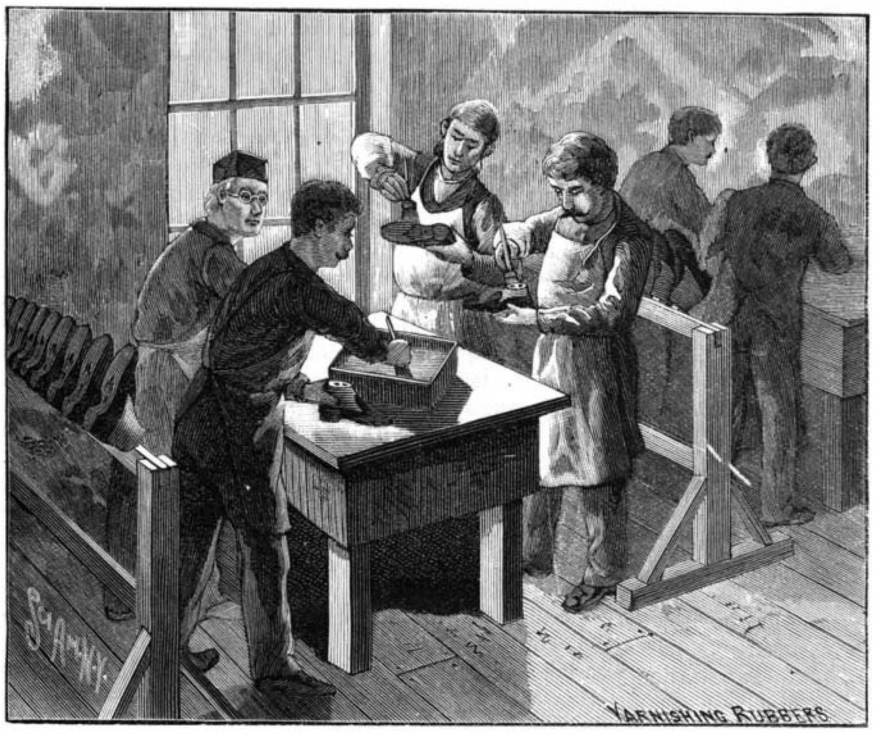
MANUFACTURE OF RUBBER SHOES.

BY B. G. UNDERWOOD.

The many good qualities of caoutchouc, or India rubber, have been known for a great many years. In 1791, Samuel Peal obtained a patent in England for waterproofing fabrics by means of this gum dissolved in spirits of turpentine, though this does not seem to have led to any practical results. In 1813 a patent was issued in this country to J. F. Hummel, of Philadelphia, for a varnish of gum elastic. In 1831, George H. Richards, of Washington, D. C., received a patent for a fluid caoutchouc and soon afterward Edwin M. Chaffee, of Roxbury, Mass., and others established the Roxbury India Rubber Company, which was chartered in 1833 and was the first company organized in the United States to manufacture caoutchouc into waterproof clothing.



Charles Goodyear, in 1835, after devoting much time to experiments, took out his first patent. In 1839 he took out a patent for the sulphuring process, which would have been of little value without the subsequent improvements which he made. The sulphur imparted an offensive odor and did not prevent the rubber from hardening in cold weather. Experiments convinced him that the application of considerable heat would cause the sulphured article to be pliant in cold weather and to increase its elasticity in all temperatures, and the result was his patent issued in June, 1844, which was reissued in 1849, extended in 1858, and again reissued in 1860.

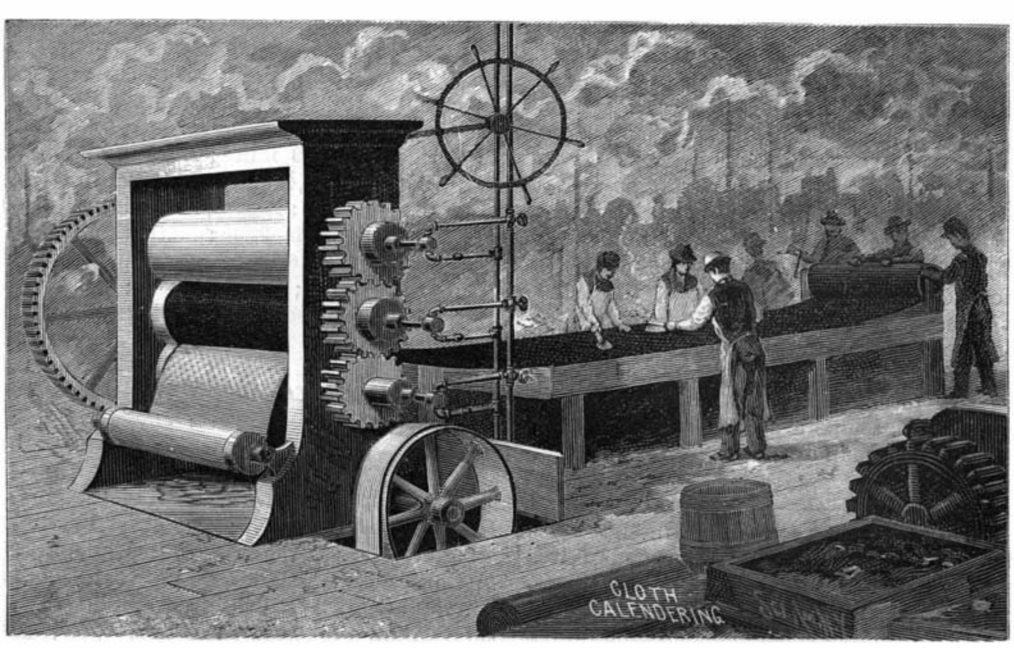
The history of the Boston Rubber Shoe Company, whose plant furnishes us with the accompanying illustrations, is a remarkable one. The company was organized in 1853 and Elisha S. Converse was chosen treasurer and manager, a position which he has occupied ever since; and to his foresight and ability the company owes its present position, having the largest plant for the manufacture of rubber boots and shoes in the world. The two factories in Malden and Melrose give employment to 3,000 people and turn out 45,000 pairs daily. The Malden factory was burned in 1875, rebuilt in 1876, and in 1882 the Melrose factory was constructed. The number of employes in each is about the same, but in the Malden factory, which is known as factory No. 1, all of the odd sizes are made, the machine shops are located, new designs are perfected, steel rolls engraved and all the miscellaneous work done.

The orders received by this company from its customers run into very large figures. Orders for 15,000 cases of goods are common, and to-day they have several orders on their books for 25,000 cases and one order for 30,000 cases. When it is understood that a freight car will hold 500 cases and a case averages twenty pairs of rubbers, the magnitude of these orders will be appreciated, and they have shipped in single orders at one time twenty freight cars to one party in San Francisco and one to Minneapolis, and filled one order recently which filled thirty-two freight cars and contained 320,000 pairs of rubber goods.

There is enough interesting machinery used in the preparation and manufacture of rubber into boots and shoes to fill this entire paper, and it has been difficult for our artist, in the limited space at his disposal, to select material, but we think the illustrations will fairly represent some of the many processes employed in the manufacture of these articles.

The crude rubber as received from Para, which furnishes the finest grades, is packed in large wooden boxes 4 × 2 × 1½ feet, containing about 350 pounds each, and the second grade in boxes twice the size, containing about 700 pounds each. The boxes are filled with crude rubber, the pieces being in every possible shape, weighing from 1 to 75 pounds. Before going to the washing machine, or cracker, which is shown in the cut at the top of the page, the original pieces are cut by a circular knife to sizes suitable for the cracking machine. It passes a number of times through these washers, water and steam being sprayed in the rubber during the operation, until it is sheeted in sheets of about 1-16 of an inch thick, first passing through a machine with corrugated rolls, and finally through one with smooth rolls, which leaves the sheet smoother and thinner. The grinding machines have a capacity of about 1,000 pounds a day, and will handle from 10,000 to 14,000 pounds of fine Para rubber a day, or from 8,000 to 10,000 pounds of the coarser grades.

From the grinding room the sheets of rubber are taken to the mixing room, where they are mixed with lamp black, whiting, sulphur, and other ingredients. Passing through a number of rolls many times, which are heated it leaves this department in sheets about ½ inch thick. This process is clearly shown at the top of our first page. From this room it passes through the refining machines, which turn it out less than 1-32 of an inch in thickness, or the right thickness for the uppers of rubbers so largely used.



MANUFACTURE OF RUBBER SHOES.

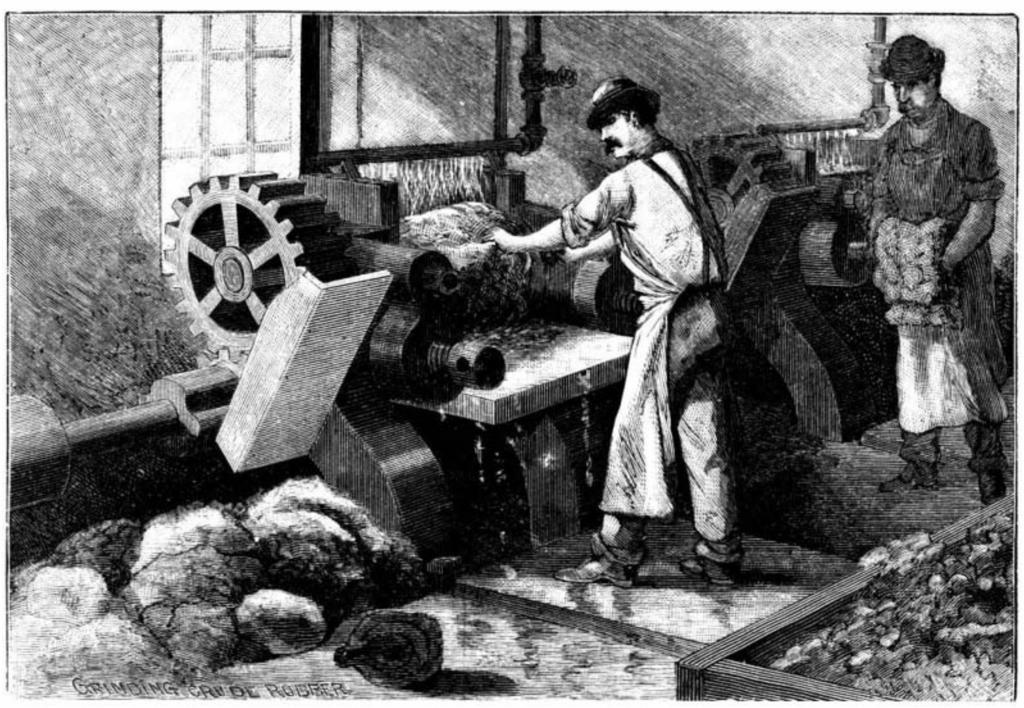
The cloth-calendering machine, which is shown on this page, backs the large roll of cloth, which is seen in the engraving, with rubber. This material is used for lining rubber shoes. The machine has great power, and turns out about ten yards a minute from a roll which is 1¼ yards in width.

For rolling sheet rubber for boot vamps, it is necessary to run in several thicknesses. This work is done in another rolling machine, which we have not space to show, and the finished rubber sheets are carried by an endless belt into the story above. The thin sheets of rubber are stamped by circular steel rolls, on which the pattern is engraved so as to mark the sheets for cutting uppers, which is done in another room.

Rubber boots and shoes could not be made without piping, which is used to hold the different pieces in place. This is cut in strips 18 inches long by 1 inch in width, and 42 of these strips are placed so as to lap over each other, making a width of 10 inches, by an automatic machine. There is nothing that piping will not hold, and we meet this indispensable necessity at all stages of rubber boot and shoe making.

The heel-cutting machine shown on front page takes in solid rubber sheets about one yard square, one inch in thickness, weighing about 90 pounds to the sheet, and from each sheet can be cut from 100 to 230 pairs of heels. The heel-pressing machine shown on front page works by hydraulic pressure of 1,000 pounds to square inch and holds 25 heels. They are subjected to this pressure from 7 to 8 minutes, with from 85 to 90 pounds of steam, and leave the press with the name and number stamped on the bottom, and so nearly finished that only a little trimming is needed about the upper edge before being attached to rubber boots.

The rubber sheets for cutting soles (see first page) vary from ⅛ to ⅕ of an inch in thickness and are a little over a yard in length. It will be noticed that piles of thin wooden boards are shown in nearly every illustration. This is necessary, as the rubber sheets must be kept apart, as they adhere to each other if brought in contact. The soles are nearly all cut by hand. This requires skilled labor, as they are all beveled. A man will cut from 900 to 1,000 pairs a day.



Sole rolling is done by a machine shown on front page. This stamps, at the same time, the pattern shown in the bottom of rubbers. The strips each contain soles for ten rubbers, and are placed on thin wooden boards, and are then carried on trucks to the sole-cutting room. There are about thirty different patterns, and sixteen sizes are made from each pattern; but the same pattern can be used for all the different sizes. The uppers are cut by hand, with a die and mallet, as shown on front page. The average daily capacity of the cutters is from 600 to 700 pairs.

We have only space to show in our illustrations one branch of the actual manufacture of rubber boots and shoes, and we have selected that known as storm slippers, which have recently come into such general use. This slipper was designed by Mr. E. F. Bickford, general superintendent of the company, and the number made of this one brand in 1891 was 800,000 pairs. We also give the patterns used in making these slippers. The shoemakers, as the girls are called, make from thirty to thirty-six pairs a day.

Iron cars for carrying rubber goods hold from 210 to 500 pairs, depending upon the size of the manufactured goods. The slats holding the rubbers after varnishing (see illustration) are placed in these cars, which are run into the vulcanizing ovens, where they remain in a temperature of from 140 to 180 degrees for a period of six to seven hours, when the goods are finished, and, after a thorough inspection, are carefully boxed and packed, and can be purchased not only in every village and city of this country, but in most of the cities of Europe.

THE SOUTHERN COTTON HARVESTER.

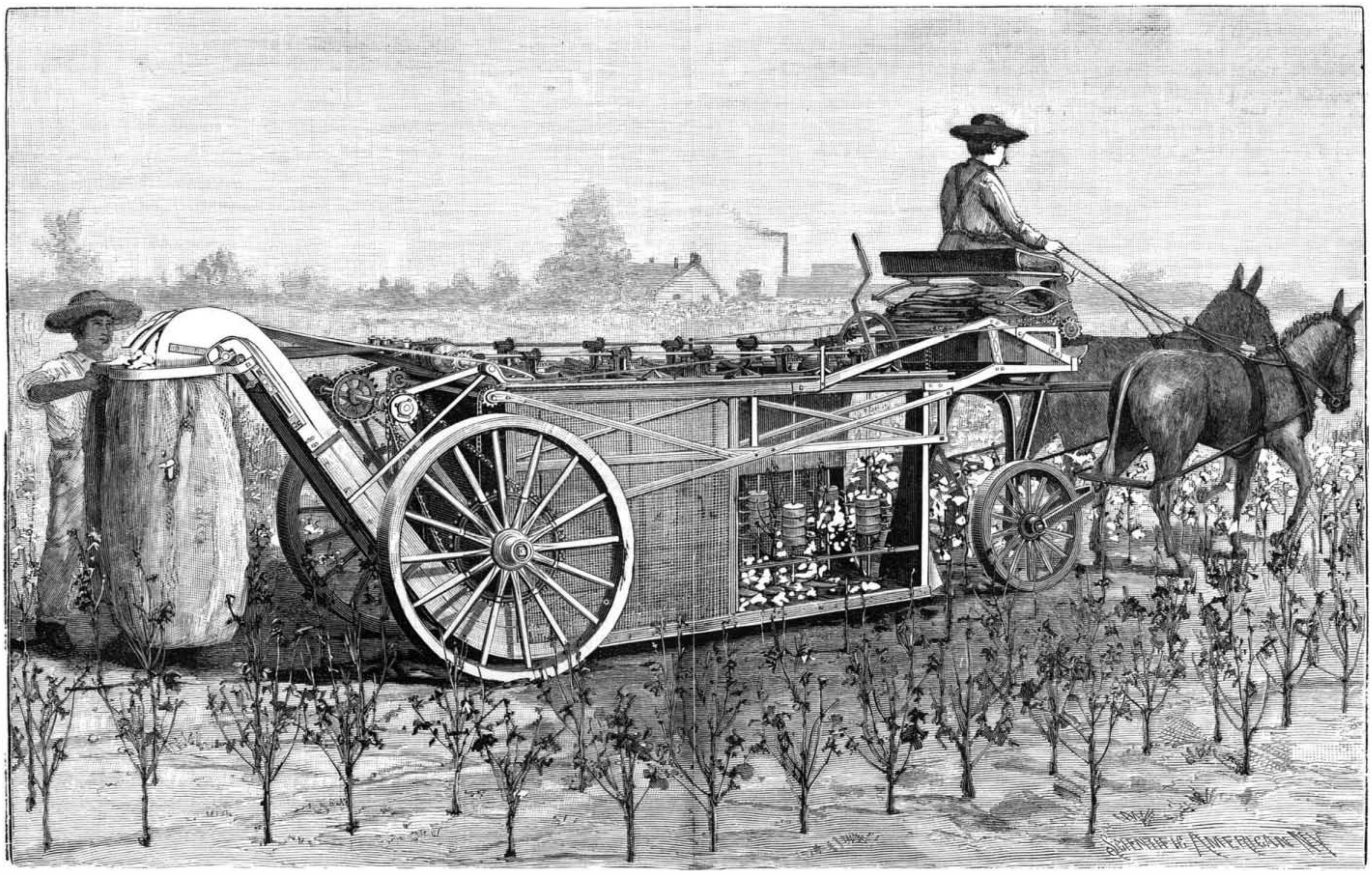
One of the subjects of invention which seem to have baffled inventors for many years is a practical cotton harvester. The cotton crop is a peculiar one, presenting the necessity of dealing with the delicate fiber and at the same time with twigs, and green and ripe bolls. In harvesting cotton by hand labor, the harvest time is subdivided into three different periods, the first of the crop being gathered from the lower portions of the plant, the second part of the crop being gathered from the central portion, and the third part from the upper portion of the plant. It will thus be seen that the problem is a complicated one, and it is not strange that there should be many failures before cotton harvesting by machinery becomes a commercial success.

To a large extent, cotton planters in the South have been hampered by the difficulty in obtaining labor at the right time, and, as a result, serious losses have followed; but at length a machine has been perfected which reduces cotton harvesting to a certainty. To run this machine, two men and a single team are required. It will harvest from 5,000 to 6,000 pounds of cotton per day at a cost of $3 to $4, as against forty men picking not over 150 pounds each per day at a cost of $30. This machine, which is the subject of our engraving, is so simple as to hardly require an explanation. A general description will render its construction and operation clear.

The machine consists of a frame suspended on ordinary wagon gear and inclosed in wire cloth. Within the frame are journaled two series of vertical shafts, upon which are placed beaters having spring arms. Through the bottom of the frame extends a slot, through which the stalks of the cotton plants pass. In the bottom of the frame are arranged conveyors which carry the cotton beaten from the plant rearwardly and upwardly, and deliver it to bags attached to the elevators at the rear of the machine. The slot through which the stalks pass is furnished with series of swinging plates which open only as the stalks pass, thereby keeping the bottom of the machine closed and retaining all of the cotton detached from the plants. The beaters are made adjustable, so that they can be placed at a suitable height to engage the ripe bolls as the machine passes along. One of these machines has been in operation this season in Alabama, yielding the results we have described above.

The New York office of the Southern Cotton Harvesting Company is located at 319 Broadway.

Mr. Isaac Blum is president of the company, and we are informed that Mr. L. R. Turner has been largely instrumental in bringing the machine to perfection.



A NEW COTTON HARVESTER.

Stick to a Legitimate Business.

Well directed energy and enterprise are the life of American progress, and safety lies in sticking to a legitimate business. No man—manufacturer, trader, or banker—has any moral right to be so energetic and enterprising as to take from his legitimate business the capital which it requires to meet an emergency.

Apologies are sometimes made for firms who have failed, by recurring to the important experiments they have aided, and the unnumbered fields of enterprise where they have freely scattered their money. We are told that individual losses sustained by those failures will be as nothing compared with the benefits conferred on the community by their liberality in contributing to every public work. There is little force in such reasoning. A man's relations to a creditor are vastly different from his relations to what is called the public. The demands of the one are definite, the claims of the other are just what the ambition of the man may make them.

The histories of honorably successful business men unite to exalt the importance of sticking to a legitimate business; and it is most instructive to see that, in the greater portion of the failures, the real cause of disaster was the branching out beyond a legitimate business, in the taking hold of this and that tempting offer, and, for the sake of some great gain, venturing where they did not know the ground, and could not foresee the pitfall.

Let Us Have Good Roads.

Colonel Albert A. Pope deserves the thanks of the present generation, and will undoubtedly receive those of posterity, for his untiring efforts in favor of the improvement of American roads. We need not repeat what has been often said here and elsewhere, that the crying need of our country is decent ordinary roads, over which the farmer can haul his produce to market and the city merchant can distribute his goods to his circle of rural or suburban customers with economy, speed, and convenience. As with all inveterate evils, it is hard for us, accustomed to the old system, to realize the difference which a better one would make in our condition. The number of horses and mules owned in the United States is about sixteen million, and the cost of keeping them is probably not less than two hundred million dollars a year. It is found, by hundreds of experiments, that one horse, working all day, and day after day, can do as much work on a good macadamized road as eight horses can on a road covered with gravel from four to six inches deep, as is usually the case with suburban roads after the annual repairing. Now, bad as are these repaired suburban roads, every person of experience will acknowledge that the labor of pulling a vehicle over them is as nothing in comparison with that involved in wallowing through a Virginia, or Ohio, or Indiana, or Kansas highway after a rain, or when the frost is coming out of the ground. Indeed, it is not necessary to make any invidious distinction in favor of any of the States, for the mud of Connecticut or New York, or the sand of Southern Massachusetts or New Jersey, have little to fear, as regards capacity for retarding locomotion, by comparison with the loam of the Mississippi Valley.—*Amer. Architect.*

A Trip to a Fixed Star.

Dr. David Gill, lecturing recently on "Fixed Stars," hit upon the following adroit method to illustrate the distance to Centauri. The doctor said, as reported in the Boston *Globe*:

"We shall suppose that some wealthy directors, for want of outlet for their energy and capital, construct a railway to Centauri. We shall neglect, for the present, the engineering difficulties—a mere detail—and suppose them overcome and the railway open for traffic. We shall go further, and suppose that the directors have found the construction of such a railway to have been peculiarly easy, and that the proprietors of interstellar space had not been exorbitant in their terms for right of way. Therefore, with a view to encourage traffic, the directors had made the fare exceedingly moderate, viz., first-class at two cents per 100 miles. Desiring to take advantage of these facilities, a gentleman, by way of providing himself with small change for the journey, buys up the national debt of England and a few other countries, and, presenting himself at the office, demands a first-class single to Centauri. For this he tenders in payment the scrip of the national debt of England, which just covers the cost of his ticket; but at this time the national debt from little wars had been run up from $3,500,000,000 to $5,500,000,000. Having taken his seat, it occurred to him to ask: 'At what rate do you travel?' 'Sixty miles an hour, sir, including stoppages,' is the answer. 'Then when shall we reach Centauri?' 'In 48,663,000 years, sir.'"

Manufacture of Cod Liver Oil.

The process of manufacturing cod liver oil at Portugal Cove, Newfoundland, is as follows: It requires, as a rule, 2½ gallons of liver to produce a gallon of oil. The livers are first carefully washed, and must then be "cooked" at once. For this process they are first put into a large tin boiler, which is plunged into a large iron boiler filled with hot water, the water not being allowed to touch the livers, which are thus gently steamed till a quantity of oil is floating on the surface. This is dipped out and filtered through bags of moleskin. The last filtration leaves the oil perfectly transparent, and without any unpleasant taste or smell. The oil is exported in 60 gallon casks.