



US011053560B2

(12) **United States Patent**  
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(10) **Patent No.:** US 11,053,560 B2  
(45) **Date of Patent:** Jul. 6, 2021

(54) **HIGH PRESSURE RAPID GAS QUENCHING**

USPC

266/249, 250, 252, 259, 432/247

**VACUUM FURNACE UTILIZING AN**  
**ELECTRICAL ISOLATION TRANSFORMER**

432/200-205; 373/5, 110, 112, 117, 118,

**BLOWER MOTOR POWER SYSTEM TO**  
**ELIMINATE GROUND FAULTS FROM**  
**ELECTRICAL GAS IONIZATION**

See application file for complete search history.

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(56)

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(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 124 days.

(57)

**ABSTRACT**

An integral high pressure rapid quenching vacuum furnace utilizing an electrical isolation transformer in the blower motor power control system in order to isolate the motor windings, reduce the possibility of gas ionization and eliminate ground faults, particularly when quenching in oxygen.

(21) Appl. No.: **15/999,873**

(22) Filed: **Aug. 24, 2018**

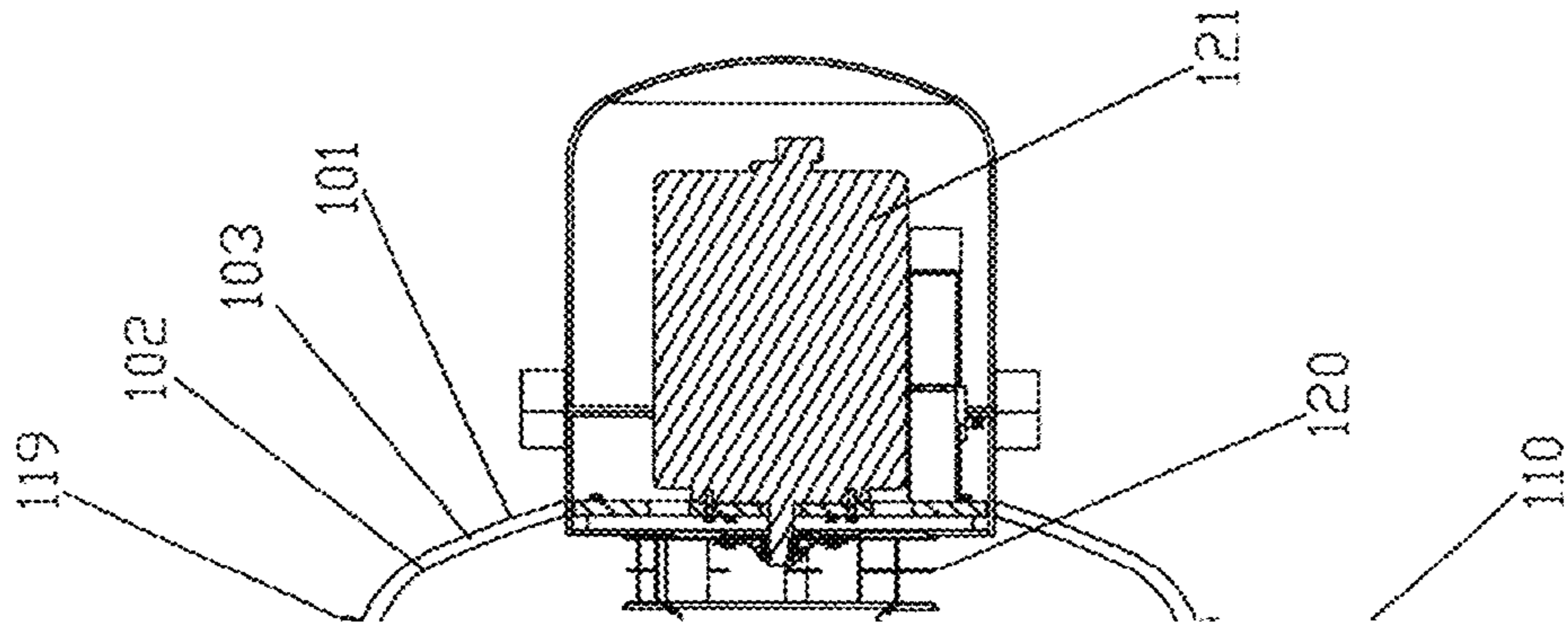
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PRIOR ART

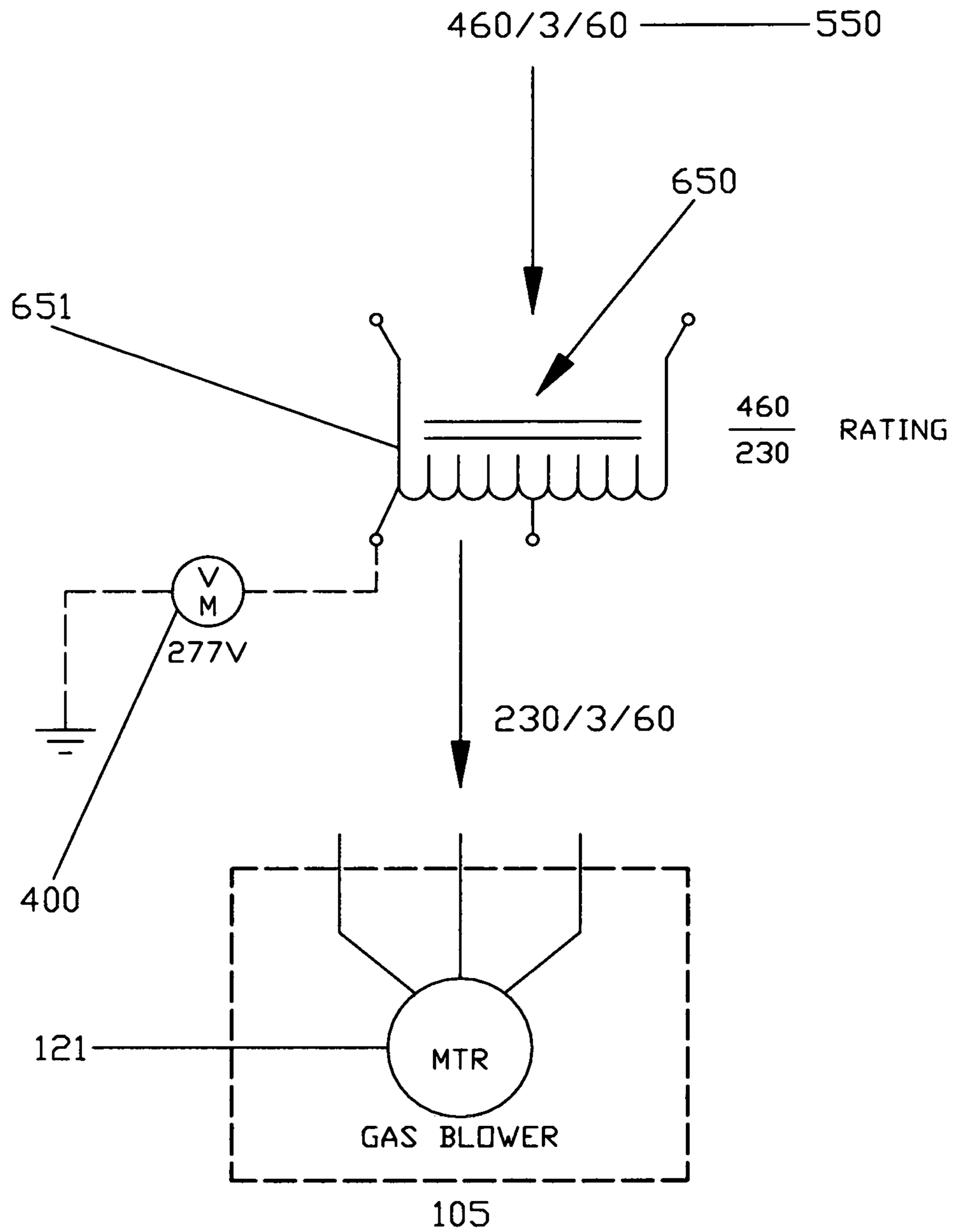
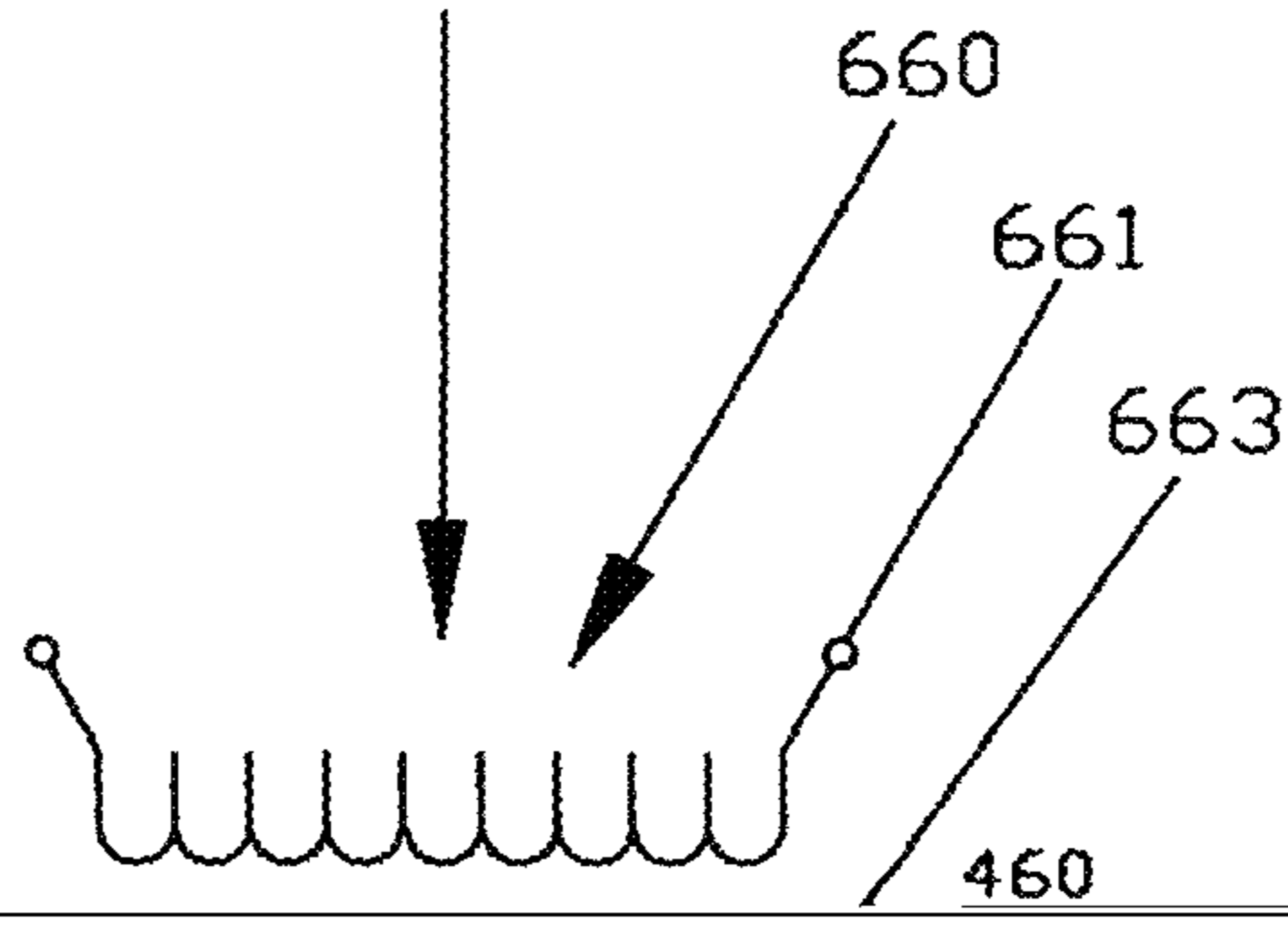
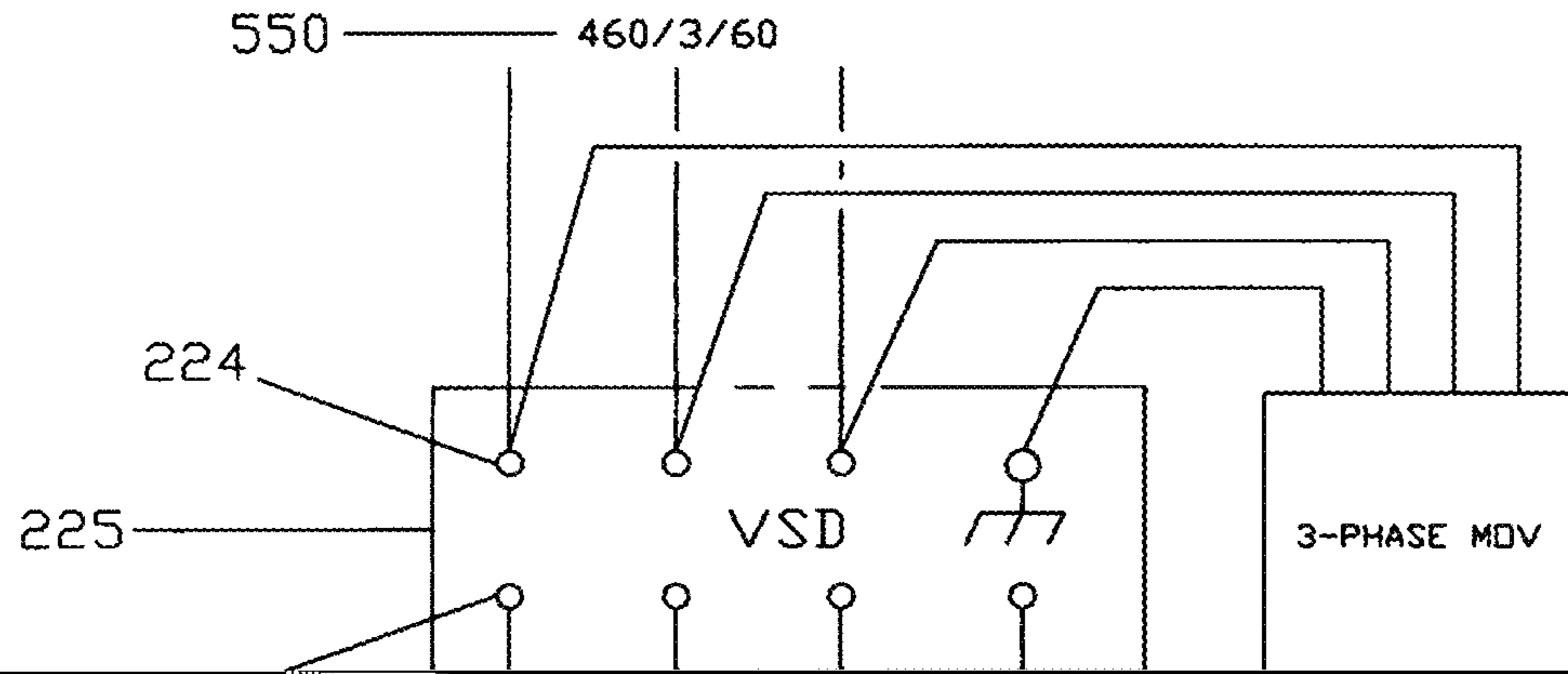


FIG. 2

550 ——— 460/3/60







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**HIGH PRESSURE RAPID GAS QUENCHING  
VACUUM FURNACE UTILIZING AN**

**IONIZED ARGON GAS**

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The only way to provide the necessary quenching rates with argon at pressures at 10 bar or higher is to increase the

**BLOWER MOTOR POWER SYSTEM TO  
ELIMINATE GROUND FAULTS FROM  
ELECTRICAL GAS IONIZATION**

**BACKGROUND OF THE INVENTION**

follows:

5 “There are three key factors that determine heat transfer in vacuum furnaces. They are cooling or heat transfer coefficient (H); temperature difference between the



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stage. A step-down transformer is not a full isolation transformer. Line to ground will cause short circuits within the blower motor.

Backfilling the furnace chamber with argon using a 460 volt motor will increase the possibility of arcing occurring

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an electrical behavior closely resembling back-to-back Zener diodes. When exposed to very high voltage transients, the MOV impedance changes dramatically from a nearly open circuit to a highly conductive level, thus dropping the

[REDACTED]

[REDACTED]

tion and a short circuit within the blower motor during the

potential transients absorbing the energy and thereby pro

quench cycle. As previously discussed, ionization forms plasma and results in an electrical breakdown causing a ground fault condition. To prevent such an occurrence the electrical design for connecting the fan blower motor to the power line had to be redesigned from prior art designs. The present invention provides such a redesigned electrical cir

protecting the blower motor windings from exposure to higher unexpected voltage that could lead to short circuits and damage the motor. This protective circuitry is very important, especially when the blower motor is located within an ionizing gas such as argon.

In one of its aspects this invention provides a high to Wilson et al the disclosure of which is fully incorporated

pressure vacuum furnace for heat treating and rapid gas quenching in argon atmosphere in the same furnace comprising a single chamber having blower means therein, the

herein by reference for a complete description of the arrangement of furnace 100.

Still referring to FIG. 1, at the rear end of hot zone 106 is a circular wall (not shown) which comprises an opening 115

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As stated previously in the background of the invention, there is a recognition that submerging a motor with greater than 230 Volts into an ionizing gas significantly increases the probability of creating an arc which would damage not only the motor, but also the furnace and any material being heat treated. The National Fire Protection Association standards and other recognized electrical codes for these type of vacuum furnaces include recommendations that a motor cannot exceed 230 Volts in the presence of an ionizing gas such as argon. Since the applicable standards and the established prior art have included the use of an autotransformer, the present invention represents an improvement when using

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scope of the invention. It is therefore intended to claim all such embodiments that fall within the true scope of the invention.

What is claimed is:

- 5 1. A high pressure vacuum furnace for heat treating and rapid gas quenching in argon atmosphere in the same furnace comprising a single chamber and access means, the chamber being segregated into an outer portion and an inner portion, the inner portion of the chamber being a hot zone and being adapted to receive a work piece to be heat treated  
10 through the access means, the furnace further including movable door means in the chamber outer portion in a form

7. A vacuum furnace in accordance with claim 1 wherein the vacuum furnace includes baffle means, and wherein said baffle means is in a form of a chevron configuration.

8. A vacuum furnace in accordance with claim 1 wherein the vacuum furnace includes variable speed drive means, 5 and wherein said variable speed drive means is operatively connected on its input side to said power supply means, and

transformer means.

9. A vacuum furnace in accordance with claim 1 wherein 10 the vacuum furnace includes 3-phase metal oxide varistor means, and wherein said 3-phase metal oxide varistor means is operatively connected in parallel with said power supply

means to an input side of said variable speed drive means.

10. A vacuum furnace in accordance with claim 4 wherein 15 the vacuum furnace includes motor terminator means, and wherein said motor terminator means is operatively connected in parallel with said secondary winding means to said blower motor means.

11. A vacuum furnace in accordance with claim 10 20 wherein said motor terminator means comprises varistor means.

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