Pharmaceutical

1. Pectinum N.F. VII for internal and topical medicine.
2. Hesperidin methyl chalcone, a new drug.

Industrial

1. Pectate pulp in oil well drilling mud chemicals.
2. Pectate pulp dispersion in paper coating and penicillin production.
3. Sodium ammonium pectate as a gum and agar substitute.

It is interesting to note that both possible approaches to a new product are represented in this partial list. There is the case of attempting to develop a product to meet some specific need, and the opposite case of discovering some new composition or constituent and then trying to find a field of use. Incidentally it is the writer's conviction that if a research program functions in these two ways successfully, not necessarily with equally frequent occurrence but at least occasionally, it is a test that the projects are reasonably well balanced as an

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REPRODUCTIONS OF PRINTS, DRAWINGS AND PAINTINGS OF INTEREST IN THE HISTORY OF SCIENCE AND ENGINEERING

2—Prints of Early Mechanical Road Vehicles*

By E. C. WATSON

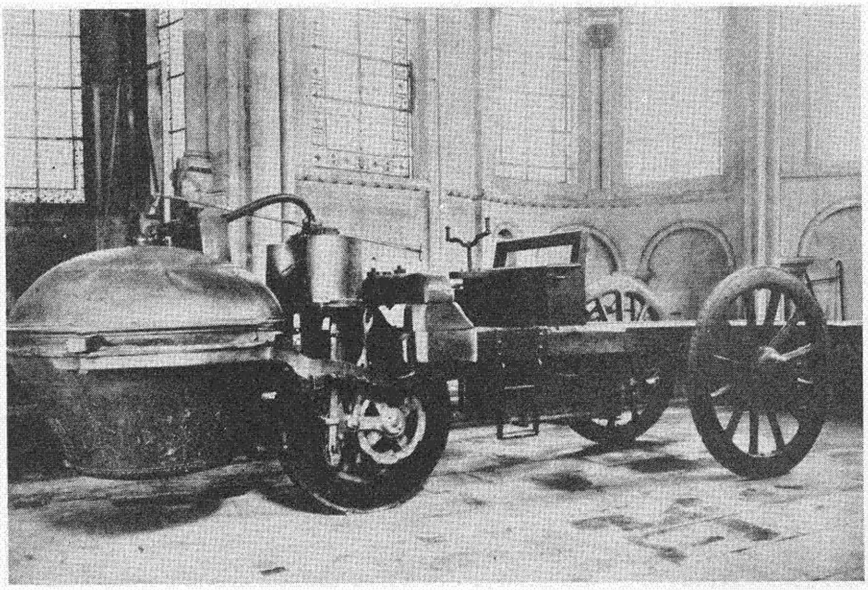

FIG. 1. Cugnot's steam tractor (1769-1770), the first practical horseless road vehicle.

THE first practical mechanical road vehicle was the steam tractor built in 1769 by Nicholas Joseph Cugnot, a French military engineer (1725-1804). It attained a speed of just over two miles per hour on a level road, but the boiler capacity was sufficient only for 12 or 15 minutes of running. By order of the French government a second tractor was constructed in 1770 for the transportation of artillery, but it was never used. It is now preserved in the Conservatoire National des Arts et Métiers in Paris, where the photograph was taken from which *Fig. 1* was made. The following description appears in the *Catalogue* of the collections in the Science Museum, London, where a small-scale model is displayed:

"It consists of a heavy timber frame supported on three wheels and carrying in front an overhanging copper boiler. The front wheel has a broad, roughened tyre, and is driven by two single-acting inverted vertical cylinders 13 in. diam. by 13 in. stroke. The two pistons are connected by a rocking beam, and their motion is transmitted to the driving axle by pawls acting on two modified and reversible ratchet wheels. The distribution of steam to the two cylinders is performed by a four-way cock actuated by a tappet motion. A seat is provided for the driver, who, by means of gearing, was able to steer the machine, the boiler and engines turning together as a fore-carriage through 15 deg. either way."

The first mechanical road vehicle to make a journey of any length was the steam carriage built in England by Sir Goldsworthy Gurney (1793-1875). The description beneath the print in *Fig. 2* reads as follows:

"The Guide or Engineer is seated in front, having a lever rod from the two guide wheels to turn & direct the Carriage & another at his right hand connecting with the main Steam Pipe by which he regulates the motion of the Vehicle—the hind part of the Coach contains the machinery for producing the Steam, on a novel & secure principle, which is conveyed by Pipes to the Cylinders beneath & by its action on the hind wheels sets the Carriage in motion—The Tank which contains about 60 Gallons of water is placed under the body of the Coach & its full length and breadth—the Chimneys are fixed at the top of the hind boot & as Coke is used for fuel, there will be no smoke while any hot or rarified air produced will be dispelled by the action of the Vehicle—At different stations on a journey the Coach receives fresh supplies of fuel & water—the full length of the Carriage is from 15 to 20 feet & its weight about 2 Tons—The rate of travelling is intended to be from 8 to 10 miles per hour—The present Steam Carriage carries 6 inside & 12 outside Passengers—the front Boot contains the Luggage."

Although planned for regular service between London and Bath, the coach of Gurney remained in an experimental state. Its chief performances were the climbing of Highgate Hill on June 14, 1828, thus demonstrating the possibilities of steam in climbing a prolonged slope, and the trip from London to Bath in 1829, the first trip of any length to be made by an automobile. Nevertheless it was not successful technically, partly because the mechanism was inaccessible and badly protected.

Between 1827 and 1838 Walter Hancock (1799-1852)

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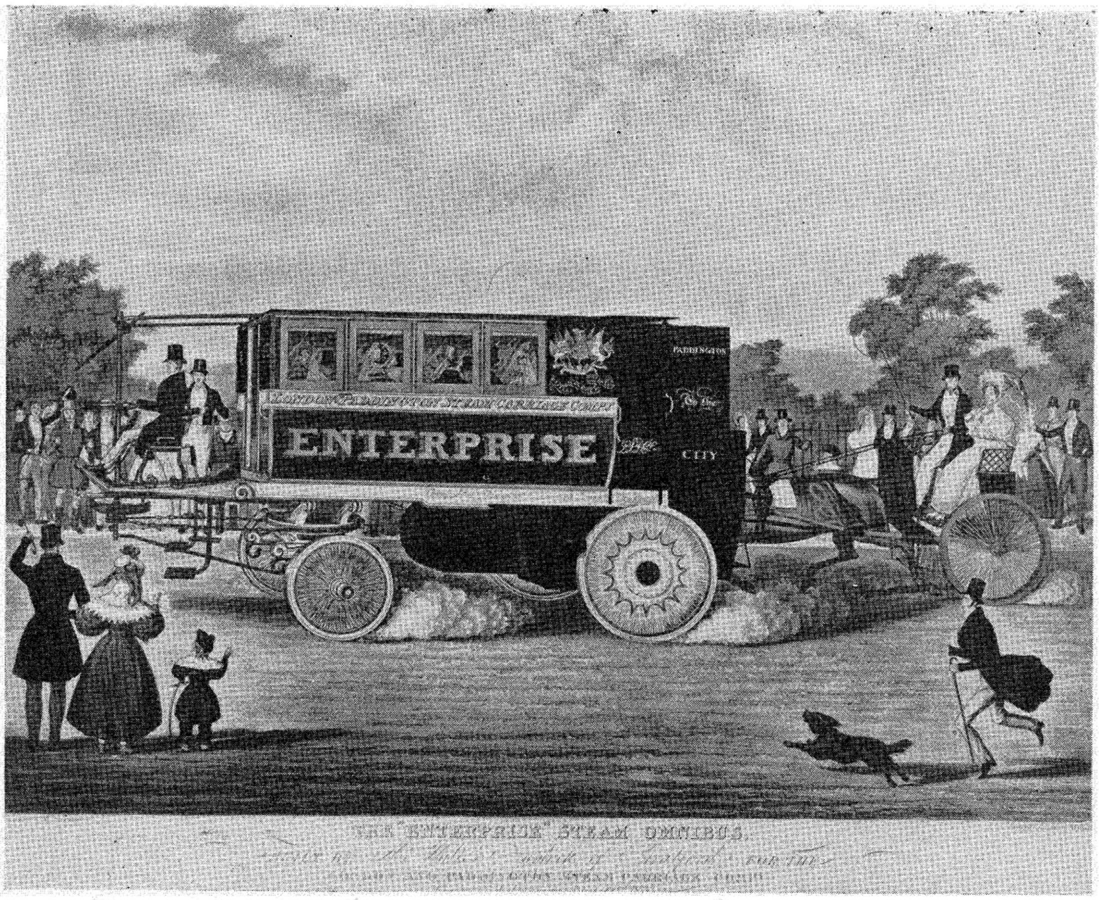

FIG. 2. Gurney's steam carriage (1827-1829), the first horseless carriage to make a long journey. (From a magnificent colored aquatint, 9.5 by 15 inches, by G. Morton and Pyall.)

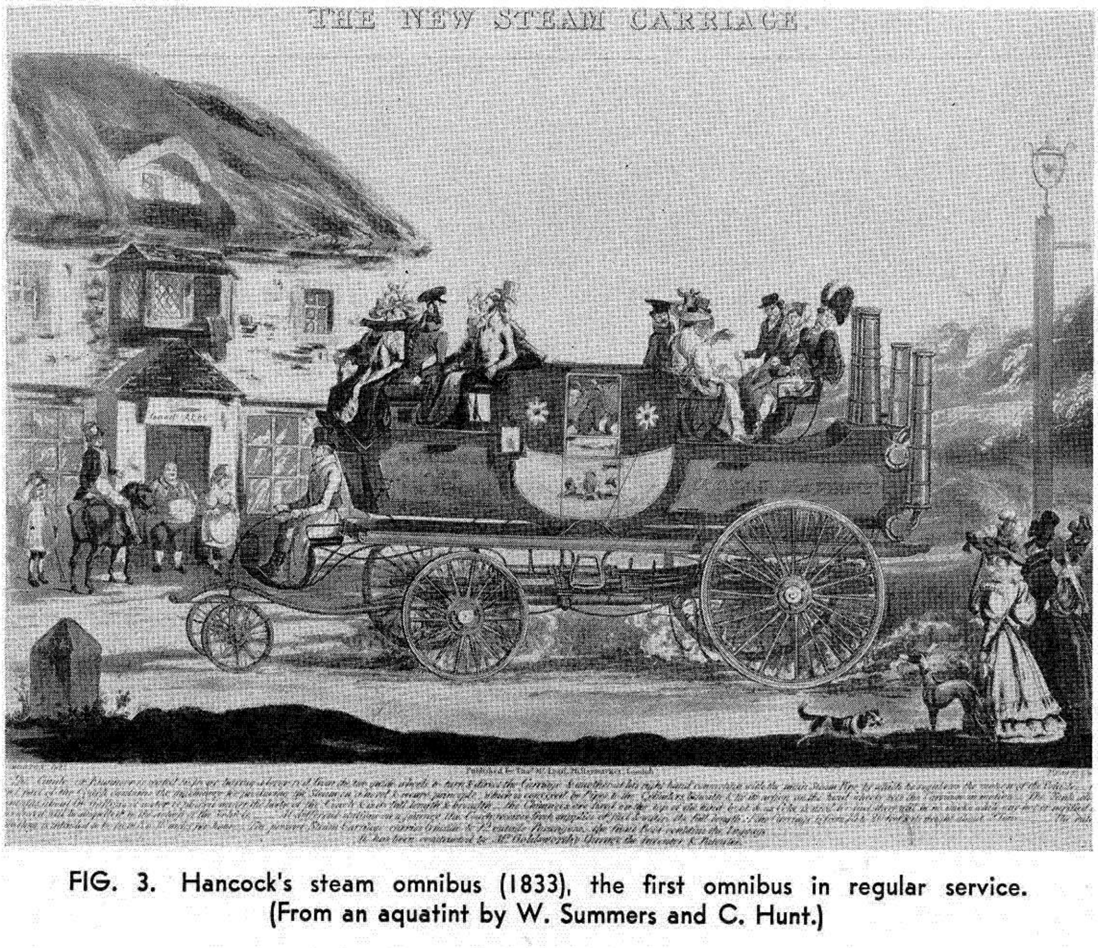

FIG. 3. Hancock's steam omnibus (1833), the first omnibus in regular service. (From an aquatint by W. Summers and C. Hunt.)

FIG. 4. Church's ornamental three-wheeled steam coach (1833). (From an engraving by John Cooke and Josiah Allen.)

of Stratford, England, built nine steam carriages of various types, all of which were mechanically successful. On April 22, 1833, one of these, named the *Enterprise* (*Fig. 3*), was put into regular service between London and Paddington. This was the first mechanical vehicle especially built as an omnibus to be put into continuous service. Being more novel than the horse-drawn coaches, it was favorably received by the public.

Fig. 4 shows a curious coach built in 1833 by William Church. This coach, which ran for a time between London and Birmingham, had wheels with flexible spokes and very broad but elastic rims.

Further details of early road vehicles and their history will be found in the *Histoire de la Locomotion Terrestre,* by Charles Dollfus (*L'illustration,* Paris, 1936) and in the *Catalogue of the Collections in the Science Museum, South Kensington, with Descriptive and Historical Notes and Illustrations. Land Transport. II. Mechanical Road Vehicles* (London, 1925), from which much of the foregoing discussion was taken.

Military Service

(Continued from Page 3)

add vocational training of some sort for every boy, the trainee being permitted to choose the field of his training. At his volition this vocational training could be manual or commercial, just as a similar choice is open to enlisted men now in the Navy. The third four months the trainee would go to sea.

The American Association of University Professors has sent a questionnaire to university professors all over the country asking for votes on details of such a program, but closing with the question: "If you are opposed to universal military training, how do you believe that the national defense can best be safeguarded?" Otherwise stated, what other alternative is there? Granted that isolationism and pacificism, two attitudes which are identical so far as their war-effects are concerned—and those effects have been to prevent us from being prepared either to defend ourselves or to help other nations in putting down international aggression at its inception, as we ought to have done before Poland was attacked—granted that we have learned our history lesson and that these two attitudes are now dead, there then seem to be but two alternatives before us as to method, namely, either (1) to maintain a powerful professional army, navy and air force (the history of Rome and of continental European nations shows how bad an alternative that is) or (2) to train each citizen to take some part in the national defense and in the maintenance of a peaceful world.

Suppose, then, that some form of the universal service bill passes. Look at the values that, if it is properly done, can come from it to life in America and in particular to life at C. I. T.

First, that year of continuous training and toughening of the physiques of the whole manhood of America will tend to form habits of bodily care that can make a healthier America than has thus far existed, and a healthier and huskier group at C. I. T.

Second, on a preceding occasion I have expressed my own confidence in the moral value of the discipline which I found in a recent visit to Annapolis, the training in punctuality, in orderliness, in cleanliness, in gentlemanliness, in truthfulness, in honor, even in religion. Can there be any doubt that subjecting every boy in the United States for a year at the age of 17 to just this kind of training under Army and Navy officers and their chaplains would make a better postwar America and a better postwar C. I. T. than existed in prewar days? The freshmen who entered here at the age of 18 would come here fresh from a year of that kind of discipline.

Third, one main purpose of a *universal* elementary and secondary school system is to train every citizen in the duties, the responsibilities, and the art of good citizenship. Democracies having universal suffrage cannot possibly survive unless at least 51 per cent of the voting population have the background that enables them to cast reasonably intelligent votes. What an opportunity that year would give to teach with all the most modern movie techniques now available the meaning, the methods, and the responsibilities of American citizenship! Imagine, for example, the Chief Justice of the United States standing, in pictures, before all the boys of the nation and talking with them for an hour on the significance of law observance. Multiply that influence say only 50 times—one talk a week for a year by 50 of the most distinguished men of the nation—and what an inspiring course in the fundamentals of citizenship you could have.

Fourth, the giving of every boy in the United States the opportunity, while living under military discipline, to make a beginning in learning some manual or commercial skill could be made to begin at least to rectify