

American Excavations in Greece.

The American School of Classical Studies at Athens was founded in 1882 under the auspices of the Archaeological Institute of America. It has enjoyed the steady favor of the Greek government. Its excavations have been prolific of results. A review of these by J. Genadios appears in the January Forum, says the New York Sun. By 1885, when the finds made in Asia Minor by the Wolfe Expedition, so called because its expenses were borne by Miss C. L. Wolfe, of this city, had been added to those secured during the previous two years, M. Waddington wrote: "European scholars have hailed with delight the entrance of America into the old field of archaeological research and will welcome such additions to our knowledge of Asia Minor as are contained in the account of the Wolfe Expedition." By this time Assos had been excavated and the site of the New Testament Lystra, as well as the sites of several ancient cities, determined.

Systematic explorations may be said to have begun in 1886 at Thorikos, within easy reach of Athens, early celebrated in fable as the home of Kephalos, the lover of Prokris. It is referred to by Homer and Herodotus, as well as others, and had fallen into ruins before the first century of our era. The remains of Thorikos theater had long been a puzzle. The American excavations showed it to be nearly the smallest of Greek theaters known, responding to the needs and poor resources of a small rural community, with seating capacity for barely 5,000 spectators. There is no trace of a stage; the orchestra was a complete circle, showing that both choruses and actors performed on the floor of the orchestra. This crude rustic structure undoubtedly preserves the arrangement of the archaic Greek theater. In this same year the American school excavated the theater of Sicyon, where Hesiod places a contest between gods and men, a town that through out its duration was more famous as a center of art than of political activity. Its school of painting produced Apelles. The object of the American excavations was to obtain the plan of the Sicyon theater one of the largest in Greece.

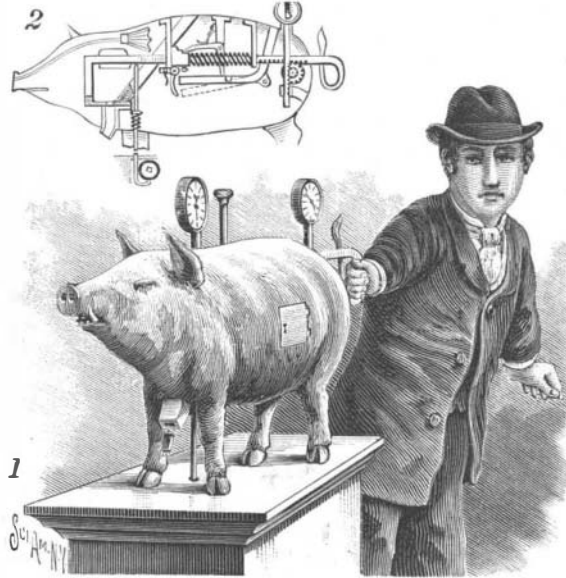
The two front rows of seats were found to consist, as usual, of seats of honor made of porous stone, each having a back and arms. As many as five other rows are cut in the rock. Fourteen stairways divide the auditorium into thirteen divisions. An elaborate drainage system forms a prominent feature of this theater adequate to carry off a heavy rainfall. But was drainage the sole purpose of an imposing aqueduct running under the orchestra and communicating with a line of earthen pipes under the stage? Complete excavation showed this to connect with a tank, and this tank was mainly intended for stage effects on the orchestra, the aqueduct also serving as a concealed passage way for the actors. Certain statements of Greek authors confirm this explanation. Certain large and small holes, worked at regular intervals in the stone floor, are shown to have served to secure the wooden columns of the early Greek stage.

An important discovery in connection with the history of architecture was that of two arched passages built without a trace of mortar or brick and corresponding with the masonry of the Hellenic walls that underlie the Roman work. These passages are therefore undisputable Greek work. When considered together with a similar instance in the Senate House of Olympia, they establish beyond a doubt the fact that the arch was not a Roman invention imported into Greece, but originated with the Greeks themselves, though used by them, as

it would appear, only in underground structures. This review is only a beginning of all the work done by the American school, but it is at least suggestive of the value of its operations.

AUTOMATIC STRENGTH TESTER AND VENDING MACHINE.

The curious and novel nickel-in-the-slot machine shown in the accompanying illustration has recently been patented by Mr. John Milo, of Williamsbridge, New York City. As will be seen from the sectional view, the mechanism is inclosed in a case formed to represent some kind of animal, and it is so arranged



AUTOMATIC STRENGTH TESTER AND VENDING MACHINE.

that, by placing the purchase coin in a slot, and applying strength in the form of a pull or a blow to the proper handle, the force applied will be measured upon a dial and the article of purchase will be automatically delivered to the purchaser.

A horizontal bar extending longitudinally through the body terminates in a handle which is shaped to represent the tail of the animal. This is kept in its normal position by a coil spring. At its front end it is bent down and back to form a flat, horizontal plate, in which is cut a hole large enough to receive a package of the articles to be sold. This plate slides horizontally beneath the end of an inclined tube, which is filled with a supply of these packages, and when the bar is drawn forward the hole is brought beneath the end of the tube and receives one of the articles therefrom. Upon being released, the bar is drawn back by the coil spring

and carries the article over an outlet tube, through which it falls and is delivered to the purchaser.

The purchase coin falls into an elbow tube, which is so pivoted that the weight of the coin causes it to rock forward and release a catch which prevents the horizontal bar from being moved, except when the coin is inserted. After releasing the catch, the coin rolls out of the tube into the body of the figure, from which it can be recovered by unlocking a door placed conveniently in the side of the machine. At the rear end of the bar is formed a suitable horizontal rack, whose teeth mesh with a pinion which in its turn serves to operate a vertical rack. The latter rack terminates in a rod, which, extending through the back of the animal, carries a pointer which indicates on a graduated scale the force of the pull.

At the forward end of the horizontal bar are attached two cams, one above and the other below. The first serves to compress a small bellows, which is arranged to produce a noise in imitation of the animal's cry. The lower cam depresses a rod which starts a music box concealed in the base of the machine.

The second indicator scale and the vertical rod shown projecting from between the shoulders of the animal are for registering the force of a blow. The internal mechanism is similar to that already described, the article being automatically presented to the purchaser as before.

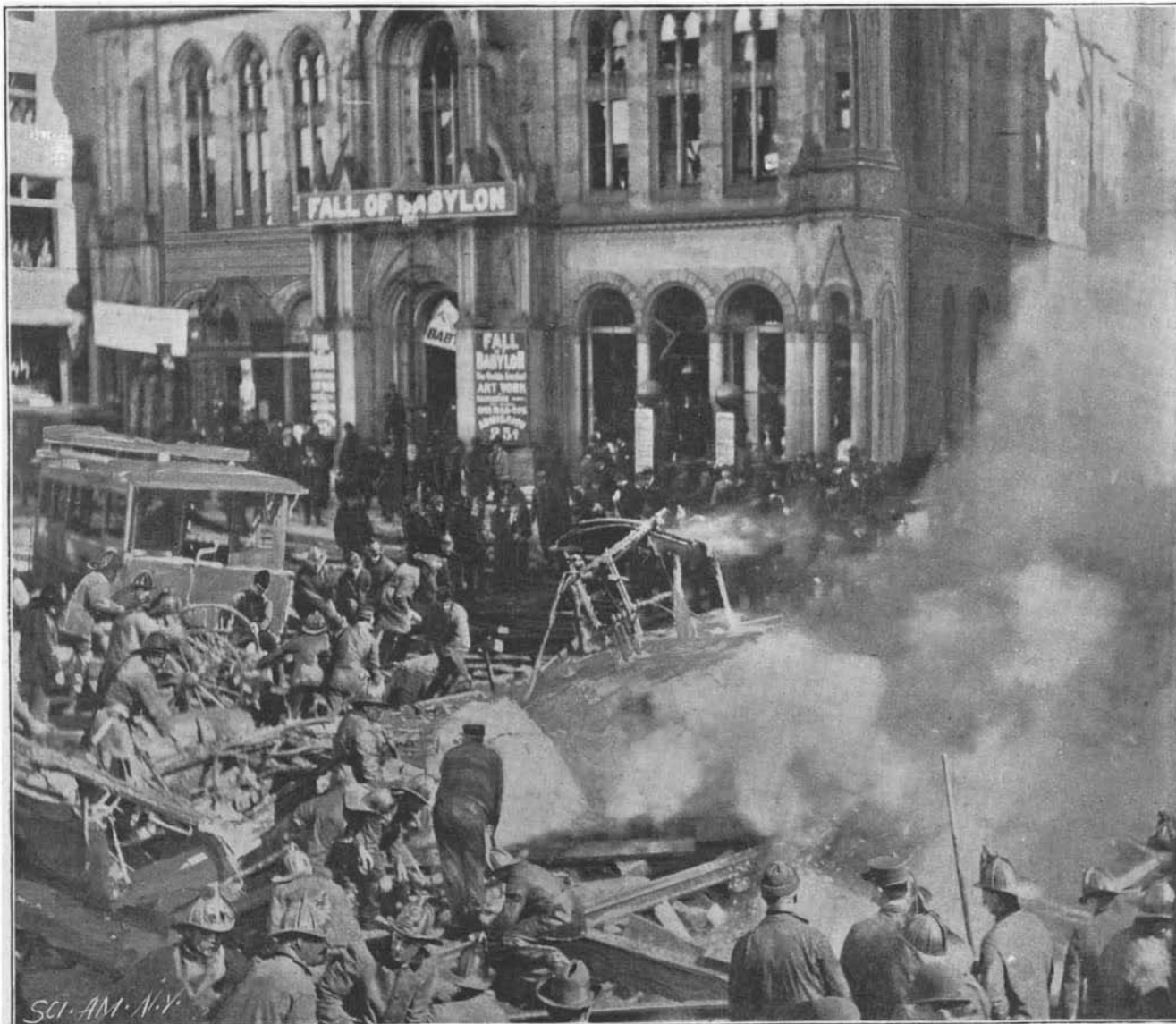
THE BOSTON GAS EXPLOSION.

We have several times illustrated the Boston Subway, which is intended to give relief to the traffic on some of the densely crowded streets of that city by running the trolley cars in the subway.

One section of the subway is practically finished, but at the corner of Tremont and Boylston Streets the space between the roof of the subway and the street was left open to permit of some repairs being made to pipes, and the excavation left open was boarded over. For several days before the accident, which occurred on Thursday, March 4, at 11:43 A. M., the smell of gas had been noticed coming from this cutting, but little attention was paid to it. The corner where the accident occurred is one of the busiest in Boston. The explosion occurred just inside the Common, at the northwest corner of Tremont and Boylston Streets, which during the busy hours of the day is always thronged by pedestrians. The streets which come together at this point are two of the most important of the city's thoroughfares, and it was largely on account of the congested traffic at this point that the subway was undertaken. It is an everyday sight to see electric cars in a practically unbroken line extending along Tremont Street fronting the Common, and up Tremont Street beyond Boylston Street, toward the west, Boylston Street is equally crowded. The cutting, which was covered over

by boards, was crossed by two six inch gas mains. It is believed that a spark from the wheels of an electric car caused the sad havoc which produced the most serious results ever caused by an illuminating gas explosion in the whole history of Boston, causing nine deaths. The exact moment of the explosion was indicated by many of the clocks in adjacent buildings, which were stopped by the shock.

The sidewalks were crowded and carriages and cars were passing in almost unbroken succession. A Mount Auburn car was rounding the curve from Boylston Street into Tremont Street, a Back Bay horse car was passing it in just the opposite direction, while a Brookline street car was crossing Tremont Street into Boylston Street. Just as the three cars were



SCENE OF THE BOSTON GAS EXPLOSION LOOKING TOWARD THE MASONIC TEMPLE.

nearest the center of the junction of the two streets the gas became ignited in some way, probably by a spark between the track and one of the wheels of an electric car in passing around the curve, and the volume of gas which had collected under the tracks exploded with a boom like the report of a cannon. The flames shot up and blazed fiercely in the midst of the thoroughfare. The first car, which was precisely in the center when the explosion occurred, was lifted up by the wooden-work which covered the excavation. The car was carried far into the air, the wooden platform also carried along the two horses of the second car. Instantly the air was filled with flying debris and above the shouts of the terror stricken pedestrians could be heard the groans and cries of the wounded.

The first electric car no sooner fell back upon the tracks than it broke in half, and the whole portion immediately burst into flames, and the remains of it are shown in our engraving, which was made from a photograph taken ten minutes after the accident.

The Back Bay horse car was terribly shattered, as shown in our engraving. Two carriages were blown into atoms and the horses drawing them were killed. The drivers of the carriages, the conductor of the horse car, one occupant of each carriage, and a passenger

on the electric car complete the list of those who were killed at once by the explosion. The motor man of the electric car and a passerby were both fatally wounded. It will probably never be known how many people were injured by the explosion, as many went away to their homes without obtaining medical attention from the ambulance surgeons who responded to the calls. It is believed that over fifty were seriously injured.

For two hundred feet in all directions from the spot where the explosion centered, plate glass windows were shattered and the buildings were shaken as if by an earthquake. The firemen at once responded to the call and one hundred and fifty policemen were required to keep back the crowd of spectators. Some of the timbers which covered the excavation were hurled two hundred feet in the air, falling on the roof of the new Hotel Touraine, and the falling electric trolley wires for quite a little distance in all directions from the central point of the explosion added to the terrors of the situation.

Ten minutes after the alarm had been sent a half dozen ambulances were on the spot, and in less than a half hour all of the dead and wounded had been removed. It was a great wonder that the casualties were not much greater. Some of the photographers in the immediate neighborhood were able to secure photographs within ten minutes of the time the accident had occurred, while the firemen were still at work trying to put out the fire. Our engravings are made from photographs

taken by N. L. Stebbins. The scene during the first hour of the explosion could hardly be described in words. The column of fire in the opening in the street roared like the escaping gas from a natural gas well, and it was an hour before the blaze was conquered.

The question of responsibility is an interesting one, and the affair is being investigated by the State and

which were strongly bolted together broken as if they had only been pipe stems. The results of the explosion give an example of the terrific force of an explosive mixture of illuminating gas and air.

Progress of the Trans-Siberian Railway.

The Siberian Railway is making rapid progress, according to an account by Mr. J. Y. Simpson in the January number of Blackwood. Sixty-two thousand workmen are employed—on the western section, Russians, Siberians, and Italians; on the eastern, convicts, Chinese, and Koreans. The best are the convicts, whose faithfulness is rewarded by the lessening of their terms of exile—a third, for instance, in one class. Technical schools for the education of engineers have been opened in three of the large towns on the line. Emigration has been encouraged by grants of land and low fares on the railways, with the result that a tide has set in from Russia far beyond the capacity of the road to handle. In the first five months of 1896 there passed through Tcheliabinsk alone 170,000 persons. Towns are springing up in great numbers along the western section, which runs through a "black earth" country. In anticipation of a great grain crop (Siberia raises now 432,000,000 pounds of grain for ex-



CARS WRECKED BY THE BOSTON GAS EXPLOSION.

civic authorities. It should be especially noted that the explosion was due to no fault of the subway itself, the explosion occurring in the space between the roof of the subway and the temporary surface of the street, composed of heavy timber and granite paving blocks. The subway has been examined by the chief engineer of that interesting engineering work, and was thought to be in perfect condition and not injured in any way by the explosion. None of the employes of the new Subway were hurt. Nearly 39 tons of glass were needed to take the place of the shattered fragments in the windows. The excavation has been filled in.

The cars were shifted by way of Washington Street and the debris was removed as quickly as possible. It was surprising to find 70 pound rails twisted, and frogs

(port) the government is constructing a railway to connect the Ob with the Dvina, so that the expensive transit through Russia to the Baltic or Black Sea may be avoided. A large sum has also been appropriated to improve the navigability of these rivers.

What Produces Prosperity?

Let me ask, says Mr. Andrew Carnegie in a recent address, under what conditions does the employer of labor make profits and become prosperous? Only when labor is prosperous, is his reply, and in great demand; when wages are the highest, and when the demand for his products are the greatest. Then, and then only, is the employer prosperous. On the other hand, when labor is not fully employed and can be obtained for the lowest wages: when there is little demand for his products, then the employer can never be prosperous. In most cases he must not only make profits, but he must see his capital impaired month after month, he cannot gain, he must lose. Before the employer can be prosperous, prosperity must exist throughout the land. He is never prosperous before prosperity comes; and he is prosperous only after it comes.

THE Cyclists' Touring Club in France has founded an Academie du Cycle et de l'Automobile for the encouragement of the inventive faculty among cycle and motormakers. A committee has been appointed, and it is intended to offer a prize of 2,000 f. for the best invention.



INTERIOR OF THE WRECKED BACK BAY HORSE CAR.

Science Notes.

The Chanute prize of \$100 for the best monograph on kites has been awarded by the Aeronautical Society to Prof. C. F. Marvin, of the United States Weather Bureau.

The odor of the sweet pea, according to a contributor to the Medical Record, "is so offensive to flies that it will drive them out of the sick room, though it is not usually in the slightest degree disagreeable to the patient." It is, therefore, recommended that sweet peas be placed in the sick room during fly time.

Mr. Alphonse Berget recently described a method of studying the expansion of liquids by means of photography. Two balances of equal sensibility, with their planes of oscillation at right angles, carry two weight thermometers, one containing the liquid under examination, and the other mercury. A ray of light is reflected from two mirrors, one on each beam, and this records on a sensitive plate a curve analogous to Lissajous' figures. This curve is the graphical representation of the expansion of the liquid.

A late circular issued from the Harvard College observatory includes, in its account of the most important recent discoveries, the spectrum of a star known as Zeta Puppis, its remarkable character being unlike that of any other yet obtained, the continuous spectrum containing three systems of lines—first, the dark hydrogen lines, such as are found in stars of the first type; second, two bright bands or lines, which may be identical with the adjacent lines in spectra of the fifth type; and third, a series of very faint lines. But the most important feature of this spectrum is a new element, not found on the earth or in any other stars, an element which, though similar to hydrogen, is yet distinctly different from it. Just what it is, or by what name to call it, astronomers are undecided, the marked peculiarity being noted that it produces a vibration systematic rather than accidental of three ten-millionths of a millimeter, and the action of which can be traced only on a specially prepared photographic plate. Another extraordinary discovery noted is a new variable star, in the constellation Crux, with a period of about a year.

Some interesting investigations have been made on the green color for which some Italian cheeses are so remarkable. This color is not, as has sometimes been supposed, due to the action of bacteria, but is a consequence of the presence of copper in the cheese. To produce a good Parmesan cheese, the milk must reach a high degree of acidity, and, while waiting for this proper pitch of acidity to be acquired, the milk in some parts of Italy is kept standing in copper vessels. During this period of repose the milk takes up considerable quantities of copper; indeed, it is customary to estimate the degree of acidity attained by the milk by noting the gradual disappearance of the brightness of the highly polished metallic surface. Dr. Mariani has examined twenty-five samples of green Parmesan cheese from various places, and has found that to about every two pounds of cheese there is present from 0.8 to 3.3 grains of copper. That this metal is solely responsible for the green color is evident from the fact that in the south of Italy cheese manufactured on the same principle, but in which the milk stands in tin lined instead of copper vessels, does not acquire any green color.

The Marquis of Salisbury recently received at the Foreign Office a deputation of representatives of science who asked the government to establish a national physical laboratory to cost \$150,000 for the buildings and \$25,000 a year for maintenance. The deputation consisted of Lord Rayleigh, Lord Lister, Sir John Evans, Sir Douglas Galton, Sir Henry Roscoe, Sir Andrew Noble, Prof. W. G. Adams, Prof. W. Chandler Roberts-Austen (Iron and Steel Institute), Prof. W. E. Ayrton, Mr. J. Wolfe Barry (President of the Civil Engineers), Prof. R. B. Clifton, Prof. G. H. Darwin, Mr. Francis Galton, Mr. R. T. Glazebrook, Prof. W. M. Hicks, Dr. J. Hopkinson, Prof. J. V. Jones, Prof. John Perry, Mr. W. H. Preece, Prof. William Ramsay, Prof. A. W. Rücker, Mr. Robert H. Scott (Meteorological Office), Mr. W. N. Shaw, Mr. J. Wilson Swan, Prof. Silvanus Thompson, Prof. W. A. Tilden, Prof. Michael Foster, and Mr. G. Griffith, Secretary of the British Association. Lord Lister said it fell to his lot to introduce the deputation as being president of the British Association, with which the idea of the national physical laboratory originated, and also of the Royal Society, which took an equal interest in the matter. Lord Kelvin desired him to say that he was unavoidably absent; he was in full sympathy with their object, and would have been present had it been possible. Addresses were made by Prof. Rücker, Lord Rayleigh, Sir Douglas Galton and Mr. J. Wolfe Barry. Lord Salisbury made a fitting reply, in which he admitted the weight of the arguments which had been submitted, but pleaded that the government was already heavily burdened with expenses; but he held out hopes to the deputation that it might be found possible in a great measure to concede to them the objects which they have in view, but he could not make any pledges at that time. Lord Lister thanked the prime minister, and the interview ended.

The New White Star Liner Oceanic.

In view of the exaggerated reports which have been published regarding the new White Star liner since we gave the first authorized announcement of her size and construction, we now publish, by the courtesy of Messrs. Ismay, Imrie & Company, the more exact details of her length and beam and some of the more important features of her design.

Next to her great size, the most striking feature in the new ship is the fact that no special effort will be made to surpass all previous records in the matter of speed. In this respect she will mark a new departure in the contest for the blue ribbon of the Atlantic. Hitherto, it is safe to say, speed has been made the first consideration, and to this all other elements, such as carrying capacity, comfort and economy, have been made strictly subordinate. Now, of all the features that go to make a first class Atlantic passenger ship, speed is by far the most costly, and when it exceeds 20 knots an hour, the most doubtful in its utility. The enormous sacrifice at which high speed is obtained is proverbial.

To drive the Oceanic at 27 knots an hour, at which, according to some reports, she is to travel, would require an outlay in machinery and a daily consumption of fuel that would render her as big a financial failure as the Great Eastern before her. This is evident from a comparison between the new ship and the Campania. The Campania is 600 feet long on the water line, 620 feet long over all, 65½ feet in beam, 12,950 gross tonnage and 22 knots speed. The Oceanic will be 685 feet long on the water line, 704 feet long over all, 68 feet in beam and 18,000 gross tonnage. It will thus be seen that the Oceanic is to exceed the Campania in gross tonnage by nearly 40 per cent. Now at 22 knots speed the Campania indicates about 30,000 horse power, and burns say 450 tons per day. At 27 knots speed she would require about 55,000 horse power, and, if her engines and boilers showed the same relative efficiency, she would burn about 825 tons of coal per day.

From these figures it is evident that The Engineer, of London, was very wide of the mark when it stated, in a recent issue, that the Oceanic was to attain a speed of 27 knots with a horse power of 45,000 and on a coal consumption of 700 tons a day. To be capable of a sustained sea speed of 27 knots an hour, an 18,000 ton liner would require fully 70,000 horse power, and her coal consumption would reach fully 1,000 tons per day. This would mean that 5,000 tons of her displacement would have to be given up to fuel alone; and by the time the enormous weight of engines, boilers and auxiliary machinery had been provided for, there would be very little space left for the accommodation of mails and passengers, certainly not enough to save her from becoming a gigantic financial failure.

By giving the Oceanic sufficient horse power the White Star Company could, of course, insure that she would land her passengers in Liverpool on Tuesday evening. They consider, however, that by giving the great ship a speed well up to the present standard, so that she can make certain of reaching Liverpool and New York with great regularity early on Wednesday mornings, the comfort and convenience of the passengers will be equally well, if not better, served. The space which would otherwise be given up to machinery can be utilized in providing enlarged accommodation for the passengers, and it is the intention of the company to make a more liberal allowance of space in staterooms and elsewhere for each passenger than has ever been known on the Atlantic route.

The Oceanic will be an enlarged Teutonic. She will have two elliptical funnels, three masts and twin screws. These will overlap, the starboard shaft extending further aft than the other to give clearance for the propellers. The shafts will be carried out in a "spectacle frame," an arrangement in which the plating of the ship is built out and around the shaft, forming a tubular protection which extends up to the stuffing box gland, and allows the shaft to be inspected at all times. A long turtle deck will extend from the bow aft for over 150 feet. The dining saloon will be placed amidships, and above it will be an unusually large and handsome library.

Altogether, provision will be made for carrying 350 saloon passengers with such surroundings of comfort and luxury as have never been attempted before, and the provisions for the other classes of passengers will be on a similar scale.

Do Not Wet a Lead Pencil.

The practice of wetting a lead pencil on the tongue before using it is an unclean habit, to say the least, and perhaps also a dangerous one, says the Medical Review.

Recently a woman of fine bearing and elegantly dressed stepped into the counting room of one of the local papers of a large city to insert an advertisement. Having no pencil of her own, she picked up a pencil which was tied with a string to a pad used for writing. At once she moistened the lead with her tongue and began to write.

An elderly woman who was standing by reminded her that the pencil had just been used by an old man, ragged and dirty, greasy and filthy, who also had con-

tracted the same habit of wetting the pencil on his tongue every time he wrote a word. The disgusted woman flung the pencil away and scolded the young man behind the counter until he sharpened a brand new pencil for her use and benefit.

The habit is a foolish one. Instead of making the pencil write more freely and easily, it hardens it and makes it write blurred and irregular.

Newspaper men and those who use lead pencils a great deal never dampen the lead in the mouth or with a sponge. Besides being injurious to the lead, it is a dangerous habit, inasmuch as disease has been known to be conveyed in that way into the system.

Russian Penal Settlements.

Dr. Benjamin Howard, who since 1859 has made a special study of penology, has arrived in England from a fourth visit to Russia and Siberia, undertaken for the purpose of confirming and bringing up to date the observations made by him in Saghalien and elsewhere since 1888. In the course of a conversation with a representative of Reuter's Agency, says the London Times, Dr. Howard touched upon some of the results of his investigations. He said:

"The special object of my last journey, which occupied six months, was to complete my studies regarding the recapture, redistribution, and means of forwarding Siberian exiles. I have been through every convict and exile prison between St. Petersburg and Siberia. I have waylaid exile gangs by road, rail and river, examined when empty the convict barges on which they were conveyed, and have had opportunities of speaking to every man on board when the boats have been full. For hundreds of consecutive miles I have kept observation on the gangs in order to see them under all conditions."

Asked concerning the result of his observations, Dr. Howard replied:

"In its main principle of productive labor the Russian penal system is worthy of imitation. In its general maladministration it is worthy of reprobation."

Asked to explain the strangely divergent accounts of Mr. De Windt and Mr. Kennan, he declined to confirm or deny such statements. He continued, "I can only speak of what I have seen. The administration of the Siberian system rests so largely with individuals that almost anything may be possible. Of all that is bad in Siberia proper, Saghalien has had the reputation of being by far the worst in every particular."

Comparing the lot of Siberian exiles with that of convicts in other countries, Dr. Howard remarked:

"The result of my experience has been to show that the treatment of a convict largely depends upon himself. After a Siberian exile's term of two years' imprisonment is over there is nothing to prevent him in three to five years from becoming, within certain geographical limits, a free man. This shows good in a general way, with very special exceptions. Escape from Saghalien is practically impossible. A political exile or a murderer in Saghalien lives with his family in a well built, and often pretty, four-roomed cottage, with its vestibule and garden. The island is populated mostly by murderers or by persons guilty of similarly serious crimes. They work peaceably and quietly on their farms, and walk about the streets to all appearance free men. You go into the bureaux of the prisons and you see men writing at rows of desks. Their general demeanor and the appearance of the place is not unlike that you would see in offices in any part of the world. Yet each man is probably a convicted murderer. Russian convicts, instead of being a heavy charge on the resources of the country, are a source of revenue. Convict labor has added to the Russian empire an island the length of England, not an acre of which was previously under cultivation, and it is only the population of Siberia by these people that has made possible the line of the Trans-Siberian Railway—the envy of the whole world." In conclusion, Dr. Howard said: "The main lesson to be drawn from this system is the absolute futility of punishment for its sake alone. The first principle taught is that of self-maintenance. Convict labor should be productive of a net profit to the state, so that instead (as in England, for instance) of costing many millions, it should prove a source of annual revenue by putting in force organized forms of industry suited to the capacity of the respective criminals. By the means employed in Siberia the convicts do not lose all self-respect, and are often better fitted than before to become useful members of society. In the English and some other prison systems the outcome is generally the opposite. The result of the convict's incarceration and of the useless forms of labor on which he has been employed has often been merely to generate a vengeful feeling which tends to render him a habitual criminal."

An effort is to be made to place the Aeronautical Society of England more prominently before the public by the issue of a serial quarterly, if not more frequently, containing reports of the meetings of the society, original articles, and records of the doings of aeronauts at home and abroad. The honorable secretary of the society is Capt. B. Baden-Powell.