1. COMPONENT	FY 19__ MILITARY CONSTRUCTION PROJECT DATA	2. DATE
NAVY		1 Sep 1983

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
MARINE CORPS BASE CAMP LEJEUNE, NORTH CAROLINA 28542	FLY ASH CONTROL SYSTEM, BUILDING 1700

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
	821-09	P-829	450

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
FLY ASH SILO WITH UNLOADER	LS	-	-	385
SUBTOTAL	-	-	-	385
CONTINGENCY - 10%	-	-	-	39
TOTAL CONTRACT COST	-	-	-	424
SUPERVISION, INSPECTION & OVERHEAD (5.5%)	-	-	-	23
TOTAL REQUEST	-	-	-	447
TOTAL REQUEST (ROUNDED)	-	-	-	450
INSTALLED EQUIPMENT OTHER APPROPRIATIONS	-	-	-	-

10. DESCRIPTION OF PROPOSED CONSTRUCTION

Provide a fly ash handling and storage system for electrostatic precipitation (ESP) fly ash at the Central Heating Plant, Building 1700. Construction/modifications to include ash transfer equipment for ESP's; separate fly ash silo and ash unloading facilities to enhance future recycling options and air pollution controls during handling; runoff controls; and auxiliary equipment.

11. REQUIREMENTS:

PROJECT: Provide fly ash control system for the Central Heating Plant, Building 1700.

REQUIREMENT: To correct excessive fly ash dust problem, as recommended by LANTDIV's Investigation of Ash Collection and Disposal System at the Central Heating Plant, Building 1700, MCB, Camp Lejeune, NC dated December 1982.

CURRENT SITUATION: Fly ash dust has become a serious maintenance problem to controls and equipment in the Central Heating Plant, as well as an environmental hazard.

IMPACT IF NOT PROVIDED: Continued frequent maintenance of controls and equipment, and prolonged environmental risk to health and safety of operational personnel.

BJD

ENCL (1)

1. COMPONENT		2. DATE
NAVY	FY 86 MILITARY CONSTRUCTION PROJECT DATA	1 Sep 83

3. INSTALLATION AND LOCATION	
MARINE CORPS BASE, CAMP LEJEUNE, NORTH CAROLINA 28542	

4. PROJECT TITLE	5. PROJECT NUMBER
FLY ASH CONTROL SYSTEM - BUILDING 1700	P-829

SPECIAL CONSIDERATIONS

1. Pollution Prevention, Abatement, and Control: This project will not cause additional air or water pollution.

2. Flood Hazard Evaluation: Requirements of Executive Order No. 11296 (Flood Hazards) are not applicable.

3. Environmental Impact: A Preliminary Environmental Assessment (PEA) will be written and forwarded under separate correspondence. This proposed project will actually enhance the environment, as it will curtail air pollution.

4. Fallout Shelter Construction: Not applicable.

5. Design for Accessibility of Physically Handicapped Personnel: Provisions for physically handicapped personnel are not required in this facility.

6. Preservation of Historical Sites and Structures: The project facilities do not directly or indirectly affect a district, site, building, structure, object, or setting which is listed in the National Register or otherwise possesses a significant quality of American history.

1. COMPONENT		2. DATE
NAVY	FY 19 86 MILITARY CONSTRUCTION PROJECT DATA	1 Sep 1983

3. INSTALLATION AND LOCATION
MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA 28542

4. PROJECT TITLE	5. PROJECT NUMBER
FLY ASH CONTROL SYSTEM, BUILDING 1700	P-829

FACILITY STUDY

1. Project: This project provides a means of controlling the existing excessive dust problem at the Central Heating Plant in Hadnot Point.

2. Current and Planned Future Workload with regard to this Project: Over one billion pounds of steam is produced annually at the Central Heating Plant, creating residue of bottom ash and fly ash.

3. Description of Proposed Construction:

a. Type of Construction: Permanent.

b. Replacement: Not applicable.

c. Description of Work to Be Done:

(1) Primary Facility: This project will consist of construction/modifications of ash transfer equipment for electrostatic precipitators; separate fly ash silo with tie-in to existing silo for backup capability when one silo breaks down; ash loading facilities; air pollution controls; and auxiliary equipment.

(2) Energy Conservation: Although the proposed project will not directly contribute to savings in energy, it will indirectly contribute to conserving oil yearly by alleviating ash residue build-up which causes equipment breakdown, at which times more expensive oil must be burned instead of coal. Further, a separate silo to handle precipitator ash would create a possibility of selling fly ash to a private concrete company. This would eliminate costs associated with hauling and landfilling of the fly ash.

(3) Collateral Equipment: Not applicable.

4. Cost Estimate: The Area Construction Index for Camp Lejeune is .95, with a contingency factor of 10 percent. This data is applicable to FY-83. Cost data derived from LANTDIV's Investigation of Ash Collection and Disposal System at the Central Heating Plant dated December 1982, and escalated to FY-84.

1. COMPONENT		2. DATE
NAVY	FY 19 86 MILITARY CONSTRUCTION PROJECT DATA	1 Sep 1983

3. INSTALLATION AND LOCATION	
MARINE CORPS BASE CAMP LEJEUNE, NORTH CAROLINA 28542	
4. PROJECT TITLE	5. PROJECT NUMBER
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5. Justification for Project and Scope of Project:

a. Justification for Project.

(1) Project: The proposed project will provide a separate fly ash silo and unloader.

(2) Requirement: A separate silo and unloader to handle precipitator fly ash is required to control the existing excessive fly ash problem.

(3) Current Situation: Both bottom ash and fly ash are now stored in the same silo, mixing the lighter fly ash with the heavier bottom ash. Upon unloading, excessive dust escapes into the atmosphere. Fly ash dust has become a serious maintenance problem to controls and equipment in the Central Heating Plant, as well as an environmental hazard to the health and safety of operational personnel.

(4) Impact if Not Provided: Continued frequent maintenance of controls and equipment, and prolonged environmental risk to health and safety of operational personnel.

b. Justification for Scope of Project: The scope of this proposed project is that recommended by the investigative report cited in paragraph 4 above. The report's recommendation will satisfy North Carolina Air Pollution Control Guidelines, 15 NCAC 2D.

6. Equipment Provided from Other Appropriations: None.

7. Common Support Facilities: There are no common support facilities available that can satisfy.

8. Effect on Other Resources: This project will not require additional funding for utilities services and operations, nor will additional operating personnel be required.

9. Siting of the Project: See Site Location Map, enclosure (1).

10. Other Graphic Presentations, including Photographs: None.

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1. COMPONENT	FY 19 86 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
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CAMP LEJEUNE, NORTH CAROLINA 28542

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11. Economic Analysis: The proposed project produces no direct economic benefits, but rather it insures compliance with environmental regulations.

12. Environmental Impact: A Preliminary Environmental Assessment (PEA) will be written and forwarded under separate correspondence. This proposed project will actually enhance the environment, as it will curtail air pollution.

13. Quantitative Data: Not applicable. This project is to correct potential environmental hazards to the local ecology and ecosystems, as well as operational personnel.

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B/A

INVESTIGATION OF
ASH COLLECTION AND DISPOSAL SYSTEM,
HIGH DUST LOADING IN BREECHING,
AND BYPASS STACK CAPS
AT THE
CENTRAL HEATING PLANT, BUILDING 1700
MARINE CORPS BASE, CAMP LEJEUNE, NORTH CAROLINA

DECEMBER 1982

DESIGN DIVISION
ATLANTIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORFOLK, VIRGNIA 23511

PREPARED BY:

R. W. TISDALE, JR.
MECHANICAL ENGINEER

I. Investigation of Ash Collection and Disposal System

A. Description of System

The ash collection and disposal system at the central heating plant was installed as a part of the original plant construction in the early 1940's. The system is of the dry pneumatic vacuum conveying type with a vertical storage silo and was manufactured by United Conveyor Corporation. A two stage steam ejector produces vacuum on the conveying system. Ash from the silo is loaded into open bed dump trucks by means of a rotary feeder and horizontal screw conveyor with water conditioning.

B. Major Modifications to Original System

Within the past five years, several modifications have been made to the original ash system. A new two stage steam ejector and a new rotary feeder and unloader have been installed to replace the original components. Additional ash collection piping has also been installed for transporting fly ash collected from two new electrostatic precipitators. No other major modifications are known to have been made to the original ash system.

C. System Operation

The original function of the ash system was to remove and temporarily store ash generated from the operation of four 100,000 pound per hour pulverized coal fired steam boilers. Ash was collected from the boiler, air preheater, mechanical collectors and stack hoppers, transported through the vacuum conveying system and stored in the silo (see figure 1). Stored ash was then unloaded into open dump trucks for hauling to the base landfill for disposal. Based on conversations with plant personnel, no undue problems were experienced with the removal and disposal of ash until the electrostatic precipitators were added. The methods of collecting, storing, removing and disposing of the ash have remained basically unchanged, however problems have been encountered since flyash collected by the precipitators have been added to the system.

D. Operational Problems Incurred

Since the flyash has been added to the system, the rate of ash flow from the silo through the rotary feeder and unloader has become very inconsistent. As a result of continuous variations in ash flow, proper water conditioning cannot be maintained. Operating personnel have been manually readjusting water flow in an attempt to provide proper mixing with limited success. During severe changes in ash flow, either a "water rich" or "water lean" mixture passes through the unloader outlet. As ash flow reduces suddenly due to large clinkers being unloaded, excessive water totally saturates the ash previously unloaded. In addition, the excess water drains from the truck creating additional water pollution problems at the silo as well as a nuisance during

transport. When ash flow suddenly surges due to fine precipitator ash being unloaded, unconditioned ash is discharged with the unwetted particles becoming airborne. These dust clouds have been severe at times, creating a nuisance to surrounding facilities. This dust eventually settles and creates additional water pollution problems in the area storm drainage system. Unconditioned ash that does fall into the truck also has a tendency to become airborne during transport and dumping, creating additional nuisances.

E. Probable Cause

The primary cause of the problems experienced in unloading and disposing of the ash stems from the variations in particle size of the ash being unloaded. The variations in flow are caused by the smaller particles being more densely packed when passing through the rotary feeder. In addition, the surface area of the smaller particles per unit volume is greater and requires more water for wetting. One other possible problem is that the charged particles collected by the precipitator may have a greater surface tension reducing the wetting capability.

F. Possible Solutions

Several possible solutions to reduce or eliminate the problems being experienced were investigated. These possible solutions and their probable effects on the system are as follows:

1. Install aeration blocks and diverter core in the ash storage silo to provide better mixing of different size particles.

   This solution may lessen the extreme variations in flow but will not resolve the problem of wetting the fine particles. The ash is segregated in the silo due to the ash being pulled from only one hopper at a time with resulting layers of ash of a particular size in the silo. Mixing at the outlet probably would have only minimum effects on the problems.

2. Install an air operated valve on the water conditioning line in lieu of a manual valve.

   An air operated valve may increase response time but will not resolve the variations in flow and the wetting problem.

3. Utilize a surfactant to provide better wetting of the finer particles.

   Wetting agents have met with limited success and do not totally resolve the problem of variations in flow. Wetting agents may help improve the wetting of the fine ash but variations in ash flow will probably minimize the improvement.

4. Install a rotary unloader designed to handle fine particles.

A rotary unloader such as the Model D-40 manufactured by Allen, Sherman, Hoff (see figure 2) would probably provide better mixing and wetting of fine particles but the variations in flow may continue to cause some minor problems. Initial cost of the unloader would be approximately $40,000.00.

5. Install a separate ash system for the precipitators.

A separate silo and unloader to handle fine ash from the precipitators separately should resolve the major problems currently being experienced. (See figures 3 and 4) By separating the fine ash from the larger particles, each system would be handling ash of similar size and consistency. Variations in flow due to particle size should be minimized. The rotary feeder and unloader could be selected to handle fine material and could be set up to properly condition fine material only. The major drawback to this solution is initial cost. A separate system would cost approximately $350,000.00.

6. Install a dust collector system to control dust emissions in the unloader outlet.

A dust suppression and collection system could be installed on the unloader outlet to contain any dust emissions. This system would probably effectively contain fugitive dust but would not affect overwetting due to variations in flow. In addition, fine particles would only be recirculated and may only build up within the silo.

G. Additional Considerations

Interest has been expressed by the activity to sell the precipitator ash to local private businesses. If the ash can be easily sold, plant personnel would be required to dispose of approximately two thirds of the ash presently handled. However, the precipitator ash would have to be handled separately and a separate silo required.

H. Recommendations

The only solution investigated that will probably solve all of the current problems would be to install a separate ash system, silo and unloader for the precipitators. The separate system would also allow sale of the flyash if desired. The major drawback to this solution is the initial cost of $350,000.00.

II. Investigation of High Dust Loading in Breeching

A. Description of System

Each of the two new precipitators is connected to two existing coal fired boilers. The arrangement of the new breeching is shown in figure 5. The common breeching was designed for a velocity of 30 feet per second assuming two boilers operating at full load. The transition into the precipitator was designed to provide a maximum velocity of 5 feet per second assuming two boilers at full load. Turning vanes and ladder vanes in the transitions and a perforated plate at the precipitator inlet were installed to provide equal air distribution into the precipitator.

B. Operational Problems Incurred

During normal operation, flue gas to the precipitator varies from one fourth to maximum design velocity. When the velocity reduces , ash falls out in the duct and on the ladder vanes. Some vanes near the top and bottom fill to where the opening becomes almost totally blocked. In addition, ash falls out and accumulates at the base of the inlet transition to the precipitator along the walkways. These ash buildups cause unequal velocity distribution through the precipitator as well as emissions when the velocity suddenly increases. The accumulated ash on the walkway also causes problems when entry into the precipitator is required for maintenance.

C. Recommendations

A team from the Navy Energy and Environmental Support Activity was requested to investigate the ash build up problems and to determine the velocity distribution through the precipitator. Site investigations were made in August 1980 and September 1981. Recommendations contained in the final report of February 1982 include removal of an 8 inch section at the bottom of the inlet perforated plate and the addition of a sonic sootblower to keep the inlet vanes free. Removal of the 8 inch section of the plate and installation of the sonic sootblowers are recommended and should alleviate the ash buildup problems at the precipitator inlet. Ash buildup in the inlet duct is not considered a major problem and should have no serious adverse effects on the system operation.

III. Investigation of Stack Caps

A. Description of System

The original boiler arrangement had flue gas breeching from each boiler passing vertically through the roof and connecting to to individual roof mounted stacks through a 90° transition. Each stack had a hopper at its base that was connected to the flyash collection system piping. No interconnections occurred between boilers.

B. Modifications to Systems

When electrostatic precipitators were added to the boilers, the flue gas breeching from two boilers were connected and a single duct routed to a common precipitator and ground mounted stack. The original breeching and roof mounted stacks were retained for use as a bypass. Two single blade guillotine dampers were installed on each boiler, one at the connecting to the old stack and one in the new breeching prior to connecting with the second boiler. This arrangement allowed isolation from the old stack or the new precipitator as required.

C. Operational Problems

Leakage has occurred past the bypass stack guillotine damper ever since the initial operation. The leakage could be caused by or significantly increased from ash accumulating in the damper seating track. Leakage of flue gas results in flyash accumulating in the bypass stack hopper and emissions occurring from the bypass stack. Whenever rain occurs, the ash in the hopper is wetted and hardens. Plant personnel are then required to manually remove the material to free the hopper outlet.

D. Possible Solutions

The possible solutions investigated are as follows:

1. External stack caps:

   The use of external stack caps which are generally limited to small boilers are not considered an acceptable solution. In order to be effective, the cap must be larger in diameter than the stack by one half and must be located above the stack at the height of one half the stack diameter when located to effectively block out the rain, the stack cap will create a downdraft around the plant. The resulting fumigation problem will not be acceptable. If the rain cap is designed to minimize the fumigation problem, the effectiveness of preventing rain from entering the stack will be greatly reduced.

2. Internal stack damper:

Use of a damper similar to a butterfly damper (see figures 6 & 7) investigated. Due to wind loading, the damper must be located inside the existing stack or within an extension to the stack. This arrangement would require a platform mounted on the existing stack or an extended operator drive from the base of the stack. The addition of a platform to the existing stack was not recommended structurally and extended drive mechanisms would probably not be reliable. From a maintenance standpoint, this solution would be no better than the current situation.

3. Double bladed guillotine damper:

Installation of a double bladed guillotine damper with compressed air pressurizing the space between the blades, should prevent leakage into the bypass stack. This alternative should prevent flyash from entering the stack hopper and therefore eliminate the problem. The initial cost for installing these dampers is estimated to be $150,000.00.

4. Install baffles and drainage trough in stack:

Installation of baffles and collection trough in the stack were investigated and determined to be ineffective. This solution would add additional draft loss and would plug up with flyash.

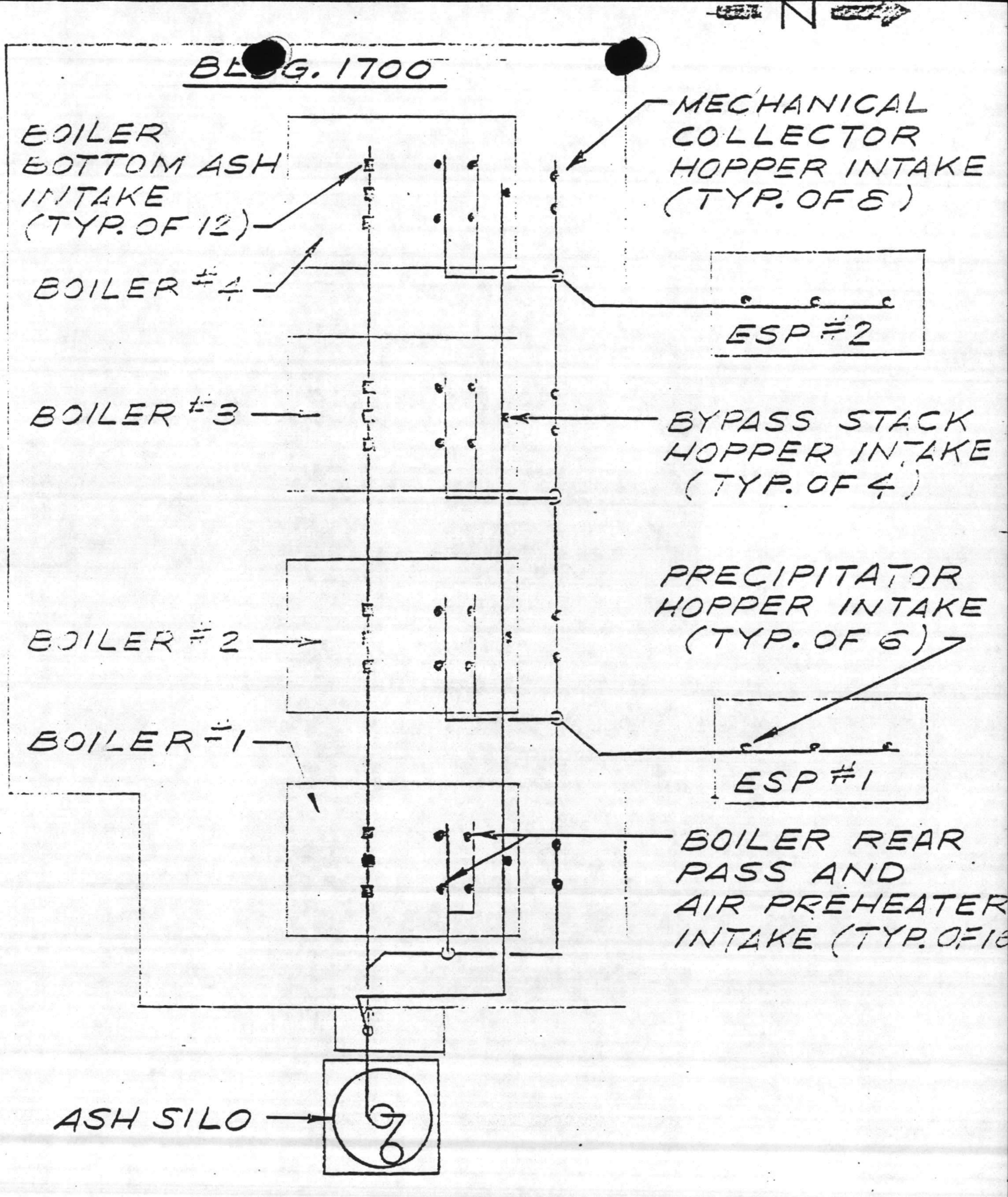
5. Install compressed air on existing dampers:

Installation of a compressed air manifold along the seating track of the damper may keep the dust from allowing the damper to seal properly. Compressed air could be used to blow the track clear prior to closing the damper.

E. Recommendations

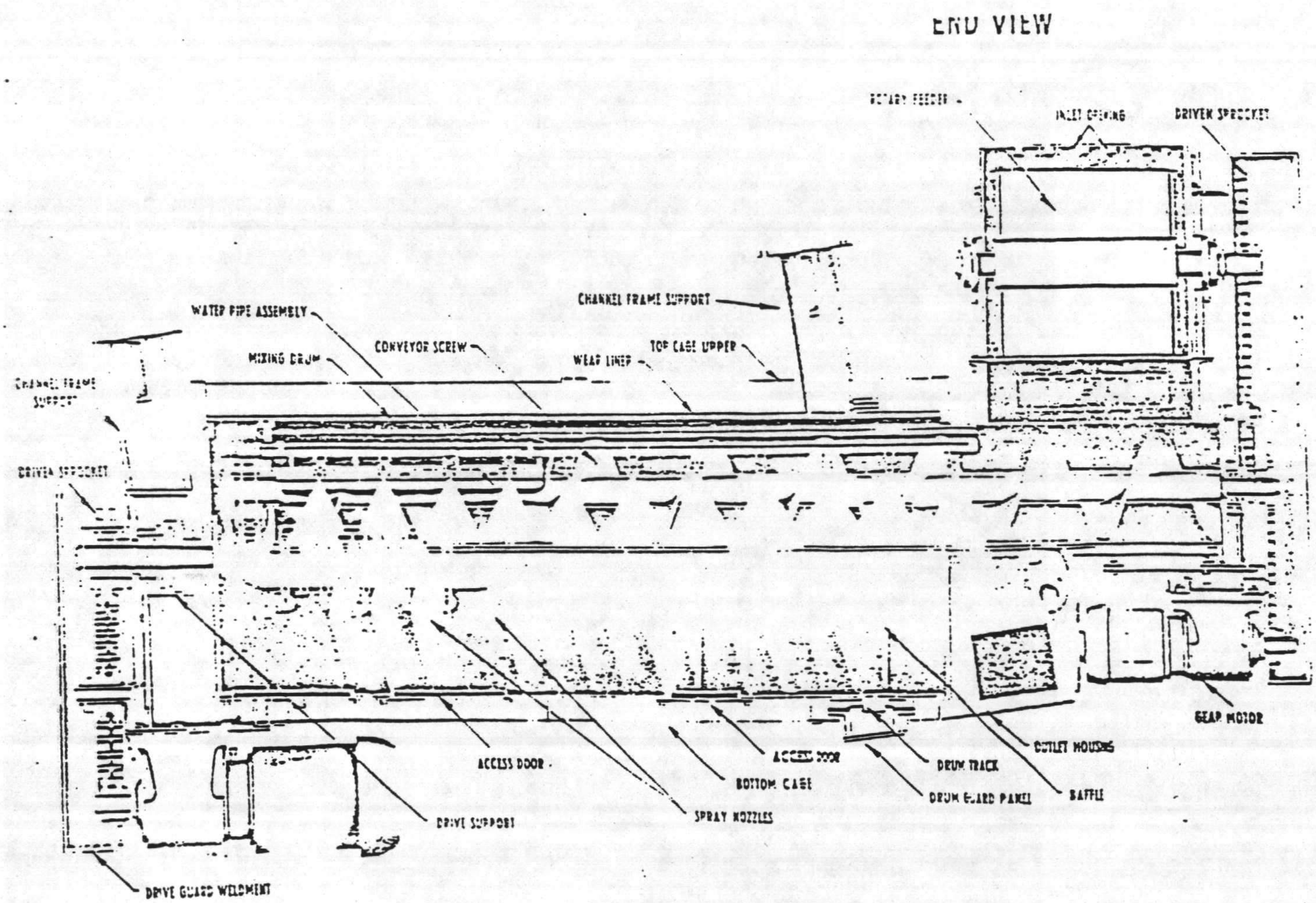
Recommend compressed air be installed on the existing damper tracks to reduce the amount of leakage to an acceptable level. If leakage is still excessive, recommend double guillotine dampers be installed.

Installation of a double guillotine damper will eliminate the flyash from entering the hopper and prevent any plugging due to rain. No additional adverse effects should be produced such as would be experienced with any of the alternatives investigated to prevent rain from entering the stacks.



ASH COLLECTION SYSTEM

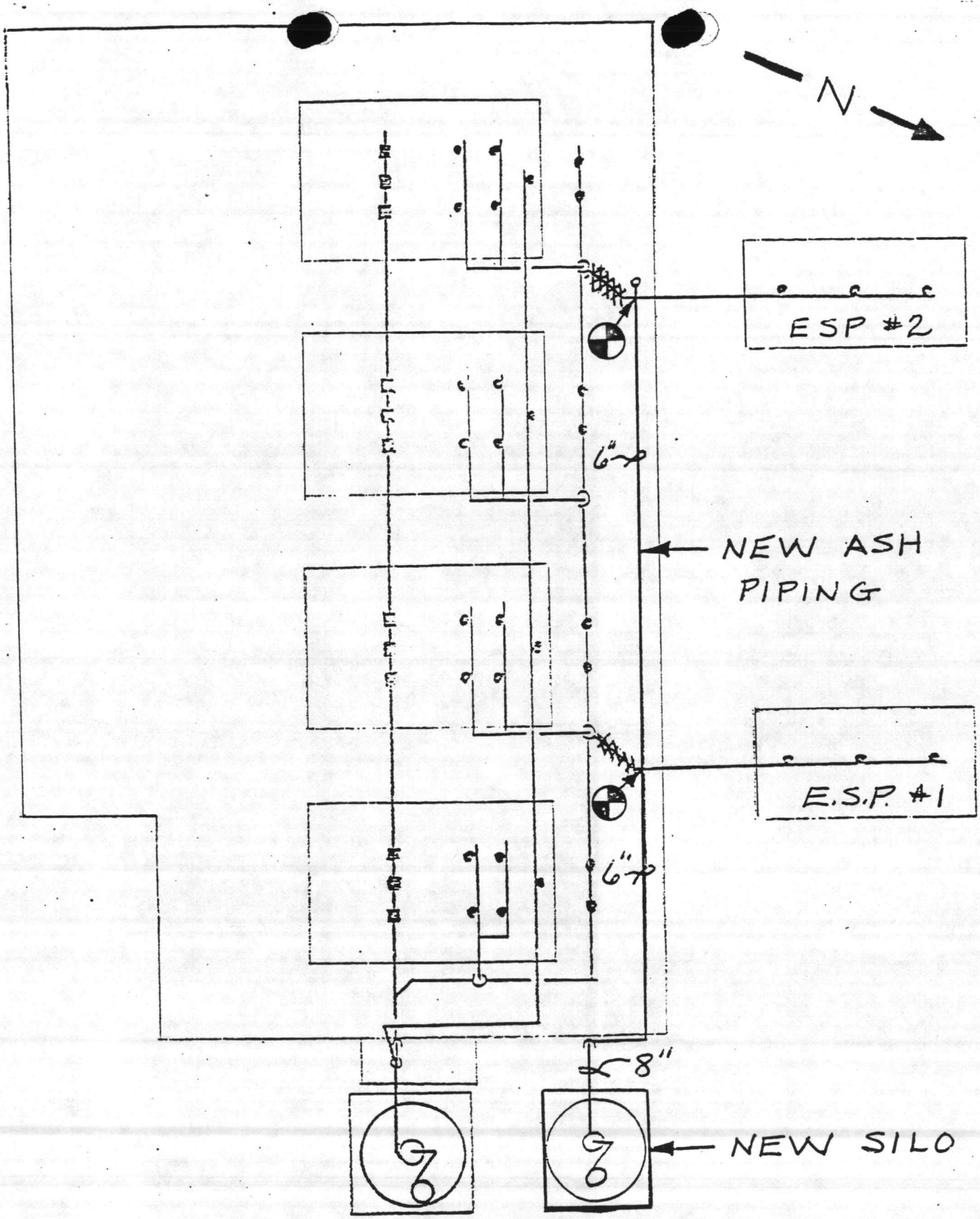
FIGURE 1



CROSS SECTION VIEW

ASH ROTARY UNLOADER

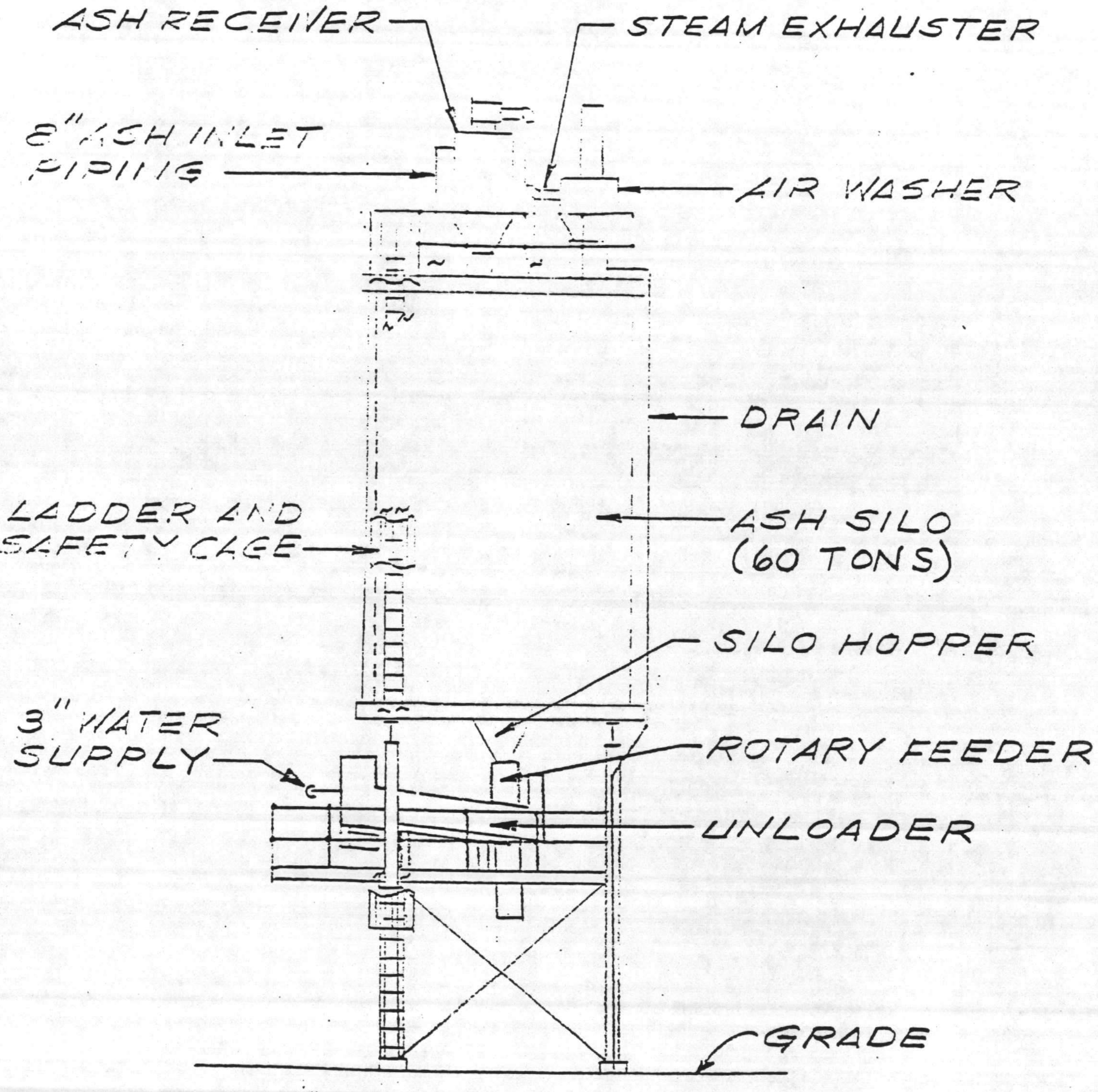
FIGURE 2



PLAN VIEW

NEW ASH SILO

FIGURE 3



ELEVATION

NEW ASH SILO

FIGURE 4

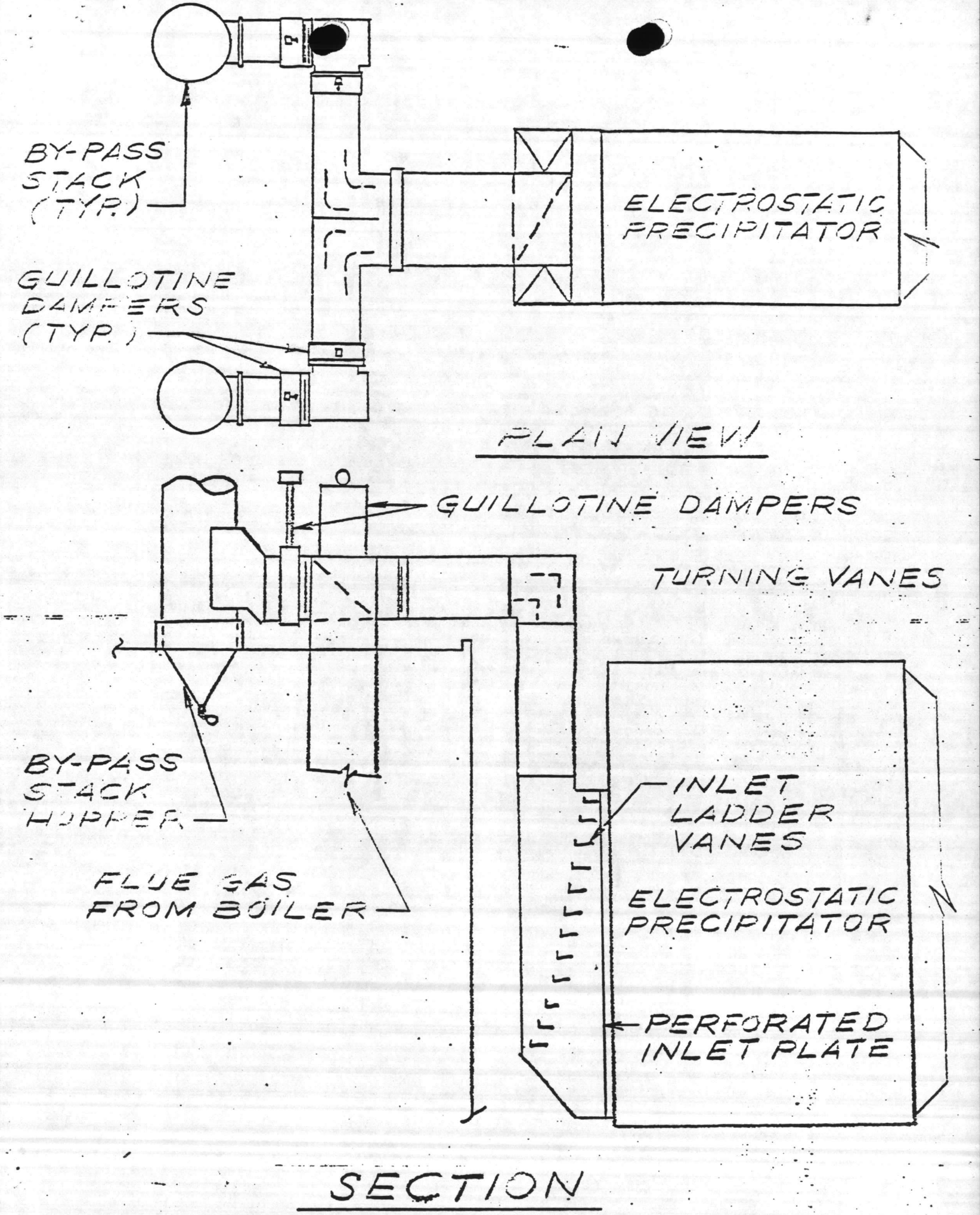
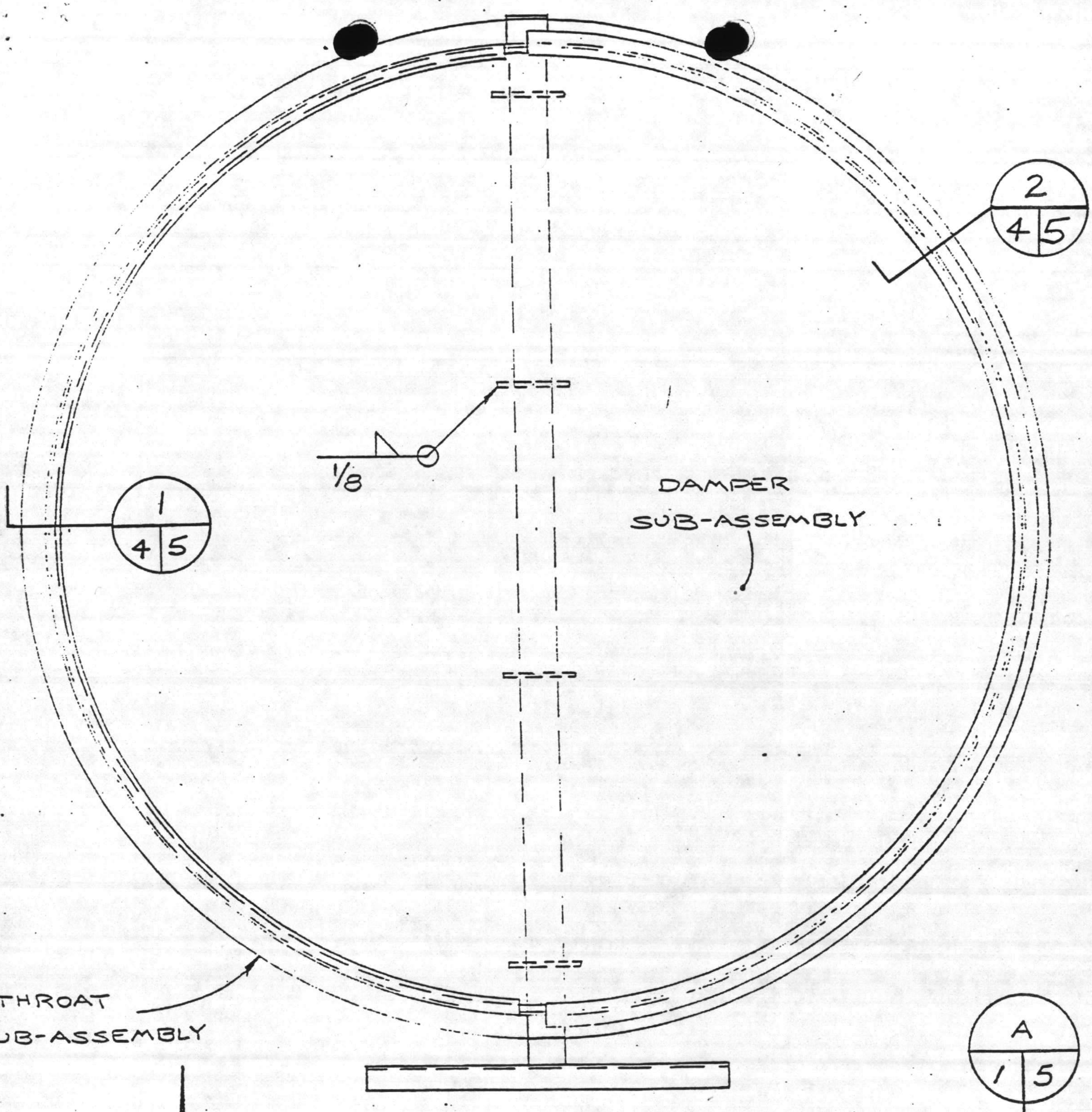

BY-PASS STACK (TYP.)
GUILLOTINE DAMPERS (TYP.)
ELECTROSTATIC PRECIPITATOR
PLAN VIEW
GUILLOTINE DAMPERS
TURNING VANES
BY-PASS STACK HOPPER
FLUE GAS FROM BOILER
INLET LADDER VANES
ELECTROSTATIC PRECIPITATOR
PERFORATED INLET PLATE
SECTION

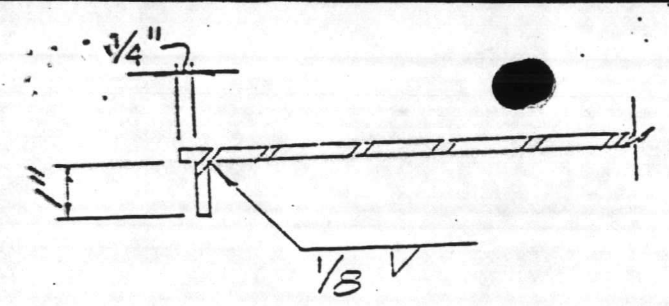
FIGURE 5



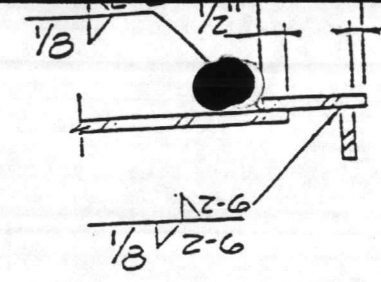
PLAN - STACK CAP ASSEMBLY

SCALE: 1"-1'-0"

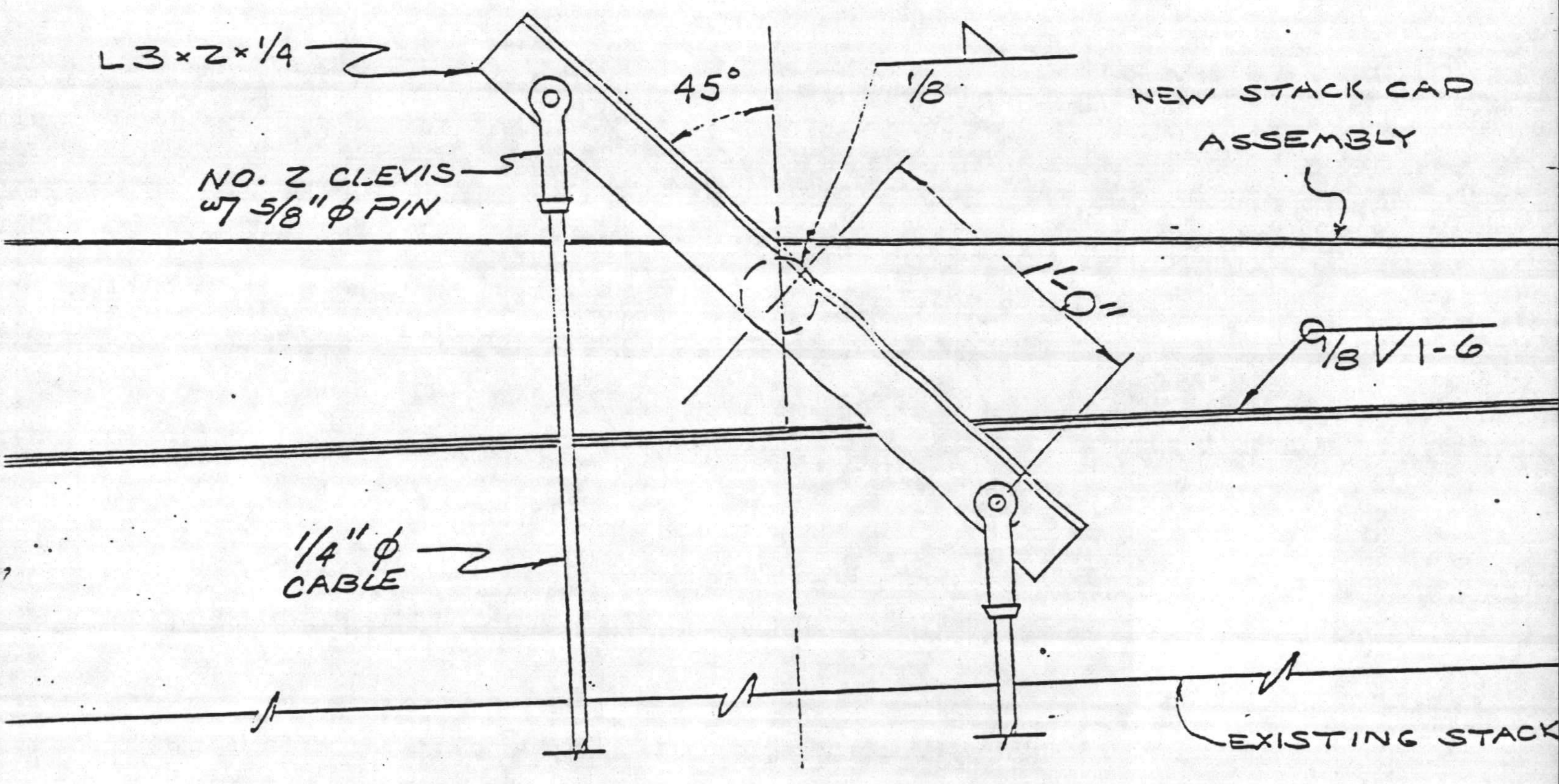
FIGURE 6



SECTION 1 / 4 | 5
SCALE 3"=1'-0"



SECTION 2 / 4 | 5
SCALE: 3"=1'-0"



ELEVATION A / 1 | 5
SCALE 1½"=1'-0"

STACK CAP DETAILS

FIGURE 7