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# SCIENTIFIC AMERICAN 

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## WIRELESS TELEGRAPHY AND THE "ST. LOUIS.

The painful uncertainty attending the belated "St Louis," of which nothing was heard, from the time she left Cherbourg until she was sighted at Nantucket, a week overdue, suggests that for passenger ships at least, the time will be welcomed when every vessel is equipped with a wireless telegraph outfit. Although none of the vessels so equipped would be capable of repeating Marconi's feat when he communicated from one of the vessels of the American Line over 1,500 miles at sea with the powerful Poldhu station, a range of say 200 miles should be quite within commercial practicability. Considering the crowded condition of the various steamship lanes across the Atlantic, it would be impossible, were all passenger ships so pro vided, for a vessel to remain unspoken for more than a day or two at the longest; and a liner disabled in midAtlantic should be able to communicate from ship to ship with her home port and news of her trouble be made known, long before the day set for her arrival In this way an enormous amount of anxiety could be spared to relatives and friends on the all-too-frequent occasions when transatlantic vessels are disabled. Indeed, we consider that just as soon as wireless teleg raphy has been placed on a thorough commercial basis, it would be quite within reason for a law to be passed requiring all ships to install some one of the wireless telegraph systems which will be on the market.

## MAGNITUDE OF GOMMERCE ON THE LARES.

The close of November on the Great Lakes usually marks the end of the season of through navigation; and the government statistics show that for the first eleven months of the past year 77,408 vessels, of over seventy-one millions net tonnage, were reported as ar rivals, and 77,899 clearances were reported, of over seventy-two million net tons. There are twenty indi vidual ports on the Great Lakes having a registered tonnage ranging from one million to over five million tons. Cleveland heads the list with $5,037,282$ tons; and five other ports, viz., Duluth, West Superior, Milwaukee, Chicago and Buffalo, recorded over four million tons of arrivals. The enormous volume of this movement is only appreciated when it is compared with similar marine operations on the ocean frontage. New York, during the entire year 1902 is credited with 8,982767 ton of arrivals: London had entrances in 1901 amounting to $9,992,753$ tons; and Hong Kong reported 8,626,614 tons entering in the year 1900 .

## NEW METHODS OF tunNfilng.

It was inevitable that the construction of the Rapid Transit East River tunnel, and the North and East Rivers tunnels of the Pennsylvania Road, should stimu late inventors to devise new and better means of tunnel ing through silt or other soft material. All the later methods that have been outlined make provision for supporting the weight of the tunnel upon the firm rock bottom underlying the silt. The Chief Engineer of the North River tunnel, Mr. Jacobs, does this by opening the bottom of the tube at stated intervals, and carrying a concrete-filled cylinder pier down to bed rock, the weight of the tube and the trains being car ried by two parallel trusses resting upon the piers, and constructed within and on each side of the tube itself. Another system, which has recently been patented by Mr. Sooysmith, employs the freezing process asso ciated with timber piling. When tunneling by this ciated with timber piling. When tunneling by this
method, a pile foundation is first driven from the river surface throughout the whole length of the tunnel; the material lying just above the piling is then frozen by driving a small pilot tunnel ahead into the surround ing material; and the tunnel is excavated through the material thus frozen, the steel tube resting upon the pile foundation that has been driven for it.

Get another method is that of Mr. Reno, who drives the tube by the usual pneumatic shiel.d method, and, as it proceeds, takes out a bottom section of the tunnel lining, excavates a rectangular chamber below the tunnel and fills it with a mass of concrete, thus placing the tunnel tube upon a continuous, deep, concrete bed of sufficient weight to prevent vertical or lateral dis placement. The great magnitude of the present tunnel schemes, and the importance of securing the system which will be easiest of construction and most secure againsi deformation when built, render this problen one of the most important that has come up in the world of civil engineering for many years past.

## A dozen new vessels for the shipping trust.

it will be remembered that when the great steamship merger known as the International Mercantile Marine Company was publicly announced, it was stated that there would be a division of all new steamship con struction between American and British yards. The company has just authorized the statement that no less than a dozen Atlantic liners are to be added to their fleets. Of these vessels six will be launched in this country, three of them from the Sparrow's Point yards, Baltimore, and three at the Camden yards, Phila delphia, while the other six will be constructed in Brit ish yards. Ail of these vessels are to be of the mixed freight-and-passenger type which has proved so popular in the "Celtic," although none of the ships will be as large as the latter vessel. Their tonnage will run from 12,000 to 16,000 tons, and the length from about 500 to something over 600 feet. It is significant that not one of these vessels is to be of the high-speed type, the average sea speed varying from 14 to 16 knots. It is well. understood that the slower vessels with large cargo-carrying capacity are the most profitable ships afloat, and that their net earning capacity increase rapidly with increasing size.

## THE HUMORS OF RAILROADING.

In a recent issue, the Editor, in describing a ride on the locomotive of the Twentieth Century Limited, over the New York Central and Lake Shore Roads, ventured, with many misgivings, to attempt the role of an impressionist. On casually reading over the cold-type result, it has occurred to him that the "impressions" are a little out of balance, inasmuch as he has failed to touch upon the lighter side of the ver strenuous life on the footplate; for although the handling of a crack, modern express train on an Am erican railroad is a task calling for the highest qualities of courage, judgment, and eternal vigilance, and although in the background of changing sights sounds and scenes that go to make up the engineer's life, there is always visible the specter of sudden death or shocking injury, life on the road has still its lighter and humorous phases. One of the "sights" which the privileged guest in the locomo tive cab of an express train will be told to watch for, is the taking of water from the trough tanks be tween the tracks. It is an interesting and even a spectacular sight, particularly if the scoop should be left down a little too long, and the tank should overflow. On the occasion of our ride, when we were making fast time over a stretch of the magnificently kept roadbed and track of the Lake Shore system, we took water at a trough while we were running at con siderably above the regulation speed of 45 miles an hour, to which enginemen, as a rule, are expected to slow down. Now, when a forwardly-projecting scoop is pushed through standing water at a speed of 60 miles an hour, it can be understood that the inrush o water to the tank is in such a volume as to fill it up in an exceedingly short space of time, and hence it requires considerable judgment on the part of the fireman to raise the scoop at the "psychological mo ment" and avoid an overflow. To provide against rupturing the tank there is a large, square hole cut in the top of the tank at its rear, just oppo site the baggage car front platform; and in case o an overflow the water boils out through this opening in a perfect cataract. When the Twentieth Century train was first run over the road, it happened tha the tank was overfilled, and the water, rushing out fell against the front end of the baggage car, burs open the door, rushed through the baggage compart ment, poured into the barber's shop, and so scared the tonsorial artist that he stood not on the order of his going, but fled headlong into the smoking compartment, with the foaming flood at his heels. There after, to provide against another accident of the kind the front door of the baggage car was battened; and the baggage master and barber henceforth pursue their respective callings, dry shod.

The scoop is lifted from the tank by means of an air cylinder. On the occasion when we made the run, the "air failed to act" (at least so said the fire man), with the result that the water continued to rus into the tank long after it was filled, and the write witnessed a display that was simply magnificent. Tons of water as it boiled over, fell against the front end of the baggage car, and, dividing, rolled off in a
splendid cataract at eac! side of the track. Here, d it struck the gravel bailast, at a velocity of a mile a minute, it acted like water from the nozzle of a gigantic fire hose, and the flying waters spread right and left in a huge cloud of foam and spray that entirely hid the following train from view
Now, it. so happened that once upon a time, sub sequent to the closing up of the front door of the baggage car for the reasons above stated, a certain tramp, seeing an opportunity for an unmolested 160 -mile ride on one of the fastest trains in the world, stole up on the front platform as the train was starting, and coiled up for the trip. There are two water troughs on this run, at each of which the scoop is used; and whether it was that the firemen accidentally caught sight of the "deadhead," history saith not; but it is a fact that by a curious coincidence, at each trough in succession there was an overflow of the most violent character. At the end of the run, when the engineer was looking over his engine, he was confronted by what he described as the most absolutely washed-out specimen of humanity that he had ever seen, who with the water still in the act of draining itself out of his hair and tattered clothing, placed his hand on the arm of the engineer, with the query: "Say, mister, what was the names of them two rivers we run through back there?'

## SUBWAY VENTILATION.

In the present rapid extension of subways and deep tunnels there is a danger of neglecting the all-important question of ventipation. Even in cases where the question has been considered, the means taken to provide for a constant supply of pure air have been more or less inadequate. Recent tests of air taken from the London tubes at various hours of the day, prove that it becomes vitiated to a degree that is a positive menace to the health of the public. It was found that while samples of air taken at street level outside the stations of the Central London Railway contained an average of 2.83 parts of carbon dioxide per 10,000 , tests of air taken at the same time from the interior of the stations, and from the cars within the tubes, showed that on the station platforms the percentage varied from 4.23 to 7.36 parts during the hours of moderate traffic, while during the rush hours the per centage rose from 11.04 parts to 20.46 parts per thousand. Now, when we bear in mind that a percentage of over 6 parts of carbon dioxide in 10,000 is considered to be, to say the least, undesirable, and that in the case of persons of weak constitution this percent age becomes positively harmful, we can understand how very injurious the atmosphere in crowded cars in a subway or tunnel must become, during the rush hours. The Scientific American has frequently drawn attention to this most important aspect of sub way and tunnel construction; and now that the Pennsylvania Road has been granted a franchise for its deep-level tunnels, and the East River and North River tunnels are under construction, the question becomes one of most vital interest to the New York traveling public. We believe that, at present, the subway engineers are trusting to the movement of the trains to produce sufficient ventilation; and, if so it looks as though they are confusing ventilation and circulation. The movement of trains will produce circulation; but if the air be already vitiated, it will require something more than the mere transfer of the air by the piston-like action of the trains to render it pure. Provision must be made for taking into the tunnels a supply of fresh air and expelling that which has been vitiated, and to secure the best results this action should be constant and not intermittent.

## COLONISTS FOR OUR NEW PUBLIC LANDS

The adoption by Congress of a homestead law for our new insular or colonial possessions will throw oren :, ....nnists a new princely domain beyond the seas ${ }^{-r h i c h}$ :lll have attractions for tens of thousands of :rs. who will undoubtedly emigrate as soon as dec:late aws are enacted to protect them in their rits Ine rush for the new homesteads in the PhilInds, Porto Rico, Hawaii, Tutuila, and Guam wi: ;esent one of the most spectacular movements oi Anc.ican population, and will inaugurate an era i1. ou: development of lands beyond our own conti$\mathrm{n} t$ ntal border unprecedented in history. The exact ef ert of this upon the industrial development and expansion or our new colonial possessions can easily be preticted, for similar opening and settlement of public lands have always been attended by rapid growih and improvement of the natural resources of the couniry.

The , iblic lands in these new islands represent some of the rinhest and most fertile soils found anywhere in the worli, with agricultural, mining, and timber resources icare ly comprehended even by our experts. For centuries these great possibilities for material weal!: ha ermained undeveloped, and they must continu: ... nder the control of the people who have alway : iflul tic appreciate their opportunities. Under Spanish ale here was little opportunity for ambitious
colonists to take possession of the lands and develop them, and even had their rights and property posses sions been respected and encouraged by the authorities the warlike condition of the native population would have made their wealth somewhat precarious. It was only along the coast and on the outskirts of the few large towns and cities that anything like civilized settlement of the Philippines was undertaken. With the restoration of peace, and adequate laws to protect set tlers and Filipinos alike, there should come an industrial awakening which will in a short time transform these fair islands into gardens of wealth and attractive ness.
Adequate steps have already been taken to protect the valuable timber growing on the vast forest domain of the Philippines of some $50,000,000$ acres, and indiscriminate destruction of the trees will not be per mitted. The forestry department in the islands has been carefully organized, and expert foresters are in charge. Besides protecting the timber from the vandals and lumber speculators, the foresters are making careful surveys of the woods to ascertain their actual resources and value. Much of this timber is too valu able for building purposes, the trees for the most part consisting of the heavy hardwoods of the tropics, and it is intimated that it will pay to ship cheap pine lumber from our Pacific coast for building and bring back the heavy woods for commercial cabinet purposes. If such an exchange of products is desirable, the work should be encouraged at the beginning, and not left until hal the valuable timber of the islands has been destroyed It is the policy of the forestry bureau on the islands to protect the forests, and to encourage their scientific culture. This will insure an annual crop of valuable trees, and at the same time preserve the woods for all time. In the tropical woods of the Philippines the trees grow so rapidly that a thinning out process can be pursued, so that millions of feet of valuable timber can be rut every year. It is possible to go over the same forests year after year and find new available timber ready for harvesting. There should be a steady income from these hardwoods of the islands amounting in the aggregate to millions of dollars. As conducted in the past, the forests have practically yielded the gov ernment nothing, and the inhabitants have wasted thei resources, so that they have found little actual profit in their great natural possessions.

Scientific experts who have examined the forests of the islands intimate that the greatest calamity which could possibly visit our insular possessions would be the denudation of the forests. The climatic changes that might follow would completely transform the con ditions of agriculture. On the other hand, judicious cleaning up of woods and swamps would produce beneficial changes of an agreeable character. There ar water courses and streams which might well be re duced in volume and intensity without interfering with the agricultural conditions elsewhere. The fina policy of forest culture which the experts will recom mend will probably tend toward the climatic and agri cultural improvement of all the islands. There will be openings for the new American colonists who will undertake scientific forest culture of the most prom ising kind. The possession or leasing of these forest lands will be regulated in such a way that denudation will be visited by prompt ejectment and punishment But it is unlikely that an owner of hardwood timbe lands that furnish a good income each year will decide to kill the goose that lays the golden egg. The export trade in valuable hardwoods will increase in proportion to the scientific culture and harvesting of the forests by settlers who have been trained for the work. Expert foresters represent to-day a new profession in this coun try, but their services in our island possessions will be even in greater demand than at home
This class of new settlers will be of a higher grade than those who file petitions for the ordinary 160 acres of homestead farming land to secure title by living on and cultivating the same. Expert foresters are not numerous, and their services are needed to develop the forests. It is not possible that others will secure possession of the valuable timber lands of the Philip pines, so strict is the forestry department of the islands. On the other hand, there will be urged the necessity of intelligent settlers undertaking the development of forest farms. Under the direction of public foresters it is possible to train a class of prastical farmers who will wisely conserve the interests of both the govern ment and the settlers. The small settler is more likely to preserve his possessions of hardwood timber than the lumber speculator, whose chief interests are concerned in robbing the forests of all he can secure in a few years. Forest culture of the hardwoods may thus become an important industry of the new colonists who go to the Philippines under the homestead law.

The time is apparently ripe now for making inducements to attract settlers to the new public domain of the United States, and both the Secretary of War and the Insular Bureau have been urging Congress to enact some homestead legislation. There is little possibility of a great industrial and agricultural development in the islands without some inducement being held forth
to American settlers. There are some forty to fifty millions of acres of land in the islands which belong to the Federal government, and much of this is the richest of agricultural and mining land. The disposition of this vast domain must carry with it a grea amount of responsibility for those who have the matter in charge. Land records have been very loosely kept in the islands, and a good many of the natives claiming land have no deeds or other titles to show that their possession is a legal one. To determine the legal owner ship of great tracts of the land will require years of study and survey, and possibly numerous decisions of the Supreme Court. But outside of the land which is held in dispute there is a vast tract of which the gov ernment has unquestionable ownership, and the opening of this public domain to American settlers according to the homestead rights will be sufficient to at tract thousands of new colonists to the islands.
G. E. W.

## MORSE'S OLD DIARY AND ITS PROPHECY

In the Electrical Review there appears a portion of the diary kept by Samuel F. B. Morse during his ear liest work on the Baltimore and Washington telegraph line in 1843. The book was discovered in the library oi. Thomas A. Edison, at Orange, N. J., and contains what are evidently the first records.
The first entry in this diary is dated March 14 1843, and consists of a copy of the letter from the Sec retary of the Treasury, J. C. Spencer, giving instruc tions as to the handling of the appropriation made by Congress for this experiment. The reply of Morse and other correspondence in the diary give a striking idea oit the troubles which beset the pioneer's work, as well as of the untiring energy with which the inven tor developed his great ideas. He never seemed to lose heart over the failures of others, which he had to overcome constantly. Under date of August 10, 1843, Mr. Morse describes certain tests he had made, and makes the following interesting prophecy:
"The practical inference from this law is that a telegraphic communication on my plan may with cer tainty be established across the Atlantic. Startling as this may seem now, the time will come when this project will be realized."
Commenting on this prophecy and old-time record, which is virtually the story of the beginning of the vast electrical industry of to-day, the Electrical Re view says:
"How well this prophecy has been fulfilled! To-day there is no ocean unspanned by a telegraphic cable. This old record of the first work in telegraphy takes added interest from our latest accomplishments. We have completed the first Pacific cable and have made good start on the second, and Marconi has established communication across the Atlantic without wires. I is difficult to realize that this diary was written les than sixty years ago. Who will venture to predict the electrical developments of the next sixty years?"

WIRELESS MESSAGES TO A MOVING TRAIN.
On the occasion of the recent Forty-seventh Annual Convention of the American Association of General Pas senger and Ticket Agents, the Grand Trunk Railway gave a demonstration of wireless telegraphy on a mov ing train. The experiment was entirely successful.
The demonstration was made by Dr. E. Rutherford, F. R. S. C., and Dr. Howard T. Barnes, F. R. S. C., both of the Macdonald Physical Laboratory of the McGill University, Montreal. Signals were exchanged between a station and a train (which was running at the rate of 50 miles an hour). No attempt was made to cover distances comparable in length with those attained by Marconi and others, but with comparatively simple laboratory apparatus it was possible to keep the train in touch with the station for from 8 to 10 miles. St . Dominique was selected as the transmitting station where two large metal plate vibrators $10 \times 12$ feet, con nected with an induction coil of the usual pattern, were situated. On the train itself the waves were received by collecting wires connected to a coherer of nickel and silver powder. The relay operated electric bells in three cars. The collecting wires were run through the guides for the train signal cord, and exfended on both sides of the coherer for about one car length. To obtain the maximum effect it would have been better to have had a long verical wire, but since such was impos sible, the horizontal wire was used. Although these were placed inside the steel frame cars, strong and defi nite signals were obtained over the distance named Another difficulty militated against obtaining the maxi mum sensitiveness, as owing to the natural vibration of the train resulting from its great speed, it was impossible to have the relay adjusted to its most sensitive point. In spite of these difficulties the distance to which signals could be sent to the train was eminently satisfactory, and with more refined apparatus greater distances could without doubt be covered. The success of this form of wireless telegraphy, of which this was but a pioneer experiment, opens up yet another method of providing for the safety of the traveling public.

It is rumored that A. Lawrence Rotch, of Boston, is to lend his aid in solving the meteorological problem concerning the permanent circulation of the atmosphere at altitudes greater than 15,000 feet. It is said that the German government is to furnish Mr. Rotch with a ship equipped for a three months' voyage in the tropics. The necessary apparatus and expenses are to be paid for by American scientific men
E. Tardy has studied the oil of Chinese anise, the oil of Japanese anise and the oil of feninel. He finds that Chinese anise oil contains pinene, phellandrene, estragol, a dextrogyrate terpilenol, anethol, a levogyrate sesquiterpene, anisic aldehyde and acid, together with traces of a crystalline body of the formula $\mathrm{C}_{3}$ $\mathrm{H}_{22} \mathrm{O}_{3}$, and of the ethyl ether of hydroquinone. The author attaches some importance to the presence of the terpilenol, to which he considers the particular odor of Chinese anise is due. The result of his study of Japanese anise (Illicium religiosum) shows that the oil has a low rotation.
Princeton University recently received from John M. Clarke, New York State palæontologist, the body of an octopus-like creature, firom Onondaga Lake. Dr. Ortmann examined the specimen and found it to be a cold-water, short-armed squid, a species of devil-fish prevalent along the Atlantic coast from Cape Cod to Newfoundland. The fish was a salt-water specimen, and how it came to be found in fresh water is not easily explained. To be sure, the specimen examined by Dr. Ortmann differs from the ocean-bred squid in that it has not the delicate membranous folds on the arms that stretch out from its body. It may be that these folds constitute a real variation, but Dr. Ortmann is inclined to believe that the membranes have been lost through abrasions or imperfect preservation. In every other respect the New York squid resembles the ocean kind.
The Stanford University has received curios gath ered by Mrs. Stanford during her long sojourn in Egypt. The collection is interesting, not because it contains many specimens of ancient Egyptian art, but because of its modern historic value. One of the most precious trouvailles of the collection is a set of vol umes recounting the history of the occupation of the Nile country by the French, and producing in colors the discoveries and conquests of Napoleon. The vol umes were compiled by Napoleon's orders in 1812. A set of fine reprints in from twelve to eighteen colors of originals dealing with recent discoveries in the ruins of Karnak, also constitute an important part of the collection. Besides these there are cases of gold embroideries, the work of the women of a great harem in Cairo; large numbers of ancient coins, vases and lamps, statuettes, and bas-reliefs of pottery

The appetite of a whale is phenomenal. His chief diet consists of jellyfish. He has simply to open his mouth and paddle along leisurely in order to take in jellyfish by the wagon-load. Such is the method adopted by the whalebone whale. The sperm whale, on the contrary, captures huge squids weighing of ten several tons. Like his brother the whalebone whale, he must be constantly on the lookout for food. Otherwise he would starve. As many as fourteen seals have been taken from a thirty-foot "killer." Other fishes of enormous appetites are not uncommon. The bluefish, for example, thrives on sardines and other small fish. Assuming that one bluefish eats ten small fish a day it has been figured that it requires ten thousand mil lion sardines to feed the one thousand billion bluefish on our coasts every summer. Most curious of all eaters is the hydra-a strange creature that can be turned inside out without impairing its appetite or its power to eat.

## THE CURRENT SUPPLEMENT.

The current Supplement, No. 1412, opens with an elaborately-illustrated article on the steam yacht "Aztec." Dr. Marcus Benjamin has made an abstract of some of the more important scientific papers presented before the Washington meeting of the American Asso ciation for the Advancement of Science. The English correspondent of the Scientific American discusses, in the fifth installment of his series on water-tube boilers, the well-known and widely used Niclausse boiler. John Joseph Flather sets forth modern tendencies in the utilization of power. An account of the diversity of the uses of cold storage, by Day Allen Willey, should be read with interest. To exporters, Consul T. H Norton's admirable summary of commercial conditions in Asiatic Turkey will be of value. The well-known manufacturing chemist W. J. Schieffelin discusses the advances made in pharmaceutical machinery and methods in the last half century. Fred T. Jane presents another installment on the naval war game. His present article tells how hits are determined. Automobilists will read with interest an account of the autochronograph, a new electric timing device for automobiles. The usual Consular Notes and Selected Formulæ will be found in their accustomed places.

## IMPROVED PAPER FILE.

A patent has recently been granted to Mr. Edmund W. Sandstedt, of Hankaw, China, for a paper file


## paper file with no projecting parts.

which cannot be opened without the use of a key. This, in a great measure, will prevent an unauthorized person from removing papers from the file, at least without tearing them out. The construction of the device further offers the advantage of having no projecting parts to mutilate the papers, scratch furniture, or catch in the clothing to the inconvenience of the reader. The file comprises two rods held together at each end by a locking device and designed to engage opposite sides of the paper. Two forms of locking devices are illustrated which differ from each other only in the fact that the con struction shown in the large detail view is rever sible, and this construction may be described as follows: An adjusting screw, $A$, is secured with a swivel connection to one of the rods; this is ef fected by seating the collar on the screw between the plates $C$ and $D$. A plate, $B$, is fastened to the other rod and is provided with a tapped pole adapted to engage the adjusting screw. The op posite ends, $F$, of the adjusting screw project into the openings $E$ of the rods, and are made angular to fit the key. When it is desired to remove or add a paper to the file the rods can be separated by fitting the key over one of the adjusting screws and turn ing the screw to feed out through the plate, $B$. The adjusting screw at the opposite end is then similarly turned outward until it also disengages with the plate, $B$. The rods are thus released from connec tion with each other, and the necessary changes in the file are made. From the fact that adjusting screws are used for locking the rods together, it is obvious that a single sheet may be as firmly held in this paper file as a month's issue of daily papers.

## A NEW METHOD OF TRANSPLANTING LARGE TREES.

Several months ago the Scientific American described and illustrated apparatus invented by Mr. Henry Hicks, of Westbury, Long Island, for taking up and transplanting large trees. Another system has been invented and is being quite extensively utilized in the West. It is the idea of Mr. John A. Wilkins, of Indianapolis, but in utilizing it the trees are transferred from bed to bed in midsummer in preference to the spring or fall, the usual seasons preferred. Mr. Wilkins believes the tree is in its most flourishing condition during the summer, and this is the best time for transplanting, as there is less danger of checking its growth or injuring it in other ways.
The Wilkins plan is quite similar to that followed by florists in transferring potted plants, special care being taken to avoid disturbing the earth immediately about the roots of the tree, as well as to avoid injury to the smaller roots and tendrils. By the Wilkins invention the tree


Driving in the Blades.
A NEW METHOD OF TRANSPLANTING LARGE TREES

Among the advances in practice to be noted in this latest tree transplanter is the operation of the lifting and conveying device according to the points of the


## IMPROVED BELT STRETCHER.

compass, rendering it possible to plant the tree in exactly the same position in which it stood originally. As indicated by the illustrations, the vehicle for conveying the tree is built with heavy framework, which can be raised and lowered by the screws upon the trucks. The power is so adjusted that two men can handle a tree ranging from 30 to 40 feet in height without difficulty. Maples, elms and other shade species, having trunks ranging from 5 to 7 inches in diameter, have been transplanted by this process in the suburbs of Indianapolis, and though the operation was performed during the summer they are apparently in as good condition in their new bed as before being moved.

## BELT STRETCHER.

We illustrate herewith an improved device for drawing together the ends of belts so as to facilitate lacing them together. The device comprises the combination, with a tackle, of peculiarly construct ed grippers, which are arranged to engage the end portions of the belt, so that by means of the tackle the ends may be brought together and held during the lacing operation. In using the device the ends of the belt, $C$, as indicated, are perforated by an awl, so that the points of the gripping fingers, $A$, may be easily engaged with the belt. The fingers are spread out so as to place the strain uniformly on the belt, and by having the ends of the fingers in different transverse lines, the puncture of the belt in a straight line across its width is avoided. This therefore, enables the belt to be perforated for the engagement of the gripping fingers without materially weakening its strength. After the gripping fingers have been properly engaged with the bel.t, the fall of the tackle should be drawn on, thus drawing the blocks, $B$. and consequently the ends of the belts, $C$, together. Then by operation of a locking device, $D$, the movement of the blocks apart is pre vented, so that the lacing or fastening operation may be conveniently performed. Any suitable lock ing device may be employed, such as that illustrated in the sectional view, in which the cam, $E$, is adapted to engage with the fall and prevent its backward movement. The dotted lines show the positions assumed by the different parts when the cam is thrown into gripping position against the rope.
It will be observed that the stretching device does not occupy, when in opera tion, a position outward from the side edges of the belt. This is particularly advantageous in the practical employment of the device, since it enables the operation to be carried on in crowded or confined places, particularly in belt housings and the like, such as are common in grain elevators. Further, by employing the tackle, the beit may be drawn together without the operation of any such device as a crank or other mechanical element requiring considerable room for its operation. A patent for this belt stretcher has recently been granted to Mr. D. R. Davis, Nemaha, Iowa.

AN AUTOMOBILE STREET CAR.
by w. e. partringe.
The illustrations accompanying this article represent a highly interesting novelty-an automobile street car built for Thebaud Brothers, of this city. Although Yankee inventive ingenuity has been directed toward this end for perhaps fifty years, success has not been
heretofore attaine by any of the designs which have been tried. Steam has failed chiefly for want of ad hesion. The storage battery car has been too heavy. The compressed air schemes seem to have failed from a complication of difficulties, one of which, and perhaps the most important, was lack of adhesion. Singularly enough, the present successful combination is
not the result of Yankee enterprise. The idea comes to us from the city of Merida, in Yucatan, and the successful car is the result of the persistent efforts of Señor Don Nicolas Escalante-Peon, at present DirectorGeneral of the Consolidated Railway systems of Yucatan. After using and becoming familiar with Amer-ican-built automobiles of various systems, and after


Fig. III. - Plan Showing the Drive Connection Between Car Axles


Fig. II.-Side Elevation; Storage Reservoirs at Left End


Looking Under the Car Showing the Engine Shaft and Drive Belts.


The Engine, Counterweights and Driving Pinion


The Boiler, Pumps, Reversing Lever and Throttle Lever on Front Platform.


Sectional Elevation of the Compound Engine.

trying unsuccessfully gasoline motors attached to stree cars, the case was put about in this way: "Steam auto mobiles are successfully used which weigh as much as our street cars, and operate at a higher rate of speed than we require. Send us out a car of our standard patterns, to be operated like an automobile." It was a difficult task to find firms willing to undertake this apparently simple engineering problem, and some two years has elapsed since the order was given to execut the idea. The John Stephenson. Company, of Elizabeth, and the Reeves Engine Company, of Trenton, N J., finally undertook the construction of the car and the equipping of it with an automobile engine of sufficient size and power for the purpose.

Our lower engraving represents an external view of the car with a truck load of lumber attached to it as a trailer, for the purpose of testing its power. The car body is 14 feet long, similar in every respec to the street cars used in the city of Merida.
The street railway system of Merida is an extensive one, but peculiar in that it radiates from the central plaza in all directions. The gage is 3 feet, and the motive power hitherto employed has been the small mules of the country, singly and in pairs. Switches and turnouts seem to be the exception rather than the rule, and the cars from the different lines come into the plaza in succession, so that the last in is the firs out. As electricity is out of the question, the need for a self-propelled unit becomes unusually great.
The small size of the car is in some respects advantageous, but the narrow gage makes it difficult to find space for the machinery. The arrangement is shown in Fig. II., which is a side elevation, and Fig. III., which is a plan. These diagrams show the machinery with the car body removed. The boiler is located at one side of one platform. The engine, shown in a ver tical position, is placed horizontally between the wheels under the car body. There is barely room between wheels for the compact little machine and the necessary gear wheels and chain.
The large view shows the location of the boiler pumps, etc., on the platform. In the long view, looking upward under the side of the car, will be seen one of the broad cradle straps, by which the engine is held against the heavy subsills of the car. The engine and driving machinery is, however, self-contained and does not transmit any of its strains to the car body beyond those occasioned by its weight.

The boiler itself is an upright tubular of the standard automobile pattern. It is 2 feet high and 2 feet in diameter, with an automatic burner suitable for either gasoline or kerosene. The engineer, standing by the side of the boiler, finds within easy reach the reverse lever, throttle whistle, and all the valves neces sary to control the apparatus. In fact, this part of the car resembles a magnified automobile.
The engine and the driving apparatus present the greatest novelties. The engine is the Reeves Engine Company's new compound engine, modified to suit the peculiar conditions of automobile service.

One view shows a partial section of the engine and its frame. The cylinders are 6 inches stroke by $31 / 2$ inches and $61 / 2$ inches in diameter. Two piston valves are employed, both of them capable of being adjusted at each end by taking off bonnets. A remarkable economy in steam is obtained by reducing the clearance to an unusually small amount.

For stationary purposes the cranks are set, as shown in the upright view, at 180 degrees, and exhausting directly across the low-pressure valve without the use of a receiver. This was impracticable for automobile purposes. The cranks being of necessity placed at 90 degrees, changes have been made in the ports and passages, and the high-pressure cylinder exhausts into the space around the low-pressure valve, which is used as a receiver. The low-pressure valve admits steam to and controls the exhaust from the low-pressure cylinders. These valves are controlled by eccentrics and a link motion, which gives a very perfect steam dis tribution and a perfect control of the engine. There are many interesting details in the construction of this engine, such as metallic packed stuffing boxes, counterbalances for the cranks and other things highly impor tant, but which cannot be mentioned here. The engine drives a crank shaft, or jack shaft, upon which is placed a gear wheel. On the axle opposite the cylinders is another gear wheel. These two are connected by a Renold silent chain gear. These chains have been very happily described as "flexible internal gears." The speed ratio is $31 / 4$ to 1 , the engine being geared down to the 30 -inch driving wheels. Both axles also carry gear wheels of equal size, over which a second Renold chain is placed, thus making all four wheels drivers.
The secret of the success of the machine is largely due to the gears. The direct-connected steam motor has but a small fraction of the tractive force possessed by a geared engine. A three or four per cent grade represents about the limit which a direct-connected ma chine can overcome, while a geared engine can suc cessfully operate on grades up to eight or ten per cent
The engine, chains and gear wheels, and fixtures
weigh about 1,000 pounds. The boiler, pumps, etc. bring the total weight of the machinery up to about 2,500 pounds. The running gear and car body weigh approximately 5,500 pounds. This makes a total load of 9,000 pounds. Loaded with the equivalent of twelve or fourteen passengers, this car handles with eas around sharp curves the loaded four-wheel truck shown in our lower engraving. This was a loaded lumbe car, weighing about 9,500 pounds. The test was mad in order to ascertain whether the car could handle a crowded trailer with ease, and it was evident tha it could do so. Probably two of the smaller cars used in Merida could be hauled when crowded to their ut most capacity.

The steam pressure is 225 pounds, and the boiler is capable of maintaining this pressure when the engine is working to its fullest capacity. In the cases of th trial trip, the car on one occasion, without a load pushed the trailer, weighing more than 8,000 pounds, with perfect ease on the straight track.
This car illustrates the fact that an invention or an idea cannot always be made successfully until the times are ripe for it. In this case we have the neces sary features of a compact, efficient compound engine; a driving chain; a safety boiler; a burner, automatic ally controlled; liquid fuel; a compact direct-acting steam pump; an air pump, and an injector. All these individual features are the result of years of ex periment in their lines, and success would be hardly possible with any one omitted.

## INDIAN PHYSIOGNOMIES

The study of facial characteristics has always been interesting. "The eyes are the windows of the soul," interesting. "The eyes are the windows of the soul,
the poet tells us; and there are few people who do not believe themselves competent to judge somewhat of character from what the face presents. Lavater and his followers believed a definite science could be constructed, the laws of which would infallibly deter mine the reading of character from facial or physiog nomic characteristics. Later scientists, while discard ing Lavater's ideas, are emphatic in their statements that important ethnologic truths may be learned by careful study and competent measurements of facial, cranial, and other physical developments. Much work recently has been done by Dr. Hridlika, of the Hyde Exploring Expedition under the direction of the Amer ican Museum of Natural History of New York, along these later lines.

A few notes on Indian physiognomies may therefore not be without interest to the readers of the Scien tific American. The Indians pictured are of the Mohave and Yuma tribes, residing on the Colorado River, on both the California and Arizona sides, and the photographs were made on a trip I took by boat from the Needles to Yuma in February of last year.

These tribes are akin and are classed by Powell as the Yuman famil.y. By some they have been regarded as of Apache kinship, but there is little, either in their language or in any other characteristic, to con nect them with this Arizona branch of the great Atha bascan family.

One thing is especially noticeable, and that is that all the older men have very wrinkled faces. These marks of time, of Nature's stern furrowing, seem to me to have one clear significance. It is the outward and visible sign of the pathetic struggle for existence which has been never-ceasing in the history of most aboriginal races, and especially so since the advent of the white man. Indeed, when I made the photograph (Fig. 1) of a Mohave Indian he was telling me of the hard fight he was having to get a sufficiency to eat for himself and his family. It is not a distinctively Indian face. Dressed as a white man, smoothed and straightened up, he would not be far from a Caucasian in appearance. His lips are not so thick, the base of his nose not so broad, and his cheekbones not so high as those of most of his tribe. His hair was done up in long "towy" kinds of rolls, and then wound around on his crown somewhat after the fashion of the Chi nese. (I coin the word "towy" to suggest the tow-like appearance of the hair as seen in Fig. 2.) The majo portion of the old men of both the Mohaves and Yu mas wear their hair in this fashion, and it is this custom that led the Indian Department a few month ago to issue an order that all Indians who were in any way dependent upon the government for bounty or pay must cut their hair shorter. Fig. 2 is of a much older man, toothless and almost blind. He is a tall, stately Mohave, and must have been a physical giant in his youth. The square jaw, thin lips (for an In dian) denote power. Yet there is a singular gentleness shown in the arch of the nostrils. The large corona or brow r!evelopment is remarkable. If one covers the eyes and back of the head, and looks but at the nose lips and chin, an astonishing resemblance is readily seen between this face and that of Gladstone.

I doubt very much whether the most renowned phys iognomist could have read cannibalism in the face of the Indian pictured in Fig. 3, but if his own confessio goes for anything, he has often been a consumer of
human flesh. Though he wears a beard, he has more genuine Indian characteristics than either of the two hitherto considered. His nose is flat at the base, cheek bones high, lips thick, and his eyes are dark, liquid, and large. There is something positively "ogreish" in the manner in which he licks his lips and rolls his eyes when reciting his cannibalistic feats before the campfire to a circle of his admiring tribesmen.
Figs. 4 and 5 are front and side views of the same Mohave. Here is a pure Indian face, with a strange resemblance to that of the late Li Hung Chang. In the smile, there is a jolly good nature shown. The profile view is by no means displeasing, though the front face shows broad base of nostrils and thick lips. The eyes are diseased, as those are of many of his people, undoubtedly owing to the constant sitting over the smoky fire of a chimneyless hut. The cheekbones are not protuberant; the ears are well shaped and set on the head. In marked contrast to most of their people, this Indian, as well as the one pictured in Fig. 3 , have beards. It is one of the most common of sights to see the Indian, with small mirror and a pair of tweezers, pulling out the hairs on his chin and upper lip one at a time. This, and not that they cannot grow a mustache and beard, is the explanation of their gen eral hairless lip and chin.
The next group of four photographs is of Yumas all belonging to the so-called friendly faction of this tribe. In almost every tribe are to be found two factions, car responding somewhat to Conservatives and Liberals The former are those who wish to adhere to the "ways of the old"-the habits, customs, ceremonies, religion, and general procedure of their forefathers; the latter compose the progressive element-those who are willing to forsake the old ways, and, ostensibly at least follow the Washington way. While the effect of this following the new way may be of benefit to their children, there is little doubt in the minds of those who know them that the old men follow the new way be cause of the "loaves and fishes" associated therewith.
Fig. 6 is of Pasqual, the leader of the Friendlies. While present with the Yumas, I got the chief of the hostile faction to call a powwow, in which I stated my desire to photograph them, and why. There must have been fully a hundred men, women, and children present, and their resentment to the whites was open and pronounced. The chief said little, and it was soon evident that he was a mere puppet in the hands of Miguel, the orator and spokesman of that faction. This man is a disappointed politician. Because he could not be selected chief, he is determined to give the authorities all the trouble he possibly can. It was his son, it is generally believed, who set fire some time ago to one of the Fort Yuma school buildings, out of revenge for his father's defeat and to show that he himself had daring blood in his veins.
The result of our powwow was a refusal to allow themselves to be photographed, and a request that the whites leave them alone and allow them to walk in their own ways.

Defeated in photographing the Hostiles, I appealed to the Friendlies, with the result that I was rebuked for not first going to them. The policeman (Fig. 7) was eminently mortified. His face is narrower than Pasqual's, and in his policeman's uniform few would take him at first sight for an Indian. It is astonishing what a great change follows the cutting of the long matted hair, and the removing of the bands and other articles of Indian wearing apparel and substituting therefor the dress of the white man. If it were not for his dark skin, the Indian of Fig. 7 could walk through any city and not be suspected as an Indian Fig. 8, though of a young man, is a far more de cided Indian type. Forehead, nose, lips, chin, cheek bones, and eyes, as well as. hair and skin, all speak him an Indian. He is one of the leading athletes of the tribe, and is skilled in playing a pole and hoop game common to many Indian peoples and described by Cat lin long ago as the chief game of the Mandans.
Fig. 9, too, is an Indian face, though much less so than some of the others. There is a keenness about these eyes, though old, and a general look about the mouth that denotes cruelty, and he is one who, in olden times, would have added a little more tortur to that already decreed against any enemy hapless enough to fall into their hands.

Of the Mohaves it may generally be said that they are the most degraded tribe in the southwestern part of the United States to-day. They are the lowest in the moral scale from our standpoint, having not the least idea of morality as we see it. They believe Godtheir God-to be dead, but that his spirit is alive and is an evil spirit corresponding to the devil of the orthodox whites; that he resides in the Needles Moun tains (passed by all transcontinental passengers on the line of the Santa Fé Railway as they cross the great bridge over the Colorado River at the Needles) This spirit acts as a judge before whom all the spirits of the dead Mohaves must pass ere they are allowed to enter into their Paradise, which is located on the Williams Fork of the Colorado River.
The Yumas are slightly more progressive, having
come in contact more with the whites since the estab lishment of the city of Yuma. Their children, too, seem to make better progress in school.
These pictures and the accompanying remarks, though necessarily brief and cursory, will show, I am sure, that there is a great field for the physiognomists of every school among the Indians of the American Southwest.
safety Exploder for $\boldsymbol{H}$ et Guncotton shells.
A new saîety exploder for use with wet guncotton s:hells has been invented by the New Explosives Com pany of London, the use of which may affect the charges for heavy artillery. Wet guncotton has been generally regarded as one of the safest and most powerful explosives in existence. The only objection to its general use for shell purposes hitherto has been that, to insure complete detonation, a prime of dry guncotton and a fulminate of mercury de tonator have been required, and both of these are too sensitive to premature ignition to be of any practical utility. The new safety exploder contains neither dry guncotton nor fulminate of mercury, but it will detonate wet guncotton with certainty an safety, and will not detonate itself under a tempera ture of 360 deg. C. It cannot be ignited by friction or shock, out at the same time it is brought int action with an ordinary detonating pellet such as is commonly employed in percussion or time fuses The force then exerted will detonate in its turn any charge of wet guncotton, without leaving any traces of unbuint explosive or residue. The composition is very stable and stands an excellent heat test At Ridsdale, the explosive experts of the British War Office witnessed a series of experiments with this material. The main bursting charges of shell were made by a new process introduced by th company, whereby changes can be formed in one block instead of being built up of smaller pieces. The first trial consisted of ten rounds from a 6 -pounder quick firing gun. The total weight of each shell was 5 pounds $101 \%$ ounces, the weight of wet guncstton burst ing charge being 3.5 ounces, and that of the explos ive in the safety exploder 138.8 grains. The shel was fitted with the ordinary Hotchkiss fuse, Mark IV The target was a $3 / 4$-inch steel plate, and the range about 150 feet, and arrangements were made for se curing the fragments of the shell. A $71 \%$-ounce charge of ordinary cordite was used. The weight of the pieces of shell recovered on these ten rounds varied between 4 ounces and $83 / 4$ ounces, and the number o pieces ranged between 81 and 337 . Of three rounds the chamber pressure and muzzle velocity were re spectively $11.28,12.26$ and 12.39 tons, and $1,800,1,827$ and 1,838 foot-seconds. $A$ second experiment con sisted of the bursting of a 6 -inch shell at rest in closed cell in order to show that the exploder would work without shock of impact at short range. The wall of the cell was burst open by the force of the explosion of an ordinary cast shell weighing 1191, pounds, fully loaded. The fragments recovered num bered 2,122 pieces, their total weight being $651 / 4$ pounds. The wet guncotton charge weighed 6 pounds 9 ounces, and the explosive composition in the exploder weighed 10.5 ounces. The fuse was of the ordinary direct acting pattern, and was fired electrically. Further trials showed that wet guncotton with this new safety exploder can be fired through the thickest armor plate without exploding until it had passed through.

## New Magazine Rifle.

It is said that the Danes have adopted a new maga zine rifle for naval and military purposes. It fires, on the proving ground at least,, at the modest rate of fifteen rounds a second, and allowing for reloading, 300 a minute. The magazine holds thirty cartridges. It is heresy, we suppose, to say so, but we are of opinion that there is an unnecessary fuss made about rapid fire rifles. They have to be aimed to be of much ser vice, and the time to aim cannot be reduced. The Danes, maybe, have read about the need of a ton of lead to kill a man, so propose to try and deliver the ton a quickly as possible. But, as the utmost a soldier can carry is 300 rounds, and supply is not easy in real warashore or afloat-there seems a fair chance of Danish warriors being short of their quota of the needful ton at critical moments. Afloat, this is beginning to be felt; and though the Vickers-Maxim firm, with the bare charge, have done much to save us feeling the "weight of ammunition problem," any advance in rapidity of fir seems likely to bring the problem back. Given weapon that fires fast, men in battle are pretty sure to fire it as fast as they can

Greatest Passenger Transortation in the World. The elevated railroads of Manhattan and the Bronx are unmatched by any open-air steam railroad system in the world in the number of passengers carried each year. The ras of the business done by these elevated railroads fu: 6 year that ended June 30 last shows that in tha: yoes: $215,000,000$ passengers (round num
bers) were transported. It might have been added that they were transported without accident to one of these passengers excepting some trifling bruises.-Philadel phia Press.

## AN IMPROVED VAPORIZER FOR GASOLINE ENGINES

The cross-sectional carbureter, seen in this column, shows very clearly it salient features, which are the invention of Mr. A. W Olds, of Hartford, Conn.

The inventor's idea, in designing the vaporizer, was to do away with the needle-valve usually employed for controlling the flow of gasoline, and substitute for it an arrangement that would never fail owing to wear of the val.ve, such as sometimes occurs with the ordi nary type. Mr. Olds had recourse to the difference in density of gasoline and merciary, in carrying out his idea; and the manner in which this difference is made use of, we will now describe

The vaporizer is made up of two cylinders-the sup ply cylinder, filled with gasoline, and the atomizing cylinder, through which the air and vapor are drawn to the engine. The supply cylinder is divided by a horizontal partition, $C$, into two compartments, and $B$, which are the gasoline feed chamber and the float-feed chamber respectively. A vertical tube, $D$ connects the two chambers, and a long, fine wire pas ing through this tube, is suspended from the bail of the float, $F$, by a collar and set screw, and carries at its lower end a cup, $E$, half filled with mercury. The gasoline, entering the small pipe hole near the bot tom of the chamber $A$, rises through tube $D$, and, overflowing at its upper end, falls into chamber $B$. As this chamber fills, float $F$ rises, carrying with it the mer cury cup, $E$. When the surface of the mercury cover the bottom of the tube $D$, the gasoline forces some of


AN IMPROVED VAPORIZER FOR GASOLINE ENGINES
the fluid up in the tube. This of course lowers the level slightly in the cup, allowing the end of the tube to become uncovered sufficiently for more gasoline to flow up in it, as a result of which the cup is again raised, and more mercury forced up the tube. A co umn of mercury is thus formed in the tube, and the gasoline bubbles up through it until its height becomes sufficient to balance the head of gasoline, when the latter will cease to flow. By this time the gasoline will have filled chamber $B$ to within a short distanc of the needle atomizer valve $H$, through which it is fed to the engine. When the engine is running, a small steady stream of gasoline overflows from the top of tube $D$ into the float-feed chamber, in order to keep up the level. That this stream is continuous, rathe than intermittent, was demonstrated in a test made on a Westinghouse gas engine in the presence of the Scientific American representative.

Besides the mercury column for controlling the feed of gasoline to the float-feed chamber, the carburete has a double valve in the vaporizing cylinder, for throttling the air inlet and vapor outlet. This valve consists of a sleeve $M$, adapted to be turned by a wrench on iug $N$. The sleeve has ports that match those in the cylinder proper, which are arranged with the lower one slightly smaller than the upper. so that there is always a slight vacuum in the cylinder, which tends to draw the gasoline through the needle valv $H$. By throttling both the vapor and air proportion ately, the suction is always the same, and the mixture never varies, no matter at what speed the engine is run. The two wire gauze cones, $L$. serve to break up the gasoline and thoroughly vaporize it. These ar not absolutely essential, however, and can be left off if desired.
The vaporizer is made of brass or aluminium, and will be found a most satisfactory article for use on al kinds of gas engines where absolute surety is wanted that there will be no leakage of gasoline. With it, an auxiliary shut-off cock is unnecessary, as the mercury column can al.ways be depended upon for shutting off the gasoline flow when the engine stops.

## $\mathbb{C o x t e x p m a d e n t e}$.

## The Aerodrom

To the Editor of the Scientific American
My attention has been called to the communication of your Mexican correspondent, F. McC..., in your issue of January 10 , which is a fair criticism of the aero drome illustrated by the writer in Supplement No 1399, for which is claimed the imporiant characteris tics of inherent stability and automatic control; also levity and translation through the air by a single physical action of aeroplanes operating under the simple law of the parallelogram of forces. He expresses the belief that the swivel support of the rider will not per mit the rider's changing the plane of revolution of the aeroplanes by varying the center of gravity, and instances a floating barrel upon which a swimmer is trying io climb

I may say that the reasonable assumption of your correspondent was anticipated and fully realized at the first conception of this type of machine years ago (caveat drawn in 1894), note taken, and provision made accordingly in such a way that, to a degree, a lighter, simpler, and cheaper combination resulted. A possibility was forestalled, and a fact, if fact it proved, curious as it may seem, was to be utilized to remedy a difficulty
As to the barrel simile, your correspondent mus admit that the boats and vessels of commerce, which approximate barrel shape, and probably descended from such primitive shapes, do not careen to such an extent as to render water navigation impracticable. Why Because in the evolution of the art of boat building and operation, the tendency is minimized and rend ered negligible.

It is hoped to show your correspondent and others whom it may concern, that notwithstanding his as sumption of absolute prohibition, it will not be realized or, more carefully stated, will not be apparent to detrimental degree in the first machine produced of the type illustrated.

As to steam power, it may be said this type of aerodrome lends itself to the adoption of steam prime movers very completely, and was so first designed, but set aside for a larger factor of safety. The trouble with it is, and always will be, the weight of water, or any substitute therefor, where lightness is a desider atum and considerable radius of action important Condensation and the re-use of the water is, for the writer, antering too much into the refinements of this particular art at this stage. 'Tis best to follow the lines of least resistance.
S. D. Mott.

Passaic, N. J., January 12, 1903.
Irrigation in the seuthwent
There was recently begun in Texas what is mianned to be the most extensive system of irrigation in the United States, for it involves the utilization of no les than 295,000 acres of land. A main canal will be con structed 100 miles in length, extending 30 miles from the town of Peccs in a southwesterly direction, cross ing the Texas and Pacific Railroad 6 miles west of Pecos, and on to Toyah Lake, 7 miles south of Pecos where one of the largest reservoirs in existence is to be constructed. From Toyah Lake the canal will run on and join the Williams Canal 30 miles farther down finally emptying into the Pecos River 60 miles below Pecos.

## The Cooper Hewitt Converter and Lamp

 EnglandThe readers of the Scievtific American are more o less familiar with Mr. Peter Cooper Hewitt's mer cury vapor lamp. It will be gratifying for them to learn that it has met with no little favor in England Lord Kelvin was unstinted in his praise of Mr. Hew itt's work. The Hewitt lamp, it will be remembered resembles somewhat Macfarlane Moore's contrivance but differs radically therefrom in the principle of its operation. Instead of employing rapidly alternating currents, Mr. Hewitt renders incandescent the vapor o mercury, for which purpose a low-pressure continuous current is employed.
Mr. Hewitt has also invented a new form of convert er which it appears differs radically from the presen machine for converting alternating currents into direct currents. In the course of his experiments with his mercury-vapor lamp, Mr. Hewitt evolved the pres ent invention. From the meager details at hand w are unable to state precisely the form of the new con verter, but we are informed that it is based, on tho discovery that certain vapors under peculiar conditions suppress certain portions of the alternating waves so as to change the flow into a direct current. The re sulting current is pulsating, however. having the same frequency as the original alternating current. The ap paratus is said to be very simple and extremely smal as compared with the rotary converters now in use It is also asserted that the new converter, in its pres ent form, will handle voltages as high as 3,000, anc that probably this figure may be increased to 10,000 upon further investigation and experiment.

HOW A TELESCOPE WAS MADE AT THE JESUIT COLLEGE, MONTREAL
Through the courtesy of the Rev. Father Foullety, we are enabled to give our readers an account of an undertaking, through which the Jesuit College at Montreal, Canada, has secured a telescope which satisfies all the demands made upon it. The telescope was built from the designs of the Rev. Father Garais, by the members of the Jesuit College. The spherical mirror of this telescope is in point of size the third in North America, being excelled only by those of the Yerkes and Lick observatories. No little admiration is due to the man who has not only designed the whole and constructed the principal parts of so intricate an instrument, but who has moreover with his own hand erected the machinery required for its production.
We are informed that a lathe was put up upon which the crude block of Mantois glass for the mirror was ground. The process used for cutting the mirror shows some novel and interesting features, and is best explained by reference to our diagrams.

A cast-iron wheel, four inches in diameter, $C$ (Fig. 1) was rapidly rotated by means of a driving belt, $d$, from the pulley, $W$. The wheel, $C$, was so fixed that it could be raised or lowered at will by means of a fine adjustment. Under it was placed the block of glass. This block, $M$, was firmly fixed upon the table, $N$, which could be rotated about a vertical axis by the handles, $h h$. The table, $N$, carrying the glass, could also be moved in a straight line parallel with the direction of the belt, $d$. From a reservoir, $R$, sand and water were fed upon the grinding wheel, $C$. The process adopted was as follows: The rapidly rotating wheel, $C$, was lightly applied to the glass block. While sand and water were continually fed from the tank, $R$, a slow rotary motion was given to the block by turning the handles, $h h$, the wheel, $C$, being gradually lowered as the glass wore away. In this way an annular channel was ground. The block was then moved in a straight line parallel to the belt, and outward from the pulley, so that the wheel, $C$, came nearer to the center of the mirror; thereupon another rather deeper groove was ground close to and concentric with the first. In this way the block was worked until its condition was that shown in Figs. 2 and 3 in plan and section respectively. By a similar process the ridges, $r$, left by the first operation were next reduced. After this the re-
maining roughness was ground away with cast iron laps ruled with a network of interlacing furrows forming squares. It is gratifying to us to hear from Father Foullety, that in this matter an article which appeared in the Scientific American Supplement (No. 582) helped to furnish the requisite information. For the polishing process the mirror was fixed upon a cask, as shown in Fig. 6, and the operator, circling slowly


Diagram Illustratung the Method of Grinding the Lens.
and regularly around this, giving at the same time a rotating motion to the lap, worked the latter with great care over the surface of the glass, finally approximating it to a parabolic shape by polishing a little more toward the edges.

The final polish was effected with the finest emery the lap being covered with a layer of wax half an inch thick. This delicate operation required about 50 hours' work. The whole of the grinding and polishing took some 320 hours.

The process used for silvering the mirror was that described in Troost's "Chemistry," French edition, 1884, p. 675. Four solutions are prepared.

1. 40 grammes of silver nitrate, dissolved in 1 liter of distilled water.
2. 60 grammes of ammonium nitrate, dissolved in 1 liter of distilled water.
3. 100 grammes of pure caustic potash, dissolved in 1 liter of distilled water.
4. 25 grammes of cane sugar dissolved in 250 grammes of water, inverted by boiling for ten minutes with 3 grammes of tartaric acid, then neutralized, added to 50 grammes of alcohol, and made up to 500 c . c. The glass was thoroughly cleaned with nitric acid, then with caustic potash. Alcohol was unnecessary. It was washed in pure water and suspended with the surface to be silvered downward in the bath obtained by mixing the above solutions in equal volumes. The operation was carried on in a room kept at 80 deg . F. ( 27 deg. C.). The mirror was kept immersed for about ten minutes. Fig. 4 shows this operation in progress.
It next became necessary to construct the tube and the mechanism for efficiently mounting the mirror. A wooden mold was fixed by radial supports upon an iron cylinder fifteen feet long. Upon this sheets of paper were rolled, and by gluing 250 pounds of paper sheet upon sheet, an excellent tube of great rigidity and strength was obtained, which for lightness proba bly surpasses anything which could have been made with other material. In Fig. 5 the tube is seen in the process of its development.
The working gear was prepared at the foundries of Garth \& Co. and of Belanger, both of Montreal, under the supervision and after the directions of Father Garais, who also designed all the parts and furnished the wooden models.

Our last illustration, which gives a full view of the completed telescope, shows also the mechanism by which the motion in right ascension is effected. Motion in declination is produced simply by hand, by tilting the tube about its axle.

We close with a table which will give an idea of the general dimensions of the instrument:

| Diameter of mirror. | 20 inches. |
| :---: | :---: |
| Weight of mirror | 150 pounds. |
| Radius of curvature. | 21 feet 9 inches. |
| Focal length. | 10 feet $101 / 3$ inches. |
| Aperture... | 4 deg .18 min . |
| Length of paper tube.. | 12 feet. |
| Weight of tube.. | 350 pounds. |
| Total weight of instrument | 1,200 pounds. |

Cherrick Westbrook, Sr., the inventor of the tele graph receiver, and general superintendent of the tele graph system of the Baltimore \& Ohio Railroad during the civil war, died on December 6 at his late residence in Harrisburg, Pa. He was 86 years of age.


Fig. 4.-Silvering the Mirror.


Fig. 5.-Making the Tube of Telescope.


Fig. 6.-Polishing the Mirror.


Fig. 7.-The Telescope Completed

## RAILROAD DEVELOPMENT IN CUBA.

With the opening of the new railroad, Cuba now enters upon an era of industrial development which must soon tend to ameliorate her existing political and economic condition and internal difficulties; to en
the island has possessed rail.way facilities: the eastern and larser area, running from Santa Clara to Santiago de Cuba, a distance of some 500 miles, has remained practically unexplored and undeveloped.
Immediately after the surrender of the country to the United States in 1898, the late President McKinley,
companies, the aggregate length of whose lines is only 917 miles, is entirely inadequate in bringing the ex treme ends of the island together, Santiago and Havana in point of time being as far apart as San Francisco and New York, though only separated by a distance of a few hundred miles. The facts gathered


The Company's Temporary Headquarters at Puerto Principe.


Righi-of-Way Cleared and Grading Under Way.

a Deep Cut on the New Railroad.


Modern Locomutive of the Type That will be Used on the New Road.


A Work Train.


A stone Culvert; Characteristic Masunry on the Cuba Railway.


President Sir William Van Horn and Party Inspecting the New Track
hance the commercial prosperity of the country, and consequently conduce to the conciliation and betterment of the inhabitants, far more effectually and expeditiously than the wisest of legislative enactments or the most reasonable and agreeable of treaties.
Until now barely one-half of the western portion of
with characteristic promptitude, commissioned Mr. Robert B. Porter to visit the island to make investigations and to report on her industrial, commercial, and financial condition. In dealing with the question of railway communications there, Mr. Porter reported:
"The railway system of Cuba, consisting of seven
on this subject point to the advisability of immediately constructing a trunk railway from end to end of the island, with branches extending north and south to the important cities and ports. From whatever standpoint it may be viewed, no one enterprise could do so much to improve the situation on the island. No revolution
could have existed in Cuba if such a railroad had been completed by the former government, and nothing will so rapidly tend to the revival of commerce and general business as the facility for quick passage from one end of the island to the other, and from the trunk line over branches to the seaboard cities. All political turbulence will be quieted thereby and prevented in the future. The entire country will be open to commerce lands now practically of no value and unproductive will be worked, the seaport towns will become active, and commerce between the island and the United States will soon be restored to the former figures.
After a careful study of the situation, it would seem extremely doubtful if such an enterprise could be made a commercial success for many years to come.'

The ominous, though honest, warning contained in the concluding sentence of this report certainly tended to defer rather than encourage any prompt measures being adopted, either by the government or a body of capitalists, to provide Cuba with what she most urgently needed for her present and future welfare, as well as for the ultimate benefit of the United States. With wonted alacrity, however, and regardless of any imme diate prospect of commercial reward, Sir William Van Horn got together a well-chosen company of American and British gentlemen interested in railways, and with out loss of time a body of competent men were dis patched to Cuba to make a thorough survey of that large portion of the island to which Mr. Porter had referred as being so much in want of railway facilities, and with equal promptness the Cuba company decided to at once undertake the enterprise at all hazards. The result is that in less than two and a half years the whole work has just been completed most successfully and satisfactorily, and to-day Cuba enjoys a through line of railway communication from one end of the island to the other, running through the very heart of the country.
There are also several branch lines-some in course of construction, and others in contemplation. The most important branches soon to be opened are those running across the island, connecting Santiago de Cuba with the Bay of Nipe and Jugaro with San Fernando, and two smaller lines forming a consmaller lines forming a conto at one end of the trunk to at one end of the trunk
line and Holguin at the line
other.
The railroad is of standard gage, and its bridges are of steel and masonry; its equipment will be similar to that of the best American railways, and it is intended to run through sleeping cars between Havana and Santiago de Cuba-a distance of nearly 900 miles.
The main object of this
new railroad is stated to be "the development of the eastern and larger part of the island of Cuba, by establishing direct rail connections between Havana, Sancto Espirito, Puerto Principe and Santiago de Cuba and to open up a vast extent of new and attractive country for settlement and cultivation." The new line will also add largely to the attractions Cuba offers to tourists, for it will make many important and interesting places and districts easily accessible which have hitherto been difficult to reach, and which have been rarely visited.
Along the main line are to be found great areas of land of the richest description, well watered and in most cases well wooded, suitable for sugar cane, tobacco, Indian corn, cotton, coffee, cacao, and all of the fruits of the tropical and sub-tropical regions. Other districts are peculiarly adapted to cattle; indeed, cattle do well. everywhere, for the grasses are luxuriant and highly nutritious, and there is usually an abundance of water. Around the coast are to be found many excellent harbors, and it is reported and believed that the unexplored part of the island contains much hidden mineral wealth.
The interior, which is sparsely populated, is comparatively ievel, and largely covered with hardwood timber, and while the soil of the different districts is generally of extraordinary fertility, some places are more desirable than others, both in this respect and in regard to healthfulness. On the whole, the climate is for the tropics, a tolerable one, and the island will soon be rendered more heal.thy by foreign irrigation, drainage, and an improved system of sanitation. The northern employes of the Cuba company have as a rule been free from illness of any kind, notwithstanding their employment on railway construction under conditions not always favorable to health. Unlike many of the West India islands, Cuba is entirely free from poison-


## THE RECENTLY COMPLETED RAILROAD THROUGH THE ISLAND OF CUBA.

vice, to say nothing of the elimination of the element of danger, always present when these heavy vehicles are driven rapidly through the streets of the crowded portions of a large city.
The plant laid down in Philadelphia covers the more congested part of the business section. At present the pumping is done temporarily by one of the fire boats moored at a wharf in the Delaware River, or by all of them, as the occasion may demand. Work has been started on a permanent pumping plant at the foot of Race Street, which, when completed, will be at all times in readiness for instant operation. Then it will be possible to pump fourteen hundred gallons of water per minute into a burning building.
The high-pressure system consists of a gridiron arrangement of piping entirely independent of the ordinary water supply, although a connection, fitted with a check valve, is maintained between the two plants for the purpose of keeping the pipes primed constantly and ready for instant service. The pressure amounts to from seventy to eighty pounds at the hydrants. A telephone system, with call boxes located in the vicinity of each hydrant, comprises a feature of the new plant; and irmediately upon the receipt of an order for water, the pumps at the water's edge will be started, and, since the pipes are kept filled by the regular water system, the pressure is available at once, so that no time is lost in getting a deluge into the burning building. Under the existing arrangement, with the fire boats doing the work, there is never a delay of more than five minutes, which is inconsiderable when compared with that of getting apparatus to a fire and into service under ordinary circumstances. When the new pumping plant has been put into operation, this delay will be reduced to a few seconds. There are three points along the river front where connections with the system may be made by the fire boats; and one of
these three craft maintained by the city in the Delaware River, will be at all times connected and ready for work, until the permanent plant is in operating order which will be about June next.
The installation consists of four principal mains laid along Market, Arch, Race, and Walnut Streets, from the Delaware River to Broad Street, the gridiron being formed by cross connections on Second, Fifth, Eighth, Eleventh, and Broad Streets. The pipe is of especially constructed, tough, gray cast iron. The principal main, on Market Street, is 16 inches in diameter, while that on Race, Walnut, and Arch Streets is 12 inches. The diameter of the cross connecting pipes is 8 inches. The thickness of the pipe ranges from $\pi / 3$ to $1 \%$ inches. The joints are flanged and securely bolted together, and other precautions have been taken to make them as strong as possible, in order to withstand the great strain to which they will be put. Heavy cast iron sleeves, or sockets, are provided at intervals in the pipe system, to allow for the contraction and expansion of the metal. Crosses have been put in at the principal street intersections, to meet any further demand for extension. There are 139 especially constructed hydrants on the system, each with two outlets for $31 / 2$-inch hose. The hydrants are of the heavy post pattern with 6 -inch inlets and 4 -inch outlets. The couplings in use are what are known as the Siamese," with which it is possible to make six connections at one time.

The new system was recently subjected to a severe test by the members of the Fire Underwriters' Association. The trial took place on Broad Street, at a point which is about 8,000 feet from the pumps. The most satisfactory results were secured, although it was impossible, under the existing circumstances, to test the pipes to their full capacity. After being laid, each section of the pipe used was subjected to a pressure of 400 pounds, and with the stationary plant in opera tion, it is expected that the pressure will almost reach that point; but
at the test, with the combined efforts of the three fire boats, the pres sure on the pipes was less than half that figure. However, the work done at the test and at subsequent fires has demonstrated that this kind of a service is far su perior to anything which could be secured with the use of portable fire engines. At one time there were twelve streams of water issuing from two hydrants, the water being hurled a distance of 175 feet through a 300 -foot section of hose The hose used was $21 / 2$ inches in diameter and had a $11 / 4$-inch nozzle. A single stream, with a $31 / 2$-inch hos and a 2 -inch nozzle, was thrown a distance of 262 feet in a horizontal direction, the nozzle being held at an angle of about 30 degrees. With two streams, the distance was decreased to only 258 feet. A single stream thrown in a vertical direction reached to within a dozen feet of the top of the North American buil.ding, in iront of which the test was conducted. The roof of this structure is 255 feet above the pavement, and it is the tallest building in the city. A stream from the highpressure system was sent aloft beside one from one of the most powerful fire engines owned by the city. The stream from the latter reached the ninth story, while that from the high-pressure hydrant touched the nineteenth. While these tests were being conducted, hydrants in distant parts of the high-pressure section were opened, in order to note the effect on the Broad were opened, in order to note the effect on the Broad
Street streams, but the decrease in the flow was hardly appreciable.
As a result of the successful demonstration of the high-pressure service, the insurance rates in the por tion of the city thus protected were at once lowered and it is possible that a further reduction will be made.

The system was installed by the Hoffman Engineering and Contracting Company, of Philadelphia The use of gas engines in the permanent pumping plant is one of the notable features of the installation. These engines, of 300 horse power each, are now being built by the Westinghouse Company.
The computation of the figures for the steam plant must take into consideration the coal consumption for the entire month, with steam pressure on the boilers all the time; but this calculation contemplates only about ten hours of actual service per month. This would cost $\$ 50$ per hour. The gas plant will require gas for the time of the run onlv, as when the engines are idle there is no consumption of gas; and, on a
basis of ten hours pumping per month, the gas plant would cost $\$ 39.20$ per hour. The services of nine men are required for the steam plant, while six are sufficient for the gas plant. Chief Hand says that in actual practice the economies of the gas plant will be even greater, for it will very rarely happen that the entire plant will be in operation ten full hours each month.

## QUEER CAPRICE OF CALIFORNIA WOODPECKERS. <br> by m. c. frederick.

For bees to establish themselves beneath the roof or over a window in a dwelling occupied by a human fam ily, is not rare; but it is seldom that woodpeckers follow their example and choose a residence for a storehouse.

The region of Santa Barbara was once well wooded with fine live-oaks, the headquarters of large numbers of woodpeckers. Their incessant noisy hammer ing from daylight till dark as they cut holes in the trunks of the trees and fitted in the acorns, their sharp calls, and the frequent flashes of brilliant red, white, and blue-black, as they flitted from branch to branch, gave a certain gala atmosphere to the woods and added much to their charm.
Montecito Valley, contiguous to Santa Barbara and


WOODPECKER'S TREE-TRUNK STOREHOUSE FOR ACORNS.
the home of most of her wealthy residents, still re tains many of these old oaks, often the chief feature of landscape gardens widely noted for their beauty. A fairly large number of woodpeckers continue to ply their vocation with unabated energy. Why they should prefer a residence in the midst of one of these groves, for a granary, instead of the regulation tree trunk, is a mystery. Perhaps they discovered that redwood is more easily worked than oak or sycamore, or perhaps it was the labor-saving feature that appealed to their thrift, since, instead of a separate hole for each acorn, a single hole answered for many acorns.

Whatever the reason of their curious choice, they have so thoroughly drilled the wood of the building as to cause serious damage and necessitate extensive repairs.

The cornice, or strip of molding that finishes the under edge of the roof, known as the crown molding, has most attracted their fancy, inclosing as it does a small triangular space back of it, extending entirely around the roof. One can well imagine the surprise of the first industrious little cabinetmaker who, having chiseled out a cavity of the proper size, was driving his acorn into place, when it suddenly disappeared.

A second acorn tried in the same place meeting the same mysterious fate, his unconquerable persistency doubtless led him to try again and again, in the hope of unraveling the mystery until, the immediate space being filled, he at last comprehended the situation and delightfully adopted the new method instead of the old. Anyway, the woodpeckers have made holes at convenient intervals, and literally crammed the space to overflowing. In some instances the molding is sprung half an inch or more from its place, the tightly packed acorns protruding through the cracks.

The holes are usually made in the upper edge of the molding, next the shingles, the shrinkage of the wood having evidently left a slight opening which facilitated their labors; but holes have also been made directly through the cornice, as the illustration shows. The shower of acorns that fell to the floor when the molding irom the roof over a corner of the balcony was retmern? is also shown.
The $\because: i$ adventurers by no means confined themselves $\because 1$ te cornice. The sides of the upper story
being shingled, they have made a number of perforations down the corners and elsewhere, and in the middle of a gable is an opening large enough to ad mit the birds themselves. Whether they found the interior to their liking, and nested there, is not known, since there is no way of entering the attic to see. It is believed, however, that there are bushels of acorns stored away in various parts of the building.
Other houses in the same locality have been at tacked by the birds-in one instance they made holes along the comb of the roof, plugging them up with acorns; but in no other case have the depredations approached this in magnitude. If any one appeared while a woodpecker was at work, he would stop for a few moments, eye the intruder saucily as if trying to divine his intentions, and then go on hammering as unconcernedly as if no one were watching.

## Automobile News.

Henri Fournier, the noted French automobilist, arrived in New York last week, bringing with him five French machines to sell to wealthy Americans. Two of these automobiles are 9 horse power Renault cars, one of which is patterned after an English cab and the other after a landaulet; the third is a 40 horse power Mercedes of double phaeton pattern, with entrance in front, King of the Belgians seats, and finished in pearl gray; the fourth is an 18 horse power Mors, with a very low frame, triple phaeton body, and seating room for seven; and the fifth is the most novel of all, being a Lohner-Porsche, 28 horse power, gaso-line-electric tonneau car, with electric motors in the hubs of the front wheels, which also steer the ma chine. A gasoline motor direct-connected with a dynamo furnishes power for generating electricity to run the car, any superfluous current being sent into a storage battery, which supplies extra power as it is needed. The car is said to have 14 different speeds the maximum of which is 48 miles per hour. This system has been so successful that the Panhard Com pany has purchased the patents and is making ma chines.

When questioned regarding his new 120 horse power racer, Fournier said: "It is short in front, like a fish's head, and then long, like its tail. After you break the air, it rushes in behind and pushes you; so you must have the car short in front and long behind. The seat is just a bicycle saddle on the rear axle. It will have four speeds and drive direct on the highest. What will it do? Oh: 32,33 , or 34 seconds to the mile.'
In regard to the 1,600 -kilometer ( 993.6 mile) ParisMadrid race of next summer, Fournier stated that Mors machines are being built for W. K. Vanderbilt, Jr., and D. Wolf Bishop to drive in it. He gave it as his opinion that in all probability the International Cup race would be over the first day's stage of this race, i. e., from Paris to Bordeaux, a distance of 585 kilometers ( 362.28 miles). The German entries in the cup race consist of two 100 horse power Mercedes ma-


ACORNS REVEALED BY THE REMOVAL OF A CORNICE.
chines, to be driven by Baron de Caters and Camille Jenatzy; Fournier and the Farman brothers will represent the French, the latter driving Panhard machines; S. F. Edge and Charles Jarrott will mount English Napier cars; and Alexander Winton, with two other
of his countrymen, will run American machines. While on the subject of racing, Fournier said that he would like to have a track race with Mr. Winton or Barney Oldfield, who drives the Ford racer, for any distance they might name; and that if such a contest could be arranged, he would bring over his new cup racer for it.
The Daimler Company, of Cannstadt, Germany, have brought out a new 60 horse power model of their popular Mercedes car, in which the frame is hung lower than usual, and which has a novelty in the shape of an electrically-manipulated change-speed lever that enables the operator to effect a change of speed by merely pressing a button. This improvement is a great one, as the changing of gears is an operation that requires considerable skill to perform properly on most of the large gasoline cars.
The New York Automobile Show closes its doors on January 24. Some of the novelties that were exhibited there we shall describe in our next issue and in a special Automobile Number, to be published the middle of next month. Most of the manufacturers


HOLES DRILLED BY WOODPECKERS THROUGH A CROWN-MOLDING.
of steam and electric carriages have added gasoline automobiles to their list of cars, and the gasoline machines are becoming more widely used than ever. Those with air-cooled motors are more numerous than heretofore, and the tendency is to simplify all parts of motors and machines as much as possible. Several cars propelled by two-cycle gasoline engines were an example of simplicity aimed at in engine construction, while the planetary transmission gear mounted on the engine shaft, as used on many of the runabouts, is without doubt the simplest and most compact form of transmission gear. Three-speed transmissions are used on many of the heavy cars, sliding gears being used for the purpose in most cases. and individual clutches, with gears always in mesh, being employed in a few instances. Wood wheels with detachable double-tube tires have taken the place of wire wheels and singletube tires; and almost all parts are made stronger, in order to stand hard use on bad roads.
The North-Eastern Railroad of Great Britain, a portion of which is to be converted to electric traction, proposes to carry out a series of experiments with petrol auto-cars to be used upon the 37 miles of track near the section to be electrified at Newcastleon Tyne. An order has been placed with a motor power company in London for the supply of a number of large four-cylinder petrol engines to develop 100 horse power each. It is intended to employ these engines for the haulage of light and frequent trains on local branches. The petrol cars which have been ordered for this purpose have done excellent work on common roads, and it is anticipated that they will achieve even better results on the specially constructed track of a railroad The advantage of this innovation in railroad traffic is that it will not necessitate any alterations of the track, such as the laying of the third current rail with its complications at crossovers and junctions.

## Chief Engincer Melville Hetires.

On January 10 Rear-Admiral George W. Melville, Chief of the Bureau of Steam Engineering, was placed on the retired list of the navy, having reached the age limit of sixty-two years. By special authority of Congress, he is to continue his service at the head of the Bureau until August 9, 1993. Admiral Melville was appointed to the navy from New York in July, 1861.

## New Use for Formaline.

At the last annual meeting of the Obstetrical So ciety, Dr. Charles C. Barrows read a paper in which he presented the results of his use of formaline as a cure for sepsis or blood poisoning. Formaline has been used as an antiseptic. but the use to which Dr. Bar rows has put it is probably new. Further experiments will be watched with interest.

Motorman John G. Flynn, of Bridgeport, Conn.. is the inventor of an insulated switch iron which will save the motorman from getting many shocks while working around his car.

## recently patented inventions

 agricultural Implements.agricultural implement.-D. Lubi ew York, N. Y. A manually-operated devic is provided by this invention for digging an operated by one person and may be used t hrow up comparatively large slices of eart nd finely pulverize them before being agai deposited on the ground. Thus with one ma hine the
POWER OPERATEI AGRICULTURAL machine.-I. Lcbis. New York, N. Y. This nvention rela
or the fine
n object be $n$ object being t motor-driven vehicle and an agricultural too the mechanisms being so arranged as to a ternately move the vehicle and draw the ool along the ground; that is, to move the mains still and then draw the tool up to the mains still and then draw the tool up to the
vehicle while the vehicle is stationary. By this division of work it is possible to em ploy a motor of comparatively low power.

## Engineering Improvement

fldid-PRESNIRE SPEEDING DEVICE. . Miechmans. Albany, N. Mr. Wieching fluid pressure and used as a transmissio gear from a driving shaft to a driven shaft he relative speeds of which are controllable will. The speed of the driven shaft ma peed of the drivins shaft and the speed of the peed of the driving shaft and the speed of th hat of the driving shaft, or in the opposit direction.
PCMP.-W. S. McRoberts, Findlay, Ohio or removing sand from oil wells, the obje bring to provide a promp of simple constructio that may be readily inserted or removed from it may be cleaned or emptied of sand without invertin" it.

## Lighting, Heating and Ventilating Appiratus.

BOSII-PLATE FOR BLAST-FURNACES. . Mccacsland, Pittsburg, Pa. The in-
vention provides improvements in that class of evices employed for cooling the walls of is "bosh-plates." The object of the invention s the produc
seryes to secu around the "nose" or inner end of the plate and the uniform diffusion of the water over the upper and lower surfaces of the plate to the end that the plate cannot become cracked Groken nor can sediment accumulate therein.
GAS-SAVING ATTACHMENT.-P. Riess of this invention is to provide a device adapted for use in any system of piping whereby to conomize in the use of gas for heating. lightir. and cooking purposes, and to so construct the: device that it may be readily and conveniently applied at a burner or at any point in the system of piping between the motor and
th: point where the gas is to be consumed. th: point where the gas is to be consumed.
A(CETYLENE-(GAS GENERATOR.-G. E. La Wa.. Lakota, N. I. This generator is so aranged that gas cannot escape through the ignorance or carelessness of attendants. nor
can the apparatus be wrecked by explosion at or subsequent to the operation of recharging The generator. The generator is removable braly and in a sealed condition from its ank. so that it may be carried out of doors,
mptied. cleaned. and recharged without permitting the escape of odor into the room. VENTILATING-FAN.-W. Burrows. Thurto provide an improved fan for ventilating mines. The blower and the casing within
which it rotates are tapered. mine the reduced or open end of the casing is located at the drift-opening and the exitpipe extended to a point where foul or impure ir may be delivered. The increasing inner space in the casing from its inlet permits expansion of the air and consequently
rapid discharge through the exit-pipe.
stean heativg apparatus
Broomall, York, Pa. The present invention overs certain improvements in steam heating apparatus for which Letters ratent were previously granted to Mr. Broomell. The imafford a simpler. more practical and more efficient construction of receiver which receives the water of condensation from the
adiator to the building and any air that accompanies it, sending the air out into the atmosp
VENTILATING-StOVE--F. R. Shafer Burlington. Wash. Mr. Shafers invention reof which fresh. cold air from outside of the building to be heated and ventilated is made o pass between an inner heated stove and an suter jacket and thence discharge into the room, after which, as the warm air cools and settles to the floor, it is taken from the room by way of the stovepipe

## Mechanical Devices. EXCAVATING-MACHINE.-C. C. MCBride alifornia. Owing to certain improvement provided by this invention Mr. McBride's ex- vacating-machine may be used to good ad-vacating-machine may be used to good ad vantage in many different kinds of work, such, or instance, as railway grading and cutting hrough banks, for narrow and deep cuts where ing work, and in all places where excavation of a bank of opposing material is necessary. SPEED-INDICATOR-OPERATING MbANS, -C. E. Kelly, Anderson, Ind. Means for operating a speed-indicator are provided in this invention. It may be used for indicat stated time, or it may be fitted to show the number of revolutions per minute of a turnin art. The operating means consists of a by centrifugal force, actuating levers which communicate the motion to the indicating de orembting means for sideed-inid ATORS.-C. E. Kblle, Anderson, Ind. This nvention relates more particularly to a or transmitting movement to a speed-indicating device. such, for example, as that de-

 or regulating a spring tension so as to register accurately the number of miles a vehiclehas traveled, or the number of rotations a rotating part has made.
Fhiction-clitteli--m. Pineit, New orleans, La. The object of this invention is to provide an improved friction clutch which is
of simple construction and effective in operaion to transmit power from a motor to the driven parts. The arrangement is such as 10 driven clutch member from the driving clutch

Winimilil.-J. G. Bexster, Moline, Ill. The improved windmill provided by this invention is arranged to insure a direct and full wheel. An improved means is provided for shifting the vane to throw the wheel out of the wind. The construction of the wheel is such
that in case a wing breaks it can be readily replaced by a new one without taking the rest of the wheel apa
REGISTER.-J. II. Warner, Westplains Mo. Mr. Warner's invention is an improv
ment in registers used in comnection with ment in registers used in comnection with a of cigars cut. The construction is such that the cigarmaker as he cuts the ends of each igar operates the register. so that he can at a glance, determine the number of cigars
made, whether the same are made by hand. in made, whether the same are made by hand. in
bunching means or otherwise. the register eeping account of the number of cigars cut COPY-HOLIDER-C. B. Towers, Miles invention provides a means for indicating to a stenographer a particular line of manuscrip ${ }^{\dagger}$ from which the copy is being taken. It provides means for automatically operating an ndicator by the typewriting machine. or fot Automatic means are also employed for re urning the indicator to the top of the conyholder on which it is tocated, thereby saving
the time and labor of the stenographer using the time and
the invention.
maciline for crtting, enfaniding and beading trobes or fleves.tion of this machine is such that it may be readily applied and fastened in position on a boiler and conveniently operated to permit cutting a tube to the proper length for bead ing. or to cut an old tube for removal from a boiler. The machine will expand the-flue for setting it firmly in a tube sheet, and will bead the end of the tube to securely hold the me postion the
TILT-HAMMER-B. C.. A. M., and .J. M. have provided an improved tilt hammer of operation and arranged to permit of quickly varying the stroke of the hammer according o the nature of the work under treatment The hammer may be used in any desired posi ion within a vessel or other places.
beating-engine.-E. A. Jiones, Pittsfield, Mass. The present invention, which is an improvement on one previously patented Mr. Jones. is arranged to insure a proper
irculation of the pulp or stock when the vat irculation of the pulp or stock when the vat is being emptied. and it dispenses entirely with
the manually-wielded rakes now usually em ployed for moving the pulp through the discharge pipe
OLIVE CRUSILER ANI IPTTTER.-W. L Morris and E. D. Smith, Woodland, Cal. The urpose of this invention is to provide means
for separating the stones or pits from olives so that oil may be made from the pure olive pulp, and. if desired. a second class of oil may made from the pits and such pulp as may ing thereto alt the separation
Gn-Cariliage.- $\mathbf{P}$ '. De Nordenphit and L. Twrysträm. 8 Rue Auber, Paris. France
In this improved carriage the slideway which n this improved carriage the slideway which cerns both the gun and the cradle. The gun is mounted to slide in an intermediate slide, the latter being also movable in the same
direction on a guideway integral with the
cradle, so that in the false position taken by
the gun when recoiling, the latter is supported both by the slideway and cradle which thus
properly sustain and guide the same in its properly su
long recoil.
WIND-WhEEL.-J. F. Hoag and C. R ion is in the nature of an improvement wind-wheels by which the stroke of the pump is lengthened as the wind increases, so as
o cause the work done to be increased in proportion as the power of the wind increas without increasing the speed of the wheel to undesinable velocity.
MEANS FOR CONVEYING OIL FOR tiago, Chile. Means are hereby provided for tago, Chile. Means are hereby provided for
duieting the surfaces of bodies of water where y protection is afforded to ships or boats o any size, by they at sea or anchored, also to etties, quays, and landings. The invention of oily liquads, which not only impedes the formation of and ascent or detachment from the surface of spray to be driven by the wind. but also impedes the detachment of larger

Rainway improvemen
Al'TOMATIC RAILROAD-CAR BRAKE. G. W. Stockin, Mobile, Ala. This railroad car brake is automatically controlled by the movement of the locomotive. When the train is running the brake shoes are off the rim ot the brake wheels. and when it is desired to
brake the train the engineer reduces the speed the locomotive, causing a rearward, sliding whichent of the brake rod under the caan tum of the cars is utilized to apply the brakes to bring the train to a standstill, if desired, or
to brake it sufficiently to run down a grade at brake it sufficiently to
at the desired normal speed.

## Vehicles and Their Accessories.

thac'tion-Wileel.-R. L. Dutcher. Stites, daho. The tread of this traction wheel is prong in an annular rib. The mud cleats project radially outward a little beyond the out $\rho_{1}$ edge of the annular rib and at right angles to slightiy into the ground and at the same time to allow the annular rib to act as the outer surface of any wheel normally acts where the ground is tolerably hard.
 laer Falls, N . Y. In the present invention the object is to provide a pressed-steel knee which can be manufactured by machinery at very
low cost. The improved knee possesses great strength with a minimum of weight, so that it will not collapse under weight and strain, and rease the weight of the structure.
birake mecilanism.-w. if. smith ism is hereby provided which is of a ism is heable and operation, and easily manipulated It is ar ranged to permit of being set to any desired degree of resistance accoiding to the use made of the car or machine on which the brake
hitheicating device for vehicle NIERLS.-N. F. Probst, Chillicothe, Ohio. Mr. Probst provides by this invention a novel
device for lubricating vehicle wheels. The construction is compactly arranged and de signed so as to not materially widen th firmly brace the wheel when assembled for

IDMIPING - VEHICLE. - C. H. Smith Greeley, Colo. The body of this dumping vehicle is so arranged as to dump simultan eously at both. sides of the vehicle or at one side at a time. The invention is of such
character that it may be attached to a wagon, cart, railroad (ar, mine car, or vesse

## Miscellaneous.

illusion aiparatis.-A. IV. Booraem and F. T. Howard, Brooklyn, N. Y. Two pat-
ents are granted to these inventors under this heading. The object of the first invention is to produce in the minds of passengers the illusory sensation that the vehicle, upon which
the passengers are carried. breaks through ice, the passengers are carried, breaks through ice,
or through some medium analogous thereto. and continuous to run upon a comparatively submarine way.
The second invention is designed more par ticularly to produce illusions in the minds of as a pleasure railway or pleasure canal.
NON-REFILLABLE BOTTLE.-.t. (. BeitLer, Lancaster, Ohio. This invention has for its object the provision of a non-retillable bottle. parts of which are so constructed and correlated that they cannot easily be injure or deranged hy tampering or by accident. A
further object of the invention is to provide device whereby when an attempt is made to exhaust air from the passageway the bottle
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small fraction of the time previously taken, the results being practically identical with those obtained with the use of Froude's formulx.
Geometrical Solution of Algebraical Problems Applied to Arithmetic.
By A. W. Fernando, Inventor of the
Sliding Decimal Scale. Part I. Co lombo. 1902. Pp. 23 . 16 mo .
The Modern Corporation. By Thomas
Conyngton. New York: The Ronald
Press. 1902. Pp. 88. Price 50 cents. Coming as it does from a lawyer, this little book deals with the corporation largely from
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## (8798) C. H. H. says: I wish to use

 my gasoline car during cold weather. Kindly the me whether chloride of lime, added tothe water used to absorb heat from the cylin the water used to absorb heat from the cylin
ders, will prevent the water from freezing when the machine is not in use, and the water
is cold. What proportion of chloride of calclum should I use? What weight per gallon ide of lime) can be used to lower the freezing point of water. All dissolved salts tend to corrode metal more quickly than pure water hence care should be taken to clean up occa slonally so as to prevent corrosion.
(8799) W. H. A. asks: 1. Does the process of steaming wood in any manner de its to this destruction: A. The steaming of wood for bending purposes seems to do no in jury, as the lasting quality of wood so treated is very evident in our old ships and bent wood in agricultural implements. 2. In small-boat
construction is there any special process for construction is there any special process for
steaming wood (pine or oak)? A. The universal practice is simply a wooden steam box con nected to a closed kettle of water over a fire. 3. If there is a destruction of the vitality of woods, would there be a way of lessening this effect? A. Even the steam boxes in use for
many years retain vitality and strength in many years retain vitality and strength in
the wood to a surprising extent. We know of no needed improvement
(8800) H. E. H. wishes the exact number of pounds ( 16 ounces) a cublc foot of
hydrogen gas will raise. A. One thousand cuic feet of hydrogen weighs 75 pounds less than 1,000 cubic reet of air at normal pres customary to allow 70 pounds as the lifting power of 1,000 feet of hydrogen in a balloon, the difference being to provide for some advan tage on the part of the hydrogen. It would balance 75 pounds, but lift 70 pounds with
(8801) A. L. writes: In query 8701 regarding the farmer plowing a field, you problem, but requires a solution in algebra Please explain why it is not an arithmetica problem, and why the following arithmetica solution is not correct. In the problem ther are given two parts to find the whole, namely the dimension of one part and the ratio of the other part to the whole. The ratio of the un the field. The question to solve there is whole side: ratio is simply a multiplie An arithmetical rule is: Multiplying or dividing the side of a square, or the diameter o a clrcle, multiplies or divides the area by the square of that multiplier or divisor. $3 / /$ in $^{2}$ the problem before us is a multiplier of an
area, viz., the srea of the field. By the area, viz., the area of the feld. By the
above rule $3 / 4$ must equal the square of the multipiler of the side. The square root of $8 / 4$
is 0.866 , which equals the ratio of the un plowed side to the whole side. $0.866+$ the 20 -rod strip $=$ the whole side. Therefore the side being unit or $1,1-0.866=0.134$, or 20 rods. If 20 rods are 0.134 of the side, the sid
will equal 20 rods $\div 0.134=149.2$ rods will equal 20 rods $\div 0.134=149.2$ rods, an
the unplowed side will be 0.866 times 149 $=129.2$ rods. As 160 square rods make one and division the number of acres can be readily found. A. The solution given above is an in genious arithmetical solution for the problem referred to, which did not occur to us when we solved it. But we still submit that suc
problems may be more easily and elegantly problems may be more easily and elegantly
solved algebraic methods, and by such methods are usually solved. The arithmetical method is to work from the conditions of the problem to determine the answer. The alge bralc method is to assume a letter to repre sent the answer, and to work with the answe thus assumed according to the data till an
expression is found for the answer in terms of the numbers or letters given as data in the problem. The two methods are thus seen to we diametrically the opposite of each other
We think most mathematicians more frequently employ the algebraic method, though we are sure that those who habitually use the arlthmetlcal method consider it preferable to the
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