SCIENTIFIC AMERICAN

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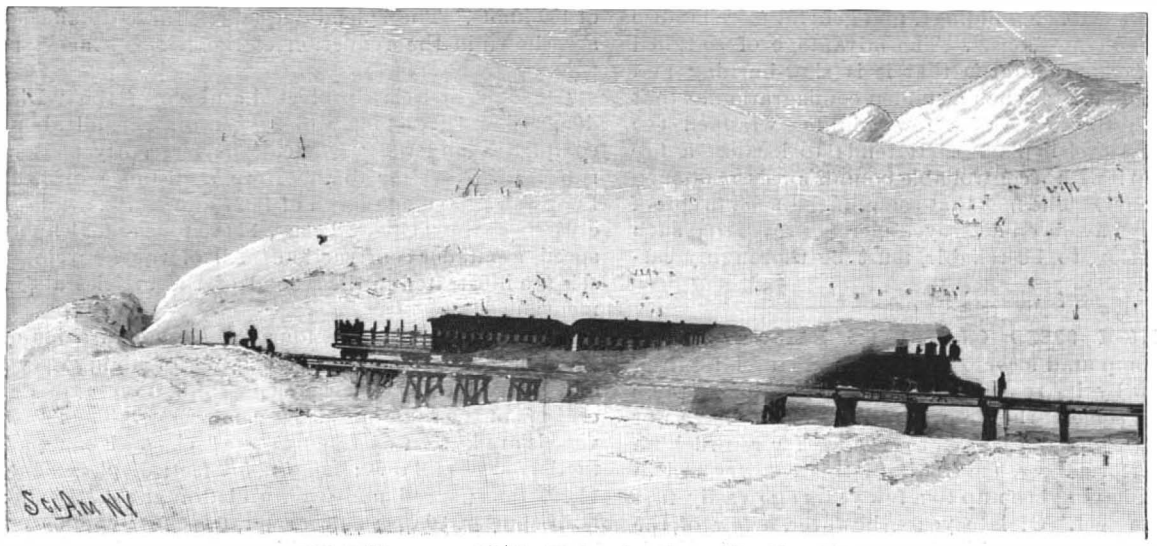
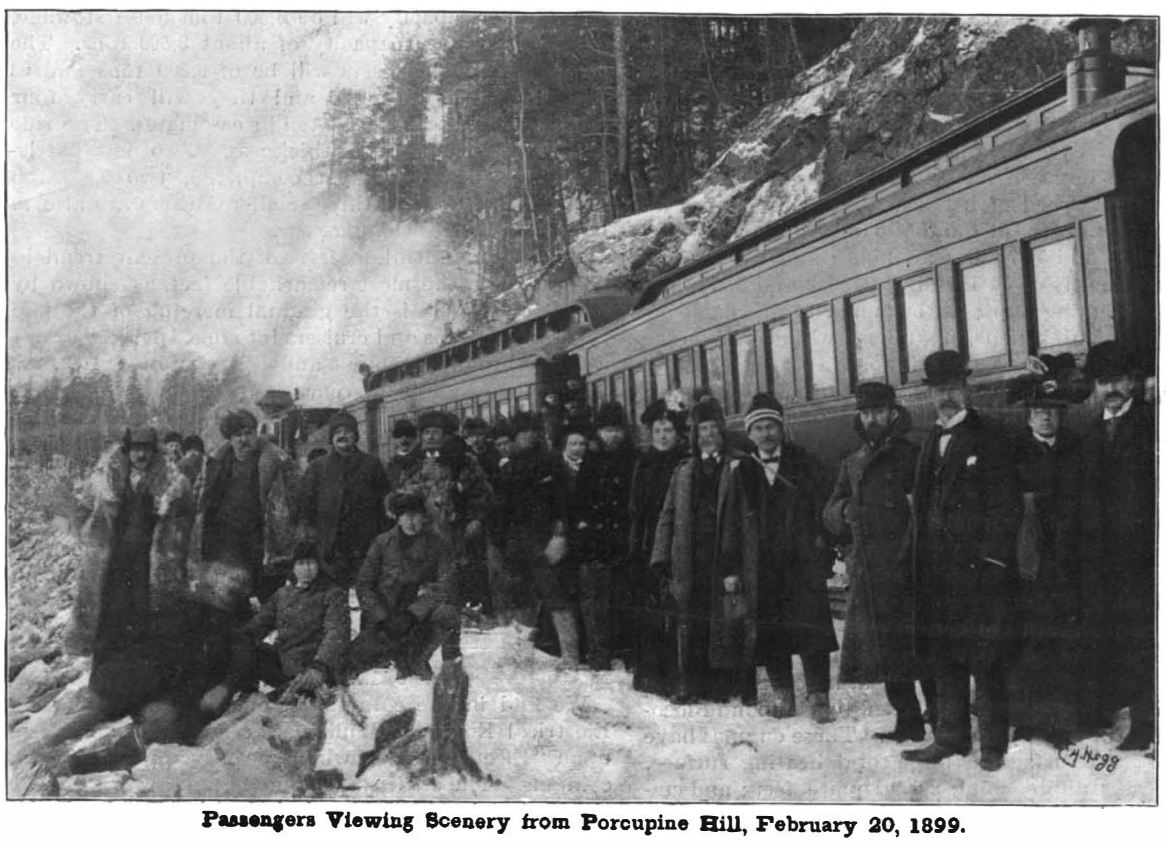


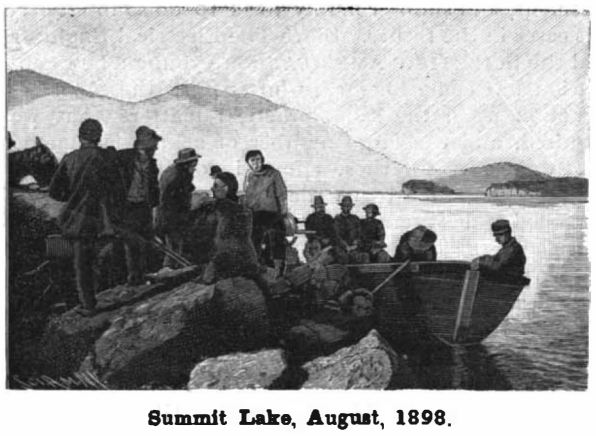
First Passenger Train Returning from the Summit.

Laborers Keeping the Track Open.

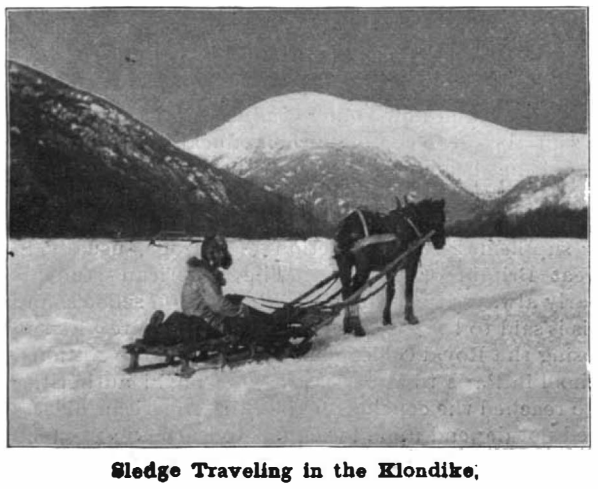


Passengers Viewing Scenery from Porcupine Hill, February 20, 1899.

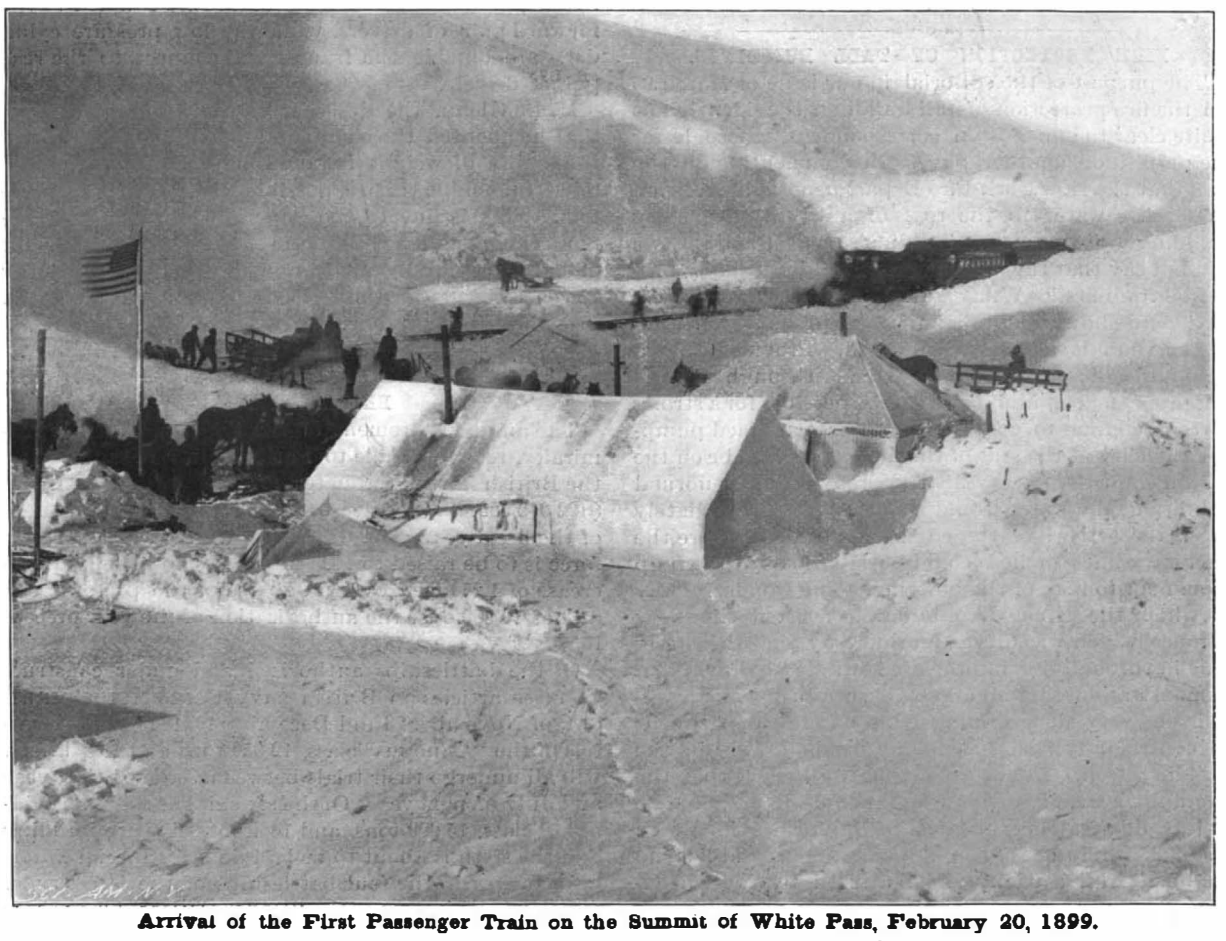
Railroad and Canadian Mounted Police Officials.



Summit Lake, August, 1898.



Sledge Traveling in the Klondike.



Arrival of the First Passenger Train on the Summit of White Pass, February 20, 1899.

THE FIRST RAILWAY TO THE KLONDIKE—THE WHITE PASS AND YUKON RAILWAY.—[See page 233.]

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OUR RELATION TO THE PEACE CONGRESS.

The formal announcement of the names of the delegates selected to represent this country at the meeting of the so-called disarmament conference reminds us that this epoch-making event is near at hand. That the conference will mark a new era in international affairs there can be little doubt—the general skepticism of naval and military men notwithstanding. That it will lead to any immediate disarmament, however, either complete or partial, is altogether unlikely, and, indeed, it is doubtful if such a result was contemplated by the Czar when he addressed his famous letter of invitation. The objects of the conference will be rather to arrest the present alarming rate of increase in naval and military armaments, and, at the same time, to determine upon some plan of international arbitration. If only the former of these objects be attained, it will be a great triumph for the cause of peace, and will carry the nations a long way toward the splendid goal of universal arbitration.

Evidently the first thing to be done is to stop the present mad competition, which is due chiefly to the rivalry between Russia and France and Germany on land and between Russia and France and England on the sea. In the determination to make her fleet equal to that of any other two, England has increased her average naval estimates from $75,000,000 in 1890 to 1894 to $132,972,500 in 1899, and other nations are increasing their naval and military expenditures in a similar ratio. If the Peace Congress is able to call a halt, it will open the way to the consideration of a gradual and pro rata reduction of armaments on sea and land.

It is rumored that, on account of the smallness of our army and navy, our delegates will be instructed to oppose disarmament and lend their strong support to a scheme of international arbitration. It is true that, in proportion to the size and wealth of the country, our forces are, judged by European standards, very inadequate; but this is a fact that will, no doubt, be taken into account by the conference. It is quite possible that in cutting down the European armies and navies to a "police" basis, it will be considered that the forces of the United States are only such as are necessary to protect the country's interests under normal peace conditions. If the nations would consent to cut down their armies from say the German basis of 1 soldier to 17 civilians to the United States basis of 1 soldier to every 445 civilians, disarmament would be within measurable distance.

FIRE PROTECTION OF TALL BUILDINGS.

The purpose of the editorial in our issue of March 25 on the fire protection of tall buildings is evidently not quite clear to our Boston correspondent, whose letter we publish on another page. In commenting on the fact that the New York Fire Department had succeeded in forcing water to the roof of a twenty-five story building by way of the building's own standpipe, we did not say that the building is therefore "amply protected from fire." What we did say was that the experiment shows our tall buildings to be better protected than is generally supposed. Provided that a standpipe of ample capacity extends through the full height of such a building, it will be possible for a strong force of engines to concentrate their combined pumping capacity at the seat of the fire, whether it be on the fifth floor or the twenty-fifth. Moreover, under normal conditions the water would be available immediately after the arrival of the engines, and long before the necessary lines of hose could be laboriously drawn up from floor to floor of the building. The wonderful way in which the Home Life building resisted the fiery furnace which was driven for hours by a northeasterly gale in through its unprotected windows proves to a demonstration that an adequate supply of water available on every floor would enable our fire department to control any fire that might originate within the building itself. At the same time we believe that the standpipe capacity of existing tall buildings should be at least duplicated, and each line of pipe provided with a sufficient number of couplings on the ground floor to enable its full capacity to be utilized by the fire engines.

The case of the Windsor Hotel, quoted by our correspondent, does not apply to the modern fireproof building. All the fire engines in Greater New York combined could not have saved such a tinder-box construction, when once the fire had fairly taken hold of the building. Hollow timber floors and hollow wooden partitions would defy all the standpipes, roof tanks, and other etcetera of fire protection that could be crowded into a building of this kind.

Literally speaking, there is, and can be, no such thing as an absolutely fireproof building. Even if doors, wainscoting, windows, and furniture were of metal construction, there would still be combustible material present in the shape of papers, letter files, and books in the office buildings, and general merchandise in the wholesale houses. The advantage of so-called fireproof construction is that it is slow-burning and renders impossible such a sudden conflagration as that which in the space of a few minutes wrapped the Windsor Hotel in flames. It tends to localize a fire and keep it within controllable bounds until the firemen can reach it. The fact that some of the semi-fireproof buildings have been destroyed merely proves that such construction, to be reliable, must be thoroughly carried out.

HIGH SPEED ON FRENCH RAILWAYS.

The compound locomotive is winning laurels for itself just now by its remarkable work in hauling express trains on some of the French railways. We have not been accustomed to look to France for record high speed performances, the trains in this country and in England having been up to a few years ago easily first in this respect. Of late years, however, a few of the French railroads, notably the Chemin de Fer du Nord, have been paying particular attention to their express train service, with the result that the last named now holds the leading place, running several of its crack trains at an average speed, including stops, of over 54·5 miles per hour.

Of the twenty-five expresses that are booked to run at a speed of over 50 miles an hour, there are six, including one between Amiens and Calais Ville, 102½ miles, with a speed of between 50 and 50 9 miles an hour; seven between 51·1 and 51·8 miles an hour; seven between 52·0 and 52·7 miles an hour; and five having respective speeds of 54·5, 54·8, 55·3, 56·3, and 57·7 miles an hour, including stops; the last named run is made between Paris and Amiens, 81¾ miles; while the average of 56·3 is maintained on a continuous run, without stop, between Paris and St. Quentin, a distance of 95¾ miles. What a splendid service this is will be understood when we bear in mind the fact that the five fastest trains exceed the speed of our own Empire State Express, which is timed to run from New York to Albany at the rate of 53·58 miles an hour, though they do not equal the Atlantic City flier on the Philadelphia and Reading Railroad. The trains are not so heavy as the Empire State Express, although some remarkable work has been done with trains of between 300 and 400 tons, running at speeds of from 40 to 50 miles an hour.

Perhaps the most interesting feature of this express service is the fact that it is worked by compound locomotives of the four cylinder type. These engines have generous grate surface; a large total heating surface, in some cases approaching 2,000 square feet; and employ steam pressure as high as 227 pounds to the square inch. The high pressure cylinders are within the frames, beneath the smoke box, and are coupled to the forward pair of drivers, while the low pressure cylinders are outside the frames and connect to the rear pair of drivers.

M. De Glehn, the designer of the locomotives, says that he adopted the compound system because, within the limits of weight imposed, he can secure a more powerful engine than is possible with the simple system. This is due to the superior economy of compounding, which he has found enables the same weight of boiler to supply an engine of from 15 to 20 per cent greater power than it could if the simple high pressure system were used.

LATEST BATTLESHIPS AND CRUISERS FOR THE BRITISH NAVY.

The annual statement of the First Lord of the Admiralty, recently made to Parliament, announces that the British naval estimates for the coming year are $132,972,500, an increase of over $14,000,000 over those of the fiscal year now drawing to a close. The total force is to be raised to 110,640 officers and men, an increase of 4,250 men over numbers for the present year and of 10,590 over the authorization of the year preceding.

Of the battleships authorized and under construction (see articles on British navy, SCIENTIFIC AMERICAN of November 26 and December 10, 1898) the six vessels of the "Canopus" class, 12,950 tons and 18¼ knots, will all undergo their trials between June of this year and July of next year. Of the six ships of the "Formidable" class, 15,000 tons and 18 knots, five are building and the sixth is about to be laid down. Special interest attaches to the four battleships of the latest type, which will be known as the "Duncan" class. They show the effects which improvements in armor and motive power are having in increasing speed and coal capacity and reducing the thickness of belts and barbettes. The particulars of the new ships are as follows: Length, 405 feet; beam, 75½ feet; mean draught, 26½ feet; displacement, 14,000 tons; speed, 19 knots with 18,000 indicated horse power under natural draught. The belt will be 7 inches, decreasing toward the bow. The barbettes will have 10 to 11-inch and the casemates 6-inch armor. The armament will be four 12-inch, twelve 6-inch rapid-fire, twelve 3-inch and six 3-pounders. The remarkable feature of these battleships is their high speed of 19 knots and the fact that it is to be obtained without the use of forced draught on a continuous run of 150 knots. The splendid qualities of Krupp armor are shown in the reduction of the belt to 7 inches in thickness.

The eight first-class protected cruisers of the "Diadem" class, 11,000 tons and 20½ knots, are all about completed, and the "Diadem" has recently made a run from Gibraltar to the Nore, a distance of 1,320 knots, at an average speed of 19·27 knots. Six armored cruisers of the "Cressy" class, 12,000 tons and 21 knots speed, are under construction. All of the above vessels are illustrated in the second of the articles above mentioned.

The latest cruisers are four huge armored ships of the same size as the "Terrible," but of higher speed and more powerful armament, and two armored cruisers of the same speed but smaller size. The larger vessels are known as the "Drake" class. Their particulars are as follows: Length, 500 feet; displacement, 14,100 tons; speed under natural draught, 23 knots; horse power, 30,000; side armor, 6 inches; casemates, 6 inches; armament, two 9·2-inch, sixteen 6-inch rapid firers, fourteen 3-inch, and three 3-pounders. The coal bunker capacity will be 2,500 tons loose stowage, with a maximum capacity of about 3,500 tons. The smaller armored cruisers will be of 9,800 tons and 23 knots (natural draught), and they will carry four 6-inch guns in turrets and ten in casemates. The side armor will be 4 inches in thickness. Two new battleships, of a design not yet completed, two 9,800 ton armored cruisers and three smaller cruisers are also to be laid down this coming year.

To any thoughtful observer of the present trend in naval design, the most remarkable fact, as shown by these new vessels, is the gradual merging of the two types battleships and cruisers into one. Here we have a battleship of 14,000 tons and a cruiser of 14,100 tons with only an inch difference in the thickness of the side armor and with a total energy of gun-fire distinctly heavier for the cruiser than the battleship. We think it is likely that the two types will in two or three years time be merged into one, to be known by the name of cruiser-battleship. Such a vessel will be of 20 to 21 knots speed and will possibly carry nothing heavier in the way of ordnance than improved 10-inch rifles of extremely high velocity and great rapidity of fire.

A CRITIC ANSWERED.

We find in the columns of our contemporary The Electrical Engineer, London, a criticism of an article upon "Electric Fuses," which recently appeared in our columns. The criticism, summed up in a word, is that the subject is not new, and the subject matter is elementary. We plead guilty to both counts of the indictment, and shall probably need to do so in numerous cases in the future. Since The Electrical Engineer and the SCIENTIFIC AMERICAN were young a new generation has come forward, who require the same instruction upon the same practical matters that we required, and the large number of acknowledgments that we receive for these efforts in our columns from time to time prove to us that such educational work is needed and is regarded by many readers as valuable to them.

We are proud to be classed as an educational journal, and no letter which comes to our office is answered with greater care than one which has evidently been written by some school boy who shows an intelligent desire for enlightenment on any subject that comes within the province of our work.

OUR NAVAL CONSTRUCTORS TO BE EDUCATED ABROAD.

The course in naval architecture at Annapolis which was started two years ago by Lieut. Hobson has been abandoned, and now young graduate constructors will be sent abroad to complete their education. For many years it has been the practice of the Navy Department to select several of the scholars of high standing of each class at the naval academy and send them abroad for supplementary instruction in Europe, usually in Great Britain or France. The American students nearly always won honors in the foreign schools, and this is said to have caused jealousies which resulted in closing the Royal College in England and the National School in Paris to Americans. Our naval authorities also reached the conclusion that the American officers need not depend upon foreigners to learn an art which was already being brought to a high state of perfection

in America. Then a course in naval construction was started at Annapolis under the direction of Lieut. Hobson. Congress at its last session withheld all appropriations for a course at Annapolis, under the impression that several American colleges had established adequate courses in naval architecture, but it has been found in many cases that these courses were wholly prospective, so the Navy Department does not now feel justified in sending officers to take these courses until they are more firmly established. It is extraordinary that naval architecture should not be taught in our great naval schools. But in view of the present condition of affairs it has been determined to return to the former practice. Two of the members of Constructor Hobson's class will, therefore, be sent to the University of Glasgow, two to the Ecole Polytechnique in Paris, while the remaining two will be compelled to abandon the construction corps and will become line officers.

NEW SYSTEM OF WIRELESS TELEGRAPHY.

A system of wireless telegraphy differing in principle from that of Marconi is attracting attention just now in the world of science, according to The New York Tribune. The essential fact which is utilized in the new method was discovered by Hertz in 1887, and has since been developed more fully by other investigators.

Ordinary white light when analyzed by a prism is broken up into a spectrum of various colors, each one representing vibrations of the ether at a different rate from those of the others. The violet rays have a much shorter wave length than the red ones. By photography and other means it has been ascertained that in addition to the waves which produce visible colors and the visible effect which is called "light" there are others which are shorter than the violet waves, and some that are much longer than the red ones.

What are called the "ultra-violet" rays, because they proceed from a region in the spectrum beyond the visible violet, possess peculiar properties. They have a singular relation to electricity. One of their characteristics is that if they are projected upon an electrified object, they will assist in discharging the store of electricity thereon. Here is another peculiarity: Suppose that a narrow gap is created in a circuit through which an electric current has been flowing; that the wires on each side of the gap terminate in knobs, and that the knobs have been so near each other that the current can leap across, in a shower of tiny sparks. Now, if the distance be increased a trifle, just enough to check the flow of sparks across the gap, and then a beam of ultra-violet radiance be made to fall upon the knobs, the flow is restored, and the sparks will again begin to leap from one terminal to the other with almost incalculable frequency.

Prof. Zickler, of Brunn, Moravia, has perfected a method of signaling with ultra-violet rays, in which he employs apparatus operating on the principle just indicated. At the sending station he uses an electric light of the arc pattern, inasmuch as the electric arc is particularly rich in ultra-violet rays. The light from the lamp is concentrated by means of a concave mirror, as in the case of a searchlight, and is projected in a slender, compact beam. A lens used in the front of the lamp to assist in the work of concentration is made of a specially selected material, a kind of quartz, which will not filter out of the light the invisible ultra-violet rays. Immediately ahead of the lens is placed a movable screen of glass, that has also been chosen carefully, because it will obstruct these ultra-violet rays, although it will not interfere with the visible radiance from the arc.

Any one at all familiar with the ordinary system of telegraphy knows that the operator alternately closes and opens an electric circuit by bringing one terminal in contact with the other and then withdrawing it. The length of time during which a contact lasts and the size of the space between the contacts can be varied enough to constitute a full alphabet. In the Zickler system the letters are formed after the Morse code or any other that may be preferred simply by removing the glass screen from in front of the lamp and then restoring it. The interruptions of the invisible radiance effected in this way are of such lengths and are so spaced as to fall into an intelligible scheme. Instead of opening and closing a "key" as in ordinary telegraphy, the operator uses a convenient device for altering the position of the glass screen in front of his arc light.

At the receiving station a bit of apparatus is used, in which a suitable lens catches the pencil of parallel rays and focuses them. Just inside the box in whose front this lens is set there are two terminals of an electric circuit brought near to each other, but without touching. One of the terminals is a small globe coated with platinum foil. The other is a round, flat plate, having a polished surface, so as to serve as a reflector as well as an electrode. It not only helps to complete a circuit for the flow of a current through wires in the station, but it also catches the focused incoming ultra-violet rays, so that they fall in a tiny spot on the center of the disk.

The disk is set at such an angle that the rays are reflected on to the globular terminal. Both, then, feel the influence of the ultra-violet rays, and are enabled to develop a stream of sparks that would not otherwise flow. The sparking is not the important feature of the performance, though. But the flow of the current thus promoted may be made to affect other instruments in the circuit, such as a "sounder" or telephone or a bell. And when, by the interposition of the obstructing screen at the sending station, the arrival of ultra-violet rays at the receiving end is stopped, the flow of the local current ceases, too. The apparatus here described can be made to give signals by any of the approved systems.

It should be noticed that this plan differs from the heliographic method of signaling with a sunbeam thrown from a mirror in this important respect: The latter plan deals with visible light, which is completely extinguished and restored. Any one near the receiving station can see the flashes and interruptions, and if versed in the code can read the messages being transmitted. But in Prof. Zickler's system the luminous rays of the arc light continue to shine steadily. No one sees any fluctuation in their brilliancy. All that is interrupted and restored is a beam of absolutely invisible radiance, which can be detected only by a suitable receiver.

The receiver, too, must be suitably placed. Unless the beam from the sending station falls upon the lens of the receiving apearatus, its signals cannot be read. The system guarantees perfect secrecy, therefore something that even the Marconi method does not now seem to promise. The electromagnetic waves which Marconi uses are generated in such a manner that they spread in all directions and can be picked up by any one who has a receiving instrument of the right sort.

Searchlights have been made which throw a beam for a distance of thirty or forty miles, and an interval of ninety or a hundred miles has been spanned by the Chicago Fair projector, which was removed to Mount Lowe, in California, and transferred to the vicinity of San Francisco during the war with Spain. Presumably the invisible rays can be detected as far away as the luminous ones. And it is conceivable that, with improved apparatus, this system can be worked successfully for more than a hundred miles. It is a costly system, however, and available only for service in which it is feasible to lay out large sums of money for the original installation.

Thus far Prof. Zickler has covered only about a mile with his successful experiments. This must not be regarded as any indication of the limitations to which the plan is subject. Although Marconi has had a line working for a year or so between the Isle of Wight and Bournemouth, eighteen miles away, and expects soon to have another working across the English Channel, between Folkestone and Boulogne, thirty-two miles, it may not be long before Zickler outdoes him in the point of distance. The system is not yet in operation on a commercial basis, but it promises to command a great deal of notice in the near future.

WOEHNELT'S ELECTROSTATIC CURRENT BREAKER.

The new contact breaker devised by Dr. A. Woehnelt, of Charlottenburg, and described and illustrated in the current number of the SUPPLEMENT, gives such remarkable results achieved by such simple means that the following notes on its structure and action may be of interest to readers of the SCIENTIFIC AMERICAN.

The coil which I use gives normally a 5-inch spark. I remove the condenser, screw the make and break in tight, so that its poles are pressed firmly together, and insert the new current interrupter in the primary circuit.

This interrupter is made in the following manner: A plate of sheet lead, 300 square centimeters in area, is placed on the bottom of a large storage battery cell and is connected to the negative pole of the current supply (100 volt direct current). The positive pole consists of a short piece of No. 14 platinum wire fused into the end of a glass tube filled with mercury, so that the platinum makes contact with the mercury. The glass tube is then fixed upright in the jar, so that the end of the platinum wire is about ½ inch above the plate. The jar is half filled with water, and the positive pole from the current supply is pushed into the mercury of the tube. The current is now turned on, and sulphuric acid diluted with twice the volume of water is added little by little until the water becomes conductible enough and the coil begins to act. This action is signaled by the formation of an arc between the platinum pole and the lead plate, together with the passage of a perfect torrent of sparks between the terminals of the secondary coil. These sparks come so fast that they appear as a thick, continuous band which wavers and curls about in a most remarkable manner. The arc between the platinum pole and the lead gives out a loud hum, the tone of which is close to middle C (512 vibrations), while the spark-band of the secondary emits an ear splitting note in the neighborhood of high C (1024 vibrations per second). On increasing the distance between the terminals, the note of the secondary becomes lower in tone, while on decreasing the distance it becomes higher and higher. The length of the spark appears to be about one-half the wave length of the sound produced.

The spark-band formation continues until the distance of the terminals is 6½ inches, when it breaks down into the spark form ordinarily seen, and so continues until 7½ inches is reached, the maximum length under these conditions. The spark capacity of my coil is thus increased from 5 to 7½ inches. No condenser and no make and break other than the one described is used.

Experiment shows that the length of spark obtained depends on the current introduced into the primary, and this may be governed with ease; in fact, the length of spark depends on: (1) The resistance in the outside circuit; (2) the area of the lead plate; (3) the strength of the electrolytic solution; (4) the distance of the platinum terminal from the lead plate; (5) the area of cross-section of the platinum wire.

For X-ray work I use a No. 18 platinum wire and let the sulphuric acid in drop by drop, stirring the while until the proper intensity is reached. The result is a surprising increase in penetrating intensity and general effectiveness, while if discretion is used in dropping in the acid, no harm follows to the tube.

This new current interrupter is likely to be a boon to the holders of comparatively small coils, for the effect obtained seems to depend more on the primary current at the service of the operator than on the length of the wire in the secondary. It is certain, at least, that a coil receives a great increase in effectiveness through very simple means. This discovery of Dr. Woehnelt's will give a fresh impetus to X-ray work, wireless telegraphy, vacuum tube lighting, and to the phenomena connected with alternating currents of high frequency.

R. K. DUNCAN,
Hill School, Pottstown, Pa. Professor of Physics.

THE HONEY BEE NOT A NATIVE OF AMERICA.

No one seems to have taken the time and trouble to thoroughly investigate the early history of the honey bee in America. Enough is known, however, to assure us that it is not indigenous to the country, but was, in all probability, imported by the early colonists.

The earliest mention of honey in America, so far as considerable research discloses to the writer, is in Irving's account of De Soto's wanderings. While the adventurer was at the village of Ichiaha, in June, 1540, his men found "a quantity of bears' grease preserved in pots, likewise oil made from the walnut, and a pot of honey. The latter they had not before seen, nor did they ever again meet with it during their wanderings." *

Some have inferred from this that the honey bee was in Florida at this period, and that it was indigenous to America. But this does not follow; first, because the village in which the honey was found was located in the country since known as Northern Georgia, or, perhaps, Northern Alabama, and not in Florida; second, the honey mentioned was very possibly the product of the humble bee, which was a native and very widely scattered.

Nevertheless, the honey bee was probably introduced by the Spanish settlers, in Florida, at least, at a later period, for Bartram, who explored the country in 1773, mentions honey and beeswax as articles of barter among the Indians. He speaks of honey in so many places in his book, that it must have been quite common, and, therefore, could not have been the product of the humble bee, whose store of honey is very scant. Bartram was told by a physician that there were few or no bees west of the peninsula of Florida, and but one hive in Mobile, which latter had been brought from Europe. Traders had also informed him that there was none in West Florida.†

At this period the honey bee was common all along the eastern shore of the country, from Nova Scotia southward. The fact that it was not found in the interior is good evidence that the insect was not a native of America. Otherwise natural swarming would have distributed it throughout the land long before the arrival of the white man.

Jonathan Carver, an Englishman, explored Wisconsin and the adjacent territory in 1766–67, and in his book, published soon after, he mentions the commonest insects. The honey bee is not among them, but the humble bee is referred to as follows: "The bees of America principally lodge their honey in the earth, to secure it from the ravages of the bears, who are remarkably fond of it."‡

According to a writer in The American Bee Journal for July, 1866, the honey bee was first noticed by white men in Kentucky in 1780, in New York in 1793, and west of the Mississippi in 1797. At the present day this industrious little bee is scattered throughout America, and the production of honey is constantly increasing.

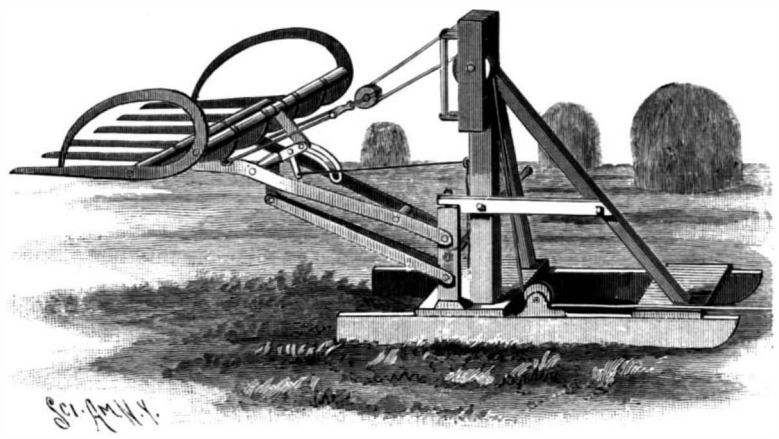
CHARLES H. COE.

THE International Air Power Company has purchased the plant of the Rhode Island Locomotive Works and the Corliss Steam Engine Works, at Providence, R. I, where auto-trucks will be manufactured. It is stated that operations will begin at once.

* Conquest of Florida, page 12.
† Bartram's Travels.
‡ Carver's Travels.

A NEW HAY-STACKER.

The illustration presented herewith represents a novel hay-stacker, the invention of Roddy C. Coble, of Marion, Kan. The stacker is provided with a base upon which there is mounted an upright and a post which may be swung by means of a bar normally locked by a foot-operated gravity-latch acting in conjunction with a keeper. Arms are pivotally attached to the swinging-post, and to the outer ends of the arms a fork is pivoted so that it can be swung up and down. A lock is pivotally connected with the fork in order to secure the fork in normal position when filled with hay. Between the arms an angle latch lever is pivoted



COBLE'S HAY-STACKER.

which coacts with the lock. Links pivotally connect the angle latch lever with the swinging-post to permit the coöperation of lock and lever. Mounted upon the angle latch lever is a releasing-lever, which can be operated by a cord to unfasten the lock and angle lever in order to permit the fork to assume its dumping-position. The fork can be raised and lowered by means of a rope which is secured at one end to the upright, is reeved through a pulley connected by a bail with the fork and through guide-pulleys in the upright and base, and is secured to a winding-drum.

When it is desired to transfer hay from one spot to another, the fork is carried to its lowest position in order to receive its load. After having been loaded, the fork is raised by means of the winding-drum. As the fork is carried upward its teeth will maintain a horizontal position, owing to the pivotal connection between the lock and the fork, between the angle lever and the lock, and between the angle lever and the links. After the fork has reached the desired elevation, the operator swings it by means of the bar previously mentioned, the gravity latch having first been released from its keeper. The fork having been swung over the desired spot, the releasing lever is operated to unfasten the lock, thus causing the fork automatically to assume its dumping position by reason of the weight of the hay. After having discharged its load, the fork returns by gravity to its normal position, and may then be returned for a new load.

THE BUNDY ACETYLENE GAS LAMP.

Since the first use of acetylene gas lamps on bicycles, numerous improvements in construction have been made in the direction of safety and convenience. Many of the improvements contributing to the desired

BUNDY ACETYLENE BICYCLE LAMP.

end are found in a lamp made by the Frank E. Bundy Lamp Company, of Elmira, N. Y.

The lamp consists of the customary generating and water chambers. The generating chamber occupies the lowermost portion of the lamp, and in it is inclosed a cartridge, which is termed a "carblot," shown in the engraving. This carblot is of novel construction and is made so that the water does not come in contact with the carbide. The cartridge is divided by means of blotting paper into a series of annular carbide cells surrounding a longitudinal central passage through which water is precipitated. The blotting paper absorbs and conducts this water to the various carbide cells, thus obtaining that uniform and slow generation of gas necessary for the production of a good light.

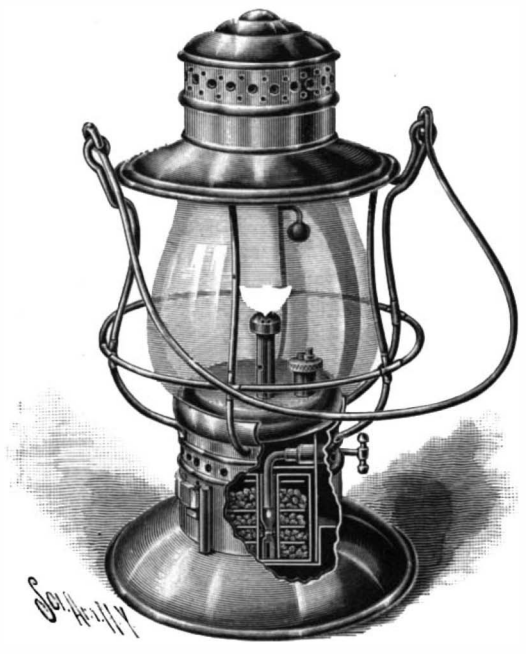
The construction of this cartridge, furthermore, enables the operator to relight his lamp with the same cartridge many times. The blotting paper being used as an absorbent and as a distributer of moisture when the water is turned into the water column, also acts as an accumulator of the moisture after the water is turned off, and the heat, which is produced by the action of the moisture on the carbide, dries the blotting paper, and the blotting paper, in turn, absorbs the moisture from the exhausted ash and leaves the balance of the carbide perfectly dry, thereby doing away with the objectionable odor after the light has died out and preserving the balance of the carbide in the carblot.

The water chamber is located above the generating chamber, with the water completely surrounding the gas tube. The water is supplied to the carbide by a supply pipe entering the central passage of the carblot. A needle valve, operated by an exterior handle, controls the supply of water. The water is also automatically controlled by a small check valve, which operates when the gas pressure becomes greater than the weight of water in the water chamber.

To dry the gas, which is necessary after generating it with moisture, a neat device in shape of a felt plug is provided, which is screwed into the gas tube, and through which all the gas is forced before it enters the gas tube. The gas tube is made in such a manner that it forms a miniature gasometer. The water in the water chamber cools the gas before it reaches the burner, thereby supplying the burner with a dry, cool gas, which gives a bright, white light.

When it is desired to use the lamp, the water chamber is first filled by means of a short filler tube, shown in the cut. The gas-generating chamber is unscrewed and the carblot placed in the carbide receptacle. After the generator has been replaced, the needle valve is opened to supply the water to the carbide. The gas generated rises, passes through the gas tube, and is then ignited.

In addition to the making of bicycle lamps, the manufacturers of the lamp described have also constructed a lantern which burns acetylene instead of oil. The generating apparatus is, in every respect, similar to that employed in the bicycle lamp; and the lantern itself presents the same general appearance as an ordinary oil lamp, over which it is so marked an improvement.



BUNDY ACETYLENE HAND LANTERN.

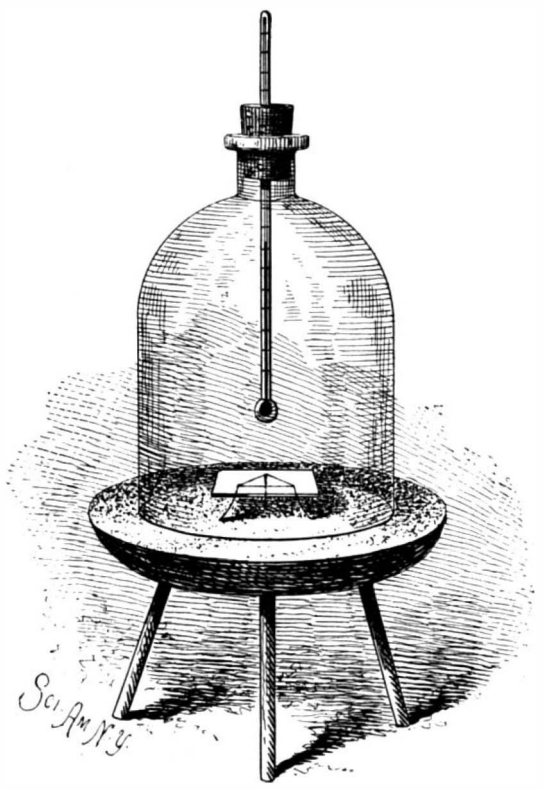
Paris Exposition Appropriations.

The secretary of the United States Commission to the Paris Exposition reports: "The exact amount of the appropriation by Congress for the Paris Exposition is $1,210,000. As the original appropriation was $650,000, this is an increase of $560,000. Of the amount appropriated, $200,000 will be expended on the United States buildings and $150,000 will be used in the display in the Agriculture and Horticulture Department. "Commissioner-General Ferdinand W. Peck has been indefatigable in his efforts to secure this appropriation from Congress, and because it is about $250,000 less than what he expected, he has issued instructions to use the utmost economy in all departments, and will cut off the expense in every direction." This will be necessary to make a display creditable to the United States.

A CHEAP FORM OF AIR-BATH.

BY PROF. RICHARD K. MEADE.

Those of the Scientific American readers who have occasion to use an air-bath will find the form described below not only cheap but very convenient, as it possesses many points of superiority over the copper or metal oven, and it is fast replacing the latter in chemical laboratories and workshops, where an oven is desired which does not corrode when substances are heated in it which give off acid fumes. The original design was one by Habermann. In his form he used a



A CHEAP FORM OF AIR-BATH.

bell jar. The writer has modified this, reducing the cost of the bath to a minimum.

Select a large glass bottle and cut off the lower part. This may readily be done by making a mark across the bottle at the proper point with a file and then wrapping two strips of wet paper entirely around the bottle, one a little above and one a little below the mark. If the bottle is revolved slowly and evenly and a small blowpipe flame is made to play on the space between the wet strips, a crack will start which may be led around the bottle by the flame. The sharp edges should be rounded with a file dipped in turpentine. A narrow strip of asbestos wound around the neck will form a convenient handle.

This extemporized bell jar is placed upon a sand bath or a ring of asbestos paper upon a sheet iron pan or iron plate. The sand bath, pan, or plate is held above the flame by a tripod. The object to be heated is placed upon a piece of glass or porcelain raised above the sand bath by a wire bent in the form of a small tripod. If it is desired to regulate the temperature, a thermometer is thrust through a cork in the mouth of the bottle. Large grooves should be cut lengthwise along the side of the cork in order to allow the free escape of the steam or vapors; in fact, there should be just enough cork to hold the thermometer in place.

The "Oceanic" and the Steel Trade.

The Iron and Coal Trades Review, published in London, recently had the following paragraph:

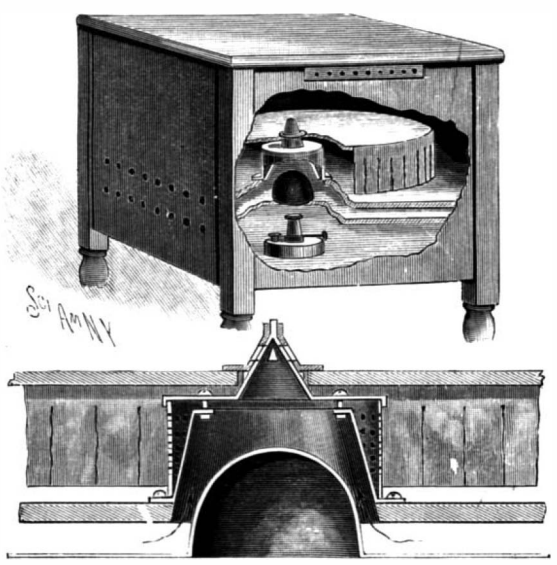
It is hardly satisfactory to reflect on the fact that although the "Oceanic"—the mightiest monarch of the ocean up to the present time—was built in our own country, with British labor, British skill, and British resources generally, for a British line, a part of the steel used in her vast structure was of American origin, a good deal of steel, in the form of plates, having during the last year or two been imported into Belfast. As the total weight of the ship, with cargo, stores, fittings, etc., is computed at 28,500 tons, the quantity of steel and iron used in her hull, machinery, etc., is not likely to be less than 20,000 tons. If the Oceanic" were to be duplicated every week, it would obviously be a good thing for the iron and steel trades.

AN IMPROVED CHICKEN-BROODER.

The invention which forms the subject of our engraving is a new chicken-brooder which has been invented by Ernest F. Hodgson, of Dover, Mass., and which provides means whereby the floor of the brooding chamber will not become unduly heated, and whereby the heat passing into the hover-chamber will be under complete control.

Fig. 1 is a perspective view of the brooder, with parts broken away to show the construction. Fig. 2 is a longitudinal section drawn on an enlarged scale.

The chicken brooder comprises a heating-chamber and a brooding chamber placed above the heating-chamber. Within the heating-chamber a ceiling-plate is located, which is provided with a heating-dome projecting into the brooding-chamber. Above the heating-dome and within the brooding-chamber a second dome is secured, which has an open top and which is surrounded by an apertured casing. The second, upper dome is covered by a plate supported from the apertured casing, and provided with a conical projection apertured to permit the ventilation of the brooder. The apertured casing serves to prevent the chicks from coming into contact with the highly heated upper dome; yet the air heated by the two domes may readily pass out through the openings in the casing. Upon the exterior of the conical projection a conical cap is mounted to turn which supports a hover-board, and which is provided with openings registering with the apertures of the conical projection. The hover-board is provided with a downwardly extending marginal apron, forming a hover-chamber.



HODGSON'S CHICKEN-BROODER.

In the operation of the brooder, cold air is drawn in through vent-holes into the space between the brooding and heating-chambers. The heated air passes up into the upper dome and through the apertured casing to the hover-chamber. If the register at the top of the hover-chamber is open, a portion of the heated air escapes, thus cooling the lower portion of the hover-chamber. By means of this arrangement, a constant current of pure warm air is obtained under the hover-board, where the chicks are located. By employing a dome instead of a flat plate, the overheating of the brooding-chamber is prevented.

A SIMPLE VEHICLE WHEEL.

A patent has been granted to Olaus L. Grimsrud, of Lead, South Dakota, for a vehicle wheel embodying in its construction a tubular elastic tire which need not be inflated, and a rim of novel form which receives the tire.

The rim of the wheel comprises two rigid sections flaring outwardly to receive the tire, and converging inwardly to form a trough, the bottom of which is formed by a flange on one of the sections, meeting the inner edge of the other section.

The tire consists of an endless strip of rubber, the longitudinal edges of which are inserted between the converging inner portions of the rim sections. An expanding or shaping section formed of a piece of spring metal semicircular in cross section is located within the tire to force it against the outer portions of the rim sections. The spokes of the wheel are secured to the rim by inserting them in the flange forming the bottom of the trough.

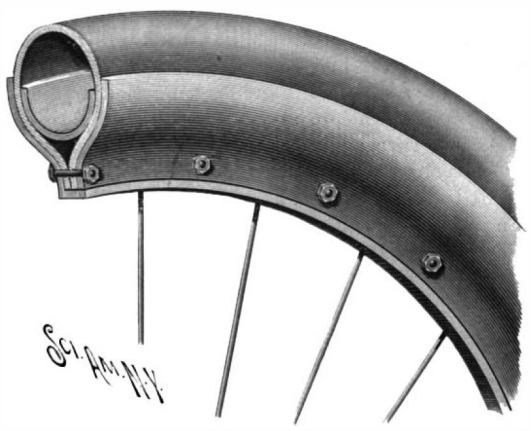
The inventor states that the tire need not be inflated, since the elasticity of the material employed and the manner in which the tire is fitted in the rim will cause the tire to remain expanded.

TURRETS OF UNITED STATES NAVAL VESSELS.

The advent of the "Monitor" upon Hampton Bay, that eventful 9th of March, 1862, was the first introduction into actual warfare of the revolving turret for protecting guns of large caliber.

Ericsson's turret, as is well known, was of the cylindrical, or what is facetiously termed the "cheese-box," type. It was practically an inverted box, resting on the ship's deck when out of action, and raised, guns and all, on a central spindle, around which it was made to revolve, whenever it was desired to point the guns on any particular object. The original plans for the double turreted monitors "Miantonomoh," "Terror," "Amphitrite," "Monadnock," and "Puritan," provided for this type of turret; but, notwithstanding its practical success on the first monitor, many serious objections had subsequently been found to this type, and the turrets of the "Miantonomoh" were changed in 1883 to "roller base;" that is to say, the central spindle was abandoned and the whole turret made to rest on a number of rollers running upon a circular rail or track, located on the lower deck. This arrangement required that the turret pass through the main deck of the ship, with a sufficient opening all around for proper working, and in the case of the "Puritan" this annular opening was as great as 24 square feet in area for each turret. The clearance space was covered with a thin, flexible apron, secured to the side of the turret armor and resting loosely on the deck, so as to permit the turret to revolve freely. This apron was liable to be destroyed by either shot or wave, when, with vessels of low freeboard, the ship would be in danger of foundering. With the advent of the modern, high power, long-range gun, the weight of the turret became excessive; the guns were necessarily close to the deck, and in the monitors too low for effective use at long range, and practically useless even in a moderate seaway.

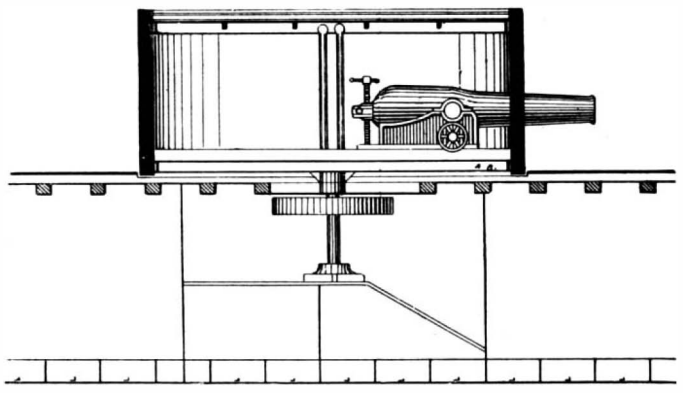
In the double turreted monitors above referred to the adoption of modern guns, in place of the old muzzle loaders, and the installment of machinery for their operation, as well as the appliances for ventilation and electric lighting, began to encroach seriously on the space allotted to officers and crew, and the designers were in a quandary how best to solve the problem, when the present distinguished head of the Construction Bureau, Com. Philip Hichborn, Chief Constructor, U. S. N., took the matter under consideration. He had just returned from a tour of inspection of European dockyards and ship-construction, on which he had been ordered by the Navy Department, and where he had made a special study of turrets, with a view to overcoming the objections to the present type. In order to improve the monitors then under construction, the guns must be raised to a greater height above the water line, and an absolutely water-tight connection



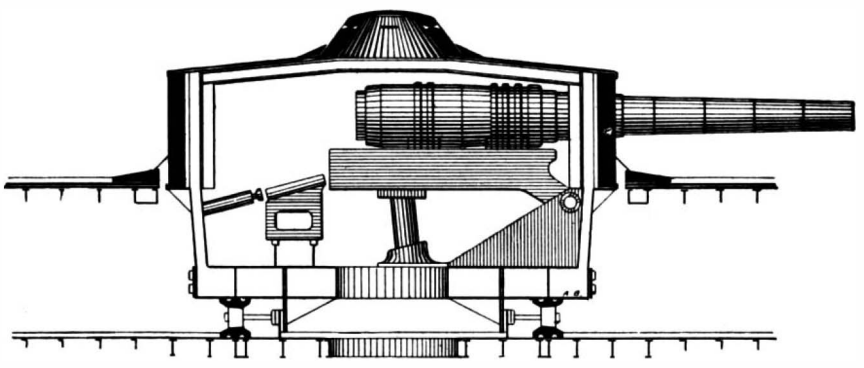
GRIMSRUD'S VEHICLE WHEEL.

must be made between the lower part of the turret and the deck of the ship. More space must also be provided by adding a superstructure, and this, if possible, without reducing the protection of the guns or increasing the weight of the vessel. These conditions required a radical change in the present turrets, and Com. Hichborn found no difficulty in adapting a general design suited to the requirements. It was found that, on account of the simplicity of construction in this new design, the weight saved on the turrets exceeded that of the proposed superstructure, which was therefore erected without increasing the weight. Raising the guns and adding a superstructure naturally raised the center of gravity of the vessel, and this, in the monitors, has been found to be of great value, making them roll easier and giving more steady platforms for serving the guns.

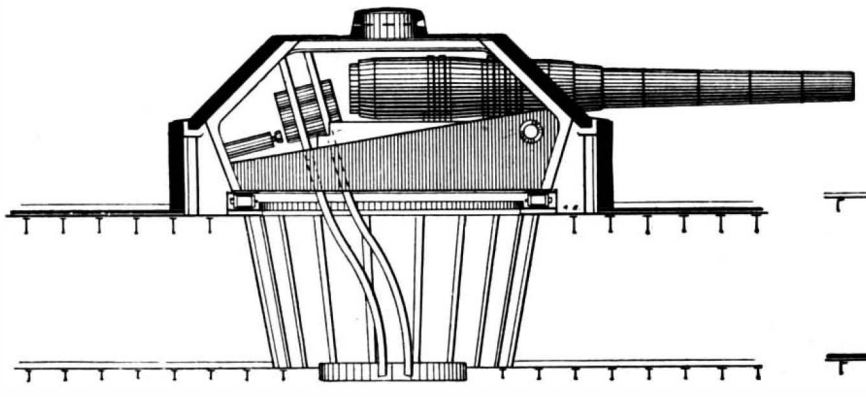
One of the characteristics of the new or "Hichborn" turret, which has been used on all the turreted ships of the navy since its adoption, is that the turret is divided into two parts; a stationary part, fixed to the ship's deck, and forming a circular vertical wall, inclosing the lower portion of the turret proper, and commonly known as the "barbette." It is constructed of steel armor, in some cases more than a foot thick, and extends, in the monitors, some four feet above the deck, forming a water-tight breastwork to that height, and enabling the guns, which are mounted above this, to be fired even when the seas are washing the decks. The upper part, or "turret," rests on rollers within the



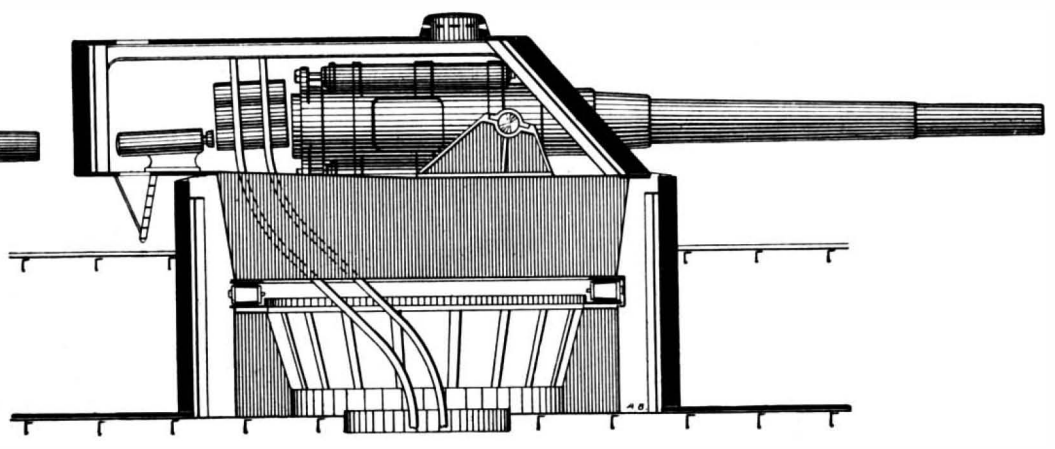
ORIGINAL "ERICSSON" CHEESE-BOX TURRET.



"MIANTONOMOH" TURRET, SHOWING OPENING IN MAIN DECK.



FIRST "HICHBORN" TURRET, WITH SIDES INCLINED.



LATEST "HICHBORN" TURRET, BALANCED, WITH FRONT INCLINED.

barbette. The portion extending above the "barbette," and through which the guns project, is inclosed in armor of about the same thickness as the "barbette," while the lower portion is constructed of steel framing as light as the conditions permit. The machinery for revolving the turret, the mounts for the guns, and the mechanism for their operation, as well as the machinery for hoisting the powder and shell, and loading them into the guns, are all inclosed within and protected by the "barbette," and are easily accessible for care and operation.

Another characteristic of the "Hichborn" turret is that the sides or walls of the turret proper are inclined toward the center, instead of being vertical, forming a truncated cone above the "barbette." In the first designs, it was intended to make the sides of the turret of a uniform inclination all around; but in later plans it has been decided to make only the front of the turret, or the portion through which the guns project, of inclined armor, on account of the difficulty in manufacturing conical armor plates. The value of inclining the armor is quite evident, particularly with an all-around inclination, as no portion of the armored wall of the turret will then be at right angles to any line of fire that, under ordinary circumstances, may be brought to bear upon it, and a shot striking the armor at an angle will either be deflected, or, if the point penetrates the surface, will, in most cases, break up under the adverse strains. Should it penetrate, it will be compelled to pass through a greater thickness of metal, on account of the inclination, than would be the case if it struck at right angles. Many practical tests have demonstrated the correctness of this deduction. In 1894 the Russian government conducted some experiments on 6-inch armor plates with improved capped shells, of which The London Engineering of July 13 of that year says: "Each of the 6-inch plates was attacked by four of these shells; the first fired normally to the plate, the second at an angle of 15 degrees, the third at 20 degrees, and the fourth at 25 degrees. The first three shots passed through the Brown plate intact, but the fourth, though it passed through the plate, was broken up. With the Cammel plate, the shot striking normally passed through; the one striking at 15 degrees passed through, but was broken up; the one striking at 20 degrees only penetrated 3·3 inches and was pulverized, and practically the same was the case with the fourth shot. Some Holzer shells were also tried. The normally striking shells penetrated the plate, but not the backing, while the oblique ones failed to get through."

These plates were of soft steel, and not comparable to the hardened plates now used in our navy.

In a lecture before the Naval War College, Prof. P. R. Alger, of the U. S. navy, who is considered an authority on such questions, stated that "At even large angles of incidence, armor-piercing shells are broken up by comparatively thin armor." A report of the Bureau of Ordnance also states that "Experimental firing at inclined armor has, at the naval proving grounds, in August, 1893, demonstrated that an 8-inch shell attacking an 8-inch nickel steel plate was wholly deflected when the angle of impact was 45°." This demonstrates fully the value of inclining the armor, and it is unfortunate that an all around inclination, as originally intended, has not been adopted in the later designs.

Yet another characteristic of the "Hichborn" turret is that it should be balanced, that is, the center of all the weights should lie, as near as may be, in the axis around which the turret revolves. This prevents the tendency of the turret to spring when the ship is rolling or pitching, and increases to a large degree the accuracy with which the guns can be trained, as well as relieving the turning machinery and turret framing of the irregular stresses to which they are subject when the turret is unbalanced.

The principle of balancing was first proposed in the original turrets for the "Monterey," as early as 1888. It has since been used for all turrets of the latest battleships in our navy, and has also been adopted on many warships constructed in other countries. A. W. Hart.

Shipwrecked Scientists.

Several shipwrecked scientists who sailed from San Francisco early in February on the schooner "Ella Erland" for a cruise in the South Seas have arrived at San Francisco from Guayamas. They were picked up in Magdalena Bay near where their little vessel was wrecked. Prof. A. W. Anthony headed the expedition, whose object was to study the flora and fauna of the Pacific coast near the equator. It is said that they stated that the Mexican customs officers confiscated all that they saved from the wreck of their schooner.

The New Chief of Ordnance.

President McKinley appointed, on April 5, Col. Adelbert R. Buffington to be Brigadier-General and Chief of the Bureau of Ordnance, U. S. army, to succeed the late Daniel W. Flagler. General Buffington has been connected with many important improvements, notably the Buffington-Crozier disappearing gun-carriage and the field gun-carriage now in use in the army.

Correspondence.

Fire Protection of Tall Buildings.

To the Editor of the Scientific American:

I notice in your March 25, 1899, issue of the Scientific American, an article entitled "Fire Protection of Tall Buildings."

An account of the test you speak of was given in The New York Sun of March 13, 1899, and was shown me by a party very much interested in progressive fire protection.

At the time I questioned the ability of Chief Bonner or anybody else to accomplish what it is claimed they did; and I made the statement at the time that if Chief Bonner had not made a report of this test at the time he did, the occurrence of the Windsor Hotel fire would have delayed his making it perhaps at all.

According to this test, the protection of tall buildings, twenty-five and thirty stories high, is assured. I would like to know just what protection is afforded a comparatively low building, say five to seven stories, the greater part of which can be reached with streams from the ground? If they have such adequate protection for tall buildings, how is it they make such a miserable failure of a low and easily reached (so far as water is concerned) building like the Windsor Hotel?

Here is the case of a building well surrounded with streets, low in height, comparatively, burning to the ground in a short two hours, in the day time, in defiance of the whole New York Fire Department, and consuming with itself the bodies of an unknown number of persons and the entire contents within the structure.

On the other hand, you have what is known as a sky-scraper, an ordinary fire engine, a six-inch standpipe, and Chief Bonner and a few of his men on the top throwing a stream 250 feet, and the building is declared to be amply protected from fire, with the exception that the couplings of the pipe are liable to burst. There are some things we do not credit, even at the end of the nineteenth century.

Thomas A. Forsyth,
Superintendent Boston Belting Company.
Boston, Mass., April 1, 1899.

End-on Fire in Our Battleships.

To the Editor of the Scientific American:

I beg to call your attention to the paragraph marked in the clipping herewith, and ask you if the same can be said of the recently launched battleships (also the proposed battleships) in the American navy. I notice that the "Alabama" and her class can fire only two 6-inch guns astern and only four of the 6-inch guns ahead, which would be miserably weak if she came end-on a ship like the "Massachusetts." I think this defect can be remedied even yet on the "Alabama" and class by having the four 6-inch guns on the upper deck mounted in pairs as the 8-inch starboard and port guns on the "Brooklyn" are mounted, and by sponsoning out the guns on each end of the central battery on the main deck. This would add four guns to the present available forward or astern battery.

As to the "Kearsarge," I notice that in a chase of a vessel it has no gun available for forward (or astern) fire between the 8-inch and the 6-pounder, and, as the large-caliber guns stand such a small chance of scoring a hit on a moving target, she stands small chance of injuring an enemy either as fast or faster than herself. I suggest that the 5-inch guns on each end of the main central battery be given an increased arc of fire, so as to enable them to be trained to the bow or stern, and thus materially increase her power. As to interference, the reason for a forward train on 5-inch guns would also make forward training of larger guns a necessity. United States.

[The paragraph referred to is an extract from an interview by an American correspondent with Lord Charles Beresford, after the latter's return from his recent visit to this country. He said:

"While in New York I went over the Brooklyn navy yard in company with Admiral Philip. I had a particularly good look at the 'Massachusetts,' one of your principal first-class battleships. I can now understand why the 'Oregon' did such destructive work without being damaged. We have no vessels that combine such heavy batteries fore and aft with such low freeboard and consequent small surface exposure. When bow or stern on to the enemy with two 13-inch and four 8-inch rifles at either end, the same effect is secured as a broadside from an ordinary ship, and yet very little of the vessel is exposed to the enemy's fire." It is generally agreed among our naval men that the ships of the "Oregon" class are somewhat over-gunned. The "Maine" represents a better proportion of guns to displacement. Turrets are more "expensive," that is, they use up more displacement, than casemates, although placing the four 6-inch guns on the upper deck in turrets would greatly increase the end-on fire for a relatively small increase in weight. It is possible to push the end-on principle too far, as the French have done. Modern sea fights will rarely be fought end-on, and a powerful broadside fire will prove to be the most effective.—Ed.]

Archæological News and Notes.

A picture by Piero della Francesca, from the Tremoille collection, was purchased a few months ago by the Louvre, at Paris, for $26,000—an almost unparalleled price for an old master of the grade of Piero.

Some interesting discoveries have recently been made at Delphi. These were bass reliefs which must obviously have decorated the proscenium in similar fashion to the Dionysiac reliefs at the Atheneum theater. They are sculptured in long plaques, each of which is carefully lettered.

All doubts as to the burial place of Louis XVI.'s great Minister of Finance, Turgot, have been removed by the opening of a tomb in the chapel next to the Lænnec Hospital, Paris. His coffin was found, which, together with those of his father and two other members of his family, were in excellent preservation.

A search of the vaults of the Corsini Palace for possible Anarchist arrangements to blow up the Anti-Anarchist Conference, which was to meet in the palace, led to an interesting archæological discovery of a secret passage from the Corsini Palace, beneath the River Tiber, to the precincts of the Farnese Palace.

The recent death of Mr. Sidney Cooper brings forward the question of the longevity of artists. Titian died when he was ninety-nine years old: Michelangelo at eighty-nine; Franz Hals, eighty-six; Hoebbema, eighty-one; Teniers, eighty; Ghirlandajo, seventy-eight; Tiepolo, seventy-seven; Mantegna, seventy-five. There are, of course, many others, so that there can be no doubt that the old masters, at least, were of a long-lived race.

In consequence of a recent report that the Palace of the Doges at Venice had become endangered, owing to the subsidence of the walls adjacent to the Bridge of Sighs and the decay of the timbers supporting the Library of St. Mark, the government ordered the distinguished architect Signor Boito and other architects to examine the condition of the structure and make a report upon the same, with a view to its restoration. The architects declare that the stories of danger are greatly exaggerated, but probably some restorations will be carried out.

The fine crusaders' castle, about twenty miles from Haifa, near Constantinople, was torn down a few months ago to build a stone pier at Haifa for the landing of the German Emperor and Empress. The castle, which was a grand old pile, was erected by the Knights Templars during the Crusaders' reign over Palestine. It was in such a fine state of preservation that up to the time of its destruction many of the rooms were actually occupied. This vandalism is comparable to that which led the builders of the Suez Canal to use for the lining of the Mediterranean entrance of the Suez Canal exquisitely carved stonework brought from the ruins of Famagusta, the old Venetian city.

The remains of a "crannog" have been found on the river Clyde. It is the remains of a dwelling built on piles. It is fairly extensive, with a circumference of 184 feet. The piles are of oak, and show under the mud the distinct marks of such cuttings as a stone ax would make. The cross beams are of fir, birch, and hazel; in the refuse mound the pastoral character of the dwellers was shown, for there were bones of cattle and sheep. Many fire stones were found and also a whetstone. The most important discovery was undoubtedly a wooden canoe, 37 feet long, cut from a single oak tree. The crannog belongs to the neolithic age. The crannog is about a mile east of Dunbarton Castle. It is below high water mark.

The Palazzo dei Trecento, at Treviso, Italy, some fifteen miles from Venice, has just been restored, at a cost to the town and surrounding communes. It dates from 1184, and is Romanesque in style. The palace has suffered much during the present century. A fine external staircase was removed, windows were disfigured, and so much vandalism was perpetrated throughout that the restoration was a costly undertaking. On the south side a fresco representing a winged lion was discovered, and it has also been restored. Within the building is an assembly hall some 30 feet high. This part will shortly be put in the hands of the restorers, and it is anticipated that several rare frescoes will be found when the walls are cleaned.

An interesting discovery was made recently at Hampton Court in the course of the excavations for a drainage pipe. Between the railings of the private gardens the foundations of the old water gate or water gallery built by Henry VIII. have been cut through. The walls or piers are of immense thickness, being no less than 25 feet wide, and they are made of the hardest chalk, faced with stone. The opening through which the state barges passed is clearly discernible. On these massive foundations, which were built in the river, formerly rose a picturesque palace of several stories. It was famous for being the place in which Queen Elizabeth was kept as a prisoner of state by her sister. It was finally demolished by William III., on account of its obstructing the view from the windows of the palace.

OPENING THE WHITE PASS AND YUKON RAILWAY.

BY W. M. SHEFFIELD.

The most important incident of the season relative to the development of the far northern gold fields was the ceremony attending the running of the first train of the Yukon and White Pass route from Skagway to the summit of the pass. The affair was made the occasion of international interest, the Canadian officials and the officers of the railroad meeting at the summit and fraternizing amid speechmaking, banqueting, and the drinking of champagne. The banqueting hall was a long tent, and though the atmosphere outside was at a temperature of 45 degrees below zero, the cold did not in any manner cool the ardor of the hosts and their guests.

The building of this road from Alaska into British Columbia and down the Yukon into Northwest Territory is the most important development that has yet transpired in the gold regions of the North. Three years ago, when the wonderful riches of the Klondike were discovered, about 60,000 men hurried from all over the civilized world to try their fortunes at digging for the yellow stuff. American and English promoters sent engineers to Skagway and Dyea and also to Pyramid Harbor to run preliminary surveys looking to the establishment of a feasible route for a railroad from tidewater over the passes to the interior. Several famous engineers were among the number, but all, save one, reported that it would be impossible to build a road over any of the passes. This single exception was E. C. Hawkins, who is now chief engineer and general manager of the present Alaskan road.

The great engineering feat was to build the road from tidewater at Skagway to the summit of White Pass. The work has been accomplished and two daily trains are operated, the grade being less than four per cent. Two thousand men have been employed all winter on the grade, and now that the weather is moderating, the force is to be increased. The construction of the road from the summit of the pass to Fort Selkirk is being vigorously prosecuted, but the hardest portion of the task has already been achieved. The trains operating between Skagway and the summit of the pass are hauling large quantities of freight and outfits bound for interior points.

Twenty-three miles of road has now been constructed and is in operation. This carries the line to a point nearly three and a half miles beyond the summit of White Pass, the distance from the summit to Skagway being 19·6 miles. The elevation of the track at the summit of White Pass is 2,865 feet, and its summit is the international boundary between Alaska and British Columbia. The road at the summit skirts the face of the steep side of the mountain, where, in order to avoid heavy rock excavation, it was necessary to support the track on a trestle stepped into the side of the bluff. The road has now eight locomotives, six passenger coaches, a baggage car and ten freight cars; ten stock cars and a number of flat cars are being constructed. New wharves are being built at Skagway, and trains are now operating almost from the very sides of steamers, thus reducing the cost of handling freight to a minimum. The company has a large warehouse at Skagway, and others will be constructed at various points along the line.

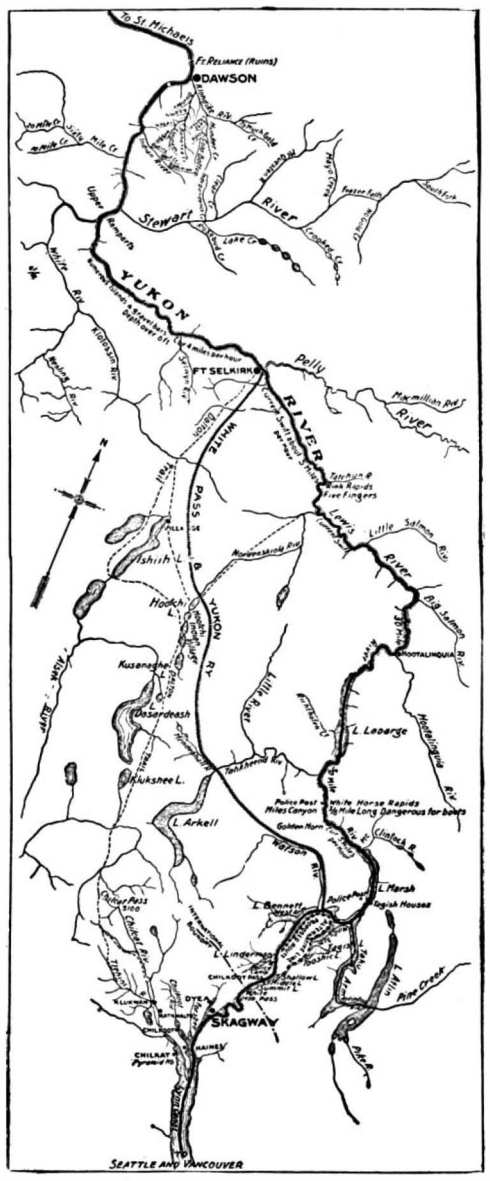
The excitement incident to the recent difficulties with Spain and the demand for news relative to the war completely overshadowed popular interest in Alaskan affairs; but the labor of constructing the road has been prosecuted with energy. The road is owned and controlled by English capital held at London but represented in America.

From a scenic standpoint a trip over White Pass in a modern upholstered railway coach has no parallel; the rugged grandeur of the rocky defiles, the jutting crags around which the railroad winds, the tunnels through which it cuts, the hundreds of waterfalls thousands of feet below and above the snow-tipped summits straining to penetrate the sky, present a scene that thrills the senses. When it is considered that this road has been built in a non-producing country, a thousand miles from the nearest railroad—transcontinental or otherwise—a thousand miles from the nearest telegraph office, and four thousand miles from the base of supply an idea of the achievement can be imagined. The construction of this mountain road has been compared with the building of the Trans-Andean line in Peru, but engineers familiar with the conditions confronting both undertakings declare that the White Pass line is the more interesting from an engineering point of view. Mr. H. M. McCartney, an engineer of ability, now living in Salt Lake City, says that the success attending the construction of the Alaskan venture is indeed wonderful. Mr. McCartney has been connected with the building of several great roads in this country and was also an engineer of construction on the Trans-Andean line. For a short time he was associated as an engineer with the White Pass route, but was compelled to return to Salt Lake City to look after important private affairs.

There is every expectation that the road will be completed and open for operation to Lake Bennett by the first of June. Traffic over this road will meet steamboat navigation on the lake, which will transport freight and passengers through the chain of lakes and down the Yukon River.

Our map does not show the section of road completed, but gives an idea of the chain of lakes and rivers, the location of various passes, and also the projected railway to Fort Selkirk from Lake Bennett. We understand from reliable sources that this railroad is to be built at once and that men have already started for the scene of operations.

The promoters of the White Pass and Yukon Route have in view not only the development of the great mineral resources of Alaska and the northern British possessions, but the development of the agricultural and stock-raising regions adjacent. In this hemisphere the northern possessions are in large measure still unexplored, while on the other hemisphere in a similar latitude great commonwealths are supported. Skagway is further south than either St. Petersburg or Christiania, and the winter climate is not nearly so bitter as in these European cities. It is the conviction of people having interests in Alaska that ten years hence the agricultural resources of Alaska alone will be capable of supporting a great people while the development



MAP OF THE YUKON RIVER AND RAILWAY.

of the mines will yield untold millions in wealth. It is on all these contingencies that this far northern railroad is counting.

Improvements at Dry Tortugas.

Rear-Admiral Bradford, Chief of the Bureau of Equipment, U. S. N., has just returned to Washington from a trip to Key West and the Dry Tortugas, where he went to inspect the important naval works under the charge of his bureau which are now in progress. Great steel coalsheds are now being built on the Tortugas, equipped with the most modern machinery for the rapid handling of large quantities of coal, and it is proposed to store 40,000 tons at this point. The distilling plant is also nearly finished, and it will have a capacity of 60,000 gallons of fresh water per day. When all these works are completed, the Dry Tortugas will be capable of caring for any number of naval vessels, and it is the only harbor between Chesapeake Bay on the north and the mouth of the Rio Grande River on the south and west where battleships can find shelter in case of need.

Another Railway for the Soudan.

The British government is considering, according to The Daily Mail, a scheme for a railway through the eastern Soudan, probably from Khartoum, on the Nile, to Suakim, on the Red Sea, by way of Kassala, in Nubia, so as to secure Abyssinian traffic. Thirty-six engines for the Uganda line are being built in the United States.

Science Notes.

More wharves are recommended by the American military authorities at Havana. The chief engineer of Havana Harbor suggests six new piers near the general wharf and the improvement of the channel. The present docks are overcrowded and much lightering is necessary.

Many Roman remains, including a colossal head of Marcus Aurelius, have been dug up at Carthage by the Director of Antiquities in Tunisia, M. Gauckler. He seems to have reached the Roman Carthage founded by Gracchus, but not to have struck the Phenician city as yet.

It is said that Prof. R. W. Wood, of the University of Wisconsin, has a new method of photographing in natural colors. Prof. Wood reproduced the colors by diffraction, and though, at present, the production of the first finished pictures is somewhat tedious, duplicates can be printed as easily as ordinary photographs are made. The pictures are on glass and are colorless, and are almost invisible when viewed in ordinary light. When placed in a viewing apparatus consisting of a convex lens on a light frame, they show the colors of nature with great brilliancy.

The Berlin Thiergarten has long been noted for its trees. A few thousand have now been cut down, leaving many acres of the ground bare. The excuse was made that it left the ground damp and unhealthy and served as a hiding place for criminals. It is believed, however, that the Kaiser's taste for formal landscape gardening and statues is the real cause of the vandalism. While Berlin is a very handsome city, it appears rather bare compared with other great capitals, and the removal of the trees from the Thiergarten will certainly not improve its appearance.

The Medical News recently gave some interesting particulars of the earliest fees for medical treatment of which there is record. Herodotus states that Darius gave the slave Democedes two pairs of gold fetters. The usual fees in Greece at that time were very small, about sixteen cents in our money being the equivalent for medical treatment, and for the kind of treatment they received, this was undoubtedly ample pay. Yet there were notable exceptions, as one King Antiochus paid $150,000 for medical treatment, and later, when the Emperor Claudian paid his physician $20,000 per annum. This was twice the income of the eminent physicians of that time.

Mr. Warwick Wroth has written an interesting book on the London Pleasure Gardens. In the history of these places he finds a strong family resemblance. They usually began as tea gardens, with a bowling green. Tea, coffee, milk, etc., were the chief attractions. As business prospered other amusements were added, and equestrian performances were given in the more important gardens. The manager of one of them kept on the grounds a fine collection of rattlesnakes. It was not unusual for the owner of a successful tavern to discover on his premises a mineral spring, of which a favorable analysis was easily obtained. This accounts for some of the famous springs and wells in or near London, as Bagnigge Wells, Hampstead Spa, and Tunbridge Wells.

As a result of the recent blizzard, the New York Telephone Company was, on February 13, deprived of the services of nearly half of its operators, on account of their being snowbound at their homes. As the day was a holiday, the service was not materially affected, as the calls upon the exchanges were light, but as the storm continued, the telephone officials were anxious to keep their operators near the exchanges, and they telephoned to various hotels to secure accommodations for over two hundred girls. Accommodations were secured with difficulty, but finally all were accommodated. The company paid for dinner, lodging, and breakfast for the girls. The order for the girls to go to the hotels was not compulsory, but they were very glad to avoid a trip through the biting storm. The next day the telephone service was unimpaired, and it was about the only means of communication in the city which was not tied up, and the drafts upon the service were enormous.

Two hundred years ago Cyrano de Bergerac appears to have anticipated in his writings one of the most important inventions of modern times—the electric light; although, of course, he could not have known of it. Still, however, the coincidence is interesting. He says, "The old landlord brought in crystals full of glowworms to light the parlor, but seeing those fiery little insects lose much of their light when they are not fresh gathered, these, which were ten days old, had hardly any at all. My spirit stayed not until the company should complain of it, but went up to his chamber and came immediately back again with two bowls of fire so sparkling that all wondered he burnt not his fingers. 'These incombustible tapers,' said he, 'will serve us better than your wick of worms. They are rays of the sun which I have purged from their heats; otherwise the corrosive quality of their fire would have dazzled and offended your eyes. I have fixed their light and inclosed it within these transparent bowls.'"

THE BEACH BROADWAY TUNNEL.

In clearing away the rubbish from the cellar of the Rogers, Peet & Company's burned building on the corner of Warren Street and Broadway in this city, which it will be remembered was destroyed on December 4, 1898, and caused great damage to the Home Life Insurance building next to it, the contractors have brought to view the entrance to the Beach Broadway Tunnel under the sidewalk vault on the southwest corner of Warren Street and Broadway, which, since the tunnel was closed, has been walled up. Our small illustration shows a portion of the entrance broken away enough to permit access to the tunnel; a portion of the arch built into the vault will be observed at the top, and the white-painted iron plates forming the interior of the curve extending from Warren Street southeast into Broadway will also be seen through the aperture.

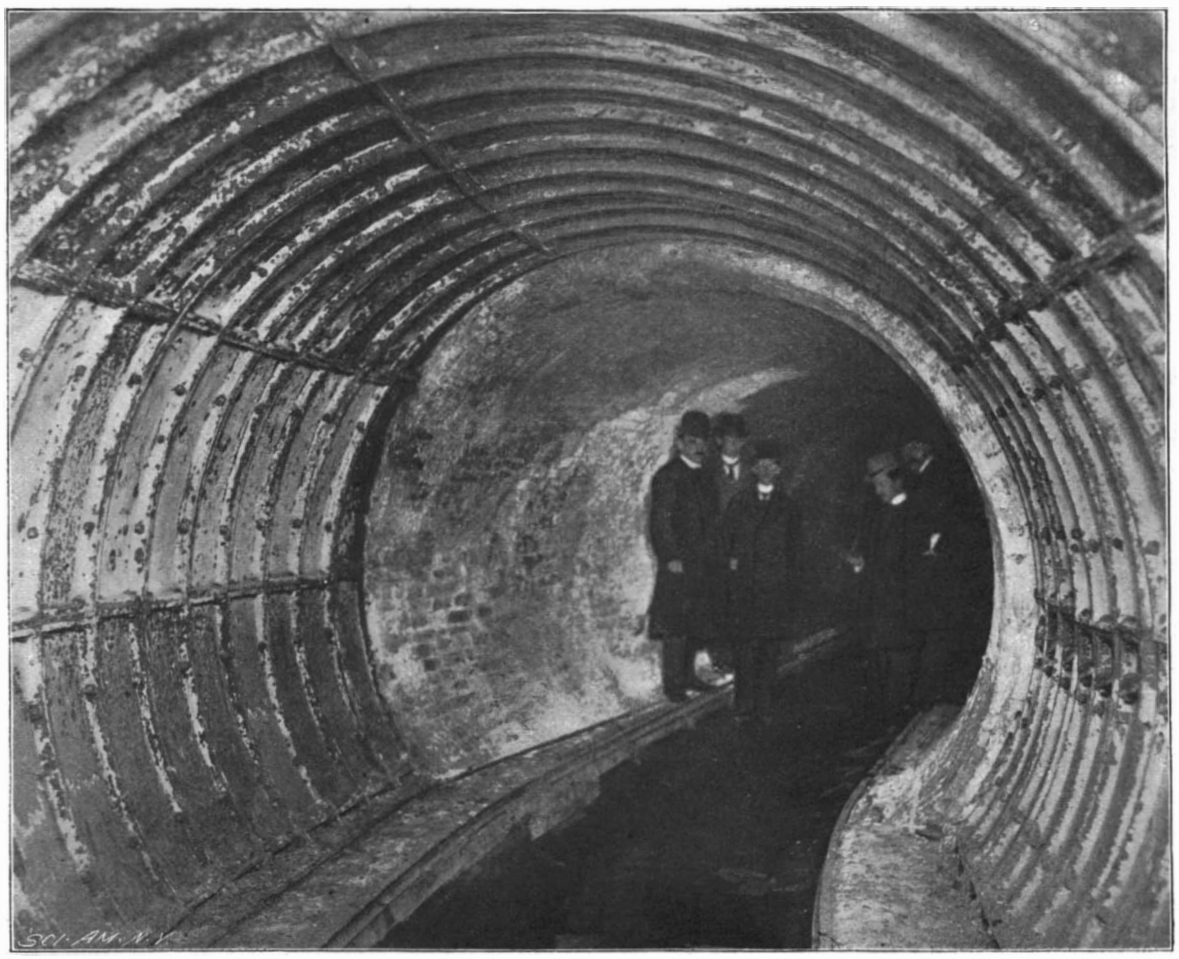
The tunnel was built in 1869, just thirty years ago, and to-day it is still in a good state of preservation, demonstrating beyond a doubt its utility for rapid transit purposes and the fact that such a work could be readily carried on under Broadway without in the least disturbing the traffic overhead or damaging adjoining property.

We think the opponents of the Rapid Transit Commission were mistaken in giving out the impression that there might be considerable damage done to adjoining property during the building of a road under Broadway; for it appeared to be such a probability that determined the Appellate Division of the Supreme Court to require a bond of unusual and prohibitive proportions to be given, which caused the commission to locate the road off Broadway on another street (the new widened Elm Street) parallel with Broadway and to terminate at City Hall Park instead of continuing on down Broadway between the rows of new high buildings to the Battery, where its natural terminus should be.

The fears of architects and engineers of former days, who contended that a tunnel passing through the center of Broadway at a depth of twenty feet below the surface might cause such a massive structure then as Trinity Church steeple to crack and fall over into the street, have been proved by actual experience, to be unfounded.

The Beach tunnel runs under Broadway south to a point just opposite the south side of Murray Street. During the past few years, on the west side of Broadway, in the same block, has been erected one of several of the highest buildings in lower Broadway, the Home Life, nearly to the height of Trinity Church steeple, yet its foundations are as solid and firm as they would be if no tunnel existed there.

This tunnel was constructed by means of the shield system invented by Alfred E. Beach, and was the first in which hydraulic power was employed for pushing it forward through the earth. The shield was forced forward 2 feet at a time, then a section of 2 feet of tunnel was built, and using that as a backing, another 2 foot forward movement was made, the earth coming in at the center, then carried to the rear. By this plan only the exact amount of earth is removed to be occupied by the tunnel, and much expense of excavation is saved. The curve of the tunnel is built of cast iron flanged plates bolted together, and is a foot larger than the brick portion, which passes directly south in a straight line under Broadway. The enlarged portion provided room for the car in passing around the curve. Our illustration, made from a flash light photograph, discloses its present condition and the junction of the iron tunnel with the brick portion. The group of gentlemen conveys an idea of its size, which is about 8 feet interior diameter.



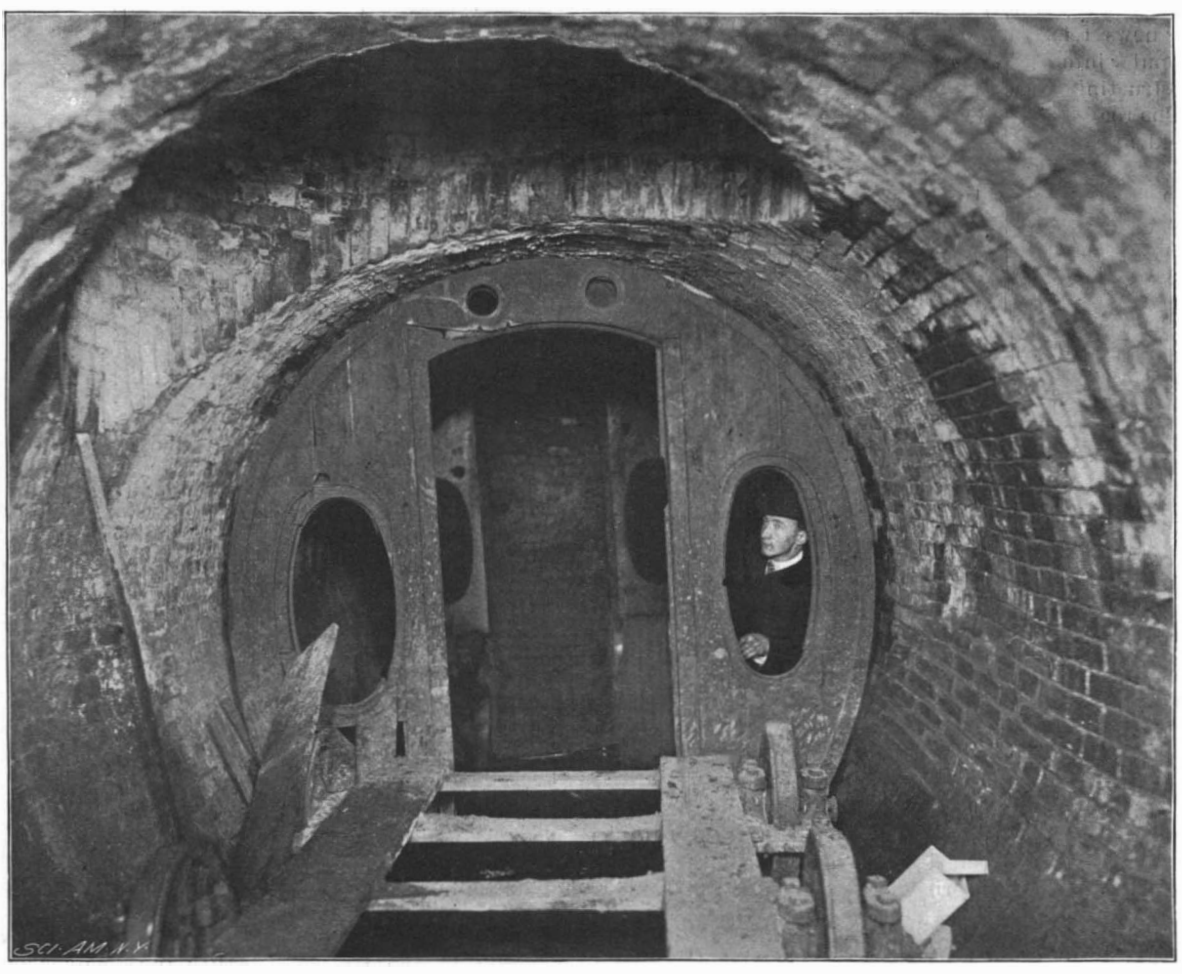
THE BEACH BROADWAY TUNNEL.

ENTRANCE TO THE BROADWAY TUNNEL.

The other illustration shows the present appearance of the car, driven by pneumatic power, now located at the extreme south end. On the opposite side of the transverse brick wall is where the shield is buried. A glimpse of the wall is seen just beyond the car. The figure in the car conveys an idea of its size, the oval aperture having once been closed with glass. There were doors at each end opening on to small platforms. All are now missing, but we see just in front the remains of the car truck which once carried the car. The large opening in the top of the tunnel just in front of the car is a vertical and horizontal smaller tunnel between 4 and 5 feet in diameter running in a northeast direction under Broadway to an air well covered by a grating in City Hall Park. This served as an outlet and inlet for air, according as the car was driven by pressure of air on its end down the tunnel from a huge blower, or drawn back to the place of starting by the suction of the air in a reverse direction. There was an air space of about 1½ inches around the car, but this leakage had no appreciable effect in reducing its speed.

In the spring of 1870 the tunnel was opened for inspection to the public and crowds of visitors enjoyed a walk through it, with the novel sensation of hearing the then Broadway omnibuses traveling over their heads. About a year later a steam engine and an enormous Root blower was installed and the car was successfully propelled back and forth by air pressure. The reversal of the air current stopped the car very gently.

Many people enjoyed rides through the tunnel in the car, including such distinguished persons as Horace Greeley and others. Though this practical demonstration proved the feasibility of the scheme, it did not become as popular as the elevated railroad, and for that reason its merits were overlooked. But to-day the slow speed of the old time elevated roads brings again into prominence the advantages of a well ventilated, clean, well lighted tunnel, which it is hoped this city will soon possess.



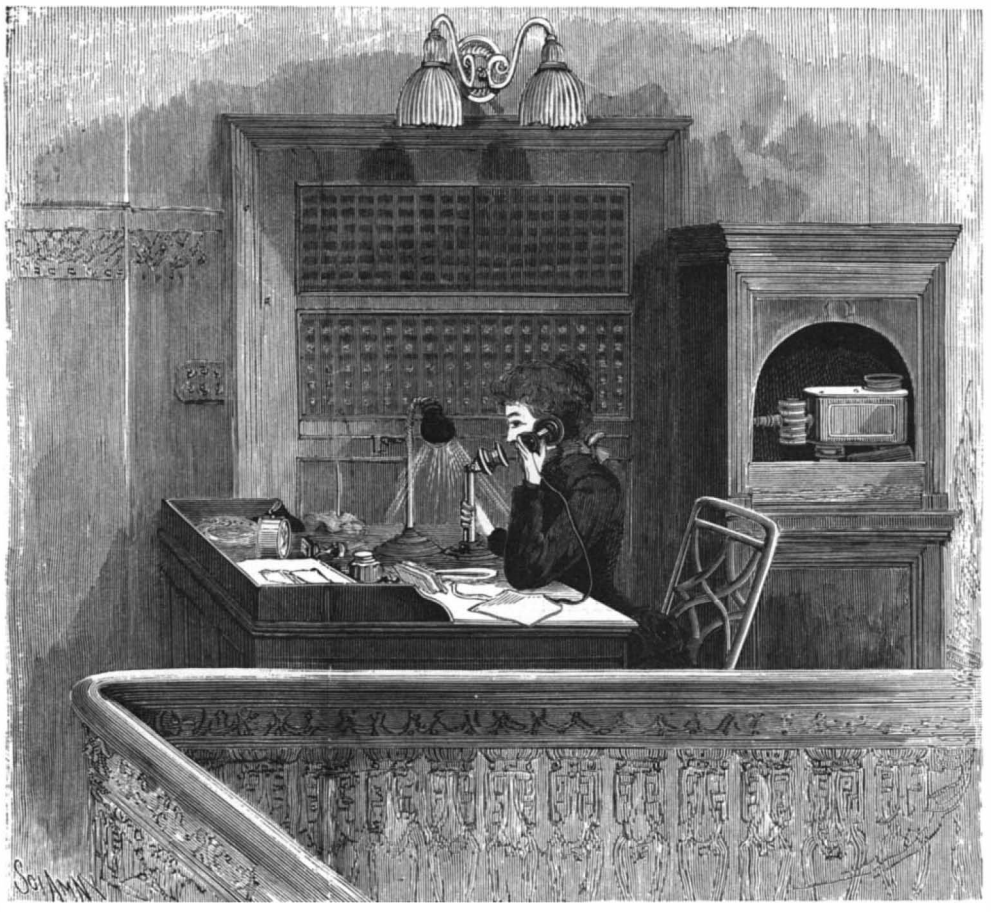
THE REMAINS OF THE BROADWAY TUNNEL CAR.

Prof. Koch and Malaria.

Prof. Robert Koch, the celebrated bacteriologist, will start some time in April for the tropics, at the head of an expedition to continue his investigations as to the nature and origin of malaria. It is hoped that his work will tend to mitigate tropical fevers. When he returned last year from the East African coast he advanced a theory that, in the case of human beings, mosquitoes played the part in communicating malaria which ticks played in the cattle disease known as Texas fever. He had reached the conclusion that where there are mosquitoes there is always malaria, and where there are no mosquitoes there is no malaria. His theory is that quinine taken at the right moment stops malarial fever, not by killing the germs, but by arresting their growth, and that a proper employment of quinine, with the establishment of mountain health resorts, would rid tropical fever of many of its terrors.

PNEUMATIC TUBE DELIVERY SYSTEM AT THE WALDORF-ASTORIA HOTEL.

The vast size of the Waldorf-Astoria Hotel, in New York city, and the necessity of catering to the wants of its 1,200 guests with the comfort, regularity, and dispatch which should characterize the most famous hostelry in the world, have necessitated the installation of some very elaborate and costly appliances. Prominent among these are the bell-work system and the system of pneumatic tube delivery. The illustrations which accompany this article deal with the latter system, but the two are so intimately related and interdependent that we will give a brief account of the electric call and telephone system before taking up the description of the pneumatic dispatch service.



Local Floor Station.

The equipment for electric signals, electric annunciator bells, house telephones, etc., includes, perhaps, the largest and most extensive network of lines ever introduced in one single building, not even excepting telegraph offices. In this instance the network of circuits has been designed and installed on the same principle pursued in the electric lighting circuit work, namely, of subdividing each floor or portions of each floor into sections or "districts." Each floor is subdivided into a number of "districts," each of which has, so to speak, its local station. All of these local stations are "interconnected" by trunk lines connecting between them, and also with the main central or operating station, which is located at the ground floor. At this main central station all the trunk lines converge from all directions. At each floor the lines also converge to a local or floor office (see illustration). An idea of the magnitude and extent of the line work requisite for all signal and communicating purposes in the building may be obtained from the statement that at each local office there are several hundred lines, while the number of lines that converge at the main central office aggregates some four thousand. There is an annunciator at each floor, and the connections are made in such manner that a call from any room in the hotel is recorded, not only at the floor office of the corresponding floor, but also in the main central station at the ground floor, thus giving notice at two points in each case. The floor office at each floor has a system of individual connections with the "service room" at each floor by means of which signals may be exchanged not only by means of electric bells and annunciators, but also by telephones. There is also an elaborate system of telephone connections between each service room and the kitchen department.

The pneumatic tube system, which was installed by the Miles Pneumatic Tube Company, of this city, has been in uninterrupted service for about a year and a half, and, although it runs continuously from six o'clock in the morning till midnight, and handles, in the busy season, as high as ten thousand letters, cards, newspapers, etc., per day, there has not been a single case of breakdown in the eighteen months' service. The enormous number of missives sent through the tubes is one of many indications of the magnitude of this hotel, whose main façade, sixteen stories, or 250 feet in height, reaches for 335 feet on Thirty-fourth Street, while the depth of the building is 200 feet, the hotel occupying the whole of a city block. There are 1,200 rooms, in which, during the present season, as many as 1,500 guests have been housed without any overcrowding.

To send and distribute the mail, newspapers, etc., and carry up visitors' cards to these sixteen floors by the ordinary methods would call for an army of messenger boys that would seriously encumber the elevators, besides inflicting an undesirable delay on the visitors. The pneumatic system was installed to expedite this work, and the success with which it is now operating renders it one of the most interesting features of the hotel plant. The tubes, fourteen in number, are carried up in a nest, one to each floor, as far as the fourteenth floor. They terminate on the ground floor at a main central station, where the combined transmitters and receivers are arranged in a long row above a marble slab, as shown in the accompanying illustration, and numbered. The tubes are of 3-inch seamless brass tubing, and each tube runs direct to a local floor station where there is a combined transmitter and receiver, similar to the one at the central station. The local station for the pneumatic system is also the local station for the annunciator and telephone system above referred to, and it is operated by a clerk, assisted by four messenger boys or "pages."

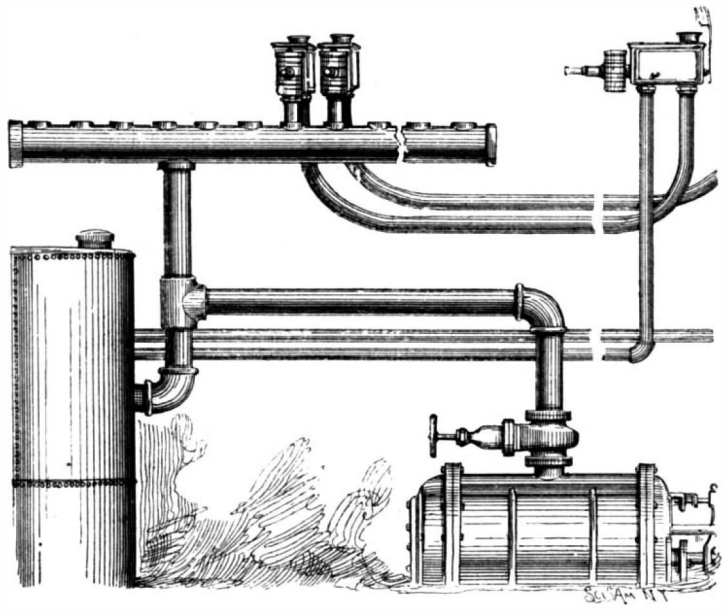
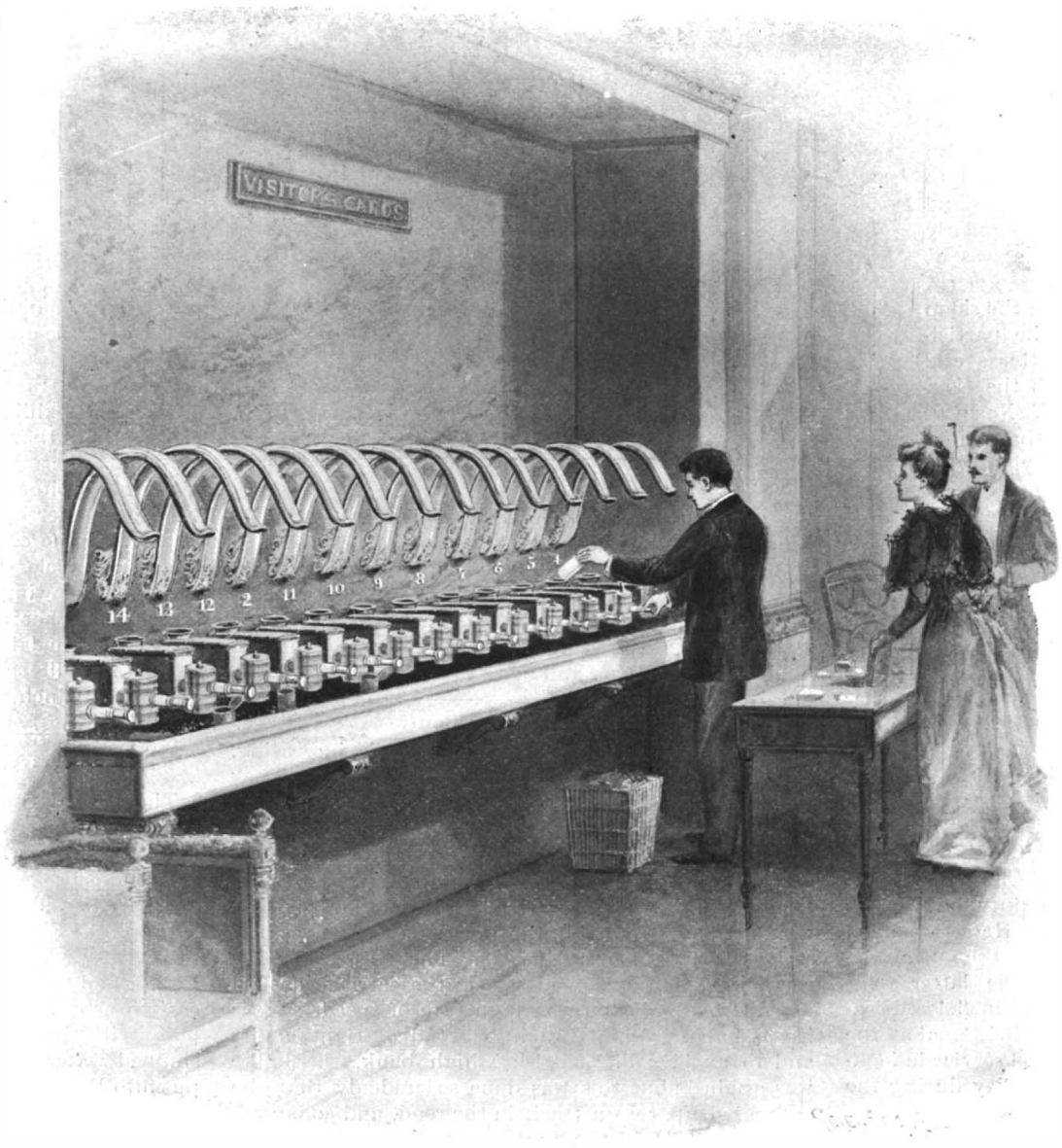


Diagram of the Pneumatic Tube System.

When the hotel mail is delivered at the office, that part of it that is to be delivered from floors 1 to 16 is placed at once on the counter of the main central station, where it is sorted and dispatched to the various floors. Here it is distributed by the "pages" at the various rooms. During the present season the postal delivery that was handled through the tubes averaged 6,000 pieces per day. The newspapers, of which some 2,000 are delivered every day, are sent up in the same way, a large carrier ten inches in length being used for this purpose. To this must be added the number of visitors' cards and various smaller articles that are carried, which together bring up the total delivery to 10,000 pieces and over in the busy season.

The arrangement of the compressors, tank, piping, and transmitters will be understood from diagram, above. The compressors, which are situated in the basement, deliver air at from two to three pounds pressure to a tank, from which mains deliver it to the central station and to each local floor station. The main to the central station conducts the air to a horizontal "manifold" pipe, which is located beneath the marble slab above which the long row of transmitters is located. The main to the local stations extends the full height of the building, and has a local branch extending to each transmitter. There is also a transmission tube connecting each local



Main Central Station.

PNEUMATIC TUBE DELIVERY SYSTEM AT THE WALDORF-ASTORIA HOTEL.

transmitter with its own transmitter at the central station.

The distinguishing feature of this system is that only one tube is necessary for both transmitting and receiving, as distinguished from the vacuum system, which requires double tubing between each station, one for receiving and the other for transmitting. A constant pressure is automatically maintained in the air tank, and there is a flow of air through the tubes only when a carrier is in transit. The transmitter and receiver, which was designed by the treasurer of the company, Mr. George H. Woodman, is an extremely ingenious automatic device, which, upon the operator pushing in the knob or button of the valve controller, admits a current of air behind the carrier and maintains the flow until the carrier has been ejected at the other end of the tube. The action is as follows: As soon as the carrier has been dropped into the tube, the operator pushes in a rod, which is normally pressed out by a coil spring. As the rod enters it first shuts a sliding gate, closing the mouth of the tube, and then by means of a cam on the rod releases a valve which admits compressed air from the main to the transmission tube at the back of the carrier. At the same time a locking piston descends and locks the valve controller stem in position. Perforations in the locking piston now permit the air to force oil through to the back of the piston, causing it to rise and withdraw the locking-pin. As soon as the controller stem is unlocked it flies back, releasing the sliding gate and leaving the tube ready for the insertion of another carrier. It is evident that, by regulating the flow of oil through the locking piston, the opening of the sliding gate can be timed to agree with the time of transit of a carrier through a given length of tube.

Particular attention has been paid to the muffling of the exhaust, with the result that the system, as installed at the Waldorf-Astoria, is practically noiseless.

REAR-ADMIRAL CHARLES O'NEIL, U. S. N.

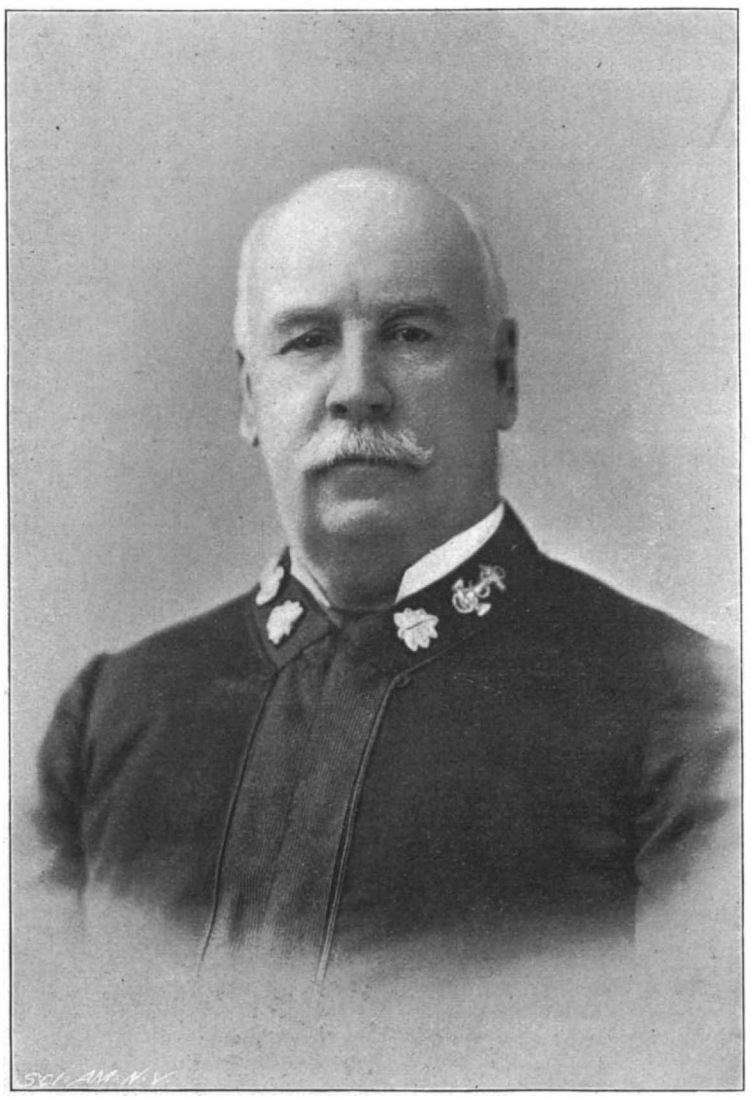
We have already given biographical accounts of Commodore, now Rear-Admiral Hichborn, under whose direction the hulls of our war vessels are constructed, and also Rear-Admiral Melville, Engineer-in-Chief of the Bureau of Steam Engineering; now in natural order we come to Rear-Admiral Charles O'Neil, present Chief of the Bureau of Ordnance, U. S. N.

Rear-Admiral O'Neil entered the navy in July, 1861, being appointed from the State of Massachusetts. He received his early education in the public schools of Roxbury, which is now a part of Boston. Before entering the navy he made two voyages to the East Indies, and on the second voyage he was wrecked in the Indian Ocean, the disabled vessel being the "Oliver Putnam," which came from Newburyport. After the vessel foundered he drifted about for several days in a small boat with five companions. They were finally picked up by a passing vessel and taken to the island of Mauritius, from whence he subsequently returned to the United States. He was at that time but eighteen years of age.

His first service in the navy was on the sloop of war "Cumberland," in which he participated in the attack on Forts Hatteras and Clark, and in the engagement with the Confederate ironclad "Merrimac" off Newport News, March 8, 1862. In this affair the "Cumberland" went down with colors flying, with a loss of over a hundred of her crew. Rear-Admiral O'Neil was promoted for gallantry on this occasion. His next service was on board the gunboat "Tioga," of the James River flotilla, in Admiral Wilkes' special West Indian squadron, and in the East Gulf blockading squadron. During the latter assignment he contracted yellow fever at Key West, but, fortunately, he recovered. He afterward served as navigator of the gunboat "Rhode Island," and took part later in both attacks on Fort Fisher. His next service was in the European squadron on board the "Shamrock," which was followed by duty on board the monitor "Dictator." He also served in various capacities on the "Dacotah," "Serene," "Galena," "Supply," "Lancaster," "Wasp," "Richmond," and other vessels in the south, South Atlantic and Chinese stations, and between cruises he performed duty on various receiving ships and at navy yards. He commanded the "Dolphin" on the home station, also the "Marblehead," and while in command of the latter went through an interesting experience at Bluefields, Nicaragua, and later took his ship to the Kiel Canal at the opening ceremonies and rendered good service in looking out for American interests in Turkey during the Armenian excitement of a few years ago.

When on shore Admiral O'Neil has been engaged for the most part in ordnance work at Boston, New York, Cold Spring, and Washington, having twice been superintendent of the naval gun factory at the latter place, and has contributed in a great measure to its development and present efficient condition. While he did not originate the manufacture of smokeless powder, it fell to his lot to introduce it into the navy for general use, and through his efforts a government factory for its manufacture is being established at Indian Head, near Washington.

He was appointed Chief of the Bureau of Ordnance, June 1, 1897, to succeed Admiral Sampson, and during his term of office he has had the opportunity of safely piloting one of the most difficult branches of the government service through a critical period, so as to secure great credit to the Bureau and to himself. He has paid particular attention to the magazine facilities for the navy on shore, and greatly extended and improved them, and through his efforts has secured a large appropriation for a first-class establishment at New York, to which we have already referred. The underwater discharge for torpedoes in new vessels has been brought about by him, and he has recently had new designs made for guns of calibers calculated to give them greatly increased power and efficiency. He also devoted his attention to new types of gun mounts and the general improvement in the details of turrets, ammunition hoists, loading and other gear, so as to embody the latest and best features that experience has shown to be desirable. Under his direction a new and thoroughly modern machine shop has just been completed at the gun factory at Washington, and the main gun shop is now extended 290 feet, which will make it 936 feet long, and one of the finest shops of its kind in the world. He has lately caused to be erected and equipped at the same place a fine cartridge-making plant, and has improved the ordnance department of the navy in all directions, and, if he is spared to fill the unexpired term of his office, he will undoubtedly contribute still more to its efficiency.



REAR-ADMIRAL CHARLES O'NEIL, U. S. N.

Motor Car Accident.

Now that the number of motor cars is increasing, we may look for a large number of accidents. They are already beginning to have them in France and England, and if the carriages are allowed to make the speed which we sometimes see even in New York, serious accidents cannot be prevented. Recently the trial trip of a motor wagonette at Harrow-on-the-Hill, near London, resulted in the death of the driver and serious injury to several others. The party left Harrow for London at a good speed; the carriage dashed down Grove Hill at a very high rate of speed, and as it was impossible to turn into a road at right angles and to avoid collision with a high bank, the brake was applied; but this was done so suddenly that the car reared up, tore a track in the road, and collapsed. The occupants of the car were thrown out and the driver was killed. A spectator states that the rubber tire first flew into the air and then the car turned completely over. The jury returned a verdict of "accidental death," and added that the wood of which the spokes were made was of a very inferior quality and not sufficiently strong to bear the strain put upon it.

Winter in the Klondike.

United States Consul J. C. McCook writes from Dawson City, under the date of February 11, stating that the weather for the last three months has been a pleasant surprise to people who have spent their first winter there. The coldest weather was between the 8th and 15th of November, the thermometer registering 40° to 50° below zero. The month of December was ideal winter weather, the thermometer remaining around zero, and there was no wind to amount to anything. In January there were a couple of weeks of very cold weather, but those who were properly protected did not suffer. There have been a great many cases of frozen limbs, and amputation was sometimes necessary. Such cases usually came from long-continued exposure on a particularly cold day, or in "stampeding" to relocate claims where owners failed to do the necessary work or to some locality which had been specially recommended.

It is not an uncommon occurrence for one to travel from fifty to sixty miles in a single day with a couple of dogs, starting at daylight and completing the trip in the same evening. Such speed can only be made in winter, however, for in summer one must traverse bogs and morasses and wade through streams. Provisions can also be transported much easier in winter than in summer, for a couple of dogs can easily pull from 500 to 800 pounds on a sled. In summer the load would have to be packed on the backs of mules and bronchos, making locomotion much more expensive and slower. The sun was lost sight of in Dawson on the 5th of December and it did not reappear again until the 7th of January. On some of the creeks some fifteen or twenty miles from Dawson, where the hills rise abruptly from the water, the sun was lost sight of the first week of November. The temperature on the creeks is generally about 10° warmer than at Dawson, because that place is more in the open and is exposed to draughts of wind. The darkness of winter days, like the coldness of the Arctic region, has been very much exaggerated. There was good daylight from 9 o'clock in the morning until 3 o'clock in the afternoon. Of course, in offices and stores lights had to be burned all day. In the first weeks of February the daylight lasted from 6:30 in the morning until 5:30 in the evening, and in a couple of months from that time there will be daylight all the time.

Motor Carriage Exposition at Berlin.

There will be held at Berlin, from the 3d to the 28th of September, 1899, an international exhibition of motor carriages open to all exhibitors. The exhibits will be placed in six classes, including motor carriages for passengers, motor carriages for freight, motor cycles and trailers, motors and accumulators for motor carriages, and parts and wheels for motor carriages. The exposition will be held in a covered building known as the Exercier-Haus. It will be open daily from 9 A. M. to 6 P. M., and it is possible also in the evening. A series of tests, races, etc., are also in contemplation. The exhibition space will be rented, and not more than two examples of the same class will be permitted to each exhibitor. Intending exhibitors must signify their intention of exhibiting either by letter or telegram before the 15th of April. The committee has power to accept or reject any article offered. Photographs must also be provided showing the carriages or other articles. There are other rules governing the show. Neither prizes nor medals will be given. The advantage to exhibitors will be confined to the results of a competitive test, which will be made with great care.

The "Somers" Again Disabled.

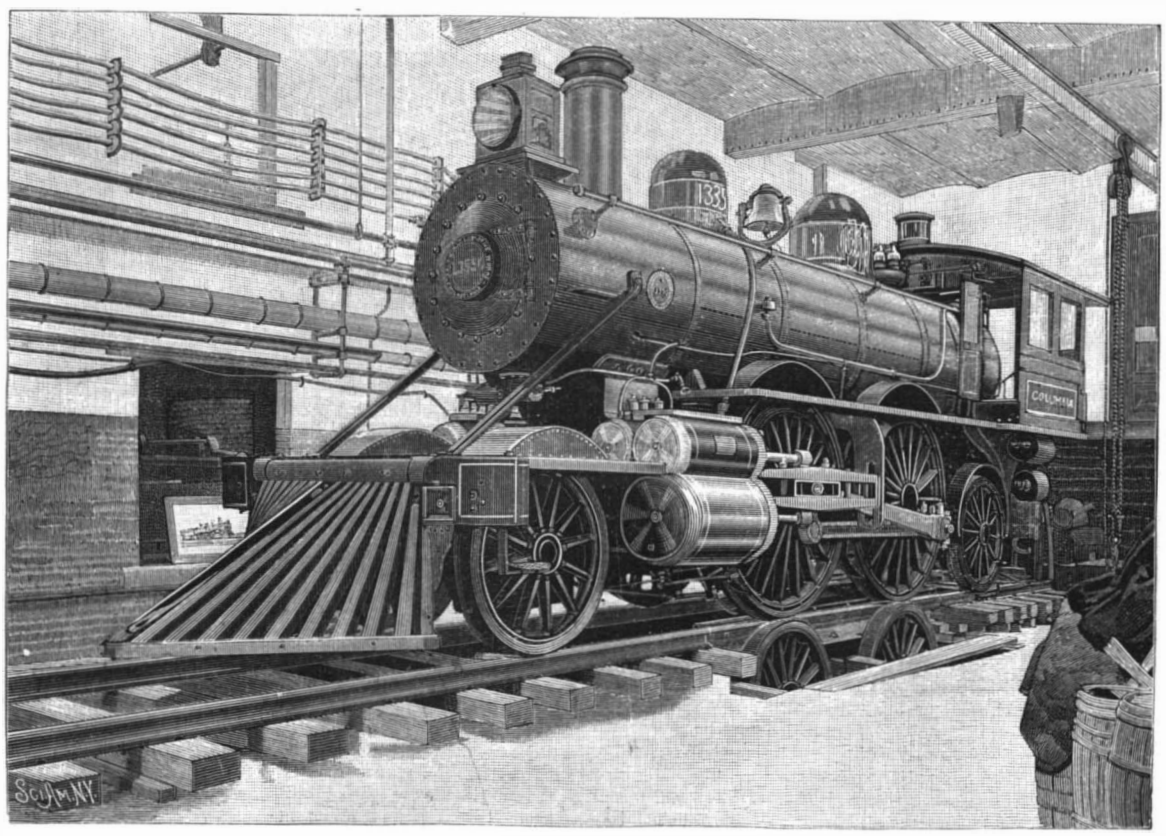
The United States torpedo boat "Somers," which was bought just before the war with Spain broke out, and was towed to Plymouth from Falmouth on April 5, has again broken down. This adds another to the chapter of accidents which this boat has suffered. She was built at Elbing, Germany, by Schichau. She was taken to Weymouth, England, just after she was completed, and turned over to the agents of this country early in April. She finally started for America in company with the "Topeka," but she sprang aleak and shipped water at such a rapid rate that she finally put into Portland for repairs. After they were made she got as far as Falmouth, and she was obliged to enter that port in a crippled condition. She was again docked for repairs, but, owing to the proclamation of neutrality made by the British government, she could not leave Falmouth, where she remained during the war.

THE NEW TESTING LOCOMOTIVE AT COLUMBIA UNIVERSITY.

BY HERBERT T. WADE.

In the development of engineering education, a most striking feature has been the great improvements that have been made in the laboratories and apparatus placed at the disposal of the student. Where formerly one or more rooms, equipped with small testing machines and working models of engines, pumps, and other machinery, were used to instruct the embryo engineer on the practical side of the subject, we now see entire buildings fitted with machinery of the same size and design as would be encountered in actual practice. While this statement holds good for a number of our larger scientific schools, it is particularly true in the case of the new laboratory of mechanical engineering at Columbia University, which is now being installed in the large basement vault between Havemeyer Hall and the Engineering building. It will contain, when completed, departments devoted to steam and motive power engineering, air and gas engines, hydraulic motors and pumps, and locomotive engineering. This equipment has been presented to the university by such engineering firms as the Allis Company, of Milwaukee; the Ingersoll-Sergeant Company, of New York; and the Worthington Pump Company, of New York; and is already in position or is in process of construction.

The locomotive laboratory, in particular, is of interest, inasmuch as its chief piece of apparatus is a full size passenger locomotive, which was the gift of the Baldwin Locomotive Works, of Philadelphia. During the winter this engine has been erected on a short section of track, and in its position at the west end of the laboratory forms the subject of our illustration. It is known as the "Columbia," and was originally built to be shown at the World's Fair, at Chicago, in 1893, where it formed a part of the locomotive exhibit at the Transportation building. At its new home in the Columbia Laboratory this engine is not to be regarded merely as a large exhibition piece of machinery, but as actual scientific apparatus that will be put to active use. In addition to its educational functions, it will be used in solving various questions connected with the design and economy of locomotives. In order that the engine may be operated under steam, it is mounted on a system of friction wheels, each of the four driving wheels resting on a large wheel mounted in massive bearings. To the axles of the friction wheels are fitted heavy brakes, which are used as dynamometers and absorb the energy developed. It may be remarked in passing, that at the present time there are only two other such locomotives in the United States, at Purdue University and at the shops of the Chicago and Northwestern Railroad. In the case of the former a number of tests have been made, and much data of importance has been obtained, which has been greatly appreciated by locomotive designers and engineers.



THE NEW TESTING LOCOMOTIVE AT COLUMBIA UNIVERSITY.

The mechanical problems involved in transportation are constantly attracting more attention from engineers, and it is the intention at the Columbia School of Engineering to give the students a thorough foundation in the theory and practice of locomotive construction and operation. The locomotive "Columbia" is what is known as a compound express passenger locomotive, and was built from designs by S. M. Vauclain, of the Baldwin Works. It is of full size, of the standard gage, 4 feet 8½ inches, and rests on four driving wheels which are brought close together directly over the center of gravity of the engine. As the engine is compound, there are two cylinders on each side, the high pressure cylinder being 13 inches in diameter and the low pressure cylinder 22 inches. The tender has been omitted from the equipment on account of lack of room, but there is a platform behind the cab supplied with scales and tanks, so that the coal and water consumption can be measured while the locomotive is being run at various speeds. The engine is fastened to a sternpost which will also absorb a certain amount of energy, and by means of traction dynamometers the hauling power at different rates of speed can be found. When running at a speed of from 40 to 45 miles per hour some 1,600 horse power is exerted, and its measurement is effected by the dynamometers mentioned above, attached to the axles of the friction wheels on which the locomotive rests. These have heavy brakes with which a force of known intensity can be applied, and the amount of energy absorbed from the driving wheels ascertained. Elaborate safety appliances have been added wherever necessary, as the effect of such a machine breaking loose in case of accident would be disastrous in the extreme. The locomotive is so arranged that it can be operated with steam from the boilers at the power plant of the university, or connected with an air compressor should it be desired to use compressed air as the motive power; or its own boiler and firebox can be used and steam generated as in actual use. There is also a full Westinghouse air brake equipment which is applied to all the wheels.

The interest that has been taken by members of the engineering profession in the equipment of the Columbia Engineering Laboratory is well shown by the generosity manifested in connection with the erection of the locomotive. The short section of track on which it stands rests on ties furnished by the New York Central and Hudson River Railroad, which also furnished the skilled labor to spike the rails in place. The rails themselves were a gift from the Maryland Steel Company, while the supporting girders for the bearings and the safety rails were presented by the Carnegie Steel Company. The Ellis bumping post was given by the Mechanical Manufacturing Company, of Chicago, and the great bearings were obtained from the George V. Cresson Company, of Philadelphia, at a specially favorable price. The dynamometers are not yet in place, as a donor has not come forward; but with this exception the equipment as regards the engine is singularly complete.

Standing near the locomotive on the opposite side of the laboratory is a trolley car of full size also, which is to be used in the same manner. It is supplied with brakes, wheels, and motors of the standard pattern and will afford opportunities for measuring the efficiency of electricity as a motive power under different conditions.

The advantage to the student of using actual size machinery in the course of his engineering education must be quite apparent, for in this way he is made acquainted with conditions as they actually exist, which in many cases vary considerably with the increased size of the machine. Having operated such machinery, it necessarily follows that he is in a better position to design or superintend its construction. In the new laboratory at Columbia it is intended to have all the practical work take this form, and the various engines, pumps, and other mechanical apparatus, either in place or in course of construction, all carry out the same idea. Such an equipment has been secured by the generosity of leading American manufacturers of machinery, who in this substantial way have shown their interest in the attempt of the university to provide a thorough education in the principles of mechanical engineering. They, however, will doubtless secure an ample return, not only in an improved grade of engineers, but also in having a place where tests and experiments of a scientific character may be made with different appliances and materials, and data deduced which in most shops and factories it would be next to impossible to secure.

A HEAVY snowstorm in Belgium has completely disorganized the telephone system around Brussels. The damage done to the wires was so extensive that it is not likely the necessary repairs can be made within a month.

Fibers and Fabrics and Their Relation to Manufactures.

At a recent meeting of the Household Economic Association and the Domestic Science Department of the Brooklyn Institute, an interesting paper entitled "Fibers and Fabrics: Connecting them with Dress and Healthful Conditions," was by Mrs. S. S. Woolman, of Teachers' College. She said it is women who are injuring the market, not manufacturers, the trouble coming from the former's failure to understand the fiber itself. A woman wishes a certain material and says she must have it at a certain rate. In order to give her what she asks, cheaper chemical dyes must be used and various adulterations must be resorted to. If women go to the stores and insist on having foreign goods for the first-class materials, it forces American manufacturers to make cheaper goods; whereas, American manufacturers can make the best quality of goods if there is a trade for them. The effect of the adulteration is already becoming noticeable. If women think they are getting a good silk at 50 cents a yard, they are mistaken; they will find it is nearly all cotton, for there is no silk obtainable at that price but the Japanese. Among the many adulterations used now in the manufacture of silk to give it the required gloss, "scroop" (the crisp rustle), and body, Mrs. Woolman mentioned the use of the rough floss silk for the woof which makes it soon wear shiny, and artificial silk made of cellulose and treated with chemicals; and the introduction of Sea Island cotton, which looks almost the same as silk, but will not wear as long, also the use of cotton which has been mercerized, as described a short time since in the SCIENTIFIC AMERICAN. This gives a transparent effect, and is excellent for cotton, but not as a silk fabric. Pressing is also resorted to in some brands of silk. This increases the weight, but sacrifices the strength. The lecturer gave a series of tests for silks.

Emperor William's New Rifle.

The Emperor William has a new rifle which resembles the Mauser revolver. It is a foot long and the magazine contains ten cartridges, as in the Mauser revolver. The rifled barrel is constructed to use a projectile covered with nickel and shaped at the end like a "Dum-dum" bullet. The propellant is cordite, and the rifle is sighted up to a distance of one thousand meters. The pistol fits into a wooden frame which, together with the butt-end proper, forms the shoulder-rest and gives the revolver the appearance of a magazine rifle. It is said that Mr. Maxim has made important additions to the weapon.

The Current Supplement.

The current SUPPLEMENT, No. 1215, is filled with interesting and important articles. "The Construction of a Voltmeter and Ammeter Suitable for the Small Switchboard" is an article by Nevil Monroe Hopkins and has been prepared at the request of many of our readers. It is accompanied by fifteen illustrations and working drawings. "A Horizontal-Base Range and Position Finder for Coast Artillery" is an article by Lieut.-Colonel George O. Squier, Ph.D., and Prof. A. C. Crehore, and is accompanied by interesting illustrations. "Trade Suggestions from United States Consuls" are published as usual, and a new feature is introduced, which is an index to all the advance sheets of the Consular Reports, by the aid of which our readers will be informed as to all of the Consular Reports that are issued, whether published in the SUPPLEMENT or not. There is also an interesting article on the "Woehnelt Current Interrupter."

Contents.

(Illustrated articles are marked with an asterisk.)

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

CULTIVATOR. — John McL. Wright, Oberlin, Kan. This cultivator is so constructed that the weight of the driver will act to hold the shares out of contact with the ground. When no downward pressure is exerted upon the handles of the beams, the weight of the driver in the saddle will be sufficient to raise the plow-beams so that the shares will be removed from the ground. By pressing down upon the handles, the shares may be buried in the ground to a previously determined extent.

Electrical Apparatus.

ELECTRIC SWITCH.—Max H. Caspari, Manhattan, New York city. The switch consists essentially of a mercury-containing chamber having attached thereto the two poles or binding posts for the circuit-wires. The binding-posts are insulated from each other and are placed at different elevations. The mercury-chamber may be raised or lowered so as to cause the mercury to cover one or both of the poles in order to make the contact. By means of this device a clean contact-surface between the two parts of the switch is maintained.

Bicycle-Appliances.

BICYCLE-FRAME. — Jeremiah C. Parker, Red Bank, N. J. This bicycle-frame belongs to that class in which the frame is so constructed that it may be adjusted for regulating the tension of the driving-chain. A split socket tube is carried rigidly at the lower end of the central brace, and receives the stem of the lower braces. By sliding the stem longitudinally in the socket-tube, the rear upper braces and the rear wheel will be moved to regulate the tension of the chain. The stem is held in adjusted position by means of a clamp.

BICYCLE-GEAR.—Cephas Whitney and Alfred C. Lazarus, Kingston, Jamaica. The crank-shaft in this bicycle-gear is provided with the usual cranks, in the free end of each crank a shaft being journaled. On the outer end of the shaft arms are carried provided with pedals. An arm extends from the shaft at right angles thereto. An eccentric has its disk fixed to the bicycle-frame and its eccentric-rod pivotally connected with the arm extending at right angles to the shaft. By this arrangement extended crank-arms are produced in which the extension is always at right angles to a line drawn through the center of the eccentric-disk and the center of the crank-shaft. Great leverage is hence obtained without causing the foot to move through a large circle.

Mechanical Devices.

FRICTION DRIVING DEVICE FOR SHAPING-MACHINES. — Wendell P. Norton, Torrington, Conn. The friction driving device patented by this inventor comprises two driving-pulleys loosely mounted to rotate in opposite directions. Between the driving-pulleys a friction pulley is arranged to be moved into frictional contact with the inner surfaces of the pulley-rims. Spring-arms connect the rim of the friction-pulley with the hub and are adapted to yield laterally and longitudinally. Thus there is obtained a uniform contact of the peripheral surface of the rim with the inner surfaces of the pulleys; and shock and jar are prevented.

FIRE-ESCAPE. — James O. Miller, Coolgardie, Western Australia. In the fire-escape provided by the present invention there is mounted within a casing a cord-carrying drum having toothed wheels connected therewith. Reciprocating bars have projecting points engaging the teeth of the wheels, thus providing an escapement mechanism which regulates the speed of the drum's rotation under the weight of the user. The device may be used for descending from any height, and may be advantageously employed in mines and wells.

PAPER-CUTTING ATTACHMENT FOR BOX-COVERING MACHINES.—Isidor Dreyfuss, Manhattan, New York city. The invention provides improvements in machines for automatically cutting off strips of paper or like material, which are being glued on pasteboard or other boxes. The machine is so constructed that the cutters can be adjusted higher or lower and forward or back without requiring any regulation of the cutter-operating devices. The cutting device can be operated by hand at any time to cut out a defective piece of paper without in any way interfering with the automatic operation of the device.

INTEREST-INDICATOR. — Charles C. Adams, Charlotte, N. C. The interest-indicator is so constructed that by depressing a key corresponding with the principal, mechanism will be operated to bring into proper adjustment figures representing the interest upon that principal for a series of periods, so that the operator can readily determine at a glance the amount of the interest for the desired period. The means whereby the desired results are obtained consist primarily of rollers carrying interest-lists adapted to register with period lists.

Miscellaneous Inventions.

KNOCKDOWN BARREL.—Philis Mayotte, Escanaba, Mich. In certain industries, especially in that of beer-brewing, it is a matter of considerable expense to return the empty kegs—an expense which might be greatly reduced by employing collapsible barrels. It is the purpose of the present invention to provide such a barrel. The inventor has therefore constructed his barrel, not with the ordinary strap hoops, but with stout chains, the ends of which are bolted together. By removing the chains the barrel falls apart.

LINE-GUARD FOR VEHICLE-POLES.—Fletcher M. Bird, Wenatchee, Wash. The object of the invention is to provide a line or rein-guard for the tongue or pole of a vehicle, which will effectually prevent the inside check-lines of a double harness from becoming entangled with or lodging upon the end of the pole or tongue of the vehicle in front of the neck-yoke ring. The guard is so constructed that it may be permanently secured to the pole or tongue in such a manner that it will not interfere with the hitching or unhitching of the neck-yoke, it being possible readily to slip the neck-yoke ring on or off the tongue or pole at pleasure.

PHOTOGRAPHIC DEVELOPING APPARATUS.—Albert Gooder, Brookville, Pa. This film-developing device consists essentially of a tray containing the developer, in which tray, frames are mounted adjustable relative to each other and relative to the tray. Rollers are located within the tray and upon the frame, and serve as supports for the film. The device may be adjusted to accommodate any size camera-film, and is designed to prevent scratching of the bromid emulsion.

PIANO-HAMMER. — John Oster, Jr., Newport, Ky. This piano-hammer comprises a rotatable elastic disk clamped peripherally by spring clamping-jaws received and embraced by a socket-holder. The jaws are held and locked down in the socket to grip the disk. Should any portion of the felt or other elastic material become hard from frequent impact, the disk may be readily loosened and turned. There are, moreover, no projecting parts on the side of the disk to cause interference between the hammers, or objectionable noise in playing.

HACK-CLAMP.—James G. B. Rouse, Way Cross, Ga. The invention is in the nature of an improved clamp for holding turpentine producing and gathering tools—such as hacks, pullers, or scrapers—when it is desired to cut out the tool. The clamp comprises a body having a flat bearing edge provided with means for securing the body to a tree or post. The front edge has a seat portion and a clamping slot and screw. When the clamp is in position, a reamer may be applied to the seat of the clamp in order to cut out the tool.

MONEY-ORDER-BLANK PROTECTOR, CUTTER, AND HAND-REST.—George Johnson, Jersey City, N. J. By providing a device comprising a base, supporting-posts carried on the base, and a hand-rest having transverse arms for extending over the face of a block of money-order-blanks and engaging the posts, this inventor enables a postmaster conveniently to fill out a money-order-blank and to separate the several parts from one another and the filled coupon from the block.

LANTERN-HOLDER.—George A. Cornish, Gillette, N. J. This invention is a device for holding lanterns so that the rays of light will be effectively shed therefrom. The means by which this end is attained consist primarily of a wire structure forming arms and hooks by which the lantern is held in place.

TILTING-CHAIR.—Alfred E. Quinlan, Sheboygan Falls, Wis. This tilting-chair is provided with a post on which a yoke and a vertically-disposed bearing are mounted to turn. The bearing is formed with longitudinal flanges terminating in lateral arms arranged to support the pivot for the yoke at one side of the bearing and below the upper end thereof. The entire device can be readily applied to a chair-seat. By the arrangement described, the bearing is well above the pivot, on which the rocking takes place, thus reducing friction on the bearing surface.

CHART FOR DRAFTING GARMENT-PATTERNS.—Marie Tucek, Manhattan, New York city. The purpose of this invention is to provide a garment-drafting pattern designed accurately to draft the outlines of ladies' waists and skirts and arranged to permit an easy and convenient adjustment of the various parts. The device consists of pivotally-connected sections slidably or otherwise adjustable to one another, the necessary graduations being marked on the sections.

Designs.

MINERS' CANDLESTICK. — William H. Pleasants, Victor, Col. The essential features of this design consist of a candlestick having a shank, and spiral convolutions at one side of the shank, which embrace the candle. At the other side a hook rises vertically. A transverse member emanates from the convolutions and has a return-bend which joins the shank of the hook.

DISPLAY-BOX.—Max W. Becton. Manhattan, New York city. The box is designed to display fountain-pens or similar articles, and is, therefore, longitudinally divided into compartments for the reception of the articles to be displayed.

LOCK-BAR FOR COVERS.—Herman Kahn, Troy, N. Y. The principal feature of this design is found in a body, having at its ends lips decreasing in thickness in opposite directions, and projections rising from the upper face of the body. The device is especially serviceable in locking the covers of jars, which operation the previously-mentioned projections facilitate.

BOX.—Richard M. Colgate, West Orange. N. J. The box is rectangular in shape and is ornamented by decorative panels. At one surface circular intaglio figures triangularly disposed are arranged. The box is designed primarily to contain soap.

Erratum.—In our issue of March 25, 1899, we described in these columns a new surgical splint invented by Robert W. Barton, whose address was given as Marion, Kansas. The address should have read Marion, Arkansas.

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

NEW BOOKS, ETC.

A Select Bibliography of Chemistry, 1492–1897. By H. Carrington Bolton. First Supplement. Washington: Smithsonian Institution. 1899. 8vo. Pp. 489.

A few years ago we received the first section of this work, and now we have a Supplement half as big as the parent volume. At the time we noted the original work we congratulated Prof. Bolton upon his wonderful achievement, and also complimented the Smithsonian Institution for the remarkable services which they have done to scientific literature in publishing such a notable volume, which could never be issued by any private publisher. In the preparation of the present Supplement Prof. Bolton has been fortunate in securing the co-operation of eminent men of science and letters in various parts of the world. They promptly responded, and have contributed more than 2,000 titles, including 760 Russian, 20 Finnish, and 13 Arabic. The same general method be used in the first volume has been adopted. The volume is a monument of American scholarship.

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

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

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

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

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7638) A. L. N. asks: 1. Should the condenser for an induction coil be in the primary or in the secondary circuit? If in the primary, should the condenser be between the coil and the zinc or between the coil and carbon of the battery? A. The condenser of an induction coil is not to be put in either the primary or the secondary circuit. The condenser is connected across the primary circuit. Attach one side of the condenser to the same place as the wire from the zinc of the battery and the other side to the same place as the wire from the carbon side of the battery. It thus receives the extra current which originates in the breaking of the primary circuit. 2. In a Supplement you write that a magnet made of tubes, and every tube inside the largest one wound with a layer of wire, is many times stronger than one made out of a solid piece; hence, would it be a good idea to put some of the iron wires in the core of a coil between each layer of the primary circuit? A. No; it would be a very bad idea to build the primary of an induction coil on the basis of an electro-magnet. 3. Have you published any article about making liquid air? If so, in which Supplement? A. There are twenty articles on liquid air in as many Supplements. We can send them to you at 10 cents each. 4. What substance would be best to mix in lard to get a good corn cure? A. Purchase corn cures ready prepared of your druggist. We have no formula for a corn cure, using lard.

(7639) E. J. W. asks: 1. What is the compound that is used in dry batteries? A. There are many formulæ for the paste used in dry cells. The active material is usually ammonic chloride dissolved in water and mixed with an inert substance to hold it in place between the zinc and carbon plates. 2. Can a 4×5 photographic lens (single or double view) be used for a magic lantern? A. Yes; any lens can be used to project a slide which will cover a photographic plate of the size of the slide. 3. How do you find the distance that the lens should be from the plano-convex condensing lenses? A. The distance is usually found by experiment, and depends upon the distance of the lantern from the screen. It may be found from the formula

$$\frac{1}{D} + \frac{1}{d} = \frac{1}{F}$$

in which D is distance of lens from screen, d is distance of lens from slide, and F the focal length of the lens. 4. Can one large magnifying glass lens be used in place of a pair of plano-convex lenses for a lantern? A. A magnifying glass can be used as a condenser for a lantern, if nothing better can be had. It answers well with sunlight, but is not powerful enough to bend in the widely divergent light from a lamp.

(7640) Reader asks: Is the line current, i. e., the current induced in the secondary of the induction coil, in a telephone circuit an alternating current or only a pulsating current? A. An alternating current.

(7641) G. W. D. writes: I am desirous of procuring the best formula for making or casting phonograph cylinders for making records. Also instructions for casting same and any other information necessary for their successful manufacture and manipulation for my own personal use. Please inform me how such information can be got. A. The composition of the phonograph cylinder is a carefully guarded trade secret.

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(Continued on page 241)

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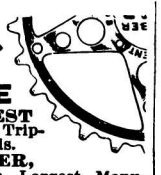

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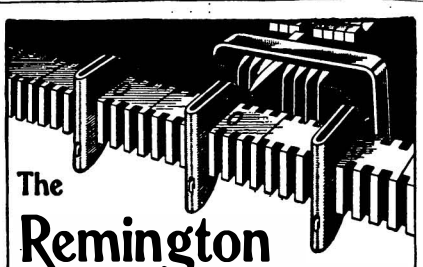

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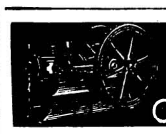

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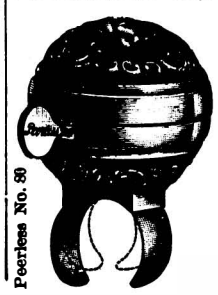

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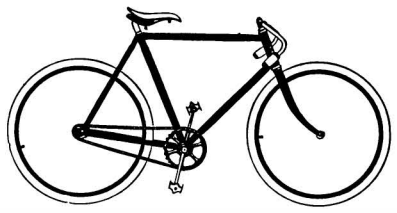

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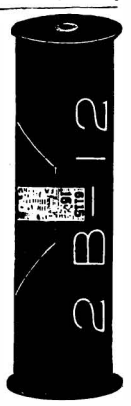

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