ing to the company fund, or they are killed and the meat turned over to the mess. Where cows are kept, a good sum is derived from the sale of milk to the officers at the post. This money, which all goes into the company fund, is used to buy the luxuries not obtained in the regular issue—to "improve the issue," as it is termed.

In the field, in maneuvers or in actual warfare, it is difficult, and sometimes impossible, to keep the cooking outfit with the company. The rations are then issued to the men individually, and they are left to their own devices as to the methods of preparing them for meals. Each soldier has a mess kit, consisting of two tin plates that fasten together, a knife and fork, and a tin cup holding a quart. While this kit is welcomed as a means of preparing his food, the trooper finds it an additional burden, not only in the extra weight, but in the labor that must be expended in keeping the outfit clean, for they must be kept bright.

At the post these hardships are removed. The soldiers' meals are cooked by the company cook, who draws the pay of a non-commissioned officer. Everything is in the hands of the mess steward, who is assisted in his work by a dining-room orderly, a private, and the kitchen police. The kitchen police is a detail of two or three privates for duty about the kitchen. The dining-room orderly has charge of the dining room, and cares for the dishes after they have been cleaned; he keeps the pantry in order, and sets the table. All of the mess force, from the steward to the kitchen police, are excused from guard and ordinary duty.

The Current Supplement.

The necessity of lightning protection arises from the consideration of the loss which might ensue from damage by lightning to buildings and other structures. This necessity has found expression in lightning arresters. In the current SUPPLEMENT, No. 1742, the fundamental principles of lightning arresters are ably discussed by David B. Rushmore in an article entitled "Recent Developments in Lightning Arresters." F. E. Drake describes "The First American Steam Turbine," which was none other than the "Bailey Jack." "Little Things in the Shop that Save Time, Money, and Labor" is the title of an article which describes some amateur mechanical appliances. Herbert Chatley contributes an interesting article on the "Difficulties in the Construction of Aeroplanes." For a number of years the German Orient Society has uninterruptedly carried on systematic excavations in two of the most important centers of the ancient Babylonian-Assyrian civilization. This work is interestingly explained, and the results summarized by Prof. Morris Jastrow. Prof. Edgar L. Larkin gives a clear description of what is known as "Doppler's Principle" in astronomy. In an article by O. Bechstein the subject of "Artificial Drying of Agricultural Products and Wastes and Its Economical Importance" is ably handled. Guenther Schmid traces the relation of chlorophyl to light.

Artificial Nitrogenous Fertilizers.

The infant industries of manufacturing cyanamide and nitrates by electrical processes are threatening to destroy each other by mutual competition. A French writer has conceived the idea of a hydro-electric establishment capable of producing simultaneously calcium nitrate, cyanamide, and ammonium sulphate. In Frank's cyanamide process, the nitrogen of the air is utilized and the oxygen is wasted. In the Birkeland-Eyde process of producing nitrates, on the contrary, it is very advantageous to direct upon the electric arc a current of air containing an abnormally large proportion of oxygen. Again, Sir William Ramsay has recently published experiments which indicate that the production of ammonia by direct combination of nitrogen and hydrogen may soon become commercially possible. The proposed factory, therefore, would include electric furnaces, apparatus for producing nitrogen and oxygen by means of liquid air, and apparatus for the electrolysis of water. The three gases, oxygen, nitrogen, and hydrogen, thus produced would be utilized as follows:

The oxygen would be mixed with the air blown into the Birkeland-Eyde electric furnaces for the production of nitrates, part of the nitrogen would go to form cyanamide with calcium carbide, and the rest of the nitrogen would be combined with the hydrogen to form ammonia, which could easily be converted into the commercially available ammonium sulphate.

The number of boiler explosions in the United States in 1908 was 470. This compares with 471 in 1907, 431 in 1906, 450 in 1905, and 391 in 1904. The number of persons killed by boiler explosions in 1908 was 281, against 300 in 1907, 235 in 1906, 383 in 1905, and 220 in 1904. The number of persons injured, not fatally, in 1908 was 531, against 420 in 1907, 467 in 1906, 585 in 1905, and 394 in 1904. The record of boiler explosions in the United States for 41 years and three months, since October 1st, 1867, shows a total of 10,051, in which 10,884 persons were killed, 15,634 injured.

Correspondence.

MAN'S GENEALOGICAL TREE.

To the Editor of the SCIENTIFIC AMERICAN:

Few people realize the innumerable number of links which bind each one of us with our forefathers. Starting from the fact that we each have four grandparents, eight great-grandparents, sixteen great-great-grandparents, and so on, ten generations back, or a little more than three hundred years, there were 1,024 direct progenitors of each family living. Twenty generations would give over a million; and thirty generations, or about one thousand years, say from the date of the death of Alfred the Great, increases the total to the amazing figure of more than 1,094 millions.

That is to say that each family represented on earth to-day had, thirty generations back, 1,094 millions of progenitors living at that time, that is contemporaries, or of the same generation; or about two-thirds of the total number of the computed inhabitants of the whole world to-day, which is estimated at about 1,500 millions.

The thirty-first generation would give 2,198 millions, and soon, doubling with each generation until a few generations further back, long before the 5,000 to 6,000 years of authentic history is reached, which after all is but a mere fraction of the time that man has lived upon the earth, would yield a number for which there would not be standing room upon the globe; and this for *one family only*.

Some would have to be canceled as being progenitors of more than one line of descent—ancestral duplicates, as they may be called; but this would not account for many, I imagine, unless people are very much more closely related by blood than is generally considered.

On second thought, however, it may be that herein lies the solution of the difficulty. If so, it would prove that mankind are truly brethren—much more closely inbred, in a sense much more real than has been supposed.

It should seem to be not an unreasonable assumption, in view of the figures given above, that the farther back we go, the more fully was the earth peopled, instead of the reverse.

And yet historical writers—Fisher, for instance—put the total population of England under the Tudors at less than two millions.

Can any of your readers throw any light upon this subject, or show where I have gone wrong in stating the problem, which fairly puzzles me?

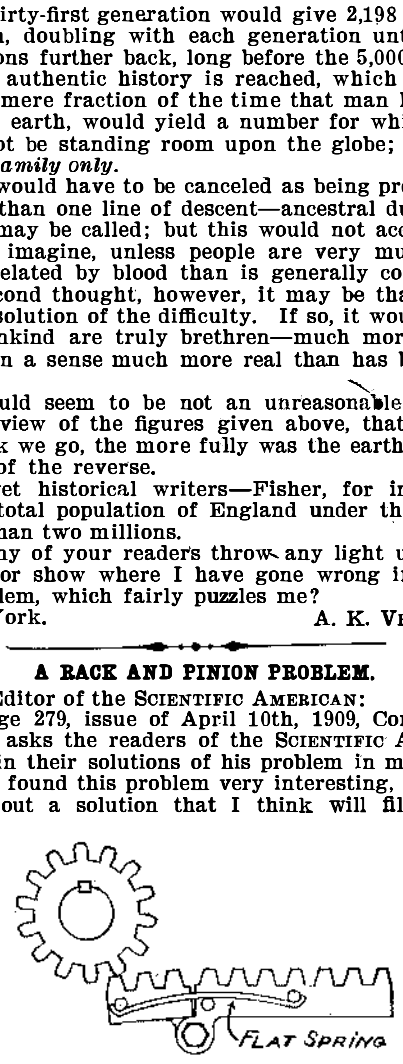
New York. A. K. VENNING.

A RACK AND PINION PROBLEM.

To the Editor of the SCIENTIFIC AMERICAN:

On page 279, issue of April 10th, 1909, Constantine Shuman asks the readers of the SCIENTIFIC AMERICAN to send in their solutions of his problem in mechanics.

I have found this problem very interesting, and have worked out a solution that I think will fill all the



requirements. In my solution I have the three teeth on the end of the rack hinged, so that if the top of one of the teeth on the gear wheel should happen to come in contact with the outer edge of the tooth on the end of the rack, instead of jamming the teeth the hinged part will swing downward, allowing the next tooth to engage with the rack. HERBERT STARR.

Malden, Mass.

SULPHATE OF COPPER AS A FUNGICIDE.

To the Editor of the SCIENTIFIC AMERICAN:

I notice in a recent number of the SCIENTIFIC AMERICAN a short article which says that the German government has failed in treating telegraph poles with sulphate of copper, and it seems they have abandoned that chemical as a fungicide.

This article leaves the reader under the false impression that sulphate of copper is not a good fungicide. The facts are this chemical stands second in the long list of germicides as to its effectiveness when used properly.

See volume i, p. 74, "Bacteriology," by I. F. Smith, published by the Carnegie Institution of Washington in 1905.

The writer treated telegraph and telephone poles over nine years ago with sulphate of copper. These poles were rotted in from one to two inches at the ground line. The decay was entirely stopped and the poles now are as good as when treated, and are still in use.

By our method, we dig around the pole at the ground line, and place a jacket around the same extending below the surface about sixteen inches. The space between the pole and the jacket is filled with a mixture of sulphate of copper or any of the well-known fungicides, with sand.

A reinforced cement is formed over the top. The natural moisture of the pole dissolves the chemicals slowly, and they are absorbed by the pole, and thus the delicate little fungus is killed.

These wood-destroying germs begin their ravages on the outside, and not from the inside of the pole. Hence by this method there is no need of deep penetration.

The difficult problem has always been to prevent outside germs from entering after those on the surface of the pole are killed. This the asbestos jacket accomplishes, and in addition prevents the strength of the chemicals from being wasted in the surrounding soil.

Canalboat builders on the Ohio Canal have been for years in the habit of placing dry salt between the ribs of their boats. It was taken up into the pores of the timber by capillary attraction and osmotic force, thus poisoning the food of the fungus. Most metal salts and the light coal-tar products have been discarded by pole preservers when the brush open and closed tank methods have been used. This was not because they were not good germicides, but because they would leach out into the surrounding soil as soon as placed in the ground.

The trouble with sulphate of copper is not that it is not a good fungicide, but it is too soluble when used by the brush or tank methods. One drop of a solution of sulphate of copper will kill all the algæ in a fish aquarium holding four gallons of water.

Circleville, Ohio. H. P. FOLSOM.

THE "NORTH DAKOTA'S" TURBINES.

To the Editor of the SCIENTIFIC AMERICAN:

In the unsigned article on the "North Dakota's" turbines in your issue of April 17th, the statement is made that in the Curtis type of turbine there is no tendency for leakage around the outside of the blades, and a comparison is made with the Parsons type, rather deprecating the latter. Leakage around the blading of any turbine is caused by a difference of pressure between the opposite sides of a given row of buckets, is it not? In the Curtis, a type of impulse turbine, the steam being expanded gradually throughout its entire course through the machine, it seems to me that there must be a difference in pressure between any two points in its course of travel, and hence a tendency for leakage. On the other hand, I have heard the same claims made for the Parsons type that this writer makes for the Curtis, i. e., the possibility of large clearances without leakage. Theoretically, the only way to prevent the tendency to leakage around the blades would be to expand the steam before striking the blades, as in the Rateau or De Laval, when there could be no difference in pressure on opposite sides of a bucket wheel, the action being due there to velocity alone. I know from my own observation that the smaller sizes of Curtis turbines are built with very small clearances, as low as 0.01 inch in some cases between rotor and stator.

In view of the unofficial reports of the coal and water consumption of the three new test scout cruisers as published, for instance, in Power for April 13th, where the Curtis turbine shows up rather poorly, are the commendatory remarks of your article referring to this type of turbine altogether justified?

I trust you will not think my remarks impertinent. I am not an engineer—yet; but only a young man seeking information and a zealous reader of your paper.

CHARLES H. ROE, U. S. N.

U. S. S. "New Hampshire," Guantanamo, Cuba.

[In the Curtis type the steam is expanded in a set of nozzles before it impinges on each set of blades, and its tendency is to pass across the face of the blades in a general direction parallel with the axis of the turbine. In the later turbines the clearance between blades and casing is large. In the Parsons type the expansion takes place within the turbine, and therefore the end clearances must be as small as possible. We shall publish the official reports of all trials as soon as they are available.—ED.]

Marble Deposits in California.

The principal deposits of marble in the United States are in Vermont, Georgia, Tennessee, and California. Extensive quarries are worked in Inyo County, California, and the existence of large bodies of marble in the desert of San Bernardino County has been known for some years; but until recently the deposits have remained untouched except at Colton, where marble is quarried in small quantities. At Cadiz, a station on the Santa Fé Railway, 240 miles to the east of Los Angeles, many varieties of marble of fine quality are found. Marble of twenty or more various colors is found in large quantity and there are smaller deposits of marble of many colors, ranging from black to pure white, with red, blue of several tints, Persian gray, and numerous other hues. The deposits also yield a beautiful black marble with figures of sea shells, named shell marble, and a black with lines of gold which is said to be found in no other region except on the banks of the river Nile. The deposits have been examined by Prof. Stephen Bowers, a geologist, and by a Tennessee quarryman, who declare that the marble is easily worked; being strong, it can be taken out in blocks of any size, sawed, and polished. Six miles from Cadiz and two miles to the west of Black Mountain is a great deposit of white marble, between 400 and 500 feet in height. The nearest point of the Cadiz quarries is only one mile, and the farthest is not more than six miles from the railroad. The country being level, the haul is an easy one. The great amount of building now going on in San Francisco, Los Angeles, and other Californian cities assures a good market for marble of high quality, which hitherto has had to be brought from the Eastern States, or from Italy, Belgium, Africa, or China.

The strength and flexibility of cotton yarn, used for weaving, can be increased by applying a dressing prepared as follows: 25 parts of white Java wax, 20 parts of cottonseed oil and 15 parts of Australian tallow are first saponified in such a manner as to produce 100 parts of soap. 30 parts of glucose, 15 parts of soda, 10 parts of manioc flour, 5 parts of zinc chloride, and 40 parts of water are mixed without heating. Equal parts of this solution and the soap are heated together, with continual stirring, to 176 deg. F. for two hours, and the mixture is then allowed to cool, the stirrer being kept in operation.