

unmixed with briquettes, as commonly practiced in France. As regards economy, the results given by the engine are said to be excellent. There are, it is true, certain details of construction that could be improved, even in the existing engine, as, for example, the square chimney, and the absence of running boards permitting the engine to be got at when under way. There is also, sometimes, an unequal expansion of the tube plate, due to a superior draught in the central series of tubes. A trouble also with engines of abnormally large grate area is the difficulty of obtaining a sufficient draught in the smoke box. The locomotive in question is one of the most unconventional developments of locomotive practice since the time of Stephenson. It was designed with a view of obtaining great steaming power without mounting the boiler dangerously high. Continental and American trains make greater demands on the steam-producing capacity of the boilers than is the case in England; hence these

Cylinders, diameter	19 in.
Stroke.....	23 5 "
Drivers.....	6 ft. 10 1/2 in. diam.
Weight, engine.....	56 8 tons.
" tender.....	29 5 "
Total.....	86 3 "

We are indebted to *Engineering* for our illustration and the foregoing particulars.

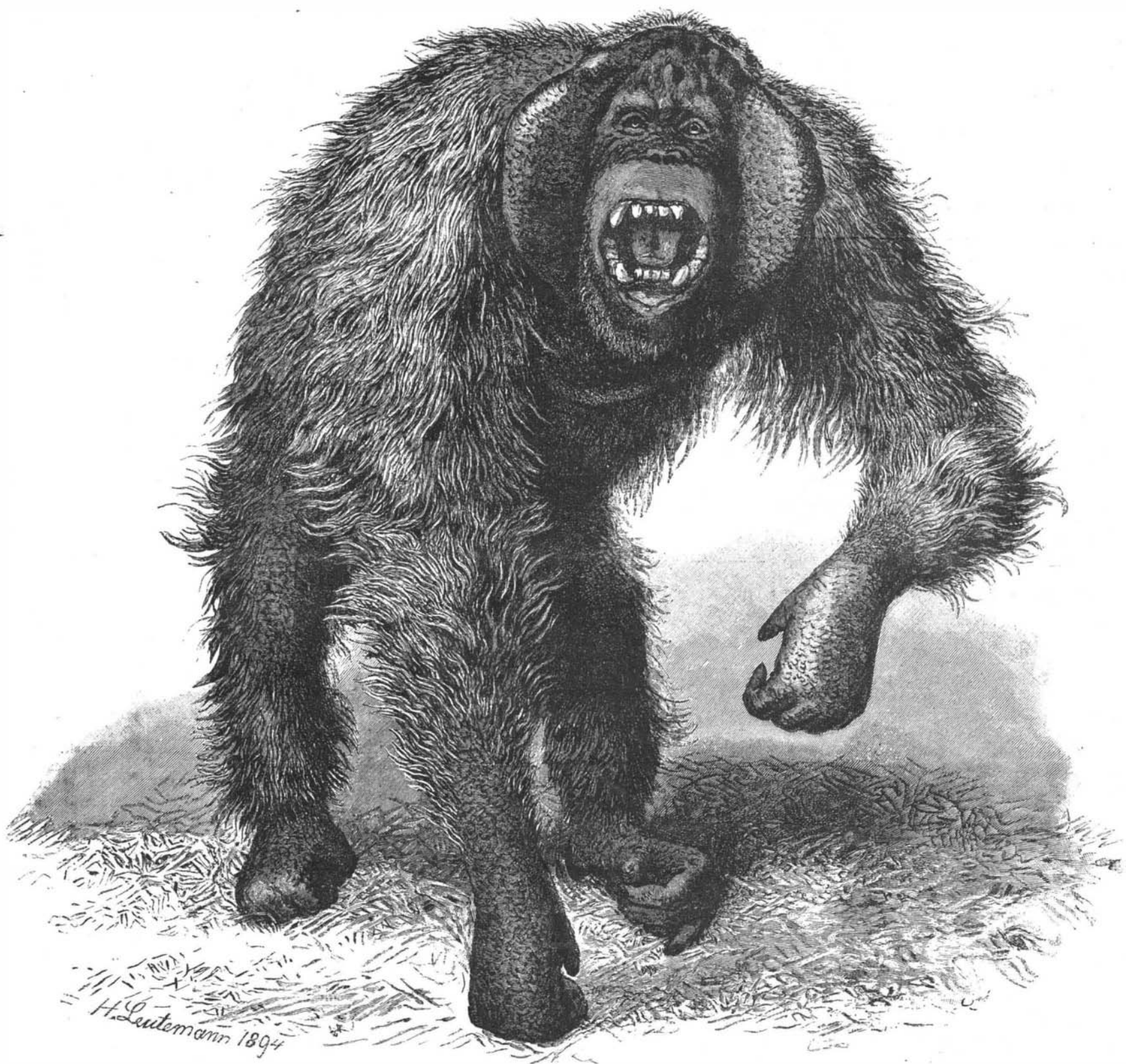
THE ORANG-OUTANG IN THE LEIPSIK ZOOLOGICAL GARDEN.

We publish to-day an engraving (for which we are indebted to the *Illustrirte Zeitung*) of the gigantic orang-outang in the Zoological Garden at Leipsic. This and two others that died last winter from the effects of the severe weather are the only full-grown orang-outangs that have ever reached Europe alive.

Any one who has formed his idea of a full grown ape of this kind from small or partly grown ones will be

and he always keeps his toes turned under, so that he does not stand on the soles of his feet, but on the outer edges. It is impossible for an orang-outang to stand upright or to turn about without supporting himself by means of his arms, nor does he ever walk with a stick, as he is often represented. The number and arrangement of his teeth are the same as those of men, but his teeth are all stronger, and his eye-teeth project like those of a beast of prey. The orang-outang shown in the illustration has lost one of his upper eye-teeth, and his other teeth are much worn. Many scars on his hands and feet show that he has led an eventful life and received honorable wounds. His left thumb is bent and one of his toes is crippled.

Although possessed of such physical strength and so belligerent, the orang-outang is a vegetarian, living on fruits, buds, and young sprouts, but varying his diet by robbing birds' nests and hunting insects. In captivity he eats soaked rice, milk, raw eggs, oranges,



THE NEW ORANG-OUTANG IN THE ZOOLOGICAL GARDEN, LEIPSIK.

multiple boilers of Flaman, the St. Leonard's Company, and others, have been produced.

The principal dimensions of the engine are as follows:

Fire box, width inside.....	9 ft. 3 in.
" " outside.....	9 " 10 "
" length inside.....	5 " 10 "
" " outside.....	6 " 3 "
" height, front.....	3 " 7 "
" " back.....	2 " 9 "
Gmte area.....	56 sq. ft.
Boiler, central.....	4 ft. 3 in. diam.
Boilers, side.....	2 " 3 " "
Tubes, central.....	180
" side series (48 each).....	96
Total.....	276
Tubes, length.....	15 ft.
Working pressure.....	130 lb. per sq. in.
Heating surface, fire box.....	121 6 sq. ft.
" " boilers.....	1931 0 "
Total.....	2052 6 "

surprised when he sees our engraving, for it would be impossible to imagine such a remarkably shaped head with little ears that are entirely covered, such a hideous face with the cheek and throat pouches.

This animal is not as tall as one would suppose from a first glance, for he measures, when standing upright, only a little over 4 feet, but with his long arms stretched upward he measures to the tips of his fingers 6 feet 8 inches. When in this position the disproportions of his body are very noticeable, the thickness of his head, the breadth of the shapeless face, the wonderful development of the powerful chest and the broad back, the thick bull-like neck, but especially the length and strength of the arms compared with the shortness and weakness of the calfless legs. The large and strong, although slender, hands are covered with wrinkled skin that gives him the appearance of wearing kid gloves that are much too large for him. His feet or his hind hands are much longer than his fore hands,

dates, and he is very fond of bananas and white bread.

British Report on the World's Fair.

The British Royal Commission to the World's Fair at Chicago has just issued its report. It is very long and complete, comprising 61 large pages, with 45 sections and appendices, and its tone is decidedly favorable to the Exhibition. It gives an excellent description of the exhibits, and concludes by saying:

"It is impossible for those who did not visit the exhibition to understand the enthusiasm which pervaded it and the genuineness of its character. It would be an easy matter to criticise its shortcomings, but it is undeniable that it was a courageous inception, splendid in execution and successful in its results."

The report also says that Europe did not appreciate the proper value of the Exhibition, European interest seeming to fall back after the opening of the Fair.

Insomnia Produced by Shortening Hours for Sleep.

Adages are not always to be depended upon for good advice. Do not be deterred from taking all the rest necessary for your particular case by the saying "Nine hours are enough for a fool." To take enough sleep betokens wisdom, but "to sleep" does not mean to lie lazily in bed when once you are awake. "Nature takes five, custom seven, laziness nine and wickedness eleven," is wrong in at least two of its assertions. There are very few instances in which nature does not demand more than five hours' sleep. It is true that sleeping, like eating, is very much a matter of habit, and you may train yourself to dispense with more than five hours' sleep, as you may to omit the third meal of the day. How long you will flourish under such a regime will depend upon the strength of your constitution. You may fare like the man's horse, who, when it had been reduced to a diet of one straw a day, in the most ungrateful manner died on his hands.

A person may need nine hours' sleep out of the twenty-four without being either lazy or foolish. Indeed, he is a wise man if, feeling that he requires them, he is sensible enough to take them. Goethe, when performing his great literary feats, took nine hours' sleep. A full grown adult, in a healthy condition, will seldom require more than eight. If, however, he discovers that he is not sufficiently refreshed by eight hours, he should take more. It is a pretty safe rule to sleep as long as you are sleepy. "There are people," says a writer, "who are wise enough to eat when they are hungry, but who have never attained that higher reach of wisdom to sleep when they are sleepy." Unless you are a very lazy person, indeed, you are not likely to take more sleep than your constitution requires, for, of course, dawdling in bed is not sleeping.

By shortening the necessary hours for sleep you may bring upon yourself the dreaded disease, insomnia. There are scientific writers on this subject who claim that the best remedy for this is to learn to sleep in the daytime.

This is very well where from some cause—work, or watching, or pleasure—you may have failed to get your needed sleep for a night or two. There is undoubtedly a great virtue in naps, even short ones, and the art of napping in the daytime, although I could never acquire it, is a desirable one, and, like most arts, is a matter of practice. Still, it is a bad practice to get into the habit of turning night into day; and, if you are not kept awake by care or illness, but merely have lain awake because you could not sleep, I should recommend you to fight the consequent drowsiness of the next day, in order that you may, if possible, resume your natural rest at night. Sleeplessness is generally the result of an unfortunate habit of "thinking," generally on unpleasant subjects, after one has retired for the night. Dr. Frank Hamilton, a great physician and a wise man, said: "Gloomy thoughts prevent sleep. The poor and unfortunate magnify and increase their misfortune by too much thinking. 'Blessed be he who invented sleep,' but thrice blessed be the man who shall invent a cure for thinking."—*New York Recorder*.

Cordite.

During the trial of Nobel v. Anderson, Sir Charles Russell admitted, on the part of the military authorities, that Mr. Hiram S. Maxim was the first man to combine tri-nitro-cellulose, or gun cotton of the highest degree of nitration, with nitro-glycerin to produce an explosive equivalent to gunpowder in the propulsion of bullets from military firearms. Cordite in its present form is a mixture of nitro-glycerin with tri-nitro-cellulose and vaseline, formed in the first place into a jelly by means of a solvent known as acetone, and spun into cords or wires—the solvent being evaporated out. Gun cotton of the highest degree of nitration will not combine directly with nitro-glycerin, but the two substances can be readily combined by the use of a suitable solvent, such as acetone. Mr. Maxim was the first to experiment with and the first to patent a smokeless powder combining these two very high explosives, the acetone being evaporated out (No. 18,663 of 1888).

He was also the first to combine a small quantity of a suitable oil or paraffin wax with the other materials, which he also patented (No. 4,477, 1889). He was also the first to recover the solvent during the process of evaporation by condensing the vapor and redistilling it by means of a suitable apparatus, which he also patented (No. 18,663, 1888). Mr. Maxim was the first to press the mixture of nitro-glycerin and nitrated cotton into cords, the object being to get rid of the air in the manufacture of blasting gelatin, and this is the subject of a patent (No. 2,628 of 1889).

All these several inventions are used by the British government in the manufacture of the smokeless powder which is known as "Cordite," in reference to its particular form, and, by a curious coincidence, the size of the cord used in the 0.303 Woolwich cartridge is identical with that made by Mr. Maxim's original ma-

chine, patented in 1887. These experiments were undertaken by Mr. Maxim at the request of the military authorities, and cost five thousand pounds of solid cash. A perfect little laboratory was erected; scientific instruments were provided for taking velocities; and a special apparatus was designed and manufactured for taking a diagram of the pressures set up by the powder, as an alternative of the usual method of pressure gauges. Exhaustive experiments were made with every possible combination of nitro-glycerin and tri-nitro-cellulose dissolved in acetone from 1 to 60 per cent of nitro-glycerin. All kinds of oil were tried, and castor oil was found to give the best results. At the official trials Mr. Maxim's powder beat all others, but Mr. Maxim was informed that the authorities could not accept any smokeless powder containing nitro-glycerin. Nevertheless, they have, by some means or other, "arrived at" cordite.

It has been decided after a lengthened trial that cordite, of which tri-nitro-cellulose is one of the ingredients, is not an infringement of Mr. Nobel's patents, which are expressly confined to di-nitro-cellulose.

Mr. Maxim's position as the first and true inventor of the admixture of tri-nitro-cellulose and nitro-glycerin by dissolving the same in acetone having been admitted by Sir Charles Russell, as before mentioned, it is perfectly true that the Maxim-Nordenfelt Company have sent in a claim to the government to be paid a royalty for the article manufactured by the military authorities under the name of "Cordite." It remains to be seen whether it will be necessary for the company to follow the example of Mr. Nobel, and enforce their claims in a court of law.—*Arms and Explosives*.

Novelties in Dentistry.

The talk of the Convention of Dental Surgeons, lately held in Washington, gave a notion of the revolution in dentistry that has taken place within the past few years. By the use of an electric light in connection with the little mirror introduced into the mouth, the teeth and alveolar processes are brilliantly illuminated and rendered translucent. Thus anything wrong about the teeth may be quickly discovered. Perhaps the dead tooth may be hidden in the jaw, never having been erupted, and may have been the obscure cause of trouble for years. The light reveals it at once. Facial neuralgia, by the way, is nearly always due to a dead tooth.

Electricity is most valuable as a motive power for tooth-boring tools, which, strange to say, cause less pain the faster they go. Most people now grown up can recall the excruciating pain caused by the excavating instrument which the dentist of a generation ago slowly revolved between his fingers. The "burrs" now made for such work are much finer than they were half a dozen years ago, being capable of cutting through steel bars. Furthermore, the laborious method of turning them out by hand has been superseded recently by a machine which produces them at a cost of 19 cents apiece.

Electricity is employed also for pulling teeth. To the battery are attached three wires. Two of them have handles at the end, while the third is attached to the forceps. The patient grasps the handles, the electricity is turned on suddenly, and the dentist simultaneously applies his forceps to the tooth. The instant the tooth is touched, it, as well as the surrounding parts, become insensible to pain. A jerk, and it is out.

One dentist at the convention remarked that there is not one tooth lost now where there used to be one hundred. If only the root is left, a new upper part of porcelain or gold, called a "crown," is fastened upon it, so as to be quite serviceable. Supposing that not even the root is left, a gap in the mouth is filled in with one or more "dummies," securely fastened by a gold "bridge" or otherwise to the sound teeth. Complete sets of false teeth are rare nowadays.

The demand for "tooth crowns" comes largely from baseball players, football athletes, and bicycle riders, who are very apt to have their teeth broken off short. But the last and most ingenious resort of the dental surgeon is "implantation"—i. e., the setting of new teeth into the jaw. For this purpose real teeth are employed, and not artificial ones. Cocaine having been first applied for producing local anesthesia, a hole is drilled in the jaw bone, and into this socket a good tooth, newly drawn from somebody's jaw, is set. If the patient is young and vigorous, the osseous structure soon closes around it, and by the time the gum is healed the tooth is ready for use. It should last from three to ten years. In the case of an elderly or feeble person it may be fastened in place by silver wires passing around the jawbone.

One of the most important improvements in modern dental practice is on the point of being accomplished. It will consist in the substitution of porcelain for gold in the filling of teeth, especially in places where repairs are likely to show. For this purpose a piece of thin platinum foil is introduced into the "cavity," and so manipulated as to take the exact form of the hole, as if it were intended as a lining. Then it is carefully withdrawn, so as not to disturb its shape. Thus is ob-

tained a mould, from which a porcelain cast may be made to fill the cavity exactly. This is secured in place by cement. The trouble is that no cement as yet invented is proof against the dissolving power of the fluids in the mouth.

The human jaw, while receding and losing its brute-like character, has been steadily growing narrower. This latter change is going on even now, so that most people have not room enough in their mouths for the equipment of teeth with which nature has provided them. Many persons are obliged to have two or four teeth drawn to make room for the rest. The "wisdoms" being superfluous for lack of space, nature is making them of poorer material in every generation. So these "third molars," as dentists term them, begin to decay usually and have to be filled or pulled as soon as they appear.

Inasmuch as real teeth are so easily lost, it is a comfort to know that artificial ones cost only 15 to 18 cents each at the manufacturer's. One maker in New York sells 8,000,000 teeth every year. They are porcelain, composed chiefly of kaolin. The enamel is put on with metallic oxides, the process being so delicate that no two teeth are exactly alike in coloring. After being finished thousands of them are taken together and matched in shades. There are fifty different shades, corresponding to variations in the coloring of natural teeth. Defects are often made in false teeth so as to render them more deceptive to the eye. The best plates are of rubber. Celluloid is the prettiest material for the purpose, but it does not resist the acids of the mouth.

A tooth is a living structure. Inside of each tooth is a cavity filled with pulp which gives it life. Nerves and blood vessels connect this pulp with the general system and circulation of the body. The ivory surrounding the pulp is covered over by a surface of enamel. Both ivory and enamel are harder than any other bones, because they contain a greater quantity of bone earth. Enamel on the tops of the teeth is one-sixteenth of an inch thick. It consists of little six sided prisms placed side by side, and held together by an exquisitely fine cement. The pulp of the tooth becomes diseased, and toothache follows. Tartar is a secretion made by three glands in the mouth, full of small living organisms which assimilate matter in the saliva and deposit it on the teeth in the shape of phosphate of lime.—*Providence Journal*.

Windmill Irrigation.

A bright Nebraska farmer writes as follows: "I have a wind power plant run by a 14 foot wheel, with an 8 inch pump that throws 4,400 barrels per day in a medium wind. I have two reservoirs, one 60 by 150 and one 80 by 150 feet. With this plant I have watered from ten to fifteen acres, and it can be managed so as to water still more by using and applying the water to some of the land during the winter season. It is necessary to use reservoirs, so as to have a larger volume of water whenever you irrigate. By this means you have more pressure and can water more land at one time and do it quickly.

"To build reservoirs, take from the inside of the dimensions that you wish to put into the reservoir the earth to make your banks with, by plowing and scraping it up from your bank, and by so doing you spoil no land on the outside. Two men and a team can make a reservoir 100 by 100 feet in eight or ten days, or less time. The Gause pump that I am using can be used in an open well or with drive points.

"To make your reservoir hold when you begin to pump water into it, commence tramping with horses as fast as the water covers the bottom of the pond until you get it into a loblolly of mud two or three inches deep, and this will then settle into the pores of the ground and stop very nearly all the seepage. Do not put manure or straw into the bottom of the pond if you ever expect to stock it with fish, as they will surely die.

"A plant like mine, or similar, with reservoirs, pumps, etc., complete, ought not to cost over \$250, counting pay for the farmer's labor that he does himself on the plant. I am lifting the water 17 feet. This pump will raise the water 25 feet from the valve successfully.

"In irrigating a great many kinds of fruit trees, berries, and in fact all small fruits, use furrows or small ditches instead of flooding the land, and by so doing save at least one-third of the water that it would otherwise take to flood the land. I have eight acres in fruit, and in the last three years I have always had enough water to flood this orchard. Where there is a sufficient supply of water underneath and you do not have to go too deep for it, say 20 to 30 feet, I would advise the use of points instead of digging open wells. Where a man is gardening, or wishes to grow an orchard of ten acres, one of these plants will pay for itself in one dry season, and the farmer who has a plant of this kind is always sure of vegetables and berries for his own family use, and I consider this one of the most essential things to the farmer, for in any country to make true farming a success the farmer must grow his own vegetables and fruit for home use."—*Irrigation Age*.