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*MOTTO:* TO TRANSLATE INDIGENOUS TECHNOLOGY INTO INDUSTRIAL VENTURES.

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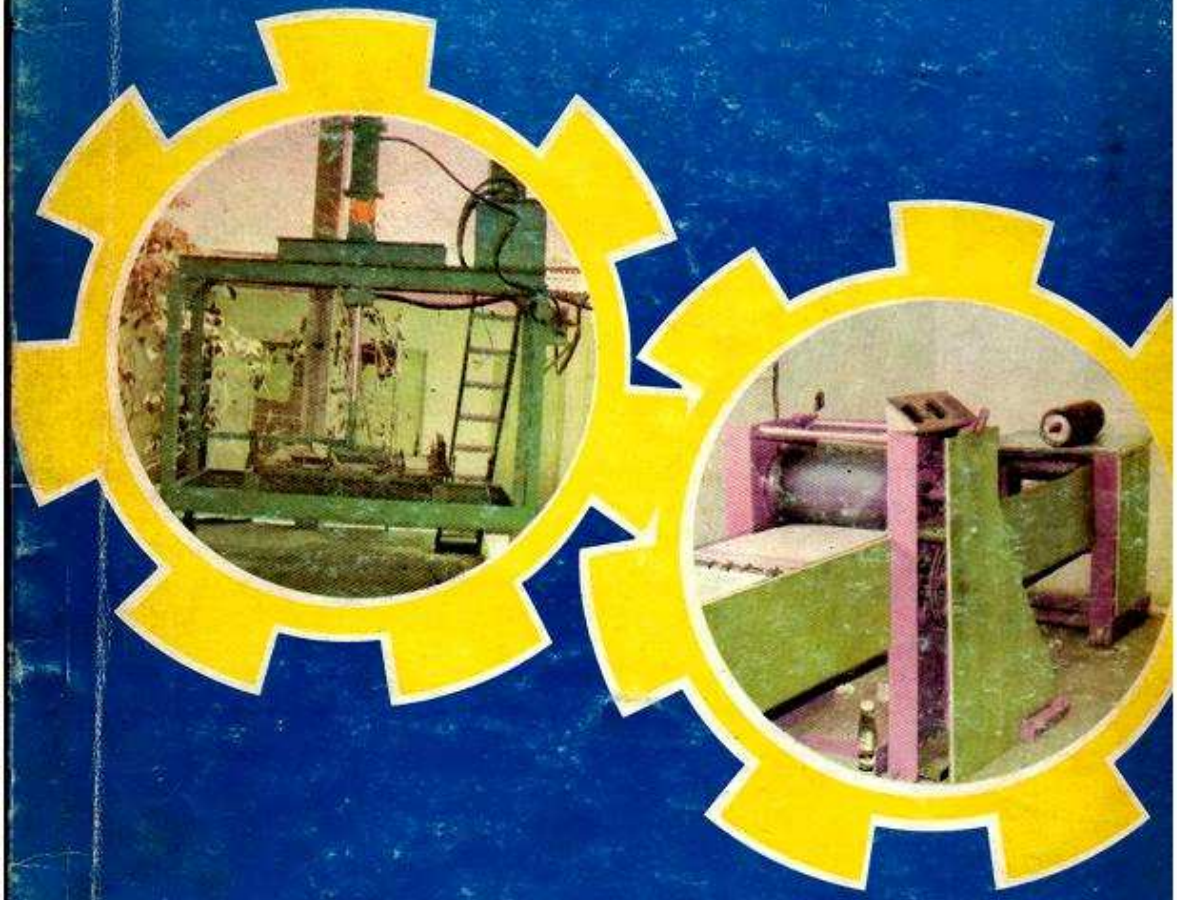

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# THE NIGERIAN INDIGENOUS TECHNOLOGIST

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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.

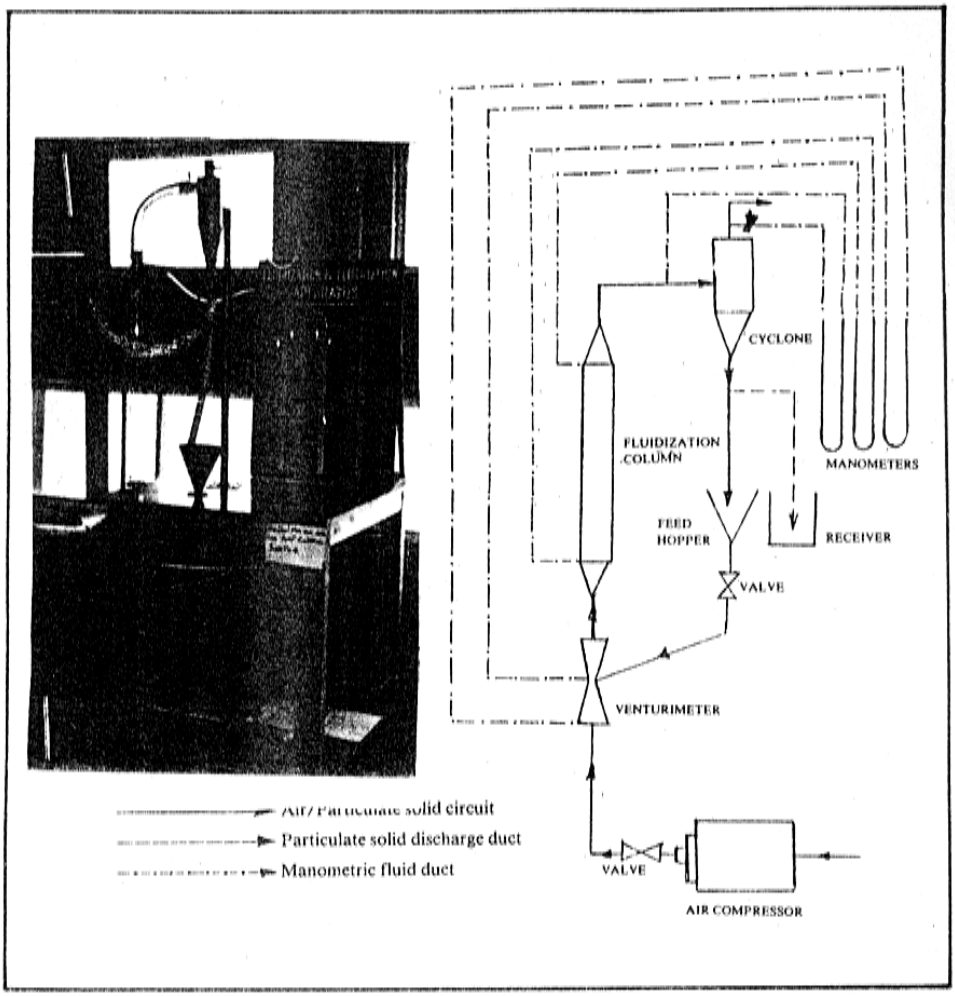
### BACKGROUND

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.