

Industrial Hygiene Foundation

INDUSTRIAL HYGIENE FOUNDATION at Mellon Institute, Pittsburgh, Pennsylvania, has contributed greatly to the concept that the industrial health program is a management *must*. In the 18 years of its existence it has made its influence felt in hundreds of plants and in almost every type of industry. Workers employed by industry and commerce and their dependents in the United States in 1952 constituted more than 100 million, or approximately two-thirds of the total population. It is not inconceivable that the nation as a whole may have derived benefits from the technical advancement of industrial medicine and hygiene brought about through the Foundation's research, surveys, and allied activities.

The Foundation's Activities

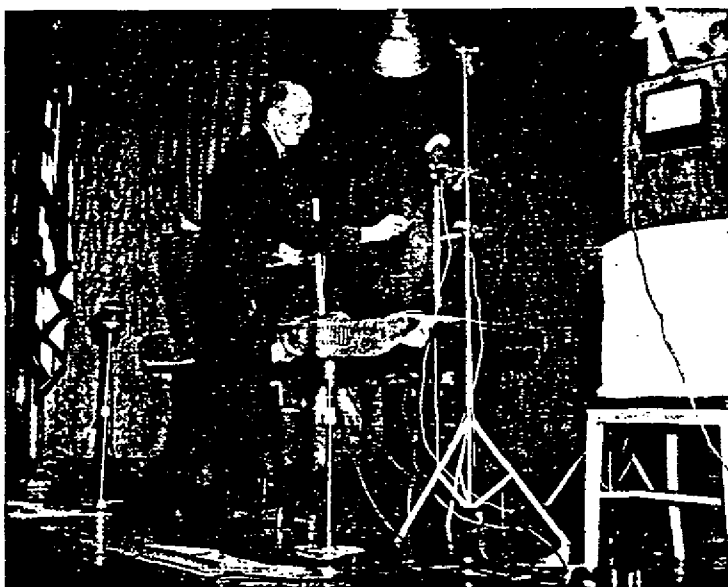
INDUSTRIAL HYGIENE FOUNDATION, Mellon Institute, Pittsburgh, is a non-profit research association. Its purpose is the advancement of occupational health. It is concerned with human resources as well as improvement of working conditions. Its staff includes physicians, chemists, engineers, biochemists, and medical technicians—all specialists in health problems arising in industry. Through affiliation with it, companies and associations are entitled to the services of these specialists, to whom the technical facilities of Mellon Institute are available.

A typical morning mail may bring a request from a member company for plant tests to determine whether existing ventilation is adequately controlling the fume exposure in a specific operation. Another wants help in drawing up plans for construction of a new plant so that engineering controls can be incorporated. Still another needs measurements of the smoke emitted by its stacks. A fourth requests that a thorough audit be made of its medical policies, practices, facilities, and costs.

Special studies made by the Foundation for its member companies have passed the 600 mark. Included are some 400 extensive field surveys, and 60 on specific phases of industrial problems encountered in the plants. In addition the Foundation's specialists in engineering, medicine, chemistry and toxicology have made nearly 150 consultation visits throughout the country. Forty-two basic research studies have been conducted at the Foundation's laboratories, and more than 125 analytical studies have been made. A number of the projects carried out by the Foundation have been on an industry-wide basis, so that many companies not directly involved in the research have benefited from them. Two hundred eighteen companies and associations have taken advantage of the field services offered by the Foundation, many on a plant-wide basis. Many



Management and Medicine—registering for the Foundation's Seventeenth Annual Meeting, at Mellon Institute.



Demonstration of radiant heat transfer and of controls applicable to radiant heat exposures—at one of the Foundation's technical conferences.

more have presented smaller problems and inquiries by correspondence, and hundreds of requests for literature on industrial hygiene are received each year.

Foundation members represent industries in almost every category, including oil producers, insecticide producers, chemical manufacturers, electric equipment manufacturers, foundries, railroads, metal fabricators, and such other industries as steel, glass, aluminum, sulfur, mining, food processing and ceramics. Surveys have been conducted in all these fields.

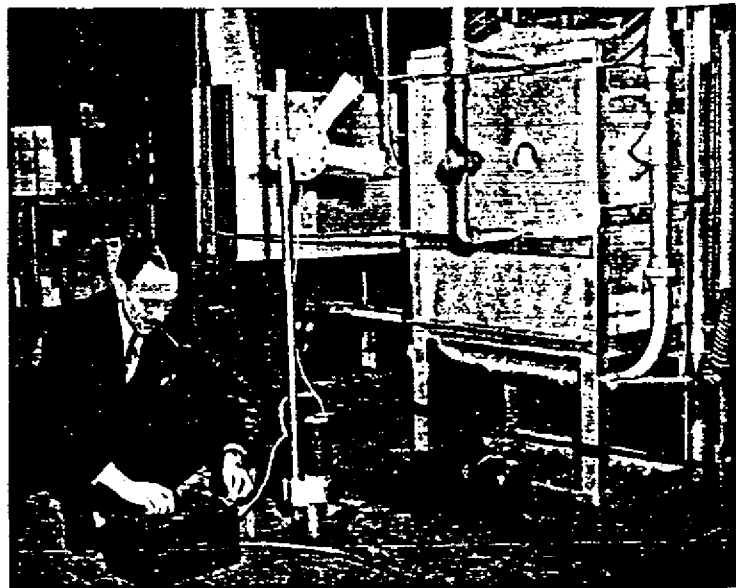
The Foundation has grown to its present eminent stature from a small but impressive beginning. The 20 companies which met in 1935 to discuss the creation of such an organization had a serious industrial health problem to solve—the problem of silicosis. They brought this problem to Mellon Institute, and representatives of the Institute met with a handful of physicians, scientists and industrialists in Pittsburgh to discuss the possibility of a scientific research program. The meeting was a closed session at which no minutes were taken, so that each participant would feel free to speak his mind. All were acutely aware of the need for assembling and evaluating available information and conducting research to provide the necessary tech-

nical knowledge to solve the problem of silicosis. Out of that meeting the Air Hygiene Foundation was evolved, and a new Fellowship in that name was created at Mellon Institute.

Organization of Mellon Institute

THE Fellowship System is a practical plan for studying long-term industrial problems under the auspices of an educational and scientific institution. It is the fulfillment of the belief of Robert Kennedy Duncan, who early conceived the idea, that industry and science could work in harmonious cooperation for the benefit of our whole country. Dr. Duncan was invited by Andrew W. Mellon and Richard B. Mellon to come to the University of Pittsburgh in 1910 to put his idea into effect and test it on a broad

scale. Mellon Institute was founded in 1913 and its Fellowship System placed on a permanent basis. The first organization of its kind, it is a privately endowed non-profit institution, incorporated in 1927 under the laws of the Commonwealth of Pennsylvania, for long-range researches in the pure and applied natural sciences. Its activities have been largely in the fields of chemistry, physics, the engineering sciences and technologies, with ever-increasing emphasis on their application to the important problems of human welfare. Thus public health, sanitation, stream



Directional radiometer for locating radiant heat sources and for measuring the relative intensity of each.

pollution control, smoke abatement, the alleviation of industrial hazards, and improvements in a great number of processes and products which will ultimately benefit everyone are the projects in which Mellon Institute's scientists are engaged. In the past, research programs of the Institute have led to many new and better products and to many new branches of manufacture.

The Institute's library, auditorium and conference rooms, although not open to the public generally, are made freely available on request to scientists and technologists. Many professional organizations of the Pittsburgh district hold their regular meetings at Mellon Institute, and it has served as the convention headquarters of a large number of national scientific societies and allied associations. In a very real sense it has become both a national and a local science-center.

How Mellon Institute Operates

WITH responsibility for the Institute's operating principles and policies vested in a Board of Trustees, its over-all activities are under the supervision of Dr. E. R. Weidlein, President of the Institute, who is assisted by an administrative staff of six Directors of Research and associated department heads.

Mellon Institute operates by means of contracts with Fellowship Donors for specific periods of time, which are required to be of at least one year's duration, with the full-time services of at least one scientist on each Fellowship. Only problems of fundamental importance or of real significance to science and industry are accepted for study. A manufacturer, seeking to investigate a major problem or hoping for general benefit from a planned scientific research program, may execute a contract with the Institute, provided that the proposed field of investigation is one in which the application of the natural sciences—particularly the chemical sciences—offers hope of success, and also provided the field is one not already under investigation in the Institute. Only one research project or Fellowship in any given field is operated at a time; hence there is no conflict between Donor interests within the Institute, and cooperative association among the individual research specialists is encouraged at all times. All results of the research of a Fellowship are the property of its Donor.

Administrative supervision of Fellowships is carried on by the members of the Executive Staff. Each of these men is a specialist in some aspect of the over-all investigational work, and each is responsible for the progress of a group of independent Fellowships. The members of the Executive Staff advise the Fellowship Heads and coordinate the activities of the Fellowships. Close relationships between the Donors and the Scientists on the Fellowships they sponsor have al-

ways been encouraged. Many of the Institute's Fellows have gone into the employ of their Donor companies upon completion of their researches. Indeed many leaders in American science and industry began their careers at Mellon Institute; their influence and understanding of the Fellowship System are major factors that continue to contribute to the success of the Institute.

Growth of the Foundation

SINCE its establishment Industrial Hygiene Foundation has operated through its staff on a multiple fellowship basis. The young organization was helped immeasurably by Dr. Edward R. Weidlein, President of Mellon Institute. His deep, personal interest in the activities of the Foundation has been a major factor in the attainment of its present outstanding position. Dr. Weidlein has an intimate relationship with the Industrial Fellowship System since its foundation in 1907, when he was an undergraduate at the University of Kansas. He has been enthusiastically interested in all matters pertaining to the betterment of human relations and working environments. Since 1916 he has been a leader in advancing urban smoke controls and all movements requiring scientific guidance that have for their aim the promotion of the health and well-being of the people.

If the Foundation seems to have attained maturity in a remarkably short period of time, much of the credit belongs to Dr. William A. Hamor, Director of Research at Mellon Institute, who has been its Adviser from the beginning. A pioneer in the field of industrial hygiene, he has made unlimited contributions of his time, energy and experience to the progress of the Foundation. Dr. Hamor's interest in all aspects of industrial health and of human resources began with his studies of the toxic properties of shale oil in the early 1900's. He is an outstanding specialist in industrial research and management and in professional and public relations activities of technical organizations.

With the encouragement and support of such leaders, it was natural that the Air Hygiene Foundation should have gone on from its first research problem on silicosis to such problems as sulfur dioxide and smoke in the combustion of anthracite and bituminous coal.

By 1941 the scope of the Foundation's activities had expanded to other phases of environmental control, and its name was changed to Industrial Hygiene Foundation. With each extension of research the membership increased, until today there are approximately 360 outstanding companies and associations in the United States who have affiliated. There is no other organization quite like it. The unique experiment initiated by the original group of unrelated in-

dustries of working together to achieve optimum industrial health has proved its value. While most of the work the Foundation does for individual companies is confidential, particularly operational procedures, much of its work concerns health practices and is fundamental in nature and therefore can be made available generally. Thus the Foundation can act as a clearing house for assembling and disseminating information, through both the accumulative experience of its able staff and the exchange of ideas of its member companies through the medium of the annual meeting and conferences. The Foundation provides a unifying force behind this endeavor in which management, labor, and the health professions join to bring progress in achieving healthful working conditions on a par with technical and scientific developments.

Annual Meeting and Conferences

EACH year at its annual meeting the Foundation brings together more than 600 top executives, physicians, attorneys, and industrial health specialists whose united efforts are developing ways of improving industrial health and human resources. A wealth of information is informally exchanged at the technical conferences by representatives from member companies on medicine, engineering, chemistry and toxicology, and the legal aspects of industrial health. Special sessions are held on selected subjects or for discussion of common problems in industrial groups.

Publications

TO KEEP the public and its membership informed, the Foundation issues a number of publications, including the monthly *Industrial Hygiene Digest*, which is sent to nearly 2,000 persons designated by the member companies. Technical papers by staff members and transactions of the annual meetings and conferences are also distributed. Nearly 300 such publications have been released to date.

How It Serves

THE FOUNDATION gives direct professional assistance to member companies in the study of industrial health problems and their solution; it assists companies in the development of health programs as an essential part of industrial organization; and it contributes to the technical advancement of industrial medicine and hygiene, through research, surveys and allied activities.

Typical of these services is a recently completed industrial hygiene survey. While excellent progress had already been made in providing a good working environment and protecting the health of the worker, the officials of the company envisioned additional benefits to be derived from a permanent full-fledged industrial hygiene de-

partment. Industrial Hygiene Foundation was asked to lay the groundwork for broadening and enhancing the scope of the industrial hygiene activities to provide even better working conditions. A study was made of the working environment, which furnished an inventory of nuisance exposures and potential hazards. Evaluations were made on the basis of observations, and information on operational procedures and representative data were obtained by measurement of chemical and physical environmental factors. Results of the study are important from the short-term viewpoint, but more significantly they have a fundamental value in providing a foundation on which the company is building a continuing and permanent program of environmental and medical study and evaluation.

Training Program

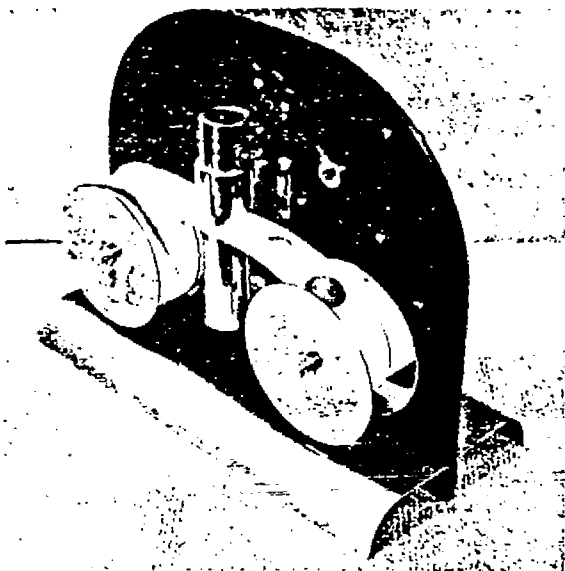
TRAINING of young men in specific fields of industrial hygiene is a service that is offered by the Foundation to all of its members. By working with the Foundation staff at its headquarters at Mellon Institute the trainee gains practical experience. Didactic training, through seminars, lectures and planned reading programs, supplements the research work. The trainee is encouraged to maintain liaison with the Foundation after completion of the training program. A similar valuable service is frequently utilized by a company to greatest benefit at the time the Foundation is conducting a field survey by selecting a company man to work with the Foundation staff. This man can then work towards a continuing maintenance program.

Air Pollution Studies

AIR pollution investigations being sponsored for the fourth consecutive year by the American Iron and Steel Institute include a trainee program. Fourteen trainees have participated in the program to date. The men contribute to the research work and at the same time are indoctrinated with an understanding of the nature of the air pollution problem. The research has included studies on the chemistry of sulfur dioxide oxidation, the development of low-cost instruments for the measurement of air pollution intensity at ground level, and a project on the kinetic behavior of particulate matter in stack gases, in relation to the problem of measuring dust in such gases, that will ultimately embrace the performance of dust-and-fume collection equipment.

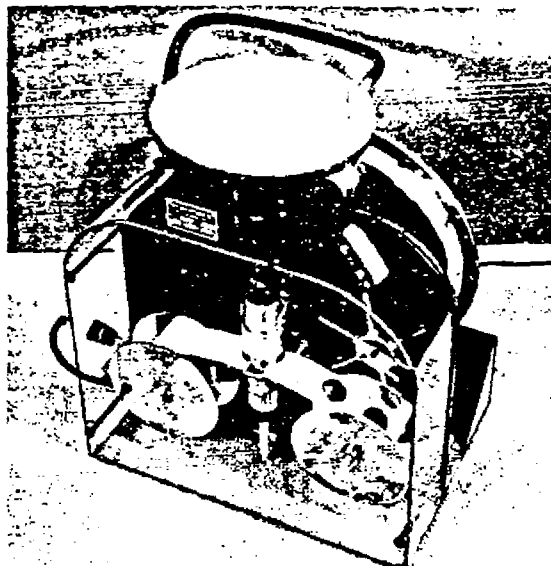
Instruments designed and constructed by the Foundation's engineering staff in connection with the air pollution studies for the American Iron and Steel Institute have made possible simpler and more reliable methods of air pollution sampling techniques.

The I.S.I. Automatic Smoke Sampler has al-



Automatic smoke filter instrument.

ready received broad acceptance, and is being produced commercially by a Pittsburgh firm. Its potential value is in a study of smoke or haze concentrations in any area for correlation with wind direction and other weather factors so that relative contribution of various sources can be established. The instrument measures the fine particles of dust which have a soiling effect on walls. It can be used to provide an historical record of the intensity of coal smoke or haze over



Hydrogen sulfide sampler

long periods or it can be applied to the measurement of some particular pollutant compound. The instrument's low cost makes it feasible to cover an area in considerable detail by the placement of a large number of individual instruments, and its freedom from noise makes it acceptable to residents.

The hydrogen sulfide sampler devised under the same program is an adaptation of the automatic smoke sampler. Used to measure the hour-



Dust analysis equipment, to measure the number of dust particles in air samples from an industrial plant.



Comparisons of records reveal that blackness in the air is generally affected by weather.

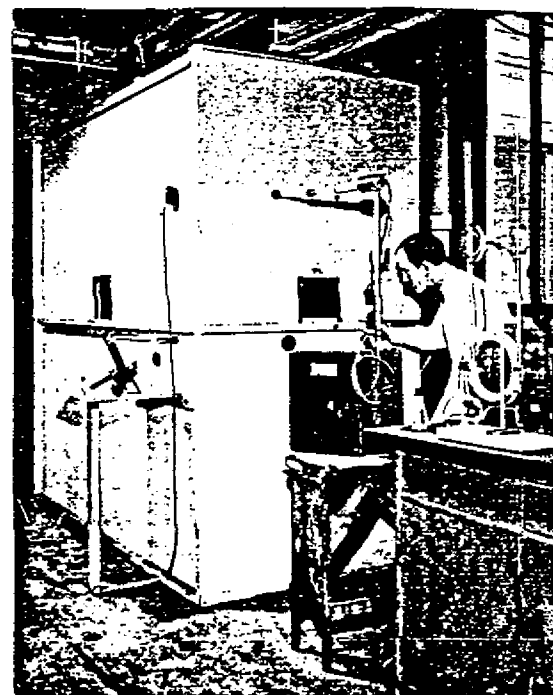


Pilot plant for stack dust sampling studies.

ly changes in the atmosphere of hydrogen sulfide, which is the air pollutant responsible for the tarnishing of silverware and the blackening of house paints containing lead pigments, it employs the automatic smoke sampler but incorporates provision for the removal of the black solids prevalent in ordinary air from the air sampler by efficient filtration while permitting passage of the hydrogen sulfide gas. It requires preparation of an impregnated filter paper tape so that some intense color change would occur that is proportional to the power of the gas content to blacken certain surfaces, e.g., lead house paints and silverware. Tests in one area revealed that there is a sharp increase in concentrations of hydrogen sulfide in the air around midnight.

Outstanding among other air pollution investigations made by the Foundation is a year-long intensive survey of air pollution in New Haven, Connecticut. The objective of this investigation was to determine the extent and nature of the air pollution problem in New Haven in order to have a factual basis for the enactment of air pollution control legislation, if warranted. All aspects of air pollution throughout the metropolitan area were studied.

One company, concerned about potential contaminants that might pollute the community in which a new plant was being built, requested that a survey be made before construction was started in order to provide a base line with which to compare measurements taken after the plant was



Oxidation of sulfur dioxide studied in smog chamber.

in operation. Going one step further, the company developed a method of virtually eliminating the effluents at the point of discharge.

Plant-Wide Surveys

AIR pollution research is only one of the industrial health fields in which the Foundation is prominent. Constant changes occurring in nature of materials and methods of processing bring up new industrial hygiene problems. Medical audits and environmental surveys are often required. Two such comprehensive studies were recently undertaken for large oil corporations. For the one a comprehensive and detailed survey of medical policies and practices was made. A representative number of subdivisions in each of the major departments were visited and inspected, and many individuals in all areas relating to medical service were interviewed. A careful evaluation was made of the facilities for treatment of injuries as well as the preventive aspects of the medical program. The preplacement and periodical physical examination methods were studied and the extent of medical care to the employees was analyzed.

For the other company an environmental study was made involving surveys of refineries for the purpose of general appraisal of environmental factors that might affect the health of employees in those plants. Six refineries representative of all the principal manufacturing operations under a range of climatic conditions were selected for study. Since the basic health problems of the



Dust classifier for separating dust particles into size fractions.

industry arise from the raw materials that are processed, the methods of manufacture, and the final products derived therefrom, the refineries selected for study constituted a cross-section of the widespread activities and covered a diversity of operations. The findings and conclusions were then given company-wide distribution.

The Foundation is aware that in addition to a complete and effective environmental hygiene program it is necessary to have an understanding of the man and his relation to the tools with which he works, the materials upon which he works, and the physical and chemical properties of the working environment.

Radiant Heat Reduced

THE need for an understanding of the way in which man responds to environmental stress was particularly evident in a study undertaken by the Foundation of the heat exposures in glass manufacture. It had been the practice in this industry to reduce heat exposures by means of ventilation and "man-cooling" fans. The Foundation's studies revealed, however, that, a major fraction of the heat load imposed on the worker is often in the form of radiant heat which cannot be reduced materially by ventilation. There is an exchange of radiant heat between hot and relatively colder surfaces which is independent of the temperature of the intervening air. The only way radiant heat can be suppressed is by lowering the surface temperature of the hot surface or by interposing a suitable screen between such surfaces and nearby workmen. The outstanding practical screening device is aluminum, although other types of screens may be used in special circumstances. By means of radiation

screening it was demonstrated that the heat load on workers in glass factories could be reduced by as much as 75% without any change in the ventilation system. In recognition of the great contribution made by radiant heat in the hot industries which this study demonstrated, considerable progress has since been made to improve the working conditions in a number of plants in the glass industry and in others where hot processes are encountered.

Ventilation Control

PROTECTIVE measures were the goal of a western mining company which requested an appraisal of production activities, particularly the smelting and refining of the metal. The Foundation assisted the company in designing appropriate ventilation and control measures to prevent the dissemination of harmful or objectionable amounts of contaminants into the breathing zone of the workers. These control measures resulted in definite improvement of the working environment.

Toxicological Laboratory

NOT ALL the extensive research for the Foundation's member companies is done in the field. Projects of great magnitude are carried on at the Foundation's laboratories. Typical is a study precipitated by the troubles lamp manufacturers were experiencing with the use of beryllium in fluorescent lighting. Although beryllium was previously thought to have a low order of toxicity,



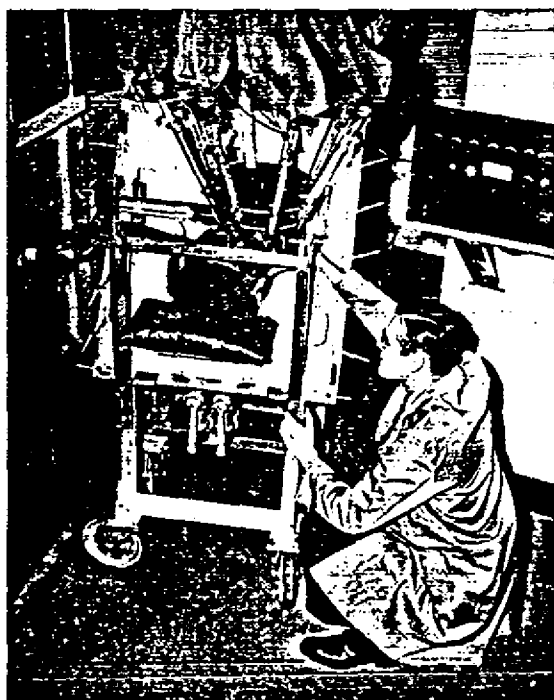
The kinetic behavior of dust in stack gases is being studied at this site near Mellon Institute.

certain serious reactions that no one had anticipated showed up after the fluorescent lights were on the market. Immediate steps were taken to develop other phosphors which did not contain beryllium. The new phosphors were investigated by the Foundation at the request of the lamp manufacturers. Toxicological testing over a period of more than two years failed to reveal any ill effects to animals even when exposure was to quantities far in excess of practical industrial exposures. It was concluded that these phosphors possess no serious toxic properties, and the manufacturers were able to proceed with confidence to produce the new fluorescent lamps.

Another investigation recently completed by the toxicology laboratory personnel dealt with the nature and extent of possible eye irritating effects of a number of formulations. Others pertained to the chloracne-producing potential of various chlorinated organic compounds. Projects relating to the effects of several inorganic dusts and to the chronic toxicity of specific organic compounds are also under way.

Iron Lung Adapted for Research

INVALUABLE in hundreds of tests made at the toxicology laboratory is the iron lung which was lent to the Foundation in 1947 by the Warren Collins Company. The mechanism, bearing serial No. 3, is probably a museum piece in that the first two manufactured by the company cannot be located. The only older models are the original



"Iron lung" respirator controls breathing of subject and permits fractional sampling of expired air.

ones designed by Professor Philip Drinker. Intended for therapeutic purposes, the iron lung has been admirably adapted to research work. In such studies as determination of dust retention in the lungs the respirator has been used to control the frequency and depth of breathing of the test subject and to actuate a mechanical partitioning valve on the breathing mask which separates every exhalation into seven separate fractions. The first fraction of the exhaled air comes from the nasal chamber and the last fraction from the deepest part of the lungs. Differences in the amounts of dust contained in the several fractions reflect the differences in the degree of dust retention in the different parts of the respiratory system.

Reversing the usual order of research procedure, the Foundation first used human subjects and then animals. Making use of exactly the same plan as employed in the human respirator, the staff constructed miniature respirators for use with experimental animals.

Noise Research Program

THE STUDY of noise was added to the Foundation's fields of research this year. Recognizing that much uncoordinated research was being carried on in conjunction with the problem of noise, its measurement, and its physiologic effects, representatives of interested groups asked the Foundation to act as a coordinating agency for a broad program of action. The similarity of this problem to those involving contaminants made the Foundation the ideal center for such work. Within its framework are the facilities for integrating research involving the closely related medical, engineering and legal problems. Its close relationship with the University of Pittsburgh and Carnegie Institute of Technology makes available consultation with acousticians, physicists, and other specialists.

The Staff

THE present staff of Industrial Hygiene Foundation, headed by Dr. C. Richard Walmer, Managing Director, includes: Dr. H. H. Schrenk, Research Director; Mr. W. C. L. Hemeon, Engineering Director; Dr. Daniel C. Braun, Medical Director; Mr. Theodore F. Hatch, Research Adviser; and other scientists. Each is a specialist in particular phases of industrial health, and Foundation members have the benefit of the collective and accumulative knowledge concentrated in this capable group. The staff is supported by a Board of Trustees, of which Mr. Andrew Fletcher, President of St. Joseph Lead Company, is Chairman; by a Research Advisory Council; and by Medical, Legal, Chemical and Toxicological, Preventive Engineering and Air Pollution Control Committees.