RECEIVING • INSTALLATION • MAINTENANCE

INSTRUCTIONS

TYPE PV

VERTICAL AIR FLOW-MANUAL WASH

Westinghouse

Precipitron®

THE *ELECTRONIC* AIR CLEANER

for

Industrial and Commercial Applications

115 Volts
Single Phase

60 and 50 Cycle
Alternating Current

The Precipitron is an electronic air cleaning apparatus used in ventilating and air conditioning systems of industrial plants and commercial establishments to remove soot, smoke, dust, oil mist and other air borne particles.

In order to produce the results expected of the Precipitron, it must be properly installed and maintained. Whether installed by itself or in conjunction with air conditioning equipment, this instruction book gives the correct steps and precautions to be taken.

WESTINGHOUSE ELECTRIC CORPORATION
HYDE PARK • STURTEVANT DIVISION • BOSTON 36, MASS.

NEW INFORMATION

EFFECTIVE MAY, 1955

RECEIVING AND HANDLING

An instruction package is forwarded separately to the customers' shipping address for each PRECIPITRON unit. This package includes a bill of material, an instruction booklet and an operation chart. Contents of this package should be carefully preserved because it is needed for receiving, installation and operation of the unit.

To facilitate handling and erection, the parts of a PRECIPITRON are packed in individual containers, each marked as to the contents. The bill of material (See instruction package) may be checked with the shipping notice forwarded with every shipment. The package containing the accessories also includes an individual packing list.

Upon receipt of shipment, any evidence of damage or loss should be reported immediately to the last carrier for inspection by an agent of the transportation company. A claim should be filed by the customer against the carrier to cover any shipping damage or loss.

Handle the equipment carefully to prevent breakage or damage. Except for the initial inspection, store the parts until needed in the original shipping container in a clean dry location protected from the weather. Do not remove shipping straps or retainers until the parts are ready for installation.

For actual erection, the parts will be used in the following order:

1. Instruction package.
2. Frame(s)
3. Frame support (2 frame units only)
4. Power Pack
5. Accessories
6. Cells
7. Ionizer(s)
8. Two frame kit (for 2 frame units)
9. High Voltage cable
10. Two ionizer kit (for 2 ionizers per unit)
11. Baffle (and filters)
12. Adhesive and Applicator

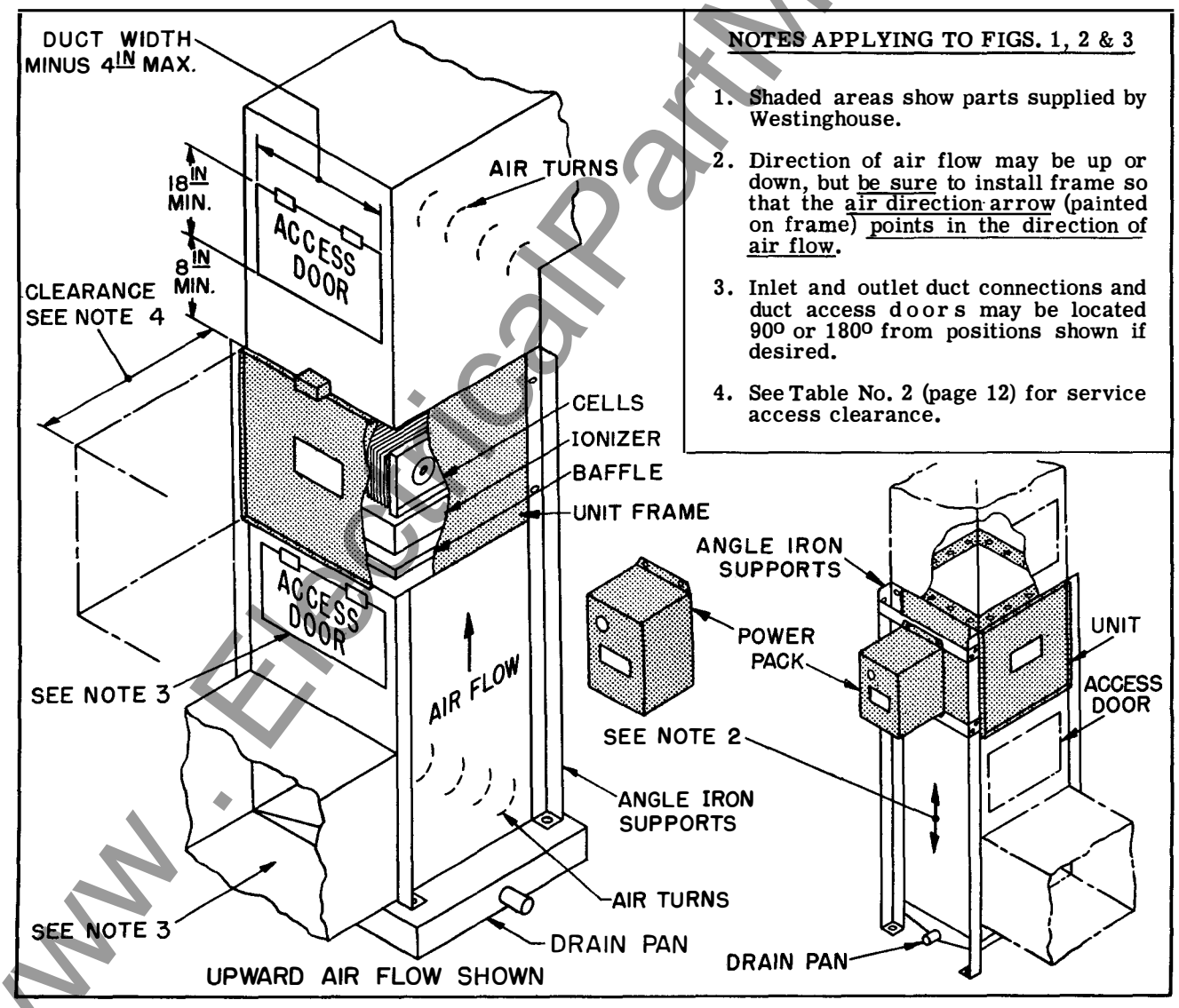

Fig. 1. Suggested Methods of Mounting on Floor

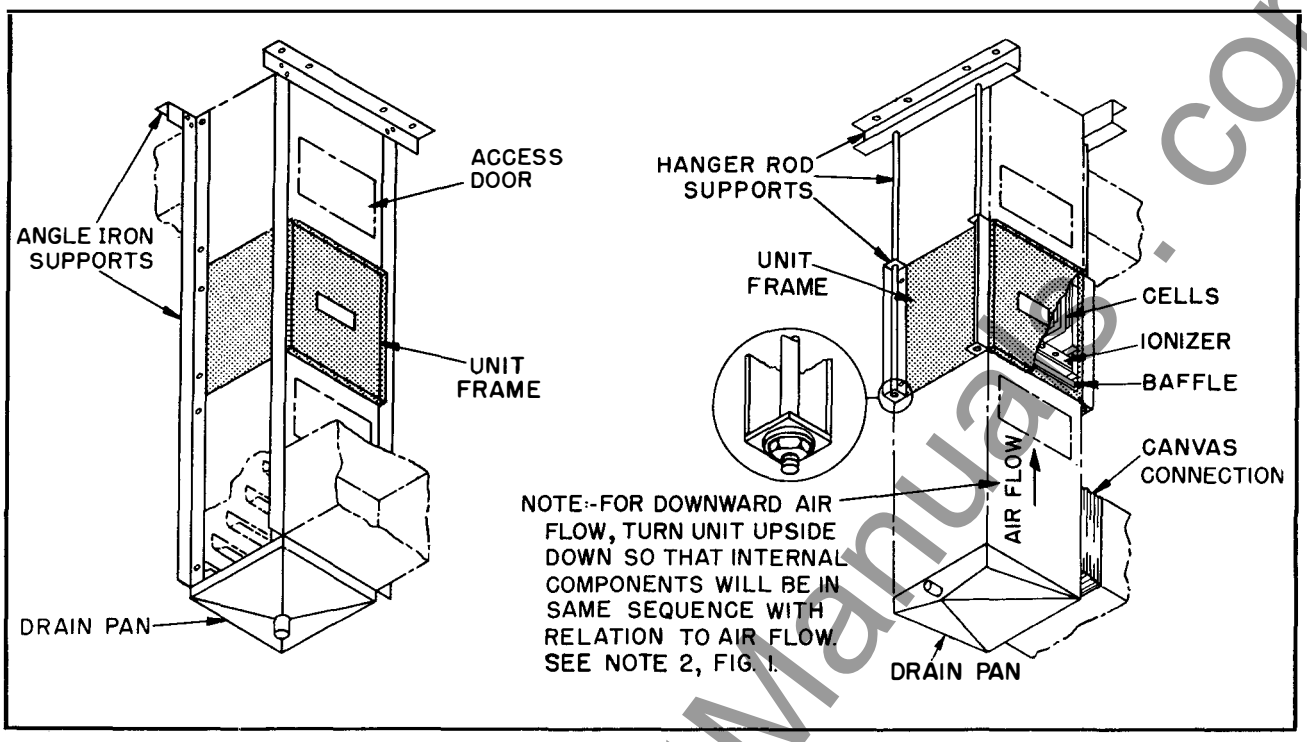

Fig. 2. Suggested Methods of Mounting from Ceiling

INSTALLATION

Application. Type PV PRECIPITRON units may be used for normal air cleaning or for oil mist control applications. Differences in installation and operation procedures are pointed out where pertinent.

Westinghouse Supplies necessary basic parts for a complete PRECIPITRON installation as listed in the Bill of Material. Westinghouse also supplies such items as: special hardware, high voltage cable and special electrical connectors.

Customer Supplies regular construction items which are not included in the Bill of Material, such as duct work, mounting supports and bolts, conduit, low voltage wiring, drain pan and plumbing. The following installation instructions give further details as to the source of individual items.

Installation and Operating Requirements. Successful installation and operation of the PRECIPITRON unit requires consideration of the following points, both before and during installation:

1. Proper air flow.
2. Sufficient space for cabinet, including access clearances.
3. Suitable mounting supports.
4. Proper duct connections.
5. Adequate drain, hot water and electrical facilities.

Air Flow Requirements. The PRECIPITRON unit is sized to clean a specified quantity of air (cfm) with an effective efficiency of 90%. To obtain this efficiency, the cfm through the frame should not exceed the rated cfm. Overall cleaning efficiency also depends a great deal on uniform air flow throughout the frame. The air velocity through any part of the frame should therefore not exceed the rated velocity of 333 f.p.m. by more than 10%. The perforated baffle helps to equalize the air flow through the frame. However, sharp bends and irregularities in the ducts may still cause unequal air flow. Where this is unavoidable, splitters, turning vanes or baffles ahead or behind the frame may be necessary to assure uniform air flow.

Outside Air Intakes should be sized generously to minimize excess dirt being sucked in by high air velocities. It should be located so as not to bring in high concentrations of heavy dirt, corrosive fumes or electrically conductive particles, and should be orientated away from the prevailing winds. Most important, the intake should be equipped with weather louvres or dampers to prevent entrance of rain or snow, plus a cleanable screen of 8 to 16 mesh to keep out leaves, insects, etc. It is a good practice to locate the PRECIPITRON frame at least three feet down stream from the outside air intake to provide a settling space for the larger particles.

Lint. Where recirculated air is brought into the unit, presence of excessive quantities of lint may necessitate some sort of lint screen across the duct opening. Lint tends to collect on ionizer wires and holders and will generally interfere with the proper functioning of the PRECIPITRON.

Space Requirements and Clearances. Exact overall dimensions and clearances are shown on Dimension Sheets 1420 supplied with the order. It is important to allow clearance space in front of the

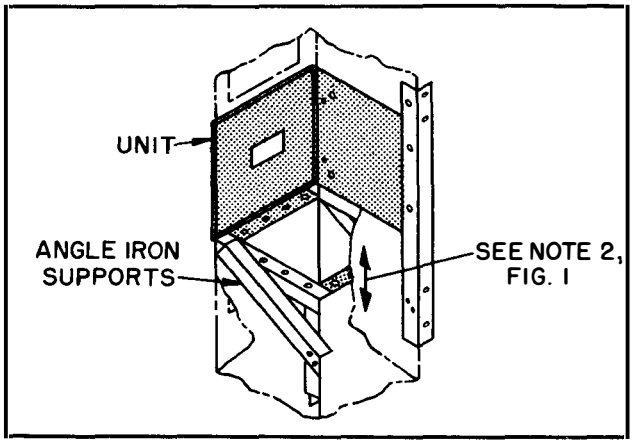

Fig. 3. Suggested Wall Mounting

access panel. See Fig. 1. This space is needed for inspection, servicing and removal of the internal parts. 30" clearance is likewise recommended in front of duct access doors.

Mounting. Type PV PRECIPITRON unit frame may be suspended from the floor, ceiling or wall as shown in Figs. 1, 2 and 3. The supporting members should be sized in accordance with good engineering practice to prevent swaying or buckling of the frames. Approximate net weights of frames, complete with internal parts are given in Table No. 2 (page 12).

Before installing the frame (See Fig. 4) remove the front access panel, being careful not to loose the hardware packed inside the frame. The internal parts (cells, ionizers and baffles) should not be installed until the frames have been mounted and duct connections have been made.

The air flow may be either up or down as required. Be sure to install the frame so that the air direction arrow (painted on the frame) points in the direction of air flow.

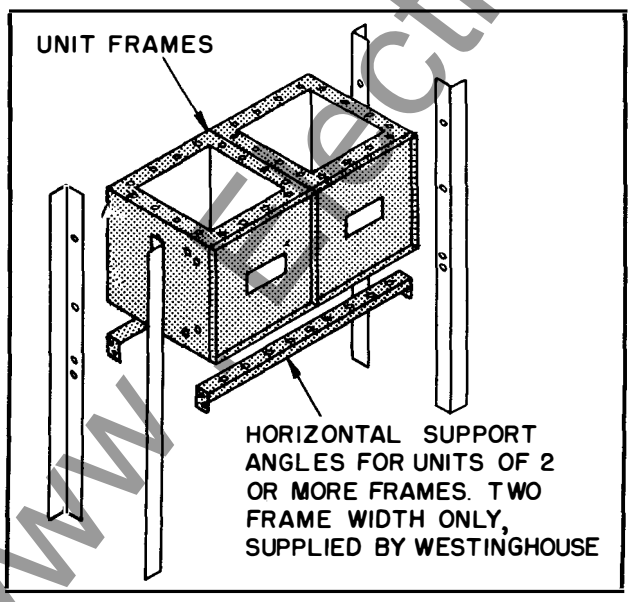

Fig. 5. Two Frame Supports

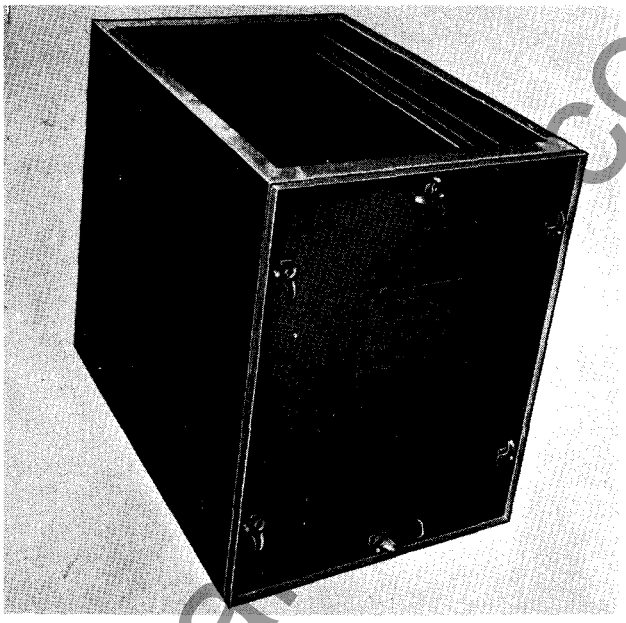

Fig. 4. Typical Frame

Use the 7/16" holes provided in the sides of the frame for bolting the frame to the support members. (Bolts and supports furnished by others).

For elevated mounting, provision should be made for convenient and safe access to the front panel and duct doors. This is needed to inspect and service the internal parts.

Multiple Frame Units. Two or more frames may be mounted side by side where larger capacity is required. These installations require horizontal supports to prevent distortion of the frames. See Figs. 5 & 6. Standard two frame units (see Table No. 2) are furnished with two support angles for this purpose. These supports are drilled to match the holes in the frame flanges. (Bolts supplied by others). Horizontal supports are not supplied for units having three or more frames and must be furnished by others to suit the installation.

In installing multiple frame units, it is best to bolt the frames together horizontally and then bolt

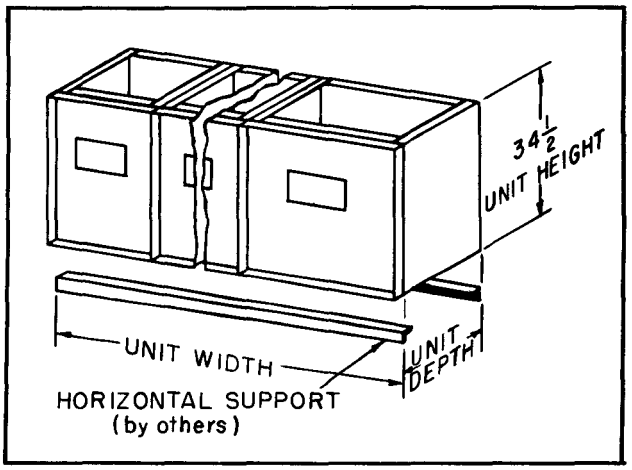

Fig. 6. Supports for Three or More Frames

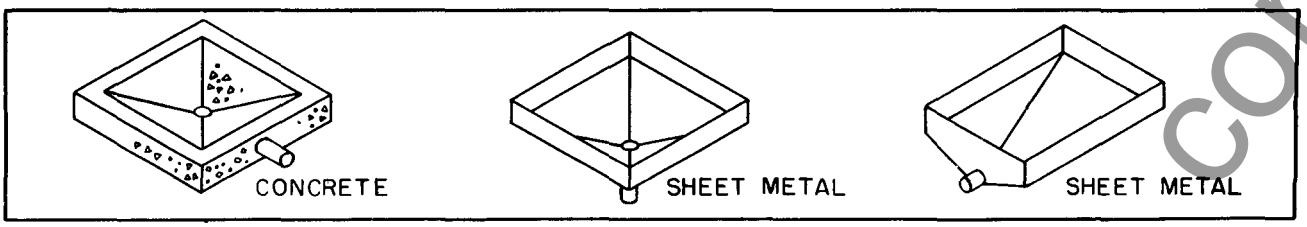

Fig. 7. Suggested Types of Drain Pans (2" Min. Dia. Drain Pipe)

them to the supports after the duct connection is made. See Figs. 6 & 9.

Drain. A drain pan should be provided as indicated in Figs. 1 & 2 for catching wash water during servicing. See Fig. 7 for suggested types. The pan should be piped to the sewer in accordance with good plumbing practice using 2" min. pipe size. The drain pan connection to the duct should be water tight. Locate the pan so that ducts below the unit frame may be pitched toward the pan.

For oil mist control applications, the drain pan should be piped to an oil sump and equipped with a "U" trap with sufficient head to prevent blockage of oil flow or air leakage due to the fan suction.

Ducts. Typical duct connections are shown in Figs. 1 & 2. Duct work must be of tight construction to prevent air leaks; particularly leakage of uncleaned air into the cleaned air stream.

Sharp bends in the ducts near the frame should be avoided to assure uniform air flow throughout the frame. See AIR FLOW REQUIREMENTS. Where duct sizes are different than the flanged openings on the frame, the connections should taper as gradually as space limitations will allow. For uniform air flow, this taper should not be greater than one foot in three feet of duct length. Ducts under the frame should be pitched toward the drain pan.

Frames are equipped with flanges top and bottom, which are drilled with 5/16" holes to facilitate connections to the ducts. 1/16" thick gaskets (Vellemoid or equal) should be installed between the flanges and the duct to provide an air and water tight seal. See Figs. 8 & 9. Bolts and gaskets for duct connections are not supplied with the unit.

Duct Access Doors above and below the frame are recommended to facilitate inspection and servicing. Doors should be gasketed and provided with latches to prevent leakage of air and wash water. See Figs. 1 & 2.

Water Supply capable of delivering 130-150°F. water with a minimum running pressure of 30 psi, is required to properly wash off the collected dirt. Hot and cold water lines (1/2" ips min.) are recommended. Provide each line with a hand valve and then bring together with a common outlet for a hose connection. Locate the water supply close to the unit. Provide a hose long enough to reach all sides of the frame, together with an adjustable stream nozzle (ordinary garden variety). See Maintenance for further details.

For oil mist control applications, facilities should be provided to dip the cells and ionizers after they are removed from the frame. See Maintenance for further details.

Power Supply required is 115 volts (plus or minus 5 volts) a.c., 1 ph., 60 or 50 cy. If the supply varies more than rated 115 ± 5 volts, the local power company or a competent engineer should be consulted and the voltage corrected to assure proper operation.

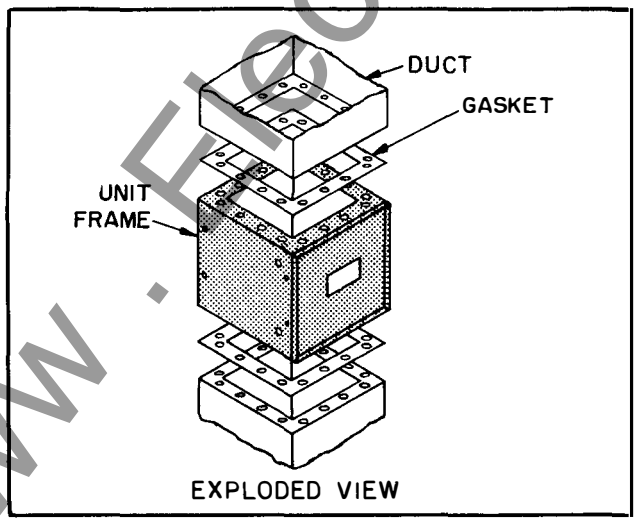

Fig. 8. Duct Connections

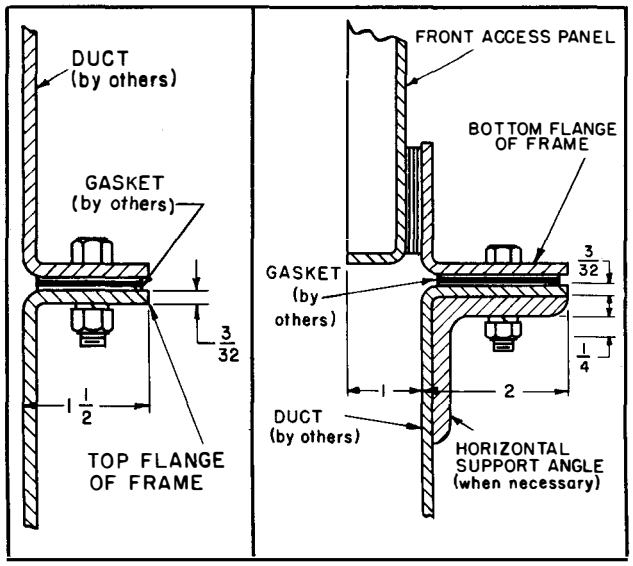

Fig. 9. Details of Duct Connections

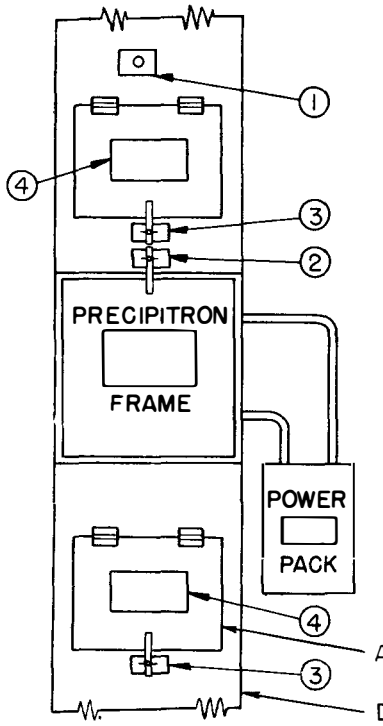

TABLE OR ACCESSORY ITEMS

ITEM	DESCRIPTION	REQ	SUPPLIER
1	Red Pilot Light	1	W
2	Frame Access Panel Interlock Switch	1 per frame	W
3	Duct Access Door Interlock Switch	2	W
4	H. V. Sign	2	W
5	Conduit Fixtures and Wiring	To Suit	Others

Fig. 10. Typical Location of Low Voltage Accessories

LOW VOLTAGE WIRING

Figs. 10 & 13 show typical low voltage connections.

Power Pack supplied with the unit should be mounted close to the frame on an adjacent wall, or on a suitable mounting stand. Four 3/8" mounting bolts (not supplied) are required. Refer to the instruction book packed inside the power pack for further details.

Interlock Switches are supplied as a positive means to de-energize the power pack when the frame access panel or the duct access doors are opened. One of these switches is packed with each frame for use with frame access panel. Two interlock switches are supplied with the accessories for the duct access doors.

Mount the interlock switches as shown in Figs. 10 & 12. Wire the switches as shown in Fig. 13.

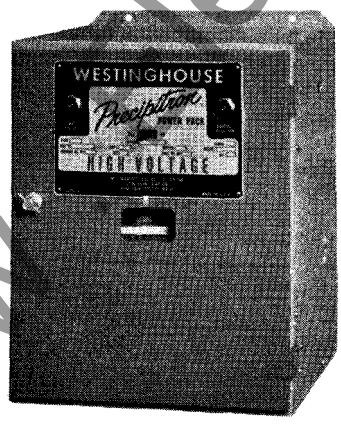

Fig. 11. Power Pack

Each access panel and duct door should be equipped with an interlock switch, installed so that the panel or door cannot be opened until the time delay screw has been removed. This is a safety precaution for the operator. The duct access doors should be equipped with separate clamps or catches to make them air tight.

Red Pilot Light supplied with the accessories should be installed so that it is visible from the frame access panel and the duct access doors. See Figs. 10 & 13. This light warns when power is connected to the power pack.

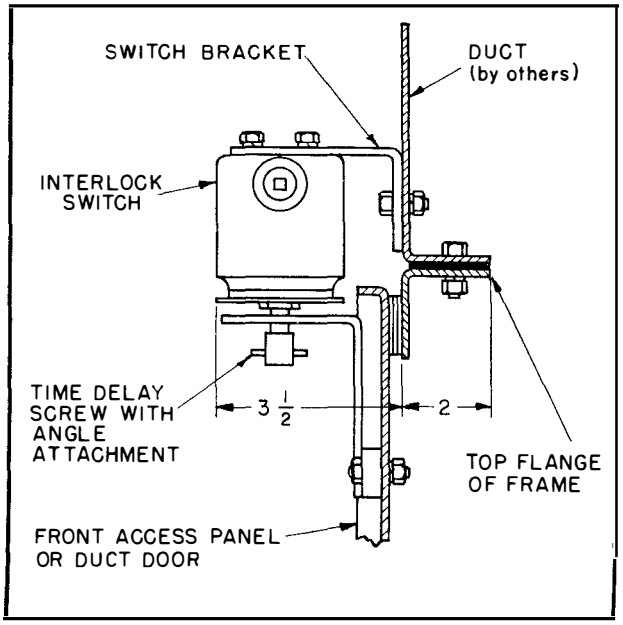

Fig. 12. Interlock Switch

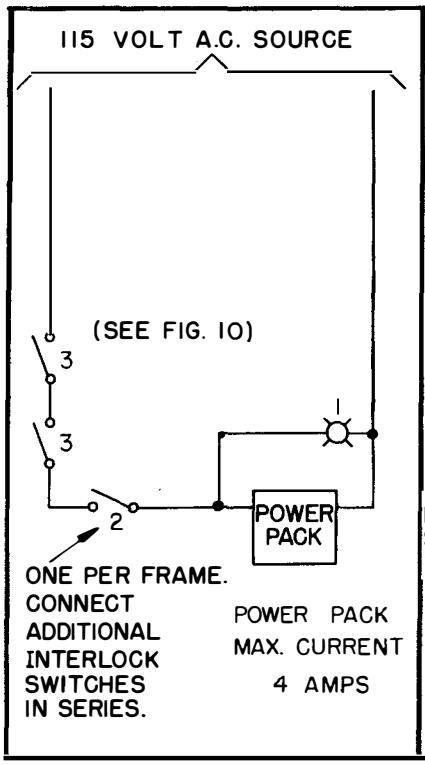

Fig. 13. Low Voltage Schematic Wiring Diagram

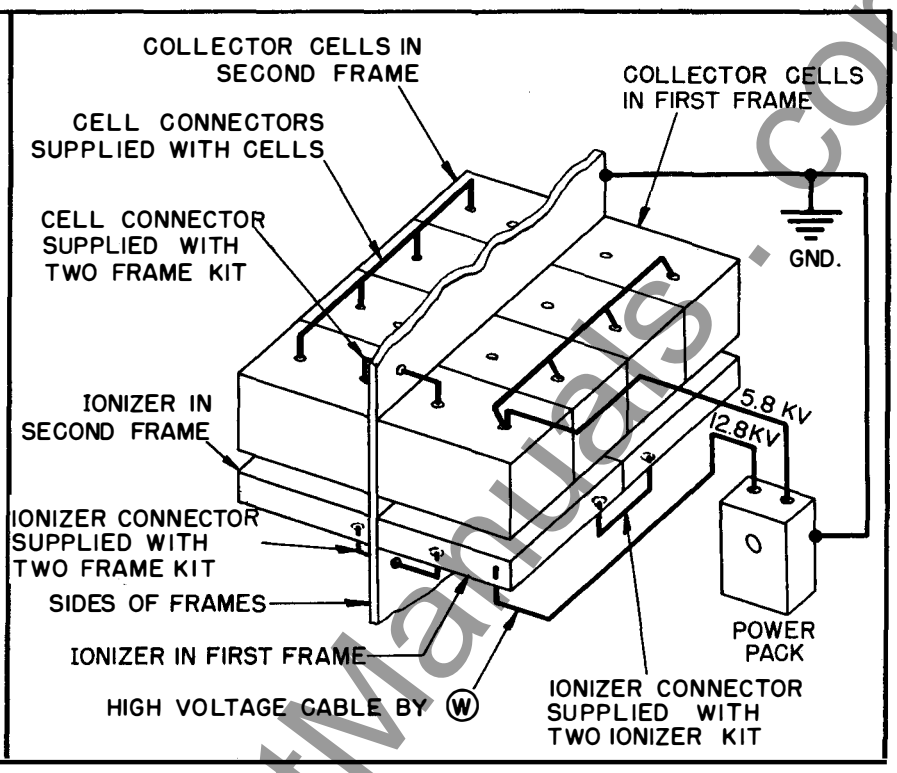

Fig. 14. High Voltage Connections (2 Frames Shown)

HIGH VOLTAGE WIRING

High Voltage Cable supplied should be installed as shown in Fig. 14. Also see power pack instruction book. Both cables from the power pack should be installed in conduit and may enter either side of the frame. The 7/8" hole nearest the inlet air side is for the 12.8 KV cable which feeds the ionizer. The other 7/8" hole nearest the outlet air side is for the 5.8 KV cable which feeds the cells. Install a 1/2" conduit nipple with a bushing inside the frame to protect these cables where they pass through the track channel. Allow enough slack in these high voltage cables to permit connections after the cells and ionizers are installed in the frame.

For multiple frame units, nipples, bushings and connectors are supplied in the two frame kits for making connections between adjacent frames. Seal the two unused 7/8" holes at the opposite side of the frame with plug buttons packed with the frame hardware.

Cells should be handled by the end frames only to prevent damage. Remove and discard the shipping braces from the ends of the cells. See Fig. 15. These braces will cause a short circuit if not removed. Also remove the cell connectors which are taped on the cells, but save them for making connections between cells as shown in Fig. 14. Carefully inspect all cells to be sure the plates are evenly spaced and undamaged. Install the cells in the frame so that the connector posts point to the outlet air side. See Fig. 14 for typical high voltage connections.

Ionizers. Inspect the ionizer for broken or damaged wires. See Fig. 16. (For wire replacement, see MAINTENANCE). Place the ionizer in the frame so that the porcelain insulators are on the inlet air side. When connecting the 12.8 KV cable to the ionizer, be sure it is taut enough to maintain a 1-1/2" min. clearance from all metal parts. For units having more than one ionizer see Fig. 14 for typical connections.

Electrical Grounding. High voltages are supplied from the power pack to the cells and ionizers with single conductor cables. A common ground re-

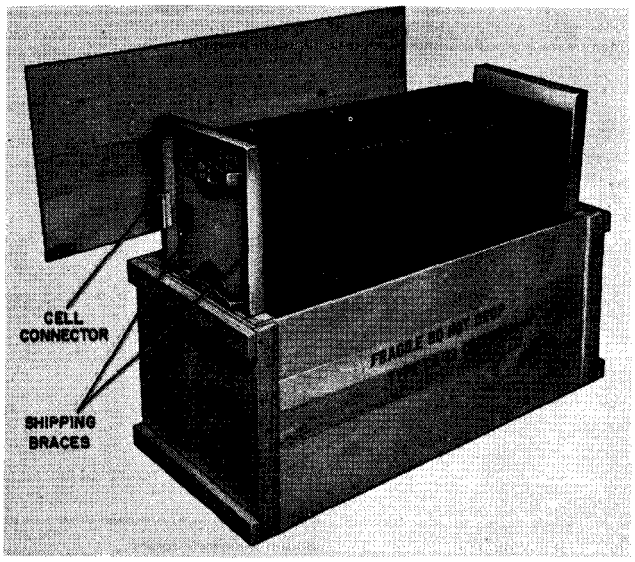

Fig. 15. Details of Cell Packing

turn through the frame to the power pack is required to complete the circuit and for safety purposes. See Fig. 14. Connect the frame and the power pack with a common low resistance ground, using solid copper wire.

Baffles-Filters. Track space for baffles or filters is provided both on the inlet and outlet air sides of the frame. The perforated aluminum baffle is normally installed on the inlet air side. Pre-filters or after-filters may be specified on the order. Install pre-filters on the inlet air side and after-filters on the outlet air side. The baffle is not needed when filters are installed.

A pre-filter is furnished for oil mist control applications which should be installed on the inlet air side of the frame.

Sealing the Unit. All unused holes in the sides of the frame should be plugged with plug buttons supplied or with bolts and flat washers to prevent leaks.

High Voltage Signs. Two high voltage signs are supplied with the accessories. These should be installed on the duct access doors. See Fig. 10.

Operation Chart supplied in the "Instruction Package" includes maintenance hints. It should be prominently displayed adjacent to the unit. See Table 2.

Checking the Installation. The following items should be carefully checked by the installer prior to starting the Unit:

Electrical Inspection.

1. All cell plates should be evenly spaced and undamaged.

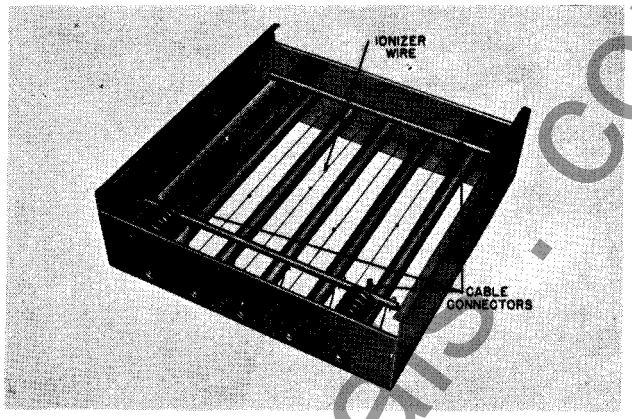

Fig. 16. Typical Ionizer

2. All ionizer wires should be under slight tension and midway between the ground tubes. (Replace broken wires with spares furnished with the accessories).
3. All wiring should be in accordance with the wiring diagrams and connections should be tight.

Mechanical Inspection.

1. Check the frame and ducts for air leaks.
2. Check the fan speed to be sure that air volume does not exceed rated cfm.

Starting the Unit. When the installation is complete and ready to be placed in service, a Westinghouse Service Representative should be requested to check and start the PRECIPITRON unit. Representatives of the contractor and the customer should be present to facilitate necessary corrections and to receive operating instructions. The adhesive and instruction books should be available at this time.

OPERATION

PRECIPITRON is an electronic air cleaner - not an air filter. Strong electrostatic forces draw the dirt particles from the air. These forces are equally effective on both large and small particles. Because of this, PRECIPITRON will remove from 6 to 8 times more dirt than a conventional filter. Moreover, it removes the extremely small particles which pass right through a regular filter - and it is these tiny particles which are the principal cause of smudging, soiling and dirt damage.

Because of this high efficiency in removing dirt from the air, frequent washings are needed to dispose of the increased amount of collected dirt. PRECIPITRON is designed to permit this dirt to be easily flushed out of the equipment with ordinary water.

PRECIPITRON removes the dirt particles from the air by first giving them an electrostatic charge, and then forcing the charged particles to deposit on charged plates. See Fig. 17. To insure that the dirt will be held after it is removed from the air, the collecting surfaces are coated with a water washable adhesive fluid. This washes off with the accumulation of dirt, and a fresh coating is applied for the next air cleaning cycle.

Oil Mist Control Applications. When specified on the order type PV PRECIPITRON units may be used to remove oil mist from the air as described in Catalog 1450 for type PO Oil Mist Control Units. For such applications, vertically upward air flow through the frame is recommended. The oil mist is removed from the air by first giving it an electrostatic charge at the ionizer and deflecting the charged mist particles by electrostatic forces to the cell plates. As the oil is collected, it drains from the cell plates onto the ionizer and then through the filter to the drain pan. This flushing action plays an important part in eliminating or reducing the need for cleaning the internal components of the frame.

When used to collect oil mist, the unit will also collect other particles which may be present, such as dirt and smoke. Small quantities of these im-

purities will usually be flushed away as the oil drains, but large quantities may adhere to the ionizer and cell plates requiring occasional cleaning. The type of oil being collected may also affect cleaning requirements. If the oil does not flow freely or forms gummy deposits, periodic cleaning will be required. For further details refer to Catalog 1450 and I. B. 1450.

Frame serves to enclose the cells, ionizer and baffle (or filter). These internal parts are supported by tracks built into the frame. A removable access panel provides maximum accessibility to the internal parts. The panel is gasketed and equipped with reliable quick acting latches. Drilled flanges at the top and bottom of the frame are provided to facilitate duct connections.

Ionizers are supplied in one or more sections. They mount in tracks at the inlet air side of the frame. When 12.5-13.3 KV, d.c. voltage is applied to the ionizer wires, an ionizing zone is created between the wires and the grounded metal tubes. Dirt particles passing through this space pick up an electrostatic charge. Anti-vibration beads on the ionizer wire prevent wire vibration - lengthening wire life and providing more uniform particle charging.

Cells are supplied in nominal 2' and 3' lengths to fit the track space in the frames. Cells are an arrangement of two sets of flat metal plates, one of which is grounded and the other supported by insulators. When 5.5-6.0 KV, d.c. voltage is applied between two sets of plates, a strong electrical field is set up which forces the charged dirt particles onto the plates.

Baffles-Filters. Perforated baffle helps even the air flow through the frame. Cleanable type filters which mount in the track may be supplied when specified on the order. A cleanable type pre-filter is supplied for oil mist applications to prevent chips and large particles from entering the unit.

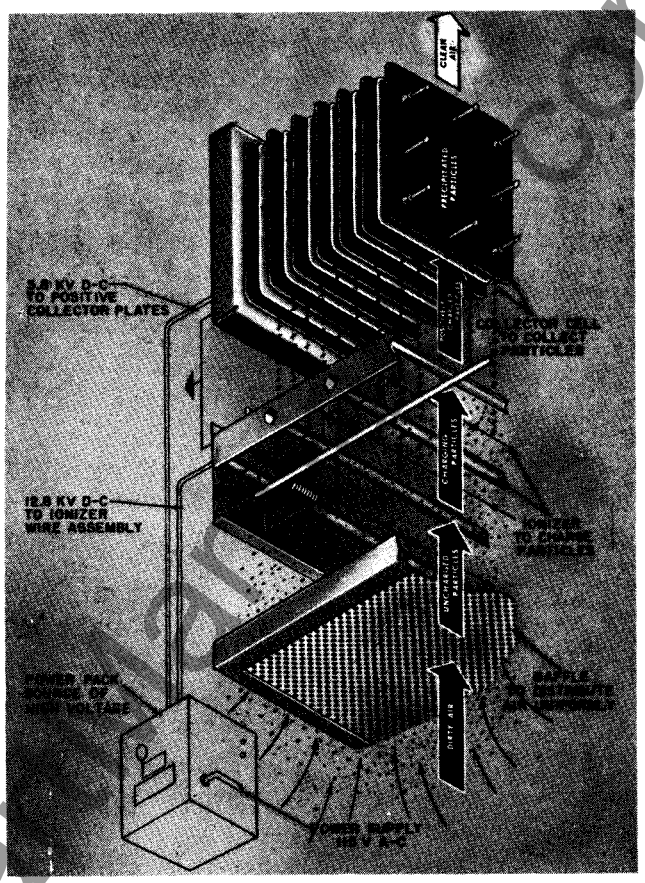

Fig. 17. Principle of Operation

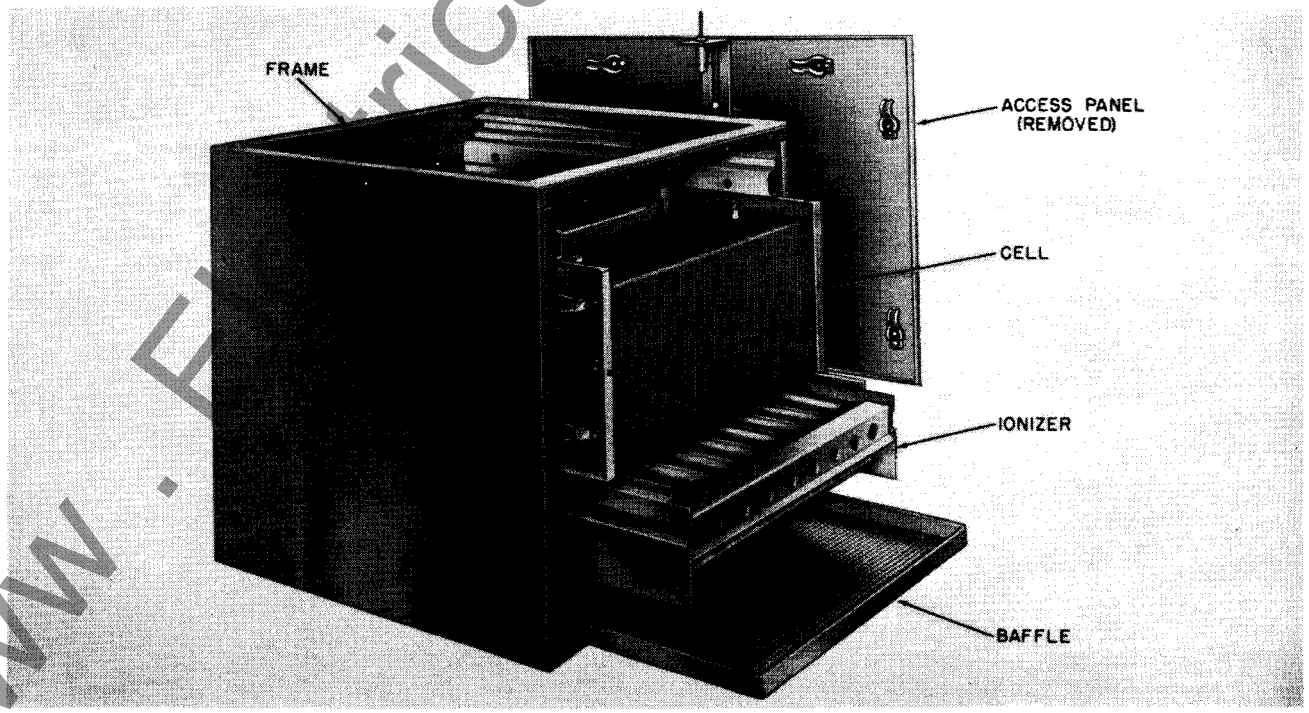

Fig. 18. Typical Frame with Internal Parts

Power Pack furnishes high voltages to the ionizers and collector cells, using a 115 V, 1 ph. source. The power pack has indicating lights to warn the operator when the unit is not functioning properly. An On-Off circuit breaker protects the internal elements.

Protective Devices for safety of the operator include screw operated (time delay) switches at the power pack door, the duct doors and the frame access panel. These open the 115 volt supply circuit and delay access to the high voltage parts until the charge in the capacitor has drained off. These switches should not be tampered with, even though the time consumed to turn the screw may seem unreasonable.

Adhesive serves two functions: (a) to bind the collected dirt to the collector plates as it is precipitated and (b) to render the deposit completely washable with water. Westinghouse adhesives are compounded to provide the proper balance between dirt binding qualities and washability. Adhesive is not supplied for Oil Mist Control Applications.

MAINTENANCE

Regular maintenance is the key to good performance and efficient operation of the PRECIPITRON unit. This includes (a) periodic inspections (b) regular washing and adhesive procedures and (c) correction of any faults.

Inspections. A simple daily inspection of the power pack is recommended to assure that the unit is properly energized while air is flowing:

(a) "Normal" indicating light should glow.
(b) "Short Circuit" indicating light should not glow.
(c) Rectifier tubes should burn with a cherry red glow.

See "Correction of Electrical Faults" if the above conditions do not exist. For other occasional inspections see "Frequency of Washing", "Inspection Before Washing" and "Dirt Build-up".

Frequency of Washing depends upon how much dirt there is in the air at the particular location. Average time between washings is every 2-3 weeks. To determine the actual interval, inspect a new installation frequently. The unit needs washing when the cell plates on the inlet air side appear to be 1/8" thick. However, the unit should not be allowed to go unwashed longer than one month. Based upon the time determined by the initial inspections, a schedule should be set up for regular washings. This will assist in scheduling maintenance work and will insure that the unit does not become too dirty.

Inspection Before Washing. An inspection of the dirt collection pattern on the cells and ionizers just before washing may disclose installation and maintenance faults:

1. Excessively dirty cells or ionizers indicate too infrequent washings.

2. Some cell or ionizer parts dirtier than others suggests broken ionizer wires, missing high voltage connections or uneven air distribution.

3. Dirt on the clean air side indicates too infrequent washings, excessive air velocity or operation with the unit de-energized.

Washing the Unit. It is usually best for normal air cleaning applications, to hose off the collected dirt with the cells and ionizers in place. Removal of these parts for hosing outside the frame is satisfactory if found more convenient, but care should be taken not to damage the parts during handling. The following procedure is for washing the parts in place.

1. Shut off fan and power pack.
2. Remove access panel and baffle (and filters if installed).
3. Open duct access doors, turn on water and adjust temperature to 130-150°F. Also adjust the water nozzle to give a strong stream.
4. Starting at the inlet air side, direct the stream of water onto the ionizer and cell plates. It is best to wash one cell section at a time being sure that the cell plates, ionizer ground tubes, ionizer wires and all insulators are thoroughly flushed. Be careful not to break the ionizer wires by striking them with the nozzle. (For deep units it is suggested that the nozzle be attached to a straight piece of pipe with a 90°short elbow.
5. It is good practice to occasionally wash the cells on the outlet air side if they appear dirty.
6. Allow approximately 20 minutes for water to drain and dry before applying adhesive. During this time, hose off the baffle (and filters) with hot water.
7. Inspect all parts for cleanliness and broken ionizer wires. Repeat washing if necessary (See "Dirt Build-Up").

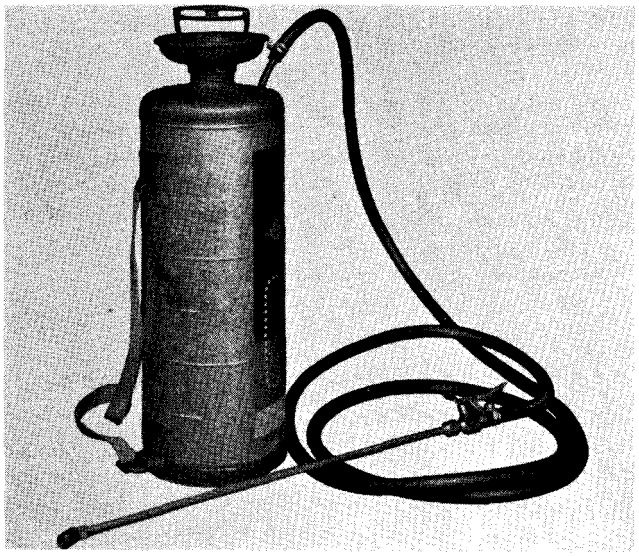

Fig. 19. Manual Adhesive Applicator

Cleaning Units for Oil Mist Control Applications. For new units, cells, ionizers, and filters should be inspected weekly for cleanliness. Experience after a few inspections will determine the need for regular cleanings. In any event, it is good practice to inspect the internal components at least monthly. If a layer of dirt or hardened oil is observed on cell plates, ionizer tubes, ionizer wires, insulators, or filters, the dirty components should be removed and thoroughly cleaned. This is not necessary if a slight oil film is noted, but its presence should be carefully observed during subsequent inspections to be sure that buildup is not taking place. Thick layers are difficult to clean off, particularly if allowed to remain for long periods.

When removing components, be careful not to break ionizer wires or bend cell plates. Also, be sure to disconnect and reconnect high voltage cables properly.

Ordinary degreasing equipment is usually quite effective in removing oily dirt, and should be used if available. If a degreaser is not available or if it is not effective, a dip tank is recommended. Mix a solution of one pound of mild detergent ("ALL" or equal) in each gallon of 130-150°F. water. Dip dirty components in the detergent solution and allow to soak ten minutes. Immediately after removing components from the dip tank, thoroughly rinse or hose with clean hot water. Inspect components for cleanliness and repeat detergent dip and rinse if necessary.

Adhesive Requirements. Westinghouse adhesive should be ordered to replace the initial supply furnished. Annual requirements may be estimated at 1-1/2 gal. per 1000 cfm unit capacity. Note: Adhesive is not supplied for oil mist control applications because it is not needed.

During cold weather, type T-675 adhesive should be stored at temperature above 60°F. for 24 hours before using. Do not dilute T-675 adhesive with water. Should other types of Westinghouse adhesive be used, be sure to read the label on the container for special instructions.

Manual Adhesive Applicator is supplied for normal air cleaning applications. It is not supplied for oil mist control applications. See Fig. 19.

Applying Adhesive (not required for oil mist control applications). After washing, a new coating of adhesive is applied with the fans shut down and the power packs turned off.

1. Fill the applicator with enough adhesive to coat the particular size unit. See Table 2. 15 strokes of the pump will give a good spray pattern for normal length of time.
2. Coat the ionizers, cell plates and insulators through the upper access door with a thin film of adhesive. (A heavy coat will drain off and be wasted). If the ionizer is located at the bottom of the frame (upward air flow) also apply adhesive to the ionizer through the lower access door. Avoid breaking the ionizer wires by striking them with the nozzle.
3. Allow at least 15 minutes for the excess adhesive to drain before turning on the fan and power pack. During this time, replace the baffles (and filters) and the access panel and close the duct doors. Some arcing at the cell plates may occur when the power pack is turned on. This is harmless provided the arcing subsides in a few minutes.
4. Flush applicator hose and tank with clean warm water and allow to dry. Store applicator in a clean location.

Dirt Build-Up. Thorough washing at least once a month is recommended for best overall results. Infrequent or incomplete washing leaves a film of dirt which will build up and give trouble if allowed to remain after each washing. If inspection discloses such a film, the trouble may be: (a) low water temperature or pressure, (b) incomplete application of adhesive, or (c) using other than Westinghouse Adhesive. Should the difficulty persist after checking these points, an occasional cleaning by one or the other of the following methods is recommended.

1. Before washing, apply a coating of adhesive (same type as is normally used) to the dirty parts. Allow to soak about 20 minutes. Thoroughly flush off adhesive and dirt with a strong stream of 150-180°F. water. Allow unit to dry and repeat soaking if necessary to get parts clean.
2. If the above adhesive soaking method fails to clean the parts, a mild detergent may be used. Make a solution of about a pound of detergent ("ALL" or equal) to each gallon of 100-120°F. water. Use adhesive applicator to apply the clear solution. Allow to soak 10 to 20 minutes. Thoroughly flush off detergent and dirt with a strong stream of 150-180°F. water. Repeat if necessary to get parts metal clean. (Flush adhesive applicator with hot water and allow to dry before again using adhesive).

Ionizer Maintenance. To replace ionizer wires, the ionizer section may be pulled out through the access space. Four spare ionizer wires are supplied with the accessories and additional wires may be purchased when needed. The wires are equipped with ball shaped dampeners, prelooped ends and made to the proper length at the factory. Be careful not to kink the wire because it will eventually break at this point. The ball dampeners prevent the wire from vibrating excessively. To check the effectiveness of the dampeners, pluck the wire to see that vibration dampens in one or two seconds. Be sure to reconnect the high voltage wiring and connectors when replacing the ionizer.

Location and Correction of Electrical Faults. Electrical faults can usually be found by careful inspection. Wiring diagrams (Figs. 13 & 14) should be helpful in analyzing possible troubles. Common faults and probable causes are shown in Table No. 1. These points should be checked first before attempting the more difficult process of elimination. If a high voltage short circuit cannot be located by inspection, disconnect the cell and ionizer cables at the power pack terminals (see CAUTION, page 12). Close power pack door and turn on the circuit breaker. Continued glowing of the short circuit light indicates that the

trouble is in the power pack. Consult the power pack instruction book for detailed corrective procedure.

If the short circuit light does not glow after disconnecting the cables, the trouble is either in the cells, ionizers or high voltage cable. This may be localized by alternately reconnecting the cables at the cells or ionizers until the faulty part is located. The cells or ionizers may be removed if necessary for close examination and correction of the fault.

CAUTION. The previous test procedure involves handling parts which are normally charged with high voltage. Always turn off the power pack and allow at least 1/2 minute before touching the high voltage parts. This time delay permits the residual charge in the capacitor and cells to drain to a safe value through the discharge resistor in the power pack. It is also good practice to ground the part with a grounded prod equipped with a suitably insulated handle.

TABLE NO. 1 OPERATION CHART

NORMAL OPERATION	FAULT INDICATION	PROBABLE CAUSES
Sentinel breaker switch on. Normal indicating lamp lit. Short circuit lamp not lit.	Normal indicating lamp not lit. Sentinel breaker switch on. Short circuit lamp not lit.	1. No power supply voltage to power pack. 2. Door switches not closed. 3. Poor contact in a door interlock switch. 4. Burned out indicating lamp.
	Short circuit lamp lit. Sentinel breaker switch on, or breaker has tripped and short circuit lamp lights as breaker is reset.	1. Foreign conducting material between cell plates. 2. Broken ionizing wire touching grounded equipment. 3. Short circuited wiring inside power pack. 4. Faulty HV transformer or capacitor.
	Sentinel breaker switch is tripped. (System otherwise normal when breaker is reset.)	1. Temporary short circuit which has cleared. 2. Momentary surge of excessive line (primary) voltage.
The tube filaments approximate a clear incandescent lamp in color, when observed through the window in the power pack door.	Blue glow around tube filament.	1. A blue glow is serious only if it is pronounced and appears to be increasing.
	Tube does not glow at all.	1. Burned out filament. 2. Open circuit in transformer filament winding. 3. Poor contact between tube prongs and socket.
Occasional arcing or crackling between cell plates is not serious, usually being due to large particles passing between the plates. Some arcing may occur after applying adhesive but should soon stop.	Continual crackling or arcing in cells.	1. Excessive dirt build-up is short circuiting cells. 2. Insulators are dirty, cracked, broken. 3. Broken ionizing wire drawn into cell. 4. Burned out tube in power pack (13 kv portion).
Only clean air should appear on the leaving air side of the frame, with circuits, indicating lamps and voltages normal.	Dirt particles or flakes appear on clean air side of unit.	1. Dirt on ionizer causing inefficient ionizer operation. 2. Low voltages or a defective power pack. 3. Cell plates not properly coated with adhesive. 4. Improper air distribution: (a) Fan speed increased or system resistance reduced, (b) sharp turns in ducts. 5. Missing or disconnected ionizer or cell connectors.

TABLE NO. 2 CONDENSED SPECIFICATIONS

UNIT CODE NO.	PV22	PV23	PV32	PV42	PV24	PV33	PV25	PV43	PV34	PV26	PV35	PV44	PV36	PV45	PV46
Capacity C.F.M.(Max) @ 90% Eff.	1330	2000	2000	2660	2660	3000	3330	4000	4000	4000	5000	5330	6000	6660	8000
*Approx. Dimensions - inches															
Height (In dir. of air flow)	←							341/2							→
Width	26	38	26	26	52	38	64	38	52	76	64	52	76	64	76
Depth	24	24	36	48	24	36	24	48	36	24	36	48	36	48	48
Min. Clearance to remove cells, ionizers & baffles	30"	30"	42"	30"	30"	42"	30"	30"	42"	30"	42"	30"	42"	30"	30"
No. of Frames	1	1	1	1	2	1	2	1	2	2	2	2	2	2	2
No. of Cells (2' wide)	2	-	3	4	4	-	2	-	6	-	3	8	-	4	-
No. of Cells (3' wide)	-	2	-	-	-	3	2	4	-	4	3	-	6	4	8
No. of Ionizers	1	1	1	2	2	1	2	2	2	2	2	4	2	4	4
Adhesive-pints per application	1 1/2	2	2	3	3	3	3 1/2	4	4	4	5	5 1/2	6	7	8
Electrical 115 v - 1 ph -60 cy. Power Pack (1 per unit)	RA3	RA3	RA3	RA3	RA3	RA3	RA3	RA3	RA3	RA3	RA15	RA15	RA15	RA15	RA15
P. P. Input (watts)	50	55	55	65	65	70	77	85	85	85	135	137	145	152	165
Approx. Weight net lbs.															
Frames, Cells, Ionizers	150	195	195	265	300	260	345	335	390	390	455	530	520	600	670
Power Pack	66	66	66	66	66	66	66	66	66	66	130	130	130	130	130

*See Dimension Sheet 1420, Sheet 1 for exact dimensions.