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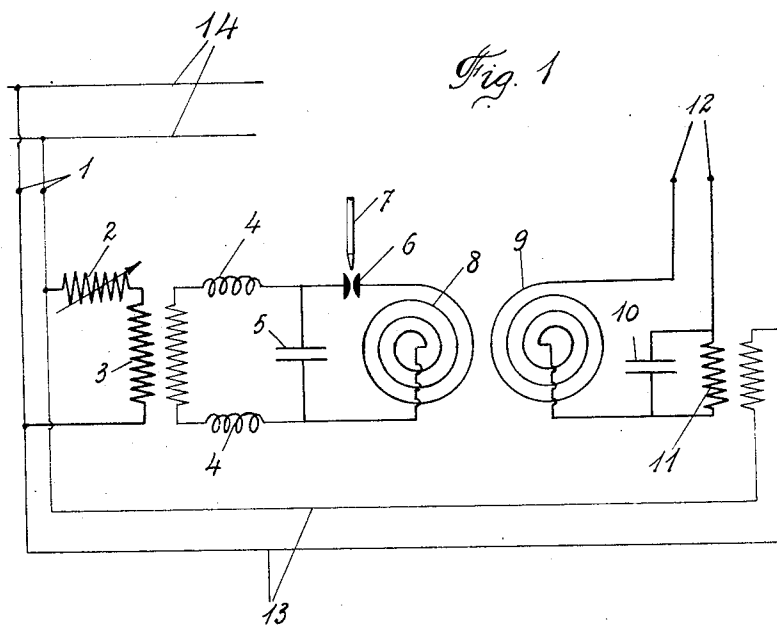
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ELECTRIC ARC FOR MELTING AND PULVERIZING METALS

Filed Jan. 24, 1924

3 Sheets-Sheet 1



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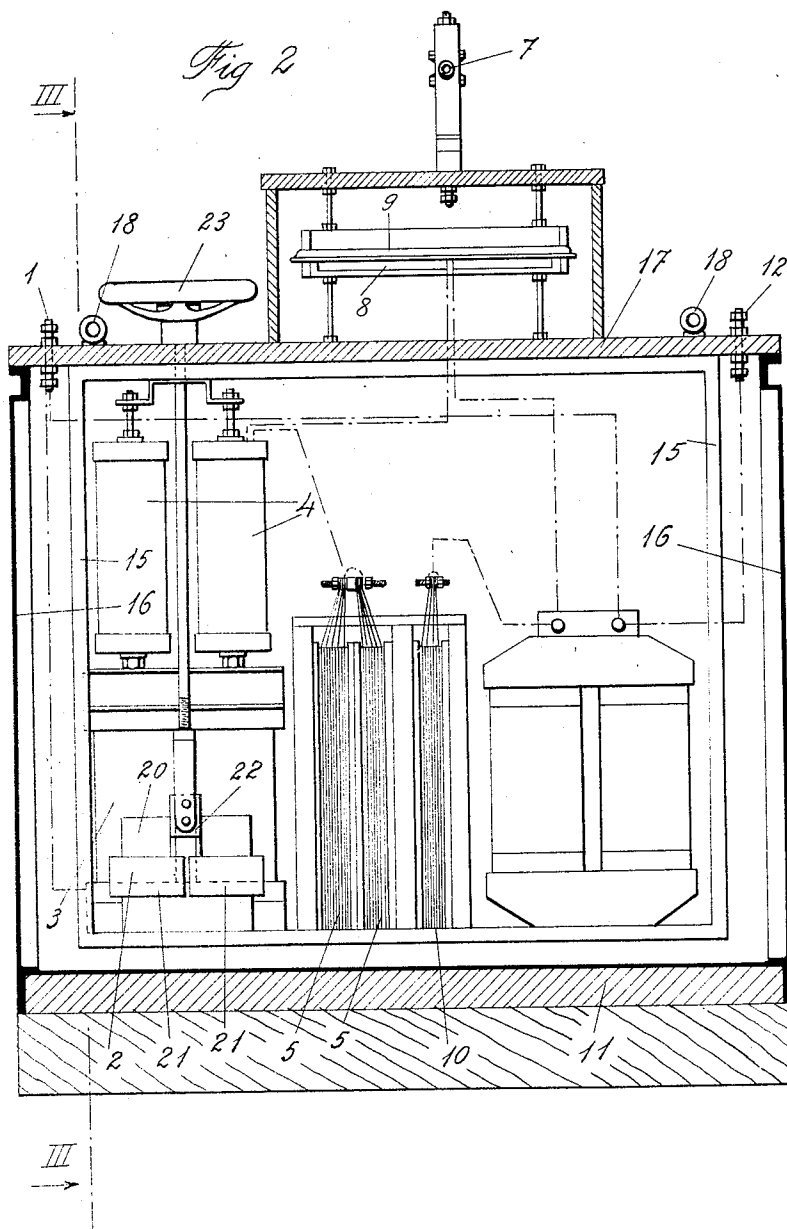
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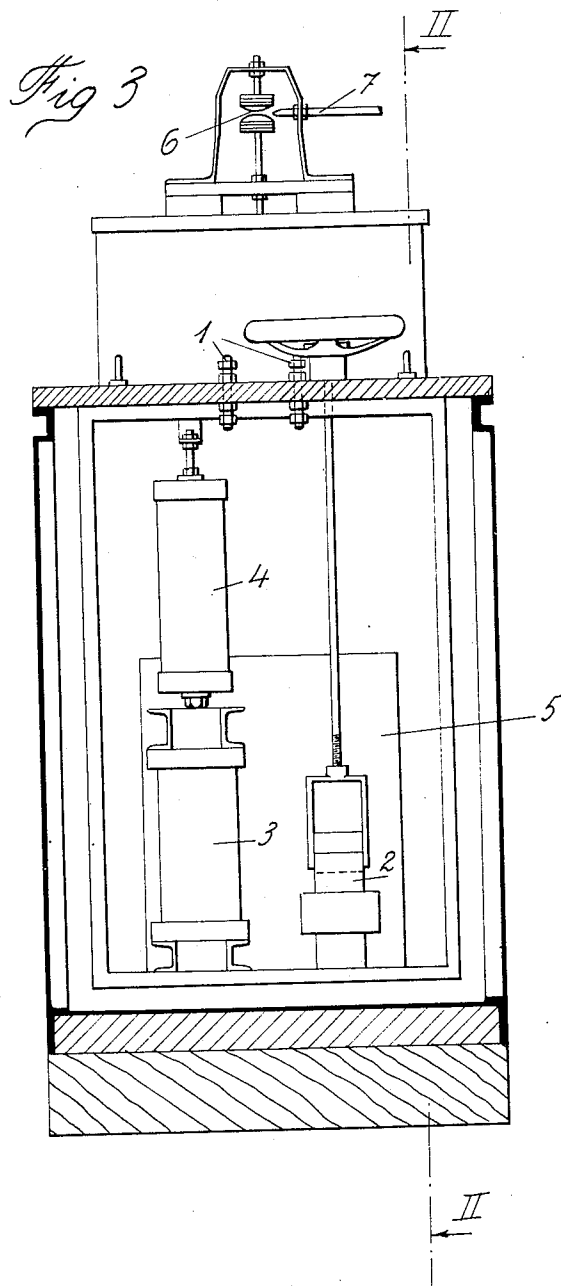
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ELECTRIC ARC FOR MELTING AND PULVERIZING METALS

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UNITED STATES PATENT OFFICE.

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ELECTRIC ARC FOR MELTING AND PULVERIZING METALS.

Application filed January 24, 1924, Serial No. 688,294, and in Spain January 24, 1923.

My invention refers to the formation of coatings of metal by the process usually styled metallization, according to which by means of compressed air or gas a stream of pulverized molten metal is projected on the body or surface which it is desired to cover; the invention has special reference to the electrical processes of this class in which the metal is employed in the form of one or two metal wires and an electric arc is formed between said two wires or between said single wire and a fixed electrode, so that the metal of the wires is melted by the action of said arc and the molten metal is pulverized through the compressed air. In this kind of process the great difficulty is to obtain that the electric arc shall be steady and regular and that it shall not be interrupted by the action of the compressed air which projects the molten metal, or, at least that if the arc is extinguished or interrupted by this compressed air or due to any other cause it shall automatically become re-lighted in the act. With this object it has been proposed to combine a high frequency current with the alternate current of normal tension and frequency which feeds the electric arc, but in the arrangements proposed up to the present it has not been possible to achieve an industrial working of the plant nor have they completely avoided the running of the high-tension current along the line of the arc-feed current and thus cause damage to other apparatus connected with this line.

My invention consists in deriving from the general feed line two transformers, one of which supplies a current of relatively low tension, for the feeding of the electric arc, whilst the other transformer supplies a current of high tension which feeds an oscillatory circuit formed by a condenser, a spark-gap and a high frequency transformer, with the object of producing a current of sufficiently high frequency which shall not be dangerous, which current joins up with the low tension current developed by the first transformer for feeding the electric arc. By this means it is possible to employ a high frequency current, of relatively high power, which ionizes intensely the air situated between the electrodes of the arc and in the case that due to any circumstance the arc should be interrupted, this ionized air immediately allows the spark to jump across

between the two electrodes and thus re-establish the electric arc. By this arrangement of adopting a transformer for obtaining the low tension current necessary for feeding the arc, and combining at the same time a condenser with this transformer, it is certainly avoided the passing of the high tension current along the general feed line and thus cause damage to the apparatus connected with the same.

In the accompanying drawings is shown an electrical arrangement appropriate for putting into practice the process of this invention.

Fig. 1 is the general scheme of the installation.

Fig. 2 is an elevation, showing a section along the line II—II of Fig. 3, of a form of construction of the apparatus.

Fig. 3 is a vertical section along the line III—III of Fig. 2.

In the drawings, 1 represents the entrance terminals of the installation, which join up with the line 14 which carries in the alternate electric current and 12 represents the exit terminals which are joined up with the electrodes of the arc. Shunted to the terminals 1 is the primary of a transformer 3 which supplies a high tension current appropriate for feeding the oscillatory circuit. For example, if the line 14 supplies alternate current at 220 volts and 50 cycles, the transformer 3 may be a monophasic transformer of $\frac{1}{2}$ kva., to raise the tension from 220 volts to 6000 volts. In order to regulate at will the working of this transformer an adjustable inductance 2 is connected in series with the primary. This inductance is constituted by a nucleus 20 in the form of a U, with bobbins 21 on its two branches and in the space comprised between the upper ends of its two branches a magnetic bridge 22 slides up and down; the position of which may be controlled from the outside by means of the hand wheel 23. By this means the auto-induction of the bobbins 21 may be varied and the transformer 3 regulated.

In series with the two ends of the secondary of the transformer 3 there are reactance bobbins 4 which are connected in the manner shown in Fig. 1, with an oscillatory circuit composed of a condenser 5, a discharger or spark-gap 6 and the primary 8 of a high frequency transformer. The sec-

ondary 9 of this high frequency transformer has one of its ends communicating directly with the terminals 12 whilst its other end, as is represented in Fig. 1, is connected in series with the secondary of the transformer 11 which feeds the arc. In order to allow the passage of the high frequency current a shunt with a condenser 10 is arranged for. The transformer 11 has its primary fed by the line 13 coming from the terminals 1 and supplies a current of relatively low tension, appropriate for running the electric arc. For example, in the case previously cited this transformer 11 may be of 2 kva. which reduces the tension from the 220 volts of the line 14 to 110 volts.

In order to prevent the formation of a permanent arc in the discharger 6 in which case the high frequency current would not be produced, in front of this discharger 6 a nozzle 7 is placed and through this a current of air or of any appropriate gas under pressure is driven against the spark, so that any continuous arc which might be formed between the two points of the discharger 6 is immediately extinguished.

Under this arrangement the high tension current developed in the secondary of the transformer 3 after passing through the bobbins of the reactance 4 charges the condenser 5 which discharges through the spark-gap 6 and the primary 8 of the high frequency transformer, in this manner developing a high frequency current which passes to the exit terminals 12 and therefore to the arc. The reactance bobbins 4 serve to completely prevent the high frequency current from passing to the secondary of the transformer 3.

The high frequency current proceeding from the secondary 9 of the transformer passes through the condenser 10 and thus to the terminals 12 without being able to pass through the secondary of the transformer 11 by reason of its auto-induction and, on the other hand the low tension current developed in this secondary cannot pass through the condenser 10 but is obliged to run through the secondary 9 of the high frequency transformer and continue to the terminals 12.

The feed-line 14 has no metallic connection at any point with the circuit through which the high frequency current runs, and in this manner is avoided that the high frequency current can run along the feed-line and thus cause damage in the latter or in the apparatus connected with it.

As seen in Figs. 2 and 3 the set of these apparatus is mounted on a frame-work 15 situated in the interior of a case 16 full of oil like the cases of transformers. Preferably the frame-work 15 should be suspended from the top cover 17 of the case, which can be provided with rings 18 for lifting out the whole of the apparatus.

The case 16 should be constructed of corrugated sheet metal so as to increase the cooling surface.

The installation arranged in this manner contains in a compact form all the electrical apparatus necessary for the working of a plant for metallization by means of the electric arc and its management is both simple and convenient, since it is only necessary to connect the terminals 1 with an electric feed line, the terminals 12 with the electric arc and the nozzle 7 with a branch-pipe from the supply of compressed air or gas which must be used for the projection of the metal melted by the arc. During the working of the installation no variation or movement of the different parts should be attempted, except that of graduating the inductance 2 by means of the hand wheel 23.

I claim:

1. An installation for melting and pulverizing metals by means of the electric arc and a stream of compressed air, which comprises two transformers connected to one same alternate current feed line, one of the said transformers providing a low tension current and the other a high tension current, the primary of the last cited transformer being in combination with an inductance capable of regulation for regulating the working of the whole installation and the secondary in combination with an oscillatory circuit which comprises the primary of a high frequency transformer, the secondary of this high frequency transformer being coupled up with the secondary of the low tension transformer so that the high frequency current shall be added to the low tension current for feeding the arc, and combined also with a condenser which allows the high frequency current to pass to the arc without the necessity of passing through the secondary of the low-tension transformer.

2. An installation for melting and pulverizing metals by means of the electric arc and a stream of compressed air, which comprises the employment of two transformers connected to the same alternate current feed line, one of the said transformers providing a low tension current for feeding the arc and the other transformer a high tension current; the primary of this second named transformer being combined with an inductance capable of regulation for regulating the working of the installation and the secondary combined with an oscillatory circuit which comprises a discharger, a condenser and the primary of a high frequency transformer, the said discharger being combined with a stream of compressed air or gas which continually extinguishes the sparks of the discharger, whilst the secondary of the high frequency transformer is coupled up with the electric arc which melts the metal.

3. An installation for melting and pul-

verizing metals by means of the electric arc and a stream of compressed air, comprising two transformers connected to one same alternate current feed line, one of the said 5 transformers providing a low tension current and the other a high tension current, the primary of the last cited transformer being in combination with regulatable inductance for regulating the working of the whole installation and the secondary in combination 10 with an oscillatory circuit which comprises a discharger, a condenser and the primary of a high frequency transformer, the secondary of this high frequency transformer being coupled up in series with the secondary 15 of said low tension transformer and with the arc, and the secondary of said low tension transformer having shunted a condenser, in order to allow the passage of the high frequency current, whilst the low tension current has to pass through the secondary of 20 said high frequency transformer.

In testimony whereof I affix my signature.

DR. WILHELM MÜLLER.