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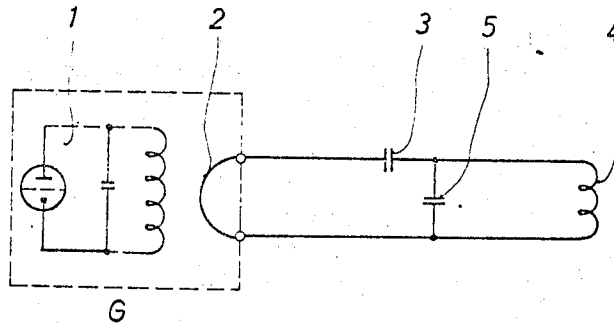
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3,440,387

HIGH FREQUENCY HEATING SYSTEM WITH INDUCTIVE PLASMA

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HIGH FREQUENCY HEATING SYSTEM WITH INDUCTIVE PLASMA

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3 Claims

ABSTRACT OF THE DISCLOSURE

A high frequency plasma induction heating system in which ignition of the gas is produced by means of first and second capacitors that form a resonant circuit with the induction coil. The usual priming electrode of prior art systems is thereby eliminated.

The present invention relates to a high frequency heating system using ionized gas or plasma as the heating medium. More particularly, the invention relates to an improved ignition circuit for supplying high frequency energy to the discharge plasma.

In prior art arrangements, it is common practice to connect the inductor directly to the output of a high frequency generator, in which case the high-frequency current passing through the inductor is substantially constant. However, since the reactance of the inductor is very low, the gas ignition has to be initiated by external action, for example, by means of a priming arc.

Furthermore, careful attention must be taken during operation of the system to prevent excessive variations of the supply of gas. A manual readjustment of the generator coupling is required in order to avoid de-energization of the overload relay or the extinction of the plasma. For that purpose a variable impedance, for example, an adjustable capacitor, is connected between the coupling coil and the inductor, as is shown, for example, in the French patent specification 1,371,963.

The initiation of the gas ionization by an external agency and a manual variation of the coupling are generally required to operate a high frequency plasma induction heating system. It is an object of the invention to avoid such complications. In accordance with the invention, a first capacitance is connected in series and a second capacitance is connected in parallel with the inductor. The two capacitances, in common, are tuned with the inductance of the inductor to the resonance frequency. In this way, a considerably higher reactive power that is always sufficient to initiate ignition, and a considerably improved stabilisation, are obtained.

A variation of the capacitances may be obtained by adding or subtracting further capacitances, whereas the inductance of the inductor may be varied by changing the distance between the turns.

It is especially effective to adjust the working point of the resonant circuit on the inductive side of the resonance curve, since apart from the reduction of voltage across the inductor subsequent to ignition due to the higher

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damping effect, a further voltage reduction is obtained due to reduction of the inductance.

The nature of the invention will be more clearly apparent from the following description, taken in conjunction with the sole figure of the accompanying drawing of a preferred embodiment of the invention.

The figure shows a conventional high frequency generator. The high frequency energy thereof is coupled out by means of the coil 2. The coil is connected to a resonant circuit formed by the series capacitance 3, the inductor 4 and the capacitance 5 connected in parallel therewith. The inductor 4 supplies the high frequency energy to the plasma.

By appropriate choice of the ratio between the capacitances 3 and 5, the mode of operation of the arrangement can be varied. A comparatively high capacitance 3, for example, provides a "rapid" action, and a low capacitance 3 provides a "slow" action of the system. An "average" action is obtained, for example, when the ratio between the two capacitances is about 1:1.

What is claimed is:

1. A high frequency plasma induction heating system wherein the improvement comprises a stabilized ignition circuit for the system comprising, a source of high frequency power of a given frequency, an induction coil for generating the high frequency plasma field, first and second capacitors, means connecting said first and second capacitors in series and in parallel with said coil, respectively, to form a resonant circuit therewith that is tuned on the inductive side of the resonance curve, the resonant frequency of said resonant circuit being approximately the same as said given frequency of the high frequency power source, and means for coupling the output of said high frequency source to the input of said resonant circuit.

2. A system as claimed in claim 1 wherein said first and second capacitors have the same capacitance value.

3. A system as claimed in claim 1 wherein said high frequency power source comprises an oscillator having an inductor and a capacitor connected to form a parallel resonant circuit connected to the output circuit of the oscillator, and said coupling means comprises a coil inductively coupled to said oscillator inductor and connected to the resonant circuit comprising the induction coil and said first and second capacitors.

References Cited

UNITED STATES PATENTS

2,662,162	12/1953	Blok	219—10.75 X
3,277,265	10/1966	Reboux	219—121
3,340,415	9/1967	De Ruiter et al.	219—121
3,353,060	11/1967	Yamamoto et al.	219—121

FOREIGN PATENTS

667,657	3/1952	Great Britain.
896,399	11/1953	Germany.

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