

# Lab. of Excellence

## (Thermodynamics)

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*SYNOPSIS :- Thermodynamics is one of the most important fields of knowledge. If the subject during education and training is treated with more care it will affect all over fields of Engineering applications. It's clear understanding may boost the development of mechanical, thermal and related systems on which the nation's industrial and economics position depends. If the system of treating this subject is made more practical oriented than is at present, the above goal may be achieved.*

### **INTRODUCTION :**

Development of any system depends on the application of various fields of knowledge. If a system requires application of a set  $N = [A, B, C, \dots, M]$  of different fields of knowledge consisting of elements A, B, C, etc. the degree to which the development is achieved depends on, to the extent of which all the required elements of N are dealt with. Today when the efficient energy conservation has become an important consideration, loose handling of thermodynamics which is very important element of N should be very seriously viewed.

Nations energy objectives are much dependent on the type of education and training. Making the method of imparting knowledge and training more efficient, will certainly have an impact on energy scenerio. Today the engineering study and grasping of the subject is done by going more on mathematical side rather than on the practical side. The effect of

change in one parameter due to another is viewed simply as a mathematical relationship. This helps students in passing out an examination, but the necessary thing for development is that a deep interest should be created in the subject. This is only possible if each and every phenomena and process is also seen practically and verified with the methemathical treatments. This enables the brain to judge the difference in theoretical and practical results.

### **LABORATORIES :**

At the undergraduate level the prescribed experiments are performed in the laboratories, just to complete the formalities. Interest in all these experiments is never observed when they are performed by the students. Along with the robust equipments and apparatus if interesting miniature or small table type apparatus are used they may attract the scholars and create interest in them which will lead to further interest in the subject. For example a boiler and an easily dismantable

set of engines, turbines, etc will create deep interest in understanding the functioning and the type of construction. Every institution has boiler, generally a robust one driving steam engine and turbines. While performing experiment on these robust type of equipment the students and instructors have tension on their brain which nullifies the interest. Further, heavy steam engines and turbines are different to be dismantled and assembled every time.

A cutsection model is excellent for understanding but for remembering the thing, it is essential that first the working model is actually studied as above and then the cutsection can be utilised to think on it.

The apparatus for the labs, if designed strictly according to the syllabus considering each and every basic process and phenomena then the subject may get clear to much grater extent.

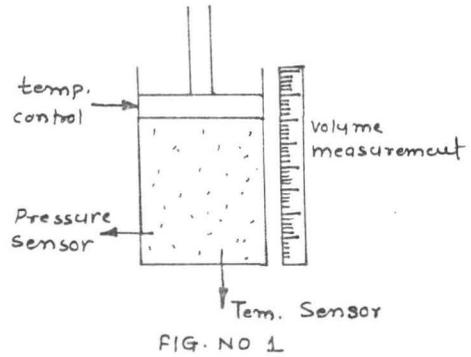
**Maximum No. of Models to be Working Models :**

**Outline of some apparatuses**

The lab may be designed considering the subject from the very begining. Thus, for example, the relationship of PVT, relation between heat, work and other form of energy, are some topics which are dealt here.

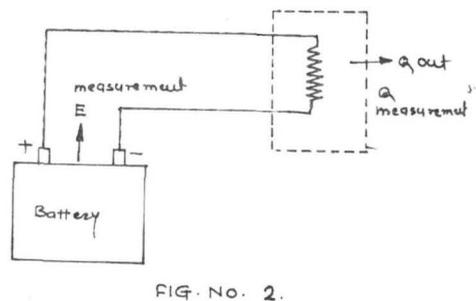
A small apparatus is needed consisting of a cylinder(transparent) fitted with a piston, valves and sensors to record temp, pressure, with an arrangement to measure volume and force on the piston. A volume of gas may be compressed or expanded and changes in the different parameters studied.

Fig. 1



2) (a) In this part of experimnet the relationship between the forms of energy is to be shown. Battery connected to a load resistance is the major portion. It is to be provided with instruments for measuring the Q output from the load, E output form the battery and losses be studied.

Fig. 2



(b) Second part of the above expt. is to study the relationship between electrical energy supplied from the bettery and the work obtained on the shaft of a motor. The apparatus is to have a battery, a dc motor and work measuring device.

Fig. 3

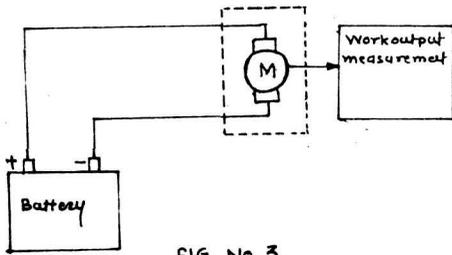


FIG. No. 3

(c) In third part of the experiment, work is to be supplied and energy stored in the battery is to be studied.

Fig. 4

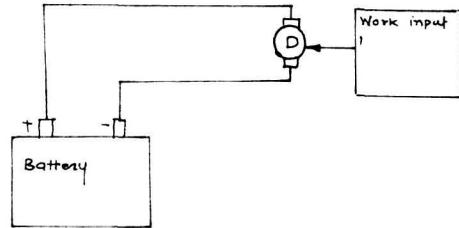


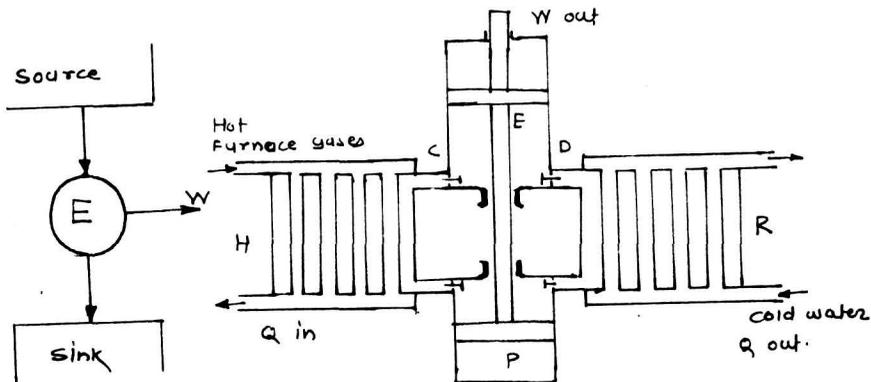
FIG. No. 4.

3. The concept of that engine and reversibility :

The line diagram of this consist of a source an engine and sink. The apparatus for this is

to be a small or medium sized Joule air engine which completely resembles with the theoretical diagram treatment.

Fig. 5



4. To drive Joule engine reversibly i.e. supplying work from outside and transferring heat

from sink to source.

Fig. 6

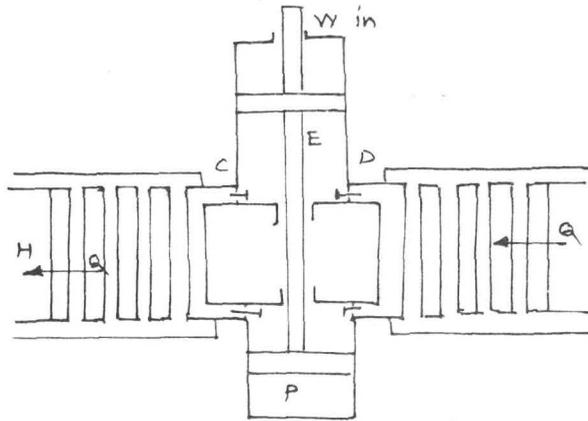
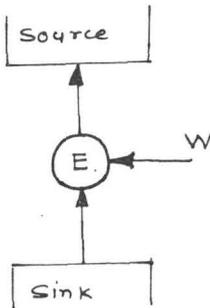


FIG. NO 6.

5. Study of steam generation :- A table type steam generator equipped with temperature and pressure sensors, to clearly show sensible heat, latent heat and super heat.

In the above manner, each and every process can be made as small as possible, during the theory treatment also can be used. If the whole lab is designed as per this pattern the subject idea will be more clear and will be easily remembered.

Fig. 7

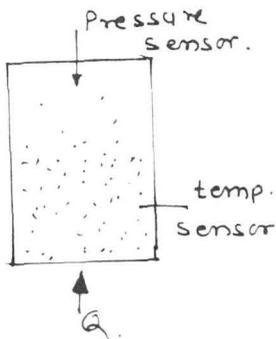


FIG. No. 7.

**CONCLUSION :**

Instead of selecting apparatus and equipments from the manufacturers list (which is made as per the convenience of manufacturer who is business oriented) the apparatus should be first designed according to each and every process and phenomenon of the subject, and then an order for fabrication should be placed. Cut models are good for explaining details but they do not create interest thus each cut model should be supported by a dismantable working model.

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