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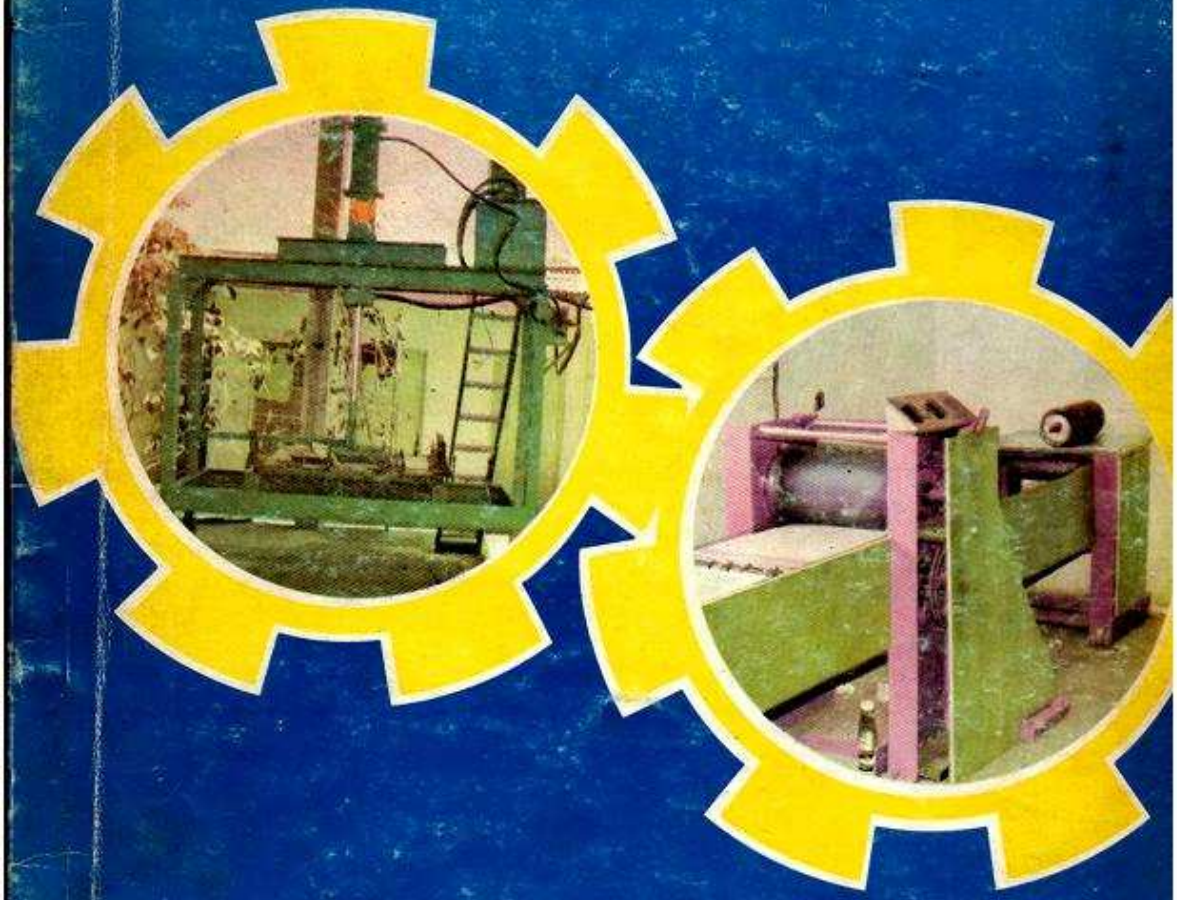
MOTTO: TO TRANSLATE INDIGENOUS TECHNOLOGY INTO INDUSTRIAL VENTURES.

THE QUARTERLY JOURNAL OF THE FOUNDATION FOR THE PROMOTION AND COMMERCIALIZATION OF INDIGENOUS TECHNOLOGY.



SPECIAL MAIDEN EDITION

2.6 IMT PROCESS-HEAT-TRANSFER APPARATUS

by

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INTRODUCTION

The Department of Chemical Engineering, IMT, Enugu, has developed a new apparatus which would facilitate students' instruction and training in heat transfer studies. Its name is Process-Heat-Transfer Apparatus. It is a pilot teaching unit. It is compact. It is self-dependent in the respective heating and cooling of fluids required for its operation.

BACKGROUND

The current demand in engineering education which emphasizes more on practicalizing concepts and principles, calls for a critical need for teaching aids. However, our country's higher institutions of learning have been suffering from inadequate supply/provision of teaching aids for the training of their students due to the proliferation of tertiary institutions in the past years without commensurate plans for the provision of teaching facilities. Subsequently, tertiary institutions of learning including research institutes could not afford to import training equipment because of dwindling subventions from government, staggering loss in the Naira value and other consequencies of economic depression. This apparatus, therefore is a contribution towards addressing these problems.

Besides the above, the chemical engineering curriculum had an active practical content which had existed for long. In addition to this, the recent introduction of Fabricational Project in her National Diploma's curriculum provided the immediate avenue for the physical realization of this apparatus, which though earlier conceptualized but could not be transformed to reality due to lack of opportunity.

PURPOSE

This apparatus would enable students to practically conceptualize the principles and facts in process heat transfer. Example, it would enable such phenomena as laminar regime, turbulent regime, and laminar-turbulent transition regimes to be practicalized for students. Consequently, the "complex" and "difficult" equations in Process Heat Transfer will be made practically active and applicative for students.

GENERAL DESCRIPTION

The Process-Heat-Transfer Apparatus basically consists of:

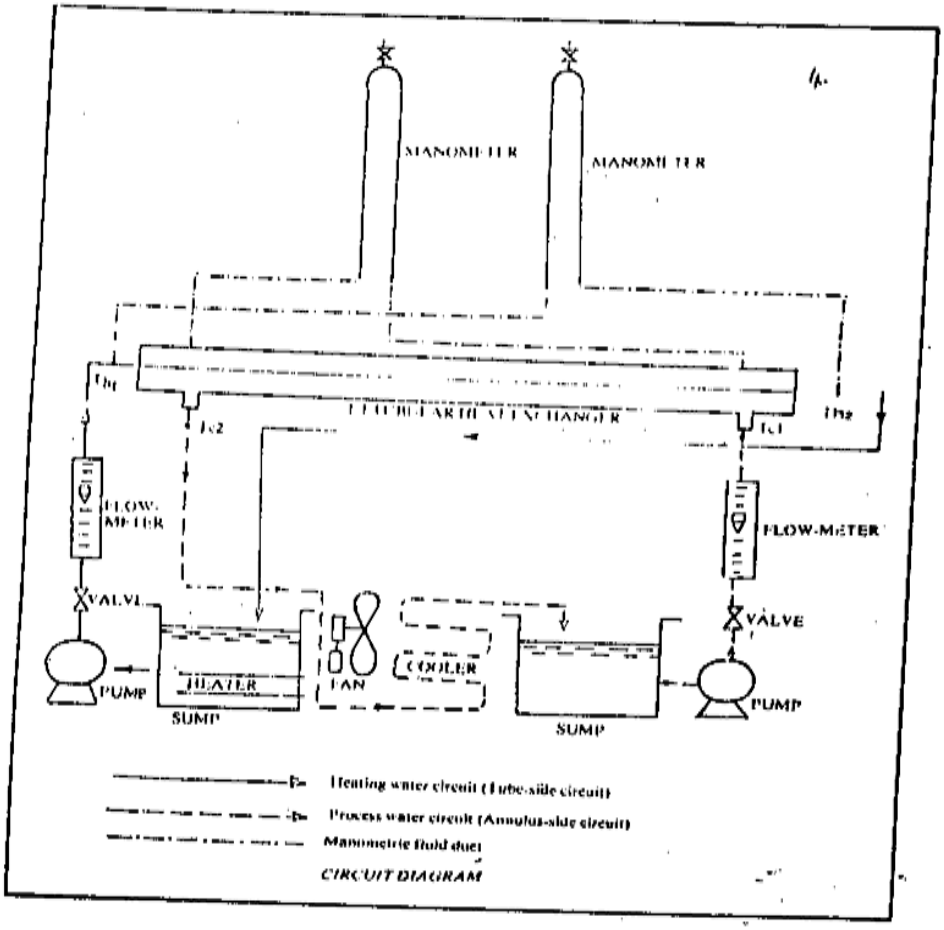
1. A single-pass undetachable linear double-pipe Heat exchanger with thermowells and pressure tapping points.

2. A hot water supply source, which consists of a heating element inside a rectangular tank.
3. A cold water supply source, which has a cooler system comprising a fan and a trombone cooler (an extended surface heat exchanger), and a rectangular tank.
4. Flow measuring devices, which consists of two rotameters.
5. Pressure measuring devices, which are basically two differential manometers.
6. Pipings that link the process heat exchange circuits. The piping circuits are made up of galvanised pipes and elbows. There are two distinct circuits in the apparatus:

   (a) The hot water circuit:
   This links the heating tank through a circulation pump and the rotameter to the tube of the double-pipe heat exchanger and back into the heating tank.

   (b) The cold water circuit which emanates from the cold water tank and connects the rotameter, the annulus of the double-pipe heat exchanger, the trombone cooler and back to the cold water tank.

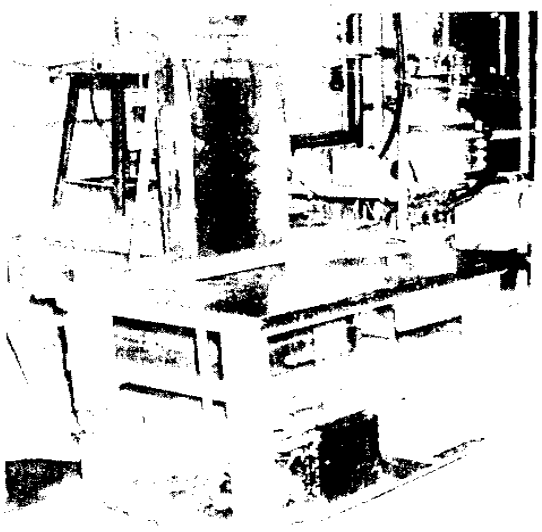
The circuit diagram shown below clarifies the two distinct circuits.



CIRCUIT DIAGRAM

Again, the photographs attached below show the apparatus after Assembly as well as after Electrical Wiring and Commissioning.

Front view of the Apparatus after Assembly.



Diagonal view of the Apparatus after Electrical Wiring and commissioning.

TEACHING CAP ABILITIES

This apparatus is designed to have the following practical teaching capabilities

1. Heat transfer rate as a function of heat transfer coefficients.
2. Heat transfer rate as a function of temperature driving forces.
3. Heat transfer coefficients as functions of mechanism ratio analysis.
4. Heat transfer as a function of thermal resistances.
5. Energy balances in a linear double-pipe heat exchanger.
6. Effect of flowrates on pressure drops across a linear double-pipe heat exchanger.

APPLICATION

This apparatus was conceptualized and developed for the training of diploma degree and certificate students in our polytechnics, universities and other tertiary colleges of education. The outcome from the use of this equipment would be students that are trained in a particular line of thinking in contrast with the current practice whereby students memorize concepts and principles that may be easily forgotten or remain passive in their memories. It could also be used in research institutes, factory laboratories and some consulting firms.

OVERALL DIMENSIONS

Length	112.5cm
Width	75cm
Height	158cm

LABORATORY SERVICES REQUIRED

Electrical power rated at 20 Amps, 220-240 V AC, 50Hz, single phase supply.

CHEMICALS

In order to prevent and control rust, scum deposits, and sludge formations in both components and pipings, it is necessary that anti-rusts chemicals such as HOL T anti-rust, obtainable from petrol filling stations be added to the two sump tanks.

COST

The estimated cost of fabrication, assembly and electrical wiring of the Process-Heat-Transfer Apparatus is N7,674.65.

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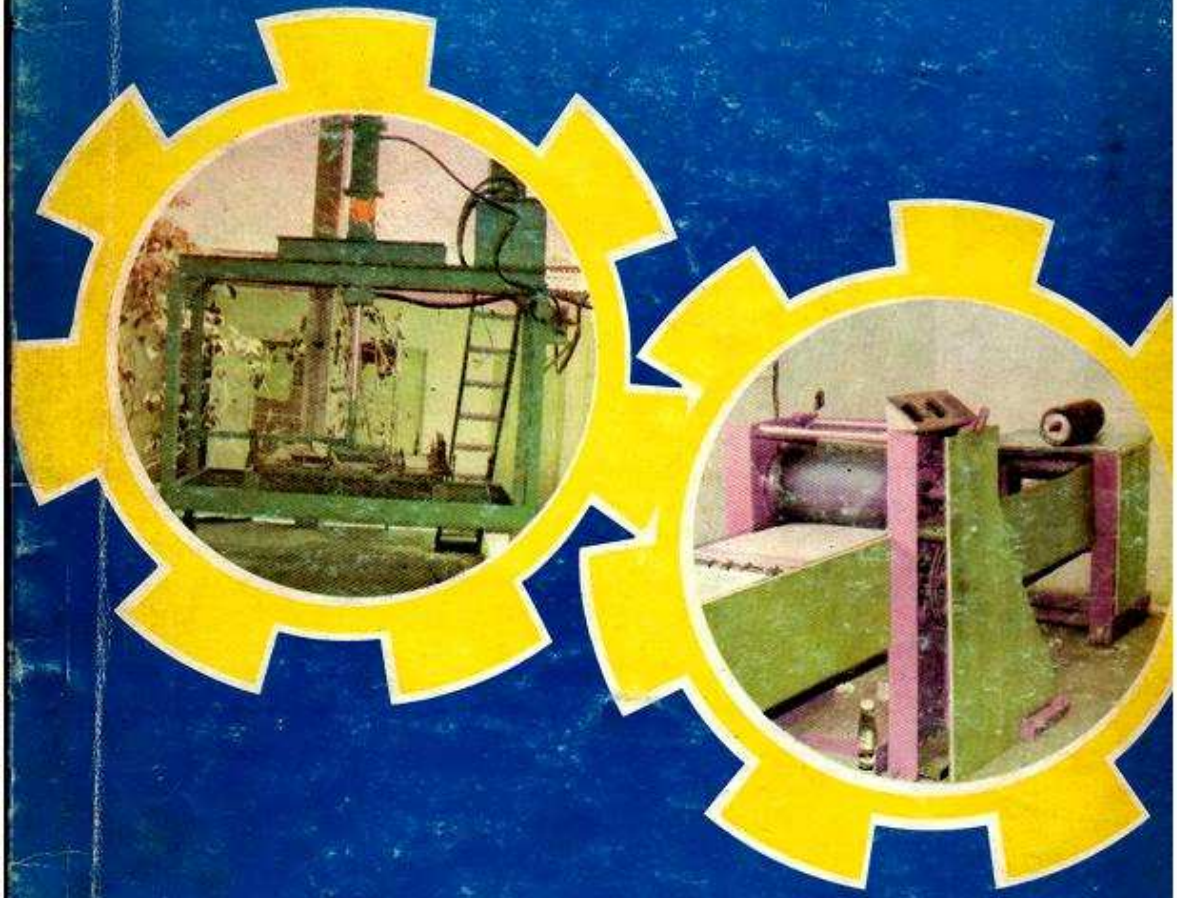

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2.7 IMT AIR-INDUCED PILOT-SCALE FUDIDIZATION-AND-ELUTRIATION APPARATUS

by

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INTRODUCTION

Again, the Department of Chemical Engineering, IMT, Enugu has procreated another new apparatus that would simplify students' instruction and training in particulate technology. This is the Air-Induced Pilot-Scale Fluidization and Elutriation Apparatus.

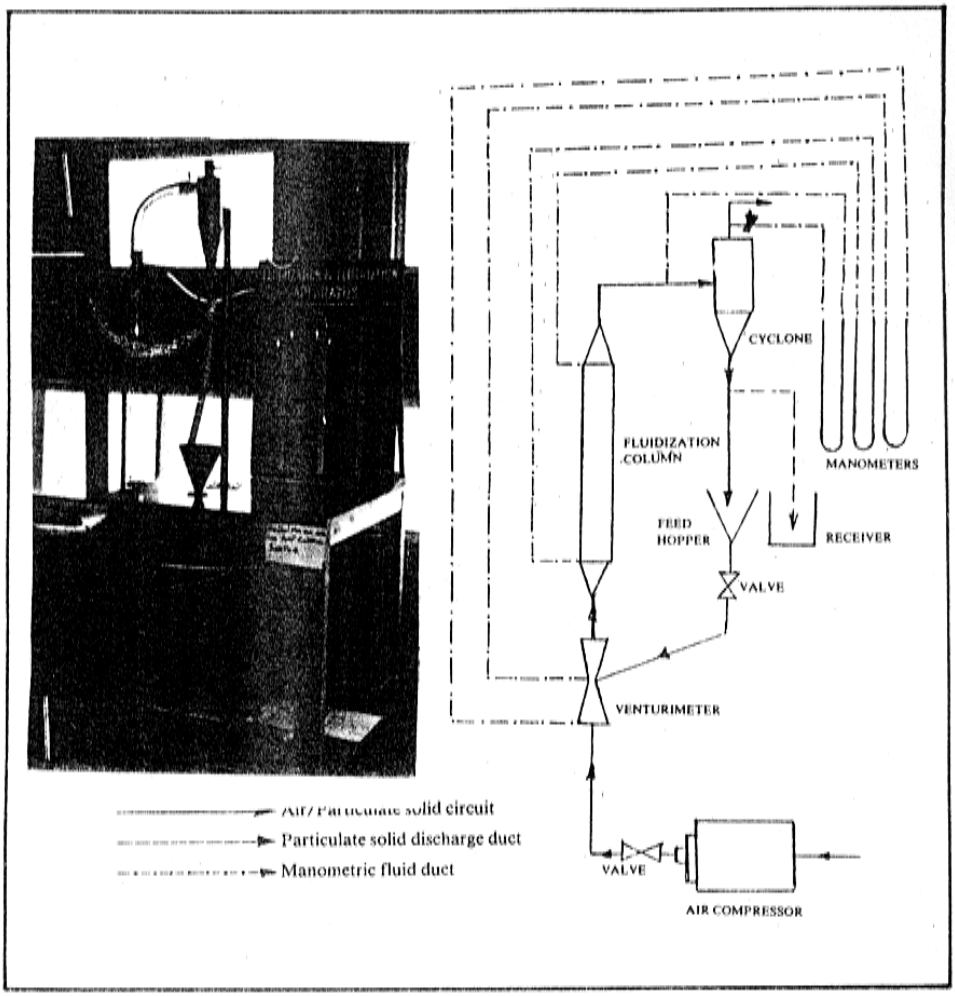
BACKGROUND

Its remote background is due to the proliferation of tertiary institutions by government in the past years; the progressive thinning down of government's subvention to the institutions due to the deepening of economic downturn; and the inability of the institutions to import teaching equipment from abroad because of the huge loss in the Naira value owing to government's deregulation of the economy by FEM/SFEM's cash-and-carry foreign exchange scheme. On the other hand, the immediate background is to contribute more to the active practical content of the chemical engineering curriculum in IMT, Enugu, through its Fabricational Project scheme.

PURPOSE

This apparatus was conceptualized and developed to enhance studies on continuous/circulating fluidization, batch elutrication, and continuous/batch vertical pneumatic transportation of homogeneous/heterogeneous particulate solids. Furthermore, it would make the study of feeding of particulate solids into a gas stream, particle entrainment, and turbulent fluidization more appreciative. During any of these phenomena particle motion results in mixing, circulation, segregation, attrition, and agglomeration of particles. These occurences would be appreciated by the students/users of this apparatus during practical studies.

The photograph annexed on next page shows the apparatus after assembly.



CIRCUIT DIAGRAM

GENERAL DESCRIPTION

Essentially this apparatus consists of:

1. a feedhopper for charging of the particulate solids.
2. a venturimeter for the metering of air rate through the apparatus.
3. a fluidization column made of glass for the observation and measurement of the phenomena of fluidization, elutriation and vertical pneumatic transport.
4. a gas cyclone for seperation of particulate solids from the gas stream.
5. three differential manometers for the venturi, fluidization column and cyclone respectively. These are for the measurement and indication of pressure change.

EXPERIMENTAL CAPABILITIES

This apparatus was developed to have the following teaching capabilities;

1. Mass balance of a homogeneous/uniform particulate solids over a circulating fluidized bed.
2. Effect of air-flow rate/velocity on pressure drop in a circulating/continuous fluidization of a uniform particulate solid.
3. Heat transfer in a circulating fluidized bed.
4. Size reduction of a uniform particulate solid in a circulating/continuous fluidization unit — a screen analysis of particles subjected to continuous/ circulating fluidization.
5. Solid mixing characteristics in a continuous/circulating fluidization.
6. Batch elutriative separation of a heterogeneous particulate solids (e.g. separation of rice grains from rice husks) — a determination of the minimum gas rate for elutriative separation.
7. Investigation of collection efficiency in a gas-solid cyclone.
   effect of particle size on cylone efficiency
   effect of air rate on cyclone efficiency
   effect of particle shape on cyclone efficiency
8. Investigation of pressure drop characteristics in a gas-solid cyclone — effect of particle size, shape and air velocity.
9. Venturi metering in a gas-solid system — effect of particle size and shape on pressure drop (DP).

APPLICATION

The Air-Induced Pilot-Scale Fluidization and Elutriation Apparatus was developed to enhance the training of students in polytechnics, universities, and other tertiary colleges of education. It may be found useful in research institutes, factory laboratories and some consulting firms.

OVERALL DIMENSIONS

Length	74cm
Width	74cm
Height	180cm

LABORATORY SERVICES REQUIRED

Electrical power rated at 15 Amps, 220-240 V AC, 50Hz, single phase supply.

COST

So far, the cost incured in the fabrication of components and their assembly to form the apparatus is ₦4,391.00.