Model Systems Show Students Methods of Industrial Design

STUDENTS CONFUSED by a conglomeration of charts, graphs and diagrams are a not unusual sight in any engineering school offering courses in mechanical, electrical, chemical or mining engineering.

Such schools as Colorado School of Mines, Stanford University and Waterloo College in Canada, are undertaking projects to clea up some of the visual aid problems encountered in certain courses (for example static structures, dynamics and kinematics of machinery). These are just a few of the colleges incorporating a three-dimensional approach to the problem by using models in the explanation of basic complex systems.

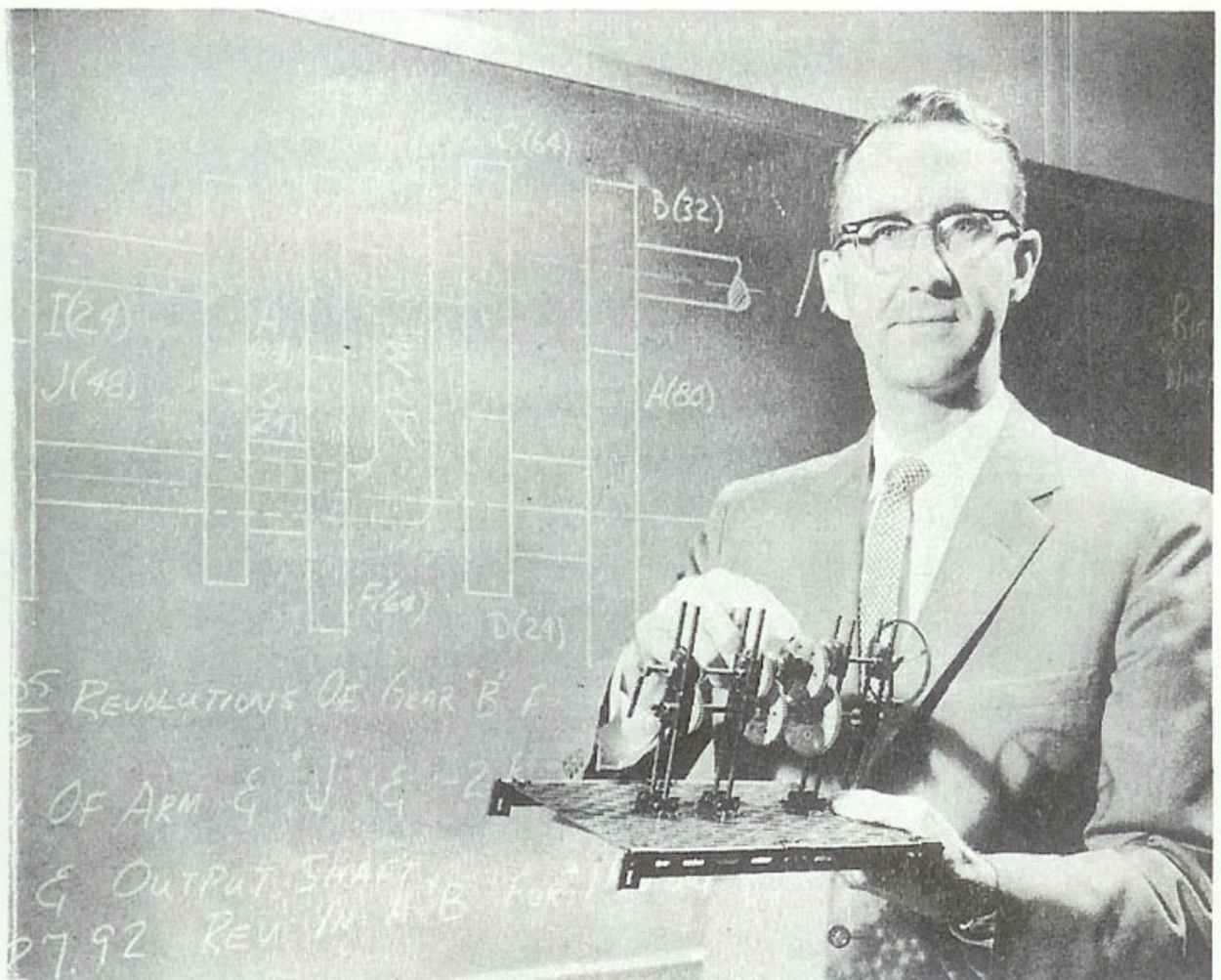
The FAC engineering kit containing as many as 2700 standard, precision-made pieces, is one of the kits providing the busy instructor with a handy study tool. Model kits have proved a great help to instructors and a welcome addition to the harassed student.

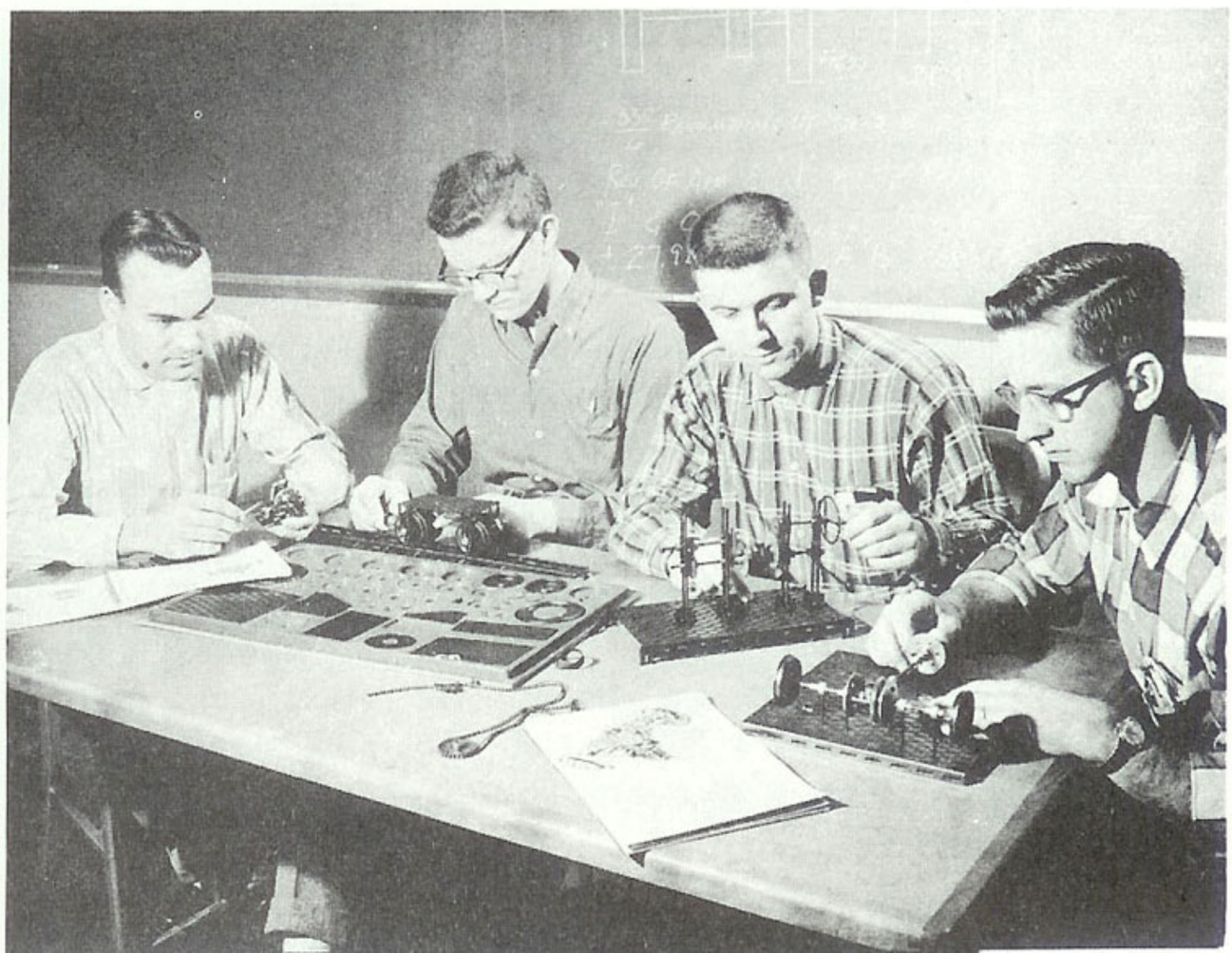
With a kit, precision working models of practically any type of machine, drive, or mechanism can be made. Included in the kits are rods, beams, ball bearings, gears of all kinds, racks, ratchets, sprockets, pulleys, springs, universal joints and other components. Easier explanation, and a speed-up in student comprehension of typical kinematic problems are reported when kits are used.

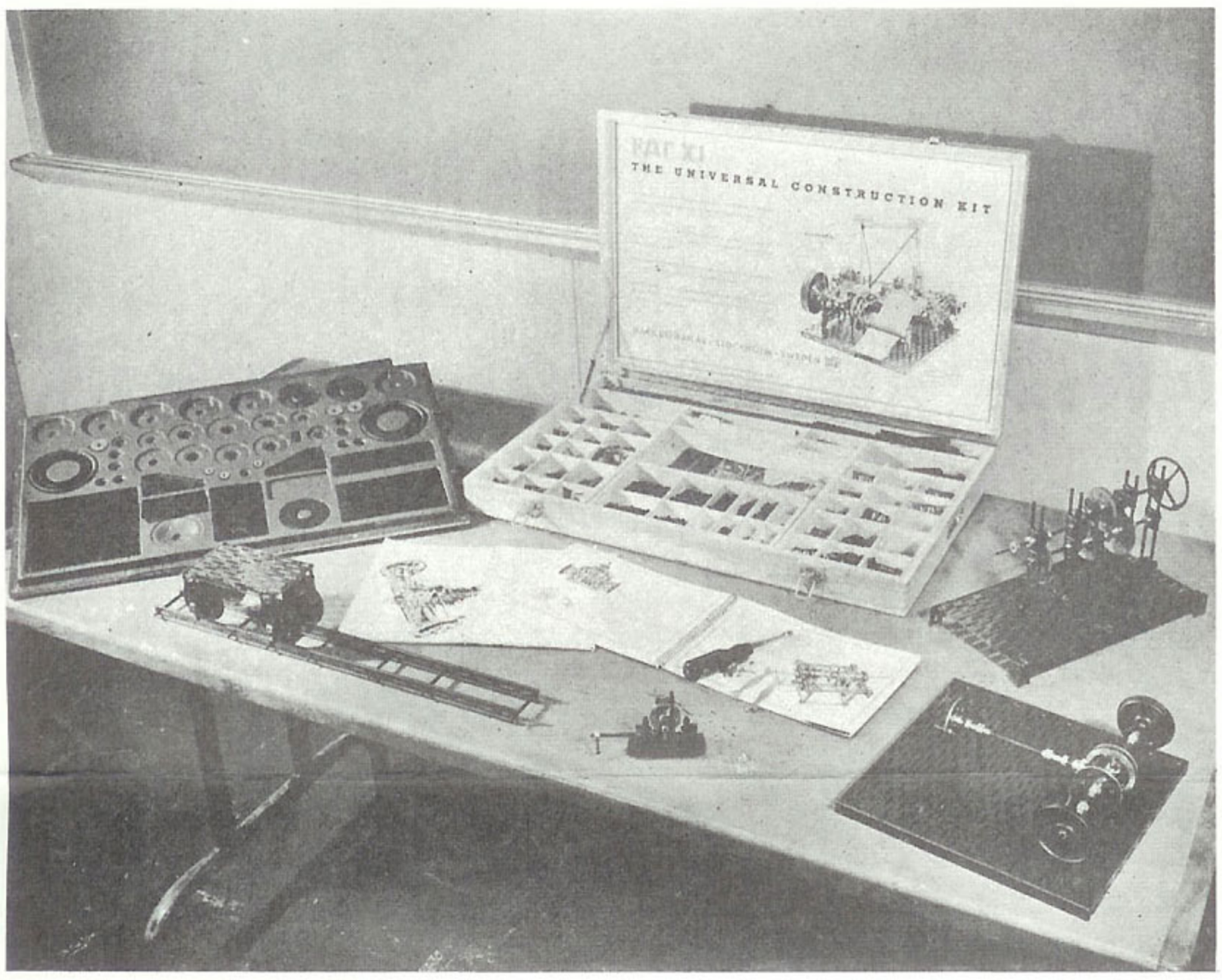
Economical and Versatile

As a comprehensive and flexible system, the FAC kit is reported to be well suited to school use. Its cost is far less than the conventional model program, wherein models are built individually and stored until ready for use. It also meets the need for a series of models to demonstrate machines, motions and drives from the simplest types studied at the beginning of a se-

Once a problem has been solved, the instructor may choose to demonstrate the system beyond the blackboard discussion stage (as at left, with a model of a planetary system). At the right, a group of students studying models they have assembled to demonstrate basic movements in their kinematics class. All illustrations courtesy of Fenn College, Cleveland, Ohio.







This universal construction kit contains 2700 precision-made parts. Shown in the foreground are a few of the models that can be made completely from the components included in the kit.

mester to the more complicated systems problems offered later in the course of study.

The Working Model Theory

Where an abundance of technical ideas and new information is constantly transmitted, as in the college classrooms and in the conference rooms of industry, visual aids effectively facilitate the flow of ideas. Demonstrating an idea or problem with scale working models is a more direct method of communication than attempting to prove a point with charts, drawings and formulas.

Theoretical solutions to engineering problems serve their purpose in the classroom as well as in industry. However, the solution may lose its worth unless it can be translated into concrete terms of actual practice. It is said that some engineering students leave school and enter the technical fields of industry with only a hazy notion of what a piece of machinery or a particular system looks like.

They may lack complete understanding of how a differential operates or what a planetary system can do. This condition apparently is not completely overcome even by the many well-planned laboratory sessions and field trips conducted by colleges.

In the solution of problems in the kinematics of machinery, for example, it can be difficult for a student to visualize a shaft rotating at a certain rate in one direction, driving a series of gears to produce rotation in a reverse direction in a shaft at the other end. It is not necessary, however, for the student to envision the system in order to calculate a solution to a kinematics problem. Through a purely mechanical process of setting down figures in columns, or by applying a standard formula he can determine the correct answer.

But when the student goes into industry, he needs to be capable of carrying problems a step further. He must resolve the solution in terms of machinery that will do work, instead of in terms of an answer that will earn him a grade.

Instructors recognize this limitation, yet often find it difficult to demonstrate solutions on the blackboard. The three-dimensional presentation made possible with kits speeds understanding of problems.

Using The Model

Models are started by using beams and rods as basic construction units. These pieces are assembled into rugged structural frameworks and mechanisms made up of the various kit components.

With this system, there is no problem with storage of models since the simpler models can be assembled and dismantled in a very short time. Even a model of a planetary system or a differential can be constructed in a few hours. These more complicated models could be left intact; and the kit would still have enough parts remaining to construct others.

Supplementary to the standard course, the models are offered as a visual aid to the understanding of the solution of a problem, rather than as a means to determine the solution. Once the students have solved a problem theoretically, a typical model can be produced and the solution demonstrated, showing not only what goes in and what comes out, but also what happens in-between. Thus, the theory is linked to understanding.

In simpler problems, students often assemble models representing some of the basic movements and drives—a further step toward practical application.

Construction of one of the more complicated models, such as the representation of an automobile differential, requires approximately four hours. Once the model kit system is used and understood, it is said to be a simple matter to assemble any type of system, drive—or even a whole operating machine. Some models can be used in class lectures to describe types of motion and illustrate solutions.

According to reports, this system of visual demonstrations makes it possible to cover more material in a given time. Through the use of models, problems can be understood much more rapidly. Information is said to be retained longer. ■