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(12) **United States Patent**
Jones

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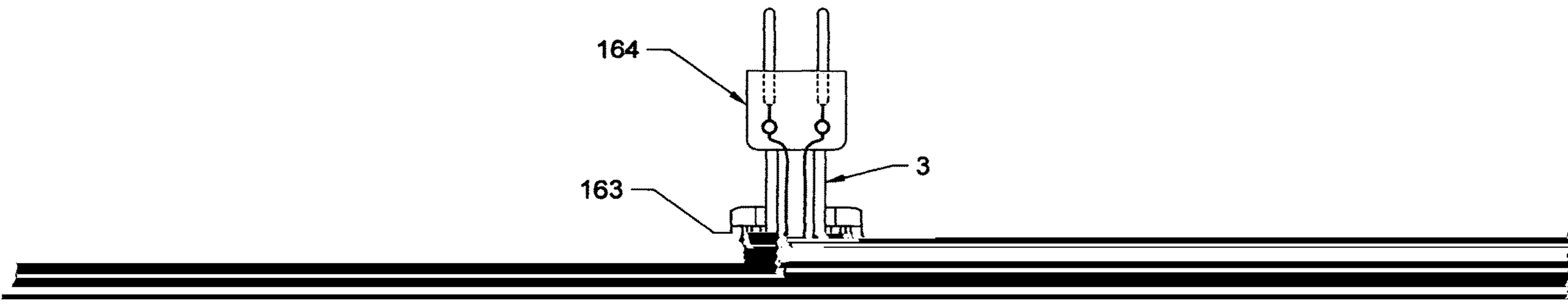
(54) **[redacted]**

FOR VACUUM HEAT TREAT FURNACES

4,021,268	A *	5/1977	Smith	.....	G01K 1/16 374/E1.021
[redacted]					
4,225,744	A	9/1980	Jones		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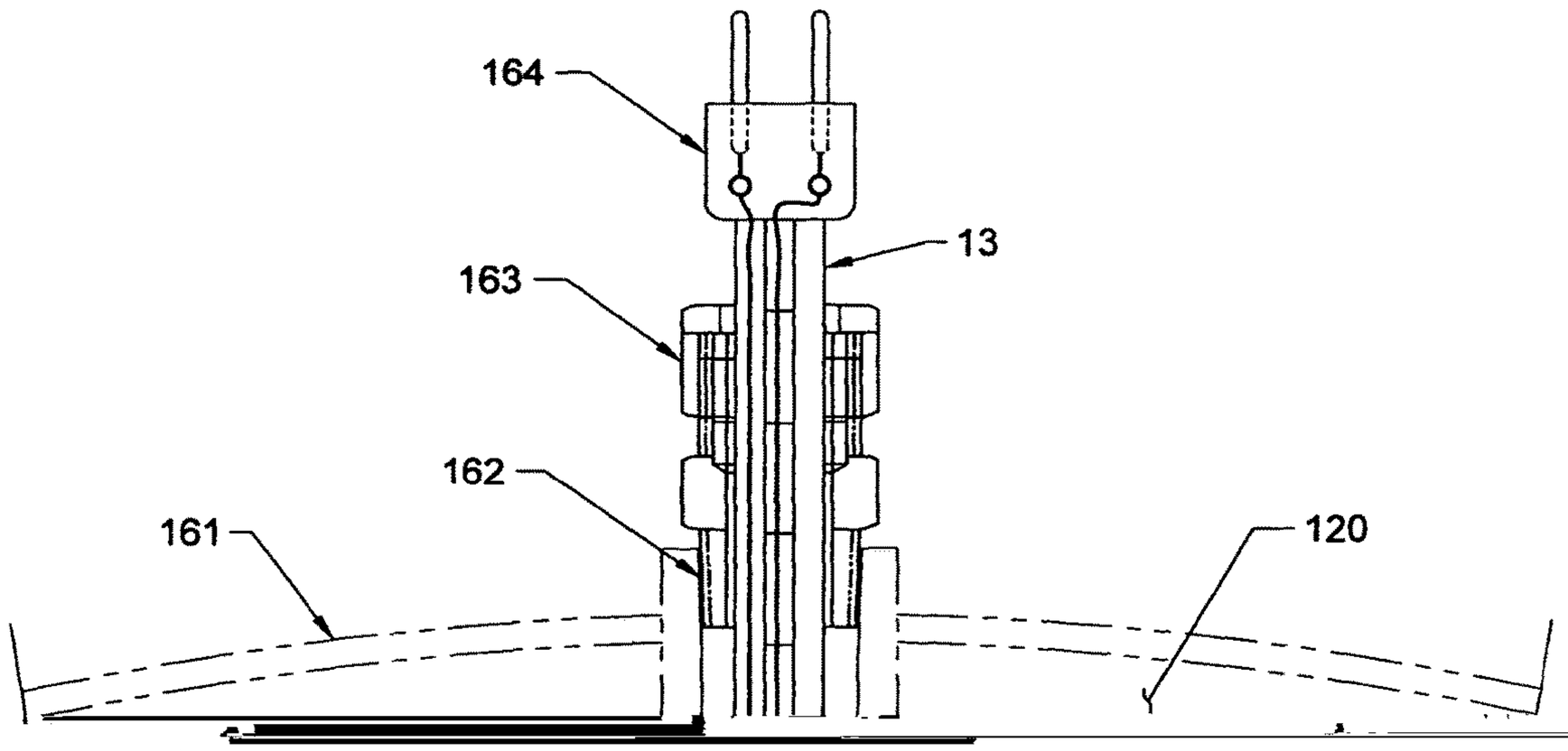
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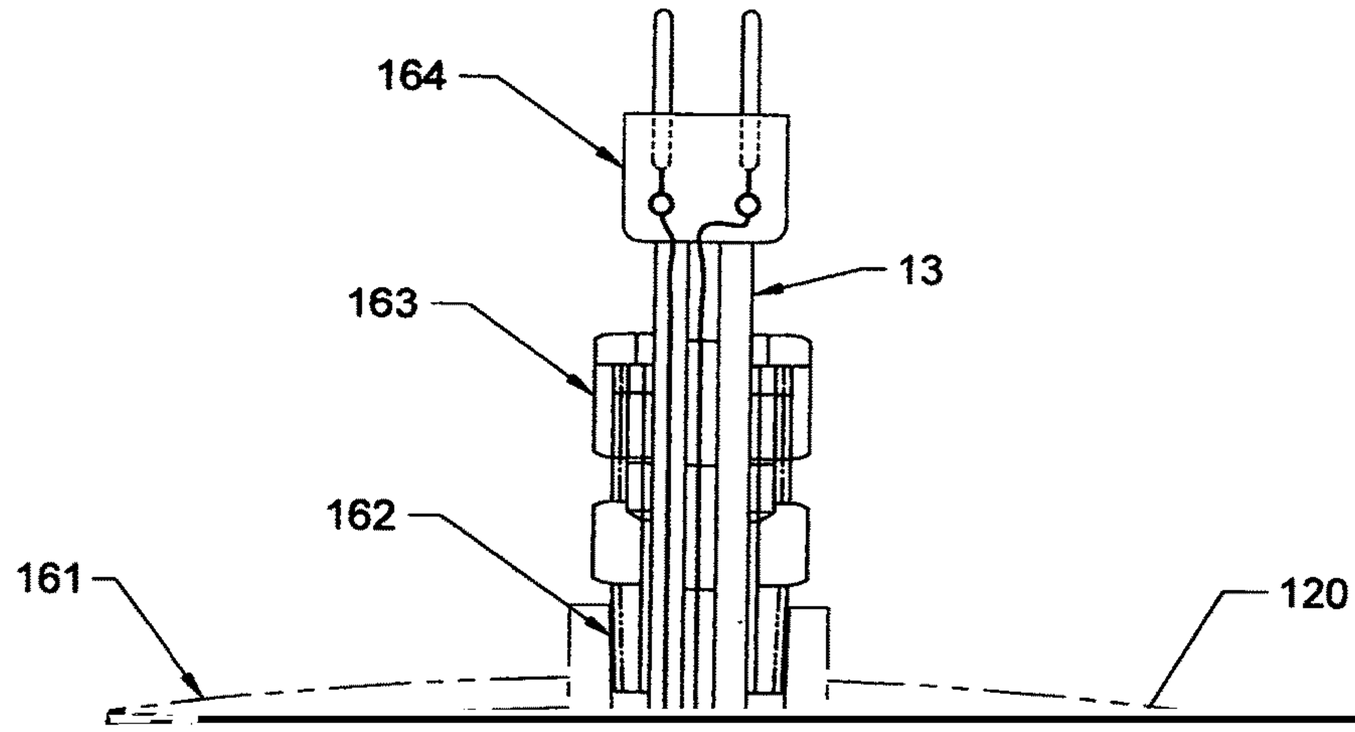
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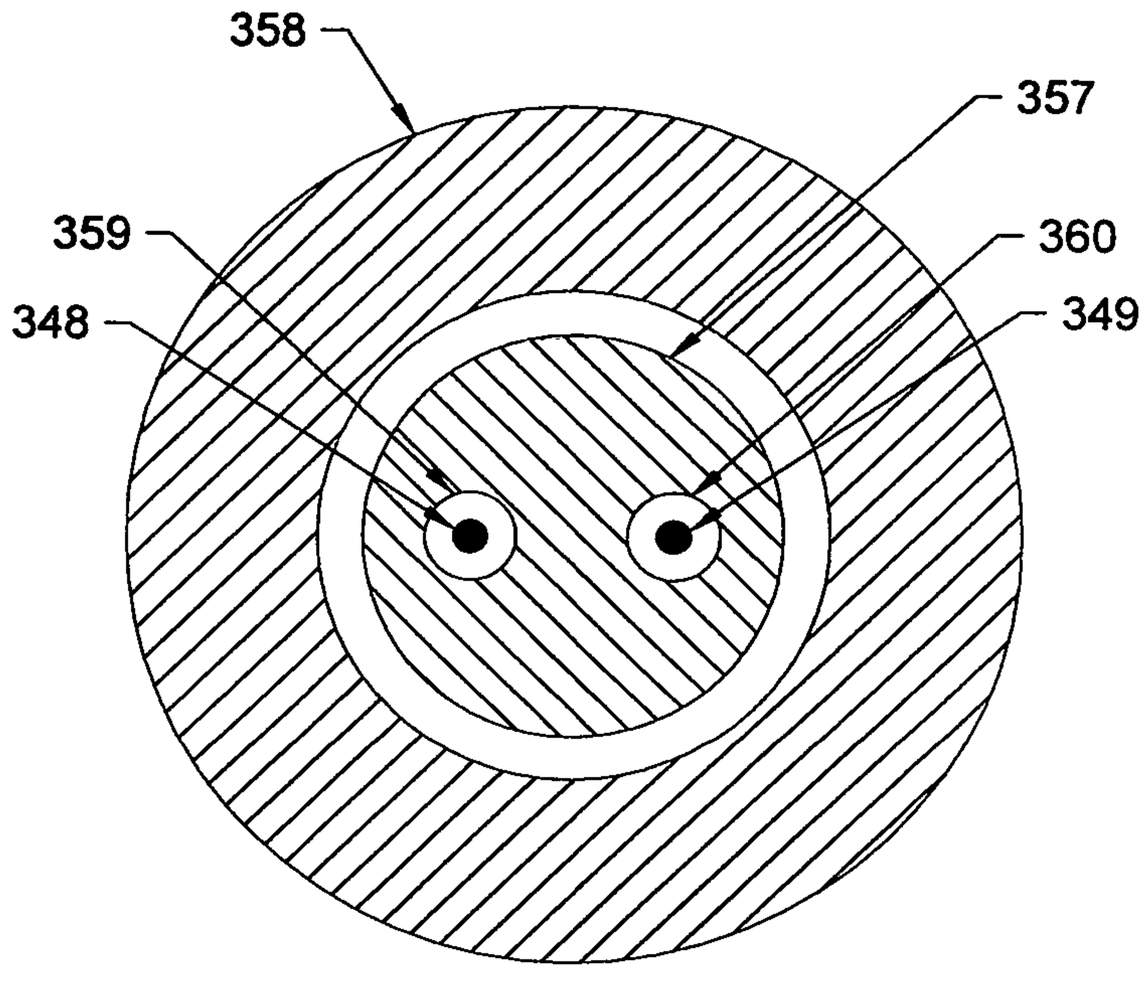
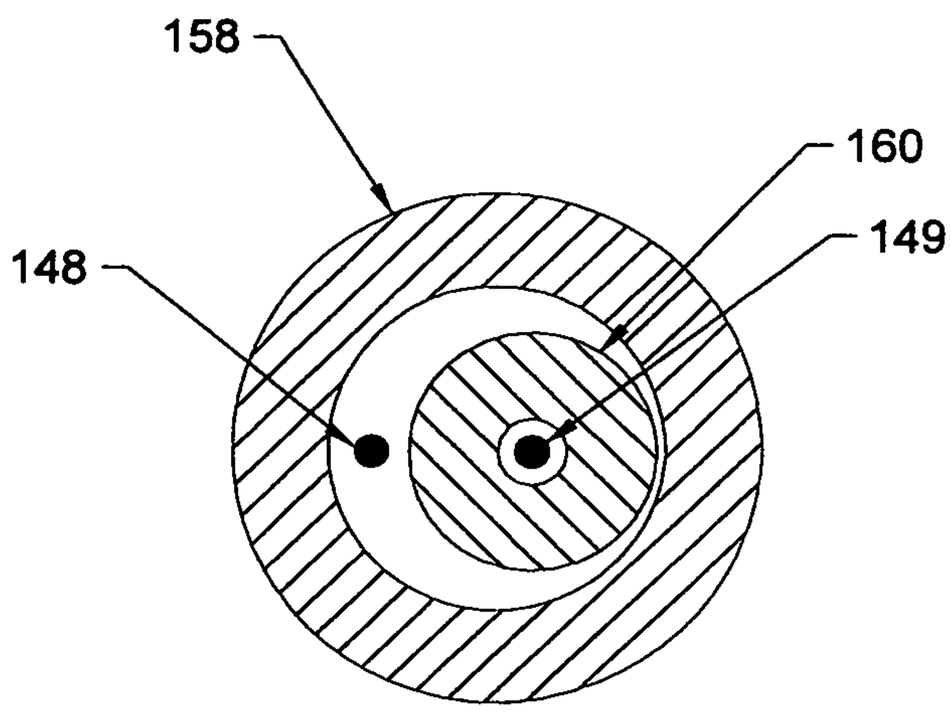
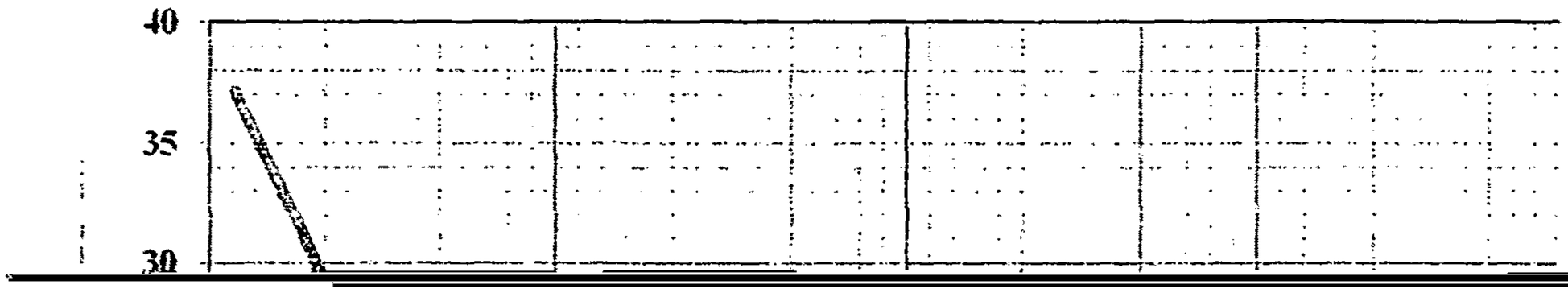


VIEW 'A'-'A'
FIG. D



VIEW 'B'-'B'


Thermal Conductivity of Alumina
40
35
30

SPECIALTY CONTROL THERMOCOUPLE FOR VACUUM HEAT TREAT FURNACES

BACKGROUND OF THE INVENTION

1. Field of the Invention

ranges, the furnace control thermocouple reads cooler than

couples. As a result, the automated furnace power source continues input energy to the furnace heating elements until the furnace control thermocouple reaches the set process

Example 1 (below) showing the old design data and Example 2 (below) showing the data with both the new thermocouple and shield design for an all-metal hot zone. The data for the graphite-lined hot zone is not separately

reducing the mass density and surface area of the alumina sheath. The basis for explaining the present invention can be explained mathematically by the conductive heat transfer Equation 1, where the key features of the Sheath L and A

FIG. **4** shows the end view, cross-sectional view of the standard Type S thermocouple shown in FIG. **1** in view "A"-"A", and the thermocouple according to the present invention shown in FIGS. **2** and **3** in view "B"-"B". In view "A"-"A" the standard Type S thermocouple is shown having a 5/16 inch outside diameter alumina sheath **358** with the inner double bore alumina sheath **357** having openings **359** and **360** with 24-gauge platinum wire **348** and 24-gauge

TABLE 1

Control TC Set Point	Survey TC Range
1000° F.	+46 to +43° F.
1200° F.	+22 to +17° F.
1500° F.	+4 to +1° F.
2100° F.	+3 to +1° F.

a reflection shield being operatively connected to an outer

7. The control thermocouple assembly according to claim

said thermocouple assembly sheath.

inches thick.

2. The control thermocouple assembly according to claim

8. The control thermocouple assembly according to claim