desire to make known to the engineers of the United States the progress in hydraulic science in Europe which he had observed during his travels abroad. This book contained descriptions of fourteen of the most prominent hydraulic laboratories of Europe, together with a description of the most important researches conducted in them, written by the directors of these laboratories. "Hydraulic Laboratory Practice," which appeared in January of this year and which Dr. Freeman sponsored and edited, is destined to have a profound influence upon the future of hydraulic science in the United States. The book is essentially a translation of "Die Wasserbaulaboratorien Europas," but has been enlarged by the description of the most recent research work conducted in the laboratories described in the German edition, by the description of many other European and several American hydraulic laboratories and by the inclusion of several chapters dealing with the theory of dynamical similarity as applied to hydraulic problems.

The laboratories described include river structures laboratories, pump and turbine laboratories and ship model research laboratories, of which the first class is treated most fully. The special apparatus developed for testing hydraulic structures in these laboratories is very interesting, particularly the glass-walled flumes in which studies are made of the flow over dam and weir sections, as well as scour at the foot of overfalls, the glass walls making it possible to watch the stream filaments and the scour in a way which can never be done in nature. The immense river flumes, shallow, but of wide extent, are capable of containing models of entire hydraulic projects. Models are also frequently built out-of-doors in order that the scale may not be too small when the structure in nature is extremely large. For example, in the out-door laboratory of the Experimental Institute at Berlin, a model of a fifty-mile stretch of the Havel and Elbe Rivers is being built to a scale of about 1:75, so that the model is approximately 3,600 feet long.

Of interest also to water-power engineers are the descriptions of equipment available in many European turbine laboratories for the study of cavitation. This is the foremost problem facing the hydraulic turbine designer to-day, yet there is not one laboratory in the United States equipped to study this phenomenon. Such a condition can not continue to exist if we are to keep abreast of foreign progress in this field. The attitude of several manufacturers of hydraulic turbines toward research is commendable, but the heads of other American concerns still can not see what part experimentation has in turbine design, although European design has been based upon experimental research for a long time.

Much space is given to the flow of water in open channels, a subject which was dealt with in a very unsatisfactory manner when the writer first studied hydraulics. Only during the last fifteen years has the existence of a third flow régime in open channels, that of "shooting" flow, been recognized generally, with many of its effects exactly the opposite of those involved in ordinary turbulent flow. The utilization in the United States of the hydraulic jump in a scientific way as a destroyer of the energy of water at the foot of an overfall dates only to the work of the Miami Conservancy Board, and as yet its possibilities are scarcely appreciated by most engineers, although its laws are now well established.

Another striking feature of "Hydraulic Laboratory Practice" is the evidence to be found throughout as to the great interest which is being shown in Europe in the study of the effect of flowing water on the form of stream beds. Not only are numerous fundamental researches being made continually in regard to this phenomenon, but the results of experiments are being applied in actual construction every day. In contrast to this activity abroad, we are practically standing still in the United States in the study of the formation of fluvial beds. Granted that this is probably the most difficult field of hydraulic research; granted also that the subject has hardly been scratched as yet; nevertheless, the possibilities are so tremendous and our river problems are so great that we should be bending every effort to acquire more scientific information, such as can be best obtained through laboratory experimentation combined with observations on our actual rivers.

It is impossible to undertake a discussion of the researches described in the book, for they cover all phases of hydraulics imaginable. Even the casual reader can not fail to be impressed with the evidence there given of the extent to which scientific methods have been applied in Europe during the past quarter century to the solution of the difficult problems arising in hydraulic engineering.[1]

HERBERT N. EATON

BUREAU OF STANDARDS

SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN IMPROVED THERMOPILE VESSEL FOR THE ELECTROMETRIC DETERMINATION OF THE VOLUME FLOW OF BLOOD

IN an earlier paper Gesell and Bronk[1] described a continuous thermoelectric method of recording volume

[1] Publication approved by the director of the Bureau of Standards of the U. S. Department of Commerce.

[1] Gesell and Bronk, *Amer. Jour. Physiol.*, 1926, 79: 61.

flow of blood. The blood of a heparinized animal is allowed to flow from the proximal end of an artery through a glass tube about 15 cm long, returning to the circulation by way of the distal end of the same artery. This tube is surrounded by a water-jacket conducting water at a constant rate of flow. The water supplied at a constant temperature by a well-insulated Mariotte bottle is heated as it passes up the water-jacket in contact with the central tube. The water-jacket is in turn insulated against loss of heat to the exterior. By placing the cold junctions of a multiple thermopile in the course of the water inflow and the hot junctions in the course of the water outflow the degree of heating of the water which varies with the flow of blood can be followed. A continuous record of changes in blood flow in terms of E.M.F. is made on smoked paper by registering the movement of the drum of a Leeds and Northrup type K potentiometer required to keep the galvanometer at zero.

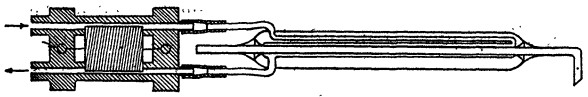

FIG. 1

The improvement of the thermopile vessel consists in substituting glass for bakelite. This construction eliminates several of the difficulties of the bakelite construction. Air bubbles in the water-line are visible and may thus be removed, and water leaks which were hard to avoid are eliminated. The outer insulating chamber is exhausted with the vacuum pump.

ROBERT GESELL

UNIVERSITY OF MICHIGAN

AN ENCLOSED DROP METHOD OF RECORDING VOLUME FLOW OF FLUIDS BY OIL DISPLACEMENT

THE method was devised primarily for following the volume flow of blood. The principle, however, may be applied for the registration of other flows as well.

The vein of a well-heparinized animal is prepared for insertion of two cannulas. The peripheral cannula is of the ordinary simple type. The central cannula is enlarged and shaped as shown in the figure. It is filled about half and half with isotonic salt solution and liquid paraffin and stoppered to the exclusion of air. The blood from the peripheral cannula is conducted into the central cannula through a glass tube which protrudes into the oil. As the blood flows it collects on the end of this tube in a large drop suspended in the supernatant oil displacing the salt solution below. The drop eventually falls and mixes with the saline and is in turn displaced into the circulation.

The flow may be recorded manually by signal or automatically by electrolytic contact as the drop falls between two sharply pointed electrodes. For electrical registration we have used a 2000-ohm telegraph relay (supplied by the J. H. Bunnell Company, 32 Park Place, New York) operating an ordinary signal magnet. Other simple methods of automatic registration may be used.

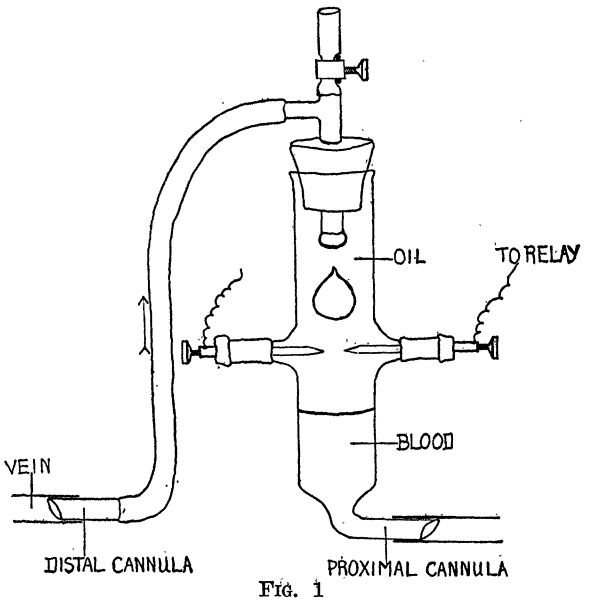

FIG. 1

The enclosed drop method of studying the flow of blood has the advantage of avoiding loss of blood and of automatically returning the blood to the circulation. Due to the buoying force of oil the drops are very large. It is thus possible to apply the drop method to relatively rapid flows.

ROBERT GESELL

UNIVERSITY OF MICHIGAN

SPECIAL ARTICLES

LOVELAND LOESS: PRE-ILLINOIAN, PRE-IOWAN IN AGE[1]

THE interpretation presented by Professor G. F. Kay in the November 16, 1928, issue of SCIENCE, that the Loveland loess is post-Illinoian, seems to be based on rather slender and inconclusive evidence. This being the case, the deduction drawn, that the Iowan falls in a separate glacial stage from the Illinoian, should be taken as tentative rather than final.

The present writer agrees with Kay as opposed to Shimek that the Loveland formation is not a fluvioglacial deposit of Kansan age, but is of much later date, and laid down on the eroded surface of the Kan-

[1] Published by permission of the director, U. S. Geological Survey.