

HISTORY OF INSTRUMENTATION

2016 CIHC PROFESSIONAL DEVELOPMENT SEMINAR

San Diego, California

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ACKNOWLEDGEMENTS

- AIR SAMPLING INSTRUMENTS FOR EVALUATION OF ATMOSPHERIC CONTAMINANTS, ACGIH, 3RD Edition, 1966
- UCLA OFFICE OF ENVIRONMENT, HEALTH AND SAFETY, Gabriel Jasso, CIH
- HEALTH SCIENCE ASSOCIATES

DEFINITIONS

INSTRUMENT

A means by which something is done. A device for recording or measuring.

INSTRUMENTATION

The application or use of instruments in the performance of some work.

RECOGNITION OF OCCUPATIONAL DISEASE AND EVOLUTION OF REGULATIONS

Hippocrates (460-370 BC) – lead poisoning in miners.

Pliny the Elder (1st century AD) – refiners using bladders.

Galen (2nd century AD) – dangers of acid mists to copper miners.

Agricola (1566) – prevalent diseases in mining, smelting and refining.

Ramazzini (1713) – treatise on occupational diseases.

Chimney-Sweepers Act of 1788 (Percival Pott) – England

Thackrah (1831) – lung diseases from mining and grinding dusts.

English Factory Acts of 1833 – 1st effective legislative acts expressing interest in health of the working man.

Not much else until after 1900

1914 - Office of Industrial Hygiene & Sanitation, USPHS

1914-1933 - Extreme hazards in the workplace.

**“Exploring the Dangerous Trades” –Alice Hamilton, M.D.
Handful of I.H.’s – essentially univ. & govt.**

1933-1939 - Depression

Social Security Act provided funds to states to initiate programs.

ACGIH – 1937

AIHA - 1939

Emphasized recognition & evaluation.

Controls/enforcement gentle at best.

Walsh-Healy Act

1939-1945 - WWII

Worsening Conditions in the war industries.

1945-1970 - Postwar prosperity.

Industrial growth.

1951 – 1st federal health & safety legislation introduced (Humphrey) – not passed.

Walsh-Healy Public Contracts Act some help.

Probably no more than 600 I.H.s in USA, mostly in government insurance and academia

1970s & 1980s - OSHA (1970)

I.H. explosion – evolution to control. Add “anticipation”.



**BEGAN MY INDUSTRIAL HYGIENE CAREER
IN 1959. AM PROBABLY A THIRD
GENERATION INDUSTRIAL HYGIENIST.
Never Met Dr. Ramazzini**

**INSTRUMENTATION PROBABLY BEGAN TO
EVOLVE ALONG WITH DEVELOPMENT OF
TLVs (1930s)**

FIRST INSTRUMENTS

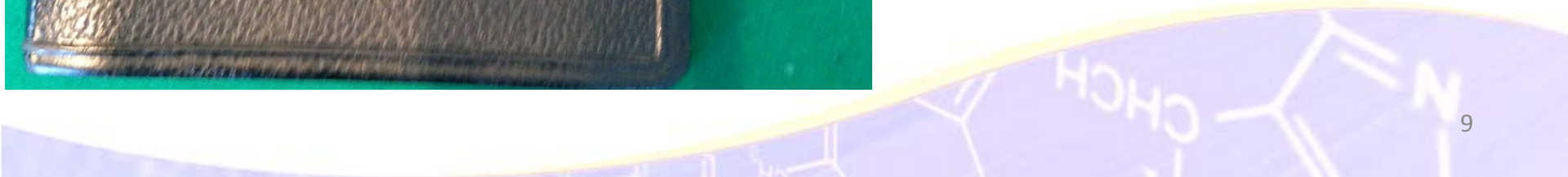
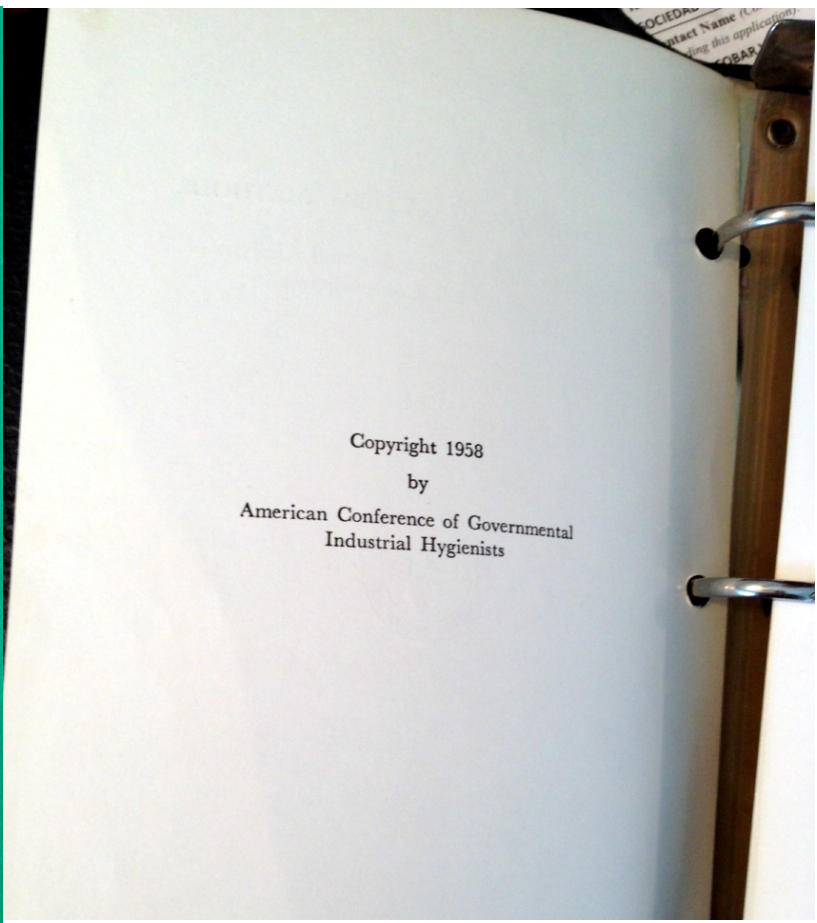
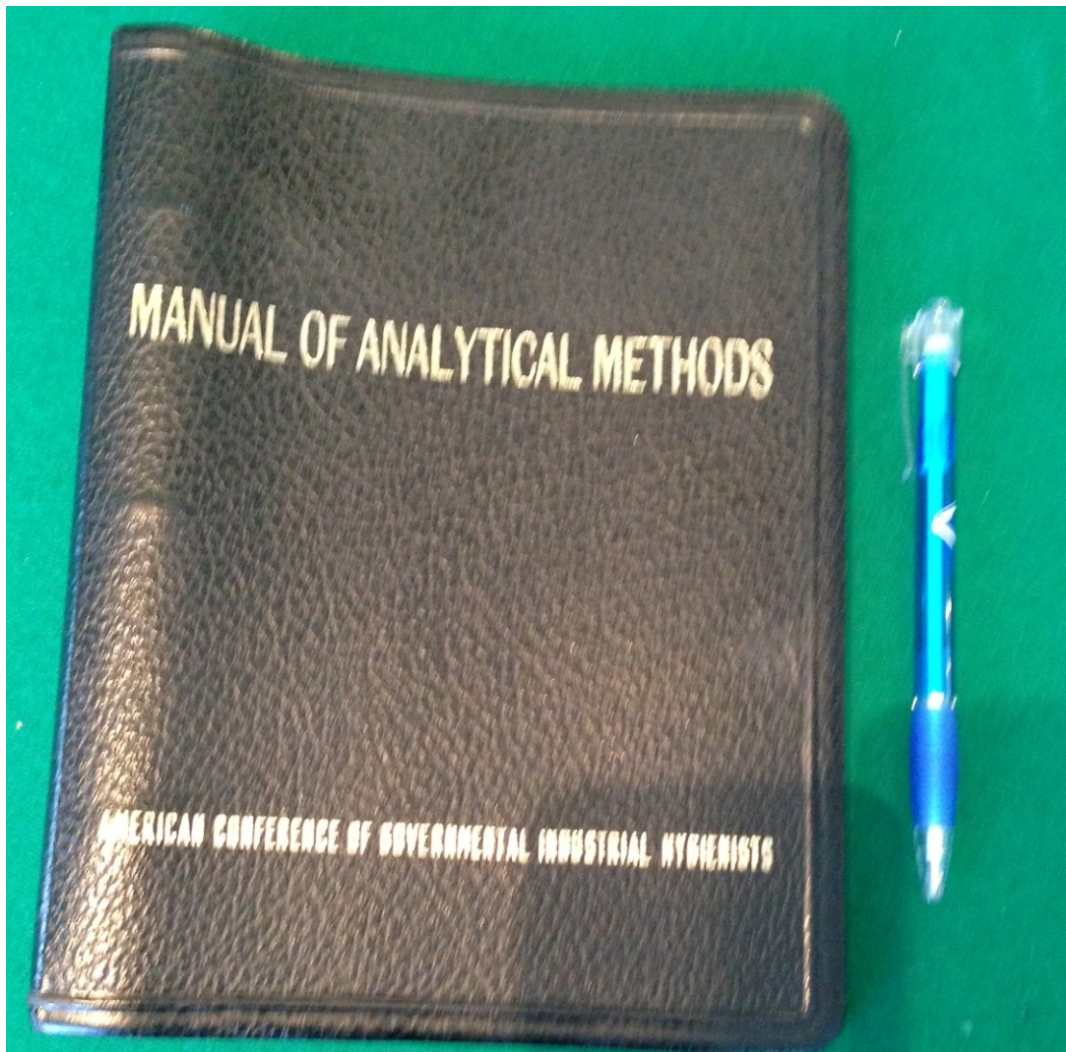
SIGHT

SMELL

HEARING

TOUCH

TASTE



PHOSGENE DETECTOR CRAYON 2
TURNS GREEN — BLUE IN HIGH
PHOSGENE CONCENTRATIONS.

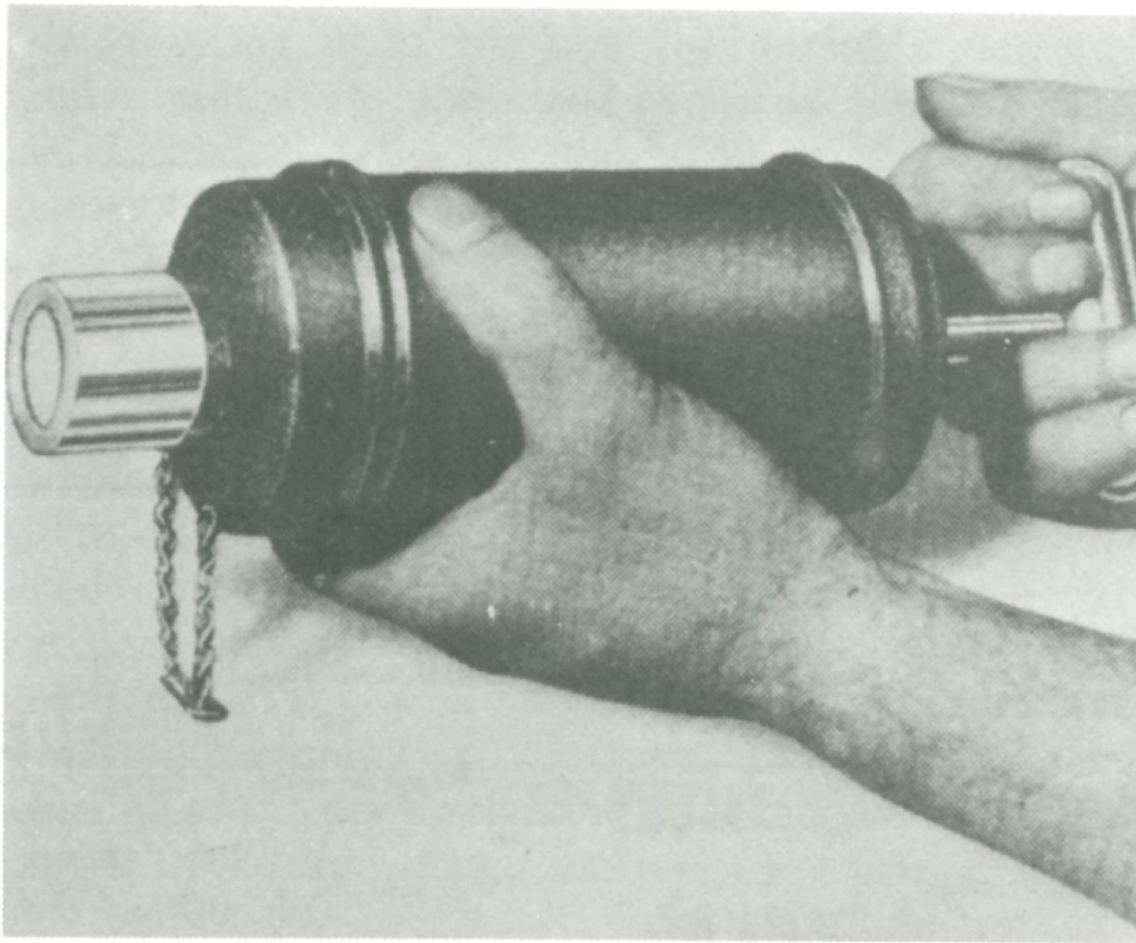


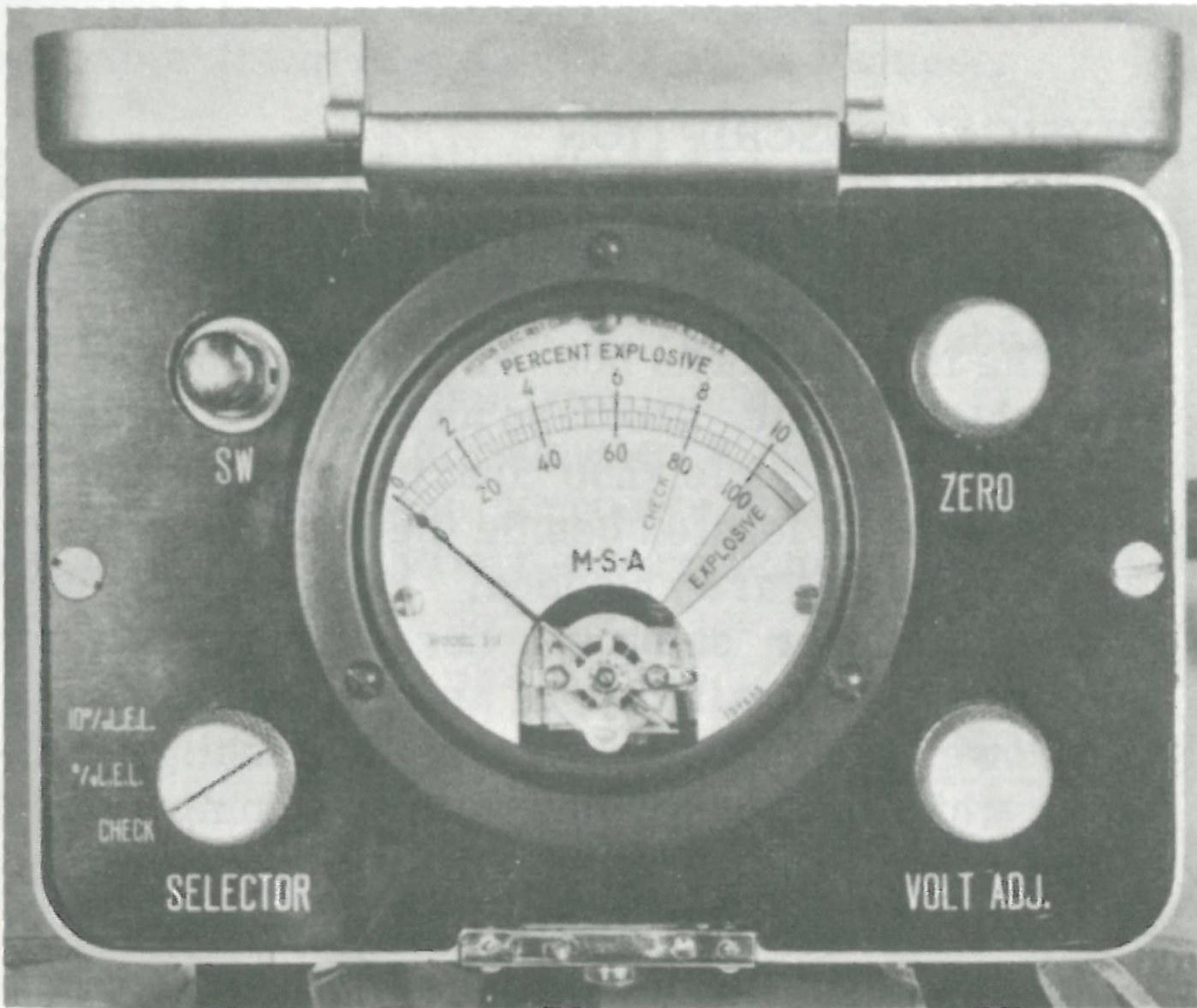
Fig. 1. Hand Sampling Pump (Samplair) as Used for Chromic Acid, Welding, Fume and Similar Exposures. (Courtesy Mine Safety Appliance Co.)



COMBUSTIBLE GAS INDICATORS
(Mine Safety Appliances Company)



Fig. 1. M-S-A Model 40 Combustible Gas Indicator for Locating Gas and Testing Flammable Gas or Vapor Hazards



**Fig. 2. Enlarged View of Model 40
Showing Dual Scale**

ELECTROSTATIC PRECIPITATORS

ELECTROSTATIC SAMPLER (Mine Safety Appliances Company)

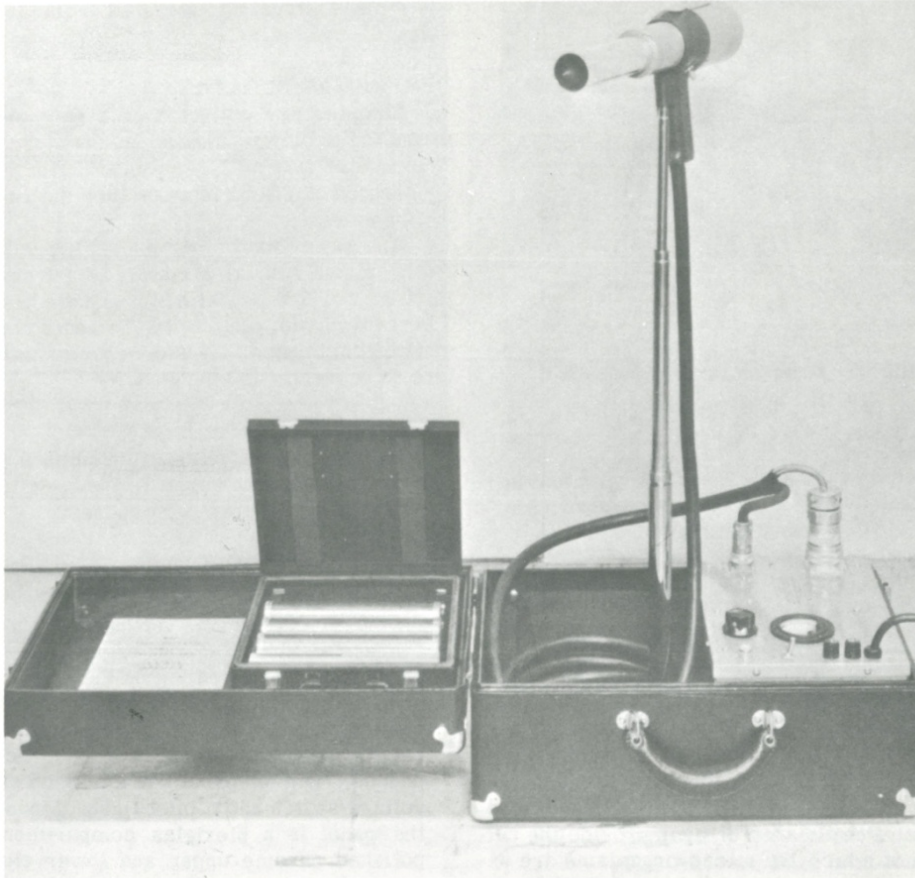


Fig. 1. M-S-A Electrostatic Sampler.

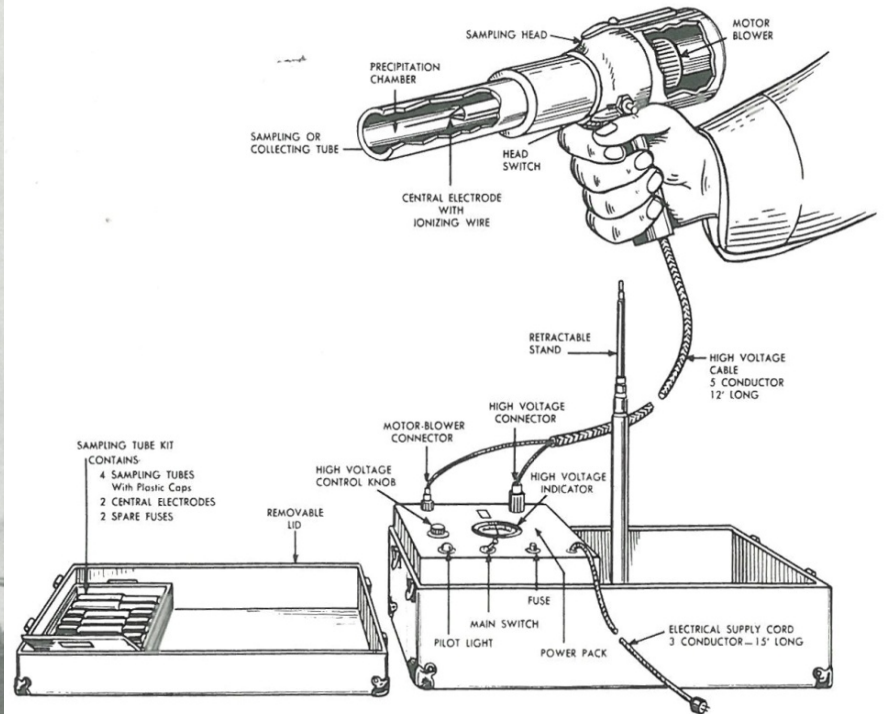


Fig. 2. Illustration of Various Component Parts.

AIR SAMPLING INSTRUMENTS

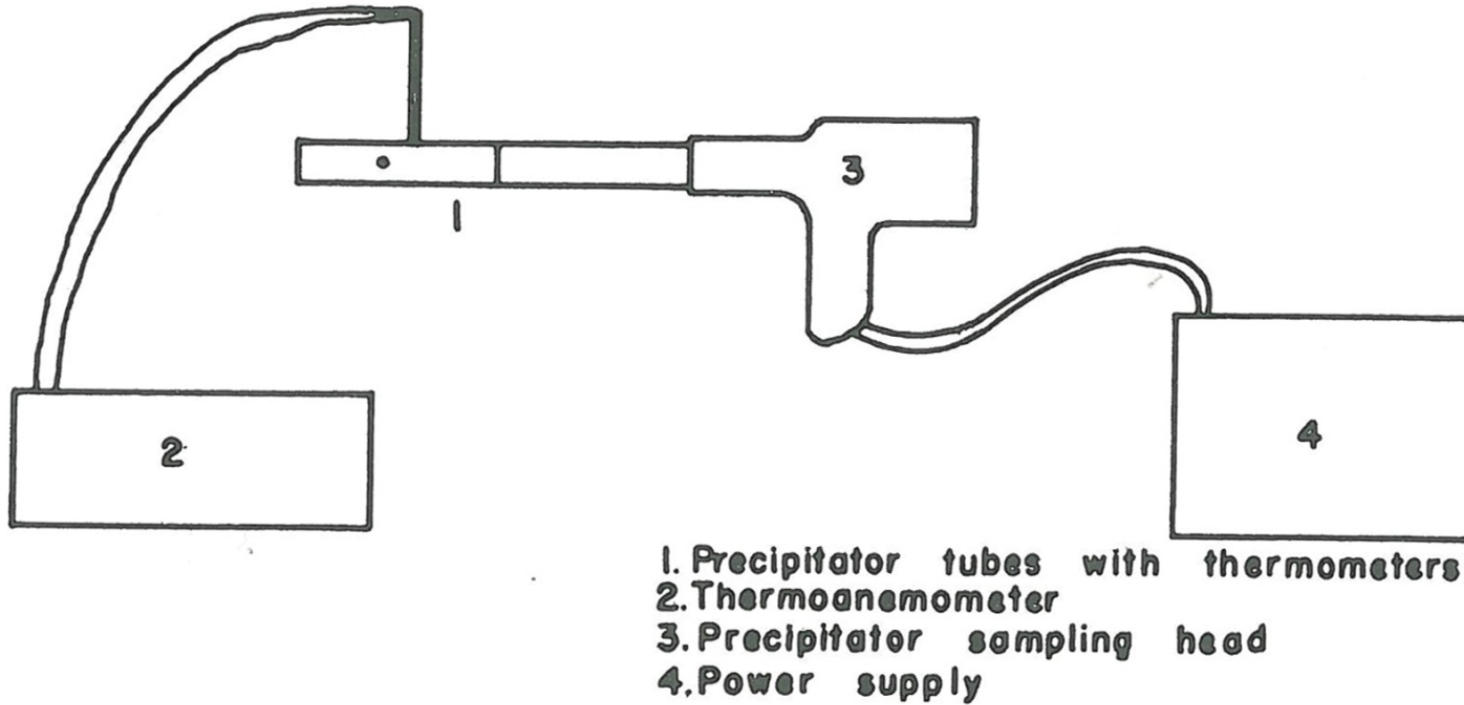


Fig. 5. Calibration of Electro-static Precipitator with Thermoanemometer.
(Reprinted from P.H.S. Publication No. 614.)

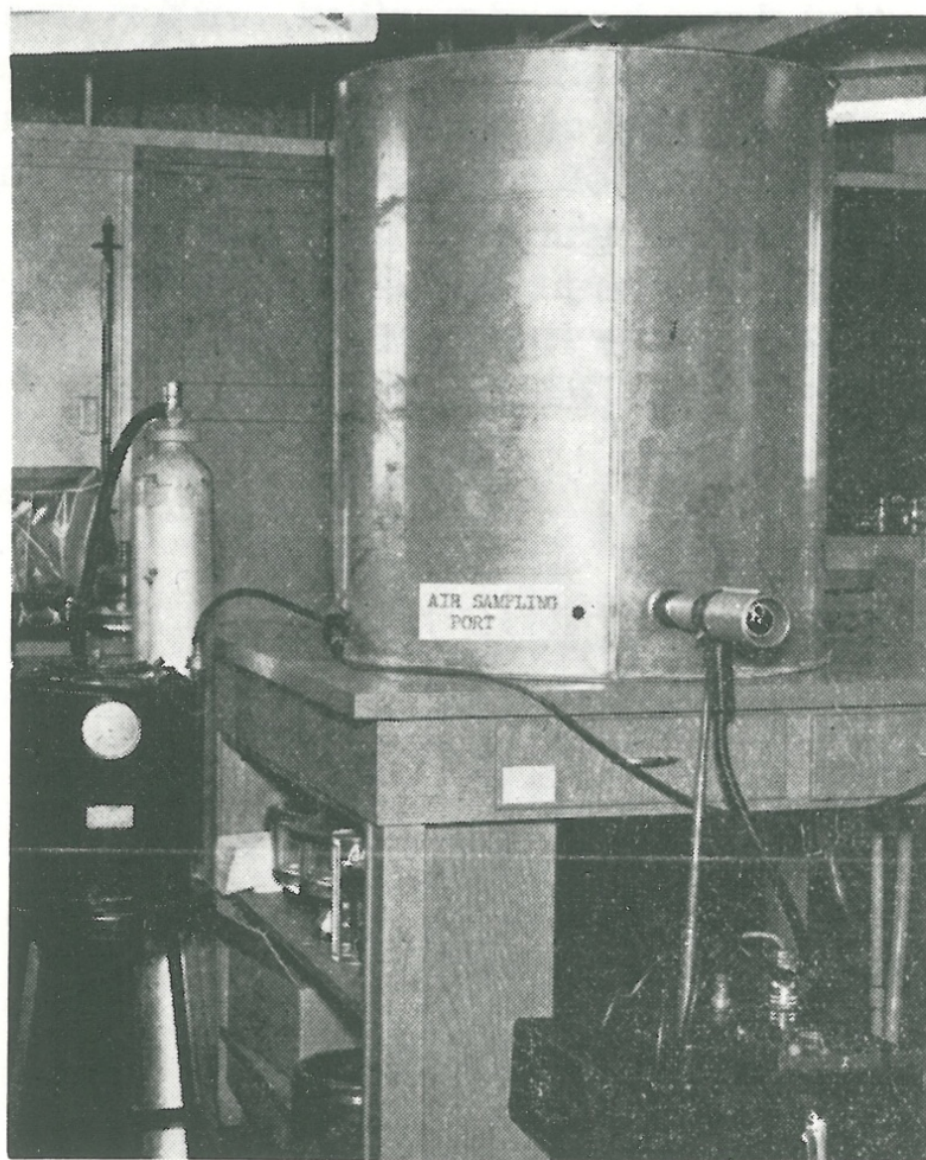


Fig. 6. Dilution Calibration of Electro-static Precipitator. (Reprinted from the A.I.H.A. Quarterly, Courtesy of A.I.H.A.)

HALIDE METER
(Davis Emergency Equipment Co., Inc.)

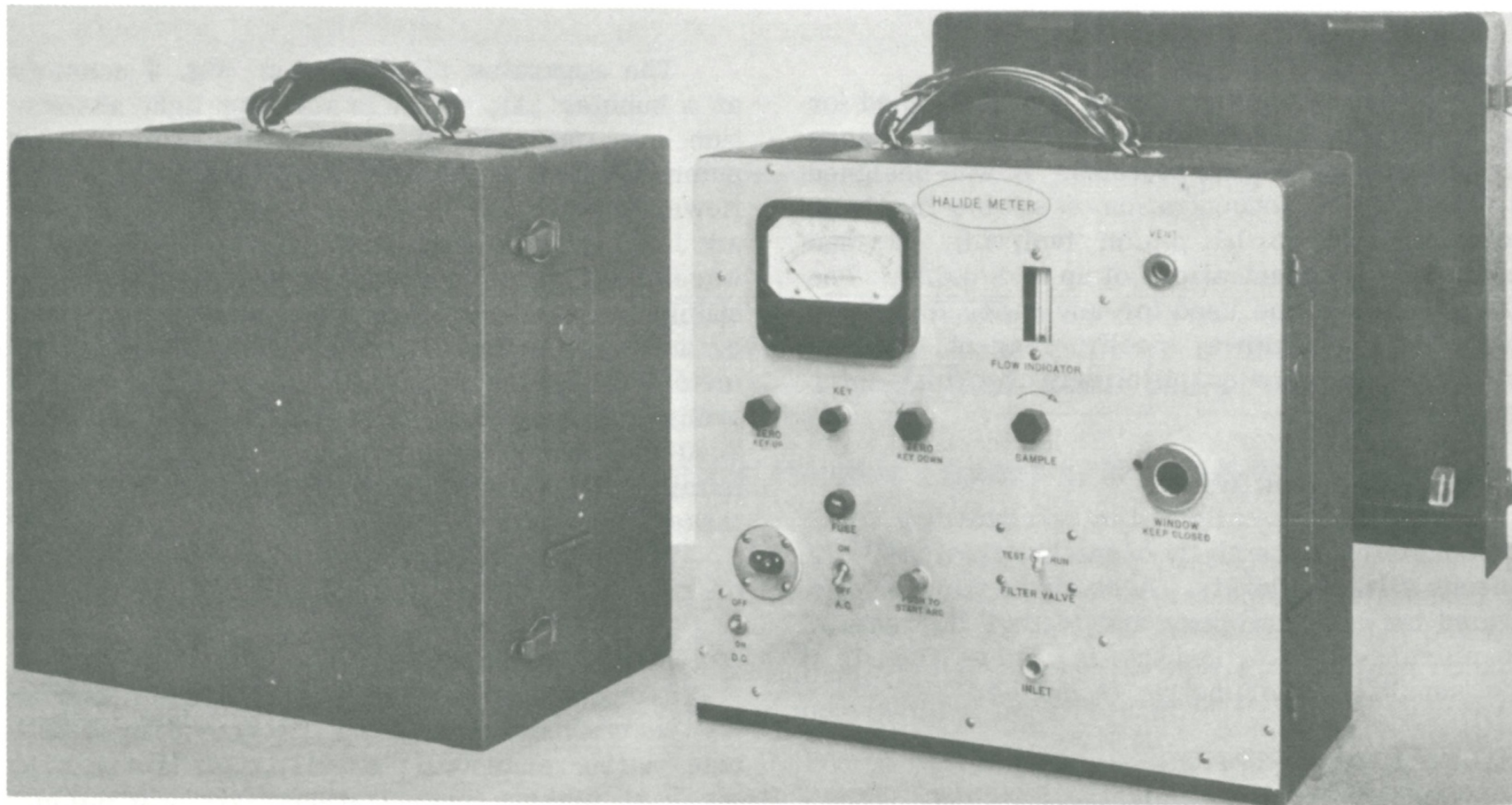


Fig. 1. Davis Halide Meter, in Carrying Case, Left; and with Front Cover Removed, Right.

INERTIAL COLLECTORS

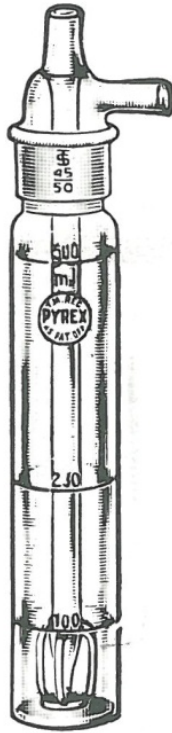


Fig. 2. Greenburg-Smith All-Glass Impinger.

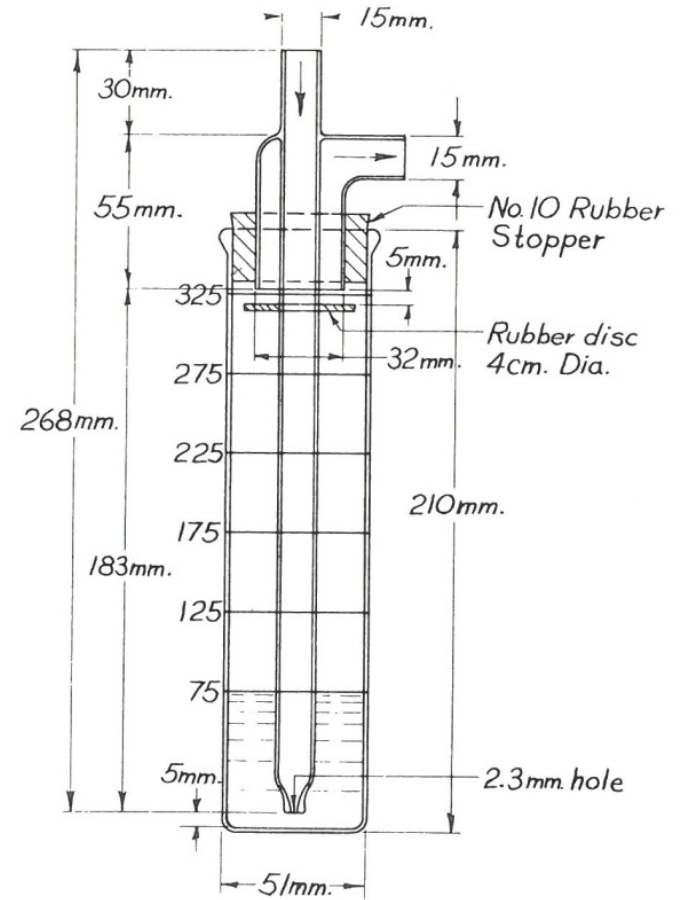


Fig. 3. Drawing of Greenburg-Smith Impinger Supplied with Unit No. 1.

GREENBURG-SMITH IMPINGER APPARATUS
(Willson Products Div., Ray-O-Vac Co.)

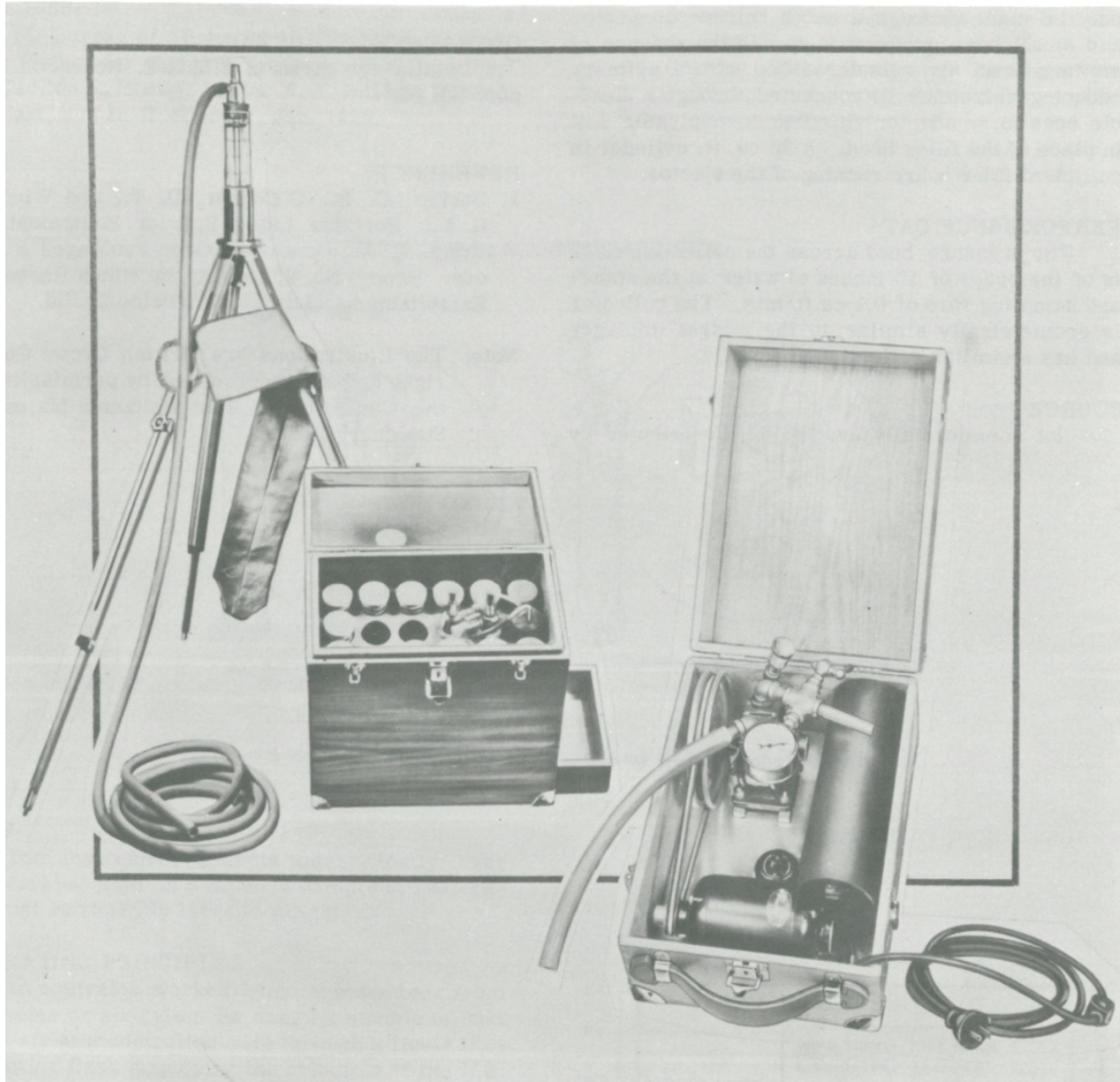
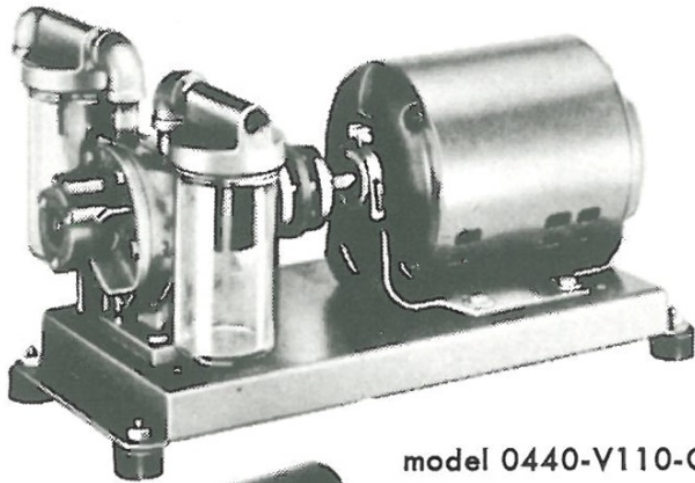
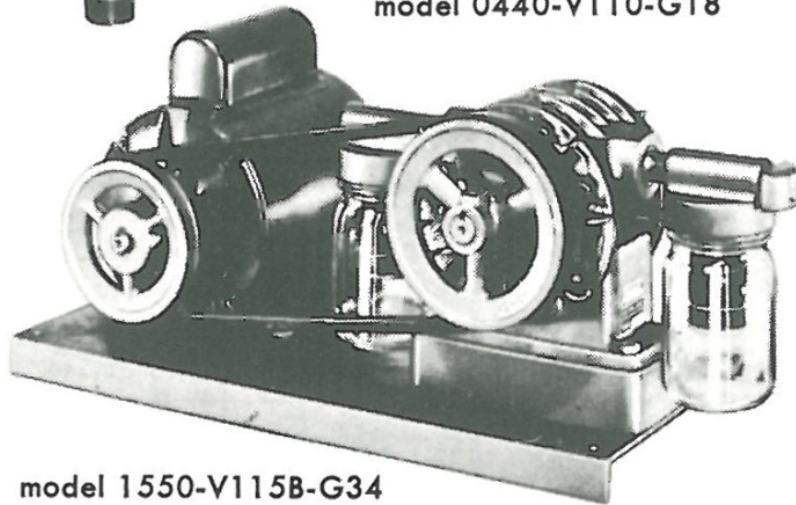


Fig. 1. Impinger Sampling Apparatus, Unit 1 Left, and Unit 3A (Motor Driven Pump) Right.

light-duty types



model 0440-V110-G18



model 1550-V115B-G34

c.f.m. free air, @ 1725 r.p.m.
(except as indicated)

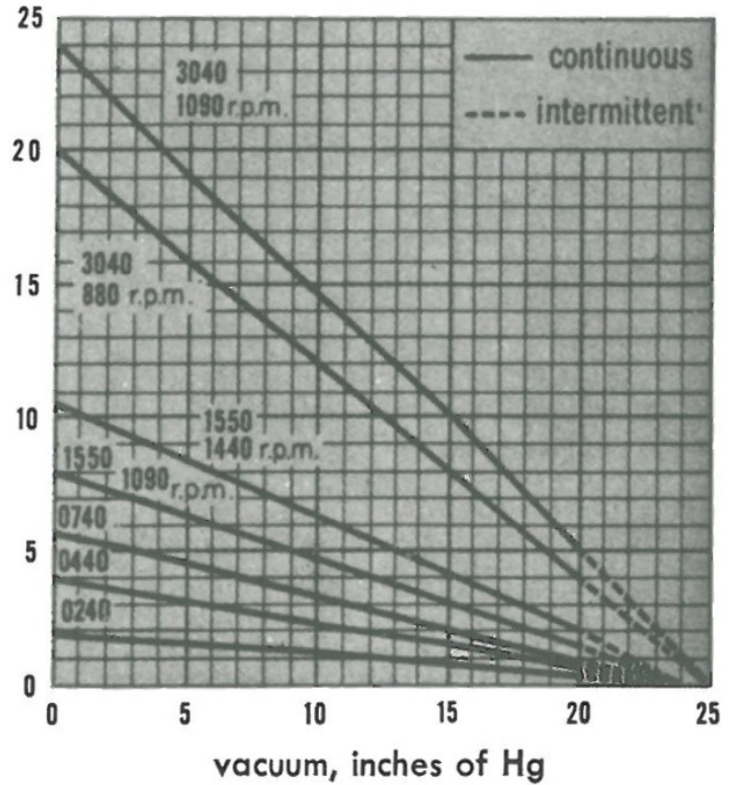


Fig. 4. Performance Curves for Gast Oil-Less Vacuum Pumps.

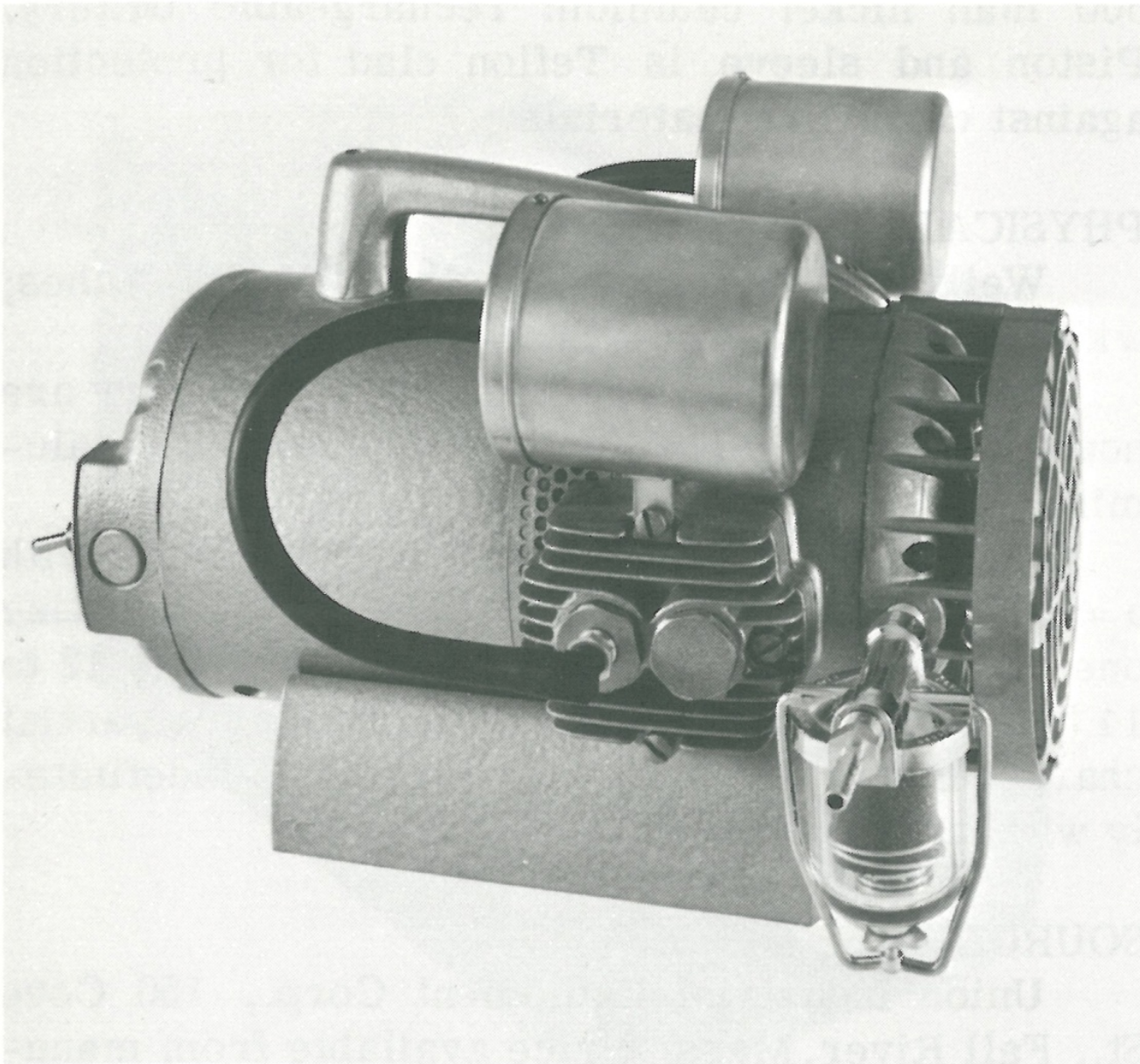


Fig. 1. Gelman Oil-Less Vacuum Pump.

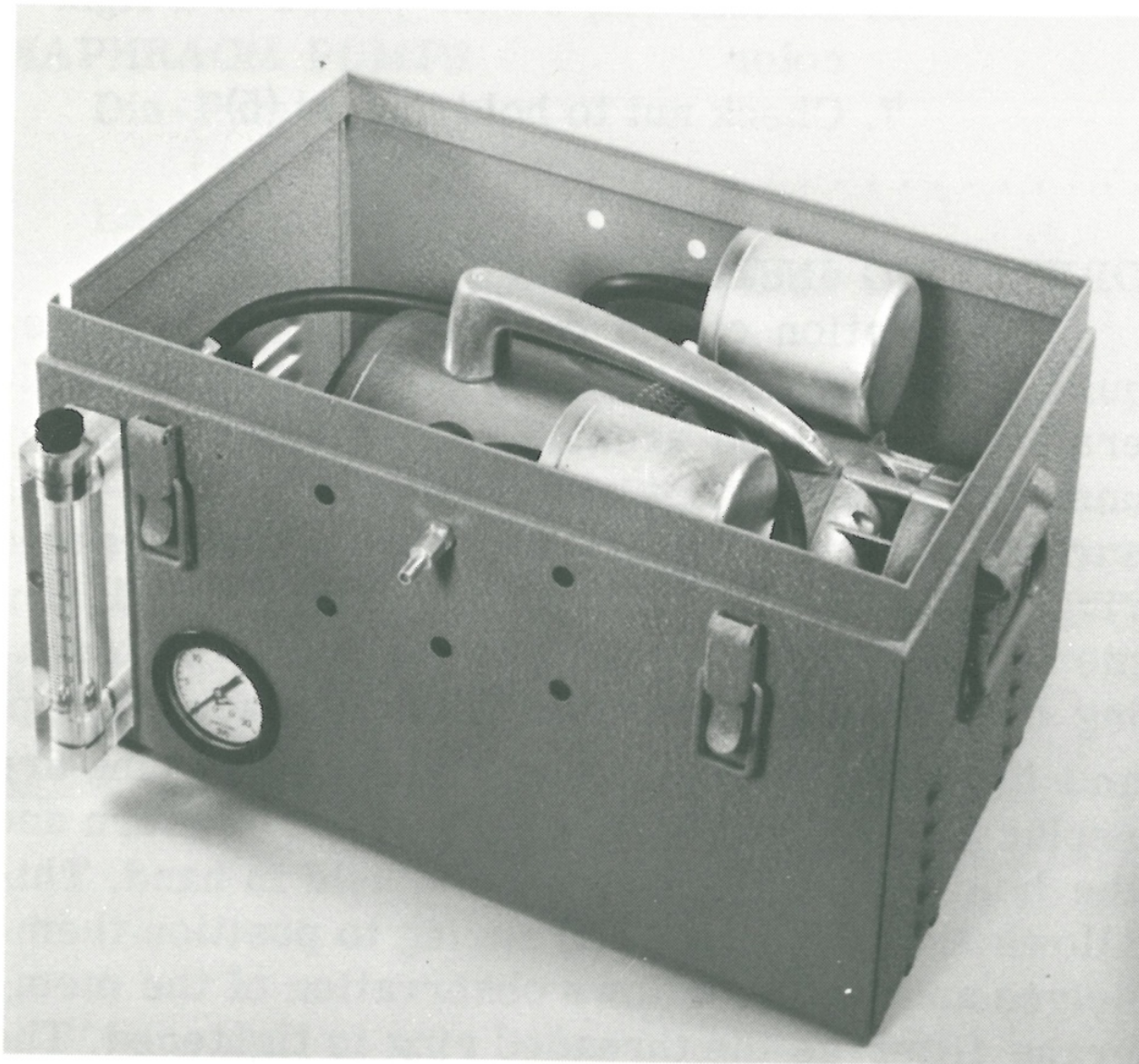


Fig. 1. Gelman Air Sampling Kit.

MIDGET IMPINGER
(Mine Safety Appliances Co.)

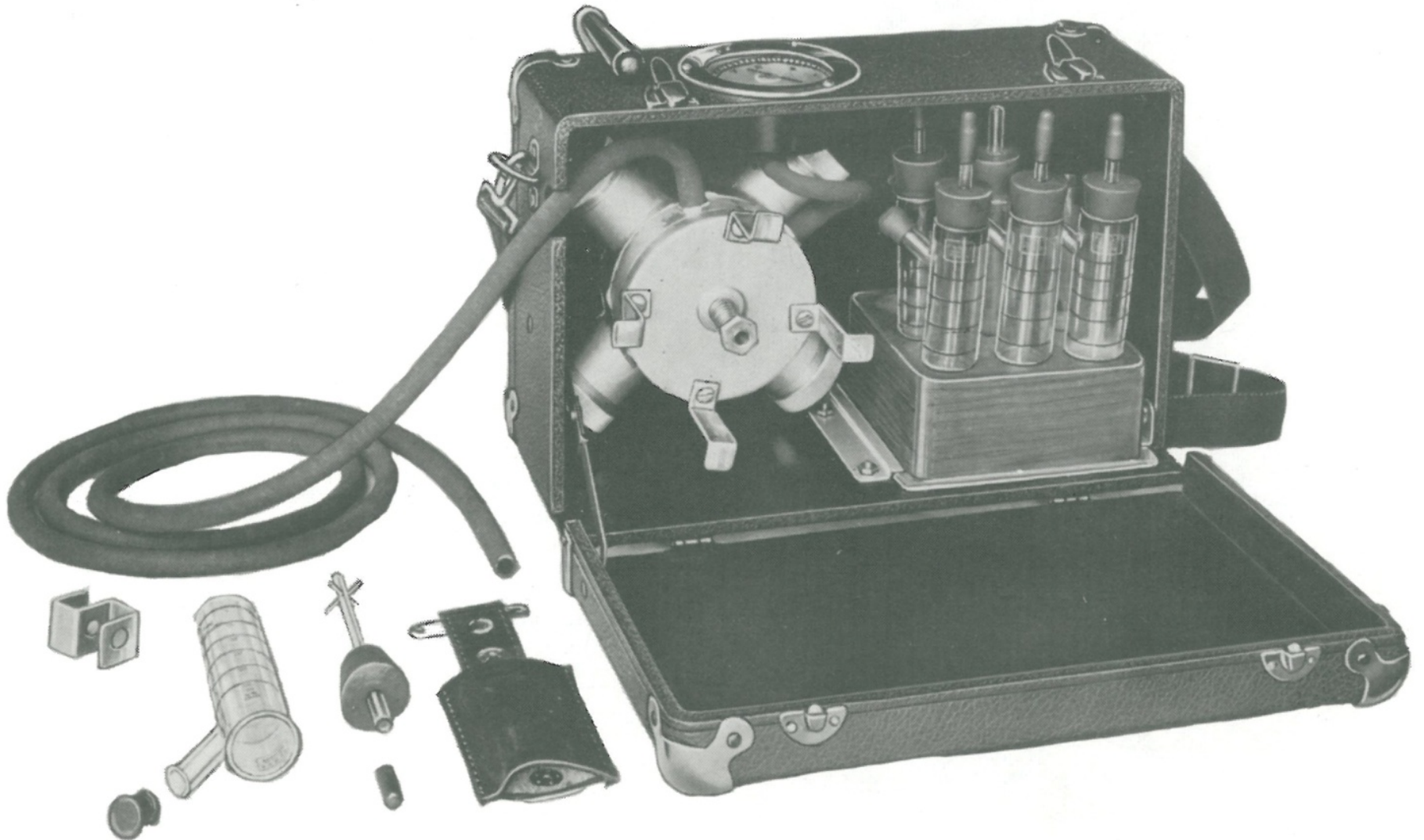


Fig. 1. M.S.A. Midget Impinger and Accessories.

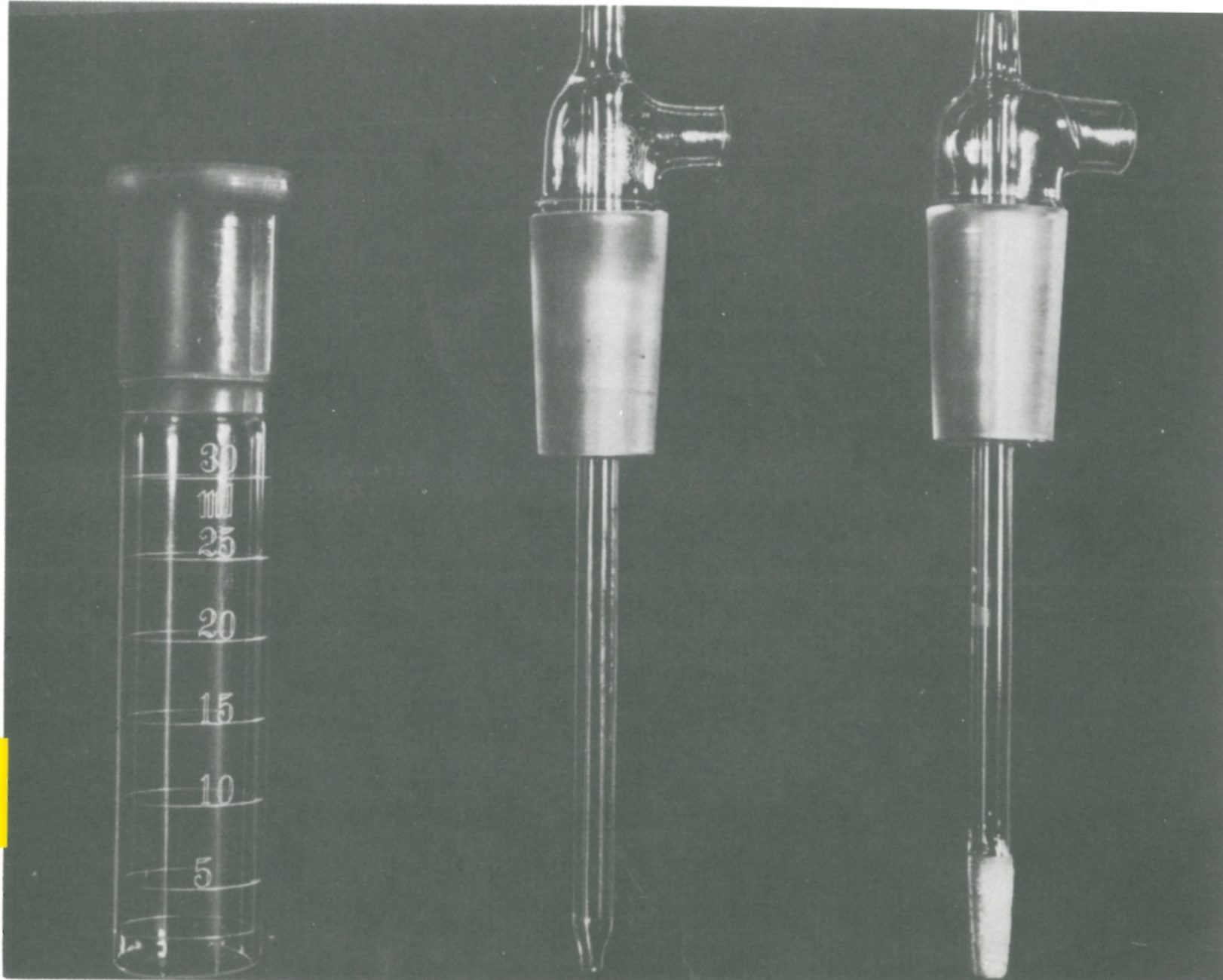
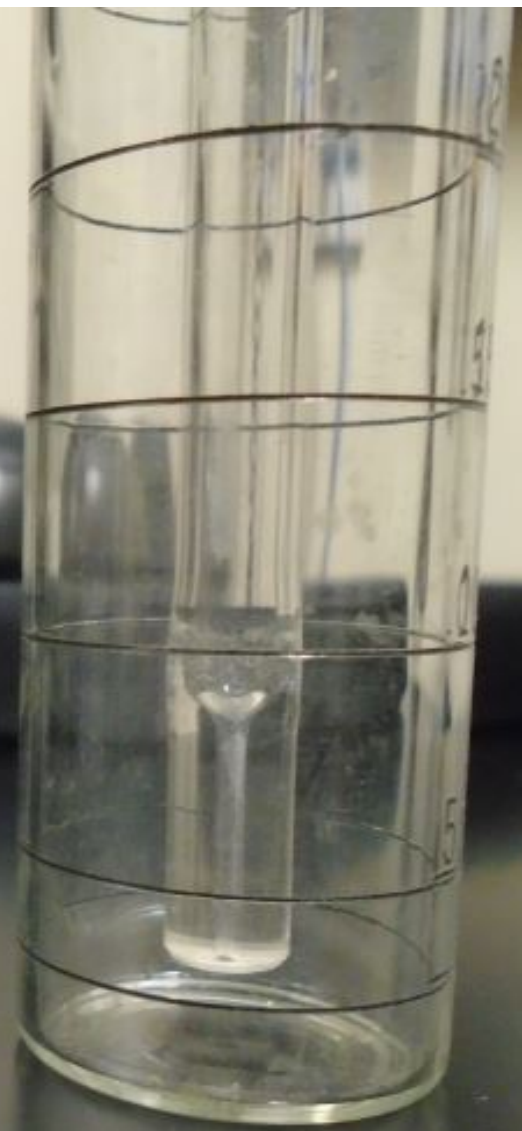
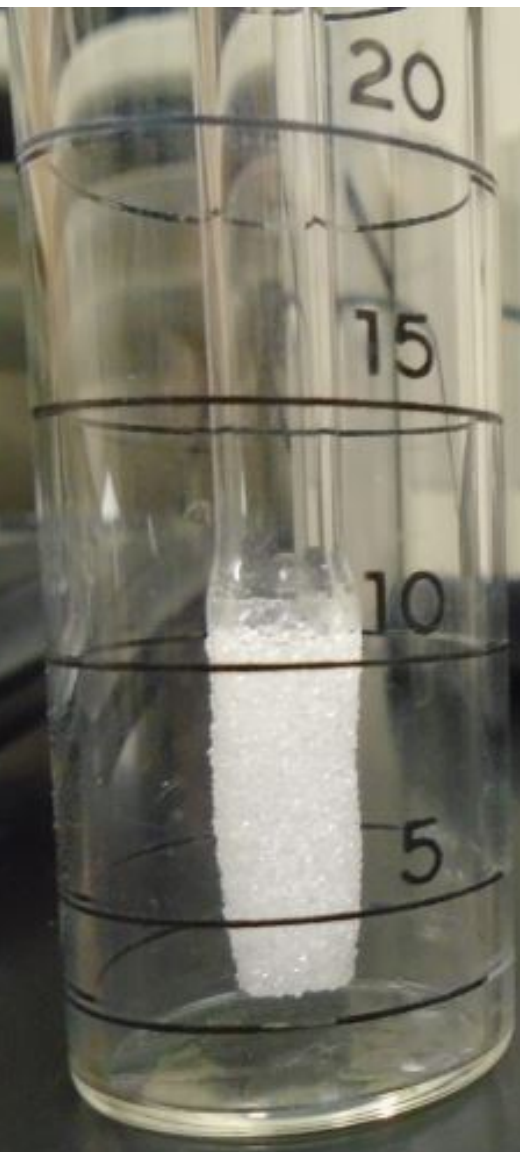


Fig. 2. All Glass Impinger Flask, Impinger Tube and Fritted Bubbler Tube.



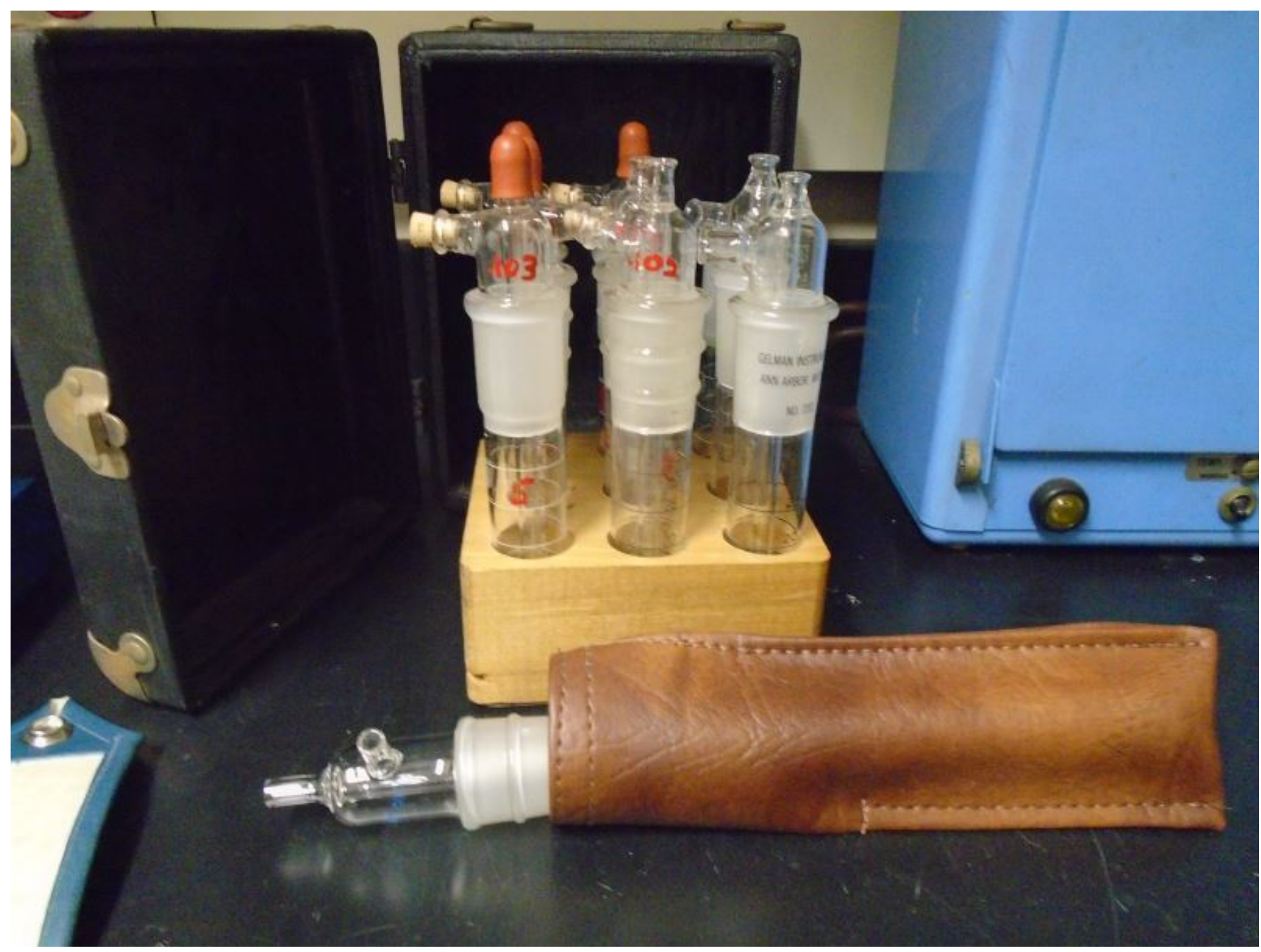




Fig. 1. TDI Detector Kit in Use.

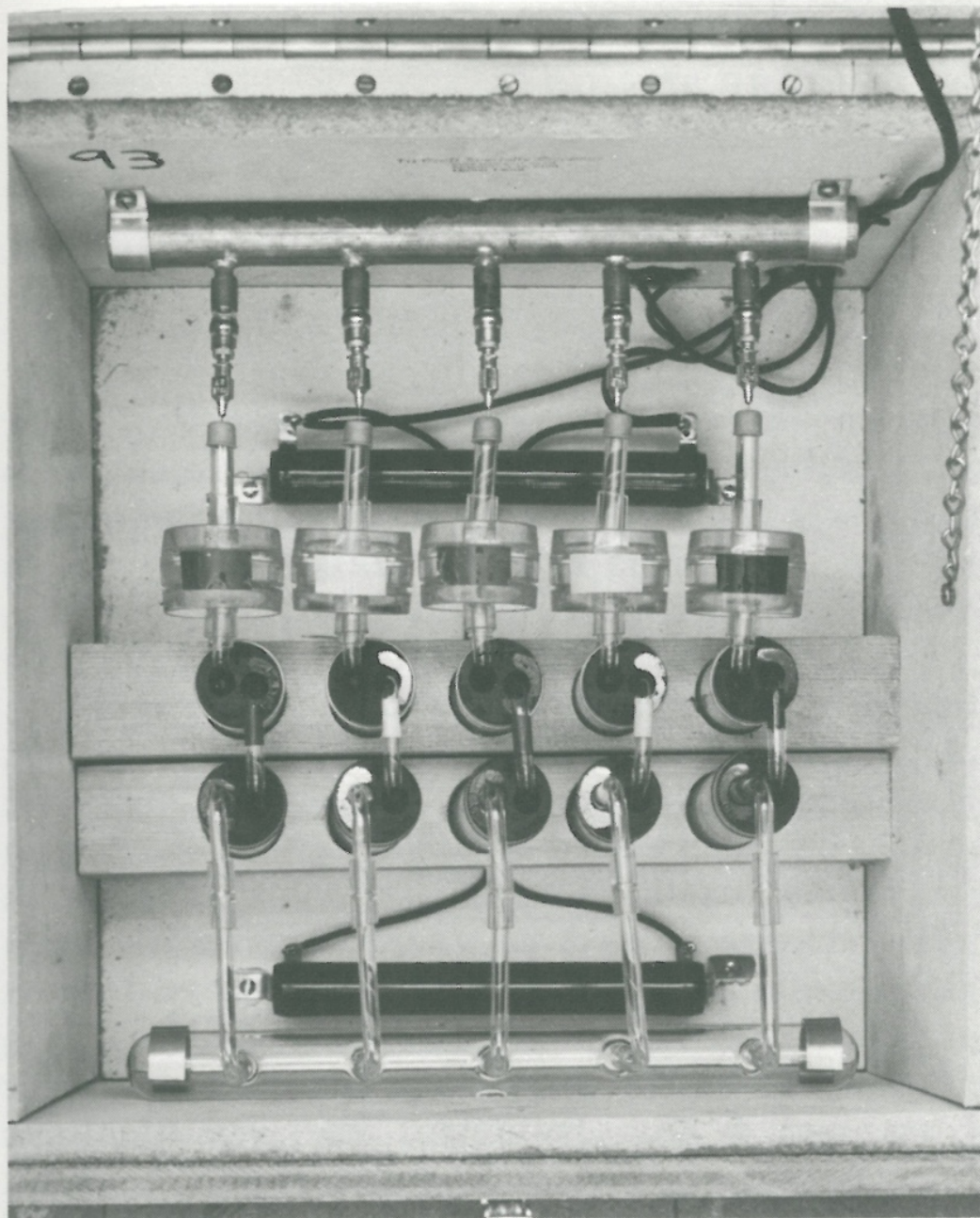


Fig. 2. Multiple Gas Sampler.

AIR SAMPLER, MODEL 30
(Union Industrial Equipment Corp.)

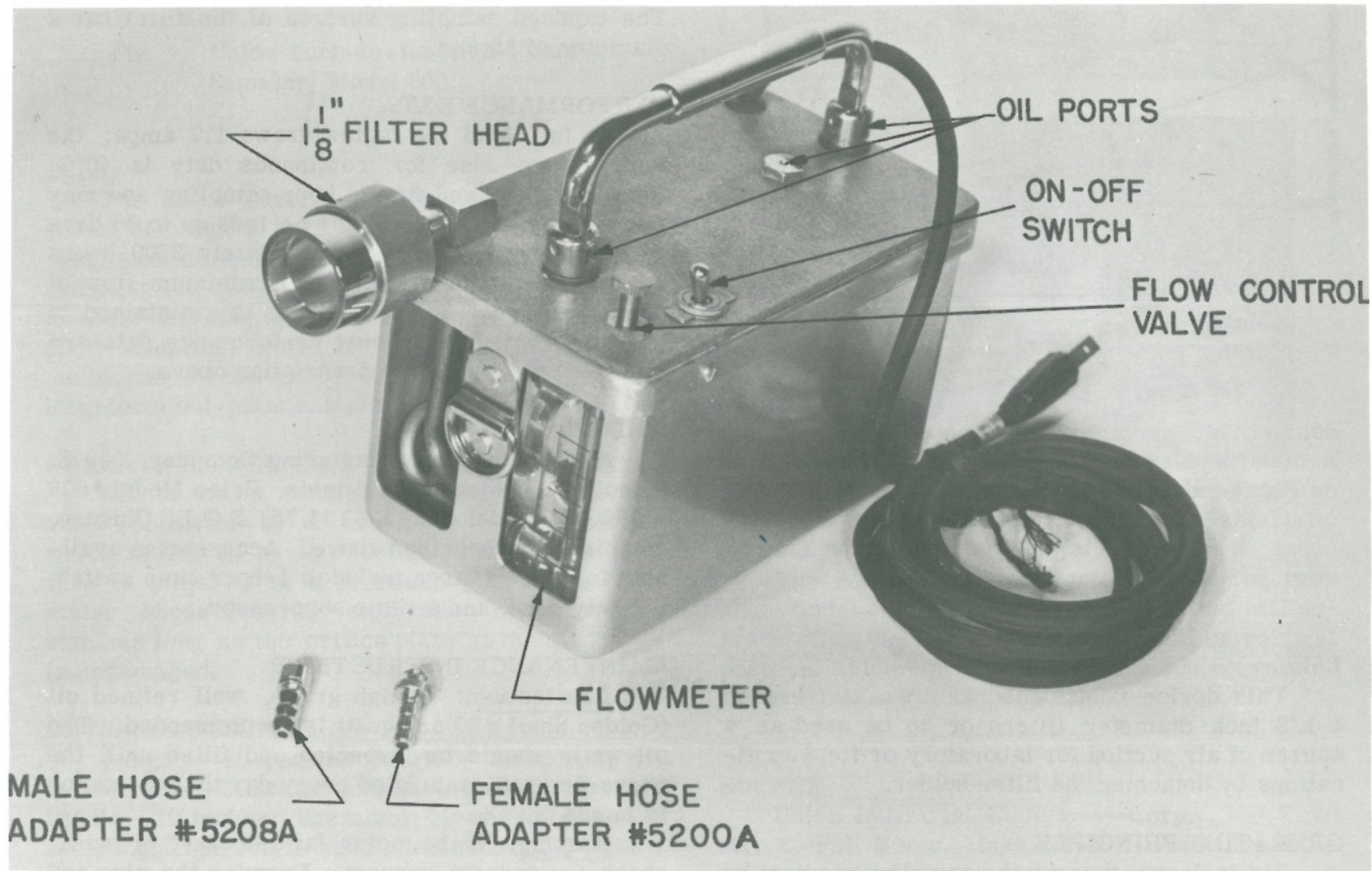


Fig. 1. Unico Model 20 Air Sampler. The Filter Head Attaches Directly to the Sampler Inlet through the Luer-Lok with a Half Turn. Alternate Hose Connections Are Shown at Lower Left.

AIR SAMPLERS AND MOVERS

MIDGET AIR SAMPLER, MODEL AD-440 (Research Appliance Co.)

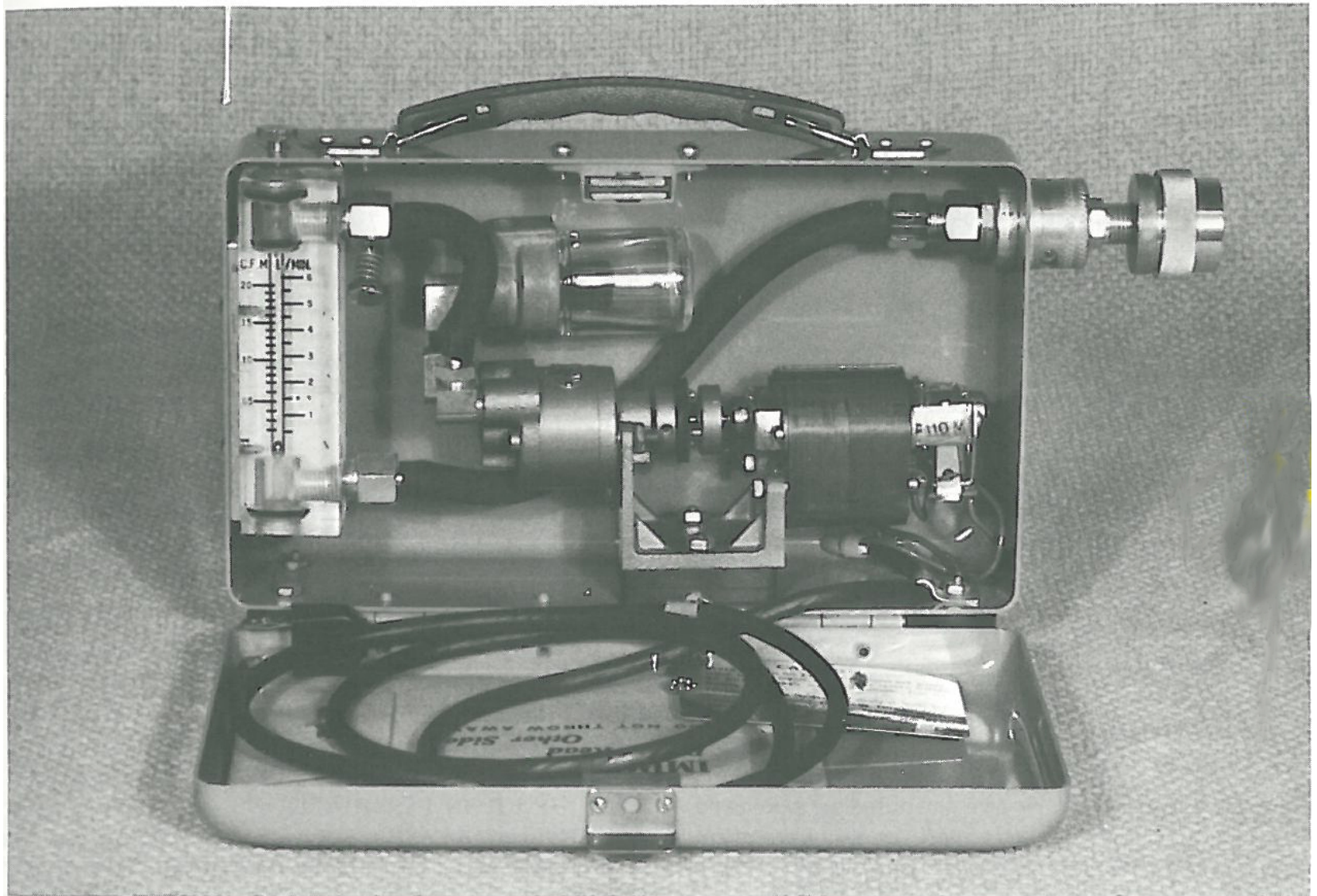


Fig. 1. Midget Air Sampler, Model AD-440 (AEC Type).

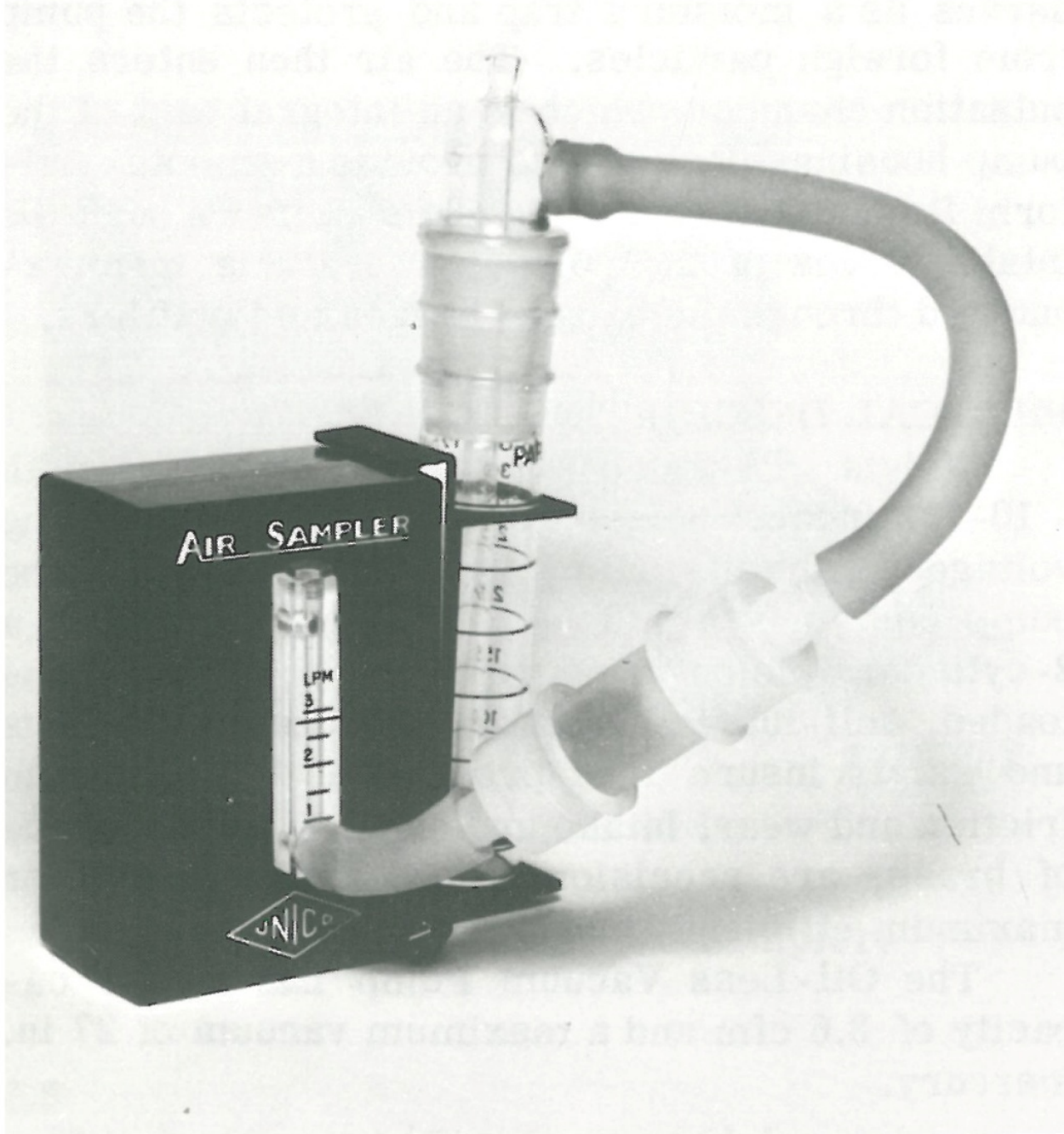
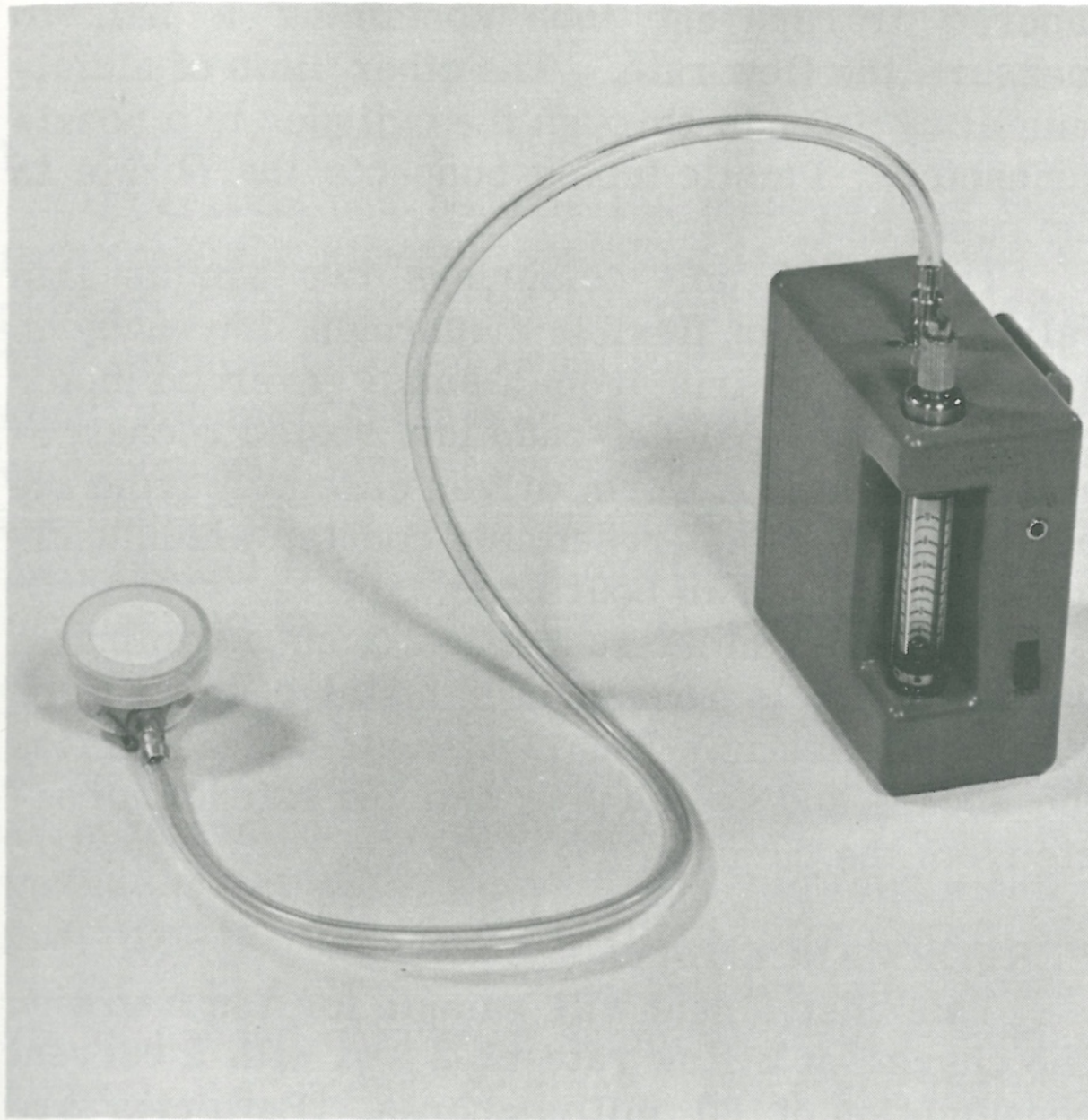


Fig. 1. Personnel Monitor with Impinger.



Fig. 1. Gelman Battery Air Sampler.



**Fig. 1. Mine Safety Appliances
Monitaire Sampler.**

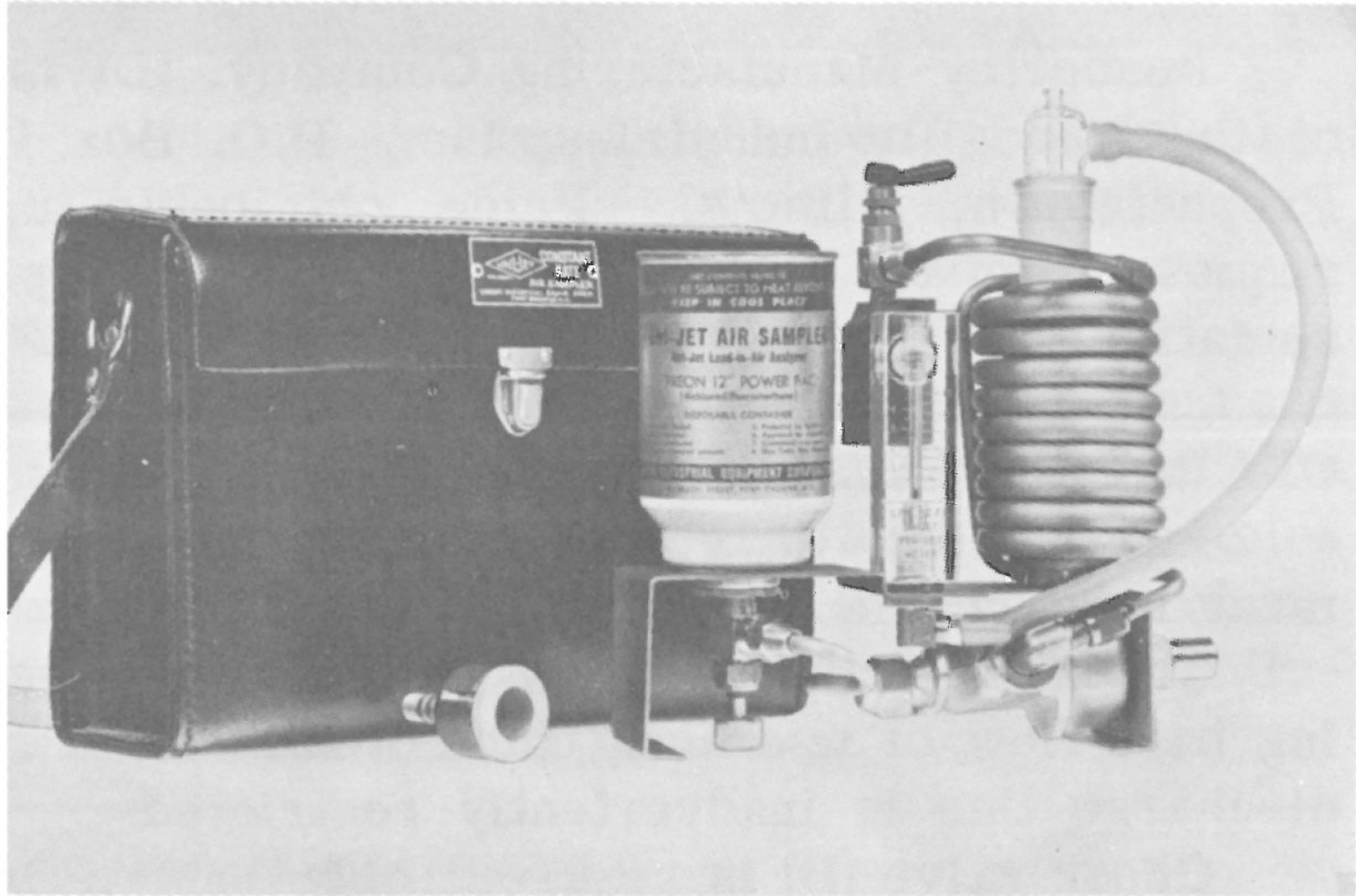


Fig. 1. Uni-Jet Constant Rate Air Sampler, Shown with Leather Carrying Case, Filter Holder, and Midget Impinger.

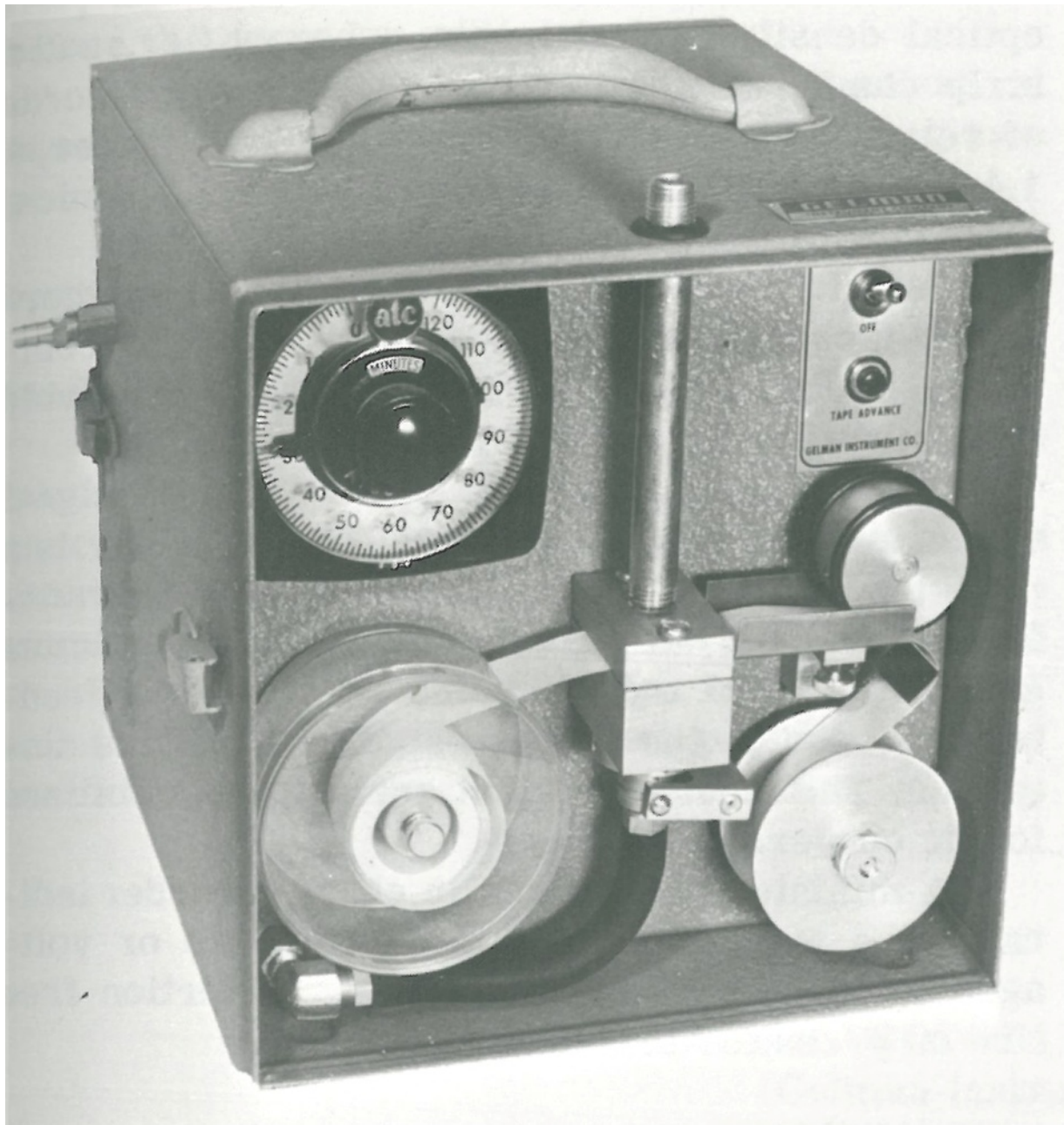
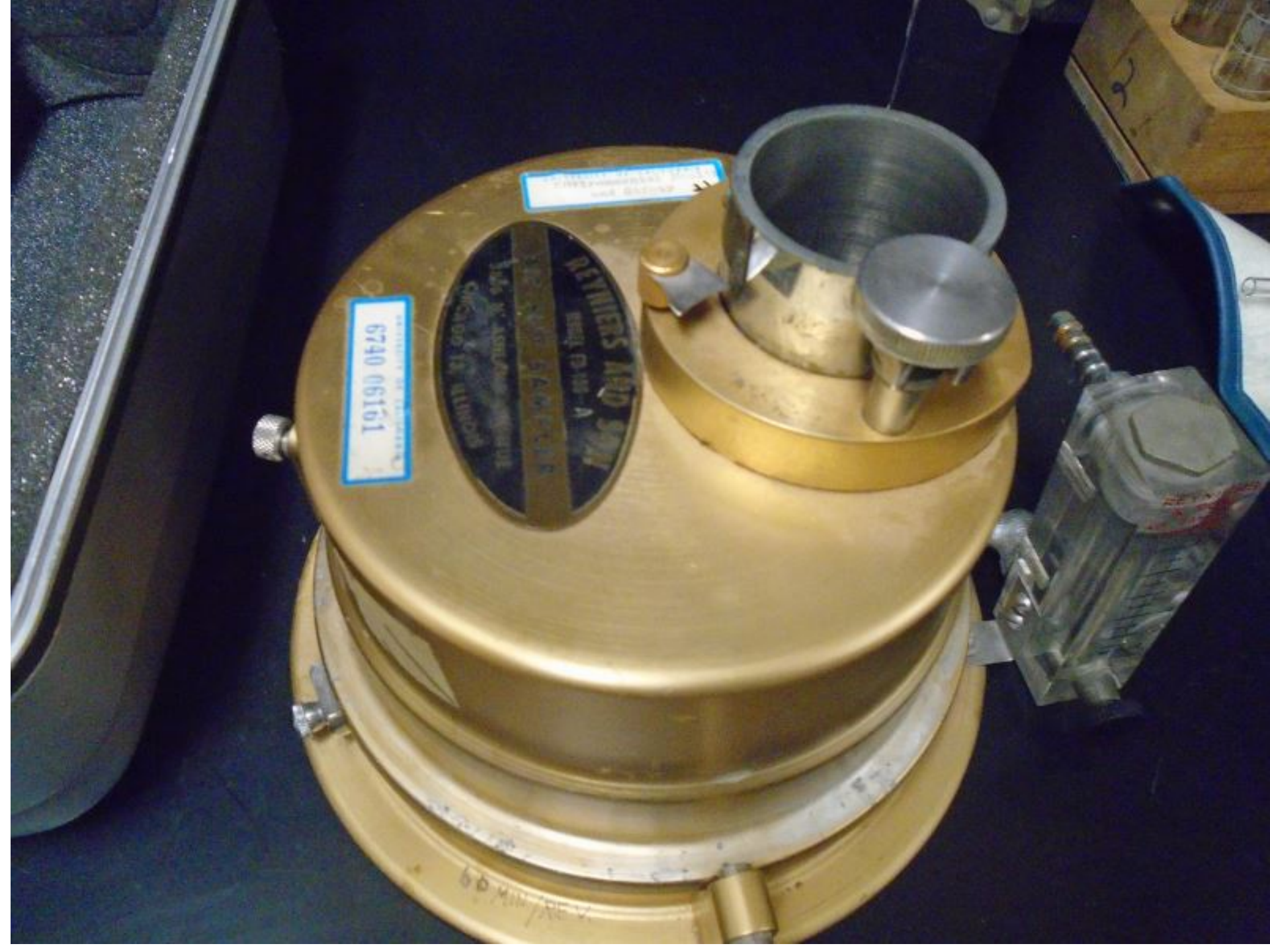


Fig. 1. Paper Tape Air Sampler.



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ST. 714-992-2780

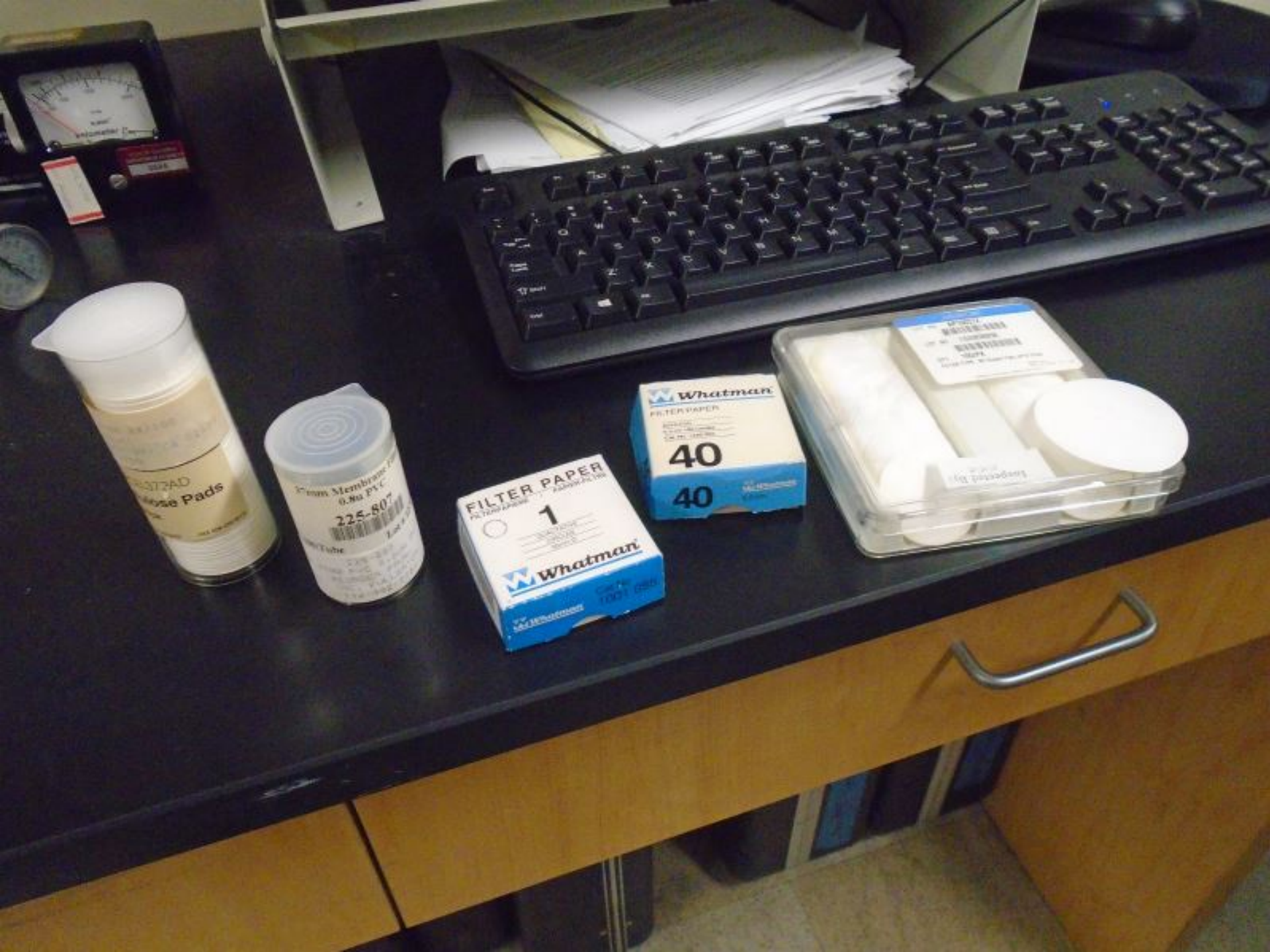
Cat# APCEL37

37mm Cellulose

100/pk

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17mm Membrane Filter
0.45 µm PTFE
225-807

FILTER PAPER
1
Whatman

Whatman
FILTER PAPER
40

17mm Membrane Filter
0.45 µm PTFE
225-807

AIR SAMPLING INSTRUMENTS

MULTIPLE GAS SAMPLER
(Tri-Craft Specialties Co.)

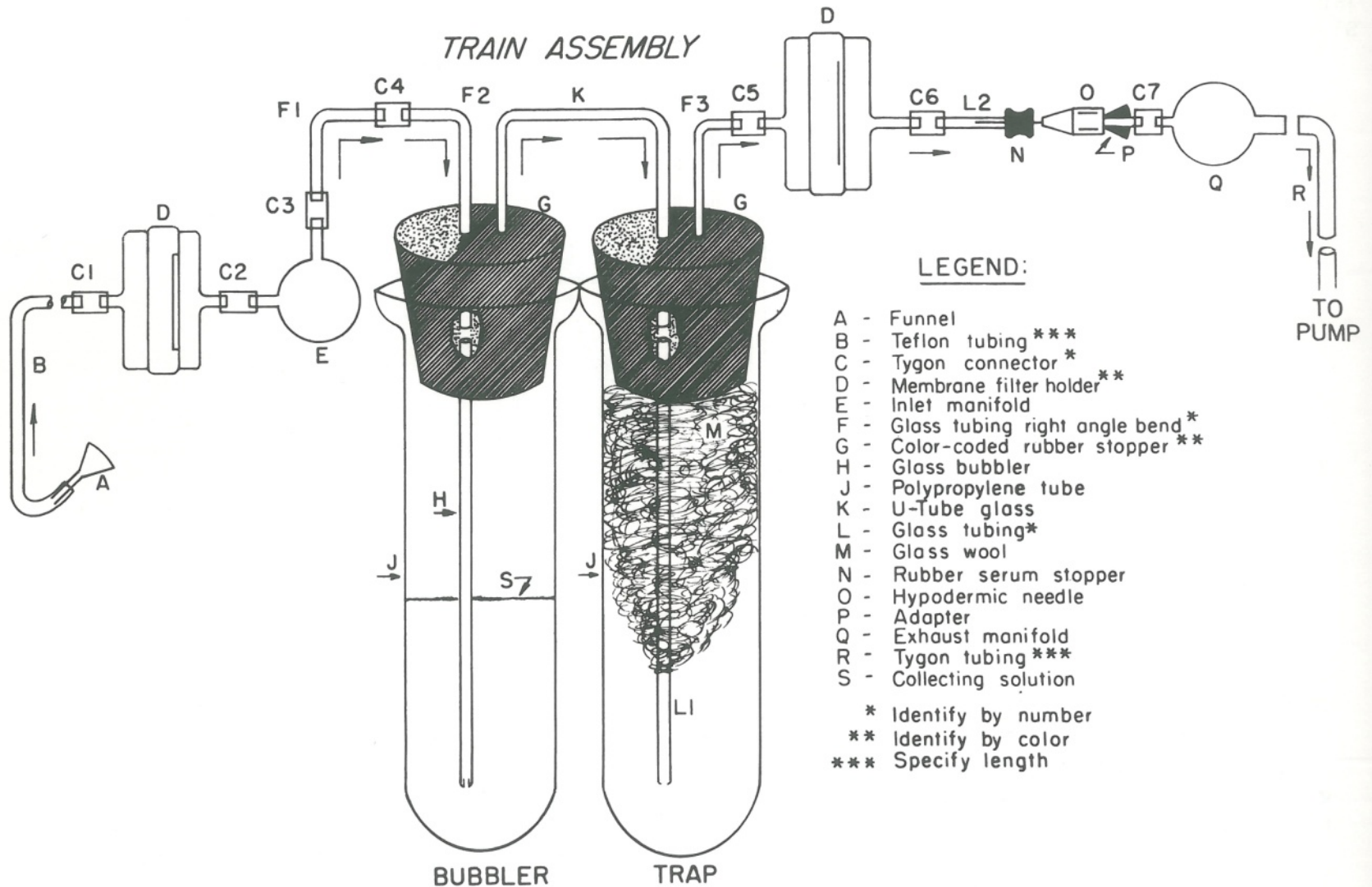
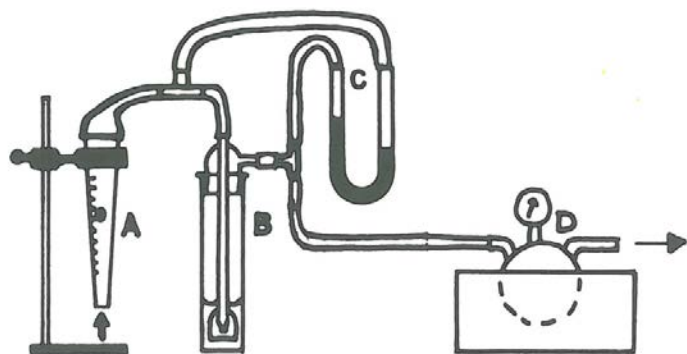
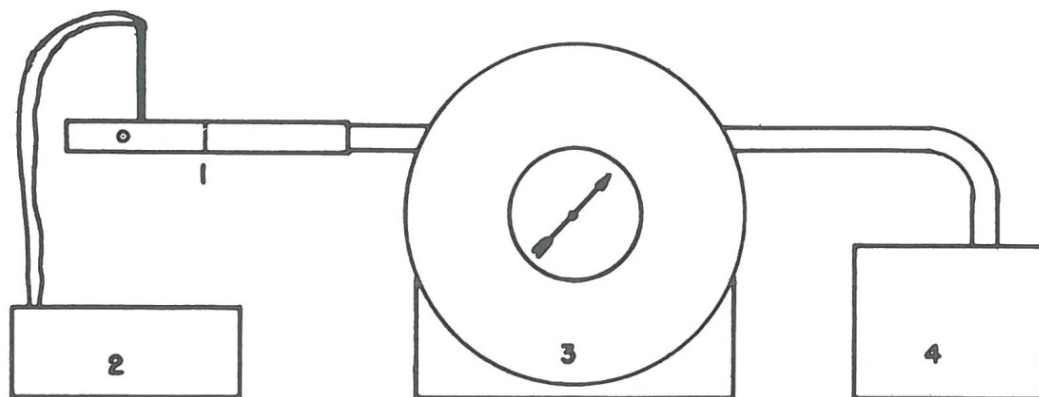


Fig. 1. Schematic Drawing of Gas Sampling Train.



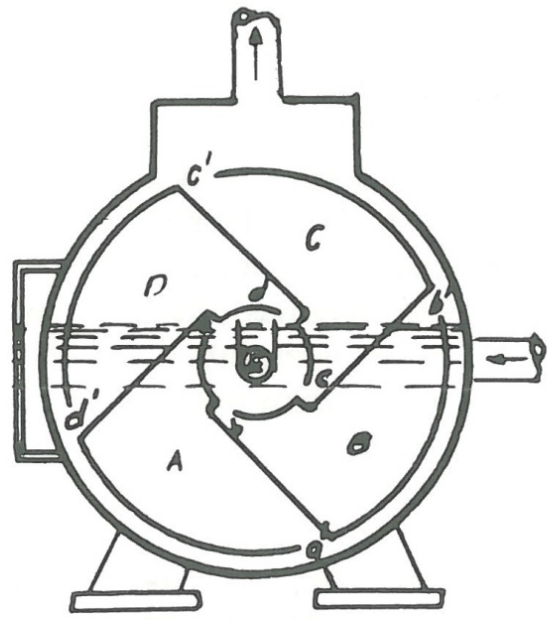
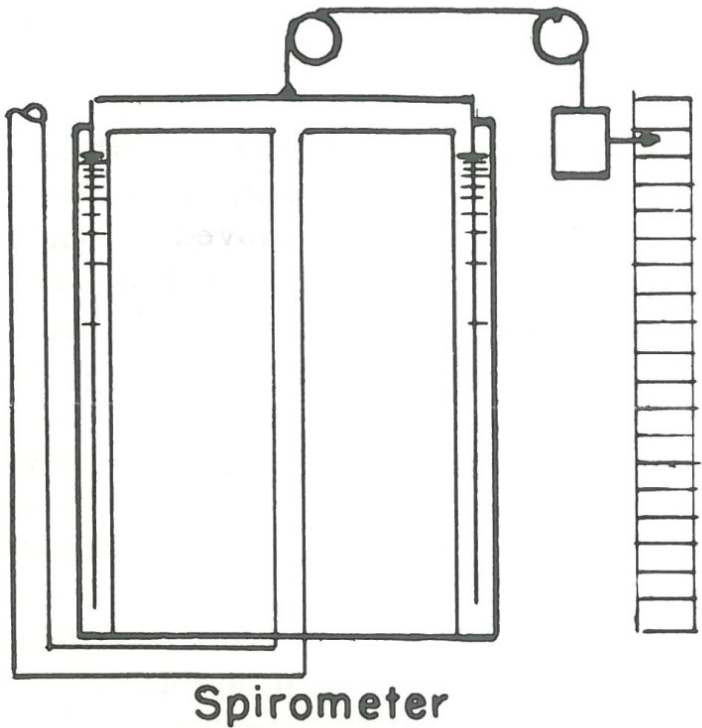
A ROTAMETER **C MANOMETER**
B IMPINGER **D WILLSON PUMP**

Fig. 3. Calibration of Greenburg-Smith Impinger. (Reprinted from P.H.S. Publication No. 614.)



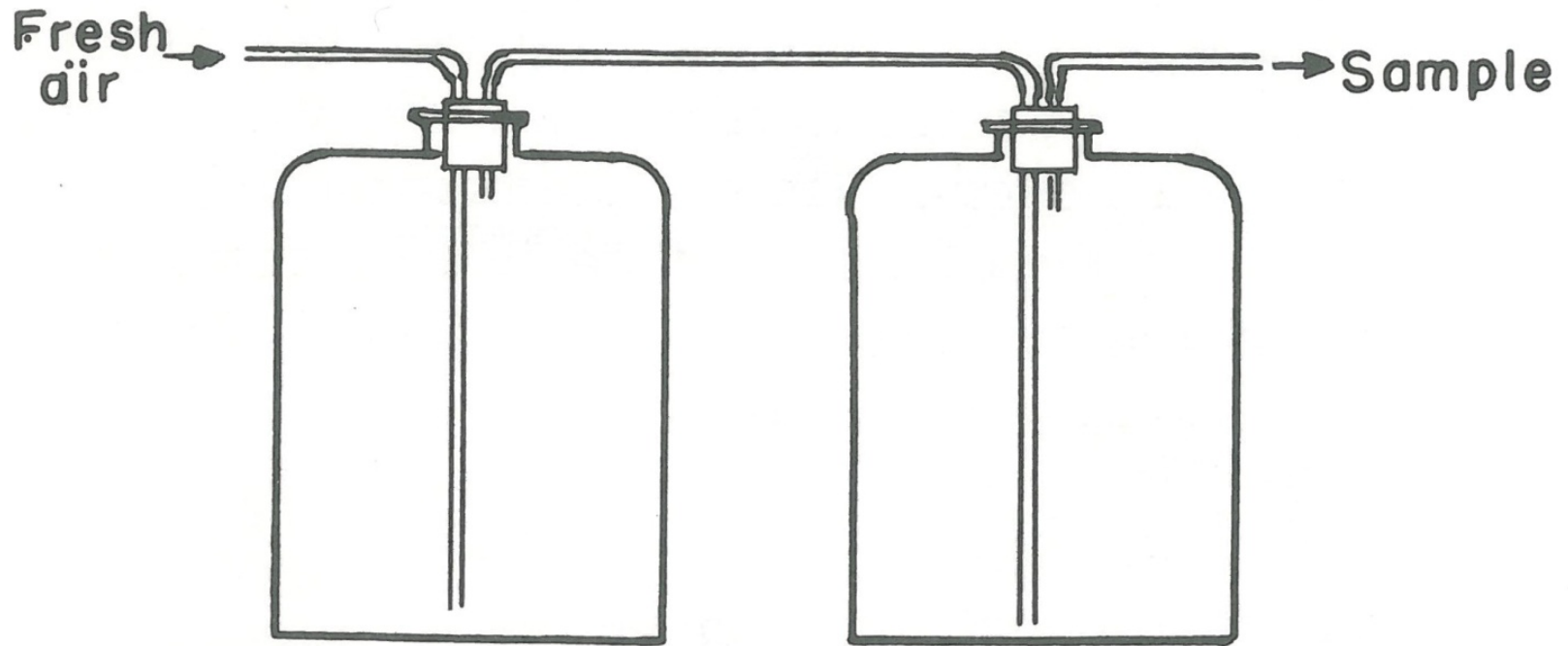
1. Precipitator tubes with thermometers
2. Thermoanemometer
3. Wet gas meter
4. Source of suction

Fig. 4. Calibration of Thermoanemometer with Wet Gas Meter. (Reprinted from P.H.S. Publication No. 614.)



A,B,C,D, metering
 compartments
 a,b,c,d, compart-
 ment inlets
 a¹,b¹,c¹,d¹, com-
 partment outlets
 E, gas inlet

Fig. 1. Schematic Diagram of Spirometer and Wet Test Meter.
 (Reprinted from P. H. S. Publication No. 614.)



Bottle Arrangement for Minimum Dilution

Fig. 8. Two (or more) Bottles in Series for Static Calibration. (Reprinted from P.H.S. Publication No. 614.)

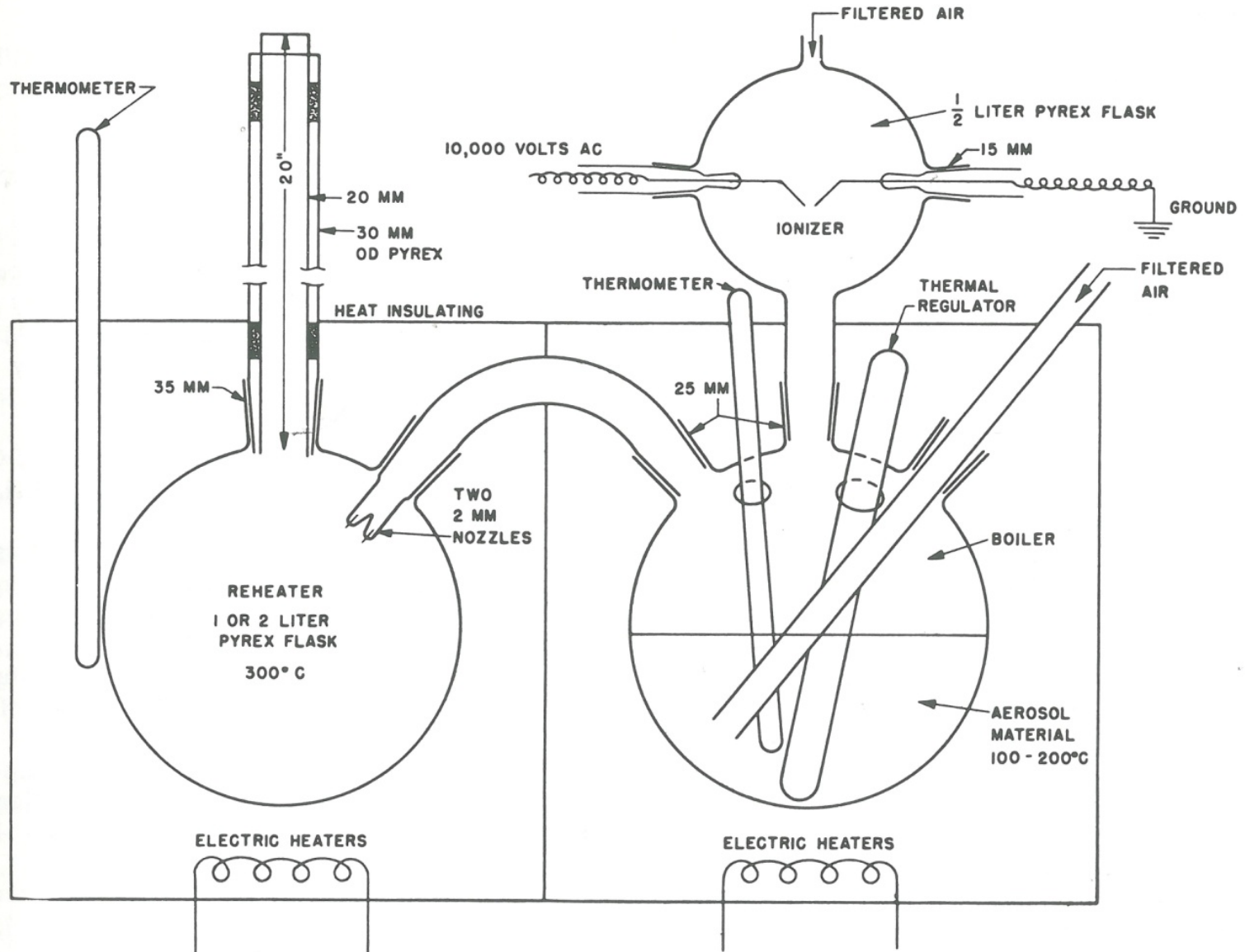


Fig. 13. Mono-disperse Aerosol Generator. (Reprinted from United States Atomic Energy Commission Handbook on Aerosols.)





CAUTION
Do not touch the inner pressure
cooker. The inner pressure
cooker is hot. Do not touch
the inner pressure cooker
until it is cooled down.
Do not touch the inner
pressure cooker until it is
cooled down.

Pressure Cooker
The Gilibrator
Gilian Instrument Corp.

The Gilibrator
Thermal Prover
P.N. C. 800274 S-16
Gilian Instrument Corp.
POWER
TEMP. CONTROL
SPD-40

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4-25-72

OFF ON WET BULB DRY BULB
RANGE: 15 TO 100% RH

622

DIGITAL PSYCHROMETER

HOLD

CHECK-IT[®]
SUBMITRONICS



ENVIRONMENTAL TECHNOLOGY CORPORATION
100 TOWERS PL. 204C

PSYCHRO-DYNE

MODEL NO. PP100

PSYCHROMETRIC CHART

BAROMETRIC PRESSURE = 29.92 IN. HG.

$^{\circ}\text{C} = 5/9(^{\circ}\text{F} - 32)$ $^{\circ}\text{F} = 9/5^{\circ}\text{C} + 32$

DEW POINT - FOLLOW HORIZONTAL LINE FROM
INTERSECTION OF BULB READINGS
BACK TO 100% CURVE.



PSYCHRO-DYNE
PSYCHROMETRIC CHART



Outline - synthetically prepared
given in units of g/l





Fig. 2. Beckman Model 24 Mercury Vapor Meter

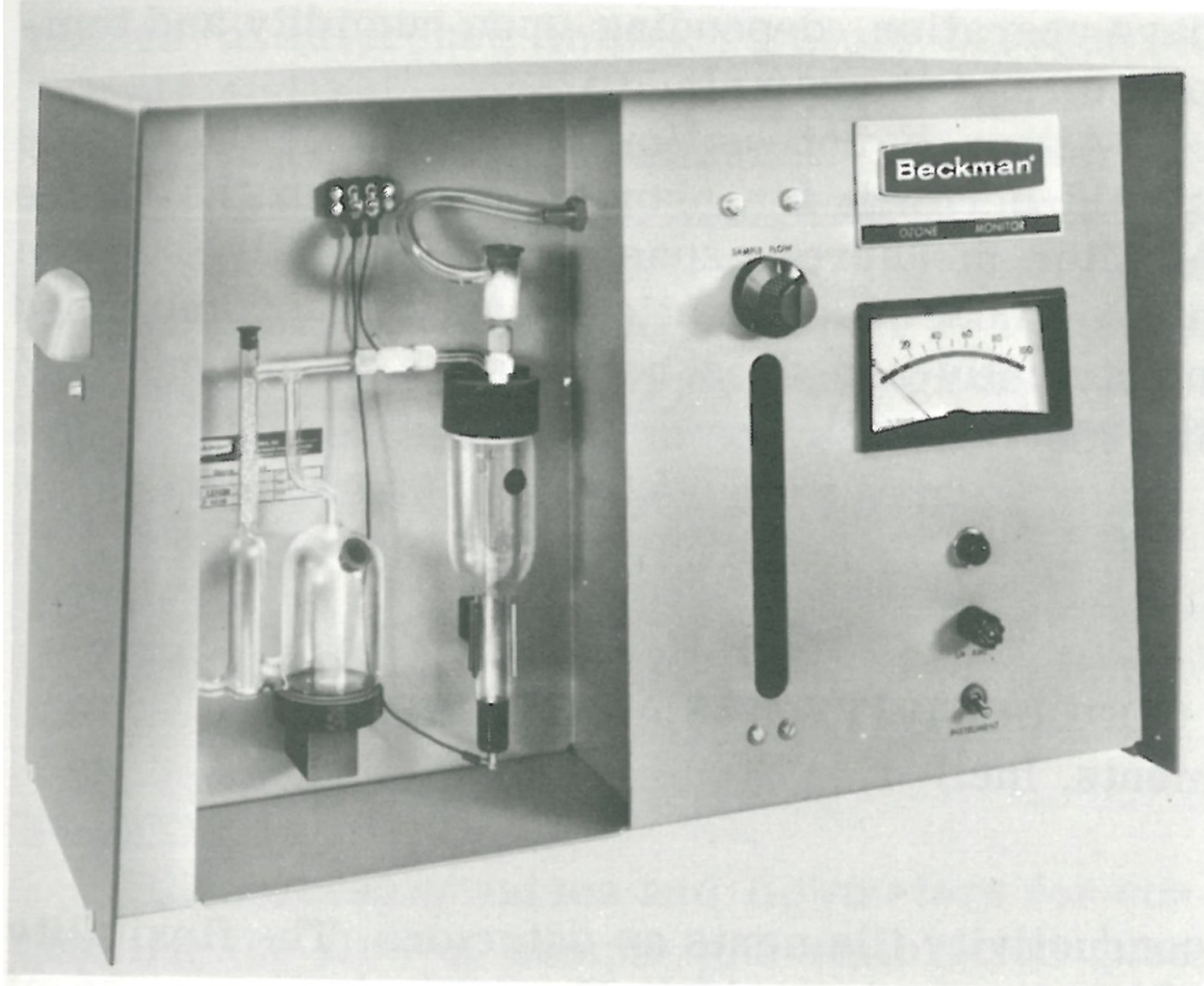


Fig. 1. Beckman Ozone Monitor.





TSI ACCUBALANCE

THE ANDERSON SAMPLER
(Anderson Samplers and Consulting Service)



Fig. 1. Anderson Sampler