Controlled Air Supply for Supercharger, Carburetor and Engine Testing, by C. S. Leopold (*Refrigerating Engineering*, August, 1943, p. 85).

Air Conditioning Aids in Artillery Optical Equipment (*Heating and Ventilating*, August, 1943, p. 46).

Air Processing Needs of Plywood Plane Parts, by F. O. Jordan (*Heating and Ventilating*, April, 1944, p. 67).

Close Machine Tolerances Possible Through Temperature Control, by R. P. Dewey (*Heating and Ventilating*, April, 1944, p. 60).

Design of Low Temperature Test Cabinets, by F. Crampton Frost and T. J. Lopiccolo (*Heating and Ventilating*, July, 1944, p. 57).

Industrial Cooling as a Production Aid, by J. Partington, Jr. (*Heating and Ventilating*, April, 1944, p. 47).

Penicillin, by Lester T. Avery (*Heating and Ventilating*, March, 1944, p. 45).

Penicillin Production Depends Upon Control of Air Conditions (*Heating, Piping and Air Conditioning*, April, 1944, p. 188).

Heating, Air Conditioning and Insulation for Penicillin Production, by J. C. Siegesmund (*Heating, Piping and Air Conditioning*, August, 1944, p. 475).

Refrigeration Insures Quality of Clothing for the Army, by A. J. Mallinckrodt (*Heating and Ventilating*, March, 1944, p. 79).

Industrial Exhaust Systems

Classification of Systems, Hood Design Principles, Hood Suction and Indraft Velocities, Duct System Design, Air Cleaning Equipment, Resistance of Systems, Air Flow Producing Equipment, Protection Against Corrosion

IN many industrial plants some type of exhaust system designed to collect and remove dusts, fumes, mists, vapors and gases is essential in order to promote efficiency, economy, and safety of operation. Definitions of these various contaminants are as follows:

Dusts are solid particles generated in manufacturing processes due to handling, crushing, grinding or impact of organic or inorganic materials such as rock, ore, metals, coal, wood, grain, etc.

Fumes are solid particles generated by condensation from the gaseous state, generally after volatilization of molten metals, etc.

Mists are suspended liquid droplets generated either by condensation from the gaseous to the liquid state or by breaking up of a liquid into a state of dispersion by some process such as splashing, foaming or atomizing.

Vapors are the gaseous form of substances which are normally in the solid or liquid state and which can be changed to either of these states either by increasing the pressure or by decreasing the temperature.

Gases are normally formless fluids which occupy the space or enclosure, and which can be changed to the liquid or solid state either by increasing the pressure or by decreasing the temperature, or by the combined effect of increasing the pressure and decreasing the temperature.

The theory of air flow in an exhaust system in the following paragraphs *A* to *D* will be found in a publication[1] of the *American Foundrymen's Association.*

A. When the air flow producing equipment of an exhaust system is properly operated it will produce a negative pressure (below atmospheric) in the exhaust side of the system sufficient to overcome all resistance and to sustain the desired air velocity; and, further, will overcome all resistances on the discharge or positive pressure side of the system so that the air drawn through exhaust inlets will be discharged against atmospheric pressure.

B. An exhaust system is entirely dependent on a *sufficient volume* of air flowing into the exhaust inlets to catch the matter to be exhausted before such matter has an opportunity to diffuse into the general atmosphere of the work place or room.

C. The velocity of the air flowing into an exhaust inlet is usually of secondary importance and becomes an essential factor only when a certain velocity is required to overcome some force acting on the matter to be caught. The velocity within an exhaust system is only important to the extent that it shall be sufficient to convey the entrained matter and prevent it from settling or dropping out in the piping system. Velocity in terms of velocity pressure is most essential in designing a system because it is the basis upon which all calculations are made. In testing and checking a system the velocity as determined from the velocity pressure reading obtained by means of a Pitot tube is the only true indication of the exact air flow in a pipe or system.

D. The total pressure within an exhaust system is only of importance in determining the power required to operate the system. Total pressure tests do not indicate the proper functioning of an exhaust system as related to the volume and velocity of the air flowing into an exhaust inlet.

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[1]Tentative Recommended Good Practice Code and Handbook on the Fundamentals of Design, Construction, Operation and Maintenance of Exhaust Systems, Page 21, Industrial Hygiene Codes Committee, *American Foundrymen's Association.*