owe the most recent and satisfactory results upon this subject. Working by different methods, each apparently faultless in its details, and carefully tested as to its sources of error before using, the substantial agreement of their results is the best guarantee of the accuracy of their work. Reiset finds 2·962 as the average number of volumes in 10,000 of air, Muntz and Aubin, 2·84. Both agree as to the fact that the air of cities is appreciably richer in carbonic acid than that of the country. Muntz and Aubin find 3·19 for Paris as an average of many determinations; Reiset finds 3·516 as the highest and 2·913 the lowest. The lowest proportion ever found by Reiset was 2·779 in the midst of a field of barley and lucerne far from the city, and therefore under conditions where, presumably, the absorption of carbonic acid from the air would be most rapid. As to the air of cities and towns, Schulze had previously shown that the air of narrow courts and alleys contained much higher proportions of carbonic acid than that of open places.

Carbonic acid is most abundant during fogs and generally during still and cloudy weather, while clear days indicate a decrease in its proportion. Rain, however, seems also to lessen it. During the day there is less than at night. Altitude of places seems to have little effect upon the quantity of carbonic acid when other conditions are constant. The influence of vegetation in decreasing the proportion is less than might be expected, and the predominance of carbonic acid in the air of cities is to be ascribed mainly to the use of fires, decreasing and increasing with the seasons as the consumption of fuel varies.

To show the influence of animal respiration, Reiset mentions that on one occasion the proportion of carbonic acid was sensibly increased by the proximity of a flock of 350 sheep, while his apparatus was in use.

In all of the above cases of variation in the proportion of carbonic acid with changing conditions, it is to be remembered that the variations are exceedingly small, never reaching 1 part in 10,000 between the extremes. The entire range for all outdoor places tested in these experiments was between about 2·8 and 3·5 volumes in 10,000 of air.

In order to find whether carbonic acid is uniformly diffused in the air throughout the world, Muntz and Aubin prepared a number of tubes for absorption of carbonic acid from the air, and put them into the hands of members of the different expeditions sent out to observe the recent transit of Venus. The tubes were sealed until opened at the appropriate stations, and after passing the proper volume of air the observers sealed them again and returned them to the above chemists at Paris. From an examination of these tubes the carbonic acid in the air of the distant station was determined, and in this way new data were obtained from widely separated points in many parts of the world. The results, as recently published, are as follows:

The general average of all the stations shows 2·78 volumes of carbonic acid in 10,000. The average for France, as given above, was 2·84. The highest results in the series were never higher than the highest observed in Europe, while the lowest results are less than the lowest of the latter. The average for the northern hemisphere is 2·82, almost that of France, while the average for the southern hemisphere is notably lower, viz., 2·71. The latter result has led to a re-examination of the air of the southern hemisphere through the aid of a resident observer at Cape Horn, and the examination, should it confirm the above figures, will indicate some agency peculiar to this hemisphere in lessening the proportion of carbonic acid. Muntz and Aubin account for such a result by reason of the lower average temperature of the southern hemisphere, owing to which, in accordance with the hypothesis of Schloesing, the absorption of carbonic acid by the water of the ocean and its fixation as calcium bicarbonate (bicarbonate of lime) would be more active.

As to the sources of the carbonic acid in the air, Dumas holds that physiological processes can have little to do with its increase, and that volcanic agencies are the principal sources. The gas is known to escape in abundance from volcanic craters and from fissures in volcanic regions. The reports of recent volcanic disturbances in Java and adjacent islands are accompanied by accounts of suffocation of men and animals by carbonic acid from such sources. It is liberated in abundance by the action of heat upon limestone and other carbonates, and also by the spontaneous decomposition of solutions of bicarbonate of lime, such as are often found in nature. The abundant deposits of limestone in the crust of the earth form, therefore, an inexhaustible source of the gas under certain conditions, and their abundance, together with that of mineral coal, points probably to a period in the earth's history when a much higher proportion of carbonic acid was present in the air.

While all evidence goes to show, therefore, that carbonic acid is at present an almost invariable constituent of the air, it is one which requires least change in the physical conditions under which the earth exists to effect a change in its proportion. Minute as the proportion is, the delicacy of its relation to animal and vegetable life on the earth makes the maintenance of the apparently unstable equilibrium a matter of serious concern to mankind.

VIRGINIA is making flour of peanuts, of which she raises 2,0 0,000 bushels this year. Peanuts, so called in the Old Dominion, were introduced from Africa, and are known in North Carolina as ground peas, in Tennessee as goobers, and in Georgia, Alabama, and Mississippi as pinders.

THE OSCILLATIONS OF THE SEA.

In a note of mine published in No. 10 of the *Revista Scientifico Industriale*, I spoke of the work of Mr. G. H. Darwin entitled "The Stress Caused, etc." In this note I said that the author, with others, had reached the conclusion that the tension produced by the weight of the continents and mountains was not adequate to cause terrestrial elevations and depressions. This conclusion at first seems contradicted by the fact of the continual oscillation of the earth's crust, the actual emergence and immersion of the continents, but in fact it is not. Adhemar and Croll have given an explanation of continental movements upon the hypothesis that, by the procession of the equinoxes, the motion of the terrestrial perihelion, and the eccentricity of the earth's orbit there was accumulated alternately at the poles enormous masses of ice. This ice once deposited displaced the center of gravity of the earth and produced a movement in the oceans, the water always flowing toward the center of gravity, hence the submergences. To-day this view has become modified, but the conclusion remains unaffected.

According to the law of gravitation, all substances attract in proportion to their mass. A continent hence exerting an attractive influence upon a surrounding sea produces an elevation of its level along the coast line and sustains the water at a height proportional to the mass of the attracting region. This result was deduced by Fischer reasoning upon the observations made with a pendulum, and Listing and Bruns reached an analogous conclusion. This of course destroys the assumption that the sea has a level surface. Moreover, the ocean is more or less high along the same line of sea board, according to the variable mass of the same from point to point. Thus Dr. Penk explained in this way many local phenomena of elevation and debasement especially conspicuous during the glacial period. He said if a region can attract the sea in proportion to its mass, whatever increases that mass increases the effect; and an accumulation of ice will bring about a raising of the sea level. I say that these views will not invalidate the conclusions of Adhemar and Croll, but in fact substitute for the displacement of the center of gravity another force, *i. e.*, surface attraction, the disturbance of the ocean remaining as before. The objection is made to the theory of the movement of the sea produced by the alternating accumulation at the poles of ice that in fact there is no difference in temperature between the north and south hemisphere. I doubt it. To decide whether the two hemispheres vary in heat, observations should be made over a century and over the whole superficies of the land. It is certain that for many thousand years this difference, assuming it, will decrease with the decreasing eccentricity of the earth's orbit. Should to-day or in the future no difference in temperature be established, it certainly obtained when the eccentricity was much greater, hence the conclusions of Adhemar and Croll as to the displacement of the sea can always stand. In the future, whether by increase of cold, or by decrease in eccentricity, the marine oscillations, from the accumulations of ice at the poles, should become less, and at length insensible.

Passing from the general question to a particular phase of it, we can extend the conclusions of Dr. Penk, saying, not only does the addition of ice over a region raise the sea level about it, but also the addition of any other body. In Italy we have two local facts of elevation and debasement, the oscillations of the sea level around the columns of the temple of Serapis, and the lowering of the plain of Venice. The first can be explained by Vesuvius, the second by the Venetian streams. Vesuvius, emptying the caverns that certainly exist in that region, attracts less, and the sea falls, and the columns of the temple of the Serapis emerge. If on the other hand by successive eruptions the mountain mass is enlarged, the surrounding sea rises, and the columns again become the home of a new generation of boring mollusks. The Po, Adige, Brenta, Piane, Tagliamento, all discharge their muddy streams around Venice. The sea by the invasion of the torrents retires, but upon the augmentation of the mass of the shore it raises the level and the plain of Venice seems lowered. The elevation of the sea causes the alterations noticed in the region, and the streams to be able to push their water into the sea at its higher level must raise their beds, which is helped by the protrusion of their mouths forward, and by the greater influence of the rising of the sea.—*Professor Zona, in Revista Scientifico Industriale.*

The Approaching Comet.

On September 3, Prof. W. R. Brooks discovered a faint nebulosity which rapidly increased in brilliancy, and which subsequent observations proved to be an approaching comet. It is now quite certain that the stranger is the comet originally discovered by Pons, at Marseilles, July 20, 1812, when its period was determined to be about seventy and one-half years. At that time it was a moderately bright object, clearly to be seen by the naked eye, and having a tail one or two degrees long.

During the present visit it will not be visible, in all probability, without a glass until the latter part of next January. But calculations concerning its greatest brightness cannot as yet be made; as during the past month it has behaved very erratically, increasing to many times its first luminosity. According to calculations made by Prof. S. C. Chandler, Jr., the position of the comet on the 10th inst. will be, right ascension 16 hours 33 minutes and 44 seconds; and declination 56° 51' north. On the 26th inst. right ascension 16 hours 55 minutes 6 seconds, and declination 53° 40' north.

United States Life Saving Service.

The report of the operations of this service for the year ending June 30, 1882, contains much information of general interest, and above that the scope of the work, whether viewed from a humane or a financial point of view, is much greater than commonly supposed. The present system dates from November 1, 1871, although the life saving service was organized in conformity to an act of Congress approved June 18, 1878. At present it faithfully watches the greater part of our coast, and is ever on the alert to render assistance to vessels in danger. It is founded on the grand principle of neighborly kindness, and its efforts are put forth to aid those of any nationality.

At the date of the report there were 189 stations distributed as follows: Coast of Maine and New Hampshire, 7; Massachusetts, 15; Rhode Island and Long Island, 37; New Jersey, 40; Cape Henlopen to Cape Charles, 11; Cape Henry to Cape Hatteras, 24; Florida, 5 ; Gulf Coast, 5; Lake Erie and Ontario, 10; Lakes Huron and Superior, 12; Lakes Michigan, 16; Pacific Coast, 7. Of the above 144 were on the Atlantic, 37 were on the Lakes, 7 on the Pacific, and 1 was at the falls of the Ohio, Louisville, Ky. On the coast of Florida surfmen were not employed at the stations, as the character of the coast for the most part makes escape from stranded vessels comparatively easy, the main danger to shipwrecked persons being of dying from hunger and thirst, as the region is but thinly settled. The keepers are in charge of houses of refuge, and are required to search the coast in both directions after every storm.

During the year there were 287 disasters to vessels, and of the 2,258 persons on board all were saved but 12. The estimated value of the vessels and cargoes was $4,758,357, of which $3,099,987 was saved. There were 67 vessels totally lost. In addition to this there were disasters to 58 smaller craft, as sail boats, row boats, etc., on which were 128 persons, all of whom were saved. The results of all the disasters coming within reach of the service were as follows:

Total number of disasters	345
Total value of property involved	$4,766,227
Total value of property saved	$3,106,457
Total value of property lost	$1,659,770
Total number of persons involved	2,398
Total number of persons saved	2,386
Total number of persons lost	12
Total number of shipwrecked persons succored at stations	468
Total number of days' succor afforded	1,379
Number of vessels totally lost	67

To the above list should be added the rescue of 29 persons who had fallen from wharves and piers and who would certainly have drowned but for the assistance of the life saving crews.

Of the disasters, 198 occurred on the Atlantic and Gulf coasts, involving the lives of 1,225 persons, all but 10 of whom were saved, and property (vessels and cargoes) to the amount of $2,676,132, 140 of the disasters were on the Lake coasts, and the people imperiled numbered 1,082, of whom 2 were lost, and the property involved was $1,722,720; on the Pacific coast there were 7 disasters, risking 91 lives, and $367,375 worth of property. During the year the surf boat was used 284 times, making 381 trips, and landing 327 persons; the self-righting and self-bailing life boat was used 11 times, making 15 trips and landing 27 persons; smaller boats were used 98 times, making 121 trips, and landing 43 persons; the river life skiffs were used 30 times, making 111 trips and landing 124 persons; the breeches buoy was used 17 times, making 170 passages, and landing 158 persons. Five persons were rescued by surfmen swimming out to them; 10 more were saved by casting lines over vessels. In one case a disabled man lying at the foot of a cliff 780 feet high was rescued by one of the life saving party who was lowered down the cliff at the end of a line, by means of which both men were drawn to the summit.

Since November 1, 1871, there have been 1,692 disasters involving 14,702 persons, of whom 407 were lost, and $29,-278,714 worth of property, of which $11,213,362 worth was lost. The total expenditures for the Life Saving Service for the year were $506,239.55.

A Fast Steamer.

The steamship Alaska, of the Guion Line, arrived in New York, September 23, from Queenstown, 6 days 21 hours and 40 minutes, surpassing her former record by more than 2 hours. Her 24-hour runs varied from 310 to 436 miles, her speed at some times, as shown by the log, being 18¼ knots per hour. The Alaska has also made the fastest easterly trip from Sandy Hook to Queenstown, covering the distance in 6 days 18 hours and 37 minutes; the faster time easterly being due to the favorable current of the Gulf Stream. Other fast trips westerly were made by the City of Rome, of the Anchor Line, in 7 days and 2 hours; the Servia, of the Cunard Line, in 7 days 3 hours; the Britannic, of the White Star Line, in 7 days 7 hours and 11 minutes; the Arizona, of the Guion Line, in 7 days 8 hours and 34 minutes; the Fulda, of the North German Lloyd Line, from Southampton to New York, in 7 days 21 hours and 5 minutes; the Werra, of the same line, in 7 days 23 hours.

A CONSIGNMENT of very lively leeches was among the first day's receipts at the General Post Office in London on the inauguration of the new parcels post. The box containing them was a very slight one, and becoming fractured in transit, the contents escaped, and traversed the establishment in search of a promising "subject."

John C. Trautwine.

This eminent engineer, after a long and eventful career, died in Philadelphia in his seventy-fourth year on Friday, Sept. 14. He was born in that city March 30, 1810. After receiving an ordinary education he entered the office of William Strickland, and was engaged on the Delaware Breakwater. Later he was employed on the construction of the Philadelphia, Wilmington, and Baltimore, and the Hiawassee railroads. In 1844 he began a five years' engagement on the Canal del Dique, in New Granada. In 1849 he was engaged on the Panama Railroad as chief engineer, and later he made a survey for the Atrato Interoceanic Canal, and in 1857 he surveyed the route for the Honduras Interoceanic Railway, a line that was never built.

He is and will be best known, however, by his writings, which have run through several editions. His book on "Railroad Curves" is the simplest and clearest book on the subject in the English language. He also wrote a book on "A New Method of Calculating the Cubic Contents of Excavations and Embankments by the aid of Diagrams." The work, however, on which his reputation will chiefly rest is his "Civil Engineer's Pocket Book." It is a monument to his industry and versatility, and is perhaps the best single treatise on civil engineering thus far published. Owing to the time when Mr. Trautwine studied and learned engineering, his book was, even at the time of its publication, somewhat behind the times. It has fallen still further behind now, but it would be difficult to find any other one book which alone would be as useful to a young student of civil engineering as this.

While engaged in work in tropical countries Mr. Trautwine contracted one of the malignant fevers so prevalent in those climates, from the effects of which he never recovered entirely, and which finally caused his death.

He was a prominent member of several scientific societies. He leaves two sons, William Trautwine, a conveyancer, and John C. Trautwine, Jr., who has been engaged with his father in his book work.—*Railroad Gazette.*

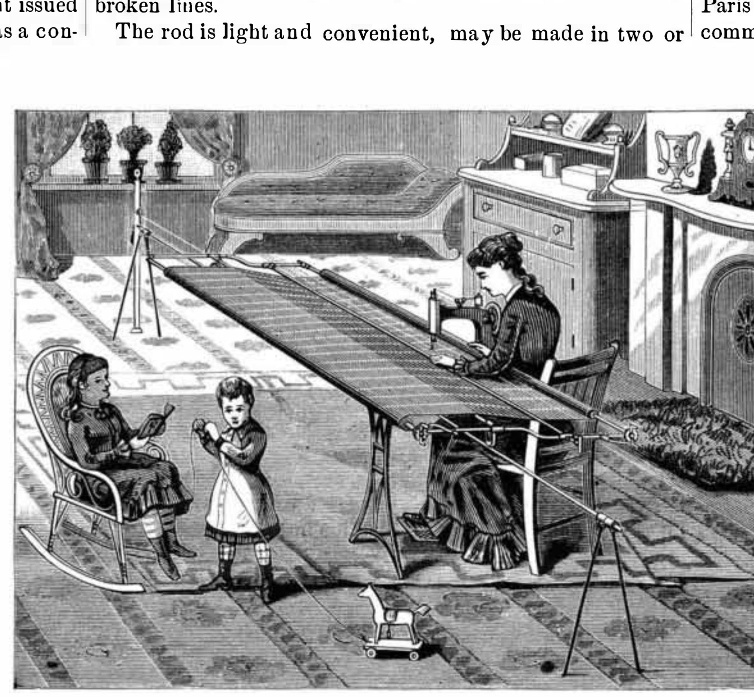
Old Steel Pens.

Says the New York *Sun:* "Pens are made of the very finest steel, and can be remelted and used again for many purposes. They can be turned into watch springs and knife blades, and can be dissolved and made available in the manufacture of ink. The suggestion is made that the children of the poor should be taught to collect cast-away pens, and thereby save valuable material and earn money."

The steel from which steel pens are made is so thin that it can be torn like stiff paper. It goes through such tormenting processes in the rolling, cutting, pressing, slitting, and forming, that it is a wonder that enough of energy is left in to stand the bath of fire, water, and the subsequent heat of the annealing furnace to have any of the original life of the steel left in it. And, in fact, there is little of the *vivre* of the original metal left when the steel pen has done its brief duty. It would be much more sensible to gather up the oxidized scales from about the smith's anvil for making into "watch springs and knife blades" than to collect rejected steel pens for these purposes.

IMPROVED QUILTING FRAME.

The Davis quilting frame is the subject of a patent issued February 6, 1883, to H. T. Davis. It is intended as a convenient substitute for the old-fashioned, cumbersome quilting bars, which required an entire room, necessitated the gathering of the feminine neighborhood, or encumbered the house for a week. Mr. Davis' invention permits the use of any sewing machine, and by its means a quilt or a comfortable may be finished by one operator in two or three hours. The bars of the frame are of brass pipe or of iron pipe japanned or bronzed; the frame stands on two light legs, and may be retracted or expanded at will, and when not in use it may be stowed away, occupying but little space. The entire frame weighs but little over sixteen pounds, and, as seen in the engraving, it occupies but a small portion of the room. It is adapted not only for large articles, as coverlets, but also for cloaks, linings, skirts, and children's hoods—any article that requires stretching on a frame for quilting. These frames are made by the Davis Quilting Frame Company, 320 and 322 Broadway, New York city. Address as above for further information. See advertisement on another page.



DAVIS' IMPROVED QUILTING FRAME

Another Electrical Boat.

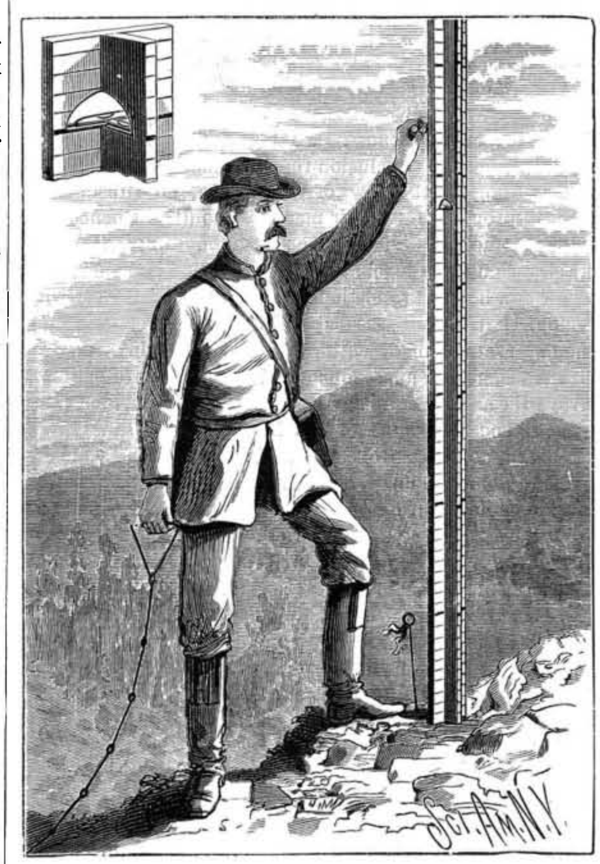
The *Moniteur Industriel* gives an account of the trial of an electric boat at Geneva on July 22. It was constructed by Messrs. Meuron & Cuénod, and was 20 feet long by 14 feet beam. The boat was driven for several hours at a speed of from $5\frac{1}{2}$ to $6\frac{1}{2}$ miles per hour, by three bichromate batteries of six cells each. The motor—which was on the Thury system—acted directly on a small two-bladed screw, there being no intermediate gearing.

THERE are in New York city 824 miles of gas pipes, 486 miles of water pipes, 391 miles of sewer pipes, $14\frac{1}{2}$ miles of steam supply pipes, and 15 miles of underground electric wires.

SURVEYOR'S LEVELING ROD.

In this invention it has been the aim of the patentee to make the use of the telescope unnecessary by placing the rod in a vertical position, as compared with as many horizontal planes as there are divisions in the rod. The rod consists of a board marked with the usual graduations, and to its center is attached another board with its plane at right angles to the first. A cross section of the rod would be shaped like a T. The outer edge of the second board is graduated to correspond with the first.

In an opening in the first board is placed a small bulb level, and in a similar opening in the second board is another



SURVEYOR'S LEVELING ROD.

level. These levels are in the same horizontal plane, but at right angles to each other, and at such a height as to be conveniently watched by the rodman. To the back of the first board is attached a handle by which the rod is held in position. When the rod is in an exact vertical position, as shown by the small levels, elevations can be made at sight in explorations, or by the aid of a spy-glass or telescope without the use of a reticule, for the reason that the division on the edge of the second or central board, which is in the same horizontal plane as the observer's eye, will coincide with a division on the other board, the two uniting to form a continuous line, thus doing away with the horizontal line in the reticule. All of the remaining divisions will form broken lines.

The rod is light and convenient, may be made in two or more pieces to obtain the desired length, and may be graduated by any system. With this rod the level can be modified by removing the leveling attachments and reticule, a horizontal and vertical movement being sufficient.

The rod has been patented by Dr. Jesus Muñoz Tébar, of Carácas, Venezuela.

Imitation Amber.

Roessler's recipe is to melt one part of rosin (colophonium), then add two parts, by weight, of shellac. When the mixture becomes sufficiently fluid one part of white rosin, that should be clear as water, is then added.

English Railways.

At a recent meeting of the American Society of Civil Engineers, a discussion by Mr. Charles Douglas Fox, of London, Corresponding Member of the Society, "On the Increased Efficiency of Railways," was read by the Secretary. Mr. Fox referred to the fact that English railway managers and engineers have long realized the great importance and economy of a thoroughly substantial road bed. The formation widths on their chief railways are now made 30 feet, both in cuttings and on embankments for the double lines, and very great care is taken to thoroughly drain this formation in cuttings by deep ditches on each side with earthenware drain pipes in them, and fill in with broken stone or other dry material. The ballast, consisting of broken stone, clean gravel, coarse sand, burnt clay, or ashes, is not allowed to be less than one foot in thickness below the bottom of the tie. For lines of constant and heavy traffic, the bullhead grade, double headed rail, having a large top member for wear, and a very small bottom member, is found to be the best section for steel rails. The weight of these rails is 84 pounds per yard. The chairs are from 40 to 46 pounds each, and the rails are secured in them by keys of compressed oak. The tendency of the English companies is to expedite traffic, both passenger and goods, not by higher rates of speed, but by reducing the number of stoppages.

The traffic lines are gradually quadruplicating their tracks —in some cases throughout, in others by sidings seven miles in length. There is a very general feeling in England in favor of identifying the driver with his engine, and holding him responsible for its working. On some lines the name of the driver is conspicuously attached to the engine. Mr. Fox forwarded also the railway regulations of the English Board of Trade, which give very minute directions in reference to the construction and running of railways.

Progress of Sorghum Sugar Manufacture.

The new Kansas Sugar Refining Company, located at Hutchinson, Kan., turned out its first batch of sugar on the 12th of September. This company has invested $125,000 in works here, and proposes making its headquarters at Hutchinson, while they will establish branch mills over the State and ship the product here for refining. The results of to-day settle all controversy about the possibility of making sugar from sorghum cane. The run to-day was a bright grade, and crystallized perfectly without the sorghum taste. The mill will be run from this on at a full capacity, which is over one hundred barrels per day of sirup. This season's product will aggregate 9,000 barrels of sugar and 7,000 barrels of sirup. All grades of white sugar will be made, but the machinery for granulating is not up yet. To run this mammoth establishment requires two hundred men day and night. The Cleveland *Leader* says the works at Hutchinson and at Sterling are both operated on the same principle, and both have met with the same successful result. Hutchinson and Sterling will soon be able to supply Kansas with her sugar.

Artificial Nourishment.

Some of our foreign exchanges relate a novel method for administering nourishment to invalids and persons with weak digestion which, it is alleged, has been practiced in Paris with great success. Diseases and enfeebled health commonly owe their origin to the imperfect assimilation of food. When the digestive functions are impaired the body is insufficiently nourished, and is unable to resist the encroachments of disease. For the maintenance of health and for restoration in sickness it is of the first importance that the food be not only of the most nourishing kind, but that it be administered in a form easy of digestion and assimilation. In a paper recently communicated to the Medical Hospital Association of Paris by Dr. Debove, he describes a form of alimentation which has attracted much attention. His system is to apply nourishment in form of powder instead of in bulk. Uncooked meat, from which the fat has been removed, is minced finely and allowed to dry in an oven at about 90° Centigrade until it becomes perfectly hard without being burnt. It is then reduced to impalpable powder by pounding in a mortar and passing through a fine sieve. The powder so obtained represents about four times its weight in flesh. The fiber and the large percentage of water contained in flesh are thus removed, and the essential properties of the meat retained and presented in a form the least difficult to digest. Other alimentary substances, such as lentils, beans, peas, etc., can be prepared in the same way.

In cases of consumption the treatment is said to have proved marvelously successful, and in general debility and nervous disorders, arising from weakness, restoration is rapid and permanent. A few spoonfuls of the powder are equal to the meal of a person with a healthy appetite. The powder, when bottled, will keep an indefinite time, and may be taken with a little milk, gravy, wine, water, or other liquid.

GALVANIZED iron pails for drinking water should not be used. The zinc coating is readily acted upon by water, forming a poisonous oxide of zinc.