AUTOMATIC PAINTING OF STRUCTURAL STEEL SHAPES

U. S. DEPARTMENT OF COMMERCE
MARITIME ADMINISTRATION
IN COOPERATION WITH
GENERAL DYNAMICS
QUINCY SHIPBUILDING DIVISION

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FOREWORD

This is a report on one of the many research projects being performed under the National Shipbuilding Research Program. The program is a cooperative, cost shared effort between the Maritime Administration and General Dynamics Quincy Shipbuilding Division. The objective, as recommended by the Ship Production Committee of the Society of Naval Architects and Marine Engineers, emphasizes improved productivity and therefore reduced shipbuilding costs to. meet the lower Construction Differential Subsidy rate goals of the Merchant Marine Act of 1970.

The studies have been undertaken with this goal in mind and have followed closely the project outline SP-1-8 as published by the SNAME Ship Production Committee.

We wish to acknowledge the assistance of Mr. David T. Bloodgood of Bethlehem Sparrow's Point Shipyard in the evaluation of proposals which resulted in the selection of Binks Manufacturing Company to do this research work.

Mr. Wilder Moffatt, General Dynamics, Quincy Shipbuilding Division, was the Program Manager. This report was written by Mr. L. M. Thorell, MarAd Program Manager and by Mr. Georg A. Rudlowski, MarAd Project Engineer.

AUTOMATIC PAINTING OF STRUCTURAL STEEL SHAPES

EXECUTIVE SUMMARY

Because of the large variety of sizes and configurations of structural shapes used in US shipbuilding, painting equipment manufacturers have been limited in the development of an automatic paint facility for this operation.

Other parameters which had to be considered in developing such a facility were all of the various coatings which are used in the US and the necessity of controlling the coating thickness within fine tolerances, particularly for weld-through primers, in order to be compatible with subsequent welding processes.

With the help of paint equipment manufacturers, we developed a prototype equipment to provide a reliable automatic paint facility capable of coating all shapes in US shipbuilding. The prototype has the capability to handle special or otherwise unusual shapes with minor modification.

Based on the experience gained in the process of developing and manufacturing the prototype equipment discussed herein, the Binks Manufacturing Company has developed an improved second generation of automatic equipment for painting structural steel shapes. This equipment can be tailored to suit the specific requirements and limitations of the user.

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Section 1
BACKGROUND AND OBJECTIVES

1.1 BACKGROUND

Because of the large variety of sizes and configurations of structural shapes used in US shipbuilding, painting equipment manufacturers have been limited in the development of an automatic paint facility for this operation.

Other parameters which had to be considered in developing the facility were all of the various coatings which are used in the US and the necessity of controlling the coating thickness within fine tolerances due to the requirements of the subsequent welding processes. The state-of-the-art in coating development vastly exceeded our ability to apply the coating correctly. It is important to note that initial application cost is only a fraction of subsequent removal and reapplication costs in the event of system failure. With the development of a suitable automatic facility for coating of all types of shapes for commercial and Government contracts, the shipbuilder's costs will be greatly reduced leading to reduced cost for the customer.

With the help of paint equipment manufacturers, we developed a prototype equipment to provide a reliable automatic paint facility capable of coating all shapes in US shipbuilding. The prototype has the capability to handle special or otherwise unusual shapes with minor modification.

A questionnaire was sent to US shipbuilders asking them to express their interest in a facility for painting structural shapes and to offer any

suggestions they had about such equipment. As the questionnaires were returned to us, we compiled this information so that we could determine the interest and needs of the whole industry.

A large number of the major shipbuilders in the US have installed or are installing automatic blast facilities for surface preparation of structural steel shapes. In some of these facilities so-called "automatic" paint facilities have also been installed. To date none of the automatic paint facilities has given the shipbuilder satisfactory results. Some of the problems the shipbuilder has incurred are the inability to obtain a uniform coating thickness on all shapes, excessive overspray, and continued mechanical breakdown.

By analyzing the questionnaires, we determined:

- What types of shape paint facilities are needed by the industry.

- Manning (optimum and required levels and disciplines per facility).

- Speeds and configuration limitations for each type of facility.

- Units of measure most representative for analysis (i.e., ton, foot, square foot, etc.) for complete facility cost analysis.

- The actual surface profile of cleaned shapes versus the surface profile requirements of the primer system. What types of painting equipment are available (manual, semi-automatic and automatic) for painting shapes.

Further we investigated the various primers that may be used in conjunction with coating shapes so we could determine what mil thickness would be required for the coating, particularly where subsequent welding procedures would be employed.

1.2 ENVIRONMENTAL REGULATIONS

We studied the Federal regulations and state and municipal environmental regulations, which vary a great deal as does the degree of local enforcement. Environmental regulations were an important factor in the shipyard's need for such specialized painting equipment.

1.3 PROCUREMENT OF PROTOTYPE HARDWARE

Equipment specifications, based on industry requirements, were developed and reviewed with the interested shipyards and sent to equipment manufacturers for solicitation of proposals. After review of the proposals, a contract was awarded to Binks Manufacturing Company for design and manufacture of the prototype hardware.

Section 2
PROJECT RESULTS

2.1 PROTOTYPE EQUIPMENT (See Appendices A and B)

The equipment developed and manufactured to automatically spray structural steel shapes is described below:

2.1.1 One Binks Type 1 Horizontal Reciprocating Machine, 18 in. Stroke, 4 Posts, 16 Guns (See Appendices C and D)

This unit basically consists of 16 Binks Model No. 61 guns mounted on a special reciprocating carriage that moves back and forth a fixed distance on double channel frame. The channel frames in turn are supported by four vertical posts.

The guns are controlled by two cam-operated three-way air valves with a variation of spray stroke from 18 in. to 12 in. The air valve is controlled by a set of split cams mounted on a wheel driven by the take-up shaft on the reciprocating machine so that the cams are always synchronized with the movement of the carriage. The cams are manually adjustable and preset before the production run starts. The split cams allow the operator to preset the cams in such a manner as to anticipate the lead and lag time of the "on-off" action of the guns.

In operation, the entire carriage assembly moves back and forth at a constant rate of speed with the conveyor carrying the ware to be sprayed. As the carriage reaches the end of each stroke, the cams provide a positive control for regulating the opening and closing of the guns. This operation, imitating hand spraying, saves considerable material and prevents accumulation of material on the nozzle of the gun which would cause spitting.

This automatic unit, as furnished, includes the vertical posts, two channel frames, complete carriage assembly including 16 guns with gun air and material manifolds, a 3/4 HP, 1750 RPM explosion-proof motor, 460 volt, 60 cycle, 3-phase mounted on a variable base, an oil and water extractor for regulating the atomization air to the guns, the necessary air and material hose with hose clamps and flexible springs to permit suspension of the hoses from the ceiling of the room.

In addition, a 3-way hand-operated air valve is incorporated in the unit which enables the operator to stop the spray guns from a remo e position while the machine is in operation. These guns can then be turned back on by the same valve.

A solenoid-operated 3-way air valve is also furnished with the machine. It is to be interconnected with the conveyor by the installer so that if the conveyor should stop due to electrical current interruption, the gums on the machine will stop spraying.

2.1.2 One Lineal Spray Control Unit (See Appendix E)

The horizontal reciprocating unit is furnished with a solenoid operated three-way air valve to control the guns as a unit. This will prevent the guns from spraying where wide gaps occur between shapes. The width is still controlled by cams manually preset.

The solenoid operated air valve is energized by the micro switches on the Binks Memory Ring. A limit switch mounted at the entrance to the booth transmits impulses to the Memory Ring whenever it is contacted by a part passing under it. The Memory Ring is furnished with two micro switches mounted on a base with a right angle drive.

Installer to mount the memory assembly and furnish means of driving the unit through a sprocket and chain from an idler or drive shaft of the conveyor.

As the shape enters the spray booth, it contacts a limit switch which remains energized as long as the shape is in contact with the switch. In this manner, the switch transmits the length of the shape to the memory unit. The memory unit energizes the solenoid air valve at the proper time to start the guns spraying as the shape comes into the spraying position.

2.1.3 One Binks Floor Type Spray Booth with Dynaprecipitor Unit (See Appendix F)

The booth is designed for a materials conveyor clear opening of 7 ft-0 in. wide by 3 ft - 6 in. high.

The dynaprecipitor unit is a special feature of the equipment package which was developed to satisfy the latest Environmental Protection Agency requirements.

The unit is equipped with a fan capable of moving the required amount of air through the booth at a predetermined velocity. Air movement in the booth is directed toward the water curtain and enters the Dynaprecipitor unit through an opening at the top of the water curtain where it passes through the first of four separate washes. This first wash and the counter-flow action of the air and water on the water curtain removes the major portion of the larger particles of pigment and a large percentage of the smaller particles. These are washed down over the water curtain into the collecting pan and therefore do not enter the wash chamber of the Dynaprecipitor unit.

In the washing chamber the air passes through three additional washing actions which remove practically all particles of paint pigment. These washing actions are formed by the circulating water which leaves the manifold at a high velocity through non-clogging orifices. A deflector plate above these orifices directs the water to each side of the manifold in a continuous and uniform flow through the unit. The quantity of water circulated, the number of individual washes and the large surfaces continually covered with water account for the superior washing action of the Binks Dynaprecipitor unit. The return line to the collecting pan from the manifold reduces the possibility of paint collecting in any piping of the system as this return eliminates all dead ends. A valve is placed in the manifold line to regulate and control the flow of water across the water curtain.

After removal of the paint pigments in the washing chamber the air passes through two rows of staggered distributing baffles which remove practically all entrained moisture from the air. From here the air passes through the fan and then to the exhaust stack where it is discharged to the atmosphere. The back wall of the Dynaprecipitor unit is provided with a full width access door for inspection and cleaning of the unit.

The collecting pan forms the base of the Dynaprecipitor unit and acts as a reservoir for the circulating pump and as a collecting pan for the paint pigments. A removable divider plate forms two chambers in this pan. By means of this divider plate the majority of paint pigment is held in the front section and can easily be removed. The divider plate is so located behind the submerged section of the water curtain as to form *a weir* which keeps the pigment in the front section and allows the clearer water to flow to the back chamber for circulating purposes.

2.2 PROCEDURE OF OPERATION

As the type and shape of structural member to be sprayed is established, the spray guns will have to be arranged accordingly.

As the structural shape is conveyed into the spray booth the spray guns, traveling back and forth parallel to the conveyor, spray the shape as it moves through the booth.

The set of 16 spray guns is split so that 8 spray guns are on each side and each set is individually controlled.

The spray guns are manifolded so that for painting smaller shapes some of the spray guns can be shut off where not required.

2.3 DETAILS OF PROTOTYPE CONSTRUCTION

Details of construction, dimensions and other information are provided in Appendix G.

Section 3
STATUS OF PROTOTYPE EQUIPMENT

3.1 TESTING PLAN

After satisfactory completion of preliminary factory tests, the equipment was shipped to General Dynamics, Quincy Shipbuilding Division. There it was planned to test the equipment under a variety of shipbuilding conditions and with an assortment of structural shapes. It was also planned to use different types of steel when blasting to ensure that we could achieve the required cleaning of all types of steel under varying conditions. Selection of necessary test samples of various configurations and types of steels was accomplished to provide a representative cross section of all shapes and types of steels which are encountered in shipbuilding.

In the meantime the manufacturing plan at General Dynamics, Quincy Shipbuilding Division was changed. This shape spray equipment was no longer required. The new manufacturing plan did not include a preconstruction weld through primer. In addition, it was originally planned to add this equipment to an existing shape conveyor system which included a shape blast unit and therefore the equipment was designed and built to be erected on an in-ground concrete pit and foundation. The equipment as built can easily be modified to a self-contained unit with an integral base for above ground installation.

However, the change in manufacturing plan and the unexpected high cost of installation of the as-built equipment strictly for test purposes negated its installation at the Quincy shipyard.

The equipment is currently in storage, in shipping containers at General Dynamics, Quincy Shipbuilding Division. Through the Martime Administration, Office of Advanced Ship Development, the equipment ‘- can be made available for use by an interested shipyard or other related industry.

Section 4
POTENTIAL BENE FITS

4.1 ANTICIPATED SAVINGS FROM AUTOMATED PAINTING OF STRUCTURAL STEEL SHAPES

The most significant anticipated benefit from the development of an automated paint facility for shapes is the reduction in manhours which will be required for those operations when performed by machine instead of manually as is now done. No attempt has been made to quantify resulting savings since many variables exist in manhour costs, techniques, assembly and erection methods, equipment and other contributing elements depending on the shipyard involved.

Other significant benefits to be gained are:

- Improved material control and utilization
- Improved quality of coating
- Reduced welding rejects due to uniform coating thickness
- Faster preparation and painting of shapes
- Reduced material handling
- Increased production flexibility because finished painted shapes could be stacked
- Uniform coating thickness on all surfaces

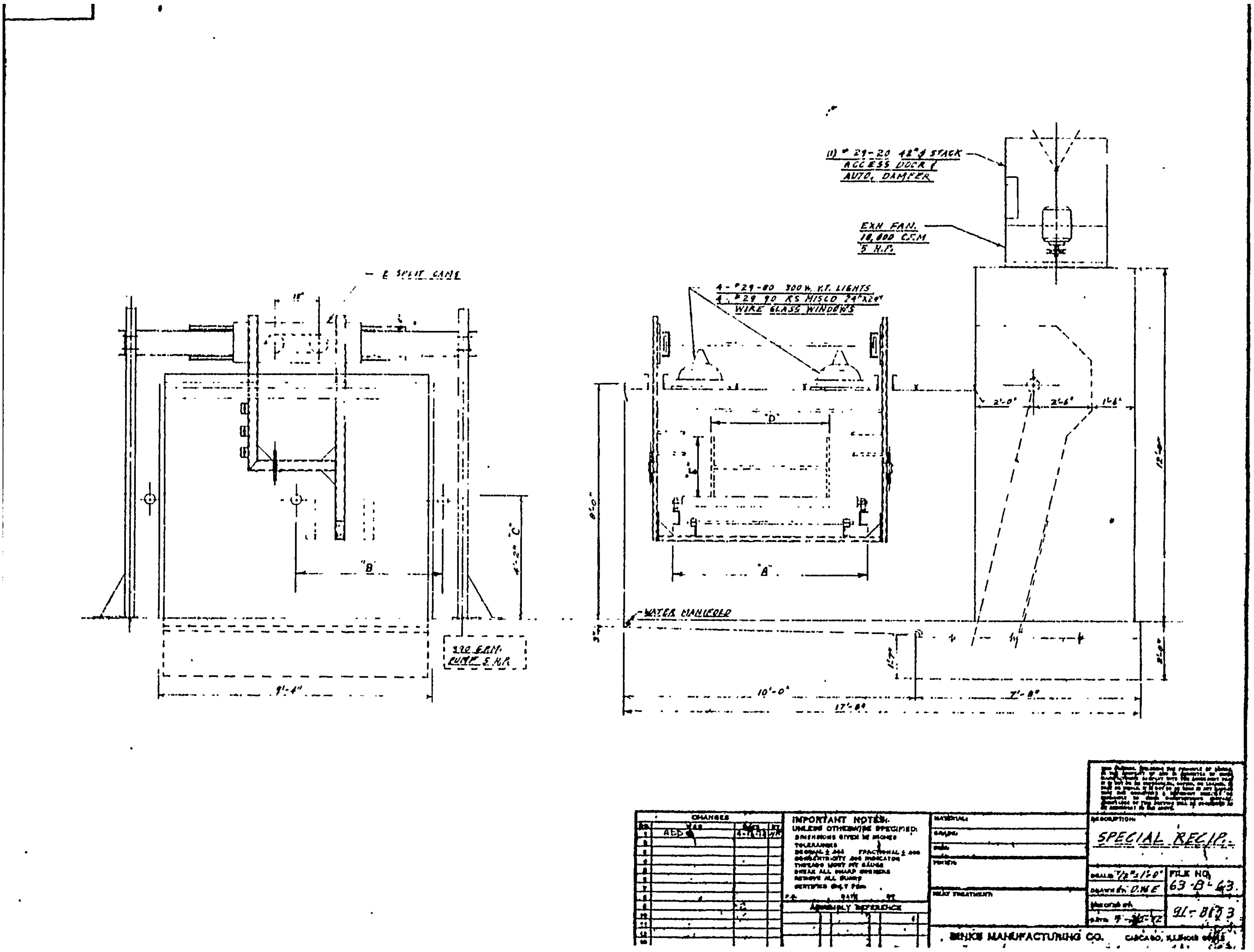
- Improved protection for longer periods of time
- Faster welding due to uniform paint thickness
- Reduction in the amount of paint used as a result of uniform application.

4.2 ADDITIONAL BENEFITS

Through the exchange of ideas with the shipbuilding industry and the design and construction of the prototype equipment the Binks Manufacturing Company gained much experience. Based on this, they developed an improved, second generation of automatic equipment for painting structural steel shapes. Depending on the specific needs of the user, the elements of the total equipment package can be integrated to automatically paint whatever shape configuration is desired. The equipment can be manufactured to be compatible with existing materials handling facilities, or for new installations, self-contained modules have been developed for installation with minimal site preparation.

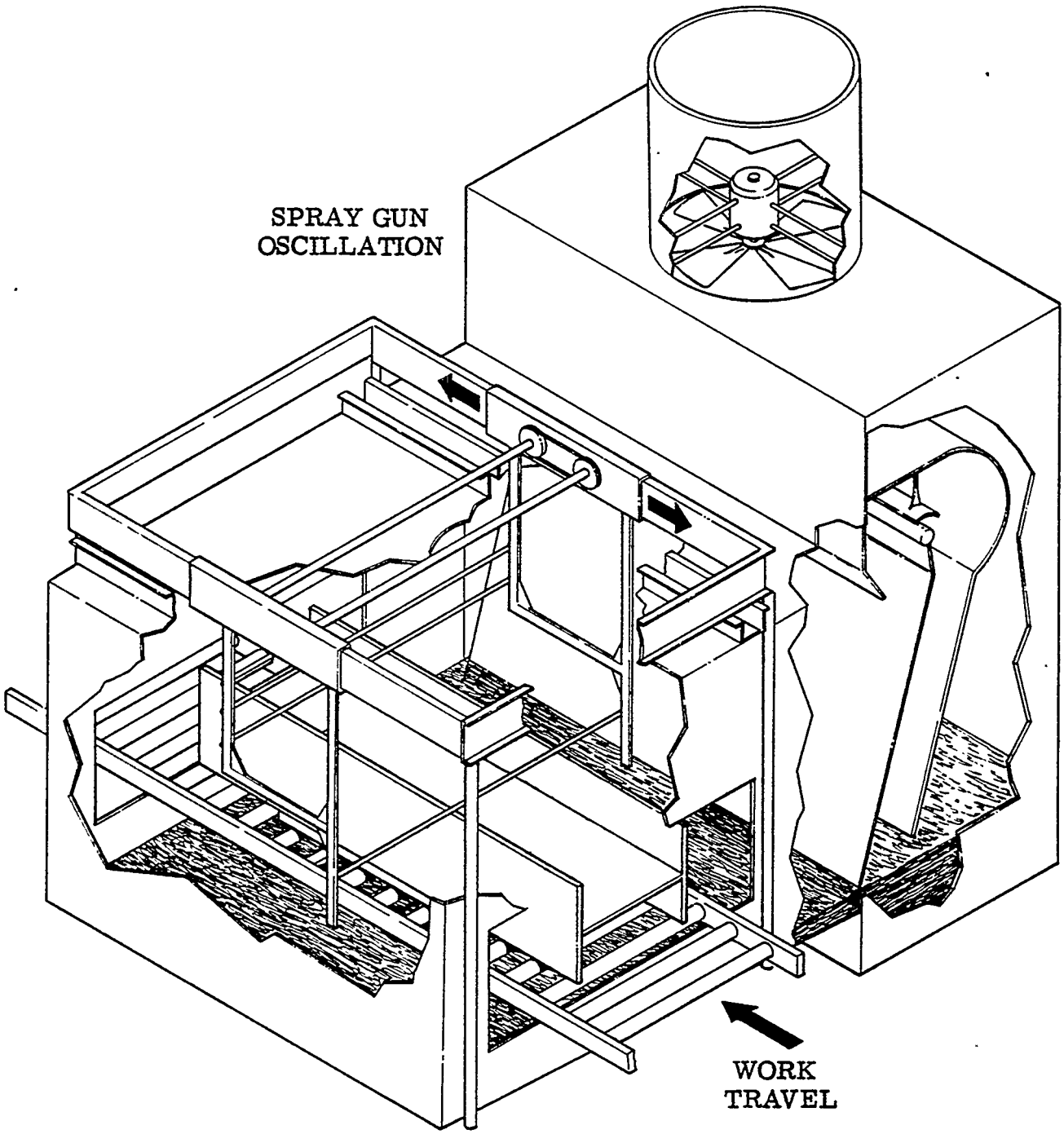
APPENDIX A

Special Reciprocator Drawing


(1) #29-20 42" Ø STACK
ACCESS DOOR &
AUTO. DAMPER
EXH. FAN.
18,000 C.F.M.
5 H.P.
4-#29-80 300 W. V.T. LIGHTS
4-#29 90 RS HISLO 24"x24"
WIRE GLASS WINDOWS
E SPLIT CANE
WATER MANIFOLD
120 G.P.M.
PUMP 5 H.P.
"A"
"B"
"C"
"D"
9'-4"
10'-0"
17'-8"
7'-8"
12'-0"
8'-0"
4'-2"
2'-0"
2'-6"
1'-6"
1'-7"
3"
IMPORTANT NOTES:
UNLESS OTHERWISE SPECIFIED:
ASSEMBLY REFERENCE
CHANGES
DESCRIPTION
SPECIAL RECIP.
FILE NO.
63-B-43.
91-8173
BINKS MANUFACTURING CO.
CHICAGO, ILLINOIS

APPENDIX B

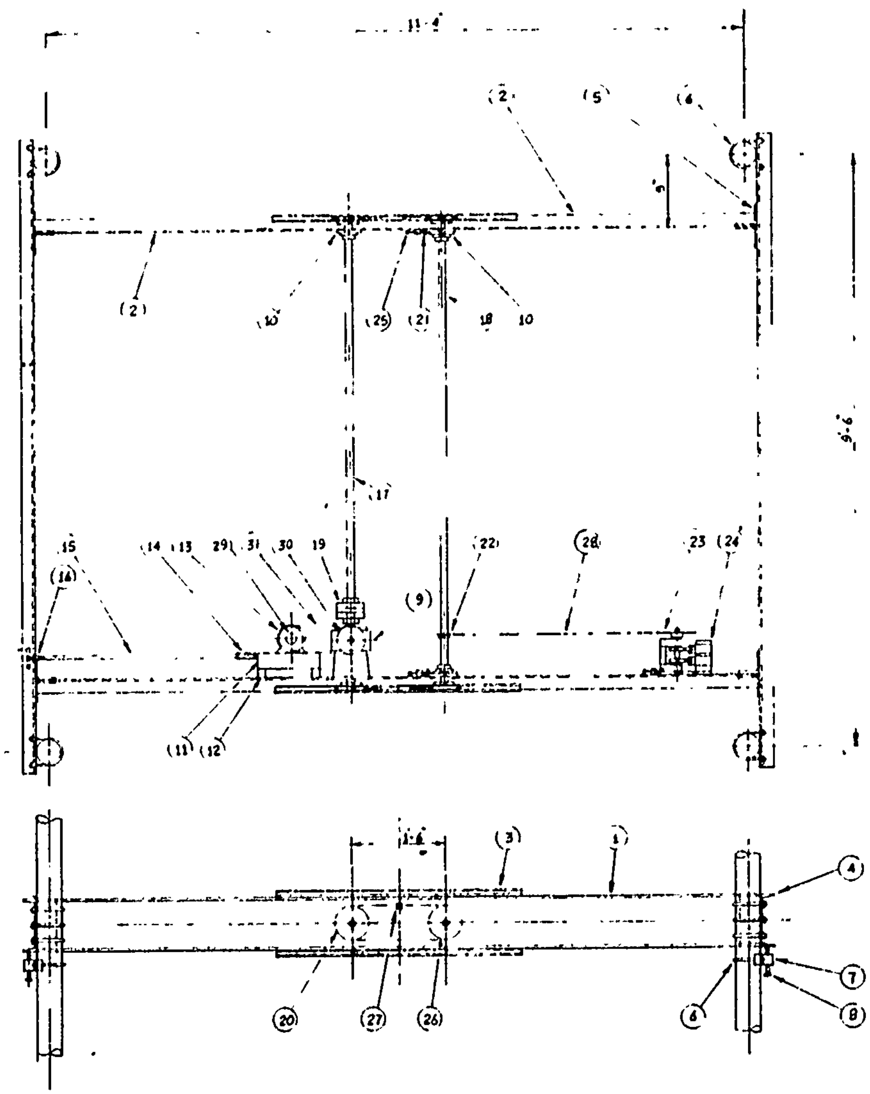
Binks Floor Type Spray Booth With Dynaprecipitor Unit



BINKS FLOOR TYPE BOOTH WITH DYNAPRECIPITOR UNIT

APPENDIX C

Semi-assembly Drawing
Double Channel Horizontal Reciprocator M/C



ITEM	PART #	FILE #	DESCRIPTION	QUAN
1	95-11222	66-B-13	RECIP CHANNEL FRAME (DRIVE SIDE)	1
2	95-11223	66-B-14	RECIP CHANNEL FRAME (IDLER SIDE)	1
3	95-11224	66-B-15	CARRIAGE TRACK	4
4	95-11225	66-B-16	CROSS SUPPORT	2
5	95-11226	38-C-191	CLIP ANGLE	8
6	93-42277		U BOLT	16
7	93-51849		ADJUSTING BRACKET	4
8	20-1975		5/8 X 5" SQ HD SET SCREW	4
9	93-9790	83-C-4	HEAVY DUTY REDUCER 9 2/3:1 R-H	1
10			BROWNING FLANGE BEARING FB200-1 1/4"	3
11	20-1844		MOTOR BASE	1
12	93-4198		MOTOR BASE SPACER	2
13	48-55561		1/2 HP EXP PRF MOTOR 440V, 60 CY, 3φ	1
14	93-4275		1/2 UNIVERSAL JOINT	1
15			1/2 CR ROD	1
16	20-1849		1/2" BRONZE FLANGE BEARING	1
17	95-11227	88-C-192	DRIVE SHAFT	1
18	95-11228	88-C-193	T U SHAFT	1
19			BROWNING FLEXIBLE COUPLING ASS'Y	1
20			RECIP DRIVE SPROCKET 40 BS 24	4
21	95-11229	88-C-194	T U BEARING MOUNTING PL.	2
22			MARTIN SPROCKET 35 B 20 W/1 1/4 BORE	1
23			MARTIN SPROCKET 35 BS 60 W/3/4 BORE	1
24	93-7516	42-B-54	SPRAY CONTROL ASS'Y	1
25	93-1344		CHAIN TIGHTNER ASS'Y	4
26	93-2050		72 LINKS OF #60 CHAIN INCLUDING CHAIN LINK	8
27	93-9124		CHAIN LINK ASS'Y.	8
28	93-2515		#35 CHAIN W/CONN. LINK 6 FT	1
29	95-3499		#850 REEVES VARIABLE SPEED PULLEY	1
30	20-2490		5" PD PULLEY A SECTION W/1" BORE	1
31	20-1165		A-35 VEE BELT	1

IMPORTANT NOTES: UNLESS OTHERWISE SPECIFIED

SEMI ASS'Y DRAWING OF A DOUBLE CHANNEL HORZ RECIP M/C

SCALE 1" = 1'-0"

FILE NO. 54-A-184

HAGY

6-28-73

95-11209

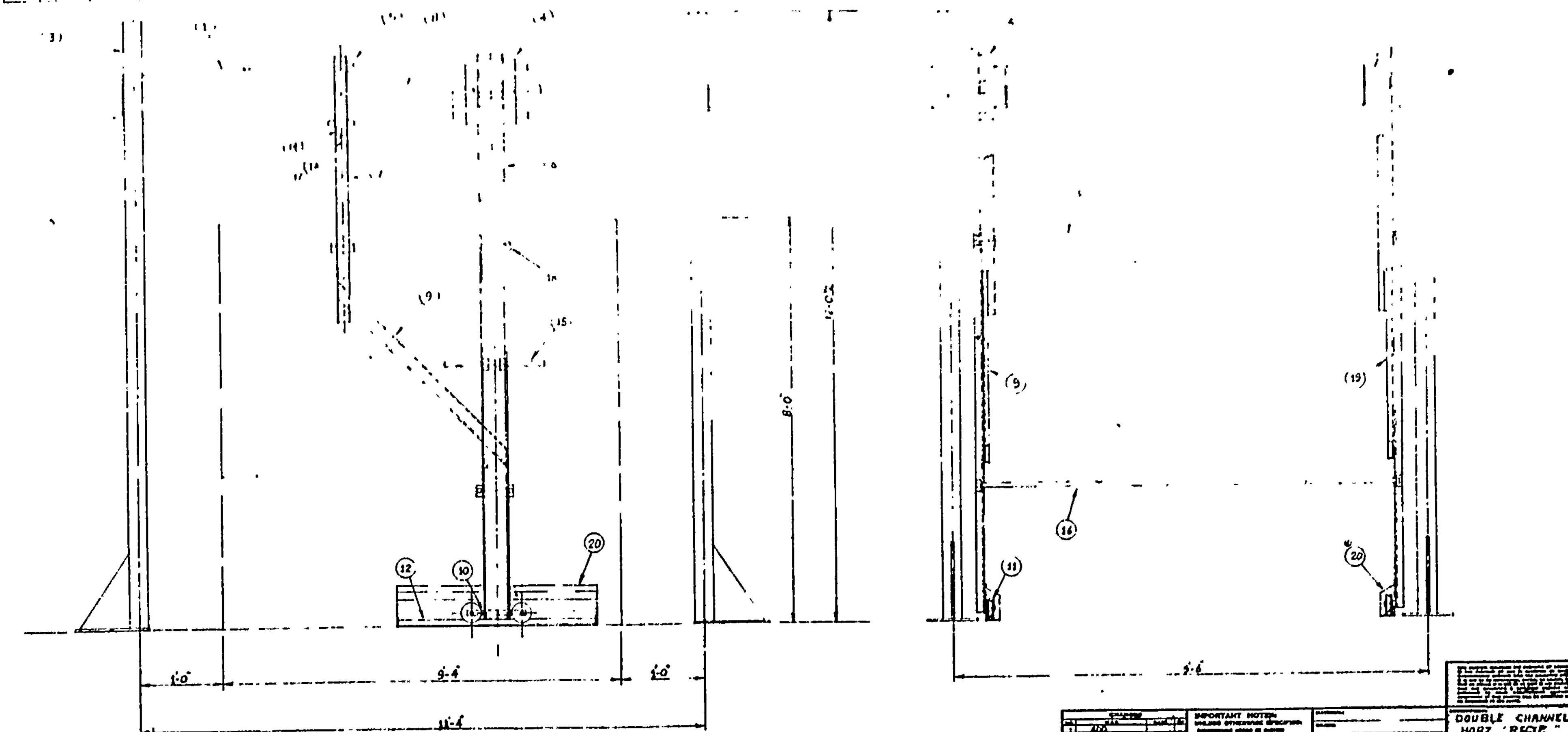
BINKS MANUFACTURING CO.

APPENDIX D

Double Channel Horizontal Reciprocator Assembly Drawing

ITEM	PART #	FILE #	DESCRIPTION	QUAN
1	95-112[illegible]	A 18[illegible]	SEMI ASS'Y OF A DOUBLE CHANNEL HORZ RECIP	1
2	95-1121[illegible]	A 185	HO.J HOOK UP	1
3	95 [illegible]	C 18[illegible]	CHANNEL POST 12-0 [illegible]	4
4	93 700[illegible]		CARRIAGE ASS'Y	2
5	93-633[illegible]		ROLLER SUPPORT ASS'Y	4
6	95 1121[illegible]	U 9	GUN SUPPORTING CHANNEL	2
7	95 11213[illegible]	H 10	GUN SUPPORTING CHANNEL (TOP)	2
8	95 11214[illegible]	C 188	CONNECTING CHANNEL	4
9	95-1121[illegible]	H 11	CONNECTING BRACE R.H	1
10	95 1121[illegible]	C 18[illegible]	CASTER MOUNT	2
11	97- 50[illegible]		4 DIA CASTER	4
12	95 1121[illegible]	H 12	CASTER TRACK	2
13	95 1146[illegible]	C-149	ROLLER SUPPORT HOLDING SCREW [illegible]	4

ITEM	PART #	FILE #	DESCRIPTION	QUAN
14	95 112[illegible]	U 39	ROLLER SUPPORT HOLDING BRACKET	2
15	95 112[illegible]	C 19[illegible]	GUN ROD - 2-0 LG	2
16	95 112[illegible]	C 190	GUN ROD - 1-0 LG	5
17	[illegible]		[illegible] SET	4
18	[illegible]		BASE	12
17			[illegible]	16
18	[illegible]		[illegible]	16
19	95 112[illegible]	U 38	CONNECTING BRACE L-H	1
20	95 112[illegible]	C 135	CASTER GUARD	2



IMPORTANT NOTES: UNLESS OTHERWISE SPECIFIED

DOUBLE CHANNEL HORZ. RECIP. ASS'Y.

SCALE 1" = 1'-0"

DRAWN BY HAGY

FILE NO. 56-A-183

A-2878

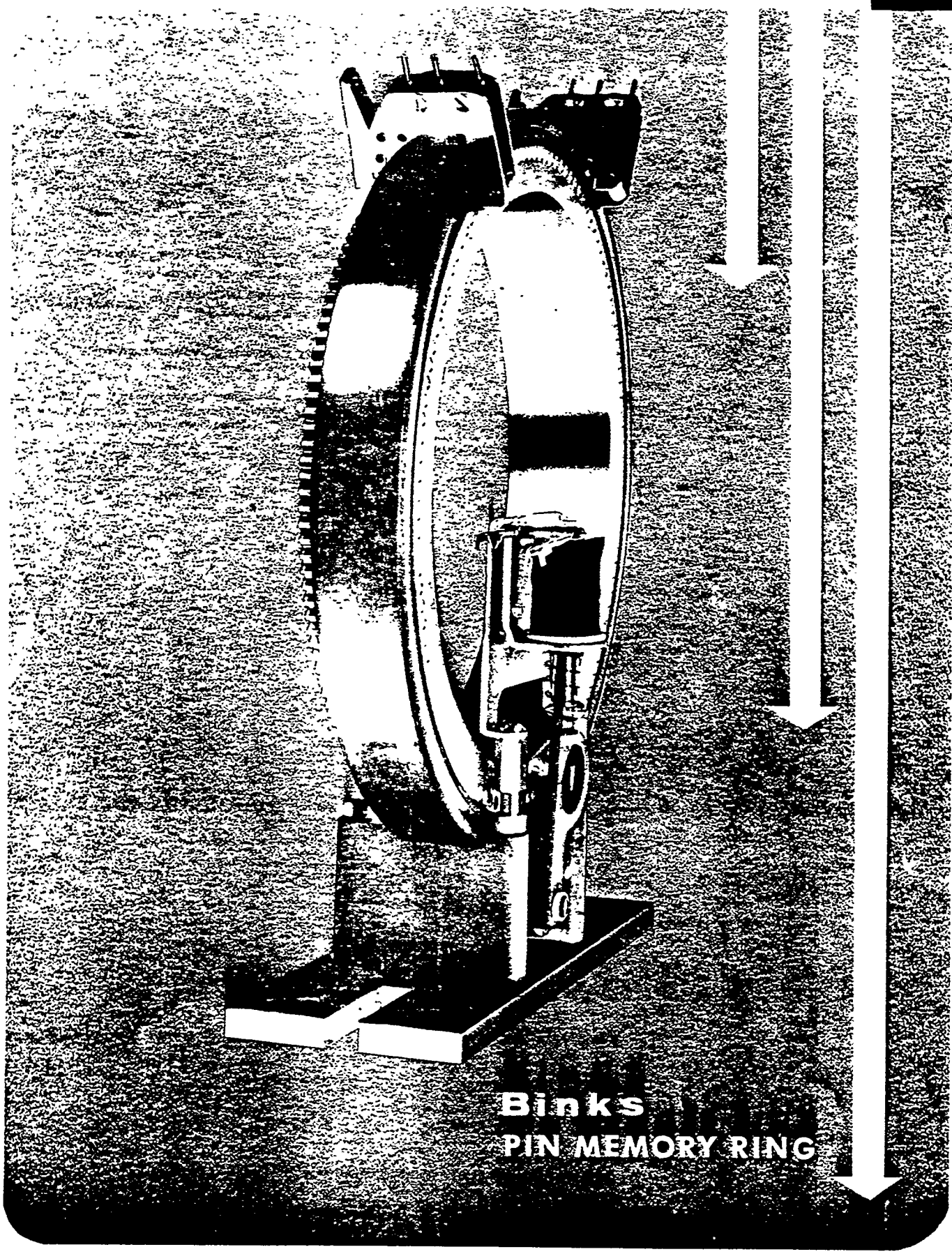
95-11208

BINKS MANUFACTURING CO.

APPENDIX E

Binks Pin Memory Ring

A96-1R-1



Features...

PRECISION ASSEMBLY

TROUBLE-FREE OPERATION

CONSISTENT PERFORMANCE

SIMPLE INSTALLATION AND MAINTENANCE

MECHANICAL MEMORY STORAGE

ELECTRICAL INPUT AND OUTPUT

INPUT 115 V AC OR 24 V AC AVAILABLE

Where to use

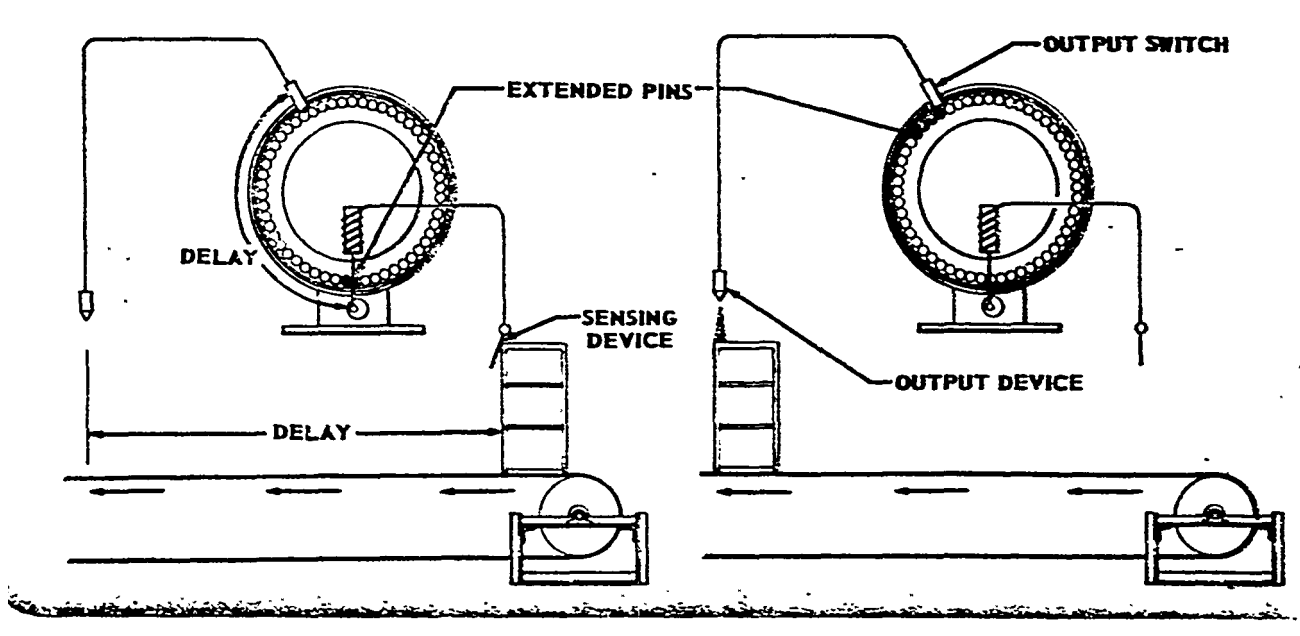
The Binks Pin Memory Ring is an electro-mechanical central device for use in electrical control circuits which require a memory or delayed output function related to a mechanical movement, such as:

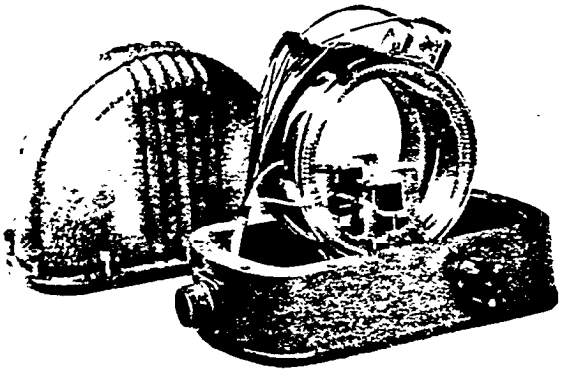
Automatic Machine Programmer
Conveyorized Process Control
Product Inspection and Rejection Systems
Product Sorting, Sizing, and Grading
Conveyor Transfer and Unlood
Package Filling and Binding
process Monitor
Automatic Spray Finishing System Control

About the Pin Memory Ring

When used in conjunction with automatic spray finishing machines, a pin memory control system can provide considerable savings of finishing material by triggering the spray guns only when the ware is in position to be coated. Where moving guns are utilized on reciprocating or rotary machines, the memory rings are used in a circuit to scan the ware on the conveyor, recognize irregular outlines and trigger the spray guns accordingly. This system permits intermixing different sizes and shapes of ware in random order and spacing along the conveyor.

In a typical system a rotating mechanical coupling is made between the memory ring drive shaft and the conveyor. A sensing device for each memory ring in the system is placed along the conveyor to measure the ware before it enters the spray zone. The sensing device signals the memory input solenoid to extend a number of pins out from the rotating inner ring. Activated by the movement of conveyor, the pins representing the ware, rotate to output switches clamped on the outer stationary ring. The output switches are placed in positions that correspond to the locations of the devices (spray gun trigger valve, solenoid actuator, alarm, etc.) to be actuated.

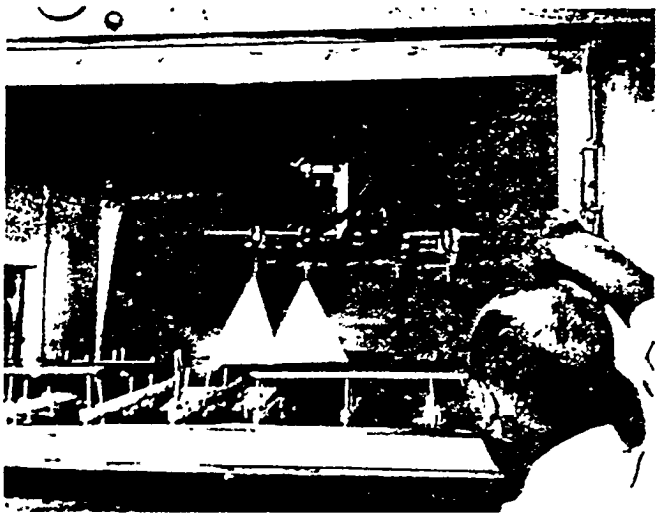




CAST ALUMINUM HOUSING WITH TWO PIN MEMORY RINGS

BASE PLATE MODEL

Horizontal reciprocating spray machine moves back and forth, spraying as it traverses width of conveyor. Under control of pin memory ring system, guns spray only when panel is in line of fire. Note that spray guns directly above panel are operating, but those at right are not, since nothing is beneath them.



Installation Standards

The memory ring should be mounted in a dust tight cabinet or cast aluminum housing to protect the unit from all dirt, dust, and contamination.

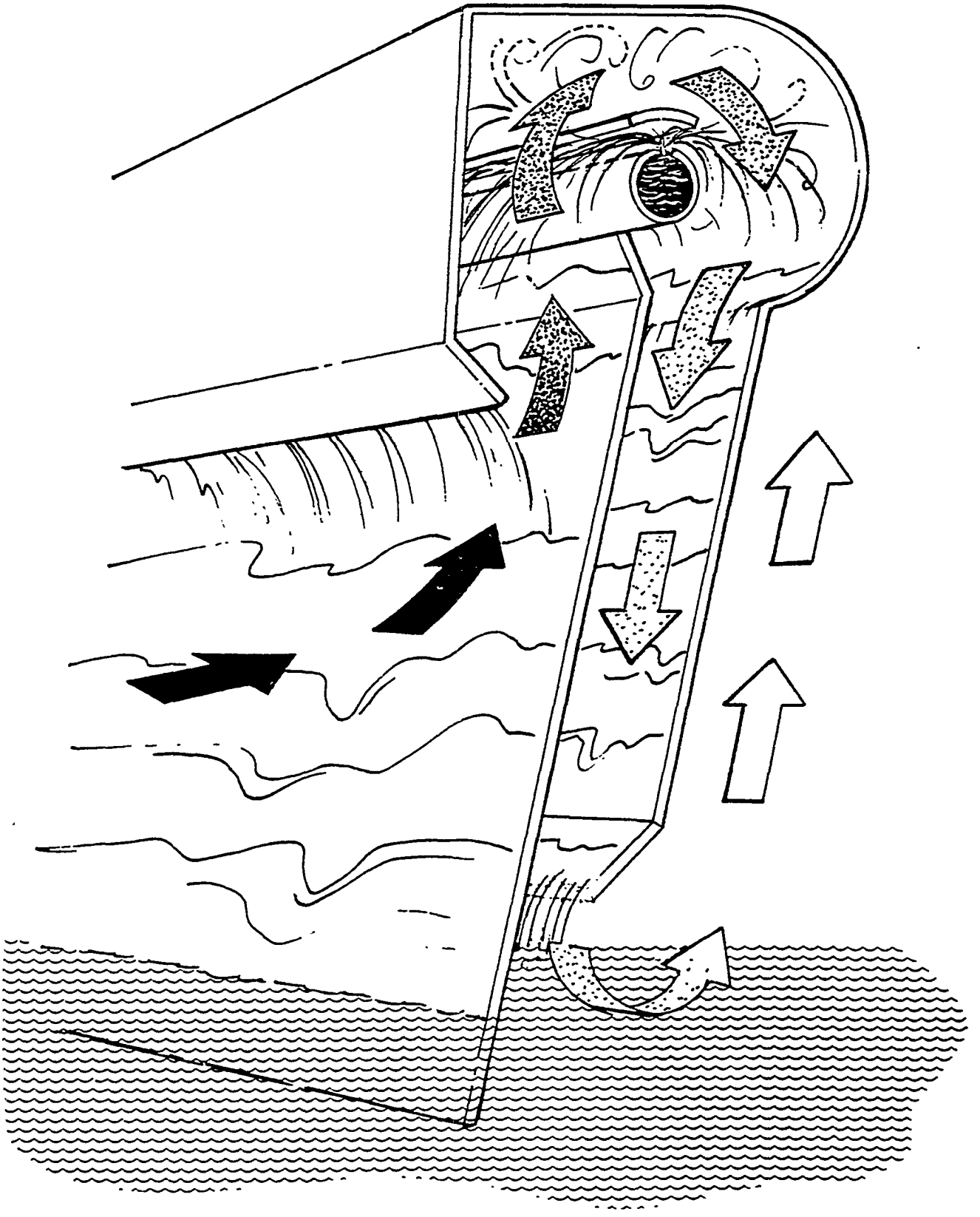
By installing a rotary connection between the memory ring drive gear and the conveyor system a synchronized movement is accomplished and the unit is then powered by the conveyor.

A sensing device, such as a micro-switch with sensing arm or photo cell relay, must be used to activate the memory ring. The sensing device may be located over, under, or alongside the conveyor at the point where the product passes. One sensing device should be used for each memory ring. Output channels are connected to solenoid valves, or other equipment activation controls.

TOTAL MEMORY	The distance in memory units (pins) from input cam to last possible output switch position – 104 pins, 3 revolutions of drive gear.
MAXIMUM SPEED	30 RPM of drive gear. Consult factory for specific recommendations. 1000 pins per minute. 10 total memory cycles per minute.
FIRST OUTPUT	First position possible for output switch after input cam – 6 memory pins.
DRIVE GEAR	38 tooth gear, 35 pins per revolution. NOTE: Gear has built-in clutch.
ROTATION	Inner ring of unit to rotate clockwise as viewed from the solenoid side. Therefore, the drive gear will rotate counterclockwise. Reverse rotation will not damage the memory ring.
ELECTRICAL INPUT	The solenoid operator can be actuated by remote limit switch, photo-relay or other sensing device. 115 V AC or 24 V AC, 6.3 volt-amp, solenoid operators available.
OUTPUT SWITCH	Clip on miniature micro-switch assembly, single pole with common normally open or normally closed terminals, U.L., 5A – 250 V AC. Output switches can be placed anywhere on outer ring between 6 and 104 memory pins from output cam. Switch is 3 pins wide. As many as 8 switches on a single memory unit are now in use.

APPENDIX F

Curtain Type Water Wash



CURTAIN TYPE WATER WASH

APPENDIX G

Details of Construction Equipment to Automatically Spray structural Shapes

DETAILS OF CONSTRUCTION

EQUIPMENT TO AUTOMATICALLY SPRAY STRUCTURAL SHAPES

GENERAL EQUIPMENT

1 - Double Channel Horizontal Reciprocating Machine
16 - No. 61 Automatic Spray Guns
16 - Gun Brackets
2 - Oil and Water Extractors
16 - Material Regulators
1 - No. 83-5707, 60-Gallon Pressure Tank
1 - Lineal Spray Control
1-9 ft - 0 in. Wide Water Wash Spray Booth

NOTE: Not provided is the conveyor, exhaust stack, motor controls, piping and wiring.

ONE BINKS FLOOR TYPE SPRAY BOOTH WITH DYNAPRECIPITOR UNIT

Booth Dimensions:
9 ft - 0 in. Wide
8 ft - 0 in. High
10 ft - 0 in. Working Depth
17 ft - 8 in. Depth Overall

The booth was constructed of No. 18 gauge black iron panels, each panel formed with companion flanges punched on 6-in. centers for bolted assembly. The panels were given a shop coat of paint. Each side of the booth contains a conveyor opening 7 ft - 0 in. wide by 3 ft - 6 in. high.

The booth has a 4-3/4 inch fire deflector curtain running the full width.

LIGHTING EQUIPMENT

4 - No. 29-80, 300-watt, vapor proof type reflectors (less lamps),
4 - No. 29-90, R. S. Misco 24-in. x 24-in. wire glass windows.

DYNAPRECIPITOR UNIT

Arranged for top exhaust.

Dimensions:	9 ft- 0 in. Wide
	12 ft - 0 in. High
	7 ft - 8 in. Deep

DYNAPRECIPITOR UNIT SPECIFICATIONS

The unit was constructed of fabricated panels of 18-gauge black iron, each panel formed with companion flanges punched on 6-in. centers for bolted assembly. All panel corners were welded. Rubber gaskets were fitted between panels. The panels were given a shop coat of paint.

A special set of distributing baffles were furnished and arranged in staggered positions. These distributing baffles form the lower portion of the secondary water curtain and are continually washed by the water from the manifold.

An 18-gauge water curtain made in removable sections forms the face of the Dynaprecipitor unit. This curtain has been properly reinforced to obtain a smooth flat surface. The air intake to the unit is located at the top of this curtain.

The water manifold located above the water curtain has been constructed of steel pipe with a series of l/4-inch nipples. Eight GPM of water are discharged from each of these nipples, which are so arranged that 24 gallons per minute of water are discharged over each lineal foot of washer, and 12 GPM of the water flows over each lineal foot of the water curtain.

The collecting pan was made of sheet steel (14 *gauge* to 10 gauge depending on width of pan) with continuous welded seams, and has been provided with a 3-inch to 6-inch drain and a 2-inch overflow. A removable plate running the width of the collecting pan divides it into two sections, one section being a settling area for accumulation of sludge and the second section providing sludge-free water to the pump.

RECIRCULATING PUMP UNIT

1 - Pump having a capacity of 390 GPM
1 - Motor, 5 0HP, 460 volt, 60 cycle, 3-phase, explosion-proof (Starter not included.)

The pump unit is of the centrifugal type, having a rigid base with a flexible coupling for direct connection to the motor. The capacity of this pump is based on a delivery of 24 GPM per lineal foot of width of the Dynaprecipitor unit at 40 ft head.

EXHAUST FAN UNIT

1 - No. 30-780, 42 in. diameter exhaust fan
1 - Motor, 7-1/2 HP, 220/440 volt, 60 cycle, 3-phase, explosion-proof

Total Fan Capacity	18,000 CFM
Average Face Velocity	200 FPM

The fan is designed to give maximum exhaust capacity. The motor is mounted outside of exhaust duct on adjustable base. Power is transmitted through "V" type belts, passing through dust-tight housing. Fan blade is constructed of non-ferrous or non-sparking material and built to meet the Underwriters' approval. The Dynaprecipitor unit includes an access door for servicing the exhaust fan.

EXHAUST STACK

1 - 3 ft - 0 in. length 42 in. diameter exhaust stack with access door and automatic damper. Balance of stack by others.

The exhaust stack has been constructed of 20-gauge galvanized sheet metal which conforms to the usual standard construction for this type of material.

PRESSURE MATERIAL TANK

83-5707 galvanized 60-gallon pressure material tank with top outlet and air motor-driven agitator, pressure regulator gauge, safety and relief valves and easily removed head for refilling paint materials used in connection with the spray guns.