the depression. It is to be pointed out that in this case three separate arcs *A*, *B*, *E* are formed between the multiple electrode and the work.

In the application of the invention to a three-phase four-wire system, the middle point of the star may be connected to the work, and the three free ends thereof to the three electrodes of a multiple electrode, as shown in Fig. 9.

In the case of a two-phase current supply, use may be made of a multiple electrode with four component electrodes, as shown in Fig. 10, two of the electrodes *a* and *b* being connected to the one phase and the other two, *e* and *f* to the other phase, and in the case of a two-phase three-wire line, a three-electrode multiple electrode may be used as shown in Fig. 11, the electrode *b* connected to the middle wire being made of larger section than the other two *a* and *e*, as it carries a larger current. In all cases where alternating current is used, it has been found that due to the use of a series multiple arc electrode that the power factor has been materially increased thus materially increasing the efficiency of the welding system.

I wish it to be understood that the invention is not limited to any particular grouping of the electrodes, as they may be arranged according to any desired design, and that during operations instead of their being advanced abreast, they may be advanced one ahead of the other in order successfully to realize the welding of beads by once passing the multiple electrode over the work.

Further, the invention is not limited to the number of component electrodes employed. For instance, use may be made of a six-electrode multiple electrode, the six electrodes of which may be arranged in one and the same plane (see Fig. 13) or be grouped in the form of a triangular prism (see Fig. 14) or otherwise, and be used in conjunction with a three-phase four-wire system in which case the middle point of a star connection may be connected to three of the electrodes and the free ends of the star to the other three adjacent electrodes, the latter being arranged to alternate or not with the former, as shown in Figs. 12 and 15 respectively.

Furthermore, in Fig. 16 I have shown the electrodes spaced apart from one another so as to produce two separate and distinct arcs, the arcs however still being in series relation with one another.

By the means provided according to this invention the workability is approximately doubled, the electrical efficiency and power factor are increased and the use of alternating currents is especially applicable because of the equal burning away of the electrodes.

I wish it to be understood that the invention is not limited to the arrangements of electrodes and connections hereinbefore more particularly referred to and that any arrangement of two or more electrodes producing two or more series connected arcs, comes within the scope of my invention.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A method of metallic arc welding which consists in striking a plurality of series connected arcs between the electrodes and the metal to be welded, on the metal to be welded, melting the electrodes into the joints, said arcs being maintained at the joints of the metal to be welded.

2. The improved method of metallic arc welding which consists in simultaneously striking a plurality of series connected arcs between the electrodes and the metal to be welded, on the metal to be welded, melting the electrodes into the joints, said arcs being maintained at the joints of the metal to be welded.

3. A method of metallic arc welding which consists in striking a plurality of arcs by means of electrodes connected to opposite terminals of a source of supply on the metal to be welded and connecting the plurality of electrodes and work in series with one another through said arcs, melting the electrodes into the joints, said arcs being maintained at the joints of the metal to be welded.

4. A method of metallic arc welding which consists in striking a plurality of closely adjacent series connected arcs adjacent to the joint of the metal to be welded, the heating effect of the arcs producing a puddle common to all the arcs.

5. The improved method of metallic electric arc welding which consists in simultaneously striking a plurality of closely adjacent series connected arcs between electrodes and the metal to be welded, substantially at the joint between the pieces of metal to be welded, and melting said electrodes into the joint.

6. The method of metallic arc welding which consists in striking a plurality of alternating current series connected arcs on the work to be welded,

7. The method of metallic arc welding which consists in striking a plurality of alternating current series connected arcs on the work to be welded, the heating effect of the arcs forming a common puddle.
8. A multiple electrode for carrying out the process of electric arc welding comprising a plurality of electrodes and an insulating flux producing binding material joining said electrodes.
9. A multiple electrode for carrying out the process of electric arc welding comprising a plurality of electrodes and an insulating flux producing binding material joining said electrodes, said binding material under

arc welding operations, being consumed at substantially the same rate as the electrodes.

10. A multiple electrode for electric arc welding cutting or the like comprising a plurality of electrodes bound together and arranged in different planes.

11. A multiple electrode for arc welding cutting and the like operations in which the separate electrodes are made of unequal sections, all of the electrodes being bound together and the electrode or electrodes of larger sections being intended to carry larger currents than the others.

In testimony whereof, I affix my signature
CLAUDE J. HOLSLAG.