

Illustrated Parts List
for the
Size No. 3 ½
Barth Type Caster

» **DRAFT** «

CircuitousRoot
Mineral Point, Wisconsin
2016

Document status:

- This document is unfinished (which is pretty obvious).
- At present the illustrations are an awkward mix of hastily retouched photographs and quick and highly schematic sketches. These should be replaced with views taken from the 3D CAD model as it is developed.
- Revision levels and dates are indicated for the sections on individual Groups of parts. Part symbols are subject to change as our knowledge increases. In order to be completely sure that you're referring to the same part as someone else, you should quote not only its symbol but the revision level/date for the section in which it appears.

For the most current version of this document, and for an explanation of the parts symboling system it uses, see:

This document is Copyright © 2016 by Dr. David M. MacMillan
and is licensed under the Creative Commons Attribution-ShareAlike 4.0 International license

The parts symboling scheme it describes is in the public domain.

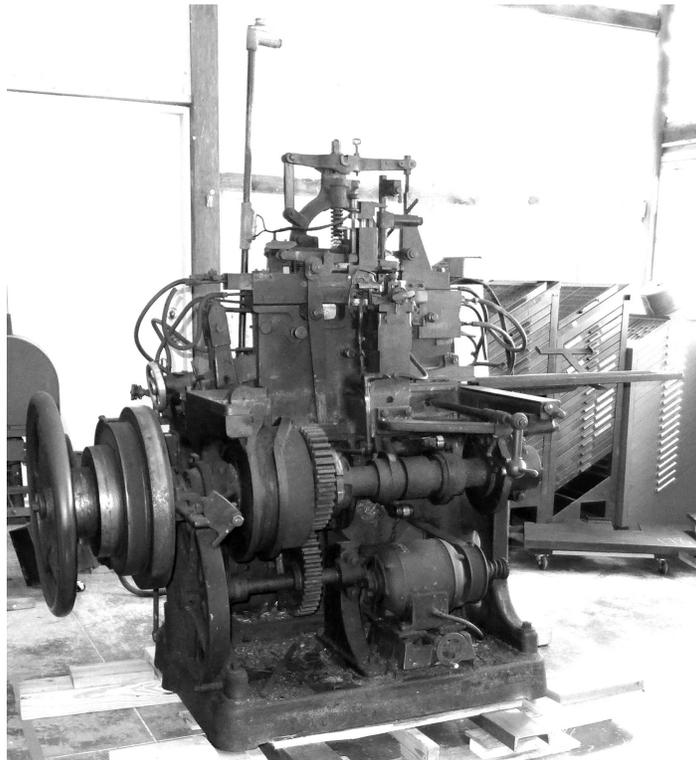
Introduction

This document is intended to be a comprehensive parts list, arranged by part symbols,¹ for the Size No. 3 1/2 Barth Type Caster as represented by the two surviving examples: Machine No. 112 (equipped at ATF and presently with a 60 point type 03 / B-4 mold) and Machine No. 149 (equipped at ATF and presently with a 72 point mold of type not yet known to me). The 60 point / No. 112 machine now at CircuitousRoot is the primary reference machine. This Parts List is far from complete.

It is also intended to be fully illustrated. As yet it is only partially (and poorly) illustrated. A 3-D CAD model of this machine is in (slow) preparation. As portions of this 3-D model become serviceable, 2-D views derived from it will replace or supplement the photographic and diagrammatic illustrations now used.

This Parts List is a component of the general study of the Barth Type Caster by CircuitousRoot at:

<http://www.CircuitousRoot.com/artifice/letters/press/noncomptype/casters/barth/index.html>



¹ Also known as "part numbers" - but in the system here they are not simply numbers.

Conventions

The parts symboling system used in this document is a newly created one, not one used by either American Type Founders or the Cincinnati Type Foundry. It is based loosely upon the Bancroft system developed by the Lanston Monotype Machine Company.

The CircuitousRoot Machine ID used for Size No. 3 ½ Barth Type Casters is BCD. In part symbols, the number in front of "BCD" indicates a logical Group of parts, while the number after it indicates a particular part within a group. For example, part 1BCD12 is in Group 1 (the Frame of the machine) and is part 12 (the Pot Base) within that Group.

Left and right are from the operator's perspective standing in front of the machine (unless specifically called out as "machine-left" or "machine-right").

Numeric references with "pat" prefixed to them, such as "pat28", are to numbers on the drawings in the Barth & Lietze, Benton, or other patents for the Barth casters. Unless specifically called out otherwise, the two basic 1888 US patents for this caster (patents 376,765 and 392,710 issued to Barth & Lietze) are the patents referenced (the part numbering in the second of these patents is deliberately compatible with the first).

In the unusual cases where we might know of Cincinnati Type Foundry or American Type Founders revisions of parts, they will be indicated by pre-prefixing a single lowercase letter to the symbol. Thus a (hypothetical) "a1BCD1" would indicate the first revision (thus second version) of the Base casting. (Aside: At present I know of no such case.)

In cases where I've created a compatible part which is, nonetheless, sufficiently different from the ATF original to deserve note, the pre-prefixes will start with 'm'. Thus if I were ever to cast a new Base for a No. 3 ½ Barth, and I made some changes, it would be "m1BCD1". (Aside: At present, I haven't created any part requiring this convention. I should.) But 21st Century new electrical systems will be given their own Group number.

There are at least two differences between the system used here and Lanston Monotype practice.

- There is no need to indicate sets of parts ordered together, or sets of parts which could only be furnished as a unit by the factory. For the Barth, the Cincinnati Type Foundry and ATF were both the users and the makers.²
- At present no system has been developed for referencing common hardware (e.g., screws or dowel pins); such a system may or may not become advisable.

Third-party assemblies (such as heating elements, the thermostat, electrical fittings, etc.) are referenced complete; no part numbers are assigned to their internal components.

2. The exceptions to this would have been pre-1892 Cincinnati sales to other foundries, and the sales by ATF to Stephenson, Blake and Typefoundry Amsterdam. But we have no knowledge of the details of their support arrangements.

List of Groups

- 1BCD Machine Base and Frame
2BCD Furnace Base-Plate Adjustment (left side)
3BCD Furnace Base-Plate Clamp (right side)
4BCD Furnance Elevating Wedge
5BCD Furnace
For other heating topics, see:
90BCD Gas Burner and its Control (Cincinnati, ATF)
91BCD Electric Pot & Throat Heaters, and their Control (ATF)
92BCD Gas Pot Heaters & Electric Throat Heaters,
and their Control (Dale Guild)
93BCD Electric Pot & Throat Heaters and Control (CircuitousRoot)
- 6BCD Metal Pot
7BCD Pump and Its Linkages
8BCD Choker and Its Linkages
Note: 376,765 patent parts order (p. 4) puts Mold here.
Instead, put the Mold at XX and do Power and Cams here.
- 10BCD Main Drive Pulley (Original Belt Drive)
For other power topics, see:
95BCD First Electric Motor and its Control (ATF)
96BCD Kimble 3-phase Electric Motor and its Control (ATF)
97BCD New Motor Control and Main Electrical Service (Dale Guild)
98BCD New Motor and its Control,
and Main Electrical Service (CircuitousRoot)
- 11BCD Clutch
12BCD Flywheel and Its Shaft
13BCD Reduction Gearing, Primary, incl. Countershaft
14BCD Elliptical Gears (pair)
15 - 19 [not yet used]
20BCD Camshaft and Its Journals
21BCD Cam 1: Mold Covering Slide³ pat069
22BCD Cam 2: Choker pat122
23BCD Cam 3: Matrix Carriage pat185
24BCD Cam 4: Mold Body Piece Vertical Travel pat141
25BCD Cam 5: Type Delivery pat118
26BCD Cam 6: Pump pat028
27BCD Mold Covering Slide Actuating Linkage
28BCD Mold Covering Slide Down-pressure Linkage⁴

³ "Mold Covering Slide" - so called in patent 376,764, p. 6, line 23.

⁴ pat127/pat128, patent 376,764, p. 6, lines 34-108.

29BCD	Mold Body Piece Set Adjustment	(upper diagonal bar & its handwheel)
30BCD	Mold Body Piece Flush Adjustment	(lower diagonal bar & its adjusting screw)
31BCD	Mold Body Piece Actuating Linkage	pat157
32BCD	Mold Body Piece Actuating Lever Adjuster	
33BCD	Mold Body Piece Actuating Lever Adjuster Release	
	Question: Is this part on the 72 point machine?	
nBCD	X	
90BCD	Gas Burner and its Control (Cincinnati, ATF)	
91BCD	Electric Pot & Throat Heaters, and their Control (ATF)	
92BCD	Gas Pot Heaters & Electric Throat Heaters, and their Control (Dale Guild)	
93BCD	Electric Pot & Throat Heaters, and their Control (CircuitousRoot)	
	Note: In all versions, the original belt drive pulley is unchanged. It is 10BCD.	
95BCD	First Electric Motor and its Control (ATF)	
96BCD	Kimble 3-phase Electric Motor and its Control (ATF)	
	Note: Includes adaptation of First Electric Motor as a Transmission	
	Note: Also includes Main Electrical Box and Incoming Electrical Service	
97BCD	New Motor Control and Main Electrical Service (Dale Guild)	
98BCD	New Motor and its Control, and Main Electrical Service (CircuitousRoot)	

Group 1BCD - Machine Base and Frame

Note: The term "Standard" here is used in the sense of an upright supporting structural component, not in the sense of a convention or a specification.

1BCD1	Base	(pat1)	
1BCD2	Standard, left	(pat2)	
1BCD3	Standard, right	(pat3)	
1BCD4	Standard bolts (4)		
1BCD5	Standard dowels		[DO THEY EXIST? - they must]
1BCD6	Center Support	(pat4)	
1BCD7	Center Support bolts		[IDENTIFY – are they all the same?]
1BCD8	Center Support dowels		[DO THEY EXIST? - they must]
1BCD9	Mold Block	(pat5)	
1BCD10	Mold Block bolts		[IDENTIFY – are they all the same?]
1BCD11	Mold Block dowels		[DO THEY EXIST? - they must]
1BCD12	Pot Base	(pat6)	
1BCD13	Bracket, left, for Pot Base	(pat7)	
1BCD14	Bracket, right, for Pot Base	(pat8)	
1BCD15	Bracket for Pot Base, bolts		[IDENTIFY – are they all the same?]

Group 2BCD – Furnace Base-Plate Adjustment (left side)

2BCD1 Pot Base Pivot

Note: This mechanism was Claim No. 1 of Barth & Lietze's basic patent, 376,765.

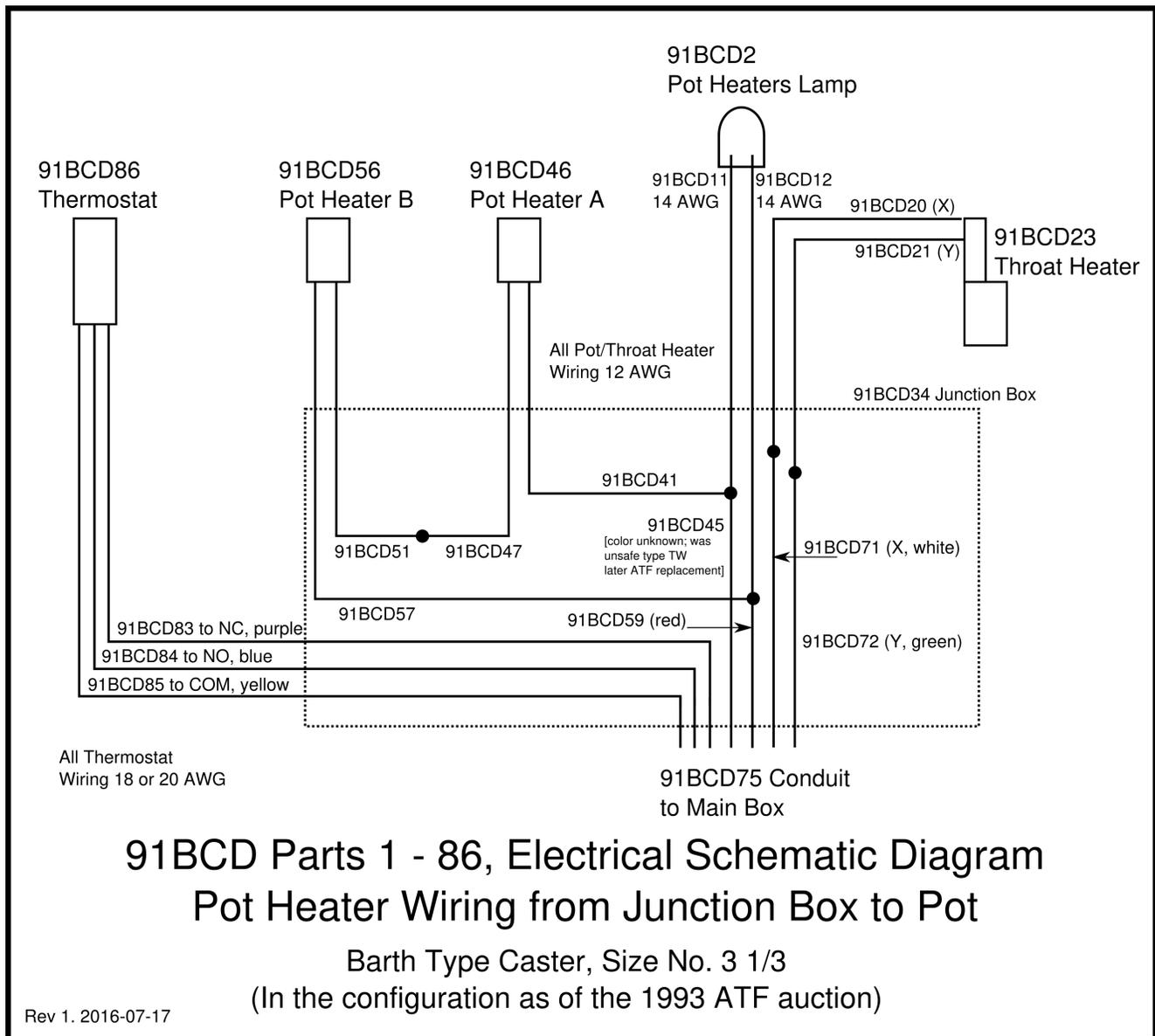
Group 91BCD -

Electric Pot & Throat Heaters, and their Control (ATF)

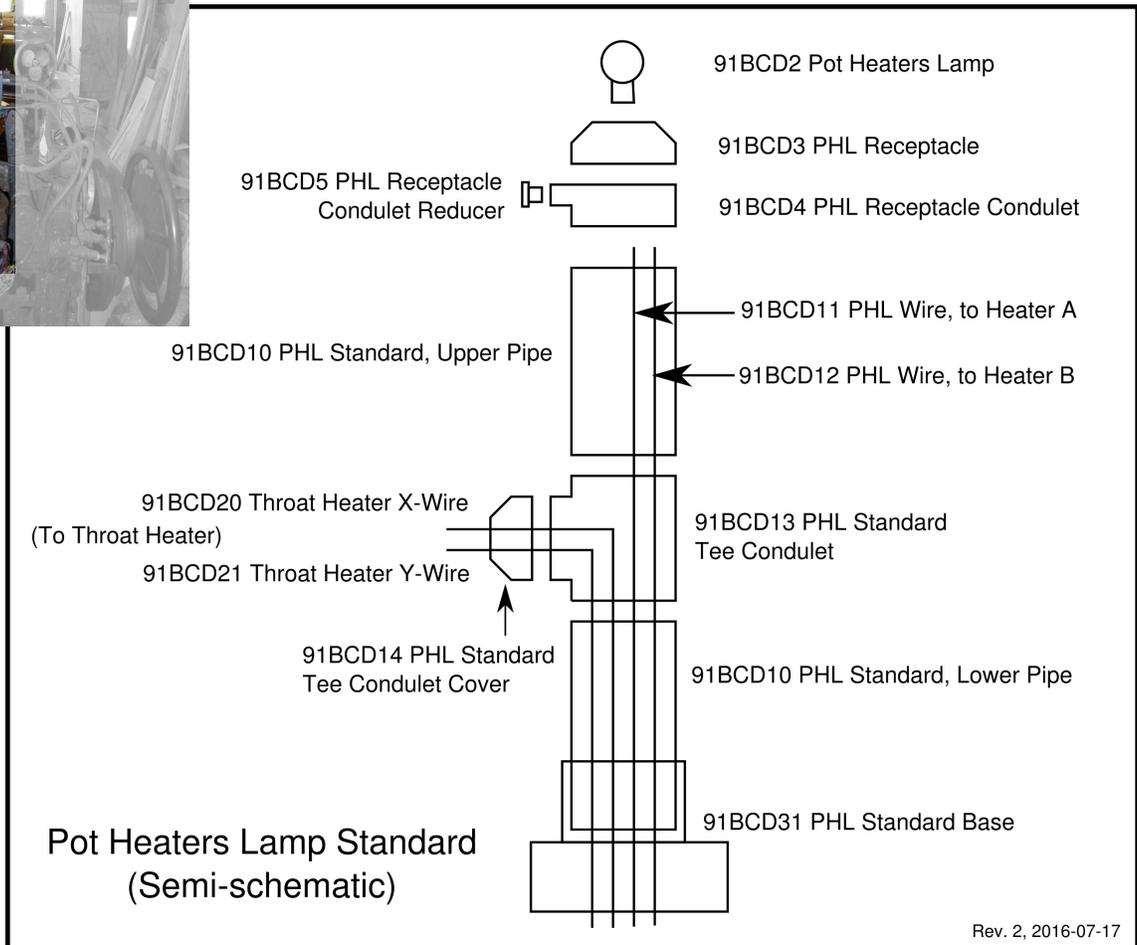
Part Symbols 91BCD1 - 91BCD86: Pot & Throat Heaters, Lamp, and Thermostat

(That is, everything from the Junction Box on the back of the machine out to the Pot.)

The wiring to the Pot and Throat Heaters, Lamp, and Thermostat looks a lot more complex on the machine than it really is. Here's a schematic diagram of the electrical wiring from the 91BCD34 Pot Heater Junction Box on the back of the pot on to the Heaters, etc.



I'll start from the (missing) light on the top of the machine and work down. Here is a photograph showing the Pot Heaters Lamp Standard¹ from the *back* of the caster, together with a highly schematic drawing identifying its parts. This is the Lamp which, when illuminated, indicates that the Pot Heaters are receiving power.



The electrical fittings for the Pot Heater Lamp Standard are third-party, by the Crouse-Hinds Co.²

1 As was the case with parts in Group 1BCD, the term "Standard" here is used in the sense of an upright supporting structural component, not in the sense of a convention. Heaters is plural because the Lamp signals the state of both.

2 The *Crouse-Hinds Products: Condulets, Groundulets, Plugs and Receptacles* Catalog No. 2200 (Syracuse, NY: Crouse-Hinds Company, 1929) is online at The Internet Archive at:

<https://archive.org/details/Crouse-hindsProductsConduletsGrounduletsPlugsAndReceptacles>
[note that the URL does not spell the Crouse-Hinds trade name "Groundulet" correctly].

Parts 1 - 5: The Lamp and its Receptacle

- 91BCD1 Pot Heaters Lamp Guard (unattested; I've no evidence it ever existed)
91BCD2 Pot Heaters Lamp
Not present on the caster. Unknown lamp wattage.



- 91BCD3 Pot Heaters Lamp Receptacle (porcelain socket on top, in left photo) and 91BCD4 Pot Heaters Lamp Receptacle Condulet™ (the cast fitting), with the 91BCD5 Reducer (the hex pipe fitting)

- 91BCD3 Pot Heaters Lamp Receptacle
Third-party: Crouse-Hinds Cat. No. 2706. See C-H Catalog 2200, p. 16.
Size 3/4 w/Shade Holder Groove. Rating: 660 Watt, 600 Volt.
This device is part of the Crouse-Hinds "Obround" series, specified by the Crouse-Hinds "Form 7" engineering definitions.
It has a one-inch diameter Medium Edison Screw socket ("MES" or "ES", equivalent to the modern E26 designation).

Warning: This porcelain Lamp Receptacle does not attach to its "Condulet"™ base. The four screws on it are for wiring, not securing the socket. It is held down only by the electrical wires. It breaks when you drop it.

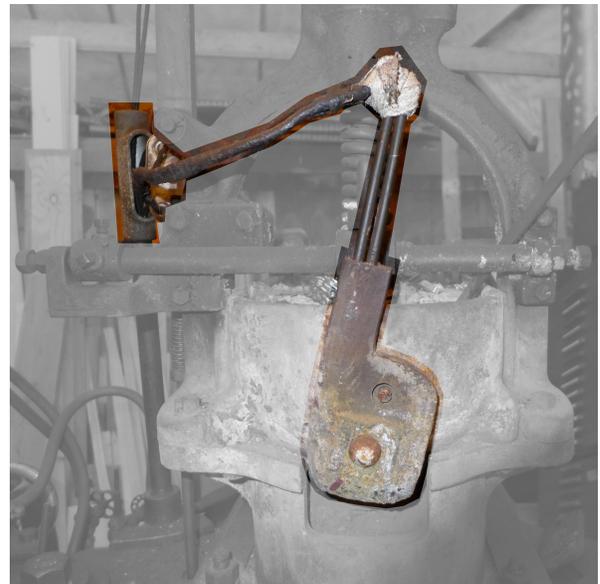
- 91BCD4 Pot Heaters Lamp Receptacle Condulet
Third-party: Crouse-Hinds type LB, Cat. No. LB27. See C-H Catalog 2200, p. 5.
Size 3/4.
"Condulet" was the Crouse-Hinds trade name for their conduit fittings. This Type LB fitting takes C-H Form 7 Covers and Wiring Devices.
- 91BCD5 Pot Heaters Lamp Receptacle Condulet Reducer.
3/4" (nominal) N.P.T. to [MEASURE]
Note: purpose unknown

Parts 10 - 13: Pipe and Wires

- 91BCD10 Pot Heaters Lamp Standard, Upper Pipe
This pipe has an outside diameter of 1". The O.D. of National Pipe Taper (NPT) nominal 3/4" Schedule 40 pipe is 1.050". So Size 3/4 Condulet is almost certainly 3/4" NPT.
- 91BCD11 Pot Heaters Lamp Wire, to Heater A
Measured diameter 0.062" solid (probably 14 AWG). Length 49".
With braided insulation.
- 91BCD12 Pot Heaters Lamp Wire, to Heater B
Measured diameter 0.064" solid (probably 14 AWG). Length 47".
With braided insulation.

Parts 14 - 29: The Throat Heater

Note that although the Pot Heaters Lamp Wires and the Throat Heater Wires all run inside the same Standard, they are not in any way connected with each other.



91bcd23 Throat Heater Assembly (right photo)
and its wiring from the 91BCD14 Pot Heater Lamp Standard Tee Condulet (left photo)
Shown from the front (nipple side) of the Pot, with the Pot swung back.

- 91BCD13 Pot Heaters Lamp Standard Tee Condulet (to Throat Heater)
Third-party: Crouse-Hinds Cat. No. C27. See C-H Catalog 2200, p. 3.
Size 3/4.
- 91BCD14 Pot Heaters Lamp Standard Tee Condulet Cover (to Throat Heater)
Third-party: Crouse-Hinds Cat. No. 272. See C-H Catalog 2200, p. 13.
"Cover with Wire Holes," 2-Wire. Porcelain. Size 3/4. Hole diameter 15/32".

Warning: Like the 91BCD3 Receptacle, this porcelain Cover is not attached with screws, but is simply held in place by the wires passing through it. It has been damaged heavily (old damage). It has one screw in it, which seems to have no purpose in this application and does not attach it to the Tee Condulet.

91BCD15 Pot Heaters Lamp Standard Tee Condulet Cap
3/4" nominal NPT plug.

Note: This part does not exist on the machine as it was at ATF. I'm adding it in case I reassemble the heater electrics without the Lamp. If there's no Lamp, then there is no need for the 91BCD10 Upper Pipe, and this Cap would cover plug the top hole in the 91BCD13 Condulet.

91BCD20 Throat Heater X-wire (top wire out of 91BCD15 Cover)
MEASURE GAUGE

91BCD21 Throat Heater Y-wire (bottom wire out of 91BCD15 Cover)
MEASURE GAUGE

Note: Identify these wires as X and Y to avoid confusion with the Pot Heaters, which will be identified as A and B.

91BCD22 Throat Heater Wire Wrapping

91BCD23 Throat Heater Assembly

I think that the Throat Heater is an ATF, not third-party, component.
Measured resistance: 75 Ohms

Reserve 24 - 28 for possible Throat Heater internal parts.

91BCD29 Throat Heater Assembly Screw (attaching it to the Pot)

Parts 30 - 33: The Lower Pipe and the Standard's Base.



91BCD30 Pot Heaters Lamp Standard, Lower Pipe

91BCD31 Pot Heaters Lamp Standard Base

91BCD32 Pot Heaters Lamp Standard Base, Screws for Standard (2)
Square-head, MEASURE SIZE (dia., thread). Takes a 5/16" wrench.

91BCD33 Pot Heaters Lamp Standard Base, Mounting Screws (2)
Hex-head, MEASURE SIZE (dia., thread). Takes a 9/16" wrench.

91BCD34 Pot Heaters Lamp Standard Base, Mounting Screw Washers (2)

Part 34: The Junction Box



91BCD34 Pot Heater Junction Box

Third-party Assembly. A standard 4" square, 1 1/2" deep electrical junction box (manufacturer unknown; not Crouse-Hinds specific) with cover, (2) cover screws, and mounting screws. About 1 1/2" deep. It mounts to a flange which is part of the casting of 91BCD31 Pot Heaters Lamp Standard Base (but which isn't easily visible behind the Junction Box).

It's really much simpler than it looks.

Parts 40 - 76: The Pot Heaters and their Wiring³



A view from behind the caster of Pot Heater 'A' (on the right in the photo, which is on the left / flywheel side of the machine as viewed from the front) and Pot Heater 'B' (at left in the photo).

The Pot Heater Junction Box is labeled at the lower right of the photo. The Pot Heater Lamp Standard goes vertically straight up from this Junction Box.

The Thermostat is the black box between the two Pot Heaters.

³ None of the original braided-insulation wiring in the 60 point machine is salvageable. It's insulation simply crumbles away. From the point of view of safe maintenance, this machine should not have been in service in 1993 when it was taken out of service (and that's not counting the replacement by ATF of one of the braided insulation (and I presume high-temperature insulation) wires with a then-ordinary thermoplastic-insulated Type TW wire rated to 60°C (140°F).

- 91BCD40 Pot Heater A, Wire Nut in Junction Box
- 91BCD41 Pot Heater A, Wire from Junction Box to Heater Box
Measured diameter 0.077" (probably 12 gauge, which is 0.80)
- 91BCD42 Pot Heater A, Junction Box to Heater Box Conduit, Junction Box Fitting
Third-party Assembly. With its screws and retaining nut.
- 91BCD43 Pot Heater A, Junction Box to Heater Box Conduit
1" approximate outside diameter.
- 91BCD44 Pot Heater A, Junction Box to Heater Box Conduit, Heater Box Fitting
Third-party Assembly. With its screws and retaining nut.
- 91BCD45 Pot Heater A, Wire from Junction Box to Main Electrical Box
Connects to Terminal Block, Post #7 in Main Electrical Box.
Note: This wire as the machine was received (as installed by ATF prior to 1993) was an unsafe replacement for the original wire. While the same gauge as the other heater wires (12 AWG), it was a "KAISER-SYNRUB K/W 12 TYPE TW 600V" wire. Type TW wire is thermoplastic-insulated wire rated to a maximum temperature of 60°C (140°F). This is way too close to an 800°F Pot to be running wire that melts at 140°F. It was also the wrong color (it was red; there was already a red wire in this circuit, 91BCD59.
The other end of this wire connects to the back (3-terminal row) left terminal of the Terminal Block in the Main Electrical Box.



Pot Heater A and Its Electrical Box
(None of the parts within this Heater or its Electrical Box
are called out as separate Symbols in this Parts List.)



Pot Heater A Maker's Plate

- 91BCD46 Pot Heater A.
Third-party Assembly. General Electric Catalog 1A170 Tubular Heating Unit,
with integral electrical box.
Specifications from Maker's Plate: 1800 Watts, 110 Volts.
Marked "K.R. 21191" ["91" portion unclear; may be wrong].
Marked "SHELBYVILLE, IN MADE IN USA"
Calculated resistance: 6.7 Ohms
Measured resistance: 7.3 Ohms

- 91BCD47 Pot Heater A, Wire from Heater Box to Junction Box (connects with Heater B)
MEASURE GAUGE (but I'm sure it is 12 AWG)
- 91BCD50 Pot Heaters Connecting Wires, Wire Nut in Junction Box
- 91BCD51 Pot Heater B Wire, Junction Box to Heater Box (comes from Heater A)
MEASURE GAUGE (but I'm sure it is 12 AWG)
- 91BCD52 Pot Heater B, Junction Box to Heater Box Conduit, Junction Box Fitting
Third-party Assembly. With its screws and retaining nut.
- 91BCD53 Pot Heater B, Junction Box to Heater Box Conduit
- 91BCD54 Pot Heater B, Junction Box to Heater Box Conduit, Heater Box Fitting
Third-party Assembly. With its screws and retaining nut.



Pot Heater B and Its Electrical Box
(None of the parts within this Heater or its Electrical Box
are called out as separate Symbols in this Parts List.)

- 91BCD56 Pot Heater B.
Third-party Assembly. Similar to, but not quite the same as, Heater A.
No Maker's Plate
Measured resistance: 7.7 Ohms
Wired in series with Heater A, which is 110 V.

- 91BCD57 Pot Heater B, Wire from Heater Box to Junction Box
MEASURE GAUGE (but I'm sure it is 12 AWG)
- 91BCD58 Pot Heater B, Wire from Heater Box to Junction Box, Wire Nut in Junction Box
- 91BCD59 Pot Heater B, Wire from Junction Box to Main Electrical Box
Connects to Terminal Block, Post #8 in Main Electrical Box.
Red wire with braided insulation.
Diameter 0.084 (probably 12 AWG)
- 91BCD70 Throat Heater X-Wire, Wire Nut in Junction Box
Not in fact present. This connection was wound, soldered, and taped.
- 91BCD71 Throat Heater X-Wire, Continuation Wire from Junction Box to Main Electrical Box
White (very dirty white) wire with braided insulation.
MEASURE GAUGE (but I'm sure it is 12 AWG)
Connects to [GET PART SYMBOL] Top Fuse Block, Right (= Front) Side.
N.B.: Does *not* connect to the Terminal Block.
- 91BCD72 Throat Heater Y-Wire, Wire Nut in Junction Box
Not in fact present. This connection was wound, soldered, and taped.
- 91BCD73 Throat Heater Y-Wire, Continuation Wire from Junction Box to Main Electrical Box
Connects to Terminal Block, Post #9 in Main Electrical Box.
Green wire with braided insulation.
MEASURE GAUGE (but I'm sure it is 12 AWG)
- 91BCD74 Junction Box to Main Electrical Box Conduit, Junction Box Fitting
Third-party Assembly. With its screws and retaining nut.
- 91BCD75 Junction Box to Main Electrical Box Conduit
1" approximate outside diameter
- 91BCD76 Junction Box to Main Electrical Box Conduit, Main Electrical Box Fitting
Third-party Assembly. With its screws and retaining nut.

Parts 80 - 86: Thermostat and its Wiring



- 91BCD80 Thermostat Conduit, Junction Box Fitting
Third-party Assembly. With its screws and retaining nut.
- 91BCD81 Thermostat Conduit
0.059" approximate outside diameter.
- 91BCD82 Thermostat Conduit, Thermostat Box Fitting
Third-party Assembly. With its screws and retaining nut.
- 91BCD83 Thermostat Normally Closed (N.C.) Terminal Wire
Thin wire. Purple. Runs uninterrupted to Main Electrical Box.
Connects to Terminal Block, Post #3 in Main Electrical Box.
- 91BCD84 Thermostat Normally Open (N.O.) Terminal Wire
Thin wire. Blue-ish. Runs uninterrupted to Main Electrical Box.
Connects to Terminal Block, Post #2 in Main Electrical Box.
- 91BCD85 Thermostat Common (COM) Terminal Wire
Thin wire. Yellow. Runs uninterrupted to Main Electrical Box.
Connects to Terminal Block, Post #1 in Main Electrical Box.

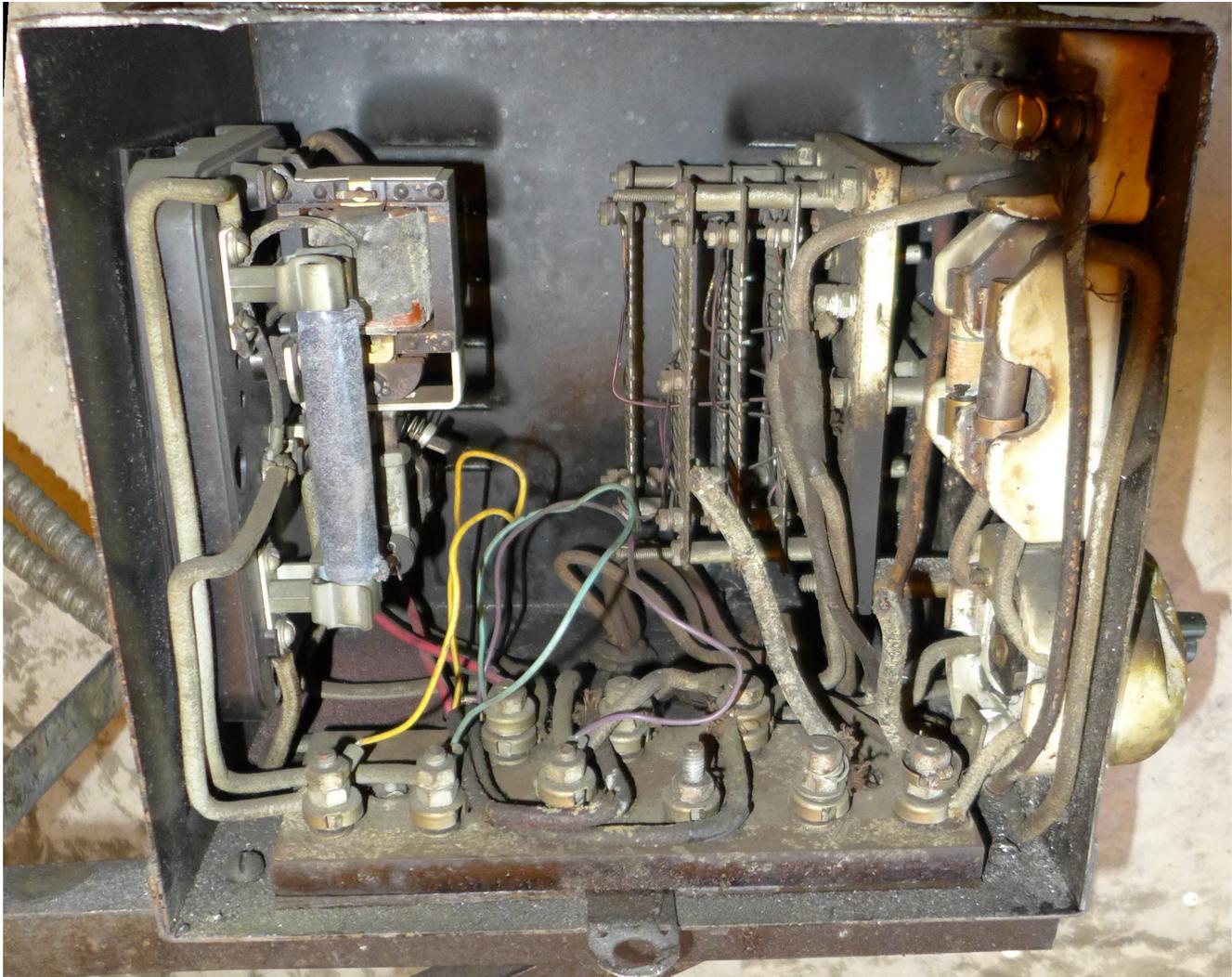
91BCD86 Thermostat
Third-party Assembly. Burling. Model H-1S

The Thermostat's Maker's Plate is of interest from the operator's point of view as well as the machinist's. It indicates that the working range for the Pot was 750°F to 875°F, with a "Factory Setting" of 800°F. These are significantly higher temperatures than those common on the Thompson Type Caster (which generally runs between 675°F and 725°F).



Part Symbols 91BCD100 - ???: Main Electrical Box and Motor Starter

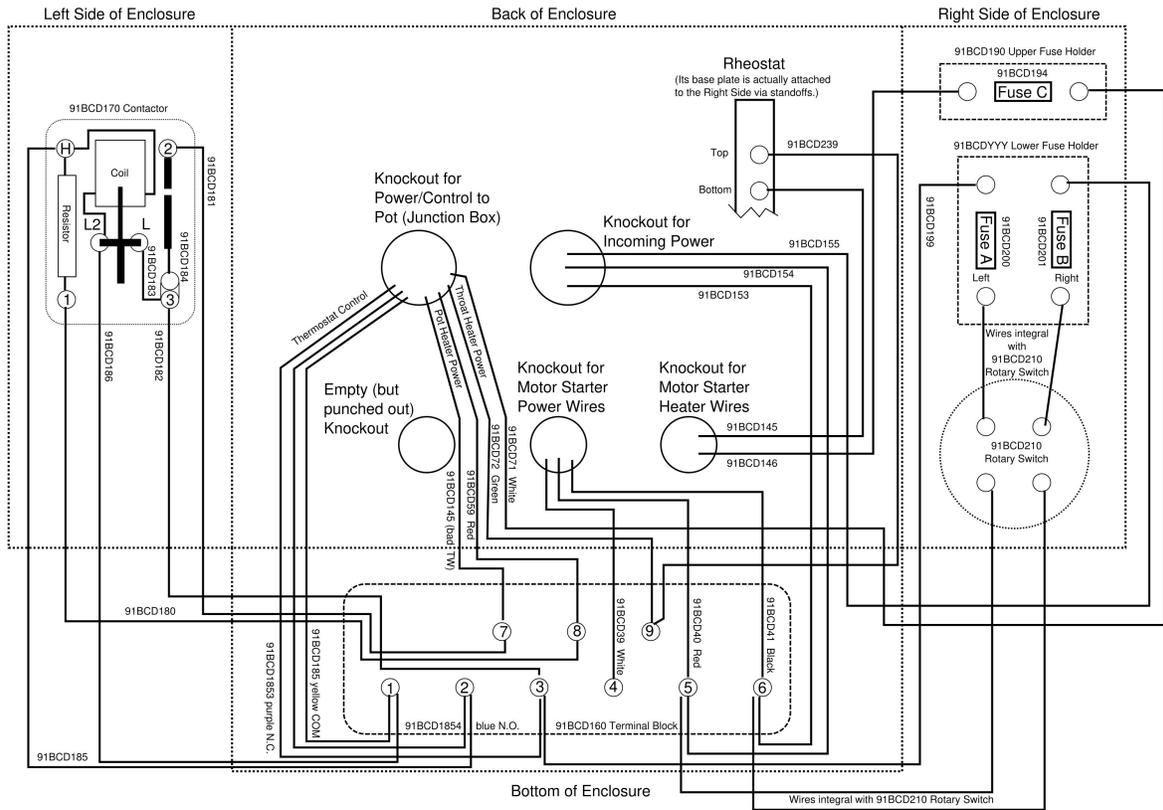
(The wiring in the Main Electrical Box and for the Motor Starter is as complicated as it looks.)



A view of the Main Electrical Enclosure, from the Front. The Cover hinges at the top and is not visible in this photo. The Terminal Block is on the Bottom Side of the Enclosure. The Relay is attached to the Left Side. The two Fuse Holders (Fuses A, B, and C) and the Rotary Switch are attached to the Right Side. The Rheostat appears at the back of the Enclosure, but is in fact attached to the Right Side via long standoffs. All wires enter via knockouts (and conduit) through the Back of the Enclosure.

At right is a view of the Rotary Switch and Rheostat Knob on the outside of the Right Side of the Enclosure.





All views of the Enclosure Sides are as seen from the INSIDE of the Enclosure

Actual Enclosure Sides are deeper than shown

Main Electrical Enclosure Simplified Physical Wiring Barth Type Caster No. 3 1/2 (BCD), Machine No. 112, Mold Equipment 60 03

Parts 100 - 117: The Enclosure Itself

91BCD100 Main Electrical Box, with Cover

Third-party Assembly.

Maker's Plate data:

General Electric.

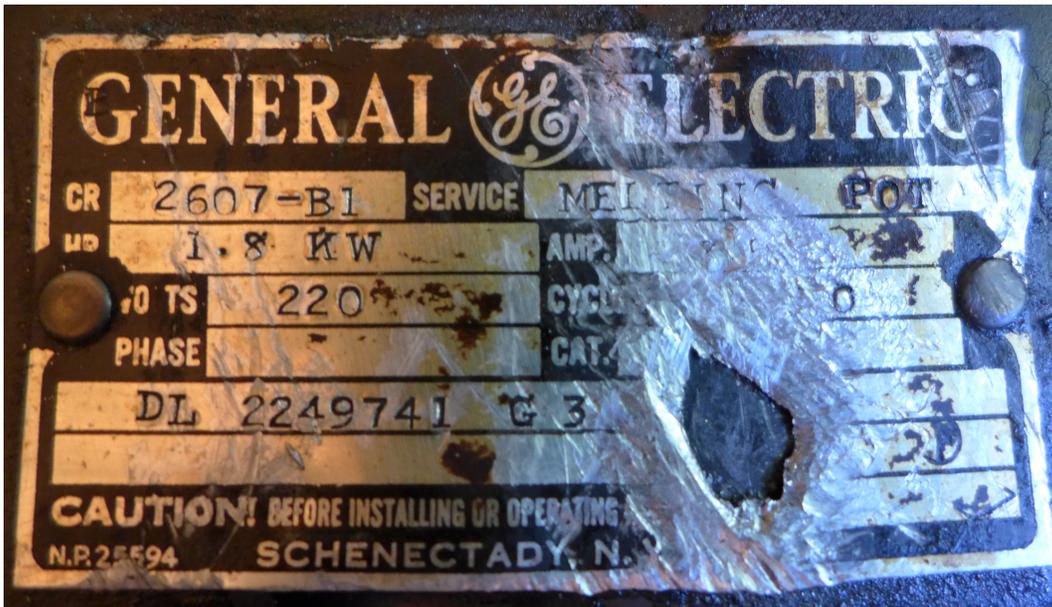
[Type]	CR 2607-B1
SERVICE:	MELTING POT
HP:	1.8 KW
AMPS:	[illegible]
VOLTS:	220
CYCLES:	[illegible]
PHASE:	[blank]
CAT.	[illegible]

DL2249741 G 3

CAUTION! BEFORE INSTALLING OR OPERATING [illegible - probably a citation of the instructions]

N.P.25594 SCHENECTADY, N.Y.

Note: In referring to items in this box, the Cover is on the "Front" (it faced the front of the machine as installed).





The Main Electrical Enclosure (closed) mounted to its Bracket.
If the perspective seems odd in this photo,
it is because the Enclosure is lying on its side on the floor
(the photo has been rotated 90 degrees counterclockwise).

- 91BCD101 Main Electrical Enclosure Bracket
Shop-made, welded from angle iron.
- 91BCD102 Main Electrical Enclosure Bracket, Front Left Screw.
Round-head, slotted drive, 1/4" UNC.
- 91BCD103 Main Electrical Enclosure Bracket, Front Left Screw, Lock Washer.
1/4"
- 91BCD104 Main Electrical Enclosure Bracket, Front Left Screw, Nut.
Square.
- 91BCD105 Main Electrical Enclosure Bracket, Front Right Screw.
Round-head, slotted drive, 1/4" UNC.
- 91BCD106 Main Electrical Enclosure Bracket, Front Right Screw, Lock Washer. [not present]
- 91BCD107 Main Electrical Enclosure Bracket, Front Right Screw, Nut.
Square.
- 91BCD108 Main Electrical Enclosure Bracket, Back Screw.
Round-head, slotted drive, 1/4" UNC. One only.
- 91BCD109 Main Electrical Enclosure Bracket, Back Screw, Lock Washer. [not present]
- 91BCD110 Main Electrical Enclosure Bracket, Back Screw, Nut.
Hex.
- 91BCD111 Main Electrical Enclosure Bracket, Mounting Screws to Caster Frame (4). [not present]
- 91BCD112 Main Electrical Box Bracket, Mounting Screws to Caster Frame, Lock Washers (4).
[not present]

Parts 120-146: The Motor Starter and its Wires



91BCD120 Motor Starter⁴ and its Enclosure

Third-party Assembly.

Maker's Plate data:

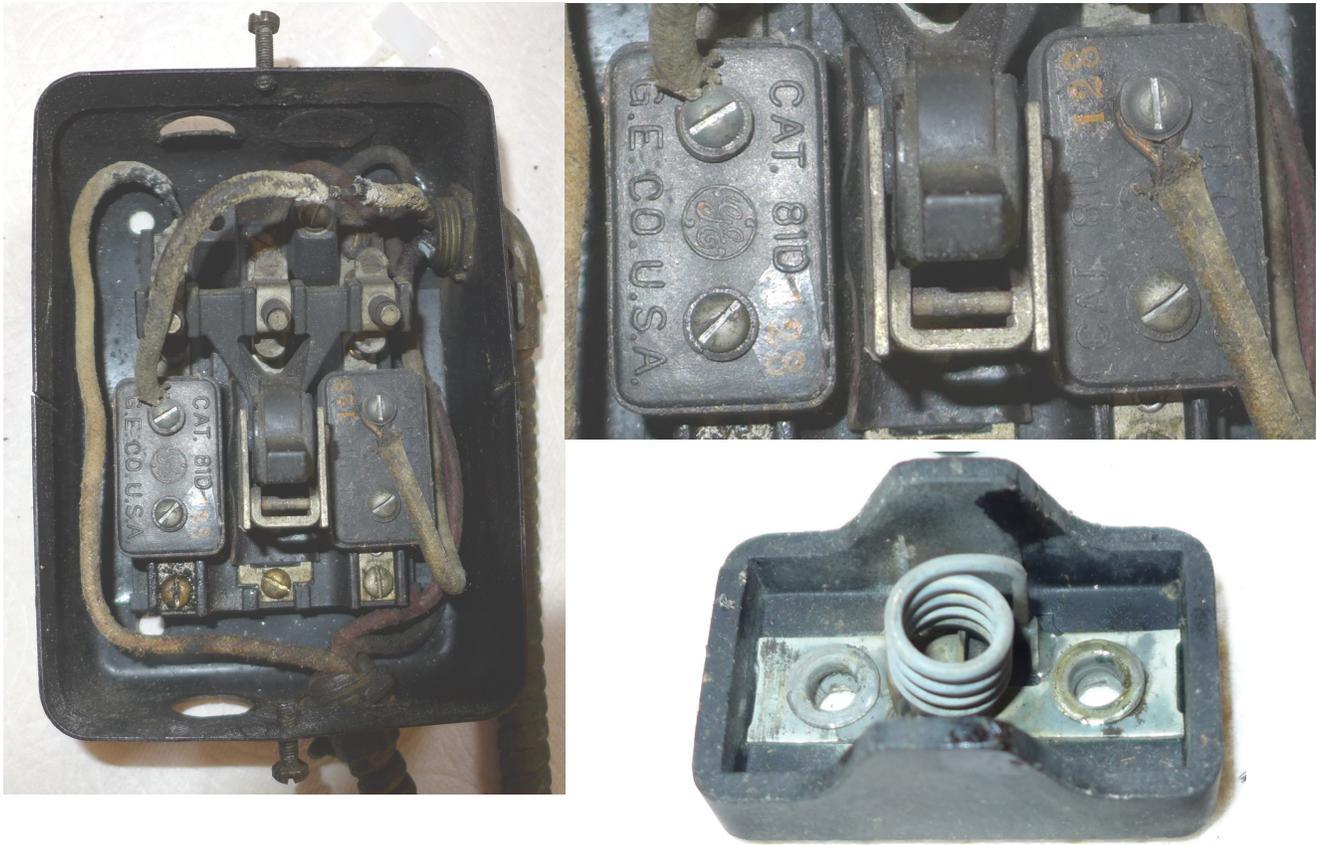
General Electric	
[Type]	CR 1062-B7
Motor Rating:	2 HP
Voltage:	110 to 600 Volts
Phase:	Two or Three Phase
Instructions:	INST GEH-872
Patent:	1,687,165

Note: ON = up, OFF = down.

There are three conduits from this Enclosure:

- Lower Left, Power Wiring to [GET PART SYMBOL] Motor
- Lower Right, Power Wiring to Main Electrical Enclosure
- Right-Side, Heater Wiring to Main Electrical Enclosure

⁴ This unit is called a "Motor Starting Switch" on its Maker's Plate, and indeed it is a switch. But in modern terms it is a Manual Motor Starter, which isn't just any old switch. It is best to call it a Starter.



The Motor Starter and the two Motor Starter Heaters (left and top right)
 A General Electric 81D -128 Overload Heater, Inside/Bottom-Side (bottom right)

91BCD121 Motor Starter Heater, Left

General Electric. Cat. 81D - 128. With (2) screws and washers.

91BCD122 Motor Starter Heater, Right

General Electric. Cat 81D - 128. With (2) screws and washers.

Electrically, a Motor Starter Heater (such as the GE Cat. 81D - 128 units here⁵) has a closed electrical path between its two terminals (the two screws on top of the 81D). Inside the Heater this path is actually a small heating coil around a switch-tripping mechanism. If an overcurrent condition causes this heating coil to get too hot, it causes this mechanism to trip (open) the Starter Switch.

Normally a Heater is used in-line within a Motor Starter. In considerable searching online and in the literature, I have been unable to find another instance of hooking a *second* wire to one of the Heater's terminals. In this case, they're wired into the Throat Heater.

⁵ Called an "Overload" heater by G.E.

Parts 130 - 146: Motor Starter Conduits and Wires

- 91BCD130 Motor Starter Enclosure to Motor Conduit, Fitting, Enclosure Side
Third-party Assembly. With its screws and retaining nut.
- 91BCD131 Motor Starter Enclosure to Motor Conduit. 0.58 O.D.
- 91BCD132 Motor Starter Enclosure to Motor Conduit, Fitting, Motor Side
Third-party Assembly. With its screws and retaining nut.
- 91BCD133 Motor Starter to Motor Wire (from lower left terminal of Starter)
- 91BCD134 Motor Starter to Motor Wire (from lower middle terminal of Starter)
- 91BCD135 Motor Starter to Motor Wire (from lower right terminal of Starter)

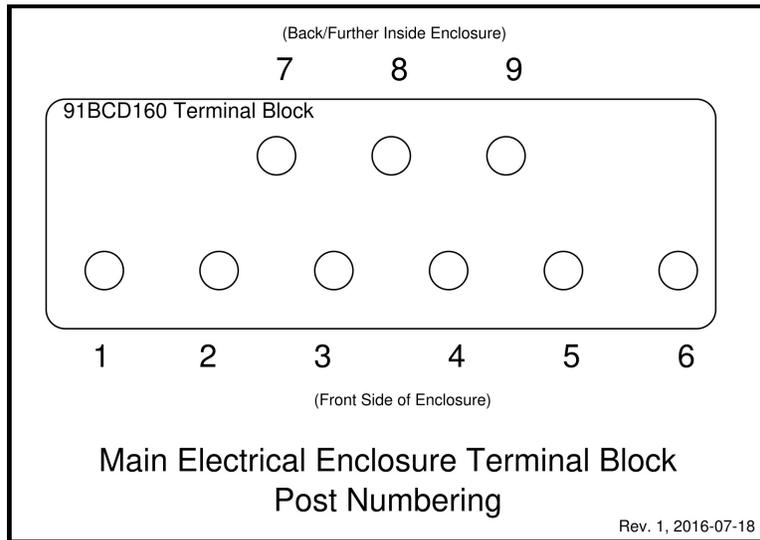
- 91BCD136 Motor Starter Enclosure to Main Electrical Enclosure Power Wire Conduit, Fitting,
Starter Enclosure Side
Third-party Assembly. With its screws and retaining nut.
- 91BCD137 Motor Starter Enclosure to Main Electrical Enclosure Conduit. 0.58" O.D.
- 91BCD138 Motor Starter Enclosure to Main Electrical Enclosure Power Wire Conduit, Fitting,
Main Electrical Enclosure Side
Third-party Assembly. With its screws and retaining nut.
- 91BCD139 Motor Starter to Main Electrical Enclosure Power Wire
From upper left terminal of Starter.
Attaches to Terminal Block, Post #4 in Main Electrical Enclosure.
White. [MEASURE GAUGE]
- 91BCD140 Motor Starter to Main Electrical Enclosure Power Wire
From upper middle terminal of Starter.
Attaches to Terminal Block, Post #5, in Main Electrical Enclosure
Red. [MEASURE GAUGE]
- 91BCD141 Motor Starter to Main Electrical Enclosure Power Wire
From upper right terminal of Starter.
Attaches to Terminal Block, Post #6, in Main Electrical Enclosure
Black. [MEASURE GAUGE]

- 91BCD142 Motor Starter to Main Electrical Enclosure Heater Wire Conduit, Fitting,
Starter Enclosure Side
Third-party Assembly. With its screws and retaining nut.
- 91BCD143 Motor Starter to Main Electrical Enclosure Heater Wire Conduit. 0.58" O.D.
- 91BCD144 Motor Starter to Main Electrical Enclosure Heater Wire Conduit, Fitting,
Main Electrical Enclosure Side
Third-party Assembly. With its screws and retaining nut.
- 91BCD145 Motor Starter to Main Electrical Box Heater Wire
From Left Heater on Starter
Attaches to Rheostat Bottom Terminal in Main Electrical Box
- 91BCD146 Motor Starter to Main Electrical Box Heater Wire
From Right Heater on Starter
Attaches to Top Fuse, Inside Side (Left) in Main Electrical Box

Parts 150 - 155: The Incoming Main Power

- 91BCD150 Main Electrical Enclosure Incoming Main Power Conduit, Fitting [not present]
Main Electrical Enclosure Side
(Would have been a Third-party Assembly)
- 91BCD151 Main Electrical Enclosure Incoming Main Power Conduit [not present]
- 91BCD152 Main Electrical Enclosure Incoming Main Power Conduit, Fitting [not present]
(Would have been a Third-party Assembly)
Note: Machine would have been hard-wired to the building; this would not have been a plug.
- 91BCD153 Incoming Main Power Wire, Three-Phase Leg ?
Attaches to Terminal Block, Post #5, in Main Electrical Enclosure
Cut in 1993.
Stranded aluminum wire with braided insulation. 7 strands. Each strand approximately 0.042" diameter; overall approximately 0.125" wire bundle diameter. That's closest to 9 AWG stranded cable (7 conductor, 0.0432" dia. each conductor, 0.130" bundle diameter), which is an unusual size.
- 91BCD154 Incoming Main Power Wire, Three-Phase Leg ?
Attaches to Terminal Block, Post #6, in Main Electrical Enclosure
Cut in 1993.
Same wire information as 91BCD153.
- 91BCD155 Incoming Main Power Wire, Three-Phase Leg ?
Attaches to upper right (front-side) terminal of right-side Fuse ("Fuse B") in 91BCD195 Fuse Holder, Bottom (Two Fuses) on right side of Main Electrical Enclosure.
1-conductor aluminum wire. Measured 0.079" diameter; probably 12 AWG.
Braided insulation.
Cut in 1993.

Parts 160 -166: The Terminal Block



- 91BCD160 Main Electrical Enclosure Terminal Block
Third-party Assembly. Manufacturer unknown. 9 Posts.
MEASURE THREAD - probably 1/4"-20 UNC. Post 3 has a side extension.
This is at the bottom of the Main Electrical Enclosure, with its 6-post side toward the front (cover) of the Enclosure. The post numbering used here is arbitrary.
- 91BCD161 Main Electrical Enclosure Terminal Block, Mounting Screws (2)
- 91BCD162 Main Electrical Enclosure Terminal Block, Mounting Screw Nuts (2)
- 91BCD163 Main Electrical Enclosure Terminal Block, Insulating Plates (2)
Two hard plastic (or fiber?) plates mounted underneath the Terminal Block to prevent it shorting to the case. They look shop-made.
- 91BCD164 Main Electrical Enclosure Terminal Block, Post Nuts (as needed)
MEASURE NUT AND WRENCH SIZE
COUNT NUMBER ACTUALLY USED
- 91BCD165 Main Electrical Enclosure Terminal Block, Post Isolating Washers (as needed)
COUNT NUMBER ACTUALLY USED
- 91BCD166 Main Electrical Enclosure Terminal Block, Post Washers (as needed)
COUNT NUMBER ACTUALLY USED

Parts 170 - 186: The Contactor⁶ Assembly

Note: Logically, the Fuses should go here, but I chose to remove the Contactor Assembly from the left side of the box first so as to have more room to get at the Fuses/Rheostat/Switches on the right side of the box.



The Contactor, shown hooked up within the Main Electrical Enclosure (left) and removed on the bench (right)

91BCD170 Contactor

Third-party Assembly, including screws for wires.

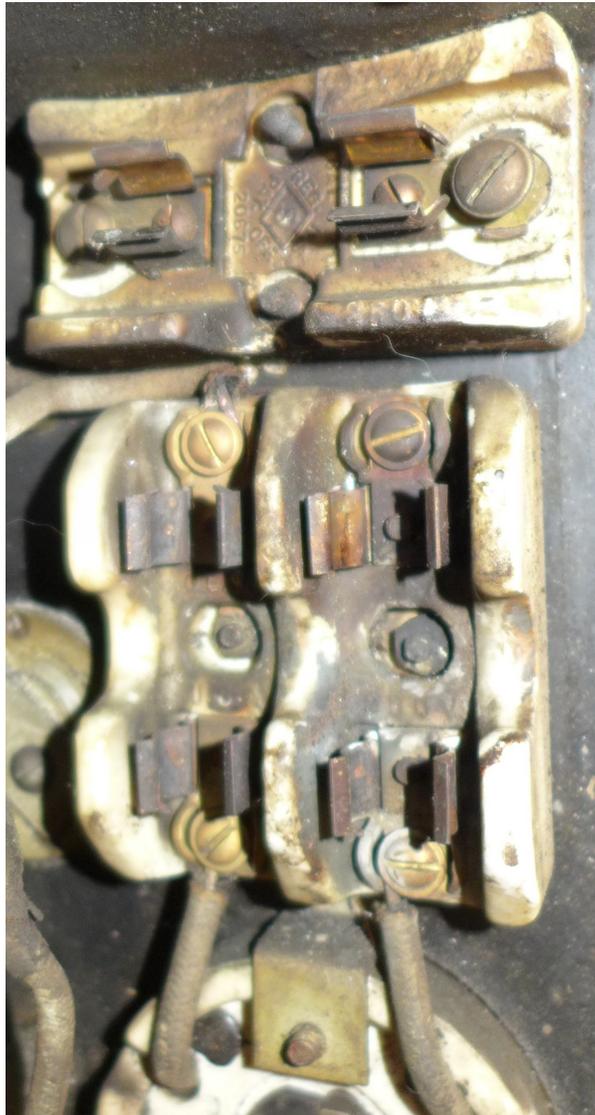
Maker unknown.

Called out as a unit, except as below.

⁶ A "contactor" is simply a relay designed for higher power levels. The term is common in, e.g., motor controls.

- 91BCD171 Contactor Resistor
MEASURE OHMS
- 91BCD171 Contactor Mounting Screws (2) [1 present]
Round-head, slotted drive. 0.186" diameter (probably #10), 7/8" long
- 91BCD172 Contactor Mounting Screw Nuts (2) [1 present]
Hex. Takes 3/8" wrench
- 91BCD173 Contactor Assembly Insulating Board
- 91BCD180 Contactor, Wire from Contactor Terminal '1' to Terminal Block Post #8.
- 91BCD181 Contactor, Wire from Contactor Terminal '2' to Terminal Block Post #7
- 91BCD182 Contactor, Wire from Contactor Terminal '3' to Terminal Block Post #3
- 91BCD183 Contactor, Wire from Contactor Terminal '3' to Contactor Terminal 'L'
- 91BCD184 Contactor, Wire from Contactor Terminal '3' (a) to [Contactor Large Contact]
- 91BCD185 Contactor, Wire from Contactor Terminal 'H' to Terminal Block Post #2
- 91BCD186 Contactor, Wire from Contactor Terminal 'L2' to Terminal Block Post #1

Note: Coil wires are integral with the Coil and are not given their own symbols. The left wire from the Coil goes to Contactor Terminal 'L2' while the right wire goes to Terminal 'H'.



The two Fuse Holders as installed
on the inside of the Right Side of the Main Electrical Enclosure

Parts 180 - 201: The Fuses

- 91BCD190 Upper Fuse Holder (1 fuse)
Holds 91BCD194 Fuse C.
Third-party, with screws for wires.
Manufacturer's trade-mark is an 'S' inside a diamond.
Cat. No. 20675. Porcelain. Old damage. On back: 5033
- 91BCD191 Upper Fuse Holder Mounting Screws (2)
Fillister-head, slotted drive. 0184 diameter (probably #10), 1" long.
- 91BCD192 Upper Fuse Holder Mounting Screws, Nuts (2)
Hex. Takes 3/8" wrench, but there's not really enough room for a wrench or socket, so you end up needing long nosed pliers.

91BCD193 Fuse Holders (Upper and Lower) Insulating Sheet



The remains of the original fuses ⁷

91BCD194 Fuse (here designated fuse 'C')

As installed: Class H
RLN-30 [Littelfuse: obsolete 2014-04-01]
LR 10 KA
Issue No. DG80-95
[possibly still serviceable, but untrustworthy]

91BCD195 Lower Fuse Holder (2 fuses)

Holds 91BCD200 Fuse A and 91BCD201 Fuse B
Third-party, with screws for wires.
G.E. 60A, 250V. Cat. No. 34367.

91BCD196 Lower Fuse Holder Mounting Screws (2)

Round-head, slotted drive. #8, 5/8" long.

91BCD197 Lower Fuse Holder Mounting Screws, Nuts (2)

RE-CHECK WRENCH SIZE

Note: One of these two screws also had a lock washer.

91BCD198 Lower Fuse Holder Mounting Screws, Washers

[1 lock washer present, but probably not necessary]

91BCD199 Fuse A Wire to Terminal Block Post #3

This wire actually connects to an extender to the side of Terminal Block Post #3.

⁷ ATF was burned to the ground by bad management, but it's surprising that this machine didn't do it sooner.

91BCD200 Fuse (here designated fuse 'A')

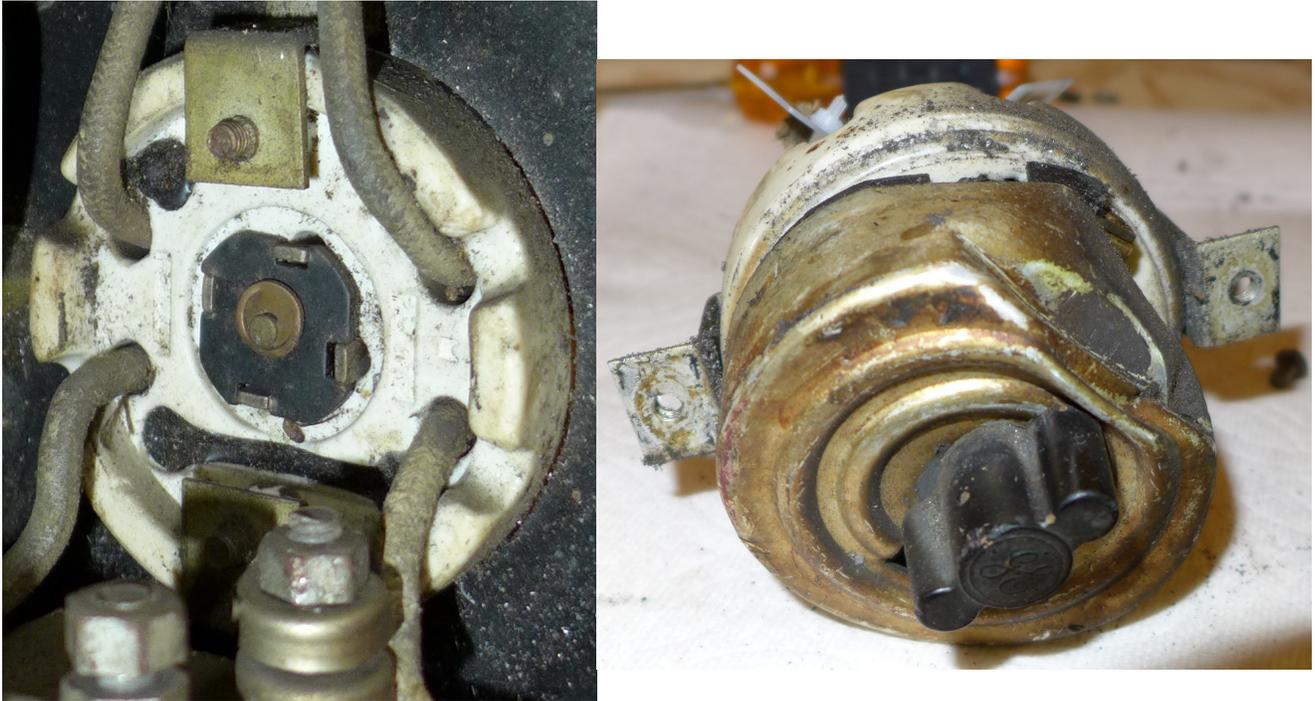
As installed: Reliance Fuse
Class H
Symbol: ERN
250V or less AC
LR 10 KA

[broken as previously installed in the machine]

91BCD201 Fuse (here designated fuse 'B')

As installed: [unidentifiable, broken as previously installed in the machine - it disintegrated completely on removal]

Parts 210-213: The Rotary Switch



The Rotary Switch as seen from the inside of the Enclosure and removed.

91BCD210 Rotary Switch

Third-Party Assembly.

G.E. #2190-2

Old damage

Note: The wires from this switch are integral to the switch and are not assigned separate symbols.

91BCD211 Rotary Switch Mounting Brackets (2)

91BCD212 Rotary Switch Mounting Bracket Screws, to Brackets to Enclosure (2)

Round-head, slotted drive. #10, 1/4" long.

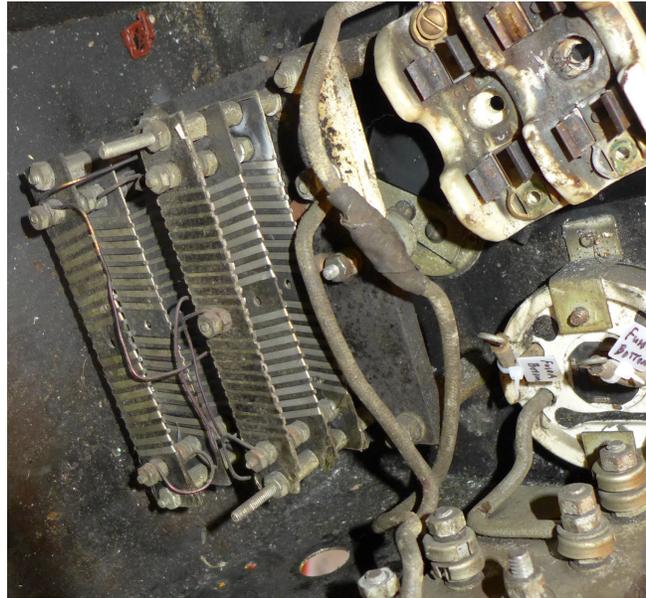
Note: No nut; bracket is tapped.

91BCD213 Rotary Switch Mounting Bracket Screws, to Switch to Brackets (2)

MEASURE

Note: No nut; bracket is tapped.

Parts 220-239: The Rheostat



The Rheostat, in four views:

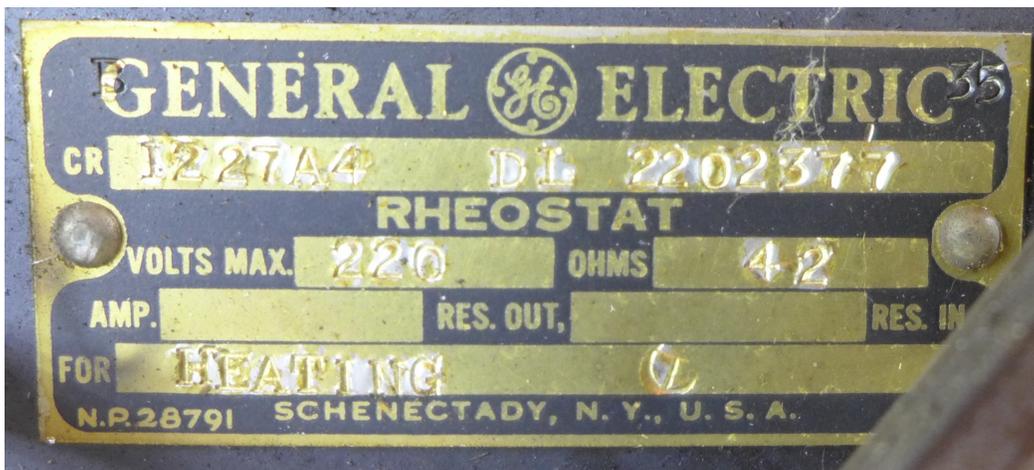
- The Knob and Scale, on the outside of the Main Electrical Enclosure. (In the right light it is barely possible to read "HIGH" and "LOW" on the left and right extremities of this scale.)
- As installed.
- Removed, looking from the underside as it is installed.
- The hidden Front Panel of the Rheostat. "Up" in this view is down as the Rheostat is installed.

91BCD220 Rheostat

Third-party Assembly, complete with screws for terminal wires.

Maker's Plate data:

Maker: General Electric
Schenectady, N.Y.
Type: CR 1227A4 DL 2202377
Volts Max: 220
Ohms: 42
Amps: [blank]
RES. OUT [blank]
RES. IN [blank]
For: HEATING
Nameplate style: N.P. 28791



91BCD221 Rheostat Standoff Tubes (4)

Steel. 1 3/4" long, 0.54 O.D. (probably nominal 1/2"), 0.37 I.D.

91BCD222 Rheostat Standoff Tube Screws (4)

Hex-head machine screws, 1/4"-20 U.N.C. x 2 3/4" long.

91BCD223 Rheostat Standoff Tube Screws, Washers (4)

1/4"

91BCD224 Rheostat Standoff Tube Screws, Lock Washers (4)

1/4"

91BCD225 Rheostat Standoff Tube Screws, Nuts (4)

1/4"-20 U.N.C., Hex.

91BCD230 Rheostat Scale

91BCD231 Rheostat Scale Rivets (2)

Scale is riveted to the Main Electrical Enclosure

91BCD232 Rheostat Knob

Third-party Assembly. Details not yet investigated.

91BCD239 Rheostat Wire, Top Terminal of Rheostat to Terminal Block Post #9

Leftover Parts

Indeed, there were four parts left over after I disassembled the Main Electrical Enclosure: (2) #8 flat washers and (2) #8 lock washers. I suspect that they fell off of the Fuse Holder screws as I was taking them out and I didn't notice.

Revision History

- 2016-06-09. Started as a "Summary Parts List." Most of Group 1BCQ (as I was then designating the machine; now BCD) done.
- 2016-07-14. Renamed machine BCD. Decided to do only one parts list, as an Illustrated Parts List. But because of deficiencies in LibreOffice decided also to split it into multiple files by Group. May still need to use Apache OpenOffice for Groups which contain large images. Integrated notes from 2016-06-30 with List of Groups 1 through 33, plus new work on 2016-07-14 for List of Groups 90 through 99. On 2016-07-16 re-checked the part symbols against the machine and renumbered some parts within Group 91BCD.
- 2016-07-16/17. Initial version of wiring, with schematic, from Junction Box out to Pot. Partial exploration of wiring inside Main Electrical Enclosure.
- 2016-07-18. Initial work on schematic for Main Electrical Enclosure