THE EDISON CONCRETE HOUSE.*

CONCLUSIONS OF ENGINEERS CONCERNING PRACTICABILITY OF THE PROJECT. THE PURPOSE OF THE INVENTOR.

BY E. S. LARNED, C. E.

Mr. Edison states that his idea of a cheap concrete house is primarily intended for families living in the congested tenement districts of the large cities, who find at present a minimum rental of \$9 per month

The photograph published herewith, Fig. 1, shows the proposed house. It suggests a building more attractive in appearance than usually occupied by families for whom it is intended, and while Mr. Edi-

FIG. 1.—MODEL OF THE PROPOSED TWO FAMILY \$1,200 CONCRETE HOUSE.

for two or three small rooms with poor light, poor air, poor sanitation, accompanied with appalling fire risks and generally unattractive and demoralizing surroundings.

In order that the cost of living should not be enhanced, it is necessary, in taking these families into the suburbs or country districts, to fix the rental sufficiently low so that the difference between the present rates and the proposed rate will cover the cost of trolley transportation to and from the city or place of employment.

Mr. Edison claims that the cost of the proposed house is estimated at \$1,200, including plumbing, heating, and lighting fixtures. The house is intended for two families, and the rental required on a five per cent investment basis would be sufficient under the present conditions to cover more than the expense of transportation of the head of the household.

son recognizes that molds for a less ornate building could be produced for much less money, he holds that the small additional expense, representing not over an annual interest charge of \$40 in the cost of the forms, is more than justified by the improved appearance and the general satisfaction of the occupant and community at large.

It may be suggested, however, that the design seems poorly adapted to concrete construction, owing to the irregularity of outline and amount of detail attempted. This is a matter of judgment and taste, and, of course, could be modified at will.

The proposed size of the building is 21 feet by 49 feet, and 35 feet high, not including the cellar. The walls will be 12 inches thick reducing to 8 inches on the second story, and it is proposed to make the roof 6 inches thick. The floors and all partitions will be uniformly 4 inches thick.

Mr. Edison's idea is to construct these buildings upon sandy or gravelly areas, furnishing material for

the concrete from the necessary excavations. The purpose of this, of course, is obvious in reduction of first cost, provided suitable materials can be found within the limits of the necessary excavation, but this limitation, if imposed, would seriously restrict the development of this class of buildings, for the reason that few areas adapted to cheap construction will be found furnishing satisfactory material for concrete, or material in sufficient quantity for construction within the limits of the cellar excavation.

The necessity of having good sand and good gravel at once suggests the difficulties experienced in most communities to obtain these materials of suitable quality, and it is fair to presume that in the majority of instances the sand and gravel or crushed stone would have to be brought to the work from sources as near by as possible.

The molds will consist of cast iron plates, but as yet the detail of dimensions has not been definitely fixed. The exterior plates for the wall forms will probably be from $\frac{3}{4}$ inch to $\frac{7}{8}$ inch in thickness; the interior plates $\frac{1}{2}$ inch in thickness; the underside of the floor molds and roof molds probably from $\frac{3}{4}$ inch to $\frac{7}{8}$ inch thick, while the upper side will probably be $\frac{1}{2}$ inch thick. The molds for interior partitions will probably be $\frac{1}{2}$ -inch plates. All mold plates are to have milled edges and faces with flanged joints drilled for dowel pin and bolt connections.

The inside faces of the mold plates will be nickel-plated or faced with brass where intricate tracery and detail is attempted in the finish.

It is expected that two houses per month can be constructed from one set of forms, and in order to secure a reasonable variety in design it is proposed to have six sets of molds, the approximate cost of the six sets being about \$105,000, but if one set only be provided, the first cost would be \$25,000.

The exterior and interior wall plates are connected and held in relative position by rods in pipe sleeves.

In the use of cast iron for mold plates the probability of occasional breakage in handling must not be overlooked, and the question of time and cost of renewals is of the utmost importance.*

It would naturally be found advantageous to have the plates of as large surface area as possible, but this is limited by the use of cast iron, of the thickness proposed, and, again, the larger the sizes the greater the danger of breakage.

Mr. Edison proposes to erect and take down the forms by means of four small electrically-driven derricks, and expects that it will take two days for erection and two days for removal.

Mr. Edison's preliminary estimate of the approximate weight of the molds for one house is 280,000 pounds; the writer's estimate amounts to something over 450,000 pounds. In either case, the question of transportation of these molds by railroad or team is not only an item of considerable expense, but sug-

* Mr. Edison states that this has been allowed for at four per cent depreciation.

FIG. 2.—EXPERIMENTS TO DETERMINE THE FLOW OF CONCRETE IN WOOD FORMS 4 INCHES SQUARE IN CROSS SECTION.

FIG. 3.—THE RESULT OF THE LAST TEST MADE BY THOMAS A. EDISON TO DETERMINE THE FLOW OF CONCRETE IN THE FORMS FOR HIS PROPOSED CONCRETE HOUSE.

A comparison of Figs. 2 and 3 will show that the test of Fig. 3 was much more severe than the previous one. It will be noted that the concrete in the upper right hand corner of the casting in Fig. 3 is imperfect. The reason for this was that shortly after the concrete had been poured, the plug at this point was pulled, with the result that part of the concrete ran out before the plug could be replaced. Except for this accident, the casting is practically perfect. A number of plugs were inserted at various points in the form as shown in Fig. 3. The arrows indicate the direction of the flow of the concrete from the hopper into which it was poured.

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gests also the possible necessity of protecting some of the more intricate and decorative molds by crating, in order to avoid breakage, which, of course, would add materially to the expense.*

The reinforcement proposed for the floors and roof, and elsewhere where needed, will consist of $\frac{1}{2}$ -inch and $\frac{3}{4}$ -inch rods. It is not yet definitely determined whether they will be round rods or some system of deformed bars. It is proposed to place all of the reinforcement in position in advance of the concrete operations, and the rods will be held in their relative positions by wiring or spacers.

Pipes for gas, water and all plumbing, also ducts for electrical wiring, are set in position in the form in advance of concreting, and the flues for chimneys are formed by thin metal forms which are left in position.†

It is proposed to have a 100-horse-power boiler and engine on trucks furnishing the power to drive motors connected with the four small derricks, concrete mixers, and elevator plant, which will also furnish any other power required.

It is also proposed to install three or four large mechanical mixers on the ground adjacent to the building, these mixers so arranged as to discharge into a storage hopper, from which the concrete is conveyed by bucket elevator to the distributing hopper at the top of the building, from which the material flows through pipes into the molds. A specific gravity device is to be attached to the storage hopper, and the consistency of the mix carefully watched and kept uniform.

It is also proposed to use plungers, power driven, operating from the top in the molds as the concrete rises, to keep the same agitated, and prevent the segregation of materials, serving also to expel the confined air, and secure a perfectly uniform face, and also assist in forcing the flow of the material into and throughout the horizontal passages.

Mr. Edison claims that in his experiments he finds that concrete of the proposed consistency and composition expands in setting a very small fraction of an inch in the greatest diameter of the proposed house, and he believes that subsequent contraction and expansion in the walls can safely be neglected in the reinforcement introduced.

Mr. Edison proposes to use a mixture of 1 cement, 3 fine sand, and 5 stone or gravel, passing the $\frac{1}{2}$ -inch mesh sieve. He realizes that the serious problem involved is to prevent segregation of materials while being deposited and distributed, and claims to have solved this difficulty by the addition of colloids or some electrolyte in small quantity, which adds to the viscosity of the combined material, facilitates the uniform flow and prevents segregation. Mr. Edison also suggests that colors may be added to the mixture, if desired, but claims that he is experimenting with specially prepared paint for exterior application, and is seeking with some promise of success, a paint that will penetrate and mechanically combine with the concrete. This treatment, however, is expected to be a considerable item of expense, using a preparation of bismuth or cobalt, and experiments are now being made in the use of barium. The use of colors or the cost of painting with such preparation as Mr. Edison may develop has been omitted in his preliminary estimate of \$1,200.‡

This preliminary step is attended with only one detail of special interest, and that is in the exact leveling of the top of the 12-inch monolithic cellar walls to receive the wall molds.

At the West Orange laboratories a few experiments have been made to determine the flow of concrete, and the illustration herein reproduced, Fig. 2, indicates the method pursued.

The first experiment represented by the two figures in the center of the picture consists of 4-inch board molds, set vertically with two horizontal connecting ribs of the same size. The concrete in each case was poured into the top of the vertical member and flowed by gravity alone into the horizontal molds and up the opposite vertical molds, apparently filling the same perfectly, and without any appearance on the exterior of the segregation of materials.

The last and most important test consisted of two upright members 10 feet in height, each 4 inches in cross section, connected at the base by a horizontal form of the same dimensions.

As one looks at the picture, the concrete was poured into the hopper of the left-hand vertical mold by means of buckets intermittently emptied. The forms were not jarred during the flow of the material, and

as indicated in the right-hand vertical form, the concrete succeeded in rising 54 inches above the base.

At the time of the writer's visit to the laboratory, the forms were still on this last section of concrete poured, and it was impossible to judge of the uniformity of the concrete formed. An examination of the photograph suggests at least a very smooth face on the side of the concrete exposed, and reveals an additional fact of much interest, and that is the apparent settlement of the concrete in the right-hand vertical arm of about 4 inches in a height of 54 inches.

Possibly this was occasioned by leaky molds, which, however, did not appear to be the case, when they were first examined, but if such settlement occurs in building operations conducted in the manner proposed, it is likely to offer serious difficulties.*

It was explained that in this experiment it was impossible to obtain concrete of as uniform consistency and composition as will be obtained in the actual work of construction.

It may be granted without question that a system of iron molds accurately fitted and duly marked for quick assembling is entirely feasible. Mr. Edison's estimate of the weight, 280,000 pounds, is not borne out by a reasonably careful estimate, assuming from Mr. Edison's own statements that the exterior wall plates would be $\frac{3}{4}$ -inch cast iron, the interior wall plates $\frac{1}{2}$ -inch, plates for the under side of floors and roof $\frac{3}{4}$ -inch, with $\frac{1}{2}$ -inch plates for the upper side, and $\frac{1}{2}$ -inch plates for all partition walls.

We find approximately 20,000 square feet of wall and floor area above the foundations, weighing approximately 450,000 pounds, without taking into account the flanges, bolts, and pins.

If \$25,000 be a fair estimate of the cost of molds weighing 280,000 pounds, it would appear by simple proportion that molds weighing 450,000 pounds would cost about \$40,000. This is on the basis of 9 cents per pound, which must include planing the faces and edges of each mold plate, drilling of flanges for pin connections, and drilling of plates for bolt connections, and nickel-plating on the side next the concrete. It will be noted in the above estimate of weight that no allowance whatever has been made for the cellar wall molds. In the detailed estimate to follow, however, we will assume that \$25,000 is the cost of forms.†

For purposes of illustration, let us assume that the molds and plant are delivered to the town f. o. b.‡ cars, and have only to be hauled to the site of the building. The cellar has been previously excavated, and is ready for concrete operations.

It is proposed to erect the molds by means of four small derricks, one at each corner of the building, and it is apparent that some assortment must be made as the molds are delivered from the cars, in order to put the plates under the derrick which will place the same in correct position.

Mr. Edison allows two days for the erection of the forms, including the placing of all reinforcement, the introduction of pipes or ducts for the same and flue forms, and it would certainly seem as if this time would be well occupied.

It is apparent, of course, that without a second set of molds for use in building immediately adjacent, the power and mixing plant must remain idle during the hardening of the cement, and the force of trained men which must be required for this operation also remains idle, or practically so.

It will probably take as long to remove the forms as to erect them, the chief difficulty being found in the plates on the inside of the building, which, of course, cannot be handled by the derricks and must be taken down by hand.

Without an actual demonstration, it is useless to state that the work cannot be done in the time named; for this reason an expression of opinion is reserved.

If, as estimated, two buildings per month can be constructed from one set of molds, it is apparent that for the greatest economy the molds should be used to their fullest capacity. This at once suggests the time necessarily lost by stormy weather, and in our northern latitudes, the disadvantage and expense of

* Since the above was written another experiment has been made and it is stated that every part is perfect.

† Mr. Edison states that his draftsmen made an error, but regarding the castings he can get them for 2.7 cents per pound and with planing at 4.80 cents per pound.

‡ On this point Mr. Edison repeats that his plan does not provide for isolated houses.

On the subject of molds Mr. Larned writes as follows: "I note in my statement of the size of the building that Mr. Edison gives the height as 35 feet not including the cellar, whereas I supposed it did include the cellar. With this correction it becomes necessary to revise the estimate of the weight of the molds and I find on a recomputation that instead of 450,000 pounds, they will weigh 530,000 pounds. This, of course, affects not only the cost of the molds but the cost of erection, removal and transportation, adding for railroad shipment four additional cars."

"I also desire to call attention to the fact that I have made no comment upon the fact that Mr. Edison apparently makes no provision for outside or inside staging to assist and facilitate the erection of the molds. In my judgment they cannot be erected without the use of staging and this introduces another element of cost which has been entirely omitted in my figures."

attempting work of this nature during the months of December, January, and February.

I give below a detailed estimate of the probable minimum cost of the proposed cement house. It will be observed that in the allowance for interest and depreciation, I have assumed that 24 houses could be built from one set of molds per annum, and have made no allowance for general expenses or contingencies. The fixed expense for labor and organization has also been neglected during the time between the pouring of the concrete and the removal of the molds.

Estimated Minimum Cost of House.

Cellar excavation, 250 cubic yards at 30c.....	\$75.00
Concrete, 200 cubic yards, 1-3-5 mixture—	
Cement—206 barrels at \$1.50 (net).....	309.00
Sand—94 cubic yards at \$0.65.....	61.00
Stone—156 cubic yards at \$1.50.....	234.00
Cost of mixing and placing same at 50c.....	100.00
Steel reinforcement, 10,000 pounds at 3c.....	300.00
Forms, erection and taking down, approximately 20,000 square feet, 225 tons at \$2..	450.00
Transportation (short haul by team) of molds and plant including installation of latter.	125.00
Plumbing and heating (reported bid).....	175.00
Windows, doors, and wood trim including paint	250.00
Fixtures	50.00

Total cost, labor and material.....\$2,129.00
Molds and plant estimated cost \$40,000 (Edison).

Allow 20 per cent interest and depreciation divided among 24 houses..... 333.00

Total cost

N. B.—No allowance made for general expense or contingencies.

It is at once apparent that the construction of a single house by the method proposed would be prohibitive in cost, unless the houses upon completion so commend themselves by reason of their fireproof qualities, low cost of maintenance, and practical indestructibility, that they would be in demand rather than cheaper forms of construction.

In this connection, it is of interest to note the extent of the equipment for railroad transportation. The molds weighing 450,000 pounds would require 10 cars of 22½ tons capacity each, the derricks, boiler and engine, and mixing plant would require at least 4 cars more, making a train of 14 cars, which if transported at a fair average rate of \$2 per ton would amount to \$600.*

The whole idea of Mr. Edison's proposition is based upon the flow of liquids. Concrete, of whatever composition, can at least only be called a semi-liquid, and if the medium be sufficiently fluid to insure its flow under gravity alone, it would be, under natural conditions, impossible to maintain the aggregates in equilibrium or suspension.

This condition is also materially affected by the size of the aggregates used, and the rate of flow is likewise affected by the same elements.

There would seem to be no particular difficulty in filling the vertical molds with reasonable certainty by pouring the concrete from the top of the building, but the flow of this material through the horizontal floor forms, impeded by the necessary reinforcement, held in position by wiring or spacers, with occasional splices, and perhaps crossings, is the doubtful problem, and unless segregation of materials be prevented, and the horizontal molds completely filled before the initial set of the cement, it would be natural to expect irregular and incomplete results.

Mr. Edison proposes to facilitate the flow of the material and assist in the prevention of segregation by the introduction of a colloid, which may be clay in a very fine state of division, an electrolyte, or possibly hydrated silica, any one of which will serve to reduce the mixture to a more or less gelatinous condition, and by the viscosity attained hold the aggregates in equilibrium or suspension.

In the opinion of the writer, the introduction of a colloid may assist somewhat while the material is in motion, but when it comes to a rest, as when the molds are completely filled, it will not prevent segregation.†

The addition of a colloid would also, in the opinion of the writer, retard the hardening of the cement to an extent to seriously delay removal of the forms.‡

It is entirely unlikely that in such a mixture a concrete of 1-3-5 proportions in flat slab construction would be even self-supporting at the end of six days. This is further emphasized by reason of the necessity of using very fine sand, which of itself retards the hardening of cement, particularly in so lean a proportion as 1 to 3.

* Concerning the table of costs Mr. Edison states that actual construction will show how accurate are the figures given. As to the cost of transportation, etc., he says: "Suppose several hundred houses were erected at this spot, what becomes of the criticism on cost of transportation?"

† This conclusion Mr. Edison insists is wrong.

‡ Mr. Edison takes exception to this statement, adding that there is variety in colloids.

* Mr. Edison calls attention to the fact that houses are to be erected in rows and in large numbers at particular localities. Isolated work is no part of the scheme, hence transportation is a small item per house.

† Mr. Edison states that he has decided to put the pipes outside of the walls in most cases like hotel and sanitary plumbing.

‡ While Mr. Edison has no satisfactory colors at present he is convinced that this expense will be trifling. He adds that he has estimated for staining walls and for red tiling color for roof. Subsequent experiments were to get a variety of color.

The addition of a colloid is also expected to render the concrete impermeable and make unnecessary any other waterproof treatment. Mr. Edison also believes that because of the low conductivity of concrete, no difficulty will be experienced from condensation of the inside of the walls, and it is proposed to leave the inside surfaces produced by the mold plates without further treatment, unless tinting be desired for purposes of decoration. It is also interesting to note that no joint will be provided to take up contraction and expansion.

The use of plungers, power driven, to keep the concrete agitated and assist in its flow, is a very novel feature, and results will be observed with much interest. It would seem that plungers large enough to be effective would subject the molds to considerable

strain, and if the effect is violent enough to cause quick or unusual motion in the concrete, it suggests the possibility of the displacement of reinforcement, unless the same be very rigidly fixed in position.*

In connection with the proposition to raise the concrete to the top of the building, by means of a bucket elevator, a computation reveals the following interesting facts, viz., if the buckets be of $\frac{1}{2}$ cubic foot capacity each, they must discharge at the rate of 18 buckets per minute to handle 200 cubic yards in ten hours. If of $\frac{3}{4}$ cubic foot capacity each, they must discharge at the rate of 36 buckets per minute. In either case, this means a belt or chain speed of from

* On this point Mr. Edison states that the area of agitation cannot extend more than three feet.

$\frac{1}{3}$ to $\frac{1}{2}$ more in each case, and the loading of the buckets by continuous discharge from the hopper suggests the possible waste of some material and the fouling of the chain or belts to an extent that would probably cause some trouble. It would be impractical to load the buckets full of such fluid material owing to waste.*

Mr. Edison has, undoubtedly, taken a bold step in the right direction, and the new ideas that are set in motion by his experiments will doubtless evolve a scheme by which the cost of the forms will be materially reduced, and the time required for construction greatly shortened.

* This Mr. Edison answers with the statement that the buckets can overflow. The elevator has a back to permit spills to flow back to the reservoir.

WHAT FORESTRY HAS DONE.

THE NEED OF THE PRESERVATION OF OUR TIMBER SUPPLY.

MANY people in this country think that forestry had never been tried until the government began to practise it upon the national forests. Yet forestry is practised by every civilized country in the world except China and Turkey. It gets results which can be got in no other way, and which are necessary to the general welfare.

What forestry has done abroad is the strongest proof of what it can accomplish here. The remarkable success of forest management in the civilized countries of Europe and Asia is the most forcible argument which can be brought in support of wise forest use in the United States.

The more advanced and progressive countries arrive first and go farthest in forestry, as they do in other things. Indeed, we might almost take forestry as a yardstick with which to measure the height of a civilization. On the one hand, the nations which follow forestry most widely and systematically would be found to be the most enlightened nations. On the other hand, when we applied our yardstick to such countries as are without forestry, we could say with a good deal of assurance, by this test alone, "Here is a backward nation."

The countries of Europe and Asia, taken together, have passed through all the stages of forest history and applied all the known principles of forestry. They are rich in forest experience. The lessons of forestry were brought home to them by hard knocks. Their forest systems were built up gradually as the result of hardship. They did not first spin fine theories and then apply those theories by main force. On the contrary, they began by facing disagreeable facts. Every step of the way toward wise forest use, the world over, has been made at the sharp spur of want, suffering, or loss. As a result, the science of forestry is one of the most practical and most directly useful of all the sciences. It is a serious work, undertaken as a measure of relief, and continued as a safeguard against future calamity.

The United States, then, in attacking the problem of how best to use its great forest resources, is not in the position of a pioneer in the field. It has the experience of all other countries to go upon. There is no need for years of experiment with untried theories. The forest principles which hundreds of years of actual practice have proved right are at its command. The only question is, How should these be modified or extended to best meet American conditions? In the management of the national forests the government is not working in the dark. Nor is it slavishly copying European countries. It is putting into practice, in America, and for Americans, principles tried and found correct, which will insure to all the people alike the fullest and best use of all forest resources.

Take the case of Germany. Starting with forests which were in as bad shape as many of our own which have been recklessly cut over, it raised the average yield of wood per acre from 20 cubic feet in 1830 to 65 cubic feet in 1904. During the same period of time it trebled the proportion of saw timber got from the average cut, which means, in other words, that through the practice of forestry the timberlands of Germany are of three times better quality to-day than when no system was used. And in fifty-four years it increased the money returns from an average acre of forest sevenfold.

In France forestry has decreased the danger from floods, which threaten to destroy vast areas of fertile farms, and in doing so has added many millions of dollars to the national wealth in new forests. It has removed the danger from sand dunes and in their place has created a property worth many millions of dollars. Applied to the state forests, which are small in comparison with the national forests of this country, it causes them to yield each year a net revenue of more

than \$4,700,000, though the sum spent on each acre for management is over 100 times greater than that spent on the forests of the United States.

France and Germany together have a population of 100,000,000, in round numbers, against our probable 85,000,000, and state forests of 14,500,000 acres against our 160,000,000 acres of national forests; but France and Germany spend on their forests \$11,000,000 a year and get from them in net returns \$30,000,000 a year, while the United States spent on the national forests last year \$1,400,000 and secured a net return of less than \$130,000.

In Switzerland, where every foot of agricultural land is of the greatest value, forestry has made it possible for the people to farm all land fit for crops, and so has assisted the country to support a larger population, and one that is more prosperous, than would be the case if the valleys were subjected to destructive floods. In a country as small as Switzerland, and one which contains so many high and rugged mountains, this is a service the benefits of which cannot be measured in dollars. It is in Switzerland also, in the Sihlwald, that forestry demonstrates beyond contradiction how

certainly secure what wood she needs in the future.

Fourth, when the forest countries are compared as to wood imports and exports, and when it is realized that a number of the countries which practise forestry are even now on the wood-importing list, the need of forestry in the export countries is doubly enforced.

Russia, Sweden, Austria-Hungary, and Canada, for instance, are making good the wood deficit of a large part of the world. Sweden cuts much more wood (106,000,000 cubic feet) than she produces; Russia, in spite of her enormous forest resources, has probably entered the same road; and England, the leading importer of wood, must count more and more on Canada. But the United States consumes every year from three to four times the wood which its forests produce, and in due time will doubtless take all the wood that Canada can spare. In other words, unless the countries of the western hemisphere apply forestry promptly and thoroughly, they will one day assuredly be held responsible for a world-wide timber famine.

Fifth, in comparison with foreign countries, the prospects for forestry in the United States are particularly bright, for the following reasons:

1. We start with the assurance that success can certainly be attained.
2. We have few of the handicaps which have trammelled other countries. We have no ancient forest rights and usages with which to contend, or troublesome property questions to settle.
3. The results which other lands have achieved by long struggle, often with bitter costs, are free to us to use as we wish. We have, it is true, our purely national and local forest questions, but the key to many of them is somewhere in the keeping of the countries which have achieved forestry.
4. In variety combined with value our forests are without a parallel in the world. They produce timber adapted to the greatest variety of uses, so that, except to meet shortage, importations of wood are unnecessary. Furthermore, transportation facilities enable us to make every forest region available. Thus, by specializing our forest management, each kind of forest may be made to yield the kind of material for which it is best adapted, and the wastes due to compulsory use of local supplies may be practically eliminated.

A SIMPLE HOME-MADE STILL.

great a yield in wood and money it may bring about if applied consistently for a number of years.

A circular entitled "What Forestry Has Done," just published by the Forest Service, and obtainable upon application to the Forester, Washington, D. C., reviews the forest work of the leading foreign countries. The chief lessons which may be learned from them are summarized as follows:

What forestry has done in other countries shows, first of all, that forestry pays, and that it pays best where the most money is expended in applying it. The United States is enormously behindhand in its expenditure for the management of the national forests, but nevertheless returns have already increased with increased expenditure for management.

A second lesson, clearly brought home by foreign forestry, is the need of timely action, since forest waste can be repaired only at great cost.

Third, private initiative does not suffice by itself to prevent wasteful forest use. England, it is true, has so far consistently followed a let-alone policy. However, England has been depending upon foreign supplies of wood. Now that all Europe is running behind every year in the production of wood (2,620,000 tons), and there are unmistakable signs that countries which lead as exporters of wood will have to curtail their wood exports, England is at last feeling her dependence and is speculating uneasily as to where she can

HOME-MADE WATER STILL.

By L. W. MARSHALL.

For producing distilled water in small quantities, I have designed a still which consists of a tin percolator, 1, a coil of pipe, 2, and a tea kettle, 3, or other suitable vessel. The percolator has a hole cut near the top to which a tin tube, 4, is soldered, in order that the water from the ice may pass off.

To use this still, fill the percolator with cracked ice and attach the upper end of the pipe to the spout of the kettle in which the water is to be boiled. The lower end of the pipe should fit the neck of the percolator tight, so that the water from the melting ice cannot contaminate the distilled water in the receptacle underneath.—Druggists' Circular.

A patent has been taken out for a process of manufacturing calcium carbide, according to which the molten substance when tapped from the furnace is poured into molds coated internally with finely-powdered coke, wood charcoal, or lampblack. The idea of the invention is that the semi-fluid carbide shall react with the carbon, the excess of lime present in the substance as it leaves the furnace being thereby decomposed and a corresponding quantity of fresh carbide being formed. It is stated that under the conditions mentioned the reaction proceeds so violently that the liberation of the oxygen causes the carbide to effervesce or boil.