Two stages in the manufacture of the Lake concrete unit dwellings which are completed with plumbing, wiring and other accessories before shipment to the buyer

The One-Piece House

Simon Lake's Scheme for Producing Ready-to-Live-In Concrete Unit Dwellings and Transporting Them to the Site

By Harry A. Mount

WHEN one recalls the wide heraldry given a few years ago to the scheme of Thomas Edison for building monolithic cement houses from forms or molds that were to be used over and over again, one is warned to hold within bounds his enthusiasm over similar projects. The Edison scheme was practical—is practical, in fact, and being used here and there on a small scale. It has not been applied on a universal scale, as was so confidently expected. Now comes Simon Lake of torpedo boat fame, who says he has found and removed the flaws in Edison's plan and is preparing to put his new scheme into effect on a nation-wide scale.

The most remarkable part of Mr. Lake's scheme is that, instead of building the house on the lot, necessitating a vast amount of labor for putting up and tearing down expensive forms, he will build monolithic concrete units from standardized forms in well-equipped factories, and deliver the finished house, ready for occupancy, to the lot!

At first thought there seems to be insurmountable difficulties to any such proposition. How could a concrete house, no matter how small, be built light enough and at the same time strong enough for transportation? But supposing that were possible, where could we find a vehicle that would pick up and carry a house of any size a reasonable distance without prohibitive cost?

In finding an answer to these questions, Mr. Lake and his collaborator in the enterprise, Robert C. Lafferty, a New York architect, have departed so far from standard practise that they have had to manufacture their own engineering data as they went, and some of their answers are nothing short of startling.

For instance, the walls, floors and ceilings of the house are hollow, with only $\frac{3}{8}$ -inch thickness of cement on the inside and $\frac{5}{8}$ -inch on the outside. And yet a house of this construction has stood tests more severe than if it had passed through a half-dozen San Francisco earthquakes without a crack or a sign of structural weakness.

These tests included transportation by motor truck five miles at speeds up to 15 miles an hour. And such a motor truck! It is a specially designed ten-wheel affair, which carries the house swung low on a structural steel cradle. It is equipped with hoists, and other machinery for handling the house in put-

THE housing shortage will be with us for several years to come, build as we may. The plain truth is that we cannot hope to wipe out a building shortage that has taken six or seven years to attain its present magnitude, even by the most extraordinary efforts, except by building to our utmost capacity for many years to come. If anything, the hope of ameliorating the housing shortage rests rather in the introduction of new and revolutionizing designs and methods of construction, and to that end numerous inventors, engineers and architects have directed their recent efforts. Dwellings must be simplified; materials other than wood must be employed; machinery and labor-saving equipment must be used to a greater degree, to the end that building costs may be appreciably reduced, finally bringing down the price of a modest dwelling to well within the means of the average American citizen. Conspicuous among the numerous schemes proposed is that put forward by Simon Lake of torpedo-boat fame, in collaboration with Robert C. Lafferty, a New York architect. The scheme is highly ingenious; it has been tried out with success; it is about to be put into production. The Lake concrete unit dwelling is quite small, but sufficient by itself for the requirements of the small family. At any rate, we have asked Mr. Mount to tell us about Mr. Lake's housing scheme, which he has done in the accompanying article.—THE EDITOR.

ting it on and taking it off the truck. It is believed that two men can load, deliver and set up a house complete within a radius of fifty miles of the factory in one day.

As startling as are the engineering features of the

house is occupied by a combined dining and living room, although ordinarily there is no hint that it is used for meals. A large mirror on one wall, when swung down

and rested on two folding legs, becomes the dining room table. This discloses, behind the mirror, a revolving server which communicates with the kitchen. When the meal is finished the dishes are piled on the server and when this is revolved they are transferred to the kitchen at the sink. The kitchen contains besides the sink a four-burner gas stove and oven, refrigerator and an electric washer. Opposite the kitchen door is the bath, fully equipped. At one end of the house, off the living room, is a small sun room with a built-in window seat. Communicating with this is a small dressing room. At the other end of the house is a den, with identical arrangement. In each of these two rooms full-sized beds disappear into the ceiling, the bottom of the bed serving as a large section of the ceiling. These beds are lowered by means of a crank in the dressing room, and at night one end rests on the window seat and the other on two folding legs.

Glass doors which may be used to shut off the sun room at night, slide back and

A single unit dwelling built by the Lake method and subjected to numerous tests with marked success

form doors for book cases on either side of the doorway in the daytime. The heating plant is a small stove in a fireproof alcove off the hallway, and this has been found sufficient to heat the house in the coldest weather. Further plans include a coal bin on the roof, holding two tons, arranged so that by pulling a lever the fuel drops directly into the stove.

The success of the scheme depends largely upon a unique method of construction, upon which Mr. Lake has been allowed broad basic patents. The central piece of apparatus of his unit dwelling is a huge traveling-factory, crane-like affair, on which are mounted two cement mixtures with loading hopper bins placed over them. The sand and cement are lifted to these hoppers from railroad cars, which run beneath the apparatus, by means of a grab bucket.

The cement, after mixing, flows by gravity into the forms. The frame of the house is first constructed of creosoted wood, on both sides of which is fastened heavy reinforcing netting. The window and door frames are then placed in position and the traveling plant moves to this position. There are two heavy wood forms for both inside and outside walls, one on each side of the apparatus, so arranged as to counter-balance each other, so that when one is lowered the other is raised. One of these forms is dropped over the prepared reinforcing. As door and window frames

ing it to its final location. Meanwhile the roof slab is placed on the four walls, the plumbing and electric wiring are completed, and the house finally finished for occupancy. Even the electric light fixtures are hung and window shades are in place when the house is finally loaded on to the big truck and trundled off!

The finished unit weighs about fifteen tons, but by means of the special truck it is readily handled by two men. If the house is to rest on piers, these are first placed and the truck then drives between them, elevates the house to the proper height and sets it down. The truck is then taken apart beneath the house and is withdrawn in two sections. These sections are subsequently reunited and the truck is ready for another trip.

The special motor truck carrier practically divides the load on two trucks comprising four forty-inch wheels each. The solid rubber tires are each fourteen inches wide, so that the hard road contact is about 350 pounds per inch. Where delivery is to be made over meadows or soft ground, a caterpillar belt will connect each adjoining pair of wheels, thus reducing the ground bearing to about 22 pounds to the square inch. The truck, it is claimed, will attain a speed of 14 miles an hour and, when fully underslung, will carry the units under an eleven-foot viaduct. The truck's elevating apparatus allows the delivery of the second

and it is certainly no longer an economical material.

"For many years cement has been recognized as an ideal building material if it can be thoroughly damp-proofed, if there is some means to dispense with the cost and waste of forms, and if, also, the requisite economy can be obtained while producing homes in an infinite variety of architectural designs.

"We think our construction meets these requirements and others. The house, by our process, is thoroughly damp-proofed. It is also heat- and cold-proof, for the hollow walls are good insulators. The house is as nearly fireproof as it can be made; the upkeep expense is minimized for no painting nor roofing is ever required. The life of the building is several times that of a frame house. We use an abundant raw material and employ the most economical production methods. We use more unskilled labor than is the customary practice. We have, in our smaller units, recognized and solved the servant problem. Other units can be added as desired. In the one-unit house seventy-five per cent of the furniture is built in, eliminating extravagant furnishings."

One-Way British Motor Plows

AMONG the most interesting of recent developments in British agricultural engineering is the one-way motor plow, which has appeared upon the British

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Bird's-eye view of a typical plant for producing the Lake concrete unit dwellings. In the center foreground appears one of the special trucks for transporting the unit dwellings in one piece

run through the walls, the frames seal these openings against cement.

The crucial part of the operation then begins. The walls are made hollow by placing in the forms the "cores" of heavy sheet iron, properly reinforced to prevent collapsing. Before placing these cores in position, they are dipped in a bath of asphalt until a coating nearly an eighth of an inch thick is deposited on them. The cores are then placed in position and the cement is poured.

Ordinarily it would be several days before the forms could be removed, and the cores would then be so tightly imbedded in the cement that they could not be removed. But warm air, held at a temperature of 180 degrees, is at once circulated through the hollow cores and a threefold result is achieved. First, the cement is dehydrated and dried within two and a half hours; secondly, the asphalt coating is melted so that the cores can be easily withdrawn; and thirdly, a heavy coating of asphalt is deposited on the inner lining of the walls, making them entirely water tight. While the cement is still warm and the pores are open so that it readily absorbs liquids, a waterproof filler, tinted in some desirable shade, is sprayed on the outside walls. The house is then picked up by the traveling machine and deposited further down the yard where it is allowed to stand two weeks to allow the cement thoroughly to harden or season in order that the house may stand the handling necessary in transport-

story of a two-story house first. It is elevated to the proper height and propped in position. The truck is withdrawn and returns with the first story unit, depositing it beneath. The second story is then lowered in place, on top of the first story.

The smallest economical plant will consist of one traveling cement machine, woodworking, plumbing and paint shops, and four delivery trucks. The plant will complete the units at the rate of four a day. For the first plant unit of this size an abandoned shipyard has been purchased at Bridgeport, Conn., and the plant is ready to begin production. It is planned to deliver within a radius of fifty miles of this factory without extra charge, and gradually to establish branch factories in other centers of population.

"Of course," said Mr. Lafferty, in discussing the new type of construction, "no single invention or method will solve the housing problem. It is too big for that. We cannot hope to build more than a small percentage of all the houses that are immediately needed.

"Our chief aim has been to produce a home that anyone could afford to own. I think a good remedy for the present discontent is to encourage the 60 per cent of our citizens who now live in rented homes to own their own dwellings. But even the most modest home should meet certain elementary requirements.

"First of all, the construction must be economical, no matter what it is. That excludes wood for we are using wood four times faster than we are producing it

market in the form—judging from field experiments—of a successful model. Upon a commercial basis, this and other one-way plows will soon make their appearance.

The one-way motor plow has features which recommend it to all farmers whose arable land is divided into comparatively small areas, as in this country, and also to those agriculturists abroad who require to economize the space left at the headlands. One-way plowing, moreover, is a simple procedure which native labor can follow with little preliminary guidance, for there is no demand upon the operator to exhibit skill in turning in a circumscribed area at the end of the furrow and simultaneously to lift the plow out of work. The reasons for the popularity of the one-way system, therefore, are obvious.

The one-way motor plow in the present case consists of six plow breasts, three being suspended from each end of the main carriage, which is modeled on the lines of a tractor body and is driven by an engine sufficiently powerful to haul three furrows in the heaviest clay land. The forward shares are held out of work as the motor plow proceeds across the field and automatically drop into work when the machine begins its return journey. Plowing therefore becomes a succession of forward and return movements. One type of one-way plow has the advantage that it can be used as a tractor to haul another implement or a laden wagon, for the plows can be removed.