Serial No. KN-71-17

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NEWARK, NEW JERSEY

NEWARK PLANT
PIGMENT COLOR RESEARCH REPORT

LEAD MELTING AND OVERFLOW SYSTEM

Period Covered JUNE 1969 - JUNE 1971

FILE: 121

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KN 71-17

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PIGMENT COLOR RESEARCH REPORT

TITLE: LEAD MELTING AND OVERFLOW SYSTEM

PERIOD COVERED: JUNE 1969 - JUNE 1971

SUBMITTED BY: B. C. HERTZ Date Submitted: 6/26/71

APPROVED BY: E. F. KLENKE, JR. Date Released: 6/30/71

ABSTRACT: This report covers the design and installation of two electric lead melting furnaces and a heated molten lead overflow system in the lead nitrate area of the Newark Plant. These facilities have replaced the single oil fired lead furnace and the manual ladling troughs.

INTRODUCTION

Newark melts ± 14,000,000 pounds of lead annually for the subsequent manufacture of lead nitrate. The area used an oil fired furnace which consisted of a cast iron pot supported on a masonry fire box. An oil flame was distributed through a brick arch constructed below the pot in order to provide uniform heating and to minimize local hot spots.

The combination of external heating and the four ton lead load stressing the pot resulted in frequent pot failure. With failure the molten metal would seep down onto the brick arch and react with the refractory destroying it. A four to six day shut-down would be needed to repair the damage. During this shutdown period no chrome yellows or Molybdate oranges could be made, after the lead nitrate in storage was consumed.

The lead, once molten, was hand ladled into an open metal trough. The operator manually transferred 20,000 pounds of molten lead per shift at instantaneous lift rates of 700 pounds per hour. He was constantly exposed to the 1100°F. heat of the pot and the danger of spillage of the molten liquid.

Modernization and improvements of these facilities were investigated, and alternate methods selected and installed.

PATENT STATUS

None

SUMMARY AND CONCLUSIONS

The oil fired furnace was an unreliable piece of equipment. Past experience indicated a pot life expectancy of approximately 10,000,000 pounds of melted lead, or less than a single year's use (See APPENDIX).

Internal and external gas fired, internal resistance and induction furnaces were investigated as replacements. The lowest initial costs favored replacement with internal resistance heating units, and the lowest operating cost favored replacement with internal gas fired units. The relative simplicity of the electric resistance unit vs. the gas fired unit, as well as its ease of maintenance and ability to perform on a limited basis with the burnout of several elements, outweigh the added energy and heating element replacement cost.

Size and space limitations had precluded the possibility of constructing a second oil fired furnace in the lead shop area. The electric resistance and the internal gas fired furnaces could be designed to fit two units of the capacity of the oil fired furnace into the area.

Two electric resistance units were recommended as replacements and were installed in March of 1971. Startup of the first furnace was uneventful. The second furnace is serving as an installed spare.

A heated overflow system was designed and installed in November of 1969 as a demonstration prototype unit. The system was successful and remained in service for a year and a half, until the new furnaces were installed. At this time another heated overflow was designed and installed which overcame some deficiencies in the prototype unit. This system was started up in March, 1971 and has been operating satisfactorily.

APPENDIX

LEAD POT REPLACEMENT CYCLES

IN	MONTHS OPERATED	LEAD MELTED (MM#)
8/35	17	7.9
1/37	3	.9
4/37	10	3.0
2/38	67	24.3
4/43	27	9.7
12/45	17	10.3
5/47	12	10.6
4/48	7	4.9
12/48	16	10.0
4/50	9	10.2
12/50	4	3.8
7/51	1	1.4
5/51	18	18.4
11/52	10	11.1
9/53	7	6.3
3/54	13	13.0
5/55	6	7.8
11/55	27	25.5
2/58	5	4.2
7/58	26	23.6
9/60	22	18.7
7/62	18	15.9
1/64	4.5	4.0
6/64	18	15.9
12/65	14	-

Lead Pot Replacement Cycles

IN	MONTHS OPERATED	LEAD MELTED (MM#)
2/67	11	-
1/68	6	-
7/68	11	-
6/64	4	-
10/69	7	10.3

ECONOMIC DATA

	External Gas Fired Unit	Induction Htd Commercial	Induction Htd Du Pont	Internal Gas Fired	Internal Resistance Htd
	(1)	(2)	(3)	(4)	(4)
Operating Unit	$9,045	$60,000	$10,000	$7,195	$5,900
Standby Unit	9,045	60,000	10,000	7,195	5,900
Equipment Installation	18,090	120,000	18,000	17,960	11,800
Service Facilities					
Gas	6,600	-	-	6,600	
Electric	-	10,000	10,000	-	10,000
TOTAL	42,780	250,000	46,000	38,900	33,600
Operating Costs Based on Cold Standby					
Energy	$3,500	$6,180	$6,180	$3,500	$4,500
Maintenance	1,300	4,800	3,000	1,010	2,000
Deprec 6%	3,560	15,000	2,750	2,330	2,020
TOTAL	7,360	25,980	11,930	6,840	8,520
Gross ROI-%	12.6	0	0	31.5	Base

Investment cost for current appraisal study only not for project preparation.

1. American Gas Furnace Company - Quote
2. Inductotherm Company - Verbal quote
3. Chambers Works Design - John Branscome estimate
4. C. M. Kemp Company - Quote

Design Data: Induction Heating

- 120 watts per foot of pipe at 60 cycle 110 volts to heat pipe to 450°C using one turn per inch and three inches of magnesium oxide insulation.

- 3 KVA transformer
  "Buck or Boost Transformer" GE model #9T5M113
  2 volts per foot of pipe at 60 amps.

RECOMMENDATIONS

The high heat loss from the open top of the lead pot would favor installation of an insulated cover. This would minimize holding losses and reduce energy costs.

Molten lead should be ladled from the operating furnace into the standby furnace to a level of ± four inches. This would cover the heating elements and facilitate an emergency startup of the second unit.

REFERENCES:

1. Drawing #d-39820, The C. M. Kemp Mfg. Co.
2. Letter from J. W. McNees, E.S.D. to Barry Hertz dated July 28, 1970.
3. Project No. 7820