A. I. Ch. E. 1932 NATIONAL STUDENT COMPETITION SPONSORED BY THE ADVISORY COMMITTEE ON STUDENT CHAPTERS

Foreword

A competition on the solution of a contest problem, open to all undergraduate members of the Institute's 23 student chapters, was held for the first time in 1932, under the direction of the Advisory Committee on Student Chapters of which Professor E. M. Baker is Chairman.

Thirty solutions of the problem—a problem in the design of a heat exchanger system for an oil refinery—were submitted and reviewed by the Sub-Committee on Awards of which Walter J. Whitman was Chairman, and Earl P. Stevenson, H. O. Forrest and Francis J. Curtis, members.

On recommendation of the Committee, Council awarded to George K. Hickin of Central Lake, Michigan, a student at the University of Michigan, 1st prize of $100.00; to Edmund Field of Chicago, a student at Armour Institute of Technology, 2d prize of $50.00; and to Melvin J. Sterba, of Hillsboro, Wisconsin, a student at the University of Wisconsin, 3d prize of $25.00. Awards were based not only on the method of treating the problem, but on the general form of presentation and neatness of the solution.

The object of the competition, to be held annually, is to demonstrate concretely the interest of the Institute in the careers of undergraduate students in chemical engineering, and at the same time to establish a definite standard of excellence among embryo chemical engineers.

On the unanimous vote of the Publication Committee, which Council approved, the 1st prize solutions are to appear in the TRANSACTIONS.

FREDERIC J. LEMAISTRE,
Secretary

The price of exchanger units is $2.10 per sq. ft. of outside heating surface and the exchanger investment should be written off in three years. Fuel at this refinery costs two and a half cents per gal. of a fuel oil having a net heating value of 150,000 B. T. U. per gal. The furnace efficiency will be about 75 per cent (based on net heating value) and the unit will be operating 96 per cent of the time. Power costs are so small that they may be neglected.

Assume, for simplicity, that furnace efficiency is not changed by a small change in temperature of stock fed to it.

(1) The most economical total area for the given conditions and (2) the proper number of individual heat exchanger units are to be determined.

Method of Presentation

The solution of this problem should be presented as a report recommending the amount of exchange equipment which is deemed to be justified. In grading reports significance will be given to the form of presentation as well as to the accuracy of the assumptions and computations.

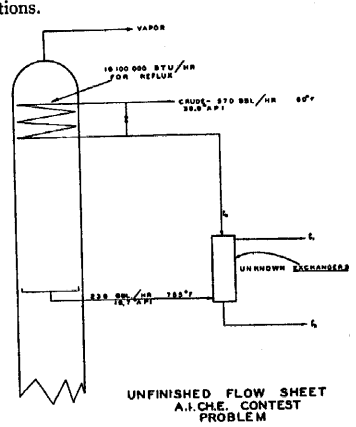

FIG. 1.

Assume that the decision on expenditure will be made by an executive who has had technical training but is not familiar with modern

CONTEST PROBLEM

STUDENT CHAPTERS—AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. OPEN TO UNDERGRADUATES ONLY

Statement

An oil refinery proposes to construct a new unit for fractionating crude and has decided upon the general design and most of the details. The size of a certain exchanger system is still in question and forms the subject of this problem.

Necessary essentials of the flow of oil are shown in the attached drawing. Mid-Continent crude oil is charged through a coil in the top of a bubble tower, sufficient crude being bypassed to give a heat pickup of 16,100,000 B. T. U. per hour in the coil for reflux purposes. The total crude stream then flows through a heat exchange system counter-current to a side stream from the tower.

Data

Crude: Mid-Continent crude at 60° F.
A.P.I. gravity (60°/60°) = 36.6°.
Viscosity in centipoises = 4.9 at 100° F.
1.0 at 350° F.
0.51 at 600° F.
Charging rate, in 42 gal. barrels = 570 bbls. per hour.
Assume that the crude is under a pressure sufficient to prevent vaporization.

Side Stream
Rate, in 42 gal. barrels = 238 bbls. per hour (at 60° F).
Temperature leaving tower = 755° F.
A.P.I. gravity (60°/60°) = 19.7°.

The heat exchanger system will be composed of units, each of which will contain six passes of admiralty metal tubes 12 ft. long, 1.0 inch outside diameter and No. 13 B.W.G. Each pass will have 90 such tubes, with the side stream oil on the outside and crude on the inside. The exchanger units will be operated in series, but provision should be made for bypassing any exchanger as desired.

The film coefficient of heat transfer for the side stream has been determined on other equipment operating under similar conditions to be 55 B. T. U. per sq. ft. per hr. per ° F. The film coefficient on the crude side must be estimated from data in the literature.

chemical engineering developments. This executive will require that his technical assistant check the accuracy of the assumptions, calculations and results in the report. However, in weighing the recommendation and reaching a decision he wants to assure himself personally of the basis for computation and of the validity of the economic method employed. His available time is limited and not more than three minutes of his attention should be required.

The exact arrangement of the report as to form and context are left to the contestant's judgment of how he can best meet the above requirements.

It is understood that the contest problem is to represent the work of the individual student and that he is not to receive assistance from others. Submittal of a report of the competition implies adherence to this condition.

Solutions must be received by local Chapter Councillor fourteen days after statements of problem are issued at that chapter.

Solutions should be mailed by the councillor of the Student Chapter before May 15, 1932 to

WALTER G. WHITMAN,
Standard Oil Company, (Indiana),
Whiting, Indiana.