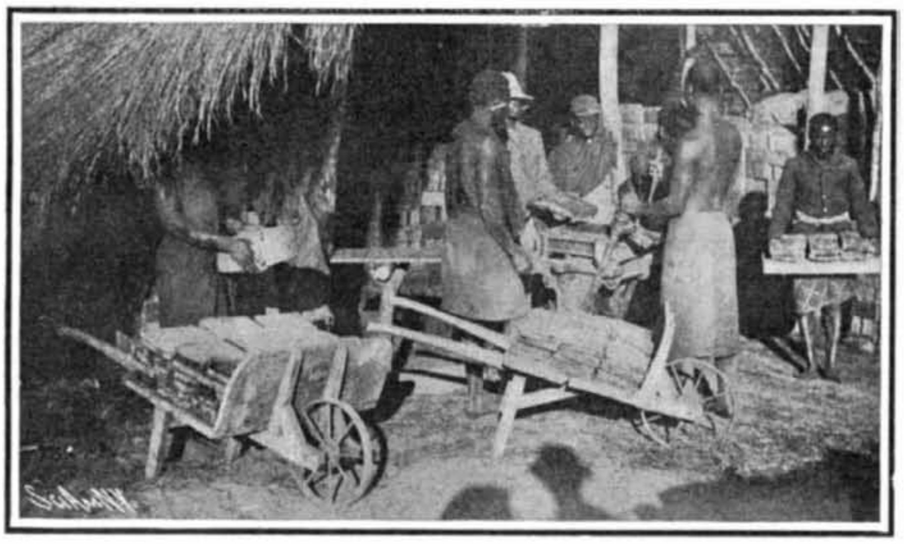
## BRICK AND TILE MAKING IN THE TROPICS.

BY C. C. FULLER.

Many readers of the Scientific American are familiar with the primitive "adobe," or sun-dried, bricks and the process of making them. Such bricks are extensively used to-day in many countries where the climate is dry and heavy rains are almost unknown.



An Immense Shed of Thatched Grass Protected the Bricks.

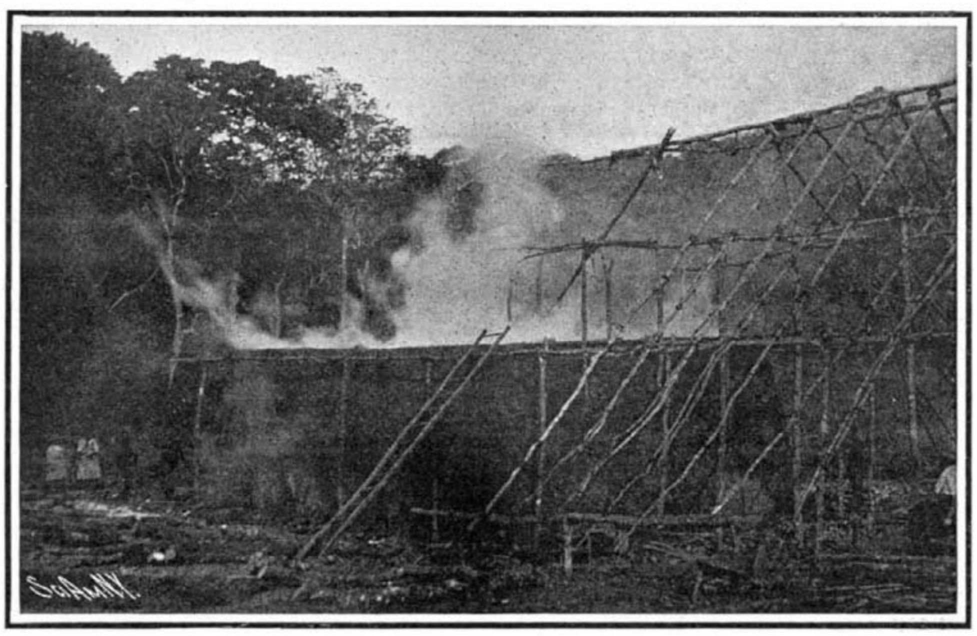
The Pug Mill Stood Between the Pits.

In the tropics, however, the annual rainy season makes their use impracticable except in very small buildings, where they can be entirely protected by wide verandas.

The brickmaker in the out-of-the-way districts, under the conditions in Rhodesia and most tropical countries, is confronted by a serious problem, into which a number of elements enter, such as the enormous cost of installing modern machinery, the lack of skilled labor, occasional torrents of rain even in the dry season, and, in many places, the poor materials available.

Throughout South Africa, outside of the modern cities, a kind of hand-made "slop" brick has been used for many years by both Dutch and English colonists, and many fairly substantial buildings are built of them. But with the introduction of modern machinery and methods into the cities, there has grown a demand for better bricks in the back-country districts, especially from those accustomed to the advanced methods in the United States, and here and there small machines have been installed.

It is only eleven years since the American Gazaland Mission was established at Mount Silinda in the mountains of southern Rhodesia, about 200 miles inland from Beira on the east coast and 150 miles south of Umtali on the Beira and Mashonaland Railway, which connects at Salisbury with the Cape to Cairo Railway. The isolated position, and consequent great expense of transporting supplies, made it necessary to use materials on the ground in the construction of the mission buildings, and common "slop" brick were used in all the older ones. Necessity, the mother of invention, led to the manufacture of flat shingle tiles, made entirely by hand, which are fairly satisfactory for roofing purposes, but very easily broken in comparison with the pressed tiles used in Europe and America.



After They Were Dried the Bricks Were Placed in the Kiln.

Three years ago the writer was sent out by the American Board of Commissioners for Foreign Missions to establish here an industrial department, something after the pattern of the well-known institution at Lovedale, Cape Colony, or our famous American school at Tuskegee, Ala. Early in 1904 preparations were begun for making bricks and tiles for the first workshop, and as the building was larger than any of the earlier ones, and must carry some heavy machinery, it was necessary to make a better brick than previously had been used. A small pug mill of English manufacture had been for some time the property of the mission, and among the industrial equipment was a hand brick repress made in Cleveland, Ohio.

We are fortunate in having fine clay for both brick and tiles, but the deposits are some distance from the mission station, which necessitates hauling either clay or the finished product about two miles. Both methods had been used, but we decided to make the brick at the pit, and so dug a ditch more than 3,000 feet long through the dense forest and jungle, to bring water from the near-by stream to the molding tables.

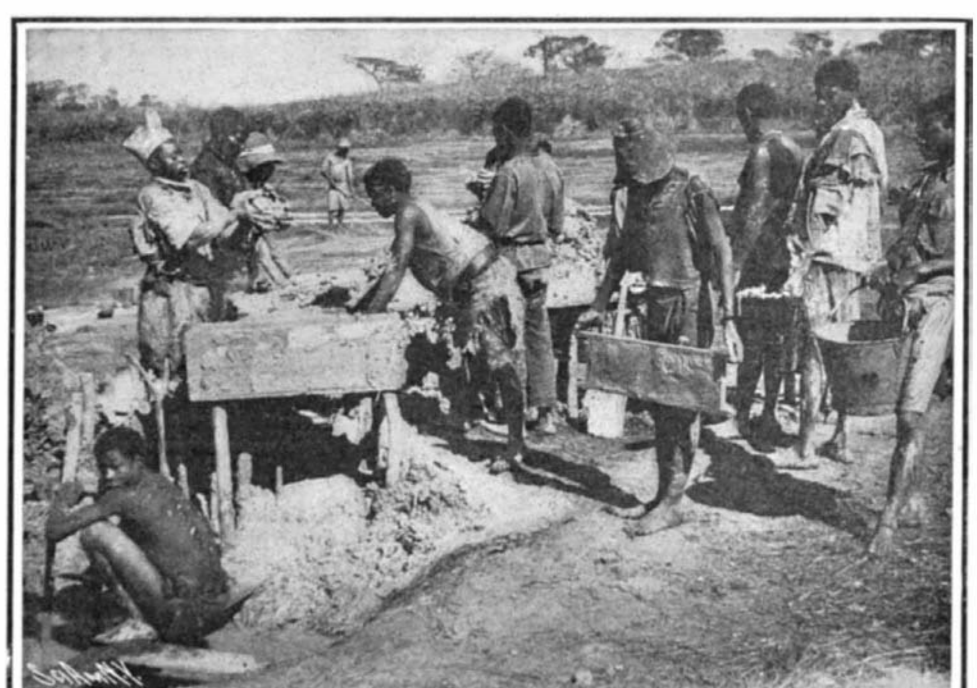
In April and May, before the close of the rains, we cleared the rank growth of grass, weeds, and vines from the field, and built an immense shed of poles thatched with grass, to protect the bricks after they were dry enough to put into the kiln. Test holes were sunk, the little pug mill set up, and everything made ready for beginning work at the end of the rains. Early in June active operations were begun. Two pits were opened, using the clay from them alternately, as in this way it could be dug up during the day and the pit filled with water from the ditch; then, by the following day, the clay was well soaked for pugging.

The pug mill stood between the pits, and the clay was carried to it in ordinary hods, the first ever seen in this part of Africa. Under usual conditions a horse or mule would operate the mill, but here neither was available, as this climate generally proves fatal to either within a few months. Donkeys were to be had, but we found them too slow, so used two to four "boys" instead, changing them frequently and experiencing little trouble. Of course, they grumbled at our making *izimbongolo* (donkeys) of them, but really they had about the easiest work on the field.

The difference between American and English machines is well illustrated by this pug mill, which simply pugs the clay and discharges it unmolded, while the corresponding American machine would force it out in form to be cut into bricks by a wire or knife.

After coming from the pug mill the clay was tramped by the bare feet of a boy or two, and then taken to the molding tables. The usual way is to temper the clay by turning a lot of cattle into the

The Traction Engine in the Jungle.



Scene at the Molding Tables.

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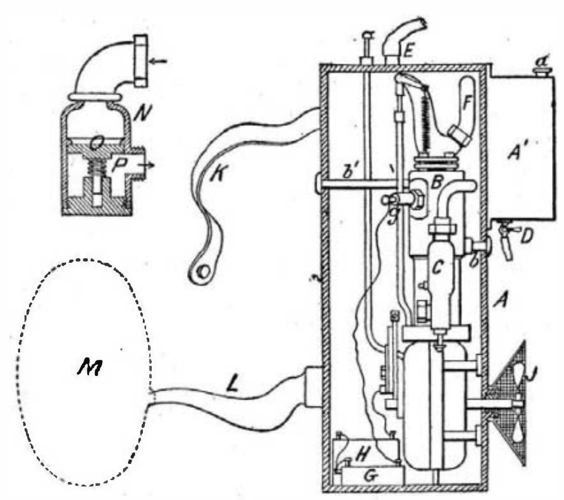
pit, and driving them around until it is well mixed. At the tables the molders press the clay by hand into the wooden forms, two or three bricks to the form, using water liberally. Boys carry the forms to the field, which is dug up into long parallel rows, smoothed off very carefully on top, and just wide enough for the bricks in one form. It is quite a trick to shake the soft clay free from the form without spoiling the bricks. In fact, they are usually rough and irregular. Here is the great difficulty in the South African "slop" brick, and just here our




**Details of the Motor.**

little repress made a vast improvement possible. In the usual practice the wet bricks are covered with grass and allowed to dry slowly, until beyond danger of cracking in the sun. Then they are dried as fast as possible, and when a few thousand are ready they are put into a kiln and burned.

We allowed them to dry under cover for five or six days, then we repressed them and stacked them loosely in piles to finish drying. Two molders averaged nearly 4,000 brick daily, and by putting four of the best men on the repress, we were able to take care of them. One man with wheelbarrows wheeled the bricks from the field to the machine, and two carried them away to dry, making seven men engaged in repressing. The record run for both molding and repressing was approximately 5,000 in a day of little more than nine hours.

This is commonly supposed to be a land of cheap labor, and the cost of manufacturing may be of interest. The molders were paid $10 per month, the best men on the repress $6.25, ordinary laborers $4.25, and boys $1 to $3 per month without food. About thirty men were employed, and the bricks cost approximately $4 per 1,000 when burned, not taking into consideration the loss in burning.

Repressing costs nearly 30 cents per 1,000, and easily doubles the value. Our brick are the wonder of all the district, and others say they will try to duplicate them.

The manufacture of tiles is very similar, but far more difficult and not so satisfactory. The clay was put through the mill three times, well tramped by boys, then worked thoroughly by hand, and molded into thin cakes 1 inch x 7½ inches x 12 inches. These must be kept very carefully covered, and repressed at just the right stage, in order to make perfect tiles. It required two extra heavy men on the lever of the repress to secure sufficient pressure, and 800 per day was about the limit. After repressing, the tiles are again covered with grass till they are quite dry. The cost in the kiln was about $10 per 1,000, but later losses brought the final cost up to nearly $20 per 1,000, and even at that price they were only about half the cost of iron roofing delivered here.

About 90,000 bricks and 16,000 tiles went into the kiln which was much larger than any before attempted in this district, and for this reason was not sufficiently burned. The consequent loss of bricks was small, but the loss of tiles was about 45 per cent, notwithstanding 6,000 were successfully reburned in the face of the assertion by old brickmakers that it could not be done.

The breakdowns and repairs were what might be expected in any country 150 miles from a repair shop, and need not be recounted here. It is hoped that tiles may be made much more successfully this season, as we have made some improvements in the dies. Possibly other readers of the Scientific American working under similar conditions may find in these experiences some suggestions of value.

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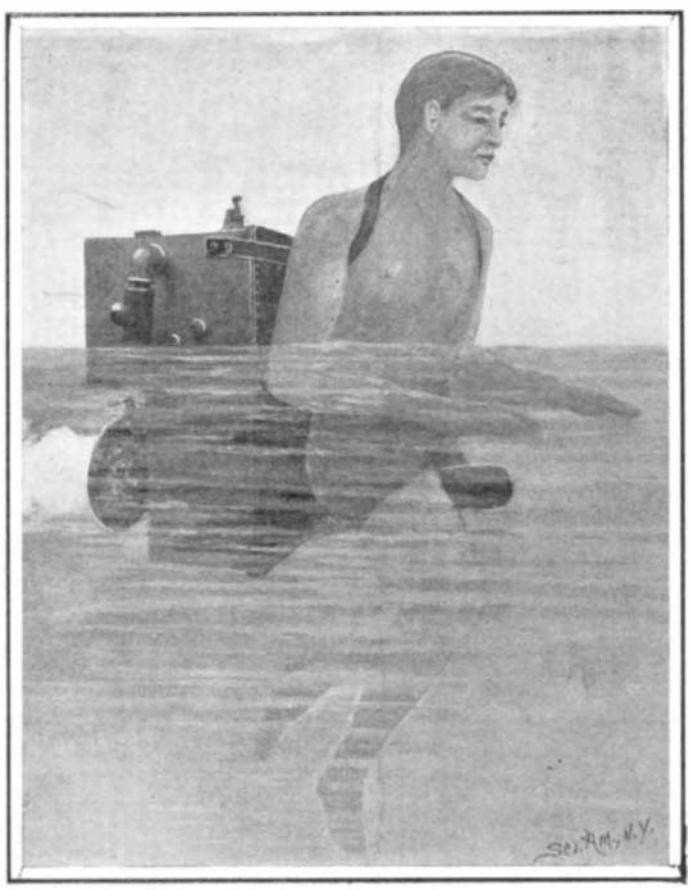
The world's production of Portland cement has increased from 2,500,000 tons to some 11,000,000 tons in the last twenty years, and the center of the industry has shifted from Europe to the United States.

## THE SCREW-PROPELLED SWIMMER.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

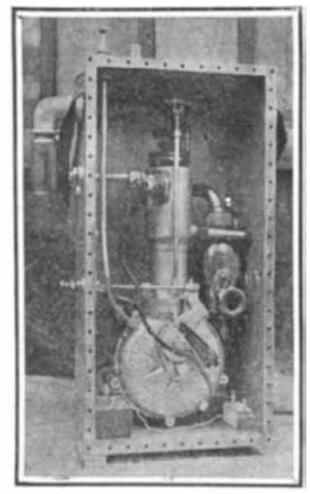
M. Constantini, of Paris, after having been successful in adapting a gasoline motor to a roller skate, which we illustrated not long ago, now brings out another use of the motor in the form of a life-saving apparatus or automatic swimming device which can be used for sport as well. Bathers, for instance, can take exercise with the apparatus along the coast. Such an apparatus must be as light as possible, and precautions must be taken so that the motor will work under water in all conditions. A good distance can be covered, even by a novice, which distance is only limited by the size of the fuel tank.

We show three pictures of the life-saving apparatus as it is now constructed. In the first view it is in complete shape, with the exception of the air-bags, which serve as floats. The second view shows the inside of the case with the front cover removed, in which we observe the arrangement of the motor, carbureter, and ignition device. The main body or case of the apparatus consists of a light aluminium box about 20 inches high which is adapted to be carried upon the back of the swimmer. It is just large enough to contain the motor and the rest of the apparatus. The propeller, *J*, which is used to drive the device through the water, is mounted on the end of a crankshaft, and the latter is made to project out through a water-tight packing in the side of the case. To protect the propeller from any shocks it might receive, it is surrounded by a conical piece, carrying a wire gauze covering. The crank for starting the motor is fitted in the usual way upon the projecting end of the motor-shaft. At the top of the case is a pipe, *E*, over which is fitted a rubber pipe going to a float bag (which is not seen here), and this bag serves at the same time to supply the air which is required for working the carbureter during the time when the box may be sunk below the surface of the water. This is only for emergencies, however, and in general the carbureter takes the air through a suitable pipe from the outside. A set of valves controls the air supply in these cases. For cooling the motor cylinder, which is jacketed at the upper part, the water comes from the outside and leaves the box again through suitable openings on either side of the case. Gasoline is supplied from an aluminium tank, $A^1$, of square section, which is fitted against the back of the case. Below the gasoline tank is placed the outlet valve, *D*, and the rubber hose on this valve is connected in turn to a pipe upon the box, which leads by a metal pipe to the carbureter. To control the working of the motor, two rods pass



**A WATERPROOF CASING CONTAINING A GASOLINE MOTOR WHICH DRIVES A SCREW IS STRAPPED TO THE SWIMMER'S BACK AND PROPELS HIM THROUGH THE WATER.**

to the outside. One of these works upon the carbureter to regulate the proportion of gas and air for the mixture; the second rod acts upon the ignition shifting. The exhaust of the motor passes to the outside by the pipe, *b*. To it is connected a special form of muffling-box, which is shown in the section. It is provided with a valve, *O*, which is kept pressed up by the spring when the exhaust ceases. This has been designed so as to prevent the water from entering the exhaust pipe when it is submerged below the surface. Attached to each side of the main case is an air-bag of some size which serves as a float. The swimmer is seated upon a projecting saddle formed of a metal plate covered with cork, *L*. The saddle is hinged to the box in order to fold it up when not in use, and at the outer end is attached an air-float which can be of any convenient size. Two straps are fixed to the upper end of the box so as to fasten it upon the swimmer's back. At the lower end the straps are fastened in place by a hook or a button projecting from the box. The storage battery and induction coil, which are not seen here, are stowed in the lower part of the case under the motor. In order to use the life-saving device, the swimmer first starts up the motor by means of the hand crank from the outside, and, after seating himself on the saddle, puts the box upon his back, tying it by means of the straps. After the air-bags have been filled up, he goes into the water. He regulates the speed of the motor by the two rods we mentioned above, which act upon the carbureter and on the ignition. Steering is done by opening the hands more or less, or inclining them at different angles. Upon reaching the shore, he stops the motor by cutting off the gas supply and the ignition.



**The Cover of the Motor Removed.**

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### The Chimera of the Commercial Synthesis of Foods.

BY PROF. TH. BOKORNY.

For some little time certain of the carbohydrates have been included in the list of substances that can be made artificially, in the laboratory. I do not allude to the commercial manufacture of glucose, on an immense scale, from starch, nor even to the possible production of glucose from still another carbohydrate, the cellulose of wood. I refer to certain preparations which are yet little known outside of a small body of specialists; for example: Butlerow's "methylenitan," Loew's "methose," "formose," and "isoformose," and Emil Fischer's "α-acrose," which have been built up by synthesis from much simpler organic compounds. Just as plants, aided by sunlight, construct carbohydrates from atmospheric carbonic acid, or from formaldehyde, methyl alcohol, etc., so chemists have produced sugars or carbohydrates by agitating formaldehyde with excess of hydrate of lime, or by heating it with magnesia.

But the commercial production of these synthetic sugars will long be economically impossible, owing to the competition of the plants and the sun, which work far more cheaply than man. Cane sugar is worth five or six cents a pound at retail. What hope is there for producing it synthetically at such a price? Potato starch costs less than two cents a pound. The synthetic production of carbohydrates at these prices will scarcely be possible until we have found a way of utilizing solar energy as economically as it is utilized by chlorophyl—and we are yet very far from such a consummation.

Only a very bold and rash spirit can dream that the manufacturing chemist will, within any conceivable period of time, supplant the former as a purveyor of food.

A sober review of the actual facts leads to a very different conclusion. Consider, for example, the cost of converting the albumen of meat into somatose—that is to say, into the substances known to the chemist as albumoses or propeptones. Although somatose is only a slightly *simplified* albumen, it costs ten times as much as the very albumen from which it is derived, and a hundred times as much as vegetable albumen. There have recently appeared, even in popular journals, reports of the synthetic production of albuminoids in the laboratory of the eminent chemist Emil Fischer, of Berlin. From the considerations given above, however, it would appear that this synthesis is likely to have as little immediate practical value as is possessed by the earlier synthesis of carbohydrates.

In regard to foods, the task of chemistry will continue to be the study of their chemical constitution and structure, the knowledge of which is of inestimable value in medicine and biology.

The synthetical production of foods is not at present a problem worthy of the attention of serious-minded chemists.—Translated for the Scientific American from Umschau.