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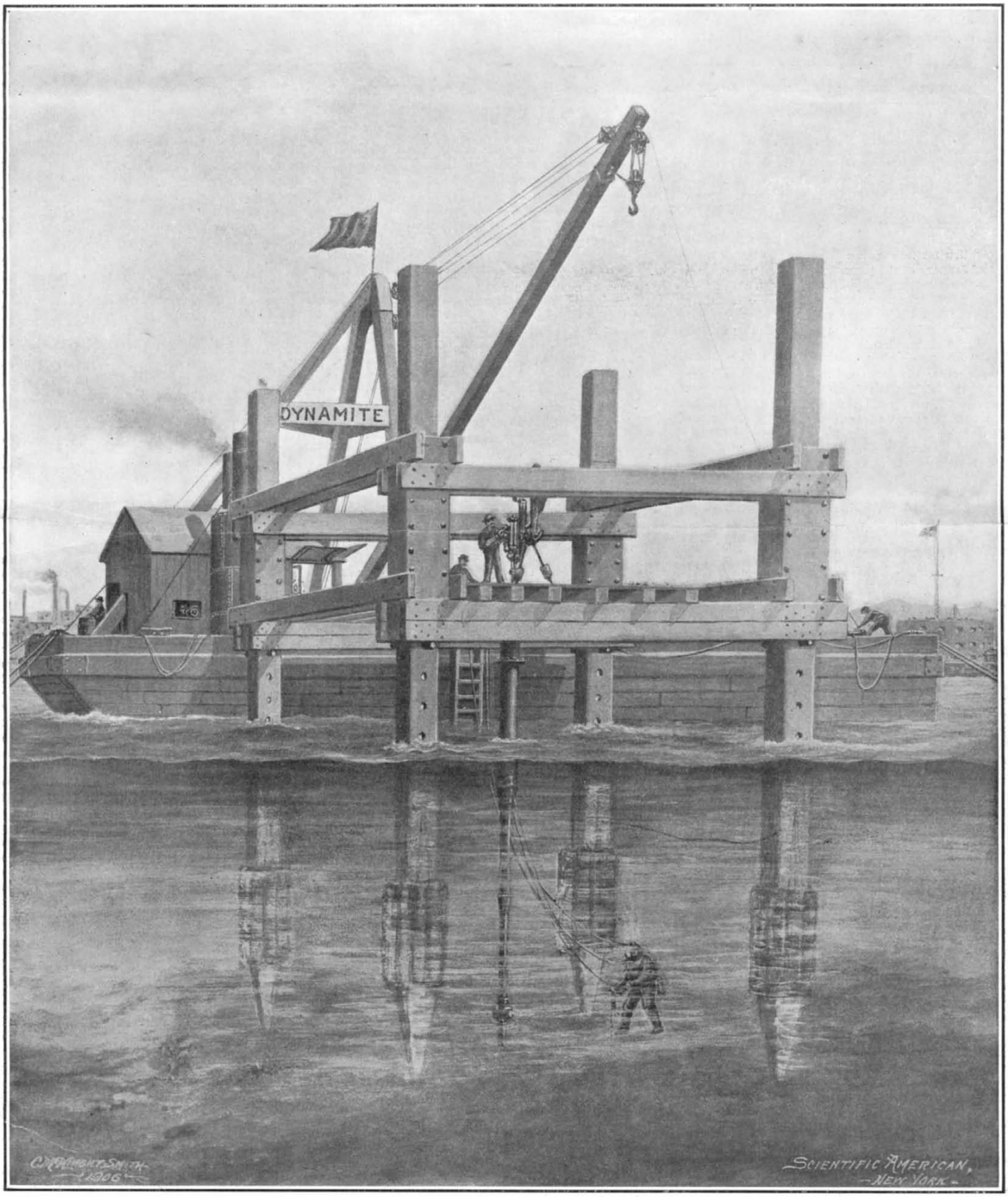

The Drilling Platform is Carried on Four Massive Timbers Sixty Feet in Length. The Drill is Inclosed in a Heavy Telescopic Pipe to Protect It from the Rush of the Tide, Which Flows at This Point at from Five to Six Miles per Hour.

BLASTING OUT A REEF IN NEW YORK HARBOR.—[See page 382.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, NOVEMBER 24, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE CONGESTION AT THE PATENT OFFICE.

There is no sign of improvement in the serious congestion that hampers the work of the Patent Office, which, more than ever before in its history, stands badly in need of a larger staff, receiving better remuneration for its services. Even as far back as the first of January of the present year, there were, in the thirty-nine divisions of the Patent Office, 17,353 applications awaiting action; while at the present writing there are about 21,000 cases on file which have not yet been examined. Moreover, the office is falling behind at the rate of from 250 to 300 cases a week.

As was to be expected, the delay is greater in some than in other divisions of the Office. In the more important divisions the delay varies from about five months, with nearly 500 cases on hand, in steam engineering, to nearly twelve months, with over 1,000 cases on hand, in the division of hydraulic motors, pumps, and sewerage appliances.

The arguments in favor of the exercise of a more liberal policy on the part of Congress toward the Patent Office are so obvious and weighty, and the appropriation that would be necessary to straighten out this miserable tangle would be so moderate in proportion to the benefit conferred, that the persistent indifference of Congress to the needs of this great institution is beyond all comprehension.

EXTRAORDINARY CONDITIONS IN THE STEEL INDUSTRY.

Rarely, if ever, in the history of modern industries, either here or abroad, has there been witnessed such an extraordinary condition as confronts the steel industry in the United States. Already the rail mills are crowded with orders to such an extent that their total output up to the end of next year will barely serve to meet the present demand; and the mills which are devoted to the production of structural steel are overloaded with work, and must be pushed to the very utmost to fill orders that are due to be delivered before the spring of 1907. Even more acute conditions prevail at the plate mills, the demand for whose output is to be attributed very largely to the growing popularity of steel cars. These mills have sufficient orders on the books to keep them going at full pressure, practically for the whole of next year. There are many evidences of the prevailing industrial activity; but none, we think, speaks so eloquently as this. Who would have predicted, at the time of the formation of the United States Steel Corporation a few years ago, that within so short a time not only that great aggregation, but also the independent concerns, would be taking orders for material which could not possibly be delivered for twelve months or more from the date of signing the contracts?

GROWTH OF THE SALTON SEA ARRESTED.

Recent reports from the locality of the Salton Sea indicate that the flow of the Colorado River from its natural channel into the Salton sink is at last under control, the recent rise in the Colorado having failed to imperil the dam which the Southern Pacific and government engineers have constructed at the break in the river's banks. Before its control the river had risen until it covered an area of several hundred square miles, and in the bottom of the depression it had a depth of between seventy and eighty feet. When the waters first reached the tracks of the Southern Pacific Railway, the latter were moved back for a distance which was thought sufficient to place them beyond danger from further encroachment. Yet it was not long before the waters were again lapping at the ties; and in spite of the fact that the tracks had been several times driven back by the ever-widening sea, the railroad, we understand, was contemplating the expense and trouble of another retreat. Recently the only indication of the original location of these tracks was the tops of the telegraph poles, which projected above the water far from the present shore line. As it is, the company was obliged to build an entirely new detour line, forty miles in length, at an elevation of about seventy feet above the old line, and nearly forty miles of the old line had to be abandoned. It is now stated that comparatively little actual damage was done to the cultivated section of the valley.

GUN TRIALS OF THE "DREADNOUGHT."

So great has been the interest aroused in the "Dreadnought," that our recent article upon this ship would be incomplete without some statement of the manner in which she behaved under the very severe gun trials to which she was recently subjected. These trials are of special interest to the naval constructor and the ordnance expert; for the former has freely predicted that when the ship came to trial, it would be found that too much had been attempted, and that the wide arcs of training through which it was claimed the 12-inch guns could be used, would have to be reduced, unless the ship were to be badly wrecked by the concussion and blast. It was freely asserted that the designed end-on fire of six 12-inch guns could never be realized, for the reason that the blast would be certain to distort the framing of the decks and vertical bulkhead forming the embrasures through which the guns, when trained dead ahead, would have to be fired; and instances were quoted where serious damage of this character had resulted to ships both of our own and the British navy. As a matter of fact, the scantling of the "Dreadnought," in those portions of the deck and superstructure that would be exposed to the blast, had been built of heavier section and weights to meet the resulting stresses; and after the gun trials, careful examination revealed no material injury to the ship. Eight of the guns were fired simultaneously on both sides of the ship, the guns being all laid at the maximum elevation of a little over 30 degrees. In spite of the fact that the aggregate energy of the broadside was 384,000 foot tons, or sufficient to raise the "Dreadnought" bodily 21 feet into the air, the roll of the ship under this heavy recoil is said to have been very slight. The forward pair of guns on the forecastle, and each pair of guns in the two turrets on the broadside, were fired simultaneously dead ahead, and each pair of guns in all the barbettes was fired on various bearings through its own arc of training; but no structural defect was revealed. Similarly, each of the guns was fired at various degrees of elevation and depression with satisfactory results. As the result of the trials, it was considered by the trial board that the whole of the ten 12-inch guns for broadside, and the six 12-inch guns for bow and stern fire, can be used effectively in any position.

THE SIZE OF OCEAN WAVES.

The latest investigation of the question of the size of ocean waves is that made by the eminent naval architect, M. Bertin, who agrees with all the qualified students of this subject in stating that the size of the largest ocean waves has been greatly overestimated. According to this authority, of the several methods by which the length of a wave may be determined, the most reliable is that of deducing it from the theory that there is a simple relation between the time of complete oscillation and the length. The longest wave of which M. Bertin has knowledge measured 2,590 feet from crest to crest, and its period was twenty-three seconds. The long waves, however, are not unusually high, and in deep water the height of a wave 2,590 feet in length would be not more than one-fiftieth of its length, or say about 50 feet. Observers, particularly those who were situated on small vessels, claim to have witnessed waves much higher than this, but their observations are not of much value, for the reason that the deck of such a vessel floats parallel to the surface of the waves instead of parallel with the plane of the horizon, and the inclination of the deck will thus give the observers an exaggerated impression of the height of an oncoming wave. M. Bertin accepts as reliable, records taken where this source of error was carefully eliminated, which show the highest waves in open water to have measured 50 feet from trough to crest, although he is of the opinion that in the southern seas waves of even greater height than this may occasionally be met. As the waves enter shoal water their period decreases and they become higher, so that on striking a shoal, a 40-foot wave will climb to a height of 50 feet or more. Should it meet an obstacle that approaches the vertical, it may easily be thrown up to a height of 100 feet or more; as at the celebrated Eddystone Light off Plymouth, where solid green water has at times been known to reach a height of 100 feet. Although the period of the longest waves may occasionally reach twenty-three seconds, and its length 2,500 feet, such waves are exceedingly rare, the common length of a long wave being something over 500 feet and the period ten seconds. The average period is from six to eight seconds, and the length from 160 to 320 feet. It is rarely that the height exceeds 33 feet.

PROGRESS OF THE PENNSYLVANIA EAST RIVER TUNNELS.

Interest has been so largely centered upon the construction of the Pennsylvania Railroad tubes beneath the Hudson River, the completion of which was recently announced, that the public is in comparative ignorance as to the extensive work which is being done by the railroad company in tunneling the East River. Altogether, four separate tubes are being driven, which are known respectively as tunnels A, B, C, and D. Of the four, tunnel A, the northernmost, is the least advanced. The tube has been driven for only about 150 feet, and the men are now beginning to get out of the solid rock into the sand and gravel. Tunnel B is the farthest advanced, the shield having been pushed out into the river bottom for a distance of over 900 feet from the shaft, which is located near First Avenue on Manhattan Island. Tunnel C is about 600 feet out from the shaft, and tunnel D a little less than 900 feet. It is gratifying to learn that the company is using every effort to protect the men from the effects of working in compressed air, a number of devices having been adopted for this purpose. The latest of these is the provision of an independent supply of compressed air for each lock; an arrangement which has the advantage that, in case of fire or accident in a lock nearer to the shore than the one in which the men are working, they will continue to receive fresh air independently of the disabled portion of the tube. In tunnel B, at a point about 500 feet from the shaft, a new bulkhead is being built for the installation of an additional set of locks. When these locks have been constructed, the air pressure back of them, that is, on the land side, will be reduced. The advantage of this arrangement is that a much smaller chamber will be maintained under high pressure, and the lowering of the pressure within the completed portion of the tunnel will afford a test of the tightness of the cast-iron tubes against the surrounding water.

SANTOS DUMONT'S LATEST FLIGHT.

A cable dispatch from Paris announces that Santos Dumont, at 4 o'clock on Monday afternoon, November 12, made a new record with his aeroplane, "14-bis," which we illustrated in flight in our last issue. This time he flew against a slight breeze for a distance of 210 meters (689 feet), or a trifle over one-eighth of a mile. The machine was in the air for 21 seconds, which corresponds to a speed of 22.36 miles per hour. Thus the machine did not show as much speed as in the previous trials, doubtless because it was flying against a slight wind. The machine showed good stability, and apparently had the capability of making a much longer flight. It also showed that it was capable of being steered with ease. M. Dumont made a sharp turn to the right, with the intention of describing a circle, but so great was the crowd of people on all sides, that, fearing for their safety, he shut off power and descended. The flight was at length made after several unsuccessful attempts earlier in the day, in which the motor failed to operate perfectly. At 2 o'clock there was a strong breeze blowing, and it was decided not to try to fly against it. By 4 P. M. the breeze had died out considerably and a number of attempts were made to fly with the wind. The machine rose in the air, but only for a distance of 270 feet. The flight occupied 7 1-5 seconds, and 82.6 meters were covered, corresponding to a speed of about 25.66 miles per hour. Finally, a flight against the wind was attempted, with the result noted. M. Dumont expects to make further trials in private, so that he will not be hampered by a crowd of spectators. He hopes in the near future to win the $10,000 prize for a flight of one kilometer in a circle. In the flight of the 12th, he won the $300 prize for the first flight of 100 meters.

While they give Santos Dumont great credit for being the first publicly to demonstrate the practicability of the aeroplane flying machine, American experimenters, who have done the most work in this line, do not believe that the stability (and therefore practicability) of Santos' machine under all weather conditions is by any means assured. The fact that he did not attempt to fly it against a strong wind, when this is just what is needed to aid in getting such a machine up in the air, shows, they argue, that he does not have much faith in its stability. Santos, on the other hand, is so elated by his success that he prophesies that aeroplanes for private transportation will soon be in use in large numbers. He admits that his present machine (which, he says, has 80 square meters, or 762 square feet, of supporting surface) is somewhat inefficient, but he thinks that others will soon be built intended for higher speed and which, with greater horse-power and less supporting surface, will be capable of transporting individuals quickly from place to place. He says that the only danger to be feared is breakage of the rudder, and he seems to forget alto-

gether that if the motor stops, the aeroplane will immediately settle down upon *terra firma.* In his enthusiasm the Brazilian aeronaut forgets also that at least three experimenters in America (Herring in 1898, Whitehead in 1901, and Wright brothers in 1903), Maxim in England (1896), and Ader in France (1897), have already flown for short distances with motor-driven aeroplanes, and yet no really practical machine of the kind has as yet been produced and demonstrated. Langley's experiments showed which was the most efficient shape of plane, and how much a given-sized plane would lift at different speeds; but with all this data to build upon, no one has produced an automatically stable machine, i. e., one with which the occupant has only to run the engine and to steer.

In view of these facts, we do not look for the sudden perfection of the aeroplane flying machine. The public successful flight of Santos Dumont will increase the interest in such machines, and stimulate inventors to further research and experiment in the science of dynamic flight without buoyant gases.

WHAT DO THE BIRDS EAT?

BY HELEN LUKENS GAUT.

In order to determine the harmful or beneficial relations of birds to agriculture, horticulture, and all plant life, a remarkable work is being carried forward by Prof. F. E. L. Beal, who is in charge of the Division of Economic Ornithology of the Biological Survey, United States Department of Agriculture at Washington, D. C. Prof. Beal has alone examined over thirty thousand bird stomachs, the greatest work of the kind ever accomplished by a single man, while his assistants have examined an equal number, making over sixty thousand in all. A seemingly endless task it is, investigating with a microscope each minute particle in each of these thousands of stomachs, yet all this has been accomplished in a period of seventeen years. When one considers that to do this intelligently and successfully requires a thorough knowledge of the anatomy of bugs and insects, and a familiarity with characteristics of the seeds of both domestic and wild plants, the labor assumes formidable proportions to the uninitiated. To increase their knowledge, workers in this line must spend much time in woods, gardens, and fields, studying hundreds of species of insects, worms, and bugs. The results of these investigations, which are invaluable to science, and of great practical importance to the American farmer, have led to a movement that can intelligently favor the increase of such bird species as are best adapted to preserve the proper balance of nature, and reduce the number of those that prey too greatly on the products of orchard and field. Ornithologists from all parts of the country, and in many instances special field agents who have been engaged for the purpose, forward great numbers of bird stomachs to the department, and thus aid in the practical and scientific research.

It is difficult, almost impossible, to determine what a bird eats by his actions, as he frequently goes through all the motions of eating a hearty meal without taking a thing. The "proof of the pudding" is found in the bird's stomach. If he is loaded with garden seeds, cultivated fruits, or beneficial insects (parasites on other insects), he is relegated to the black list; but if examination reveals a goodly number of bugs, worms, and insects that are injurious to plant life, he is hoisted high upon the pedestal of usefulness, and woe betide the human who does him bodily injury, or tries to besmirch his character.

The contents of a bird's stomach consist of a pulverized, soggy mass, and it is necessary to separate and study each minute particle in order to determine to what species of fruit or insect it belongs. Caterpillars are sometimes recognized by their skins, always by their jaws, and the tiny chitinous plates that surround the breathing holes. The presence of ants and wasps is discovered by the hard thorax, spiders by their mandibles, and sometimes by their eyes, which sparkle in the stomach mass like rubies. Angleworms have hard, indigestible spicules, which project from their sides. Beetles have fierce bony jaws, grasshoppers hard mandibles and tiny leg-armor plates, and so on through the entire insect world. The greatest difficulty is experienced in determining the species of fruit found in stomachs. Usually it is crushed, and if it contains no seed, the only method of examination available for the investigators is to place particles of skin under a microscope and discover the texture. Grain can be recognized by the shape of the starch granules when other methods fail.

"Most astonishing things have been found in the stomachs of birds, everything but diamonds," says Prof. Beal. "A bird stomach which had been kept in alcohol for two years, waiting its turn to be examined, contained poison oak berries, which are the favorite food of many birds. The man who examined this stomach was badly poisoned. Vicious and deadly-poison spiders constitute a favorite bird food. The mere touch of a blister beetle would scorch the flesh of a human, yet in the stomach of one king bird, fourteen of these fiery creatures were discovered. Caterpillars with stinging spines, beetles with acrid secretions that are bitter and burning, bugs with an odor so fierce that a skunk is fragrant in comparison, and fruit bitter and rasping as quinine, and thousands of other obnoxious things, are consumed greedily by the feathered throng."

While sojourning in some localities, certain species may do inestimable damage to crops, after which they migrate to other fields, where they charm with their sweet music, their good nature, and their innocent and harmless demeanor. For instance, the bobolink ravages the rice fields of the South, annually destroying millions of dollars' worth of rice; then, as if remorseful, he wings his way to the North, where he is thoroughly well-behaved, where, with his sweet voice, immaculate decorum, and his propensity for eating bugs and other insects injurious to crops, he earns an enviable reputation. But after the fashion of "Jekyl and Hyde," his methods change with abruptness, and he becomes an incarnate fiend when he returns to the southern rice fields. So great a pest is he to the planters, that in one season 2,500 pounds of gunpowder were used on one plantation in an attempt to reduce his numbers.

After examining hundreds of linnet stomachs, the investigators have passed the verdict that this bird is an abominable pest, with but few redeeming qualities. He ignores insects that are injurious to plant life, and gleans his living by robbing the wealth of orchard and field. He works with systematic energy, defoliating trees, eating fruit, and scratching up seed. He is a cheery, well-groomed little fellow, but he is wicked, deserving all the bad names and gunshot bestowed upon him. Birds are most seriously harmful to crops when a single species is super-abundant in a certain locality, and there is no remedy other than an unsparing use of powder and shot, else orchards will be devastated, the labor and hopes of the farmer be lost, and families left financially destitute.

Crows do immense damage in New England corn fields, and about the only method of protection is to tar the corn before it is planted. The efficiency of this scheme was demonstrated by Prof. Beal, who planted several acres to corn. Toward the end of the planting the supply of tar ran out, and he was compelled to finish without it. The areas planted to tarred corn were ignored by the crows, while the untarred patch furnished a glorious picnic ground for the croaking banqueters. Though crows are ravenous corn eaters, it is stated that this fault is more than counteracted by their usefulness in destroying harmful insects. In one crow's stomach the investigators found the mandibles of ninety grasshoppers, showing that these birds are partial to such food. Robins steal fruit with a vengeance, and many an eastern farmer has been near distraction because of the ravages of these birds. It has been discovered, however, that they prefer wild fruit, and that whenever it is obtainable they scorn fruit that is useful to man. In the stomachs of three hundred robins were found the seeds of forty-two species of wild fruits, and only four or five domestic. Because of this preference, the department suggests that wild fruits be planted in close proximity to orchards, so that birds may be attracted and kept out of mischief. As many of these wild growths are ornamental, the advantages of having them about would be doubled.

Woodpeckers are both harmful and useful. The good they do is in excess of the injury. Flickers thrive on ants. In a single stomach were found five thousand of these little pests. The ants best liked by the flickers are those that befriend plant lice, carrying them from one growth to another, as each becomes defoliated. The red-bellied woodpecker, common in the north of Pennsylvania, causes some disturbance in the orange groves of Florida by pecking holes in the ripe fruit. The yellow-bellied woodpeckers, indigenous to the northern part of the United States and the Alleghany Mountains, have an exasperating trick of girdling trees, and pecking holes in the trunks in order to obtain a sap that exudes from the bruises. They also eat insects that become imprisoned in the glutinous sap.

On expanding leaves and flower buds plant lice accumulate, and most of the warblers perform a work of benevolence for the farmer by going over orchards systematically, and gleaning the offensive and destructive insects. They are indefatigable insect exterminators, and are of great value to the world of agriculture. Meadow larks and cuckoos are helpful, and have no black marks against their names in the ornithological records. The worst insect enemies of the fruit grower are caterpillars, cankerworms, fall webworms, tussock moths, and codling moths. All these creatures the cuckoos dispose of with gusto and dispatch. Few other birds will eat the hairy caterpillars, because the stiff hairs pierce the inner lining of most bird stomachs, and produce discomfort. But the cuckoo experiences no bad result, though sometimes his stomach is completely furred with these hairs. As the food rotates in the stomach, these hairs are brushed round and round like the silk nap of a silk hat. In the stomach of one cuckoo the remains of two hundred and fifty tent caterpillars were found. Bushtits and other small birds are found invaluable for ridding orchards of scales and minute insects that destroy the value of crops. The microscopic eyes of these birds detect the tiniest insect eggs and every species of life, and they perform tasks in insect extermination that would be impossible for man. It is said they can be attracted to orchards by hanging meat on trees.

Hawks and owls are useful to orchardists, for they prey on gophers, ground squirrels, field mice, rabbits, and many other rodents that do great mischief in girdling trees and stealing seeds. True, these birds sometimes feed on small birds and poultry, but their chief food consists of harmful rodents. This was proved by examining two hundred and seventy stomachs. Out of the seventy-three species of these birds to be found in the United States, only six were found to be really harmful. Some States have offered bounties on hawks and owls, while rabbits are allowed to go their mischievous way unmolested. Rabbits are found to be of more harm to farmers than they are of value as food. Owls and hawks are helpful, and it has been suggested that the bounty be placed on the head of the erring rabbit, and removed from those of the enterprising birds.

SCIENCE NOTES.

Free ammonia in water always indicates organic matter in the process of decomposition. In polluted surface waters it is rarely high, being removed almost as fast as formed by vegetable and animal organisms in the water, and an amount of nitrogen as free ammonia above 0.05 milligramme per liter is unusual, and if it does occur the water cannot be considered as an unpolluted water unless that fact is clearly established by other data.

According to the recent experiments which have been made by Prof. Niccolo Vaccaro, connected with the physical department of the University of Genoa, relating to the spectrum of nitrogen in a magnetic field, he finds that when applying the field so that the lines of force run transversely through the tube containing the rarefied nitrogen, in which the electrodes for the discharge are placed at each end of the tube, the phenomena vary to a considerable degree according to the pressure in the tube, the latter being connected to an air-pump. The present researches, which were made with considerable detail, show in general that when using pressures which are relatively high, the spectrum in the tube of rarefied gas increases both in luminous effect and in the number of lines under the influence of the magnetic field. But for very low pressures the effect is seen to be clearly inverted, and the magnetic field has a weakening effect. He finds that there is a critical point at which no effect is observed from the field, and this is at a pressure of 0.02 inch of mercury in the tube. At this point the magnetic field has no appreciable influence upon the spectrum of the rarefied gas.

A French chemist, L. Ouvrard, has formed a series of new compounds, the boro-stannates of the alkaline earths. He has also succeeded in reproducing the mineral nordenskioldine by artificial means. Researches upon the metallic borates led him to form the boro-stannates by different methods, and among these is the boro-stannate of calcium, which is identical with the above-mentioned mineral. First, he tried by fusion, in chloride of calcium, of a mixture of boric acid or borate of lime and broxide of tin. Here the reaction is not decisive, and no doubt there results a chloro-borate. A better method is to mix in a platinum trough, the precipitated borate of lime, corresponding nearly to CaO, $2B_2O_3$, with a small quantity of broxide of tin coming from the calcination of meta-stannic acid. The trough is placed in a porcelain tube and brought to a white heat, while passing a slow current of hydrochloric acid vapor. After three-quarters of an hour he finds a melted opaque mass, covered with hexagonal scales, some of which are also deposited upon the trough. These scales, when isolated, are found to be the boro-stannate of calcium B_2O_3, SnO_2, CaO. This body is colorless and transparent, and not easily melted. It scarcely dissolves in hydrochloric acid, even when concentrated. The crystalline scales are fragile, with a glassy lustre, and resemble the natural mineral. Some of the largest ones are 0.05 inch wide and 0.0004 thick. This compound is identical with the mineral nordenskioldine, which was described by Brügger in 1887. By an analogous process, he was able to form the corresponding compounds of strontium and barium. These, however, are more difficult to produce. Using as above a current of gaseous hydrochloric acid at a red heat he obtains some scales of boro-stannates mixed with numerous crystals of casserite. By reacting upon stannic chloride the results are generally better, and he was able to form the new compounds of barium and strontium in a nearly pure state. These are crystalline bodies having about the same appearance as the calcium compound.

COOKING WITHOUT FIRE.

BY GEORGE J. JONES.

The fireless cookstove is not exactly a new thing, for its economies and conveniences have been known to the people of an out-of-the-way portion of the German empire. Only a year or two ago some ladies of that country had their attention attracted to the fireless cookstove, and they became so interested in it that an organization was effected for the purpose of making the women of the country generally familiar with it. In this manner one of the United States representatives in Germany heard of the scheme, and reported on it. This attracted general attention in this country, and the supply of government pamphlets was soon exhausted.

The system is based on the fact that a perfectly insulated vessel containing meat or vegetables and a proper supply of water will continue to cook for a long while after once having been brought to the boiling point. The operation of cooking proceeds just the same as if it were directly over the fire, except that it is much slower.

This apparatus was known as the hay box in Germany, and consisted of a crudely constructed box, which was insulated in that it was lined with some cloth or other material which happened to be convenient and then filled with hay. The article to be cooked was placed over a fire for a short time, a minute or two, and then quickly transferred to the hay box, where it was placed in a sort of a pocket made in the hay. Here the cooking continued slowly without any further application of heat or any attention.

The subject was called to the attention of the President, and he directed that the hay box be experimented with by the Commissary Department. This was done at Fort Riley, Kansas, under the direction of Capt. M. S. Murray with the assistance of Latrobe Bromwell, instructor of the school of army cooks at that place. These experiments were very successful, and the scheme was heartily indorsed. A box suitable for army use has been designed, and it is likely some great changes in the conduct of the company kitchen are about to be made.

This method of food preparation has been recently made available for domestic use by the introduction of the cooking cabinet. In the main this is nothing more or less than a well-constructed box of oak, thoroughly insulated to keep in the heat. It is thirty-six inches long, fifteen wide, and seventeen deep. It is equipped with three enamel vessels of a construction especially designed for this character of work, having covers which are clamped on to further facilitate the retention of the heat. The lids of these vessels are held on by a revolving bar-lock device, which not only makes a hermetically tight joint, but also acts as a handle. One of these three vessels is of eight quarts capacity, and the other two four quarts each. After the viands in the kettle have been exposed to the heat of the stove until boiling has taken place for a minute or so, the lid is clamped into place, and the whole pot transferred to one of the pockets of the cooker.

The actual time consumed in the preparation of food by this process is about double that ordinarily required, but the food may be left in very long and will not be overdone. The saving of fuel resulting from the use of the cooker is considerable, and the burdens of the housewife are about halved.

Steps of Trolley Cars.

A recent number of the Electrical World says that the New York State Board of Railroad Commissioners has received many complaints from women in reference to the excessive height of the car steps on the street surface roads in that State. It was decided by the Commission that a remedy could be more quickly obtained by a conference with the managers of the different roads than by recommendations to individual companies against whom the complaints have been received. For this reason the matter was brought to the attention of the New York State Street Railway Association, which at its last convention appointed a committee to consider the subject. This committee has reported to the Association that the preferable maximum height between the top of the rail and the first step of all cars of the box type with 33-inch wheel is 18 inches, with a minimum height of 14; that the maximum distance between the first step and the car platform be 15 inches, with a minimum distance of 12; and that the maximum distance between the car platform and the top of the floor of the car be 10 inches, with a minimum distance of 8. "It is the opinion of the committee that an ideal condition would call for a height of 17 inches from top of rail to the first step, and from the first step to the platform, 14 inches, and from the platform to the floor of car, 10 inches, making a total distance from top of rail to floor of car, 41 inches. It is also recommended that the tread of all steps be not less than 10 inches."

Latest Form of the Fireless Cooker.

A CURIOUS CHEMICAL EXPERIMENT.

BY GUSTAV MICHAUD, D.SC.

To keep an egg continually rotating in the midst of a liquid mass, without ever allowing it to come up to the surface or to fall down to the bottom, is a feat which does not seem easy to perform. Owing to a peculiarity of the composition of the shell the experiment is easily made, and will afford entertainment as well as impart some knowledge.

The eggshell contains a considerable amount of calcium carbonate, and will evolve carbon dioxide gas when submerged in a solution of hydrochloric acid. The reaction differs, however, from that which takes place under similar circumstances with ordinary limestone; the organic matter which enters in the composition of the shell causes most of the gaseous bubbles to remain attached to the egg. They increase its bulk, and hinder the contact of the acid with the shell to such an extent that a solution which would in a few minutes consume a piece of marble the size of a nut, takes several hours to dissolve the thin shell of an egg. The phenomenon is most interesting to observe when produced by means of the following apparatus:

Take a glass jar and half fill it with water. Then, by means of a glass tube which reaches to the bottom of the jar, pour an equal amount of hydrochloric acid under the water, as shown in Fig. 1, until the water rises to the top of the jar. If no effort be made to mix the two liquids they will remain neatly separated for days, the density of commercial hydrochloric acid being greater than that of water. Let an egg sink gently into the water. It will pass through it, reach the hydrochloric acid zone, and there almost instantaneously become covered with a thick layer of bubbles. These decrease its density and prevent its farther downward progress. The egg does not come up to the top, however, but settles on the dividing line between the two liquids. There it begins to revolve slowly around its greater axis, and will keep up that queer motion for more than an hour. The bubbles on the top of the egg gradually dissolve in the water, while they increase at the bottom, which is nearer the acid. The double process continually raises the center of gravity of the egg, and its rotation is due to this continued alteration.

Fig. 1.

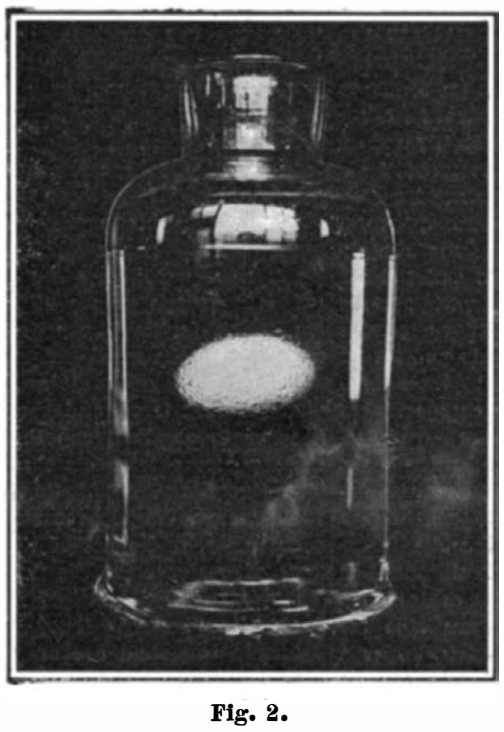


Fig. 2.

HOW TO KEEP AN EGG CONTINUALLY IN ROTATION IN A LIQUID WITHOUT ALLOWING IT TO RISE TO THE SURFACE.

Chinese Wood Oil.

Investigations by W. B. Hemsley at the Kew Herbarium (Bull. Kew Gardens) have led him to the conclusion that the wood oil, or "tung oil" of China, which it has heretofore been supposed was obtained from the seed of Aleurites cordata, is not derived from that species, but from another, to which he has given the name of Aleurites fordii, Hemsl., and has figured in Hooker, Icones Plantarum, t.t. 2,801 and 2,802. In this species the flowers are developed before the entire leaves, the styles are shortly bifid, and the apiculate capsule is not wrinkled. It is found in the Chinese provinces of Chekiang, Kiangsi, Fokien, Hupeh, and Yunnan. Aleurites cordata, R.Br., is, however, found in Japan, Formosa, Hainan, and Tonking, but apparently does not occur on the mainland of China. It has narrower petals, deeply divided styles and a wrinkled fruit. Shirasawa, Iconographie des Essences Forestières, vol. I., p. 93, treats this as a cultivated tree of Japan. Aleurites triloba, Forst., occurs in Malaya and Polynesia, and is naturalized in many other tropical countries. The seeds of a fourth species, A. trisperma, Blanco, were imported into Liverpool in 1891 and 1897 under the name of "Balucang," and are so much like those of A. cordata that they have been mistaken for them. There is no doubt that A. cordata yields a similar oil (probably in Japan and Cochin China). According to Dr. A. Henry, Aleurites fordii succeeds best in barren, rocky places where farming cannot be carried on, the soil being very thin. It grows where the temperature rises to 100 deg. F. in July, and where the snow lies on the ground for days in winter, but where severe frosts are unknown. It succeeds also in tropical regions. The oil is made in two qualities; the kind usually exported is cold-drawn. It is used in central China for varnishing, and for lighting purposes. The inferior quality, which does not appear to be exported, is extracted by heat and pressure, and is thick, blackish, and opaque. It is used for making putty for calking boats, etc. The wood oil is said to be sometimes adulterated with oil expressed from the seeds of a kind of soy bean, Glycino hispida, Max., which seriously affects its drying properties.

Timber Testing at Purdue.

A long series of experiments has been completed at Purdue University affecting certain processes to increase the life, strength, and physical qualities of timber. These processes are regarded necessary because of the steady diminution of the timber supply. The feeling is prevalent that everything possible should be done to increase the durability of the timber that is now being used for various purposes. The experiments at Purdue have been made chiefly in the interests of railroads by making mechanical tests of the ties treated by different processes. Over 400 ties were used, and upward of 600 tests were made. The timber-testing laboratory at Purdue is the one used by the government at the St. Louis Exposition.

There are now over 700 motor omnibuses owned by London companies. According to the Commercial Motor, 469 of these were in service on October 4th, over 200 being in the repairers' hands.

A NEW APPARATUS FOR THE COALING OF WARSHIPS.

BY OUR BERLIN CORRESPONDENT.

An apparatus for the coaling of warships on the high sea, based on the principle of the Miller apparatus used in the American navy, has been recently invented by Georg Leue, a Charlottenburg engineer, and has just been submitted to severe tests in the German navy. The apparatus comprises: 1, an endless rope for transferring coal bags from one ship to another; 2, a "compensator" station; 3, a reversing station; 4, a "compensator" to account for the variable position of the endless rope; 5, a driving mechanism connected with the compensator, to move the end of the rope; 6, the "elevator" installed on the coal ship, which lifts the sacks up to the ropeway; 7, a slipping device for throwing off the end of the rope in case the towing rope should break, or when the coaling is finished; 8, the sack hooks with the sacks; 9, the chutes on which the sacks slide down upon the deck.

In starting the apparatus, the towing rope is first brought out, after which the endless rope is reeved. The slip rope is passed over to the other ship and fastened there to a block. The proper sag of the endless rope is next fixed by easing off the towing rope, and the motive agent (compressed air, steam, or water) admitted to the compensator, thus stiffening the endless rope. The driving motor is next started, when the rope, and with it the elevator, begins to run, and the whole outfit will be ready for operation.

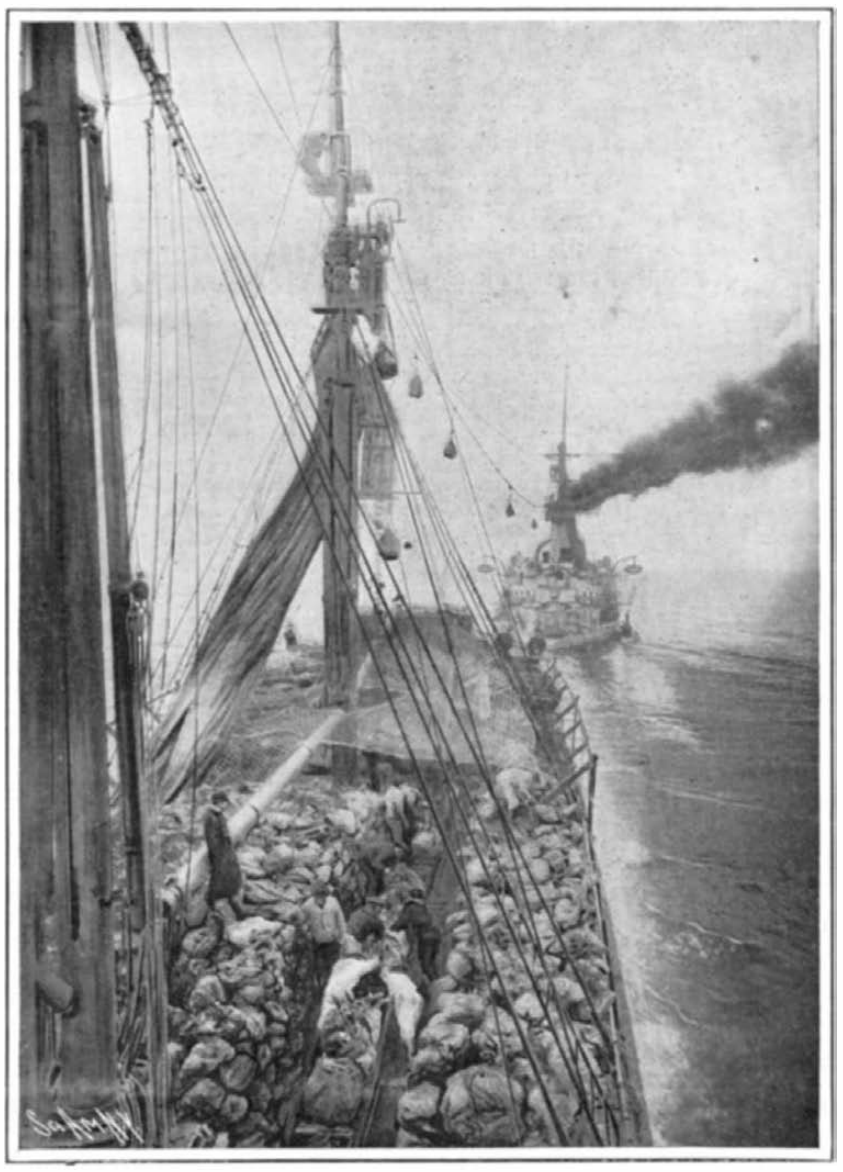
The sacks, provided with hooks, are hung on the elevator installed on board the collier, and after having been raised, remain firmly attached to the rope. During the rotation of the endless rope they arrive at the mast of the other ship, and there are automatically detached from the rope, falling into the chute and sliding down upon the deck, where they are emptied. Several empty sacks having been put into another empty sack, are conveyed back to the coal-ship on the endless rope.

Owing to the motion of the ships and of the sea, the tension of the towing rope is submitted to great variations. The conveying rope connecting the two ships would share this movement even in an increased measure, so as to render any hauling impossible. To obviate this drawback and to maintain the proper tautness of the conveying rope, there has been provided the apparatus called the "compensator." This is of a similar construction to a tackle, and releases the rope by a multiple of the distance to which the pulleys approach each other, drawing it in in a similar manner by a multiple of the distance to which the pulleys are drawn away from each other. The pulley systems are united by cylinders sliding inside one another and in the interior of which a certain pressure is maintained, counteracting the tension in the rope. If this tension augments, air escapes through a maximum valve, and the systems of pulleys approach one another until the pressure and tension accurately counterbalance each other, while just the opposite process takes place when the tension in the rope is lessened. The apparatus thus tightens or relaxes the rope to the extent of 200 feet and more. If the towing rope should break, the endless rope is thrown off automatically, as the slip rope being tightened actuates the releasing mechanism of the reversing pulley, tilting this over, so that the rope springs out of it and is also thrown out at the reversing station. The rope itself falls into the water, whence it is withdrawn. The ships then are quite separated.

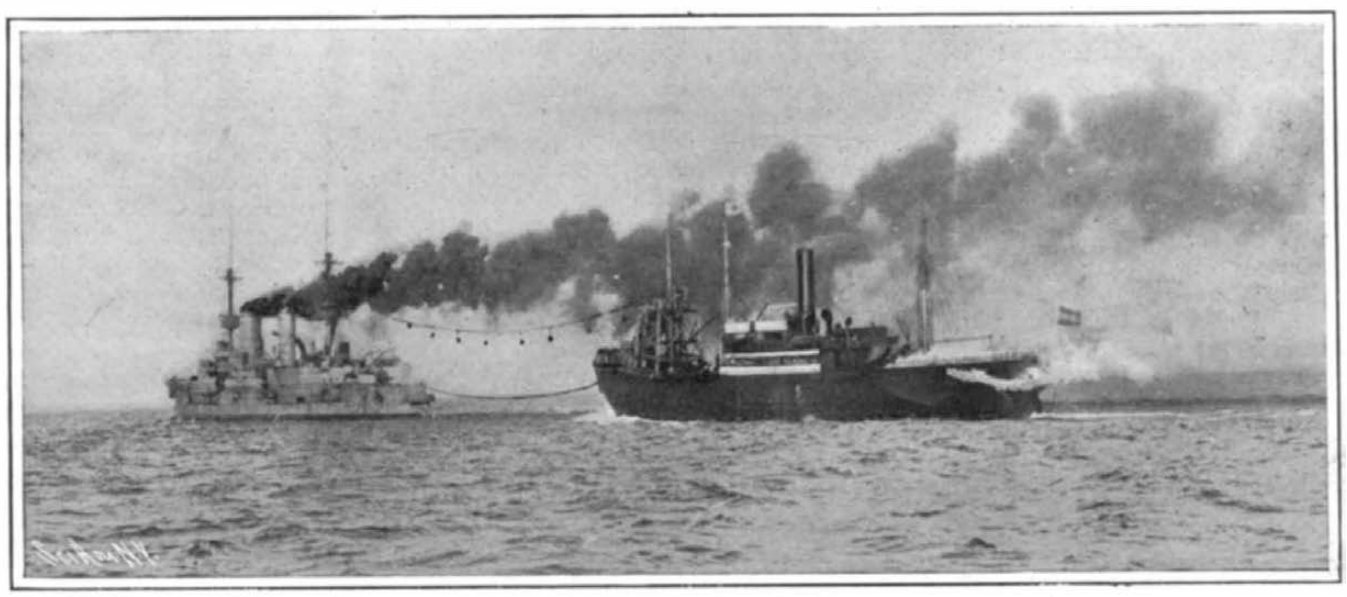
After the coaling is finished, the endless rope can also be thrown off by hand, by pulling at the slip rope. As the stations on the mast adjust themselves automatically to the relative position of the ship, sheerings up to 45 deg. in either direction are of no influence whatsoever on the working of the apparatus.

An interesting series of trials was carried out in February last in the German navy between the armored cruiser "Prinz Heinrich" and the collier "Hermann Sauber," chartered by Mr. Leue. On February 17, while there was little wind and a smooth sea, as much as 56 tons of coal per hour were transferred to the "Prinz Heinrich," which towed the collier at a speed of 11 knots per hour. The weight of each coal sack was 250 pounds. On the 22d of February these experiments were continued in very bad weather with a strong gale and very rough sea, during rain and snow storms, while the ships were sailing at the same rate of 11 knots per hour. During the first two hours 105 tons of coal were transferred to the "Prinz Heinrich," which figure, according to the opinion of experts, might however have been easily increased up to 60 tons and more per hour, had there been a greater number of sacks and more men available on board the warship, so as to allow the arriving sacks to be more rapidly emptied.

The apparatus, from the time the rope was shot off until the first full sack of coal was transported, was got into working order within 24 minutes. This has not been approached by previous inventors.



Placing the Bags on the Conveyor.



The German Armored Cruiser "Prinz Heinrich" Coaling at Sea.

A NEW APPARATUS FOR THE COALING OF WARSHIPS.

Who Owns the Prescription?

In certain States where prohibition laws are in force the pharmacist is compelled under penalty to retain prescriptions for spirituous liquors and to refrain from refilling them; and in one or more other States this restriction is applied also to morphine and cocaine.

Now, the pharmacy law of Rhode Island (unless it has been recently amended in this particular) requires the retention of the prescription by the dispenser, but it also provides that a copy of it must be furnished free of expense to either the writer, or the "purchaser" of it, whenever demanded. With these exceptions there are no statutes which bear on the subject.

The Rhode Island law, it will be noted, while it makes the dispenser the custodian of the prescription, does not prevent the patient from still making use of it—the copy is, of course, practically the same thing as the original.

Magistrates have decided the question of ownership both ways; and there have been rumors from time to time of decisions by the higher courts settling the matter, but there is no such decision on record; and although the subject has been discussed with considerable frequency, no one has yet given us a reference to one.

Usage favors the pharmacist in this country as being the proper custodian of the prescription, but abroad this is quite the reverse. If a customer demanded from a pharmacist the return of a prescription which had been retained by him, a successful legal resistance of this demand might turn somewhat on the motive of the refusal. If it were shown that the pharmacist was in the habit, as is usually the case, of refilling prescriptions at the request of the patient, and that consequently his refusal was not a matter of public policy—an effort to protect the ignorant from the dangers of self-prescribing—but merely intended to compel future custom, a court and jury would not be likely to sustain his refusal.

In view of the many evils resulting from the application of medical advice intended for one condition to another perhaps totally different—even extending to the "lending" of prescriptions to sick friends—it would be to the advantage of the community if the refilling of prescriptions without the authority of the physician could be prevented. Perhaps this could be constitutionally done by law on the ground stated, but until it is, the patient will have rather the stronger side when there is a dispute about ownership.—The Druggists Circular and Chemical Gazette.

A motor-driven rail mill is in operation at the Edgar Thomson plant of the Carnegie Steel Company at Bessemer, Pa. It is equipped with two 1,500-horse-power, 30-pole, 220-volt, direct-current motors overcompounded 15 per cent, which operate at from 100 to 125 revolutions per minute. Each motor carries a 125,000-pound cast-steel segmental flywheel which relieves it from the extreme shocks of rolling. The power delivered by each motor ranges from 950 to 1,450 horse-power in rolling rails, with occasional jumps to 1,700 horse-power; the friction load on the mill running light is estimated at about 500 horse-power.

A wind pressure of 30 pounds per square foot is specified in the New York building laws for buildings more than 100 feet high, with an allowable unit stress of 50 per cent more than for dead or live loads. Fowler gives 20 pounds for buildings less than 20 feet high and 30 pounds for buildings 60 feet high; with no extra allowable unit stress.

BLASTING OUT A REEF IN NEW YORK HARBOR.

Some few years ago, when the cruiser "Brooklyn" was passing through the fairway to the southwest of the Battery, the ship being fully equipped with stores, etc., and therefore at her maximum draft, she grounded quite heavily upon some obstruction, and received injuries which necessitated her docking at the Brooklyn navy yard, where extensive repairs had to be made on her damaged bottom.

As there was supposed to be an ample depth of water at this point, it was presumed that the ship had struck some sunken barge or vessel, of which no record had been kept. Subsequent examination of the locality, however, developed the surprising fact that at this point there was a reef of rocks where the channel shoaled from its normal depth of 40 to 45 feet to a least observed depth of 28.6 feet at mean low water. Complete soundings were made of the reef, and its contours established. The projecting mass of rock, which is of the same gneiss which underlies New York city, was found to vary from 32 feet in length by 25 feet in width at the 30-foot depth, to 200 feet in length by 77 feet in width at the depth of 40 feet, where the total area was found to be about 10,160 square feet and the total amount of rock to be removed was estimated at 1,450 cubic yards. Tenders for the removal of the rock were invited, and the contract was let to J. B. Miller, of this city, to whom we are indebted for assistance in the preparation of the present article.

The task of removing the rock is rendered unusually difficult by the depth of the water and the velocity of the currents, which vary from 5 to 6 miles per hour. Furthermore, the blasting and dredging operations have to be carried on at one of the busiest points in New York harbor. The reef is about 1,000 feet south by west from Pier A at the entrance of the North River, where it lies in the track of both the incoming and outgoing traffic from the North River docks and also directly in the way of the even heavier traffic which passes around the Battery between the North and East rivers. The most difficult task was that of drilling, and to expedite this work the contractor devised the movable platform which forms the subject of our front-page illustration. It consists of four massive spuds, each measuring 16 x 16 inches on the side, and 60 feet in length. These are pointed at the bottom, and weighted with iron in order to overcome the buoyancy of the timber at the greater depths. The working platform is carried upon four movable spud boxes, which are built of 4-inch yellow pine, strongly bolted together and adapted to slide vertically upon the spuds. A heavy framing of 4 x 6 waling pieces connects the spud boxes at their upper and lower edges, and upon the lower framing is laid the working platform from which the drills are operated. The platform is supported upon the spuds by means of 1½-inch steel pins, which are placed in holes bored through the spuds. From this description it will be seen that the contractor had at his disposal a platform whose legs could be readily adjusted to the uneven surface of the reef.

The drilling was done by a 5½-inch Ingersoll special submarine drill, steam being supplied from a scow moored alongside the working platform. When operations first started, it was found that the rush of the tides was so swift that the steel drill was bent as much as 7 inches out of line by the pressure. This condition was met by providing a heavy telescopic cast-iron pipe, which varied from a diameter of 4 inches at the bottom to 12 inches at the platform. The pipe was lowered down to the rock, and provided a shield within which the drill was operated without any further trouble from deflection.

The current was found to be strongest on the last of the ebb tide after heavy storms of rain, when special precautions had to be taken to keep the platform in its proper working position. Because of the heavy current, the diver was able to go down only at slack tide, which he did for the purpose of locating and charging the holes. When it became necessary to shift the platform, a scow was first floated between the spuds to receive the weight of the platform. The derrick then took hold of the four corners of the frame and lifted the weight off the pins, which were removed and the platform was lowered down on the scow.

The pins were then placed in the holes above the frame, and as the scow rose with the tide, it lifted the platform and spuds, and was moved with its load to the new position. Here the platform was lowered, and the spuds allowed to settle to their bearings, after which the pins were inserted, the scow floated out, and the platform was left in position for further drilling.

The work, which was started in the summer of 1905, has been delayed by various collisions which have wrecked the platform and necessitated repairs; but it is expected that the whole of the reef will have been blasted out and dredged away by the spring of next year, leaving everywhere a uniform depth of 40 feet at mean low water.

The Aeronautical Congress of 1906.

BY OUR BERLIN CORRESPONDENT.

An International Aeronautical Congress is being held at Berlin in connection with the twenty-fifth anniversary of the Berlin Aeronautical Association. While the first day of the congress was given up to the novel military sport of balloon hunting by means of automobiles, the second day was devoted to lectures.

Prof. Hergesell, of Strasburg, lectured on Studying the Atmosphere Above the Sea by means of balloons and kites. That old children's toy, the kite, has been developed into a most valuable instrument for scientific research. The first attempts made in this connection above land were extended to successful investigations of the atmosphere above the sea, by starting a captive kite from a vessel. The first more extensive trials were carried out from the imperial dispatch boat "Sleipner" and from the yacht of the Prince of Monaco. Great difficulties, however, were encountered in investigating the trade winds by means of kites, the raising of the latter up to a height of 13,120 feet requiring many hours. Another drawback in investigating the direction and speed of the winds in any region was found in the fact that the proper velocity of the wind at great heights is apt to be concealed by the winds set up by the motion of the vessel. These difficulties were done away with by using recording or sounding balloons, the ascension of which was found to be most rapid, and which readily reached heights of 5,248 and even 5,904 feet, while indicating the direction and speed of winds as faithfully as the moisture of the atmosphere. Special difficulties were, however, met with in the polar regions in which recording balloons have been sent up as far north as 81 deg. northern latitude.

Two recording balloons are generally connected together by a cable about 164 feet in length, from the center of which another cable branches about 80 feet, carrying the apparatus, to which another 160 feet of cable and finally a float are fitted. The whole system will rise until one of the balloons explodes, whereupon the other, unable to support the whole system, will drop until the float has reached the sea. The system being again in equilibrium, the balloon will then float at 3,280 feet above the sea, carrying the apparatus at a height of 80 feet.

Prof. Miethe next delivered a lecture on color photography from balloons and photography in the service of meteorology, and exhibited some beautiful specimens of colored cloud photographs. Aeronautics and meteorology are intimately allied, in so far as the former is a most efficient aid to the latter. The problem of taking photographs from a balloon may be said to be almost identical with that other problem of photographing clouds, in so far as the absence of any foreground in the picture in both cases requires the use of practically identical apparatus, rendering it possible to take the three views necessary for a color photograph. Colored views can be taken in a very small fraction of a second with the improved methods designed by Prof. Miethe. The views of Berlin taken from heights of 2,500 feet to 3,000 feet show the interest inherent even from a technical or military point of view to such colored balloon photographs. It may be said that color photography will possibly avail itself also of the rocket cameras which have been constructed quite recently.

Major Gross lectured on the development of motor-propelled airships in the twentieth century. The problem of the dirigible airship may be said now to have been solved, the main drawback formerly encountered being the disproportionate ratio between the capacity of the balloon and the weight of the motor. The experiments made by Santos Dumont, who traveled round the Eiffel Tower, have been continued by the Lebaudy brothers. The mammoth airship of Count Zeppelin and the Parseval airship had not so far met with the same success as those of the French aeronauts. According to the lecturer, any airship should be provided with a keel, to protect it against any rolling motion. Steam engines and electro-motors are unsuitable for the purpose, their output being insufficient as compared with their weight. Explosion motors, as used exclusively for the purpose, are still, it is true, far from being perfect. Zeppelin's airship recently made an entirely successful ascent.

It is reported from Paris that Prof. Behring has discovered a new method of sterilizing milk, without boiling it or destroying any of its essential principles. The method is based on the powerful qualities of German perphydrol, simply oxygenated. One gramme per liter of this substance is sufficient to destroy all noxious germs. Milk thus sterilized can be kept a long time, and is not injured by transportation, but cannot be drunk until it has been gently warmed and a drop of a catalytic substance added. Dr. Behring has proved that light has a very harmful effect on milk, whether sterilized hot or cold, and he recommends that it should be kept in a dark place or in red or green bottles.

Correspondence.

A "Rain Circle" at Niagara.

To the Editor of the SCIENTIFIC AMERICAN:

While at Niagara Falls the past summer, I witnessed an unusual phenomenon. I was standing on the wall at the brink of the Canadian falls in the thick of a drenching mist from the tumbling waters. It was a spotlessly clear day, and the point where I stood was on a line with the sun and the center of the cloud of mist. Here the gorgeous rainbow that spanned the falls from other points of view resolved itself into a circle, a tangent of which passed along the wall on which I was standing. The iridescent circumference extended to the upper rim of the cloud, having an apparent diameter of fifty yards or thereabout. Here was a digression from the traditional rainbow, and a "rain circle" lit up the fog-sea with a halo of the most vivid and strikingly beautiful colors. Some of the readers of your valuable publication must have been witnesses to the same phenomenon. READER.

Montreal, November 11, 1906.

Night Work on Panama Canal.

To the Editor of the SCIENTIFIC AMERICAN:

The chief difficulty with the Panama canal problem is the labor problem. Suggestions are sometimes harmless and sometimes helpful, and I therefore send forth this one: That the canal be built by night rather than by day, so as to escape the midday sun, and if the night air is not too miasmatic the plan would allow workers to be employed that could not stand the tropical sun at midday. Work two relays, commencing at 4 P. M. and working until 12 midnight, then the other relay, commencing at 12 midnight and working until 8 A. M., and all resting during the heat of day until 4 P. M. This plan would enable the negro as well as hardy laborers from our cities to stand the climate and save to ourselves the millions that our government will pay out. Let the plan be tried.

Chicago, Ill., October 30, 1906. CHARLES ROGERS.

United States Army Erosion Experiment in 1864.

To the Editor of the SCIENTIFIC AMERICAN:

In your editorial of September 15, in the article on erosion as a detrimental factor in the rifled gun problem, I wish to state that the proposition of Maxim, Vickers & Co. is untenable in practice. I will state that in 1864 there was issued to the infantry a lot of ammunition in which every tenth round consisted of a ball having at its base a saucer-shaped zinc plate, which by the impact of the charge was flattened and thereby wholly filled the bore of the gun. It presumed to act as a cleaner, and it surely fulfilled its office, as after about ten to fifteen shots of this kind the best Enfield rifle was no better than an old smoothbore musket, having so stripped the rifling that it was scarcely discernible.

In other words, the gun was draw-bored until it was a smoothbore. J. R. WILKINSON, 3d U. S. A.

Ex Reg. Artillerist, Army of the Cumberland.

Sanger, Cal., November 17, 1906.

The Current Supplement.

It is generally supposed that it is necessary to go to the Rhine, to England, or to Italy to see the stepping stones which connect the past with the present; yet in various parts of this country we have ruins of antiquities that reach far back, and with which romance and history are intimately associated. The California missions are striking examples. Mr. Charles F. Holder has taken the California missions for the subject of a vivid illustrated article, which opens the current SUPPLEMENT, No. 1612. Interesting from a medical point of view is an article on predigested and malted breakfast foods. Dr. J. D. Pennock gives some data on Mond producer-gas engines. For the purpose of contributing to the knowledge of an imperfectly investigated subject, Mr. J. Alex. Smith writes on air in relation to the surface condensation of low-pressure steam. Mr. A. J. Jarman gives some valuable hints on gelatino-chloride emulsions for gaslight developing paper. It is difficult to find a square yard of soil in which, under proper conditions of heat and moisture, seeds of some kind will not grow. This curious tenacity of life is well discussed by Mr. Craig S. Thoms in four papers bearing the general title "How Seeds are Carried." The first of these, published in the current SUPPLEMENT, deals with seeds that fly. Mr. C. F. Jenkins's paper on single-phase electric traction is concluded. Sir William H. Preece presents a very good discussion of incandescent lamps and the grading of voltages. The scientific investigation of automobile pneumatic tires is taken as a subject by the English correspondent of the SCIENTIFIC AMERICAN. Our Paris correspondent writes on light-weight gasoline motors for aeronautical work, a subject which is becoming of considerable importance in view of the recent developments in aeroplane flight. Dr. H. W. Wiley's paper on the source of industrial alcohol is concluded.

THE OPPOSITION OF MARS IN 1907.

BY FREDERIC R. HONEY, TRINITY COLLEGE.

A favorable opposition of Mars is an event which occurs at such rare intervals as to make it one of unusual value to the astronomer. This is especially the case at the present time, when speculations are rife respecting the surface markings of this interesting planet. We are assured by the astronomers that some of them are of a permanent character, while others undergo periodical changes. The alternate appearance and disappearance of white patches at the polar regions suggest the presence of ice and snow, and therefore of an atmosphere, which renders life not only possible, but highly probable. It should be noted, however, that, on account of the greater distance of the planet from the sun, the light received by Mars is very much less than the earth receives, although its heat from recent measurements cannot be much below that of the earth. It should also be remembered that the diameter of Mars is not much greater than one-half that of the earth. There are indications which are interpreted by some as explainable by the existence on the planet of intelligent beings. Should such exist, we are naturally led to reflect upon the geography and landscape of the planet as compared with those of our earth. But the purpose of this paper is not to discuss these speculations, but to exhibit graphically the peculiarly favorable conditions under which the astronomer will labor during the month of July, 1907.

The ability to observe a planet satisfactorily obviously depends very much upon its proximity to the earth. The distance between the earth and Mars varies between very wide limits. This is due to the great eccentricity of the planet's orbit, which is second only to that of Mercury.

The accompanying drawing is a plot of the orbits of the earth and Mars; and while they are elliptical, the difference between the lengths of the major and minor axes in each case is scarcely noticeable in a plot of these dimensions. But the eccentricity of the orbit of Mars is between five and six times that of the earth, which accounts for the great variation of the distances between the two planets at different oppositions. The center of the sun is represented at *S*. Through this point is drawn *P A*, the major axis of the orbit of Mars. *P* represents the perihelion, and *A* the aphelion of the planet.

In order to obtain a clear understanding of the precise relation between these orbits, the reader should realize that the earth's orbit is represented in the plane of the paper; while the orbit of Mars is inclined to it at a very small angle (nearly 2 deg.). That part of the orbit of Mars which includes aphelion, viz., *b A c*, is supposed to be above, while the remaining portion, viz., *c P b*, is supposed to be below the paper. The line *b c* is the intersection of the planes of the orbits of the two planets.

The positions of the earth and Mars are represented at different dates beginning January 5. Straight lines representing the distances between them are drawn connecting the centers of the planets at nine corresponding dates, viz., January 5, March 2, April 27, June 22, July 6, 13, 20, September 14, and November 9. The greatest possible distance would be reached if Mars were at conjunction and aphelion at the same date. This distance, represented by *d A*, is equal to the entire diameter of the earth's orbit (= *d e*) increased by *e A*. The least possible distance between the planets would be reached if Mars were at opposition and perihelion on the same day, i. e., if Mars were at *P* and the earth at *d*. It is represented by *d P*, and is equal to the minimum distance between the sun and Mars (= *S P*) diminished by the radius of the earth's orbit.

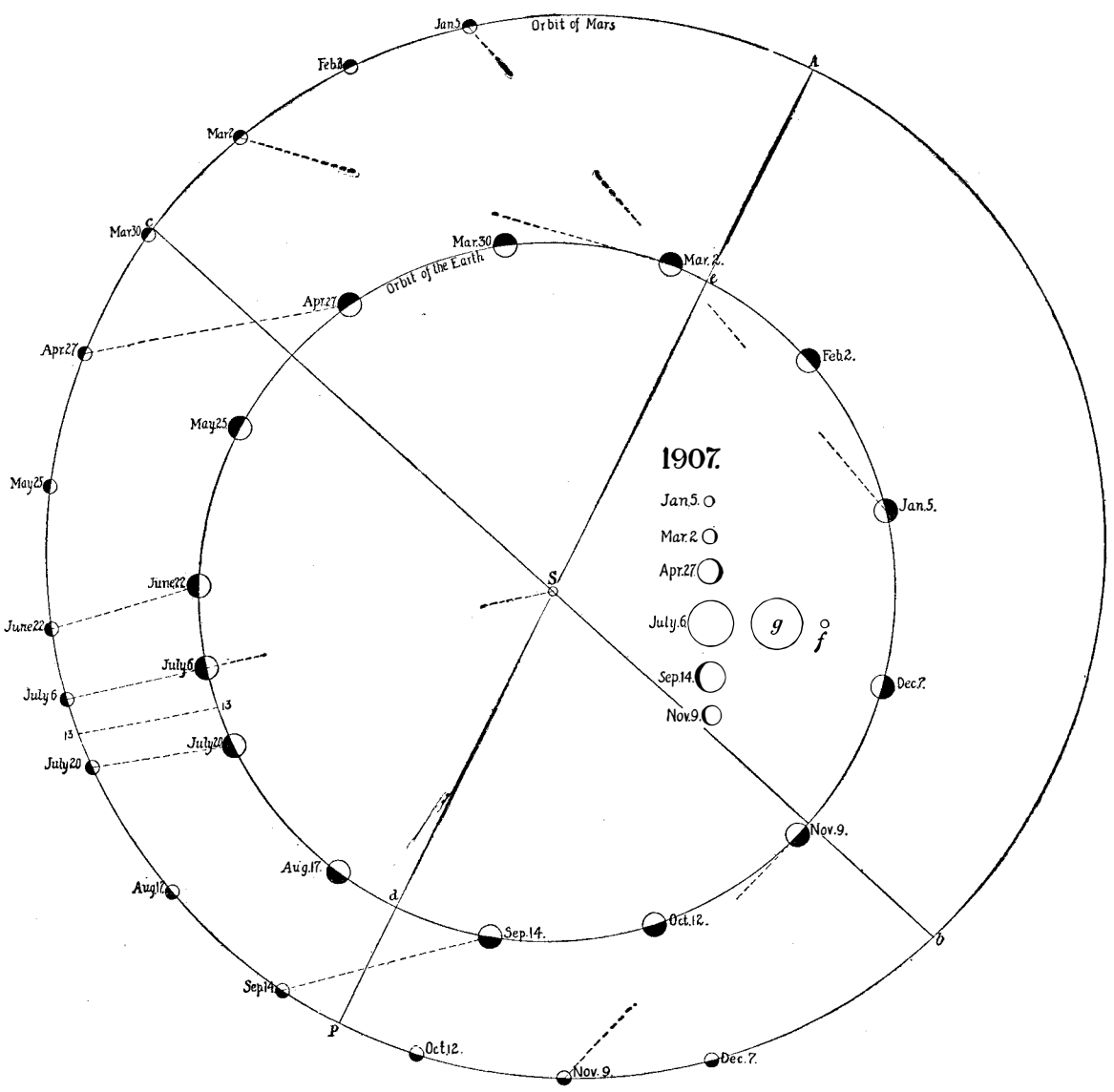
Some of the variations in the apparent diameter of Mars between these extreme possible positions are represented within the plot of the earth's orbit at six dates of next year; and in each case the illuminated and shadow surfaces of the planet are indicated. The reader will readily determine the position of the dark surface prior to July 6; and will see that its position is changed after that date.

If the small circle *f* be taken to represent Mars when at that conjunction which is most unfavorable for observation, i. e., when the earth is at *d* and Mars at *A* (the greatest possible distance), the circle *g* will represent him at the opposition which is most favorable for this purpose, i. e., when the earth is at *d* and Mars at *P* (the least possible distance). The circle *g* is more than seven times the diameter of *f*, or more than fifty times the area.

The opposition which is most unfavorable for observation would occur if the earth were at *e* and Mars at *A*. In this position Mars would be represented by a circle a little smaller than that dated September 14 within the plot. The reader will readily convince himself of this by comparing the distances between the planets. The measurement *e A* is a little greater than that representing the distance between the earth and Mars on September 14.

By a comparison of the dates the reader will observe the gradual approach of the earth to Mars during the first six months of 1907, and their gradual separation during the latter part of the year. On July 6, when opposition occurs, the sun, the earth, and Mars, in the plot, are in the same straight line; and at first sight we may be disposed to say that the minimum distance will now be reached; but on a careful examination we discover that, owing to the great eccentricity of the orbit of Mars, and the consequent diminution of his distance from the sun, the shortest distance from the earth will be reached a week later, i. e., July 13, when the earth will have gained upon Mars about 2½ deg. On July 20 the distance between the planets will differ a very little from that of July 6, when the earth will have gained nearly 5 deg. on Mars. During this period of two weeks, viz., from July 6 to 20, the apparent comparative diameter of the planet will be represented by the circle opposite the date July 6 within the plot. If we compare it with that marked *g*, we see that its diameter will not differ very much from that which it would attain if the planet should reach its apparent maximum size. The difference is in the proportion of 65 to 72, or about eight-ninths.

An examination of the great variations in the apparent diameter of the planet, together with a consideration of the intensity of the light received and reflected when it is at its maximum distance from the sun and earth, as compared with the amount received and reflected when these distances are reduced almost to a minimum, will convince the most casual observer of the peculiarly advantageous position of Mars relative to the earth during the month of July, 1907.



THE RELATIVE POSITIONS OF MARS AND THE EARTH DURING THE YEAR 1907. OPPOSITION OCCURS IN JULY.

RAILWAY ACCIDENTS AND SURGERY.

Despite the institution of the most elaborate precautionary and disciplinary methods, the railroad operator, owing to the nature of his calling, is necessarily exposed to accidents and fatalities. According to the latest available returns upon this subject, no less than 3,632 men were killed and 67,067 injured during the course of a year upon the railroads of the United States. In Great Britain the calamity returns are considerably lighter, despite the congested nature of the railroad traffic, the fatality roll aggregating 416 killed and 6,590 injured. In this country one man out of every 357 is killed and one in 19 injured. In Great Britain the percentage is considerably lower, the proportion being one in every 10,144 killed and one in 747 injured. Upon the railroads in the latter country ambulance corps have been inaugurated among the operatives for the express purpose of succoring their injured comrades. The railroad operator, no matter in what path his duties may lie, is ever confronted by danger in a wide variety of forms. At the same time, many injuries have proved ultimately fatal, because of the long period of time that has elapsed between the time of the injury and the arrival of the doctor; whereas had first aid been rendered, the life might have been saved, or at any rate the extent of the injury appreciably minimized, by the successful prevention of subsequent complications. In this country the effect of such delay is particularly marked, owing to the great distances separating points at which medical aid can be obtained. More than once, when a man has been injured during the journey of the train, he has had to lie unattended for an hour or two, so that when the surgeon received the case, the effects of the accident had so developed that the possibility of saving the life had become very remote.

Realizing this salient point, the employees on the Boston and Maine Railroad have adopted the movement in vogue among British railroads, and have inaugurated a means whereby the rendering of first aid to the injured may be taught among the numerous operatives.

The scheme was originated by the Railroad Branch of the Boston Young Men's Christian Association, and when it was brought before the directors of the company, its widespread benefits were immediately realized. The authorities forthwith sanctioned the idea, and decided to defray the cost of initiating the men into first-aid work, the task of drilling the men being devolved upon Dr. H. H. Hartung, who is an active member of the National First Aid to Injured Society. Among the men too the scheme was warmly received, and the whole of the employees are being made proficient in the art of succoring the injured. The large shunting yards are the scenes of the greater majority of accidents, and the railway authorities have shown practical sympathy with the movement by the establishment of emergency stations, replete with every appliance necessary to render first aid, and to which the injured can be carried to await the arrival of the doctor. The greater part of the injuries received by railway men comprise fractures, contusions, crushings of various parts of the body, burns and scalds, and in some instances the supervening of blood poisoning within a short time of the accident, owing to the entrance of some foreign substance into the wound.

"Any surgeon will tell you," states Dr. Hartung, "that nearly everything depends upon the skillful and successful treatment of an injury immediately after it has been inflicted. Many an accident which is comparatively trivial in nature develops seriously, owing to the shock the system has incurred before the practitioner arrives. For instance, take a compound fracture. Many a poor fellow struck down has lain in

agony for an hour or so, owing to the absence of even the most rudimentary ideas of first aid, and when at last medical assistance is obtained, the case has so far progressed that it is practically hopeless for the patient's life to be saved, or should the medical man triumph, the man possibly becomes a cripple for life, when had his comrades been able to succor him immediately, the subsequent complications might have been averted. Again, the knowledge of how to apply the tourniquet and check bleeding is very often a matter of life and death, while the ability to treat poisonings, dress rough wounds, severe scalds, and burns very often gives the unfortunate patient a chance of living.

The railway men are taken through a complete curriculum, which is divided into two stages. The first course comprises a series of ten lectures together with the study of a manual. At first the men are acquainted with the anatomy of the human body, the names and positions of the various bones, and the functions of the muscles and vital organs. Then the blood circulation system is explained, as well as the principal arteries and veins. They are instructed in the application of the tourniquet and other means of checking bleeding. Respiration is then dealt with, and the men shown how to handle suffocation cases in various forms."

These elementary principles explained, the employees have described to them the various kinds of wounds, such as contusions, lacerations, poisonings, and so forth, together with the correct treatment for the respective types of injuries. Burns and scalds are treated, and demonstrations carried out to show the proper methods of applying the various bandages. Following this comes the treatment of sprains, dislocations, fractures, together with the utilization of splints. The men are practically shown how to improvise necessary appliances from the various facilities that are available, such as brooms and broken boxes. Many of them carry upon the trains complete emergency kits, but others are not so fortunately provided. Then they have to devise the most serviceable substitutes they can from things which are within convenient reach. In this direction the men have exhibited considerable ingenuity. At times efficient stretchers have been quickly and rudely fashioned from branches of trees growing on the railway embankments, while should wood be unavailable, as is the case in open and desert country, serviceable splints can be improvised from pillows or even coats.

When the men have mastered theoretically the principles expounded in the lectures, they are submitted to a rigorous practical training, whereby they are able to demonstrate to the instructor how they would act in cases of emergency. For these tests the various shunting yards are utilized, one man acting as the supposititious victim. At such times one may see little groups of men darting hither and thither among the engines and cars with stretchers and other equipment with the utmost coolness, precision, and dispatch. The victim is supposed to have been crushed between two vehicles, run down by the locomotive, fallen from the train, or scalded. At the word of command the men dart across the rails, dodging the traffic, armed with their requisite impedimenta, and quickly, though tenderly, pick up the injured man, swathe him in bandages or splints, repose him on a stretcher, and consign him to the railway car ready for the practitioner when the train arrives at a convenient point for such assistance, since in the sparsely-populated districts an hour or two may elapse before the train reaches a station where a doctor is available. While engaged in these operations the doctor-instructor follows them through their work, pointing out the various symptoms of different injuries that the men must observe, and correcting them should their treatment be erroneous, at the same time carefully timing the operations. "It is imperative," urges Dr. Hartung, "that you should administer aid in the simplest and most effective manner. You must do something, and what is more important, do it quickly. Many an injury simply depends upon the speed with which the wound is bandaged up."

In another part of the yards men may be seen engaged in practising the proper methods of removing an injured man from a precarious position, and carrying him either single-handed or with assistance to a more convenient spot. A common type of casualty is that in which one of the men on the engine, perhaps while walking round inspecting or oiling his charge, is struck by the cowcatcher through the engine starting unexpectedly, and is then thrown with force across the buffer frame. In such an accident the injuries invariably comprise fractures of the leg and skull. The position of the patient is an awkward one, and great skill and care are required in his removal without accentuating the pain or aggravating the injury. Again, there is a proper way of removing a victim from the train itself, when the case is not sufficiently serious in character to necessitate the employment of a stretcher. The man is placed in a chair, and gently removed from the car to the ground without the slightest jar.

When the men have become proficient in this work, they are initiated into the peculiarities of poisoning. The differences between common poisons are explained at great length, together with their respective symptoms and the methods of treating such cases with the means generally within reach.

Shock to the nervous system as the result of a serious accident, and unconsciousness, together with the treatments for the same, are also explained. Other forms of unconsciousness, such as might result from fits, concussion, and sunstroke, are fully dealt with, and the best remedies shown. Sunstroke is a very prevalent complaint among the railway men during the summer months, and in many instances the attacks are of such severity that instant treatment is essential to avoid fatality.

When the men have thoroughly mastered the theories in this work of first aid, they are submitted to a severe oral and written examination. Those that pass through this ordeal are awarded a diploma. The successful student can then, if he feels so disposed, participate in the advanced series of five lectures. These

Instructing the Class in Bandaging a Victim at the Scene of the Accident.

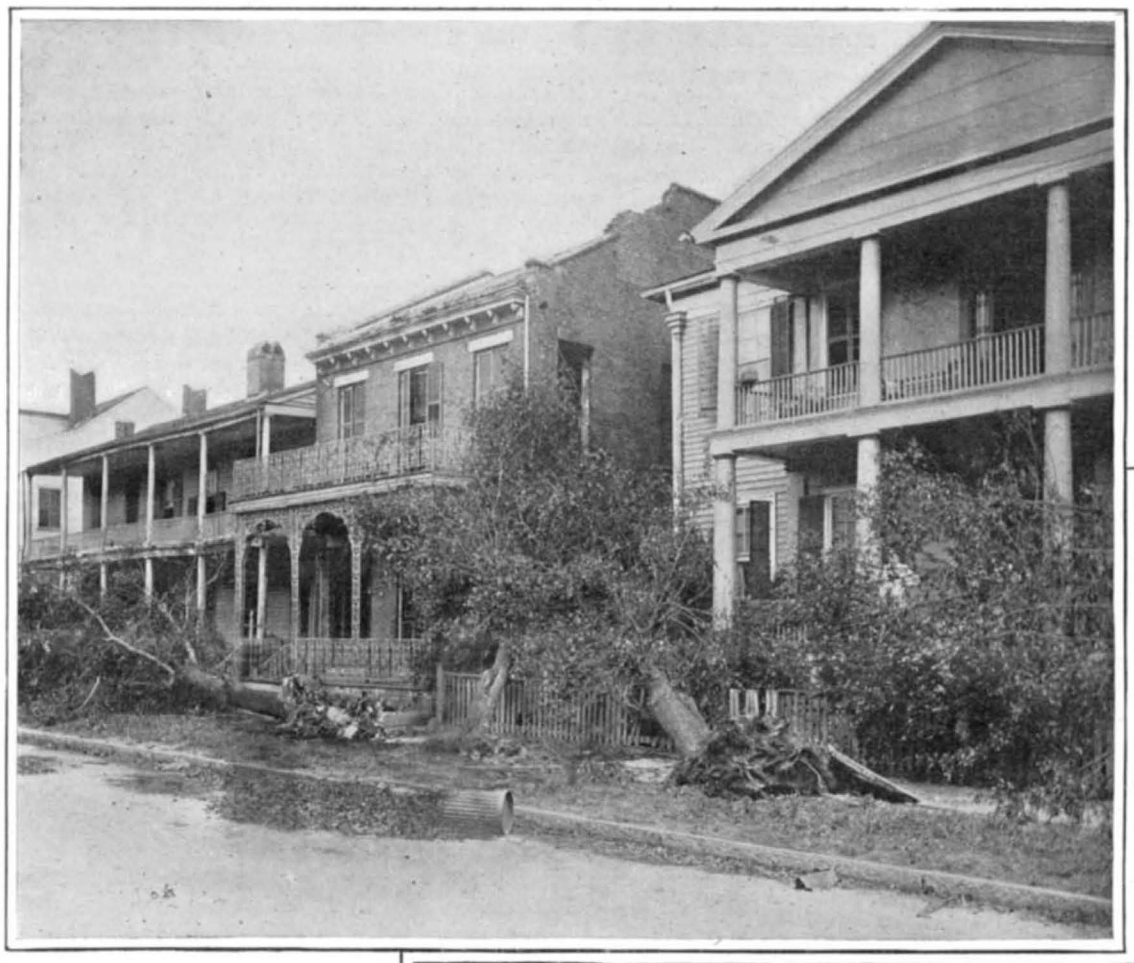
Bandaging the Head and Limbs. Because of Great Distances, an Hour May Elapse Before Medical Aid Can Be Obtained.

The Proper Way of Removing an Injured Man Who Has Been Struck and Has Fallen on the Front End of the Engine.

The Correct Way of Carrying an Injured Man Single-Handed.

Struck and Thrown Upon the Cowcatcher, With Serious Injury to the Legs and Skull.

A MEDICAL CORPS FOR RAILROAD OPERATORS.



The Destruction Among Mobile Live Oaks; Ninety Per Cent of the Trees Were Destroyed.

deal more in detail with the work of first aid, while the qualifying examination is much more severe, the successful ones receiving the medallion of the Association.

The whole cost of the undertaking is borne by the railway authorities, so that the employees do not have to expend a single penny in acquiring their knowledge. All that they have to do is to devote their own time to the instruction, and in this connection they have displayed commendable willingness.

Indirectly also the movement is of inestimable value to the traveling community in general, especially in view of the fact that railway disasters in America are much more frequent and serious than in England. A scrutiny of the points at which such catastrophes occur will demonstrate the fact that they frequently happen at some lonely and desolate spot far removed from medical aid. Consequently, two or three hours may elapse before the doctors arrive on the scene, and the death roll is accordingly heavier than would have been the case, had some assistance been forthcoming within a shorter time of the accident. With these trained railway men, the injured are bandaged up until more expert skill can arrive.

Typical Scene Along Mobile's Wharf Front; a Fruit Steamer Cast up on Shore.

EFFECTS OF THE RECENT HURRICANE AT MOBILE.

BY DAY ALLEN WILLEY.

One of the most interesting storms, from a scientific standpoint, which has ever been experienced in the Southern States was that which recently caused so much damage along the Florida peninsula and the coast line of Alabama and Mississippi. Generally known as a "tropical hurricane," it differed from the usual disturbances of this class by reason of its duration, while in some features it bore a resemblance to the cyclone which at times prevails in the level regions of the West.

As is well known, the storm center hung over the West Indian Islands and the adjacent waters for a considerable period before it changed its course to the northwest. Consequently, the hurricane was not unexpected; its violence, however, surprised even the meteorological experts. Passing over the Florida peninsula and devastating the towns on the west coast of this State, including Pensacola, it veered farther to the west, including in its zone much of the low-lying country that comprises the southern portions of Alabama and Mississippi, and the islands skirting their shore line.

In the confusion incident to the storm, the newspaper reports from the places visited by the storm are in the main so incomplete, that the reader cannot get an intelligent and comprehensive idea of the extent of the disaster and the actual causes of the greatest damage. Enough information is available from Mobile, however, to describe the character of the disturbance, the actual destructive force of the wind and water, and other phases which would be of special interest to the student of meteorology. The duration of the hurricane (for such it can properly be called) was remarkable. Beginning shortly after the midnight of September 26, the wind blew for fully twelve hours with a minimum velocity, with the exception of a few intervals or lulls, of 40 miles. The average velocity as recorded by the instruments at the Mobile Weather Bureau was but 55 miles an hour—not sufficient in the opinion of the experts to cause the destruction that resulted. The maximum velocity, however, was much greater. There were times when it exceeded 70 miles an hour. These "gusts," which might be termed a series of tornadoes, were responsible for most of the damage inland.

The site of Mobile is such that it was exposed to the full blast of the hurricane; for the city is built on ground which is low and flat. It is located partly at the head of Mobile Bay and on the northwest shore, a portion of the water front being on the Mobile River.

A House on the Long Shell Road; the Collapse Was Due to the Washing Away of the Foundations.

A River Steamer Lying Totally Wrecked in a Slip.

EFFECTS OF THE RECENT HURRICANE AT MOBILE.

This was another unfortunate circumstance, since the direction of the wind was such as literally to pile up the water of the bay and drive it ashore, the water rising fully ten feet above the surface of the piers. The bay is 36 miles long, and the hurricane swept its entire length in the direction of Mobile. To this fact is due the extensive loss by flooding; but the terrific force of the wind was shown in every part of the city, and many were the curious effects which it produced.

As we have stated, to those familiar with the work of the western cyclone the storm of September 27 bore a very noticeable resemblance to western disturbances. Objects offering little resistance were in many instances unharmed, while greater obstructions were razed or torn to pieces, and scattered over the ground. An odd prank of the wind was the partial destruction of a frame building located at the junction of two streets. Although trees and telegraph poles were leveled all about it, and the structure was apparently directly in the path of the hurricane, only a part of it was demolished. A partition wall extending from the ground floor to the roof had been built from front to back. The air current cut off a part of the house on one side of the partition as neatly as if it had been torn away by human hands. The part removed was blown to pieces, but not a crack was made in the walls left standing, except what had been there before the disaster.

While most of the residences and smaller structures in the city are of wood, in the business section are a number of brick and stone warehouses. The churches and public edifices are mostly of massive design. Christ Episcopal Church is of masonry, except the steeple, which was built in three sections, the two upper ones being supported on wooden pillars. The force of the wind removed every vestige of the tower, even snapping off the timbers which anchored it to the framework of the main roof. The only protection to the city, if it could be called a protection, was the tree growth. Many of the streets were shaded with trees from two to four feet in diameter at the base of the trunk. Bienville Square, one of the smaller parks in the heart of the city, contains a grove of the largest species. On the avenues could be seen rows of fallen trunks, not a single tree left standing for blocks, the impact of the air current being so great that usually the main portions of the roots were torn from the ground as completely as if the work had been done by some powerful explosive. For some unexplained reason, most of the trees in Bienville Square, while not uprooted, were stripped of every twig and small branch, leaving them absolutely bare of foliage. On the other hand, very little of the foliage was torn from the trees blown over, except that on the side of the tree which struck the ground.

Skirting the bay for a distance of about six miles was a driveway composed of oyster shells packed down to the depth of a foot or more, and rolled until the foundation was apparently as solid as a mass of stone or concrete. The action of the wind and water, however, so completely destroyed this, that not a piece as large as the width of a shovel could be found after the storm. The shipping in the harbor suffered not only from the wind, but from the waves which it created; but much of the havoc on the water front was caused by the timbers, logs, and other material which had been washed from the shore into the harbor. Hurled against coasting schooners and other small vessels, they crushed in their hulls as if they had been made of paper. One of the most picturesque wrecks was of a river steamer. Lifted by the combined force of the wind and waves, it was dashed against the wharf with such violence, that its framework was twisted from end to end, and the steamer buckled amidships. In this position it toppled against the wharf and sank.

The hulls of the ocean-going craft riding at anchor suffered little damage, save where struck by the floating missiles driven by the waves; but rigging and spars were blown away like so many splinters and threads. The height of the waves can best be appreciated, when it is stated that the largest of the flotsam, such as timbers two feet thick, were pitched upon the piers with smaller driftwood, some of the piles being ten feet high above the flooring of the piers. The piling supporting much of the wharf front was crushed in by blows from floating material, and the many small boats were thrown against it. The warehouses for storing bananas and other fruit presented a curious appearance. One of the largest had all of its roof and one of its side walls blown completely away. In another instance the ends of a shed were blown out, leaving the sides and roof intact. An examination of the wreckage of these buildings revealed another point of similarity to the Western cyclone: the destructive force had apparently been exerted within, as the planking and framework had been thrown outward in each case, and not inward. This seems to prove the theory that a wind current of great velocity causes such a vacuum in its vicinity, that it creates a strong suction or draft, which often causes more damage than the current itself.

Observers of the effect of the air currents agree in the statement that they frequently changed their directions. The continual veering of the weather vanes was further proof of this fact. The pathway of the storm was of such width that it was not clearly marked by the debris left in its wake, as is so frequently the case in a Western cyclone.

The location of Mobile also afforded an opportunity to show the enormous lifting force which a violent wind exerts upon even a small body of water. The heavy rains rapidly swelled Mobile River and its tributaries. While this flood water flowed into the bay, the rapid rise in the harbor as already stated was due more to the fact that the wind crowded the water into it. Waves which resembled Atlantic seas rolled inshore to such a height that the water washed over the wharves and along the streets for a distance of over half a mile from the piers. Much of the $5,000,000 damage caused in Mobile and its vicinity was due to the undermining of buildings by this unexpected flood.

The Scene at the Oyster Docks; the Wharves Were Demolished for Over a Mile and the Oyster Fleet Sunk or Piled up on the Piers.

House on St. Louis Street With a Side Blown Away.

EFFECTS OF THE RECENT HURRICANE AT MOBILE.

Sweating of Pipes.

Insulating cold water pipes is frequently done in sections of the country where the water flowing through the pipes is at a comparatively low temperature, the warm air passing over them cooling so quickly as to cause condensation of the moisture in the air. The wet spots under the water pipes are frequently attributed to leaks, but the experienced plumber diagnoses the case as one of sweating. The remedy is to cover the pipes with some kind of non-conducting covering like some of the asbestos productions, protecting the pipes from the warm air.

The Alpine Trip of the Balloon "Milano."

The balloon "Milano" left the grounds of the International Exposition of Milan on Sunday, November 11, and arrived at Aix-les-Bains after having traveled over Mont Blanc, a distance of 175 miles, in three hours.

The "Milano" had splendid weather from the start, and soon reached an altitude of 16,000 feet, accompanied by 10 deg. F. of frost. The balloon traveled northward over Mont Blanc, and as it progressed it grew colder and colder. Below them the travelers could see nothing except an extensive field of snow, broken by sharp peaks and dotted with frozen Alpine lakes. The highest altitude reached was 20,500 feet. The rarefied atmosphere made it necessary for the men to resort to their supply of oxygen to keep alive. At one point of the trip Signor Usuelli succumbed to the nervous strain and burst into tears. On the other side of the mountain the balloon descended gradually and landed safely at Aix-les-Bains.

The "Milano" has a capacity of 1,000 cubic meters. The men in the car were Signor Usuelli and Signor Crespi. The report received is from the latter aeronaut.

Volcanic Fertilizers.

That there is a silver lining to every cloud, Dr. Stoklasa, professor at the Technical High School at Prague, again proves in the results of his tests in connection with the late eruption of Mount Vesuvius. In fact, according to his calculations, the crater has thrown out upward of fifty milliard kilos of volcanic mud, sand, lava, ashes, etc., upon the surrounding ground. These, he estimates, contain an average of at least 0.1 per cent nitrogen in the form of ammonia. The mountain has consequently produced about fifty million kilos of fertilizer, representing more ammonia and nitrous acid than is used in the whole of England. He has found besides enormous deposits of potassium phosphate and other fertilizers readily assimilated by the vegetable kingdom. The vapors constantly rising from the mouth of Vesuvius already contain much plant food, in fact the surroundings of volcanoes are always highly fertile, and have no need whatever of artificial fertilizers. Dr. Stoklasa has shown that ammonia is always rising from the crater as white smoke.

A New Comet Located by Holger Thiele.

A cable dispatch has been received at Harvard Observatory from Prof. Kreutz at Kiel saying that a comet, visible through a small telescope, was discovered by Holger Thiele at Copenhagen early Sunday morning in right ascension 9 hours 15 minutes 21.3 seconds, declination 12 degrees 16 minutes 50 seconds.

A second observation cabled at the same time gave the position in right ascension 9 hours 16 minutes 2.3 seconds, declination 12 degrees 28 minutes 31 seconds.

An alloy called "Monel-Metal" consists of:

	Per cent.
Nickel	75.0
Copper	23.5
Iron	1.5

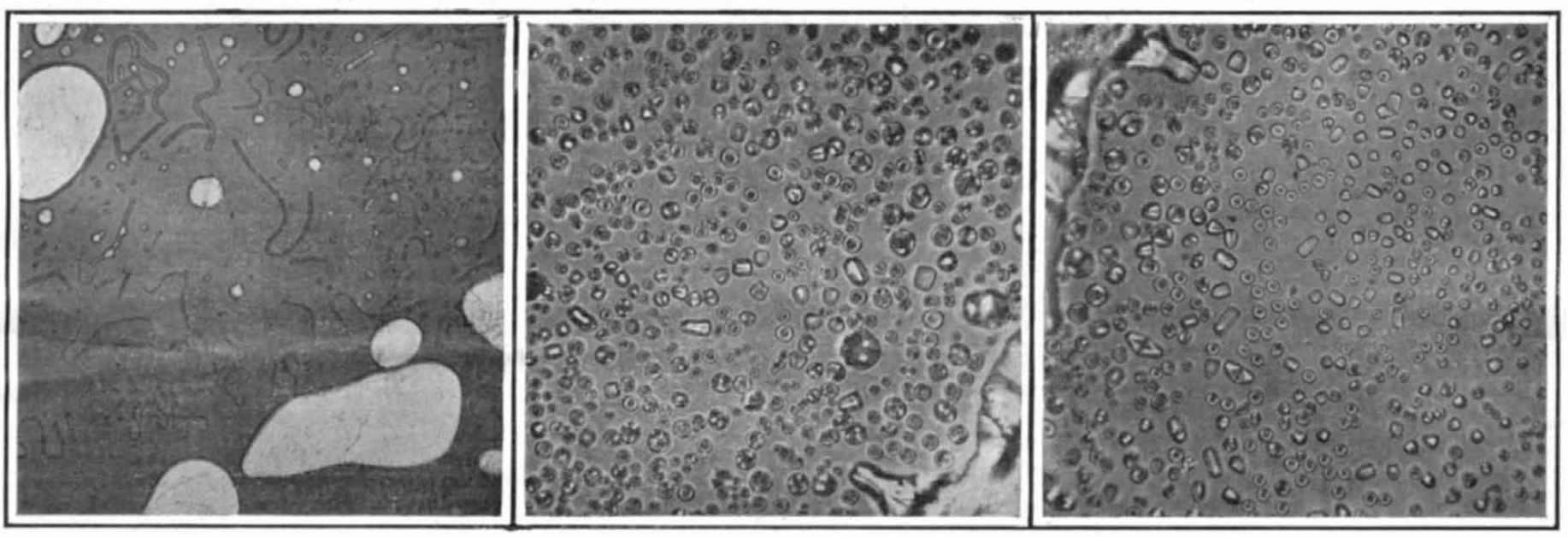
The alloy possesses a high tensile strength and elastic limit. It is also non-corrosive and takes a high polish. The color is practically that of nickel.—Brass World.

SOFT CRYSTALS SHOWING APPARENT LIFE.

BY DR. ALFRED GRADENWITZ.

The present tendency of physical science is rather toward evidencing a continuity between provinces that were formerly entirely separated from each other than to establishing new boundaries corresponding to new categories. The impossibility of establishing a definite boundary between solid and liquid states has been evidenced in the course of the last few years by the work of Prof. O. Lehmann, of Karlsruhe, Germany, whose researches on liquid crystals deserve the highest interest, the more so as the soft crystallinic forms produced and investigated by this physicist show some striking analogies with the world of living beings, thus constituting another link in the chain of recent researches on the boundary between living and apparently dead matter, to which attention has been drawn especially by Butler Burke's recent investigations. As a complement to these researches on one hand and to Prof. Leduc's work on the other (of which the writer has published an account in a recent issue of the SCIENTIFIC AMERICAN) the following observations may be of interest.

An organic substance called para-azoxy-cinnamic-acid-ethyl-ether, obtained in the "fleeting" crystallinic state between 139 deg. and 248 deg. C., is one of the most remarkable substances susceptible of assuming this condition. In fact, the phenomena observed under the microscope seemingly show a perfect analogy with the phenomena of living beings, so that partisans of the ancient theory of spontaneous generation might avail themselves thereof in establishing the basis of their theory. While modern science abhors premature conclusions, so far from discarding such phenomena as are incompatible with present laws, it should most thoroughly and without any prejudice examine any facts brought to its notice.



Long Crystals Squirming Like Serpents. Creeping Crystals. Fleeting Crystals at Rest as Seen by Polarized Light.

SOFT CRYSTALS SHOWING APPARENT LIFE.

In the present case its task will be to investigate how far the forces working in the living organism agree with the forces of lifeless nature. A striking difference in the behavior of these two classes, as so far observed, has been that while the growth of living beings takes place in virtue of internal absorption ("intussusception"), and while by the copulation of two individuals into a single one, or the subdivision of one individual into two or more, an increase or decrease in their size is produced, the crystals so far known would grow only in virtue of the gradual adding together of molecules. Now the substance referred to in the beginning just shows the same phenomena as were so far attributed solely to living matter, and in addition exhibits some most striking motional phenomena, that are quite analogous to those of micro-organisms. So far from considering these soft crystals as living beings, Prof. Lehmann suggests that they fill up a gap in our knowledge of molecular effects, the forces acting in the case of both classes being possibly identical.

When heating a small amount of the substance above mentioned, after moistening it with some monobromine-naphthaline as solvent until only a few particles of the jelly are left, and cooling to about 200 deg. C., some short, square columns with rounded edges and angles will, under the microscope, be found to be separated, showing in some cases the shape of pyramids. The lower the temperature, the less will be their tenacity, possibly owing to their absorbing some of the solvent in a way analogous to other crystals, dyeing stuffs, etc. While being colorless when inspected in a longitudinal direction, they show a yellow and sometimes a reddish-yellow tint on being viewed transversely.

Whenever two individuals come in contact with each other, they are seen immediately to combine like two oil drops, especially in case their position is a corresponding one. In the event, however, of their being placed in opposition, the summit and base of the pyramids coinciding, twin crystals will be produced, showing at the juncture, owing to the refraction of light, a cross on a gray rhomb.

While crystals of an oily consistency are produced as the temperature continues dropping, they are no more able to withstand the pressure of surface tension (increased owing to the decrease in temperature, and which acts like an elastic membrane encompassing the whole) so as to be compressed to spheres, the crystalline structure of which is only manifested by their special refraction. If any one of these spheres is turned over, it is found not to be absolutely round, but to show a flattening or funnel-shaped depression at some point, from the middle of which a dark straight line leads to the centrum of the sphere. If the latter be so placed that the depression is situated either on the top or underneath, everything being symmetrical round the center, it will show a set of concentric circles; this is what is called the "first main position." If on the other hand the depression be situated sideways, the dark stroke will be seen leading from the center to the periphery; this is what Prof. Lehmann terms the "second main position." If now two drops combine in the first position, one drop with only one core or center and one depression will be obtained, and the same in the second main position if the positions be corresponding ones. If, however, the depressions be placed in opposition, both will be maintained in the resulting drop. If finally two individuals strike each other at their depressions, a twin form will be produced, the spheres being combined without flowing together into a single one. Such twin structures may also be produced spontaneously, an extension growing out of the depression of a drop gradually taking the size of an equivalent sphere. This shows a perfect analogy with the springing up of a bud, as observed in the case of micro-organisms, this bud being thrown off after some time, and continuing its existence as an independent individual of the same species as the original. A perfect analogue to the ordinary phenomenon of subdivision as observed in the case of the smallest organisms is likewise noted, the drop in the first main position being frequently drawn out to a bacterium-shaped small rod, this being suddenly divided into two pieces. Before this separation a sort of partition wall is observed at the dividing point, as ascertained by a strange light refraction due to the twin position of the molecules.

So far from being at rest, the drops are susceptible of rotating around their axis. The miniature rods frequently show phenomena of motion analogous to those of the diatoms, being a slow creeping both forward and backward, while passing through what seem to be obstacles to the motion. The small rods in some cases suddenly take the shape of long serpents, bending incessantly with great energy, and even moving from their ordinary position and performing what seems to be a peristaltic motion. The growth of these serpents, which is evidently intensified by cooling, actually forms an analogy to growth by internal absorption (intussusception) in the case of living organisms. Though the separation of substance occurs at the surface of the serpent, its thickness remains perfectly constant, there being only an alternation of its length. Any molecules joining the structure are evidently drawn immediately into the interior, dispersing the existing molecules. Sometimes such a serpent will expand with extraordinary speed, covering the whole field of vision of the microscope, while sometimes disappearing before the eyes of the observer. If the latter succeed in studying the various phases of the phenomenon, he will see the serpent to be instantly contracted to a sphere, thrown away by the force of contraction.

Similar phenomena are observed in the case of the ordinary rods. These will in fact bend into a ring, while a contraction to a sphere occurs as soon as the ends meet. A similar effect is observed in the case of the contact of two rods, while a combination of rods to twins and threefold structures is observed in some cases. Serpents will sometimes spring up from the depression of drops in the second main position, or else a given serpent will give rise to the production of a thinner one, or else its thickness will gradually decrease during growth, resulting in a structure analogous to a germ filament, showing a similar oscillatory motion of the tail.

Rods and serpentine structures are frequently observed in the case of the separation of a bud connecting the latter to the mother individual as well as in the case of a subdivision. The addition of foreign substances may result in some kind of poisoning, the phenomena of motion being slackened or the morphogenetic force vanishing, or else some disfiguration being produced. Even the absorbing force of the glass may result in disturbances, the drops being attracted by it. A multitude of remarkable structures is formed even in normal conditions, a serpent being, e. g., suddenly separated into a chain of droplets, or else into a miniature rod showing expansions which are gradually converted into a drop.

Wormholes in Wood.

Wood felled and worked up is frequently subject to wormholing. The sapwood is much more attacked than the perfect wood, and it has to be cut off when we wish to produce durable work; whence a pretty considerable loss. Mons. Emile Mer noticed that the species attacked are those whose sapwood contains the most starch; on the other hand, analysis revealed to him that the dust from the wormholes no longer contained starch. The insect, therefore, introduced itself into the wood in order to nourish itself at the expense of this material. Now, starch is produced by the leaves under the influence of the light; there go branches to the trunk and to the roots through the *liber* or inner part of the bark. Removing a ring of bark intercepts the descent. The starch newly elaborated accumulates above the ring; that which existed in the inferior region is soon absorbed and transformed by the cells of the wood, whose food it constitutes. Hence an annulation of a few centimeters' length at the top of the trunk, three or four months before the felling, is sufficient to eliminate the starch from the trunk. The best season for operating is the spring; the trees can then be felled in October. It is essential not to allow any shoot to develop below the excoriated part.—L'Illustration.

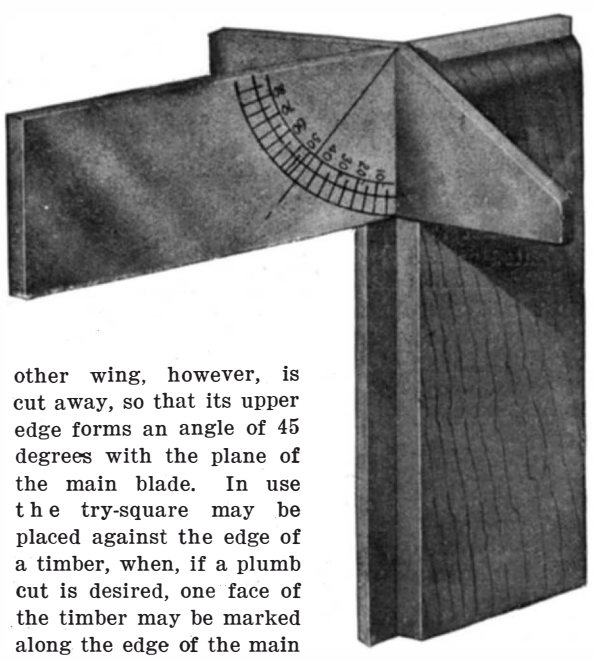
It is said that tantalum has great possibilities when used for tool making, its toughness and hardness rivaling the diamond. Von Bolton made a laboratory experiment recently, when a sheet 0.04 inch was hammered from the first piece produced of the pure metal, and all attempts to drill a hole through it were found to be futile. Finally a diamond drill was employed, and after continuous work for seventy hours at a speed of 5,000 revolutions per minute, about one-fourth of the task had been completed, while the drill was so badly worn as to necessitate a discontinuance of the test. Tantalum is entirely non-magnetic, has a specific gravity varying from 14 to 17, and fuses at about 2,300 deg. C. (4,172 deg. F.). In the form of a wire it has a tensile strength of about 128,000 pounds per square inch.—Mechanical World.

A UNIQUE NON-REFILLABLE BOTTLE.

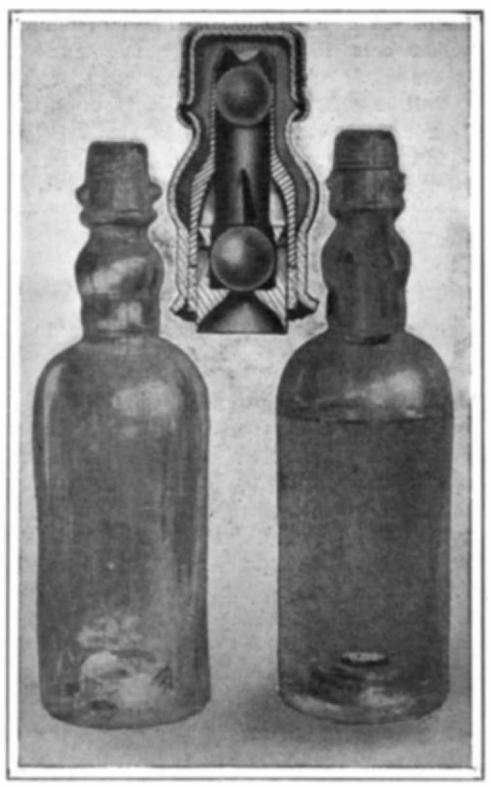
A non-refillable bottle has recently been invented, whose chief claim to distinction lies in the fact that it has no mouth, but is assembled and filled through an opening in the bottom, which is thereafter closed in such a manner that it cannot be opened again. A pair of small apertures are provided in the side of the neck, through which the contents can be poured out. The bottle is first blown in the form shown at the left in the engraving, with no openings in it whatever. In the neck of the bottle are two bosses of thin glass, while the bottom is formed with a recess. The upper wall of this recess is broken away to effect an opening into the bottle, and this leaves an inwardly-extending annular flange with rough or broken edges. The bosses on the neck are also broken off, to form the apertures through which the contents of the bottle may be poured out. A metal cap is fitted over the neck of the bottle and held in place by crimping the edges over a shoulder in the glass. A cork ring between the cap and the bottle neck serves to seal the apertures. The opening in the bottom of the bottle is large enough to admit the mechanism which is fitted into the neck. This mechanism is clearly illustrated in one of the views, which shows a section of the neck. It comprises a tube, in the upper end of which a ball valve is seated. The lower end of the tube is enlarged to receive a member in which a second ball valve is seated. This member is securely fitted into the bottle neck by means of a cork collar. The bottle may now be inverted and filled, after which the opening in the bottom is closed by a glass stopper. The stopper is provided with an annular recess, in which a cork collar is fitted. The collar bears tightly against the annular flange of the opening, and swells over the broken edge. The exterior face of the stopper lies flush with the bottom of the bottle, so that it cannot be pried out, and being of glass, it cannot be easily drilled out. In use, the metal cap of the bottle and the cork collar are removed from the neck; then when the bottle is tilted the ball valves are unseated, permitting the liquid to flow through recesses past the lower valve, then through the tube, and out of the apertures in the neck of the bottle. These apertures are so placed that it would be impossible to tamper with the valves by inserting a wire into the neck of the bottle. The mechanism is simple and inexpensive, and does not require an expert to assemble it. The complete bottle costs but a fraction more than an ordinary one. The inventor of this bottle is Mr. L. A. Robertson, 638 East 139th Street, New York, N. Y.

AN IMPROVED TRY-SQUARE.

Illustrated in the accompanying engraving is an improved try-square of such design as to enable the marking of two faces of the work simultaneously. Furthermore, it permits of marking the timber for a square or plumb cut, and also for a beveled cut. In general, the new square resembles the standard type, consisting, as it does, of a stock at one end of which a blade is attached, projecting at right angles thereto. On the stock a central tongue is formed, which extends longitudinally of the stock. The thickness of this tongue is the same as that of the blade, so that its faces lie flush therewith. A similar tongue is formed on the end of the stock by the projecting edge of the blade. Thus far the description applies equally well to the standard square. The improvement, however, consists in a short blade, which fits at right angles to and across the main blade, and is seated in the recess in the stock, so that its outer face lies flush with the edge of the stock. The short blade thus forms two wings lying on opposite sides of the main blade. One of these wings is square, so that its upper edge lies in the plane of the upper edge of the main blade. The other wing, however, is cut away, so that its upper edge forms an angle of 45 degrees with the plane of the main blade. In use the try-square may be placed against the edge of a timber, when, if a plumb cut is desired, one face of the timber may be marked along the edge of the main blade, and the other face of the timber along the edge of the square wing. If a bevel cut is to be made, the timber is marked along the inclined edge of the other wing, while the other face of the timber is marked, as before, along the edge of the main blade. When the try-square is used in the ordinary way, the wings will not be found to offer any inconvenience, but will assist in keeping the stock square with the edge of the timber. The main blade is provided on each face with a graduated arc which can be conveniently used as a protractor. The inventors of this try-square are Messrs. James Collie and Charles Beauchene, of Lake Linden, Mich.



AN IMPROVED TRY-SQUARE.



A UNIQUE NON-REFILLABLE BOTTLE.

Proposed Excavation of Herculaneum.

The recent great eruption of Mount Vesuvius drew the attention of the entire civilized world to the region in which the great volcano manifested its activity. It is, therefore, with exceptional interest that we hear of the proposed completion of the excavation of Herculaneum, buried under the first great historic upheaval of Vesuvius in 79 A. D. Prof. Charles Waldstein, Professor of Fine Arts at King's College, Cambridge, England, has long entertained the idea of a complete excavation of the buried city, and has at last succeeded in perfecting an agreement with the Italian government for the carrying out of the project. Prof. Waldstein has obtained the active co-operation of King Victor Emanuel of Italy, as president of the organization, and has, furthermore, had the assistance and support of Emperor William, King Edward, and President Roosevelt. Prof. Waldstein is an American, though holding the professorship of Fine Arts at Cambridge. He began the preparatory work of forming his organization for the purpose of laying bare the hidden secrets of Herculaneum some two years ago, when the project aroused considerable interest throughout Europe and America. Despite political opposition to the scheme in Italy, where it seemed at first that the attitude of the Italian government was one of unwillingness to permit any other country to take part in work of this character, the concession has practically been obtained, and the work will doubtless be inaugurated in the near future.

The excavation of Herculaneum will be a gigantic enterprise, totally different, in regard to the amount of labor necessary, from the excavation of Pompeii, which was buried at the same time. As early as 1738 attempts to excavate Herculaneum were made by King Charles III. The work, which had hardly proceeded further than the initial stages, was continued under the direction of the Italian government in 1866. Since that time practically no further progress has been made. The work has always been attended with the greatest difficulty, for the reason that the modern town of Resina, with 20,000 inhabitants, is located over the ruins of the ancient buried city, and, therefore, it has usually been found necessary to abandon the research work after a short period of excavation.

As Prof. Waldstein observed in his lecture at the White House, in December, 1904, the difference in the present status of the buried cities of Pompeii and Herculaneum is due to the fact that the former was covered to a depth of only about 15 feet, while Herculaneum, on the other hand, in many places was buried to a depth of 80 feet. Herculaneum, of distinctly Hellenic foundation, was a far more representative home of Greek art and literature than Pompeii, for the latter was a purely commercial city. The slight excavation which so far has been carried out at the site of Herculaneum has produced vast numbers of specimens of art and literature, one villa alone yielding 1,750 papyri. Some of the bronzes recovered are in a far more beautiful state of preservation than the majority of those from Pompeii. The latter city, though much influenced by Hellenic culture, was never a real center of Greek civilization, such as Herculaneum, and, doubtless, the excavation of the latter will bring forth priceless treasures of the literature and art of antiquity.

Prize Competition for Scientific Research.

The Academy of Sciences of Copenhagen recently decided to award the following prizes for research in different branches of science: Astronomy—gold medal of the academy and the sum of 400 crowns for the detailed study of Faye's periodic comet, the observations of the return of the comet to be made the basis of the calculations during the period of 1873-1896. Communications are to be handed in before October 31, 1908. Botany—Gold medal of the academy and the sum of 400 crowns. A sufficiently large selection is to be made of the microscopic vegetable organisms which are found in the sandy soil or mud on the Danish coast. The research is to distinguish between the specimens and determine which of them are of native origin and which have been brought by the sea or in any other way. A special prize of 800 crowns is to be awarded for a research as to the method of determining the proportion of dry substance and starch contained in the potato. The method is to be a simple and practical one, and give exact results. It is to be based upon the careful and thorough examination of the amounts of these substances in different specimens under test. The experimenter is to study the degree of precision with which it is possible to calculate these proportions by determining the densities or by other easily-applied methods, and he is to indicate the best processes for taking samples and for the ulterior treatment. The paper is to contain a critical account of preceding work in the same field. It is to be handed in before October 31, 1908. The above manuscripts can be written in Danish, French, Swedish, English, German, or Latin, and are to be anonymous, accompanied by a sealed envelope with the name and address. They should be sent to Prof. Zeuthon, secretary of the academy, Copenhagen.

SAFETY CAN LIFTER.

In canning certain kinds of food, it is customary to place the filled jars or cans in a kettle of water, and place the latter on the fire. Then when the water has come to a boil, the jars are sealed. The task of removing the jars from the boiling water without scalding the hands is rather difficult. To render this task safer, Mrs. Emily A. Austin, of Bethel, Sullivan County, N. Y., has invented the can lifter illustrated in the accompanying drawing. The device is extremely simple, consisting merely of a base plate on which the can rests, a standard, and hinged to the latter a bail, which is adapted to be swung over the neck of the jar. The standard consists of a pair of wire legs bent to form an eye at the top, which serves as a handle, and a pair of eyes at the sides, to form bearings for the bail. The latter, which is of horseshoe shape, is formed with a handle bent upward, so that by raising the handle the bail can be swung up clear of the top of the can. In this raised position it may be held by slipping the handle over a hook at the top of the standard. In use the base plate is passed under the jar or can, and the handle is unhooked, permitting the bail to fall over the neck of the jar. The jar may then be easily lifted out of the kettle, and thereafter removed from the holder by raising the bail. The entire operation is performed without touching the jar with the hand.

SAFETY CAN LIFTER.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

TROUSERS-SUPPORT.—A. M. TAYLOR, Port Ewen, N. Y. The object of the invention is to provide a support which is easily manipulated for placing the trousers in position on the support or removing the same therefrom and arranged to clamp the waistband of the trousers in position, so that the trousers hang naturally down from the support, to avoid folding and consequent undesirable doubling up and creasing of the trousers.

GARMENT-HANGER.—E. T. PALMENBERG, New York, N. Y. The inventor's object is to provide a hanger designed for supporting one or more garments, such as coats, skirts, and the like, and arranged to securely hold the supporting-bar in position on the hook and to readily accommodate the velvet or other delicate coat collar without danger of crushing the same.

TROUSERS-BRACE AND STOCKING-SUPPORT.—J. T. ANDREW, Montgomery, Ala. The invention relates to improvements in combined trousers-braces and stocking or sock supporters, the object being to provide a device of this character that will prevent the trousers from bagging at the knee and also to maintain the front crease of the trousers-legs for a considerable length of time, thus preventing frequent pressing.

Electrical Devices.

VOLTAGE-REGULATOR. — T. M. PUSEY, Kennett Square, Pa. In the present invention there is a tipping beam, controllable by the action of a main solenoid and adapted to control the opening and closing of certain contacts encircling the main solenoid are annular solenoids for preventing the solenoid core from racing.

ELECTRIC SIGNALING SYSTEM.—J. S. ANDERSON, Ames, Neb. It may happen that a portion of a track is displaced by landslide, or a bridge turned, or one or more cross-ties dislodged, or the track maliciously tampered with. In these and all cases of a similar kind by means of this invention warning is given directly and automatically to the locomotive engineer as soon as the locomotive approaches within a suitable distance of the part of the track thus affected.

Of Interest to Farmers.

SHEEP-HOOK.—E. W. STAUFFER, Chinook, Mont. This hook is very efficient and easily operated without injury to the leg of the sheep. Very light pressure is required to release the catch or to return it into an operative position. When in operative position, it is impossible for the sheep to release itself. It may be used with equal facility as a goose or turkey-hook, in which case it should be made of lighter material.

Of General Interest.

PEN-WIPER.—J. S. STULL, JR., and C. P. BERKES, Philadelphia, Pa. The device is particularly for use in wiping draftsmen's ruling pens, the object being to provide one that will be simple in construction and by means of which the pen-points may be quickly and thoroughly cleaned of ink at both the inner and outer sides and more conveniently than by employing the usual cloth.

COAL-WASHER AND ORE-CONCENTRATOR.—A. C. CAMPBELL, Asheville, N. C. The object of the present invention is to provide a washer and concentrator arranged to effectively separate the more dense material from the less and to insure a uniform distribution of the material into the separating pan. It relates to coal-washers and ore-concentrators such as shown and described in the Letters Patent of the U. S., formerly granted to Mr. Campbell.

AUTOMATIC FIREARM.—J. J. REIFGRABER, St. Louis, Mo. The invention relates particularly to that class of automatic firearms in which the several operations—such as the unlocking and opening of the breech after firing a shot, the extracting and ejection of the empty cartridge-shell, the cocking of the hammer, the introduction of a fresh cartridge into the firing-chamber, and the closing and locking of the breech—are automatically effected by the pressure of the gases generated by the cartridge explosion.

APPARATUS FOR DISTILLING TURPENTINE.—J. G. SAUNDERS, Lake Park, Ga. By the operating means of this apparatus the hot spirit of turpentine as it comes from the worm of the still is cooled down to or even below atmospheric temperature without exposure to the air and without any loss by evaporation or any swelling and subsequent leakage of the barrels.

CAMP-BED.—F. D. RAPPELEE, Green Bay, Wis. The purpose of the invention is to provide an economic form of camp or field bed, and to so construct the same that it can be compactly folded for storage and transportation, quickly set up for use, and so that all parts will remain connected at all times.

PROPORTIONAL CALIPERS.—J. PRARIO, Mount Hope, W. Va. The aim of the inventor is to provide a means whereby any definite relationship between the lengths of the opposite legs may be secured at will and in which there is no liability of this relationship being accidentally varied or changed during the use of the instrument on any one particular piece of the work.

APPARATUS FOR HANDLING HIDES.—B. A. MCNABB, Lowell, Mass. The improvement pertains to a means for handling hides or skins, particularly those being treated for so-called "patent-leather," and by means of which the hides fastened to the boards in the usual manner may be readily placed in proper position in the drying oven, and when the drying process is finished the hides may be removed from the oven in far less time and labor than by the ordinary methods of handling.

LAUNDRY-TAG.—F. F. AKERLY and W. BORCHERT, Reno, Nev. One purpose of this invention is to provide a tag especially adapted for laundry use and which can be quickly and conveniently applied to any article to be laundered and which will remain on the article until purposely removed, the removal being very readily accomplished. It can be applied by hand or machine, and will not rust a garment.

ANCHOR.—F. B. LANGSTON, Brooklyn, N. Y. The invention has for its purpose anchoring devices in which the seizing device is sunk, owing to the fact that the ground is softened or loosened beneath it by fluid under pressure in such a manner that the seizing device is able to sink into the subsoil owing to its own weight.

EXTENSION BRACE-BAR.—J. W. KOMINEK, Cedar Rapids, Iowa. In this patent the invention refers to improvements in brace-bars particularly adapted for use in supporting theatrical stage-wings or the like, the object being to provide a brace that may be readily adjusted as to length and firmly held when adjusted.

Hardware.

WRENCH.—A. LOVELL, East St. Louis, Ill. The invention has reference particularly to the type commonly termed "pipe-wrenches." The principal object is the provision of a simple and durable implement the jaws of which may be drawn toward and separated from one another to set them upon the work by a force applied to and tending to revolve the handle about the work.

LOCK.—O. KATZENBERGER, San Antonio, Texas. The lock belongs to the padlocks of the keyless combination type, and the inventor's aim is the provision of a lock of this character that will be simple in construction, having no parts liable to get out of order, and that may be opened only by a person knowing the combination.

NUT-LOCK.—W. S. MASON, La Salle, Ill. Mr. Mason's improvements are applicable to either square, hexagonal, or octagonal nuts and are effective in locking the nut in position on the bolt without requiring any extra turning of the nut in either direction. They are also applicable for intended purposes irrespective of the particular number of turns required to be made of the nuts upon the bolt in order to bring the transverse holes in the bolt and the case in proper registry to receive the locking-pin.

Heating and Lighting.

AUTOMATIC-LIGHTING BURNER. — H. LYON, Oneonta, N. Y. The aim of this inventor is to provide simple and improved means for automatically lighting a burner, such as a gas-burner. The invention is applicable to gas, gasolene, or petroleum burners of all kinds used for lighting purposes and seems especially useful in connection with gas-burners for illuminating purposes.

DRAFT DEVICE FOR FURNACES.—W. G. MCPHERSON, Portland, Ore. Special means are employed by which air may be introduced to the fuel on the bottom of the fire-box of a furnace at numerous places throughout the mass of the fuel rather than at those portions only thereof lying at the front of the furnace. Such means may be constructed separately from or as an integral part of the furnace and may be renewed or replaced from time to time, no dismantling or separation of other portions of the furnace being necessary for enabling this to be done.

Household Utilities.

CAKE-TRIMMER.—J. B. WINFREE, JR., Lynchburg, Va. The device is chiefly applicable and useful for trimming the edges of layer-cakes, which it expeditiously effects with economy of material without breaking away any portion save that which is eccentric or too rough. It is very difficult to cut the edges of such cakes while hot, but this invention performs the operation in such a manner that the cakes are left in the best practical form.

Machines and Mechanical Devices.

DECAPPING, RECAPPING, AND SIZING MACHINE.—D. E. SWAYSGOOD, Mark Center, Ohio. The invention relates to cartridges; and its object is to provide a machine arranged to permit convenient decapping and recapping of the shells and accurate sizing thereof. The shell is first decapped, then resized, and finally recapped before leaving the machine, and it is not necessary to handle the shell a number of times for performing the several operations.

UNIVERSAL WORK-HOLDER FOR POLISHING-MACHINES.—I. L. POMEROY, Lockport, N. Y. The principal objects of the device are to provide for the universal adjustment of the holder, so that it can be applied to any kind of work and so that the work may be manipulated in any desired manner to secure the desired polishing action without introducing any necessity for moving the polishing-wheel itself, except the ordinary rotation of the same upon the axis. The means provided saves a large percentage in the cost of labor in these operations.

SAWMILL.—J. H. HOWSER, Dawsonville, Ga. The principal objects of the inventor are to provide for automatically reversing a reciprocating carriage at each end of its stroke, so connected with other operating parts that the reversing means will not interfere with the operation of a hand-operated means for stopping and reversing the carriage, and also permitting a saw when used in a sawmill to rotate continuously and to be driven from the same source of power as the means for driving the carriage.

MACHINE FOR DECORTICATING RAMIE AND OTHER FIBROUS PLANTS—J. M. A. FAURE, 21 Place du Champ de Foire, Limoges, Haute-Vienne, France. The invention consists of a finishing-cleaner adapted to operate in an automatic and continuous manner and so constructed as to effect in succession the introduction of the previously-disintegrated textile materials between a pair of cleaning scraper-cylinders and their subsequent submission to a drawing action in a direction opposed to that in which the cylinders tend to draw the materials, such action continuing until the stems, etc., are entirely disengaged from the cylinders.

WOODWORKING-MACHINE.—E. S. BERRY, Putnamville, Vt. The machine operates upon wood and similar materials, and while capable of general use is especially adapted to making blanks from which clothes-pins are to be made. The principal objects are to provide means for feeding and holding the blanks for grooving opposite surfaces thereof and for beveling the edges.

TYPE SETTING AND DISTRIBUTING MACHINE.—A. G. BAKER, Albion, Mich. In this instance the invention relates to a machine for setting individual type under the control of a keyboard and for automatically distributing the type into various compartments or cases provided therefor, the machine being capable of performing the operations of setting and distributing either simultaneously or independently.

Prime Movers and Their Accessories.

MULTIPLE-CYLINDER ROTARY EXPLOSIVE-ENGINE.—B. F. WALKER, Bridgeport, Conn. The prime objects of the improvement are to attain, first, several expansion-strokes from each cylinder at every revolution of the engine, thereby giving greatly-increased power with light weight and small area; second, direct thrust with no lateral strain on the piston and cylinder; third, dispensing with crank; fourth, a means for mechanically opening the inlet and exhaust valves; fifth, devices for automatically reversing the engine.

ROTARY EXPLOSIVE-ENGINE. — B. F. WALKER, Bridgeport, Conn. In its present form the invention comprises a stationary cammed member of circular undulating form, this member sustaining revolubly a central shaft with a cylinder or cylinders, which turn with a shaft and which have their pistons connected with a part running in or against the cammed part, so that by the reaction of the piston movement on the cam a continuous rotary movement is imparted. It relates to a specific form covered, broadly, in a copending application for engines formerly filed by Mr. Walker.

GOVERNOR.—A. C. CAMPBELL, Asheville, N. C. The invention relates to devices for regulating the speed of engines, motors, and other machinery; and its object is to provide a new and improved governor, more especially designed to subject the source of power to such automatic restraint as to check any tendency to variability of the speed of the motor, the governor being exceedingly sensitive, and positive in its action.

STEAM-BOILER.—C. E. CHAPMAN, Fort Edward, N. Y. The inventor provides a quick-steaming purely coil-boiler in which coils are continuous from around the firebox throughout the body and header in the dome from which live steam is taken, the water being forced under pressure in the fire-box coils, passing in vapor to the body-coils, the vapor entering headers of the series of body-coils farthest from the fire-box and then entering headers of next series at a point close to the fire-box, so that the vapor travels from any series to the other in the direction of the fire-box and contrary to direction of travel of products of combustion.

REGULATOR.—E. A. BEYER, Marquette, Mich. The regulator is adapted to be applied to governors, valves, and other spring-actuated parts by means of which the set of the governor or valve under the spring may be regulated at will, for instance, if the invention is applied to an air-brake governor the spring of which is set at a certain pressure. Said adjustment of the spring may be temporarily changed by the device, so as to bring about operation at another pressure or pressures.

Railways and Their Accessories.

SIGNAL.—C. P. RUGGLES, Texarkana, Texas. The object of the present invention is the provision of a flag holder or staff which will normally conceal a plurality of flags or similar signals of different colors or significance, arrangement being made for bringing any one of these flags into view when desired.

TIE-BAR.—J. F. MCKECHNIE, Eleele, Hawaii. In this case the invention relates to railway-tracks; and its object is to provide a new and improved tie-bar for connecting the rails with each other with a view to prevent spreading of the rails, especially at curves, and to relieve the sleepers of undue strain.

SWITCH-ROPE COUPLING.—D. F. KNAPP, Portland, Ore. The purpose here is to provide a device which can be coupled to an automatic coupler-bar by removing the knuckle and using the same knuckle-pin that holds the knuckle in place, and which will also be adapted for application to the arch-bar of a truck to slue the truck around in line with the track. To this end the coupler has a body portion and is provided at one end with a link to which the switch-rope may be secured.

RAILWAY-CAR.—C. M. FUNK, Centralia, Wash. This invention is an improvement in railway-cars, and especially in cars designed for carrying logs or other heavy timber or commodity which it is desired to bind upon the car. By extending the binders under the load at the sides of the car the tendency is to bind the car together instead of spreading it.

SIGNAL.—C. R. DOWLER, Lamar, Col. This "automatic danger-signal" is designed for location near the approach of a railway-bridge at places along railway trackage and on public roads where through action of high water the bridge may be washed away or rendered unsafe and places along the track or roadway made dangerous by washouts, land-slides, or due to other impediment to travel.

CIRCUIT-BREAKING DEVICE.—C. R. DOWLER, Lamar, Col. This invention may be generically stated as comprehending an electric circuit along railway-tracks, suitable signal devices, and means in the circuit for breaking same, the circuit-breaking devices being adapted for automatic operation, through action of peculiar means, upon undermining action or washout of the roadbed embankment or from spreading of the rails.

TORPEDO-PLACER.—W. D. JACKSON, Escanaba, Mich. The object of this inventor is to provide a device for placing alarm-torpedoes on a railway-rail by means of which a person on a rear platform of a moving train may readily place a torpedo in position to be exploded by an approaching train, and thus give signal as to a train ahead.

FREIGHT-CAR.—W. I. BROCK, Erie, Pa. In the present patent the invention pertains to freight-cars; and the object is the provision of a car capable of transporting liquid or solid material and which shall be strong in construction, durable in use, and adapted to be freely and quickly loaded and unloaded.

Pertaining to Recreation.

AMUSEMENT DEVICE.—O. HENRICHSEN, New York, N. Y. One purpose of this improvement is to provide a device which will represent a miniature race-course and horses, automobiles, bicycles, or men racing thereon, and, further, to so construct the device that the objects will be capable of independent action and so that the speed of the objects will be under complete control of the operators, since the game can be played by one or more persons.

Pertaining to Vehicles.

AUTOMATIC BACK-STOP FOR VEHICLES.—C. A. NOBLE, Catskill, N. Y. The invention relates to automobiles and other vehicles, and more particularly to the means employed for preventing the vehicle ascending a hill from running backward in case the power is shut off. The object is to provide a back-stop for vehicles arranged to automatically stop the vehicle on a slope to prevent it from running backward down the same and previous to obtaining any momentum.

Designs.

DESIGN FOR A GAS-STOVE.—C. SCHAEFER, Cambridge City, Ind. The designer has produced an ornamental gas-stove. The body is round and tapers down sharply from the top and sets on a sloping circular base on four feet. Body and base when they meet are encircled with a band giving a wasp-like waist effect. A shade surmounts the upper part of the body and a wire woven pendent is suspended therefrom.

DESIGN FOR A GAME-BOARD.—L. HUDGIN, Nogales, Ariz. Ter. The board is laid out in 255 squares. At intervals there are six patches of ambush trees. At the top of the board, there are opposite alternate rows of square tunnel holes in the hills that make up the landscape of lake and valleys beyond. A railway track with switch is at the bottom of the board.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 8483.—Wanted, the addresses of the Birkeland E. Y. de Process, also the apparatus for the artificial production of nitrates.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 8484.—Wanted, machinery for carding, spinning and making twine, rope and plaited cord, from cotton, mohair and Angora goat hair.

I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 8485.—Wanted, rotary engine for oil or alcohol.

Headquarters for new and slightly used machinery. Liberty Machinery Mart, 138 Liberty Street, New York.

Inquiry No. 8486.—Wanted, makers of typewriter ribbons.

Metal Novelty Works Co., manufacturers of all kinds of light Metal Goods, Dies and Metal Stampings our Specialty. 43-47 S. Canal Street, Chicago.

Inquiry No. 8487.—Wanted, manufacturers of devices controlling valves by electricity.

The celebrated "Hornsby-Akroyd" safety oil engine. Koerting gas engine and producer. Ice machines. Built by De La Vergne Mch. Co., Ft. E. 138th St. N. Y. C.

Inquiry No. 8488.—Wanted, machines for grinding graphite and pulverizing minerals.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machine work and special size washers. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

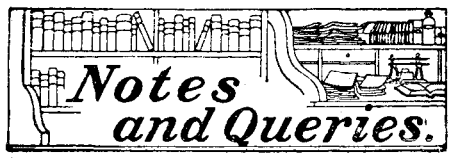
Inquiry No. 8489.—Wanted, second-hand drop hammer heads.

Inquiry No. 8490.—Wanted, manufacturers of electrical heating appliances.

Inquiry No. 8491.—Wanted, a power punch about 20 inches to 24 inches throat and punch a ⅛ inch hole in ⅛ inch iron, new or second hand.

Inquiry No. 8492.—Wanted, manufacturers of croquet supplies.

Inquiry No. 8493.—Wanted, a mill for shredding and grinding alfalfa hay into ground feed.



HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(10221) A. H. asks: Please describe how salammoniac is obtained or produced. A. Salammoniac is prepared from the ammonia water of the gas works, by the addition of hydrochloric acid.

(10222) E. B. S. writes: I have a dynamo that gives 25 volts and will light two 16-candle-power lights. Must the light be rated at 25 or will it light two 110-volt lamps and how many one-candle-power lamps of 100 volts will it light? A. Your dynamo, rated at 25 volts, will do anything which a pressure of 25 volts will do. but it cannot do work requiring 100 volts. It cannot light any 110-volt lamps. The lamps for this dynamo must be 25-volt lamps.

(10223) E. L. S. asks: What is the voltage of the hand-power dynamo in "Experimental Science" when wound as directed with No. 16 wire on fields and No. 18 armature? What sizes of wire should be used to give an E.M.F. of 25 volts? About how much wire will be required in each case? A. The hand-power dynamo gives about 3 amperes at 12 volts. The voltage would be doubled by doubling the number of turns on the field. For the field as designed, about 5½ pounds of No. 16 B. & S. wire are required, and for the armature about ½ pound No. 18 is required.

(10224) J. W. J. asks: Have you plans in any of your SUPPLEMENTS of a dynamo that will charge storage battery described in SUPPLEMENT No. 1195? If so, state what number or numbers? A. The dynamo described in SUPPLEMENT No. 600, price ten cents, will charge the storage battery of SUPPLEMENT No. 1195.

(10225) A. W. P. asks: 1. I am building a 10-inch spark coil, and wish to insulate it with some kind of oil. I have allowed an inch space between primary and secondary, in addition to a thin fiber tube enveloping the primary. I have tested linseed oil (boiled) and kerosene, finding the latter a somewhat better insulator; but the odor is more objectionable. Can you advise me on the subject? A. Any heavy petroleum oil is a good insulator for a coil immersed in it. We do not know how to get rid of the odor of any oil. If inclosed in a tight box the odor will not be perceived very much in the room. 2. I have seen several accounts of Roentgen rays producing acute dermatitis and causing the hair to fall out. Will you please explain to what extent this danger exists, and what means, if any, may be taken to prevent its occurrence? A. The danger of producing X-ray burns is very imminent if the operator is inexperienced or the tube is not properly shielded. The best mode of avoiding these burns is to have an apparatus which will do its work so quickly as to not produce them. It is, however, prudent to cover the patient in the parts exposed to the rays with a piece of aluminium foil which is grounded to a gas or water pipe or has a wire carried to earth. 3. In an interrupter where the circuit is quickly broken under water, is it necessary that the contacts be made of platinum? A. The same heat is produced in breaking a certain current under any circumstances. If water is interposed the heat is carried away more readily, but the spark and heat of the break is able to burn the wire, and platinum should be used for the terminals.

(10226) J. E. P. asks: 1. In substituting a button to throw the drop at the central telephone station, how many Mesco dry cells will be required instead of the magneto-electric machine usually used in small towns? A. This depends upon the distance from the central, and the number of telephones in series if the line is a party line. It may be that a small number will do the work. Experiment is the solution probably in this case. 2. What cells would you consider preferable for this charge? A. There are a number of dry cells differing but little from each other. We have no recommendation to give to one of these over another.

(10227) G. S. T. writes: Will you kindly give me your opinion of the following statement made here to-day: That a cube of iron one inch square, being dropped overboard at the greatest known depth of the ocean, would not sink to the bottom, but that there is a depth where it would be held in suspense. A. The cube will drop to the bottom of the ocean at the greatest depths. Anything that is heavier or has a greater specific gravity than salt water sinks to the bottom at all depths. The compressibility of sea water is only about 0.000044 of its bulk per atmosphere of pressure and not materially denser at great depths; thus at a depth of a mile its density would be only about 1-130 greater than at the surface. Sand and mud sink to the bottom of the ocean at great depths, and shells are dredged from the deepest seas.

(10228) C. R. M. asks: I want to get the table for carrying capacity of copper wire and German silver wire. I have seen tables run as fine as 26 B. & S. gage, but not any finer. I would like to get a table or a way to figure for finer wire if possible. I also would like something on the size of wire to use on motors and dynamos. A. A finer wire than No. 18 has no carrying capacity, since its use is not allowed by the fire underwriters for wiring buildings. The wires in dynamos and motors are selected on the basis of 2,000 to 3,000 amperes per square inch of cross section in ring armatures, and even 4,000 amperes in drum armatures. In magnet coils only about 2,000 amperes per square inch is allowed.

(10229) A. L. S. asks: 1. In the engineering notes of your paper for September 28, 1901, there is a paragraph on obtaining oxygen from the air, stating that it can be mixed with water gas for lighting. Is not this an explosive mixture? A. A mixture of oxygen from the air and street gas is explosive in certain proportions; but in the burning of these in a jet the fire cannot get at the mixed gases till they are ready to be burned, as in the calcium light jet. 2. Also, will you kindly give the principle of the Nernst lamp? A. The Nernst lamp employs a thread of a substance like that used in the Welsbach mantle. This, heated to a white heat, gives out light.

(10230) J. N. P. asks: Kindly furnish me with explicit definition of the term "equivalent focus," as applied to a compound photographic lens. Give one or more rules, as free from mathematics as may be, for accurately determining the equivalent focus of such a lens. Is the relation of diaphragm aperture to focal length of a lens based upon the actual or equivalent focus? How can we determine the diameter of the circle of illumination of a lens upon which its covering power is dependent, since this dimension varies with the distance between lens and ground glass? A. The equivalent focus of a photographic combination is "the focal length of the single lens which will produce the same sized image." This focus is measured from the optical center of the lens. It is not the "back" focus. Several methods are given for measuring the equivalent focus in Taylor's "Optics of Photography," price $1 by mail.

(10231) C. E. D. writes: It seems to me that you have not yet gotten at the gist of my query. I did not assert that the ice would not freeze to the cold spoon, but that it froze to the hot spoon in less time, as has been observed, not only by myself, but by many others under the conditions described by me. My two objects in writing were to bring before your readers a pleasant and simple cooling confection, very cheap, and also to find out why less time was required in connection with the hot piece of metal than if a cold piece was used. It is my belief that a hot spoon shapes the ice and thus gives a better contact and when lifted brings with it more ice than the cold one. This would seem to me to be the proper solution, but it does not alter the fact that of the two spoons introduced at the same moment, the hot one will have the more ice clinging to it when withdrawn. If you did not find this phenomenon, then you have not carried out the experiment as I have regularly done. A. In the question under consideration, the action of chipped ice and sugar mixed upon a hot and a cold spoon, we did not intend to misrepresent your position in the former letter. We quote: "The ice ought to be just as cold and just as liable to attach to the cold spoon as to the hot one—in fact, more so; but it does not do it." This certainly seems to us to say that the ice does not freeze to the cold spoon. As you now say you did not intend it so, we do not insist on the point. It is clear that nothing can freeze to ice till that thing is cooled to the freezing point. It is also clear to us that the ice which is attached to the hot spoon is not frozen to the spoon but simply sticks to it. We note that you now do not say "freeze" to the hot spoon, as you did in former letters, but "the hot one will have the more ice clinging to it when withdrawn." This is quite true, as we observed, but since this clinging ice was not frozen to the spoon at all we paid no attention to it. It simply clung to the spoon by surface tension and capillarity. That was all there was to that. We froze pieces of ice to the cold spoon and to the hot one after it had cooled. The hot spoon, as you say, melts the pieces of ice into better contact and so they adhere to it more closely when it cools. We must confess we do not see any mystery or puzzle in the action. There are many instances in which ice freezes to the object with which it is in contact, if only a thin film, or pellicle of water can come between them. If no film of water can be formed between the two surfaces no freezing will take place. Lumps of dry ice in a place below freezing will not freeze together, unless pressure is exerted to bring them together.

(10232) A. O. asks: Can you furnish drawings and directions for building a small generator for charging storage battery cells, such as are used on automobiles? Have you a revised edition of "Experimental Science"? I have a copy of the 1890 edition. Would like to know where I can buy storage battery plates, etc.—something up to date. A. Our SUPPLEMENT No. 600, price ten cents, gives plans for a dynamo giving 50 volts and about 10 amperes. This would charge twenty cells in series. If you have any such number of cells to be charged this would answer very well for the work. With a smaller number a rheostat may be used to take up the excess of voltage, and so any number of cells in reality may be charged up to twenty, the capacity of the machine. We have not the plans for a machine especially designed for charging batteries.

NEW BOOKS, ETC.

THREE MEN IN A MOTOR CAR. By Winthrop E. Scarritt. New York: E. P. Dutton & Co., 1906. 8vo.; 267 pp.; 16 ill.

This is an interesting and instructive little volume by the foremost apostle of the automobile in America. Mr. Scarritt has owned and operated more than twenty different makes of cars in the past six years, and his description of his first machine, contrasted with the auto of to-day, shows vividly what progress has been made. The book deals mainly with a trip around Europe in a modern motor car. Not only is it full of descriptions of scenery and the writer's impressions, but it gives much practical advice upon touring and the transport of a car to Europe and back. When *en route* and stopping at the best hotels, the three men found that it cost them $12 per capita per day, all expenses included. A good chauffeur can be hired for $5 a day, for which he will board himself. The book concludes with chapters on early American automobiles and automobile races, and a prophecy of what is to be the future of the automobile in this country.

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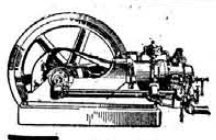

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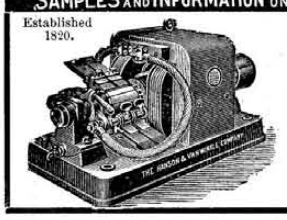

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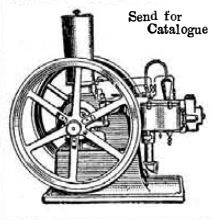

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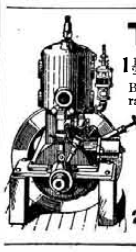

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