Recovery of weighed amounts of halogenated hydrocarbons has been within 95-100 percent.

Source—

Not commercially available. Contributed by: Dow Chemical Company. Approximate cost—$200.00.

Construction Details

Figure 1 is a drawing of the fritted glass absorber used in conjunction with the combustion apparatus. The apparatus was assembled as shown in Figure 2.

p rating Instructions

1. Prior to sampling, the furnace must be heated to about 900°C. Approximately twenty to thirty minutes is required for a warm-up period.
2. Connect the furnace to a sample point by means of a Saran line joined with rubber and glass joint connections.
3. Pipette 25 ml of trapping solution (1 percent sodium carbonate, 1 percent sodium formate solution) into the absorber. Turn the pump on and adjust the air flow rate (1.0 lpm proven efficient). The length of time of sampling will depend on the estimated concen-

[illegible] the contents of the absorber to a 50 ml volumetric flask. It is necessary to blow air through the inlet of the absorber to remove liquid below the fritted glass. Wash absorber several times with distilled water and make to volume. The sample can now be analyzed or transferred to separate sample bottles for later analysis.

Calibration Instructions

To insure correct rates of air flow the flow meter should be periodically checked against a wet test meter.

Maintenance Instructions

1. Proper lubrication of pump should be maintained.
2. Fresh dessicant should be maintained in the drying tube.
3. Flow meter must be kept clean to insure accurate readings.
4. Temperature of combustion furnace should be checked periodically.

Bibliography

Determination of Chloride: A Modification of the Volhard Method. Caldwell and Moyer. Ind. Eng. Chem. Anal. Ed. 7: 38 (1935).

HALOGENATED HYDROCARBON ANALYZER

Uses

The halogenated hydrocarbon analyzer is used to record continuously in the parts per million range the concentration of halogenated hydrocarbon gases in the air throughout a plant.

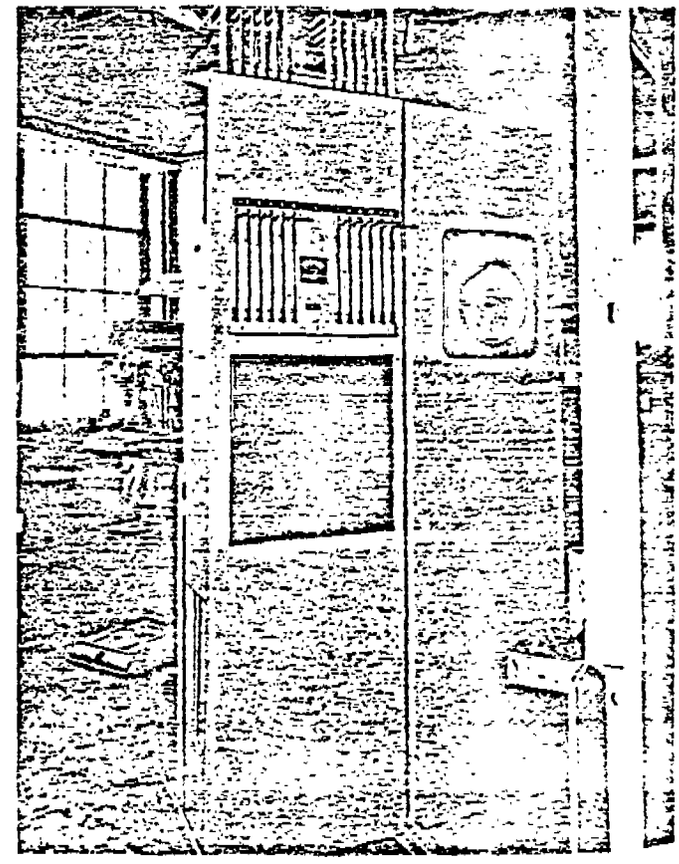
Operating Principle

A continuous sample of air is drawn from each of twelve plant areas through Saran tubing and is metered through twelve rotameters located on the front panel. The air is then passed through a furnace containing twelve quartz tubes operating at approximately 1000°C. The halogen in the presence of water vapor in the air is converted to the halogen acid. From here the acid is mixed with water through absorber tubes, the water being metered to each absorber by means of a rotating orifice operating under a constant head tank. Two 6-record Foxboro Dynalog recorders are used to measure the resulting conductivity.

Physical Description

	Measuring Unit	Panel
Weight—	Approx: 500 pounds	Approx: 150 pounds
Height—	8 feet, 10 inches	7½ feet
Width—	2 feet	2 feet
Depth—	1 foot, 10 inches	1 foot

The sampling and measuring unit is designed for permanent installation but the panel containing the two Dynalog recorders may be mounted remotely with respect to the



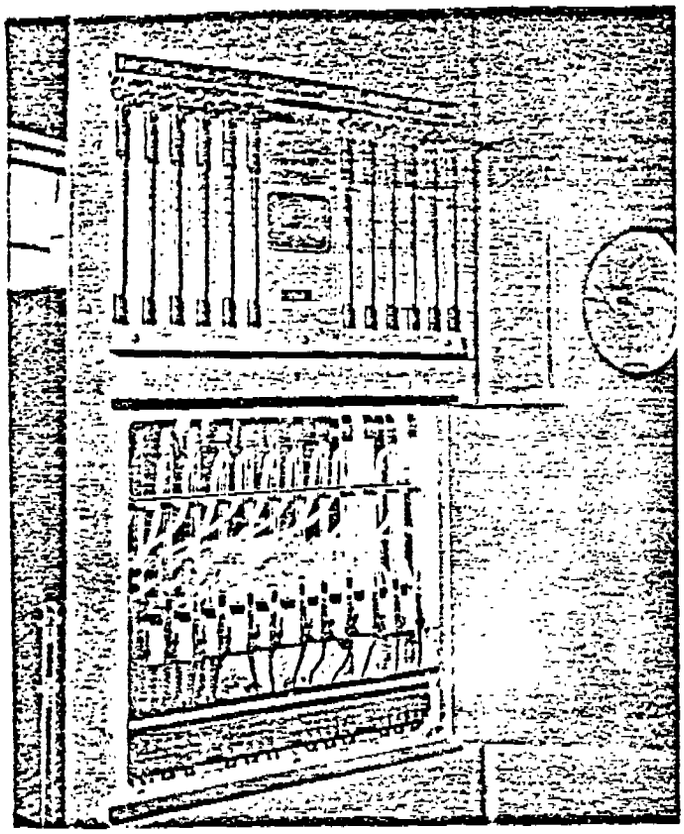


Figure 2 — Enlarged Front View Showing Rotameters, Absorbers, and Conductivity Cells

Performance Data

This instrument has been used successfully over a period of time on methyl chloride, ethyl chloride, methyl bromide, carbon tetrachloride, vinyl chloride, and vinylidiene chloride. Its range is limited by the purity of water available, range of recorder, and CO_2 or other interfering gases present in air deemed as "zero."

Range:

Range limitations of this instrument have not fully been investigated. Air rates, water rate, recorder range and cell constants all may be varied, giving this instrument abundant flexibility. Extreme ranges have not been required in the Dow applications. Toxic limits have somewhat determined ranges of instruments now in use; i.e., vinyl chloride 0-1000 ppm; vinylidiene chloride 0-500 ppm; ethyl chloride 0-1000 ppm; carbon tetrachloride 0-300 ppm. Experimental units have been operated at both lower and higher ranges with excellent results and further investigation is in progress. The accuracy of all instruments now in operation is within 10 percent of analyzed gas samples.

Source—

Not commercially available. Contributed by: Dow Chemical Company.

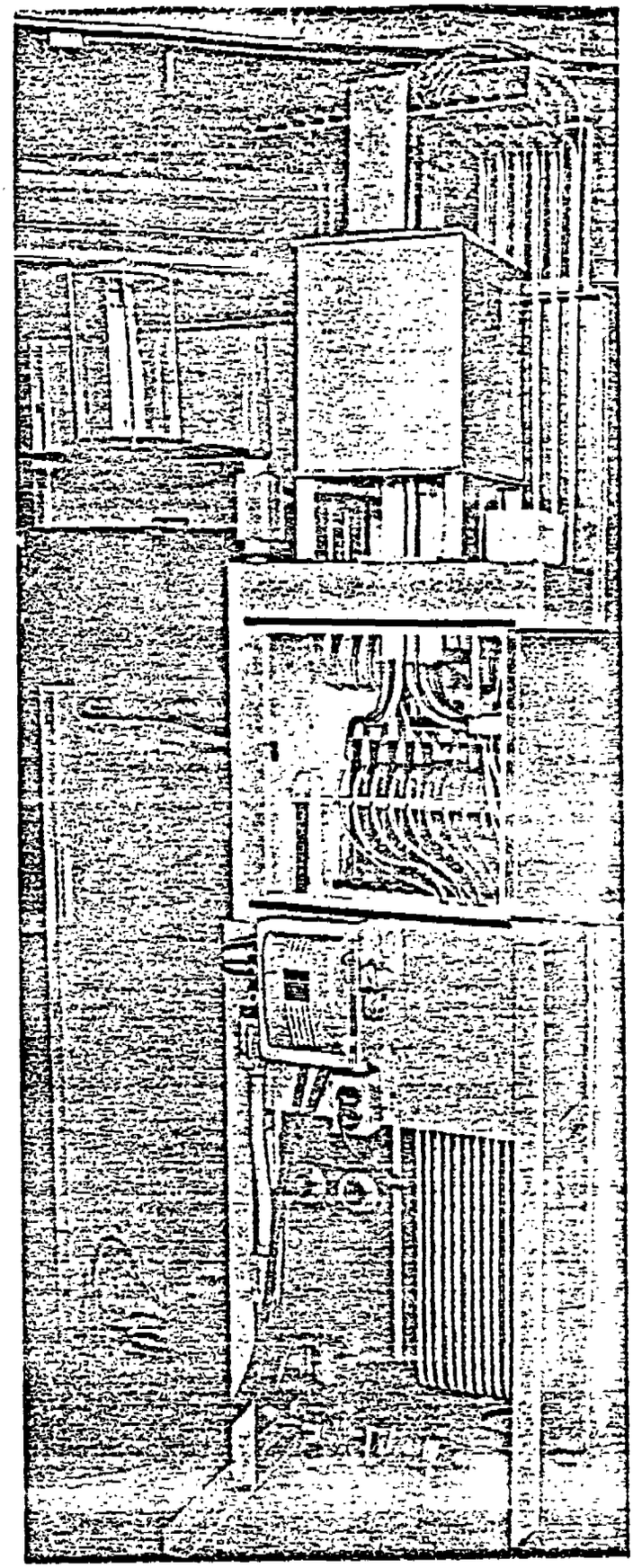


Figure 3 — Rear View of Analyzer Showing Measuring Unit and Recorder Panel (From Top of Photo). A. Measuring Unit—(1) Sample Line Inputs (12 in this Case), ¼" Pipe; (2) Furnace; (3) Quartz Tubes Passing Through

Construction Details

Following are the essential components used in the construction of this instrument:

12 points # Req'd.	6 points # Req'd.	
1	1	Heavy Duty Pyrometer
1	1	Heavy Duty Furnace
1	1	Heavy Duty tap changing transformer
1	1	Vacuum pump
1	1	Bodine motor
1	1	Constant level water chamber
24	12	Needle valves
12	6	Rotameters
4	4	Fittings (Crouse–Hinds)
1	1	Switch box
		Tygon tubing
4	2	Terminal strips
6		Elbows 45° brass ⅛ inch
6		Couplings brass ⅛ inch
12	6	Quartz tubes
1	1	Steam condenser or ion exchange tower
2	1	Foxboro Dynalog conductivity recorder

Op rating and Maintenance Instructions

1. Check pyrometer at top of front panel on measuring unit. This may vary from 1000°C to 1090°C. At no time should this temperature vary from these limits.
   a. If in excess of 1090°C, adjust taps located on transformer. An adjustment decreasing the "fine" control 1 or 2 divisions should be sufficient.
   b. If less than 1000°C, check furnace fuse. (Located on right facing rear of panel, in fuse box.) Check thermocouple, check taps on furnace and increase "fine" adjustment 1 or 2 divisions.
2. Check rotameters. Balls should ride with their bottoms adjacent to top of marking tabs. Adjustments are made by needle valves on top header. Any oscillations may be damped by adjusting needle valves on water leg located inside panel. Check to insure constriction is not too great so as not to allow the allotted quantity of water to reach the cell. This may be done by removing rotating arm and filling leg in question, replacing the arm and checking to see whether or not the water level decreases. Rotameters should be cleaned periodically when the end of sample tube is subjected to a dusty atmosphere or when dust or oil film accumulation is noticed in tube.
3. Remove rotating arm from water distributor and check flow.
4. Check vacuum pump for oil level in trap on vacuum side of pump. This oil is used for lubrication. No fluid should be present in the trap on pressure side of pump.
5. Check absorption tubes and rubber tubing.
6. Check conductivity cells for bubble formation on plates. If present, partially remove cell allowing inrushing air to remove bubbles.
7. Clean pens on recorder and replace ink pads when needed.
8. When instrument has been shut down and is again to be put into operation, allow the water system to run 10 minutes before starting pump so the water legs will be full. Also check the ball in the vacuum release valve to insure free operation.
9. In case of pump failure and a replacement pump is not available immediately, voltage on furnace should be reduced by changing taps on transformer to lowest possible value to avoid operating the furnace at higher than rated capacity.

Calibration Instructions

Calibration is accomplished by contaminating a metered air stream with a known amount of material. This stream is sampled, analyzed by the instrument and at the same time checked against a standard.

CARBON DIOXIDE INDICATORS

Uses

Carbon dioxide indicators can be used to determine the concentration of CO_2 present in the atmosphere of a closed space or compartment. Other uses include analysis of flue gases and combustion testing.

Operating Principle

A measured volume of air or flue gas under test is drawn into the absorption column by means of an aspirator bulb. Carbon dioxide in the sample is absorbed by a solution of potassium hydroxide contained in the absorption and manometer columns. The resulting reduction of gas pressure (the scale having been previously set to zero at the top of the liquid column) is an indication of the percentage of CO_2 present in the sample. Percent CO_2 is read directly from the scale.

upon the various ranges. The model shown in Figure 1, for example, weighs 1 pound and is 2½ by 1¼ by 9 inches high.

All models are built of acrylic plastic construction employing stainless steel for all metallic parts in contact with the fluid. The instruments are portable in design and provided with carrying cases and other accessories as needed to operate in the field.

Figure 2 is an enlarged drawing of the # 800-5 (0 to 5 percent) Carbon Dioxide Indicator showing the various components.

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Performance Data

Various ranges and accuracy limits are available as follows. # 800-5 Carbon Dioxide Indicator, range 0-5 percent CO_2, minor divisions 0.10 percent accuracy at full scale