

# SCIENTIFIC AMERICAN

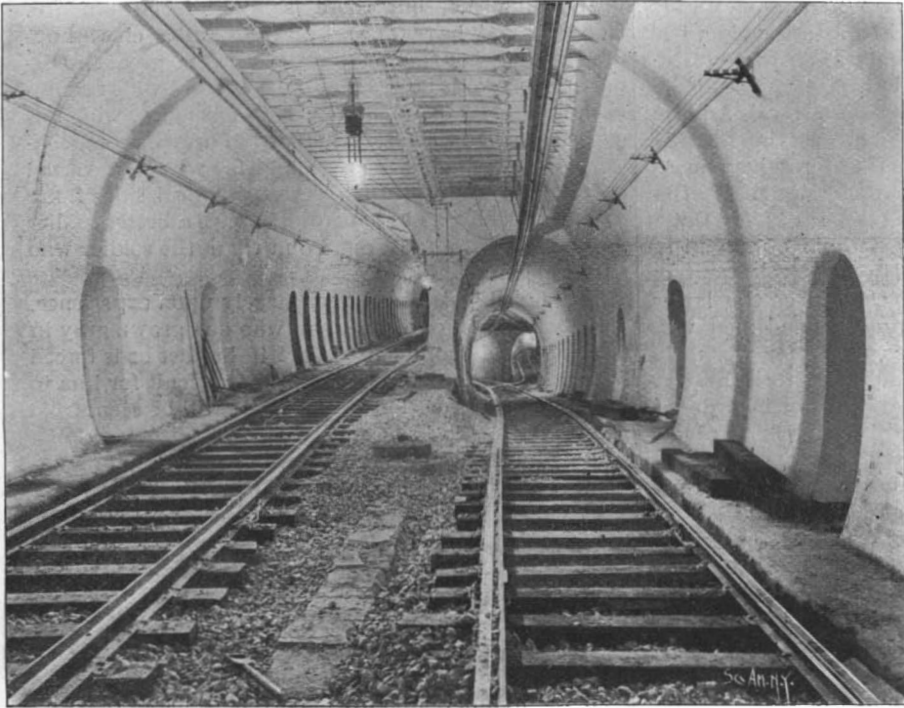
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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

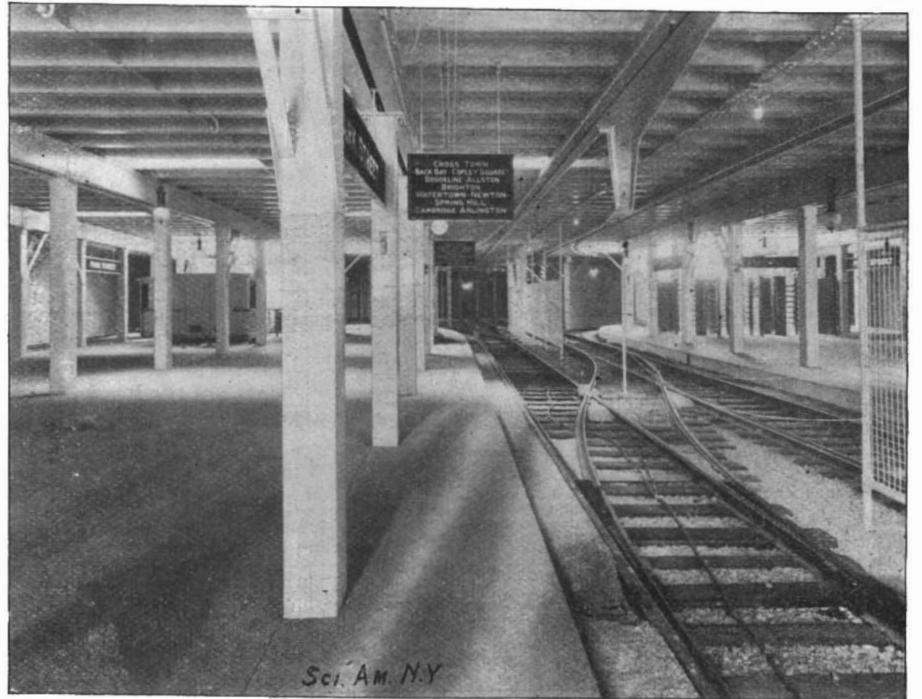
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NEW YORK, SEPTEMBER 18, 1897.

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THE SUBWAY SOUTH ON TREMONT STREET, SHOWING CROSSING OF TRACKS AT DIFFERENT GRADES.



INTERIOR OF THE PARK STREET STATION LOOKING NORTH, SHOWING LOOP.



THE BOYLSTON STREET STATION, LOOKING DOWN TREMONT STREET, THE SUBWAY BEING UNDER THE MALL AND COMMON.

THE NEW BOSTON SUBWAY FOR TROLLEY CARS.—[See page 184.]

Scientific American.

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NEW YORK, SATURDAY, SEPTEMBER 18, 1897.

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OUR BIG WAR SHIPS IN FLEET PRACTICE.

During three days of last week Assistant Secretary of the Navy Roosevelt inspected, participated in, and, no doubt, infused with some of his own energy and decision the operations of the North Atlantic squadron in some of the most satisfactory fleet practice that has yet been achieved by our new armorclad vessels.

Immediately upon Mr. Roosevelt's arrival, Admiral Sicard, from the New York, which was the flagship, signaled the battleship New York to receive the Assistant Secretary, and also to "clear for action," so that when he came aboard everything was ready for target practice under such conditions as would obtain in an action with an enemy.

A SCHOOL OF FIRE EXTINGUISHMENT.

The State safeguards the individual, hedging him about by wise laws which protect him from the services of incompetent persons. Thus disease may only be cured by men who are possessed of the proper medical knowledge to insure that the treatment shall be scientific; cases in court may be conducted by men only who have assured certain members of the bench selected for that purpose that they are properly equipped with the necessary legal knowledge to give their clients the benefit of proper advice and counsel.

Unfortunately, in many of our great cities fire extinguishment is taken up as a recompense for political support, and the fire department is looked upon as an important center for partisan and political influence.

Removals from office in a fire department, either of the chief or firemen, should only be made for incompetency or where there is good ground for believing that the service would be permanently improved.

The status of the volunteer fireman is not more satisfactory. Too many men are enrolled as members of the volunteer fire companies either to escape local taxation, jury duty, or to secure social advantages, for in small towns the volunteer fire company often partakes of the nature of a social club.

We now come to the consideration of a school for fire extinguishment. At the present time, according to a well informed authority upon the subject, there is no

school of fire extinguishment in the world. At Paris and Berlin the firemen are given lectures illustrated by dissected model houses, and while this is a step in the right direction, it does not go far enough. The nearest approach to a school of fire extinguishment is the fire drill with lectures which is given at the Cambridge Manual Training School for Boys, but this is only a minor part of the school work.

Fire fighting is based very largely upon experience, and the experience of one man who has grown gray in fighting the demon of fire is lost if he dies or is forced from his position, and it would be difficult for him to impart this information to others.

Such a school should be established in a great city like New York. Here the student of fire extinguishment would find a paid fire department, maintained at an expense of upward of \$2,000,000 per annum, equipped with the latest forms of apparatus.

Great manufacturing plants, railroad stations, all important risks, are provided at the very doors of the school, while in the suburbs excellent examples are given of what is technically known as the "village street," in which the buildings are all massed together, and the open country, where the risks are isolated.

The school should possess large grounds, enabling the firemen to practice with approved apparatus. Laboratories and testing furnaces should be established in which samples of combustible material could be studied and tests made of fireproof methods of construction and of new fire extinguishing apparatus.

The need of such a school may be brought out by a couple of examples. In one great city the firemen turned a hose on a flaming gas jet in a cellar and a few minutes later four men were hurled through the windows by the explosive mixture of gas and air.

The necessity of a school for fire extinguishment is evident, not so much for the firemen of large cities as for those who work in villages and the small city. Such a school would dignify the calling until it reached the stage of a profession and would tend to render life more secure and diminish the loss of property.

RAPID WORK IN THE CONSTRUCTION OF NEW YORK ELECTRIC STREET RAILWAYS.

Probably never before in its history have so many miles of the streets of New York City been torn up and rendered almost impassable to travel as at the present time. On the east side the work of changing the Fourth and Madison Avenue line from its old horse

car system to that of the electric conduit trolley is being prosecuted simultaneously in different sections which extend over almost the entire length of the line, and it is expected the section between the Grand Central Depot and the General Post Office will be in operation early in October. In this work six thousand men have been employed for more than three weeks past, and, great as has been the temporary public inconvenience, it must be conceded that the contractors are making every endeavor to push the work as rapidly as possible. On the west side of the town, also, and in some of the cross streets, the Broadway and the Third Avenue lines are doing work on miles of streets, each endeavoring to advance the work ahead with all possible speed. This strife on the part of the various established lines of surface street railways to get ahead of each other in putting their roads in condition for the greatly increased transportation now demanded of them affords a striking object lesson on the imperative need which exists for the long delayed, and so much talked of, rapid transit system, and demonstrates besides the possibilities and advantages of a systematic division of labor in street railway construction, said to be the most rapid yet undertaken.

**THE CHAINLESS BICYCLE.**

There is a general impression among those who follow the developments of bicycling that the year 1898 will see the chainless wheel firmly established as a rival to the chain-driven type. More than one of the leading manufacturers have lately expressed their intention of offering to the public a bevel geared machine, or its equivalent. It is freely stated that the mechanical difficulties, which have been made the subject of considerable and costly experiment during the past two or three years, have been thoroughly mastered, and that the chainless wheel has been brought to a pitch of perfection which warrants the launching of a few of these machines upon the market.

The idea of a chainless bicycle, as many of our readers well know, is not by any means new. As far back as 1893, a firm had put on the market a bevel geared wheel, and not a few of these machines may still be seen upon the road, and are apparently giving satisfaction; although, for some reason, there has never been any great demand for this type. To judge from the sentiments of the press, the manufacturers and the wheelmen who take any interest in the subject, there is no question that, if it can be mechanically perfected, the chainless wheel will be incontestably superior to the chain and sprocket type.

It will be an interesting study to consider the two systems on a few leading points of comparison, such as simplicity of parts, ease of running, and durability. As regards the first, it must be admitted that the chain gear has everything in its favor, provided, of course, that the chain is regarded as one piece—which, for the purpose of the present comparison, it fairly may be. A chain that is properly made, with links of equal pitch and uniform hardness throughout, will show an even wear, and may be considered as a single link in the driving mechanism. Assuming the future chainless wheel to be a beveled gear machine, in place of the chain we shall have a shaft, two bevel wheels, and two sets of adjustable ball bearings to transmit the motion from crank axle to rear wheel. While a slight variation in the chain line will not seriously affect the running of the chain and sprocket gear, a similar variation in the bevel gear will produce a binding action that will result in hard running and rapid wear. Hence the gears must be cut and the shafting lined up with the nicest care and accuracy. This, of course, is a mere matter of good workmanship, and the firms that contemplate building these machines will doubtless turn out a smooth running and perfectly aligned gear.

A comparison on the score of friction and ease of running under everyday conditions will probably show results in favor of the bevel gear; whereas a comparison under ideal conditions on the testing machine will show, and, if we remember rightly, has shown, results in favor of the chain. The difference is due to the fact that the bevel gear is always inclosed in a gear case and running in clean oil, whereas on the road the chain is not merely transmitting the power from the cranks, but is using up a certain amount of that power in grinding up the grit and dust of the road into the pasty mess with which the average chain is encumbered. As a matter of fact, the chain has never been given a chance to demonstrate what it can do. In the first place, it is not improbable that, except in the case of the best makes, it receives less care in the selection of its material and the machining of its pins and links than any of the other wearing parts of the wheel. Certainly it does not compare in this respect with the bearings. And whereas the bearings are carefully incased, and various precautions in the way of dust caps and felt washers protect it from dust and mud, the chain, for some inscrutable reason, is left to gather up all the friction-producing matter it may. Except on the ground of appearance, there is absolutely no defense to be offered for a custom which does vio-

lence to the first principles of good mechanical practice.

Before the chain is pronounced inferior to the bevel gear, it should at least be given an opportunity to prove its efficiency under the protection of a satisfactory gear case.

What has already been said on the question of friction applies with equal force to the question of durability. A protected bevel gear will undoubtedly outlast an unprotected chain gear; though we think that, under equal conditions, the results might be reversed, particularly if the same high class material and workmanship were put into the chain and sprockets as will be sure to characterize the chainless gear. In such a case the chain gear would have a great advantage in the fact that it is adjustable, whereas the other is not—an advantage which will increase in proportion to the distance the wheel is ridden.

There is one respect, however, in which the chainless wheel will possess an undoubted superiority to the present type, and this is in its compact and shipshape appearance and the ease with which it can be cleaned and kept in presentable shape. It is likely that this will prove to be one of the most important factors in establishing the new type in the public favor; but how far the chainless type will succeed in demonstrating its mechanical superiority to the present popular machine, time and the test of hard usage alone can tell.

**THE MENTAL EVOLUTION OF MAN.**

In the section on psychology, at the recent meeting of the British Medical Association, at Montreal, Dr. K. M. Bucke, of London, Ont., presented some novel views in a paper bearing the above title. He said: "So-called telepathy and clairvoyance seem to be specimens of nascent faculties. I place in the same class the phenomena of what is often named spiritualism. The labors of the Society for Psychical Research have made it to me plain that these phenomena, as notably in the case of W. Stainton Moses, really exist. And I think that a study of the above-mentioned case, together with that of Mrs. Piper and that of Mary J. Fancher, of Brooklyn, would compel any unprejudiced person to make the same admission. But to me these are not cases in which outside agents are acting on or through a human being, but are cases in which a given human being has faculties which are not commonly possessed. Whether any given faculty, such as one of those now alluded to, shall grow, become common, and finally universal in the race, or wither and disappear, will depend upon the general laws of natural selection, and upon whether the possession of the nascent faculty is advantageous or not to the individual and to the race. But of infinitely more importance than telepathy and so-called spiritualism (no matter what explanation we give of these, or what their future is destined to be) is the final fact to be here touched upon. This is that superimposed upon self-consciousness, as is that faculty upon simple consciousness, a third and higher form of consciousness is at present making its appearance in our race. This higher form of consciousness, when it appears, occurs, as it must at the full maturity of the individual, at about the age of thirty-five, but almost always between the ages of thirty and forty. There have been occasional cases of it for 2,000 years and it is becoming more and more common. In fact, in all respects, as far as observed, it obeys the laws to which every nascent faculty is subject. Many more or less perfect examples of this new faculty exist in the world to-day, and it has been my privilege to know personally and to have had the opportunity of studying several men and women who have possessed it. In the course of a few more millenniums there should be born from the present human race a higher type of man possessing this higher consciousness. The new race, as it may well be called, would occupy, as toward us, a position such as that occupied by us toward the simple conscious *alalus homo*. The advent of this higher, better, and happier race would amply justify the long agony of its birth through the countless ages of our past. And it is the first article of my belief, some of the grounds of which I have endeavored to lay before you, that a race is in course of evolution."

**HOW TO GO TO SLEEP.**

At the recent meeting in Montreal of the British Medical Association, in the section of therapeutics, Dr. J. B. Learned, of Northampton, Mass., gave his experience with the many methods of inviting sleep without taking drugs. He detailed the positions of the body after retiring which he employed. He said the cause of delay in sleep coming is generally the brain running automatically without our consent, after we go to bed. He sets the brain to work at once on retiring—it is to direct the respiratory process. It is to count respirations to see that they are fewer in number, regular, deep, and somewhat protracted. In addition, certain groups of muscles are employed in routine order in silent contraction. By constant change other groups are brought into use. He has completed a systematized routine of contraction and relaxations. A slight ele-

vation of the head from the pillow for a definite time by count of respirations is one of the many changes of position. All this is without any commotion, and need not be recognized by a sleeping companion. Brain and muscle and all parts of the body soon come into the normal state that precedes and invites sleep. A sense of fatigue soon overtakes one while thus employed, and before he is aware, the brain has forgotten its duty to regulate the breathing process, the muscles have ceased to expand to the call made upon them in the beginning, and sleep is in control of all the forces and all the organs. The details of this method of inviting sleep will not be the same for the strong and the weak. The principle, however, is one and the same, viz., the proper direction of vital energy to brain and muscle, according to the condition of the individual. The effect of brain and muscles combined, under direction of will, counteracts the one-sided automatic whirl of a little portion of gray matter that has come to antagonize normal sleep and to make night a source of gloom and unrest.

**OUR NEW BOOK ON MAGIC.**

Were it possible for Houdin, or Heller, or Herrmann, the great sleight-of-hand performers and professors of magic of a generation not yet past, to appear again upon the scene and enjoin the publication of this volume, as an infringement upon the rights and privileges of their confreres and successors, we do not doubt that they would promptly take most vigorous measures in such direction. So too, most likely, would be the disposition of the great majority of the jugglers and trick performers of all kinds, including not a few actors of some repute, who endeavor to cater to the public amusement by providing entertainments in which something more or less mysterious is introduced; for this book is the most complete exposé yet produced on the subject of magic and stage illusions. It is something unique in its way, in that the subject is treated on such broad lines and so exhaustively—being the first time, we believe, that so comprehensive a volume has ever been undertaken. In all explanations and descriptions of tricks and illusions, as one can readily understand, it is difficult to make the subject plain by mere words, no matter how exactly the details are gone over, but in this volume the great number of costly illustrations amply supplements the text, making it entirely clear how numerous illusions have been successfully presented to the public. The pictures not only afford views "behind the scenes," as it were, but take the reader into the workshop of the designer and mechanic, and expose at a glance the methods and means of producing what to the general public has been matter of wonder and astonishment.

The volume, edited by Mr. A. A. Hopkins, with the Introduction by Mr. Henry Ridgely Evans, is divided into five books, the first covering conjurors' tricks and stage illusions, comprising mysterious disappearances, optical tricks, miscellaneous stage tricks, conjuring tricks, jugglers' and acrobatic performances, fire eaters and sword tricks, ventriloquism and animated puppets, shadowgraphy, mental magic. Book II treats of ancient magic—including temple tricks of the Greeks and their miraculous vessels, the origin of the steam engine, Greek lamps and toys, etc. Book III treats of science in the theater and Book IV of automata and curious toys.

In "Photographic Diversions," which forms the subject of Book V, a great deal of interesting matter is presented, never before brought together in book form, including especially a description of the method of taking and projecting moving photographs, as the vitascope, the cinematoscope and the mutograph. The chapter on trick photography comprises apparatus for taking silhouettes, artificial mirage, duplex photography, illusive and spirit photography, a multiple portrait, multiphotography, a photographic necktie, etc. On another page will be found an illustrated article taken from this work, and the formal announcement of the publishers appears in the advertising columns.

**TRIPE AND ONIONS.**

Scientific research has again knocked all the stuffing out of one of the most popular of gastronomic theories—namely, that the humble but appetizing tripe (with onions) was exceptionally digestible. Even Brillat-Savarin had not a soul above well dressed tripe for supper, mainly on the ground that it was at least "light" on the stomach—certainly much "lighter" than beef, mutton, or any other kind of meat. That theory must now be abandoned in the face of the conclusions to be drawn from extensive experiments carried out by Dr. P. Solomon, and published in statistical form by the United States Agricultural Department. The experiments were divided into two three-day periods. In the first period the diet consisted of tripe, bread, butter, and a little flour; in the second, an equivalent of meat was substituted for tripe, and in both instances beer was used as a beverage. The details of the chemical analyses cannot be entered upon. Suffice it to say that Dr. Solomon arrived at the conclusion that "in general there is no marked difference in the digestibility of tripe and meat."

**A NOVEL BURGLAR ALARM.**

An alarm which may be used in connection with a door or window, exploding a cap on the unauthorized opening of either, is shown in the accompanying illustration, and has been patented by Clayton L. Knapp (address Mrs. Coralie J. Knapp, No. 104 West Ninety-second St., New York City). It is shown attached to a door, a plate secured upon the jamb having at one end a recessed portion, in which turns a disk or wheel having a number of pockets, each adapted to receive a cap, while in the back of the disk are ratchet teeth. Hinged on the front of the plate is a spring-pressed hammer carrying a firing pin or stud adapted to enter one of the pockets in the disk, as the latter is revolved by means of a dog engaging its ratchet teeth each time the hammer is carried outward. Pivoted upon a plate on the door is a trip bar, adapted to engage the under side of the projecting end of a cross bar on the hammer, so that, as the door is opened, the hammer will be gradually raised, as shown in the small view, until it slips off the end of the trip bar, such movement of the hammer revolving the disk to bring one of the cap pockets under the firing pin, and the hammer being forced down suddenly by the spring to explode the cap. The trip bar is supported in operative position by a pin, but it may be carried entirely out of engagement with the alarm device by turning it rearward, as indicated by the dotted lines. The free end of the trip bar has on its under side beveled surfaces, permitting it, when extended, to ride over a beveled surface on the end of the cross bar on the hammer, the trip bar then dropping to normal position, as shown in the principal view, and the alarm setting itself after a cap has been exploded and the door closed. The device can be applied to a door opening to the right or left, and a single alarm will protect both the upper and lower sash of a window.

**ACROSS ALASKAN PASSES.**

The discovery of the Klondike gold fields has, of course, resulted in an awakened interest in Alaska, and there is hardly a magazine or a newspaper which has not been filled with either glowing accounts of the find or descriptions of the difficulties in reaching the new Eldorado.

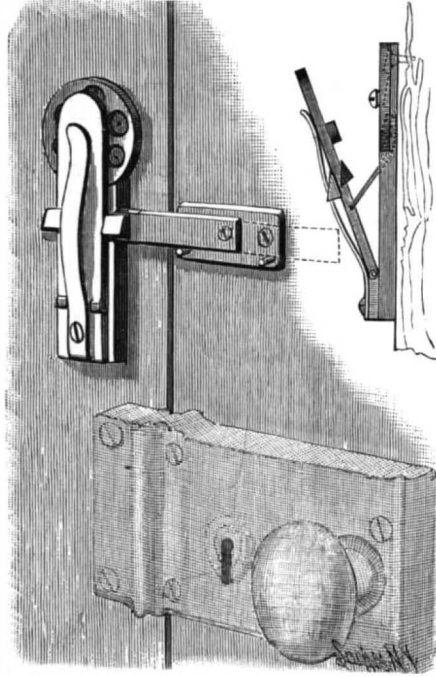
Our engraving, for which we are indebted to Black and White, shows some of the hardships to which the traveler to the Yukon by the overland route is subjected. White Pass is the favorite, although it is fourteen miles longer than the Chilkoot route from Dyea. The former involves a climb of 2,650 feet, the latter one of 3,500 feet, part of which is so steep that it is almost impossible for a novice to carry a pack over it. The main drawback to the White Pass route is the long stretch of swamp which intervenes between the eastern base of the range and the lakes and it is almost impassable. Men have been employed to corduroy the road, which will make it more passable.

From Dyea the traveler traverses a three mile grove of cottonwood and then follows the river channel until Sheep Camp is reached. Here is quite a village of prospectors, who gather strength to climb the Pass. Above Sheep Camp the ascent is made by a narrow cañon barred with boulders and sharp stones. The slope is so precipitous that at times the travelers have to follow the zigzag trail on all-fours. At last the cold summit is reached. It is almost impossible for even the stoutest Indian to carry more than 100 pounds up this slope, so that transportation is effected in installments. As the outfit of the miner is hardly ever less than from 500 to 1,000 pounds, it will be seen that the expense is great. No horse can be got over the Chilkoot Pass, and the cost of transporting goods over

the Passes varies from \$15 to \$25 per hundred, the goods being delivered at Lake Bennett.

Once over the Pass the whole country is a succession of lakes, all connecting with each other by outlets which are often a succession of rapids.

On Lake Bennett is a saw mill which is busily en-



KNAPP'S BURGLAR ALARM.

gaged in sawing logs into boards for use in building the boats.

It is now easier to get from the lakes to Dawson than from the head of the Yukon to Juneau. The river waters run down, and there is in all the lakes a strong northerly and northeasterly current. Hence it is quite possible that the gold seekers may reach their destination more easily than they can send news of their fortunes to their friends. The mail does find its way from

Fort Selkirk to Juneau, but it is a long time on the way, and in case of bad weather it is often delayed for several days at a time. At some of the rapids between the lakes boats have to be tracked.

On Lake Bennett many voyagers have followed Schwatka's example, and built rafts of the large birches which grow alongside the lake. At Lindeman scows or flat-bottomed barges are the fashion. They are built of soft white pine, and are generally about 24 feet long, 5½ feet beam, and 3½ feet deep. Such a vessel propelled by four oars and a single sail hoisted on a rickety mast is calculated to carry five passengers and two tons of goods. If it escapes shipwreck in the rapids, it will answer every purpose, and carry its occupants till they reach the Klondike or are stopped by the ice. Travelers who have found their way to Lake Bennett say that in ten-days with good weather they will arrive at Dawson. If they do, they will be lucky. Still, the river is hardly blocked before the first week in October.

The accounts which have been given of the difficulties of reaching the gold fields by way of the Chilkoot Pass create an impression that the gold seeker carries his life in his hand, but the journey really involves no more perils and hardships than hundreds encounter every year in Canada, Maine, and Northern New York.

**How Weeds Are Distributed.**

There is always a strife between the various plants and weeds as to which shall occupy the ground. Some plants crowd others out. Those producing great numbers of seeds will often occupy the ground against those which produce fewer seeds. Then, again, some plants, like the thistle or wild lettuce, scatter their seed to the four winds of heaven, while the seed of the yellow dock is dropped close to the parent stock. Weed seeds are scattered with wheat, grass, clover, and other grains. Some of our worst weeds have been brought into this country in shipments of cheap clover and other seeds. And, right here, permit me to remark, Congress ought to prohibit the importation of cheap and worthless seed from foreign lands, and the legislature ought to forbid the many fake seed houses in this country from shipping into Ohio, unless first tested. Weed seeds are carried and transplanted by birds and animals, by the wind, by currents of water down streams and ditches, along highways and along railroad right of ways. They are sometimes planted by foolish persons, and thus a start given them so that others may be afflicted. Old fence rows furnish a steady and undiminished supply of weed seeds and so do old abandoned corners and uncultivated lots.

The railroad right of ways are the means of furnishing the farmer an inexhaustible supply of obnoxious weed seed; the right of ways being long narrow strips of land adjacent to so many different farms, will soon seed such adjacent premises. The weeds are often permitted to grow on the right of ways until they go to seed. The numerous trains carrying live stock seed the right of ways from one end to the other. This is demonstrated by the great variety of weeds growing around Chicago, where so many railroads center.—Hon. D. J. Cable, in paper read before Farmers' Institute, Harrod, Ohio.

LUCIEN BIART, who died recently, was a talented author, and although he chose to veil his scientific knowledge in the form of novels, that knowledge was incontestable, says Natural Science. A great love of travel took him, in 1845, to Mexico, where he studied archaeology and ethnography. In addition to his novels, the chief of which are "Le Roi des Prairies," "Entre deux Océans," etc., he wrote a volume on the red races for the Bibliothèque Ethnologique, as well as a monograph on the Aztecs.



THE TRANSPORTATION OF BAGGAGE ACROSS THE CHILKOOT PASS.

**THE SAVAGE RIFLE—SMOKELESS POWDER AND EXPANDING BULLETS.**

The deadly effect upon game of small metal-covered expanding bullets, with high velocity smokeless powder, has been recently satisfactorily demonstrated with a 0.303 caliber Savage rifle, using cartridges with a 0.303 soft nose expanding bullet. The rifle and cartridge are manufactured by the Savage Repeating Arms Company, of Utica, N. Y. The flight of the bullet was 2,000 feet per second. Modern 0.303 weapons possess several important advantages over the old large calibers in flatness of trajectory, absence of smoke, long range, increased penetration, high velocity, less recoil,



and light weight ammunition. The expanding bullet is a big game projectile. It invariably expands with an area of laceration greater than ever produced by any projectile before used. Without calculating the effect of the nervous shock, it is easy to see from the accompanying illustrations that immense splintering and laceration was produced. The largest game in the world, the royal Bengal tiger of India, the elephant and rhinoceros of Central Africa, are now being successfully hunted and slain by sportsmen using the 0.303 caliber rifle. Sportsmen who have never tried the small caliber rifles and smokeless powder ammunition are somewhat skeptical as regards the killing or stopping power of small metal-covered expanding bullets. The secret of the deadly effect of these small projectiles lies in their expanding qualities and extraordinary high velocity, which impart a percentage of energy to the otherwise inert flesh and bone; and these substances being acted upon by so quick a blow become themselves projectiles, lacerating the surrounding tissues and bone. The high velocity resulting from the use of smokeless powder is only possible when confined by small calibers. If a bullet is omitted from one of these cartridges and the primer struck, no explosion of the powder will occur. The rapid twist of the rifling and the great pressure of smokeless powder compels the use of some less yielding metal than lead, as a soft lead bullet would strip and be blown directly out of the barrel.



The difference in the weight of one grain of smokeless powder adds considerably to the pressure. The two accompanying figures represent the expanding bullet before and after being fired. This bullet weighs 185 grains. The metal covering is made of a soft light metal which does not injure or wear the rifling of rifle barrels. Extremely high velocity is attained by the



**WOUNDS CAUSED BY SMOKELESS POWDER AND EXPANDING BULLETS**

comparatively slow combustion of smokeless powder, which continues its expelling action, accelerating the speed of the projectile until it leaves the muzzle of the gun. In the accompanying exhibit the bone and tissue were literally pulverized by the missile. These bullets, when they strike, spread, tearing and cutting in all directions.

**Improved New York Postal Service.**

The improvements in progress and contemplated in the United States postal service at the great New York office, and which have been actively promoted by the Postmaster-General during his recent visit, bid fair to make the postal business at this populous and busy center one of ideal excellence. The pneumatic tube system which is to connect the main office with Brooklyn, the Grand Central station, and the Produce Exchange is being rapidly pushed forward, the six pipes connecting therewith entering the wall of the Federal building at the corner of Park Row and Mail Street. It has been arranged that the compressed air necessary to operate the system will be furnished by the dynamo of the new electric plant recently established in the building. As the New York office, large as it is, has long been greatly embarrassed for room, arrangements

have been made for gaining considerable space for the accommodation of mail wagons on the north side of the building; but of more importance still are the plans by which it is being provided that incoming mails, to be dispatched abroad, by steamship, shall be assorted for their several destinations on the trains by which they arrive, thus relieving the New York office of a vast amount of work, and the extra handling of great quantities of mail matter, as well as promoting quick dispatch. Another improvement, which will be particularly agreeable to all travelers arriving from abroad, has also been planned.

Heretofore letters addressed to passengers on incoming steamers, which sometimes form a large mail, have been put in the hands of the consignees of the vessels, and so have not been received by those to whom they were addressed until after the vessels arrived at their docks. Instead of this method, it is now proposed to send this mail down the harbor to meet the steamers as they come in, employing therefor the boats that take the incoming mails from the steamers at quarantine. In this way the pursers will be able to sort and deliver mail matter to the incoming passengers aboard the steamers—a delivery which would generally be some hours in advance of that now accomplished after landing, affording a most signal convenience to the passengers. People are never so hungry for greetings from their friends or news of what is going on in the world as on arriving in port from an ocean voyage, and the contemplated improvement cannot fail, therefore, to be correspondingly appreciated.

**Automobile Vehicles in Warfare.**

In an article discussing the above subject in *La Revue Technique*, Col. Fix examines the requirements and conditions which must be met in order to achieve success.

Since all military vehicles must be both solid and simple, many features which might be otherwise acceptable must be omitted, says the *Engineering Magazine*. Roads which in time of peace are good soon become neglected and demoralized in time of war, and a vehicle, like a soldier, should be able to accommodate itself to all inconveniences. Tires of rubber, whether pneumatic or solid, are inadmissible, both because of the greater weight to be carried and because of the rough usage to be endured. Iron tires alone meet the requirements, and, in view of the great torsional strains, the hubs should be larger than they would otherwise need to be, while, in order to clear surface obstacles, the diameter of the wheels should not be less than that now found in field artillery.

Electricity is barred as a motive power, on account of the impracticability of charging accumulators in the field or en route, and steam or petroleum motors alone remain, between these steam having the preference, at least for greater powers, since the petroleum motors at present are not satisfactory above ten horse power.

Practically an automobile vehicle for military service must be a carefully designed steam traction engine, planned to haul artillery and supply trains anywhere where horses can go; the questions of speed and personal comfort, so important in pleasure vehicles, need hardly be considered.

Col. Fix shows some very interesting figures relating to the cost of horses in military service, and makes out a strong case for the side of the machine, and it is not at all unlikely that the use of machinery in warfare may soon enter the field service as extensively as it has already entered other departments.

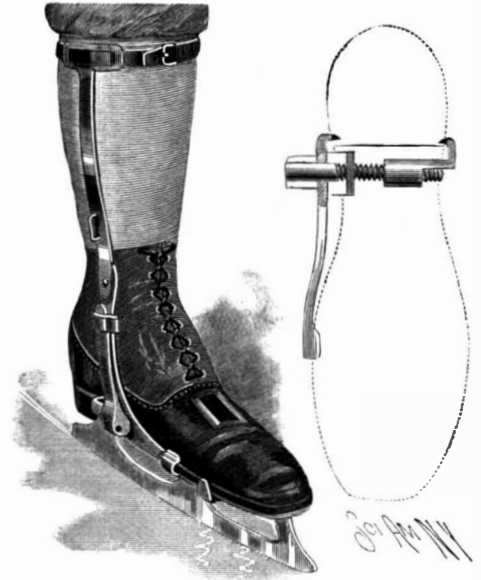
**Recovery of a Body on Mont Blanc.**

In October, 1866, Captain Henry Arkwright, the guide Michel Simond and two porters, François and Joseph Tournier, were killed by an avalanche on the Grand Plateau of Mont Blanc. The bodies of the guide and the porters were found a week after the accident, but that of Captain Arkwright was only found last month. The entire body was recovered, with the exception of the head and feet. The right hand was marvelously lifelike. The ice had preserved in it the red tint of the blood. He was found with all his jewels and white handkerchief in his pocket with his name on it. An inquest was held on the remains and they will probably be buried at Chamounix. The body was recovered 9,000 feet below where he was killed thirty-one years ago.

**AN ANKLE BRACE FOR SKATERS.**

The illustration represents a device designed not only as a support for weak ankles, but to prevent the tiring of the ankle during long exercise in skating, while it is also intended to give the skater better control over the skates. The improvement has been patented by Carl Engberg, of St. Joseph, Mich. The device is applied on the inside of the foot, and has an upper section made fast by straps, to which is pivoted a lower section having an integral arm extending alongside of the sole, the arm having at its forward end a jaw adapted to clamp the edge of the sole, while its rear end terminates in a claw adapted to engage the side surface of the heel, as may be seen in the outline view. The arm forms virtually a clamping arm, in connection with a screw passed

through a bracket at its bottom, and entering an opposite threaded bore in a sleeve which terminates at its outer end in a claw. Pivoted to the head of the screw is an adjusting arm having at its lower end a cam surface, and after this arm has been turned to effect a ready engagement of the claws with the sides of the heel its outer end is carried up against the lower

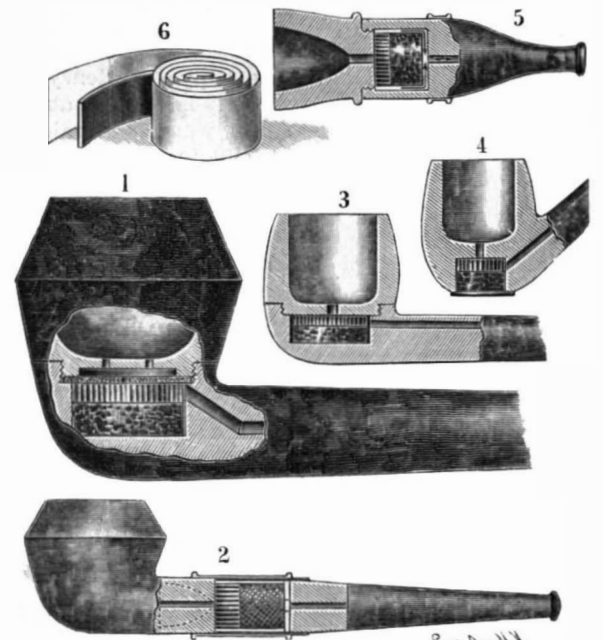


**ENGBERG'S ANKLE BRACE FOR SKATERS.**

section of the shank and secured in such position by a sliding loop or equivalent device, the cam surface then engaging the clamping arm to hold the claws firmly in engagement with the heel. The device being applied on the inside of the foot, its presence is not especially noticeable.

**A NICOTINE ABSORBING, SMOKE COOLING PIPE.**

To prevent nicotine and other unhealthy substances from passing to the mouthpiece of a pipe when one is smoking, and also to cool the smoke as it passes through the pipe, with the view of rendering smoking more pleasant and innocuous, the improvement represented in the accompanying illustration has been patented by William S. Hannaford, of Pasadena, Cal. Fig. 1 is a sectional side elevation of the pipe, of which Figs. 2, 3 and 4 are modifications. As shown Fig. 1, the bowl is adapted to be screwed to the enlarged end or sub-bowl of the stem, and in the bottom of the bowl are smoke outlets terminating in a recess covered by blotting paper or similar material, this cover closing the top of a spiral passage connected at its middle with a central opening in the cover. The outer end of the passage connects with the inner end of the bore in the stem, and the under side of the spiral passage rests on an absorbing pad. By unscrewing the bowl, the cover and the absorbing material may be renewed from time to time to keep the pipe always in a fresh condition. In Fig. 2 the coil or spiral passage and absorbing wad are shown arranged in the stem of the pipe, there being nine inches of smoke passage in the coil, and the stem being also suitable for use as a cigar holder, although a special arrangement for a cigar holder is shown in Fig. 5. Figs. 3 and 4 represent a pipe filled from above and from below, in the former case the bowl unscrewing and in the latter case a metal shell sliding out below.



**HANNAFORD'S TOBACCO PIPE.**

Fig. 6 represents a combination coil and wad made by rolling up two strips of paper, one being thin and half an inch wide and the other blotting paper five-sixteenths of an inch wide, the arrangement in either case affording a long spiral path for the smoke in a comparatively small space, and the smoke in its travel depositing nicotine and other impurities.

**The New Southampton Record.**

It is a matter for national pride that both the westward and eastward record between Southampton and New York are now held by American-built ships. The St. Paul has held the westward record for more than a year, and the St. Louis has now broken the eastward record by the trip ending at Southampton on September 8, the time of passage to the Needles being six days, ten hours and fourteen minutes. The record of the Hamburg line steamship Fuerst Bismarck, which was held since September, 1893, was lowered by forty-one minutes, and the St. Louis broke her own best previous record by one hour and sixteen minutes. What is particularly gratifying is that the American ships have been taking away the records from the German ships which were based upon Clyde-built models, and it all goes to prove that it is no fault of our shipbuilders that we have not long ago regained the maritime position which we held some forty years ago when our tonnage was almost that of Great Britain.

**AN IMPROVED LATHE.**

The accompanying illustration represents a ten inch foot power engine lathe, which when desired is also furnished with a countershaft for power. It differs from other lathes of its class in that it is much heavier in design, and great care has been taken to secure the utmost strength for the amount of material used. It is manufactured by the W. P. Davis Machine Company, Rochester, N. Y., and is strictly a high grade lathe in every particular. The following dimensions will assist in determining the relative strength and driving power of the tool. Front bearing,  $2\frac{3}{4}$  inches long,  $1\frac{1}{2}$  inches in diameter; back bearing,  $1\frac{1}{2}$  inches long,  $1\frac{1}{4}$  inches in diameter; nose of spindle,  $1\frac{1}{2}$  inches in diameter, 10 threads to the inch. Hole in spindle 9 16 inch, conforms to Morse taper. Swings over ways  $10\frac{1}{4}$  inches; swings over rest 7 inches; distance between centers,  $32\frac{1}{2}$  inches. Cone has three sections:  $3\frac{1}{4}$ ,  $4\frac{3}{8}$ ,  $5\frac{1}{2}$ , face  $1\frac{3}{8}$ . Ratio of back bearing,  $7\frac{1}{2}$  to 1.

**The Origin of the Weather Bureau.\***

BY PROF. CLEVELAND ABBE.

The writer well remembers the day when, as a youth, over forty years ago, he visited Merriam, "the Sage of Brooklyn Heights," whose publications had awakened his attention to the possibility of publishing reliable daily weather predictions.

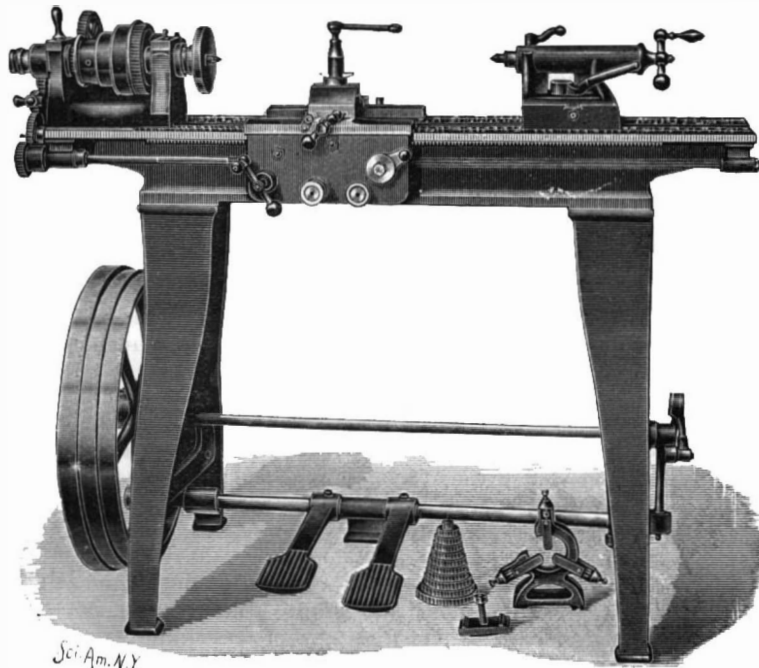
In those days the New York evening papers printed a daily weather bulletin, furnished by the enterprise of the telegraph companies, which gave the temperature, wind and weather for some early morning hour at a large number of stations scattered over the whole country. Had these items been displayed graphically upon a map of the country, it would have been possible to practice daily forecasting for New York; but as this was not done by the newspapers, the readers probably picked out only a few interesting temperatures as items of news, and never realized how nearly they had in their grasp the power of predicting the weather. But I suspect that this daily charting is precisely what Merriam may have privately done, and on which he may have based his occasional public predictions of "heated terms" and "cold terms."

If those telegrams had contained the readings of the barometer in addition to the other items, and if Merriam had charted them, as Espy and Henry were then doing, he would undoubtedly have been able to add also the prediction of storm winds and rain. If Merriam's manuscripts are still in existence, they would afford valuable material for a history of meteorology in America. An old scrapbook of mine, begun in the year 1851, still reminds me of my vivid interest in the prediction of the weather by rational methods. It was not until ten years later that I realized that this daily telegraphic bulletin in the New York newspapers was directly due to Prof. Joseph Henry, who in 1849 had asked that these weather items be telegraphed for the use of the Smithsonian Institution, in order that he and Espy might study the origin, development and progress of American storms. From 1842 to 1857 James P. Espy was the official meteorologist of the United States, and carried on his work in co-operation with the army, the navy and the Smithsonian.

No man ever had a broader appreciation of science for its own sake, and also of science as a means of benefiting mankind, than Prof. Joseph Henry, the noble-hearted first secretary and organizer of the Smithsonian. His natural gifts and his scientific researches were well known before he was elevated to this position, of whose duties and responsibilities he entertained the most exalted conception, and to which he was faithful to the last.

There is scarcely a branch of practical or applied science that he was not able to advance; among these

telegraphy and meteorology, with their applications to the benefit of mankind, stand pre-eminent. In 1848 Redfield, of New York, Loomis, then of the Western Reserve College at Hudson, O., and Espy, of Philadelphia, were the leaders in the study of storms. Henry was the friend of all, and indorsed and advanced their views. The telegraph companies, recognizing and acknowledging their indebtedness to him for his discoveries and inventions in electrical matters, granted him freely those daily weather dispatches that he asked for and which enabled him to be the first to demonstrate systematically the truth that Redfield, Espy and Loomis had long maintained; i. e., that through the telegraph, although then in its infancy, we had the power to predict the coming storms. The Morse telegraph line was open for public business in April, 1845, and in 1846 Redfield published his conviction of the probable value of the telegraph and the daily chart; it is on record that merchants in New York, Boston and Cincinnati, in their individual capacities, were often guided by weather reports telegraphed from a few neighboring stations. But systematic and public work for the benefit of all was the object that Henry had in view. To this end a daily telegraph bulletin was compiled at his request, and was communicated both to the Smithsonian and to the daily press. To this end he immediately displayed this same data daily on a map at the Smithsonian Institution. To this end he constantly interviewed members of Congress as to the propriety and the necessity of a public weather service, illustrating his talk by actual predictions for Washington. To this end finally, in 1864, he was preparing to revive his map, which had been temporarily discontinued during the war, when a disastrous fire in the Smithsonian building checked all further work in this direction. But Henry's agitation of the importance of the subject did



DAVIS' TEN INCH FOOT POWER LATHE.

not cease, as is shown by the testimony of several members of Congress whom he interested in the subject. Meanwhile, England, Holland and France had awakened to the possibilities of the case.

Owing to the labor of Espy, Redfield, Loomis and Henry, there was widespread throughout this country a conviction that something useful could be done in the way of weather predictions. When the writer proposed the subject in May, 1868, first to the trustees of the Cincinnati Observatory, then to Mr. John A. Gano, as editor of the Cincinnati Commercial, subsequently again to him as president of the Chamber of Commerce, there was an immediate response to the effect that "this is what we have long been doing for our individual business interests and will be glad to have you do for the city as a whole." When, in August, 1869, on behalf of Cincinnati, he made a similar proposition to the Chicago Board of Trade looking to co-operation, there was a temporary difficulty in accepting it; but an editorial in the Chicago Evening Journal called public attention to the nature and importance of the work, and "The Weather Bulletin of the Cincinnati Observatory" began September 1, 1869. When in December, 1869, Prof. I. A. Lapham's memorial to the Academy of Sciences was, by the Hon. E. D. Holton, converted into a memorial to the National Board of Trade, and by the Hon. H. E. Paine into a memorial to the Senate and House of Representatives at Washington, there was from each an immediate favorable response. Prof. Henry was at hand to say that from a scientific point of view the scheme was thoroughly sound; the representatives from Ohio were at hand to say that the work was being successfully done in Cincinnati; Gen. Myer was on hand to say that the Army Signal Corps were ready to carry out the practical part of the great national work. Thus Mr. Paine's bill was rapidly forwarded through the various stages of legislation, and the act of February 4, 1870, accomplished the great object that had been held

steadily in view for forty years by Henry and his co-laborers—a national weather bureau was established; another department of science was recognized as of eminent utility.

During the past twenty-seven years the American public, and for that matter the world at large, has, with increasing admiration, viewed the energy, the accuracy and the practical value of the work of the Weather Bureau. Those who admire climatology as well as those theoretical students who deal with the difficult mechanical problems involved in meteorology have sometimes felt that the bureau pays too little attention to scientific investigations, and that many nice points are lost sight of in the breadth of the work and the rapidity of execution that has always been imposed on us by the public and by our successive chiefs.

But, whatever reason there may have been for this criticism, it is likely to be removed if the plans of our present chief are allowed to come to full fruition. The fact is that meteorology, considered as the scientific study of the laws of atmospheric phenomena, is not yet in a perfectly satisfactory position. This is not to be wondered at when we recall that, in 1870, Ferrel was the only man who possessed clear views of the mechanical problems involved in the movements of the winds.

His work was broad and general, and it was necessary to collect more facts before attempting any future developments in unraveling the mechanics of the atmosphere. Since those days our knowledge of the laws of mechanics and thermodynamics, as applied to the air, have been advanced by the study of skillful mathematicians and physicists. Simultaneously with their work, the publication of daily weather charts, and the exploration of the air by means of high mountain observatories and by balloons and kites and the spectroscope, has given us such a solid observational basis that we can now begin to handle the problems of nature in a manner that promises partially to satisfy the demands of exact science.

If our universities would give dynamic meteorology a prominent place in their courses of study, it would greatly facilitate our future progress and the development of a new race of students. In the matter of observations, the most desirable improvement is the invention of some method by which to ascertain the actual condition of the air as to pressure, temperature and moisture at a considerable height above the ground. When Prof. Moore shall be able to realize his ideal of obtaining, at any moment, the wind and temperature from any altitude up to two miles by means of kites or other devices, we hope to have a satisfactory solution of this problem, and shall be able to apply the recent development of mechanical ideas to comprehensive studies of the atmosphere.

**Luminous Photographs.**

These photographs, according to J. A. Randall, in an article on "The Magic and Mystery of Photography," published in the American Journal of Photography, were first introduced

at a ball in Vienna, where programmes were decorated with a luminous picture representing an alchemist at work. "There are several ways of making luminous photographs, the simplest being that of W. B. Woodbury. A sheet of cardboard is coated with a luminous paint and exposed to light under a glass positive or transparency. On removing the cardboard to a dark room a striking and brilliant phosphorescent image is seen, with all the gradations of the positive. The effect may also be produced by arranging a series of glass tubes containing a phosphorescent substance behind a thin glass positive. On exposure to light the luminosity of the tubes will shine through the positive in proportion to its density. When viewed in the dark, a glowing image is the result.

"Another method, which can be applied to an ordinary print on thin paper, is as follows: Take a sheet of cardboard and spread over it as evenly as possible a thin coating of starch paste; when still tacky, dust over it an even layer of powdered calcium or barium sulphide, rubbing it well over with a brush to make it adhere in every part. Then take the print, which should be light, and fixed and toned as usual, and saturate it with a mixture of castor oil and oil of turpentine, taking off all excess with a clean rag. The print, thus made semitransparent, is next pasted upon the prepared cardboard, and the whole well dried before the fire. A print thus prepared, when exposed to light, receives the rays on the phosphorescent sulphide beneath, which becomes luminous in proportion to the absorption which has taken place; it is, therefore, luminous in the dark by the light transmitted. A silver print is soon destroyed by this process, for the sulphide attacks the image. It can be applied to the carbon or other processes not having silver as a basis. Moonlight pictures and landscapes give the most striking effects as luminous photographs."

\* The Independent.

Correspondence.

Inventor of the Gimlet Screw?

To the Editor of the SCIENTIFIC AMERICAN:

We have read with much interest the sketch in your issue of August 28 of Hayward Augustus Harvey, and while we do not wish to appear hypercritical, and have no desire to detract in the slightest from the merits of the Harveys, yet, as the article purports to be original, we think that, for your own credit and for historical accuracy, one or two statements therein should be corrected.

For instance, you state (referring to Gen. Thomas W. Harvey) "he was the inventor of the gimlet pointed screw," the fact in this particular case being that the inventor is not known; for, as we have stated in previous communications which have been published, gimlet pointed screws were undoubtedly made as early as 1755, for in September, 1879, there was exhibited at the Worcester, Mass., musical festival a piano inscribed "Jacobus Kirekman, Fecit, Londini, 1755," and numerous gimlet pointed screws were taken from this instrument, apparently inserted when the piano was originally constructed.

In a work entitled "Recueil de Planches sur les Sciences et les Arts Liberaux et les Arts Mécaniques," Paris, 1771 (Plate 7, Fig. 7, Planche 9), is an illustration of a screw with beveled nicked head and tapering shank threaded to the point.

The drawing of the slotted head cold rolled screw which you illustrate is misleading, as the cut shows a head sufficiently enlarged to correspond to the diameter of standard thread; the fact in the case being that this enlarged head on the comparatively small sized wire was made commercially possible only through the inventions of Mr. Charles D. Rogers.

The work performed by Mr. H. A. Harvey in rolling threads was the use of a series of three cylindrical dies or rolls for developing a thread of sufficient depth to be used for wood screw purposes in place of flat dies, which had for many years previous been employed in Connecticut and elsewhere for the rolling of machine screw threads. For these three cylindrical dies or rolls he finally substituted a single roll having the grooves and ribs on its surface, but the use of this invention has been abandoned.

OLNEY ARNOLD (second),  
Secretary American Screw Company.  
Providence, R. I.

Andrée's Balloon Expedition.

To the Editor of the SCIENTIFIC AMERICAN:

In this journal for September 4, page 150, there is a quotation from a letter written by Dr. Nils Ekholm to a Swedish paper. There are one or two errors in this paper which should not pass unnoticed. The balloon could not possibly have risen to 25,000 feet, as this would have required throwing off several tons of ballast. French journals just arrived give full accounts of the launch of the balloon. The original balloon, of 68 feet diameter and containing 162,000 cubic feet, was enlarged last winter by putting in a strip 37.5 inches wide around the equator. This enlarged the capacity to 180,000 cubic feet. At the first the loss of gas was 890 cubic feet a day, or one-half per cent. Owing to necessary repairs and unavoidable punctures, however, the loss of gas at the start amounted to 1,770 cubic feet a day, or one per cent. This does not seem excessive, though double what had been anticipated.

Dr. Ekholm gives the balloon a voyage of from 22 to 24 days, but it is not easy to understand his computation. The lifting power of the balloon was over 12,000 pounds. The total weight of the balloon and necessary cordage ought not to have been much over 2,000 pounds, and the three men would weigh 500 pounds. This would give over 75 days' flotation. It is probable that Dr. Ekholm has computed in the weight of the car, instruments, steering apparatus, etc. It is customary to calculate everything movable as ballast to be used in an emergency, the voyagers finally clinging to the ring of the balloon. In many cases a disabled balloon has been able to keep afloat, even after it touches ground or water, for the release of a part of the weight by touching keeps the balloon going.

The start of the Eagle was Sunday, July 11, at 14:35 hours. Its first bound was to a height of 330 feet, but immediately after there was a drop, owing to a recoil, little understood at present, which almost invariably attends an ascension in a high wind. Andrée at once threw off 460 pounds ballast (estimated probably from the bags of sand emptied). This left him only 880 pounds of sand ballast, as most of the ballast consisted of food and ropes. The balloon at once rose to about 2,600 feet, just clearing Vogelsang Island. The balloon was visible over an hour and presented a beautiful sight as it sailed away toward a point a little north of Franz Josef Land, or about where the intrepid Nansen boldly left his steamer Fram to push as far north as possible.

There is not the slightest doubt that, under proper auspices and with a full comprehension of the problem, a balloon voyage can be made to the pole, and this too with much less hazard than is ordinarily thought. It

is a significant fact that, notwithstanding the extreme doubt of the safety of Andrée, the French are already planning a second attempt to reach the north pole by balloon. There should be a thorough study of the problem of releasing a balloon in a high wind and of overcoming the peculiar recoil. It would be a grand thing if the balloon could be brought to this country and a voyage be made to Europe. This would be in the track of numerous steamers and the least untoward event would not be absolutely fatal, as it is likely to be in the Andrée voyage. Such a trip would serve to give one perfect confidence in the power of the balloon and would also give invaluable experience in managing a balloon in a long voyage.

Above all, efforts should be primarily directed toward maintaining the balloon at an altitude of 6,000 feet or so. It ought to be just as easy to do this as to keep it at a lower level. If a smaller balloon has its neck connected with the larger, the overflow can be caught by it, and after enough gas has leaked from the large balloon, the smaller could be emptied into it and it would then serve as ballast in an emergency. At 6,000 feet the currents of air are about three times as rapid as at the earth, and they are far more constant. It has been demonstrated that practically the same distribution of pressure in highs and lows occurs at the pole as in lower latitudes; hence any current setting strongly to the north would be likely to accomplish the object. Paradoxical as it may seem, any wind near the pole is a favoring one to take one there and the same wind (in fact, wind at the pole) is a favoring one to bring one back.

At the height of 6,000 feet there would be far less danger of rain and fogfreezing on the balloon—a circumstance that would be practically fatal. At 6,000 feet the precipitation, if any, would be rarer, which could be swept off, but this would be impossible with ice or frozen sleet. It is not generally known that this country holds the record for a long distance voyage. La Mountain and three companions, on July 1, 1859, sailed from St. Louis, Mo., and landed in Henderson, N. Y., 870 miles in 19 hours. Most of the voyage was at about 7,000 feet, and it is certain that no such record could have ever been made at a much less height.

H. A. HAZEN.  
Washington, D. C., September 3, 1897.

The Production of Large Artificial Diamonds.

Consul Germain, of Zurich, says: Diamonds of a very small size have been produced artificially heretofore, but no one has as yet succeeded in producing large ones. Mr. E. Moyat claims to have discovered a new process by which to produce diamonds of large dimensions. In principle, his process is about the same as the one already invented by others, and that is to obtain crystallized carbon out of iron and coal, by means of high pressure and high temperature. Yet there is some improvement in the Moyat process as regards the technical operation. Pulverized coal, iron chips, and liquid carbonic acid are placed in a steel tube and hermetically sealed. The contents are then subjected to the action of an electric arc light by means of two electrodes introduced into the tube. The iron liquefies, is then saturated by part of the pulverized coal, at the same time the liquid carbonic acid evaporates, thereby creating an enormous pressure on the mixture of iron and coal. This pressure again considerably increases the dissolution of the coal in the liquid iron. While the mixture is cooling, the carbon crystallizes partly in the form of real diamonds and partly in the form of similar stones. These crystals are then segregated by dissolving the iron in diluted muriatic acid. The mixture, by the above method, remains under high pressure during the operation of the electric current, while by other methods the pressure is obtained later on only by means of the rapid cooling process of the crucible.

Asiatic and African Explorations in 1896.

The long list of geographical explorations accomplished during 1896 includes, says the Popular Science Monthly, the exploration of a large region pertaining to the upper Yang-tse-Kiang River, Chinese empire, by M. Bonin, a French officer in Tonkin, who visited countries not previously traversed by Europeans, and has been able to make important corrections in the map of the Yang-tse-Kiang and its tributaries. Dr. Sven Hedin, in exploring the Takla Makan, a continuation of the Desert of Gobi, has found the ruins of two of the towns said to be partly buried in the desert, and has made interesting investigations on the past and present hydrography of the Lob Nor region. M. D. Klements, sent out by the Siberian Geographical Society to the Khengai Mountains of northwest Mongolia, found a great glacier on the western slope of the mountain, and everywhere signs of former volcanic activity. A Russian expedition has been exploring the course of the Amu Daria, with a view to ascertaining if it would be possible to divert its waters by means of a canal into the Caspian Sea. The exploration of Asia Minor, predominantly archaeological, has been continued by young men of the University of Oxford.

Science Notes.

The largest known flower is said to be the Rafflesia, of Sumatra, whose diameter is nine feet, and which smells like a piece of putrid beef.

On July 8 the Geographical Institute of Lisbon, founded in commemoration of the four hundredth anniversary of Vasco da Gama's departure for the Indies, was opened by the Geological Society of Portugal, says Natural Science.

Paris barbers and hairdressers are now obliged by the police to take sanitary measures in carrying on their business. Elaborate regulations have been sent out requiring them to use only nickel-plated combs, to substitute pulverizers for powder puffs, to cover the hair cut off with sawdust and have it removed at once, to wash their hands before working on a customer, and to place all metallic instruments, razors, shears, combs, cutting machines, etc., in a solution of soap and boiling water for ten minutes before they are used.

The city of Breslau recently consulted the chemists of the university respecting some old manuscripts of the sixteenth century, which damp and old age had made quite illegible in some parts. A remedy was very easily found. It was ascertained that gall nut ink had been used, as had been expected. When painted with a one per cent alcoholic solution of tannic acid, the characters became at once fairly discernible. Ammonium sulphide brought them out again in full distinctness. This is the well-known cure, which once more has proved reliable.

William Pierson, San Francisco, donor of the Pierson photographic lens to the Chabot Observatory in Oakland, has offered to bear the expense of sending Prof. Charles Burkhalter, astronomer in charge of the observatory, to India to take observations of the solar eclipse next spring. The Board of Education decided recently to grant Prof. Burkhalter leave of absence from October until May 1 with full pay. Prof. Burkhalter confided to friends that, had the leave not been granted, he would have handed in his resignation. He is particularly anxious to observe the eclipse, as he has invented an appliance for use in astronomical work which he wishes to test, and from which he expects great results.

Emperor Francis Joseph, of Austria, has given his consent to the union of the two great imperial libraries at Vienna, the Hofbibliothek and the Kaiserliche Familienideicommissbibliothek. The step is taken in order to do away with the purchase of duplicate books, but one result will be the throwing open to students of the private family library, which hitherto has been reserved for the use of members of the imperial household. The library is noted for its enormous collection of portraits as it includes the collection begun by Archduke Francis, of Tuscany, in 1784, which now contains 90,000 portraits, 22,000 engravings from the collection of Lavater, the physiognomist, and 100,000 portraits detached from printed books.

From a series of investigations on the effect of cutaneous excitations on the formation of red blood corpuscles, Prof. H. Kronecker and Dr. A. Marti, writing in the *Atti dei Lincei*, draw the following conclusions: (1) Feeble irritations of the skin promote the formation of red blood corpuscles, but modify the formation of hemoglobin in different ways. (2) Strong irritations of the skin determine a diminution of the number of red corpuscles, and, in a minor degree, of the hemoglobin contained in the blood. (3) Darkness diminishes the number of blood cells; after about a fortnight, a minimum is reached, which is followed by a limited increase. (4) Continued exposure to intense light (even at night with electric light) induces the formation of red blood corpuscles, and also, in a lesser degree, of hemoglobin.

The State of Indiana has undertaken to defray the expense of publishing annually the Proceedings of the Indiana Academy of Science, and the two reports, for the years 1894 and 1895, for the printing and publication of which the State has paid, have just come to hand, says Nature. By publishing the proceedings of the Academy the State secures, without further expenditure, the service of a number of investigators working in various departments of science, and spending a large portion of their time upon new problems the solution of which is of importance to the development of the Indiana commonwealth. These investigators, who constitute the best authority in the State upon their several subjects, will act without pecuniary compensation with the legislative body of Indiana, just as the National Academy of Sciences acts in conjunction with the United States Congress. They will freely advise the legislators when consulted upon scientific subjects, and assist in giving direction to scientific investigations undertaken by the Legislature as a basis for logical laws. The work of an academy like the Indiana Academy is an important factor in developing mineral, vegetable and animal resources, and it greatly strengthens educational agencies. The State has thus acted wisely in giving encouragement to the scientific workers within its borders, and doubtless the funds it has undertaken to provide will be returned a thousandfold.

**COMPLETION OF PART OF THE BOSTON SUBWAY.**

Some years ago the horse car system of the city of Boston was converted into a trolley system and now the city is traversed in all directions by electric cars, and the combined routes of various companies serve almost the entire suburban district as well as the city proper. After the introduction of the trolley, it soon became apparent that Boston required additional facilities for the transportation of street car passengers to the lower parts of the city. It was found that the problem of rapid transit was not solved by the trolley, owing to the overcrowding of traffic at certain points. The wholesale introduction of the trolley did not tend to improve the appearance of the handsome city, and the wires were particularly objectionable on Boylston and Tremont Streets, where they ran at the side of the Public Garden and the Common. The congestion of traffic on these two streets was very bad, and at times a solid line of cars made travel well nigh impossible.

The problem was not one of providing rapid transit for a long distance, but of facilitating traffic upon certain existing and stated routes within a very small area, about one mile long and one-quarter of a mile wide. After a lengthy discussion of the matter, the Boston Transit Commission decided upon a subway system under certain streets by means of which the electric cars would be diverted from the surface of the streets on some of the heaviest lines of travel, and would be run underground in a well drained, ventilated and lighted tunnel, which would, of course, be free from the objections to underground railways in which steam locomotives are used. Three of the twelve sections are now entirely completed and cars are running through them, giving great relief to the overcrowded streets above.

The subway act was passed in July, 1894, by the Legislature of the Commonwealth of Massachusetts. There was a persistent fight made against it by an element of the community which was hostile to the construction of a subway. The friends of the subway were also obliged to contend with those who were hostile to it from a purely business point of view and also against a public sentiment which wished for no encroachment on the sacred soil of the historic Common. The latter were extremely bitter in their antagonism to the subway plan, but at last the friends of the plan succeeded in stifling the opposition and the Subway Act became a law. The opposition was soon after revived, and an injunction restraining the commission from constructing the subway was refused by the Supreme Court, June 15, 1896. The subway has been constructed under the direction of a commission of five men appointed by the Governor and the Mayor, the Hon. George G. Crocker being the chairman. The completed work will cost something under \$7,000,000.

Having now briefly referred to the plan as a whole, we will take up our engravings. Many of the salient features of the subway have been described in the SCIENTIFIC AMERICAN for August 31, 1895, and September 5, 1896, and in the SCIENTIFIC AMERICAN SUPPLEMENT, June 29, 1895, No. 3017.

Sections 1, 2 and 3 consist of a two track subway, commencing at the foot of the incline at the Public Garden, just west of Charles Street, and running un-

der the Boylston Street mall of the Common at the intersection of Boylston and Tremont Streets, where the Boylston Street station is located, as shown in one of our engravings. The four track subway extends northerly from this station under the Tremont Street mall to

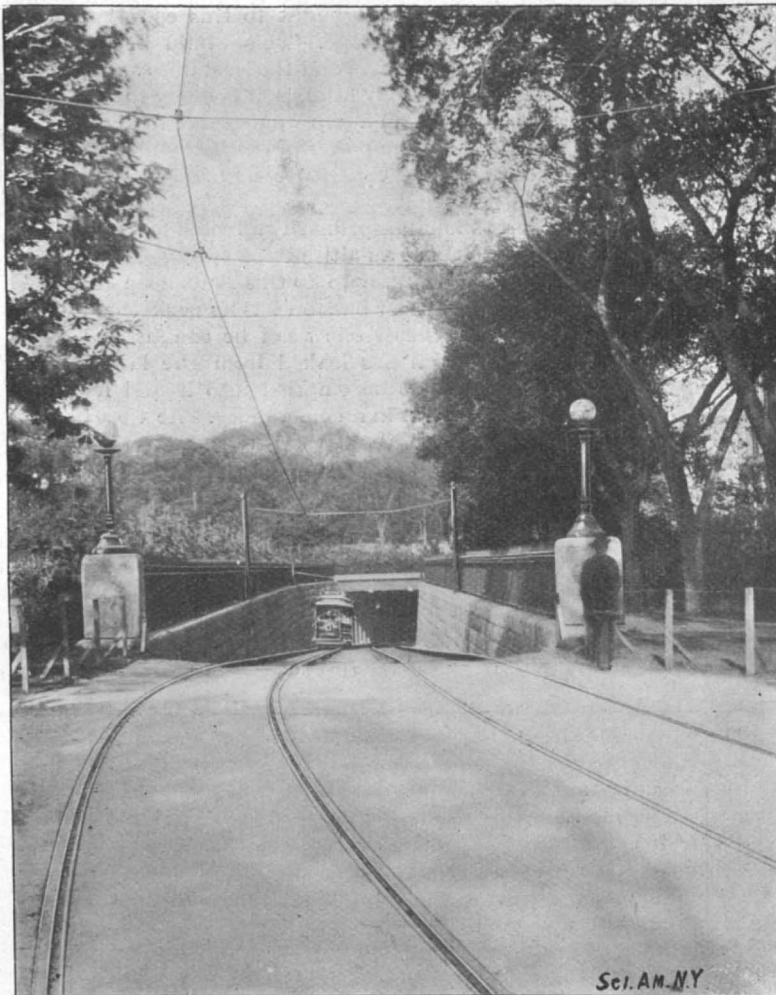
Street and Shawmut Avenue respectively. For a short distance this is a four track subway, but the four tracks run into two which pass through to Causeway Street in the northern part of the city.

The cars coming down from Boylston Street turn out of this street at Church Street and enter the subway in the Public Garden by an incline, which is shown in our engraving. The entrance to the incline is intended to be monumental in character and mask it. The first section consists of 318 feet of incline, 685 feet of two track subway and finally 408 feet of four track subway, the latter beginning at the Boylston Street station. The incline was illustrated in the SCIENTIFIC AMERICAN for September 8, 1896, this engraving showing the retaining walls which were constructed upon concrete foundations. In this two track subway, in order to avoid lateral pressure in the tunnel near the surface, the arch type of construction was not used, and the tunnel has been given a flat roof supported by brick arches turned between I beams. The sides are of similar construction, the I beams standing vertically. This establishes a number of arches both horizontal and vertical, each one of 6 feet chord. Diagonal struts connect the vertical and horizontal beams across the upper corners. Some attention was paid to draining this as well as the other parts of the subway, the concrete forming the side walls being plastered with Portland cement and a coating of asphalt applied in turn to it. This asphalt waterproofing was continued over the roof. The pump chamber in the Public Garden contains automatic electric pumps by means of which leakage and rain water are discharged into the street sewer. A masonry ventilating chamber has been constructed near the Boylston Street station and there are others at various points. They are supplied with 7 and 8 feet fans to be driven by electric motors.

The four track subway was made by an open excavation and is 48 feet wide, the two track subway being 24 feet wide. The middle row of steel columns support the roof of the four track subway.

Section 2 really consists of the Boylston Street station and its approaches. The station proper is 634 feet long, and consists of four tracks and two island platforms, each thirty feet wide. Entrance and exit is given to the Boylston Street station by four ornamental buildings of chiseled granite, which somewhat resemble the stations used in Budapest for the underground railway. One of these is intended for north bound passengers, one for south bound passengers and two for exit.

The plan for receiving passengers at the subway stations has been a matter of careful study, the desire of the officials being to reduce to a minimum the possibilities of confusion incident to a heavy rush of passengers. In the place of the surface ticket office, there are set up at the foot of the stairways leading into the tunnel from each of the buildings three booths for the sale of tickets. As the passenger passes into the subway he will stop before one of these offices and obtain a ticket and receive a coupon, which he retains until the conductor of the car takes it up. Between the ticket offices are passages, each of which is wide enough to admit one person at a time. The subway platforms are of smooth artifi-



ENTRANCE TO THE SUBWAY IN THE PUBLIC GARDEN.

a point just below Temple Place, where the tracks separate to form the important Park Street station, the two inner tracks forming the north and south bound tracks for the cars running to and from the Back Bay, Brookline, Brighton, etc. At the Park Street station the inner tracks terminate in a loop which accommodates the cars which formerly ran to the old Tremont House and then returned.

Sections 4 and 5, which are nearly completed, are also shown in our engravings. The cars run up to Tremont Street to Warrenton Street, and then emerge from the subway by an incline and run up Tremont



THE OPEN CUT, SHOWING TRACKS FOR TREMONT AND SHAWMUT AVENUE CARS,



cial stone and between the platforms are high barriers of netting designed to keep people from crossing from one track to the other. The interiors of the stations are as light as day and are covered with enameled brick, which reflects the light of an arc lamp. One of our engravings shows the interior of the Boylston Street station looking south on the track which turns to the right into Boylston Street, passing over the Tremont Street track, which is seen at a lower level through the fence at the right. Our last engraving shows the south bound Tremont Street track passing under the curve to the Boylston Street track just referred to. This crossing of tracks at different levels is a very interesting piece of engineering work, and will tend to avoid accidents and confusion.

Section 3 consists of a four track subway running from the four track portion of Section 1, which is north of Boylston Street, and the Park Street sta-



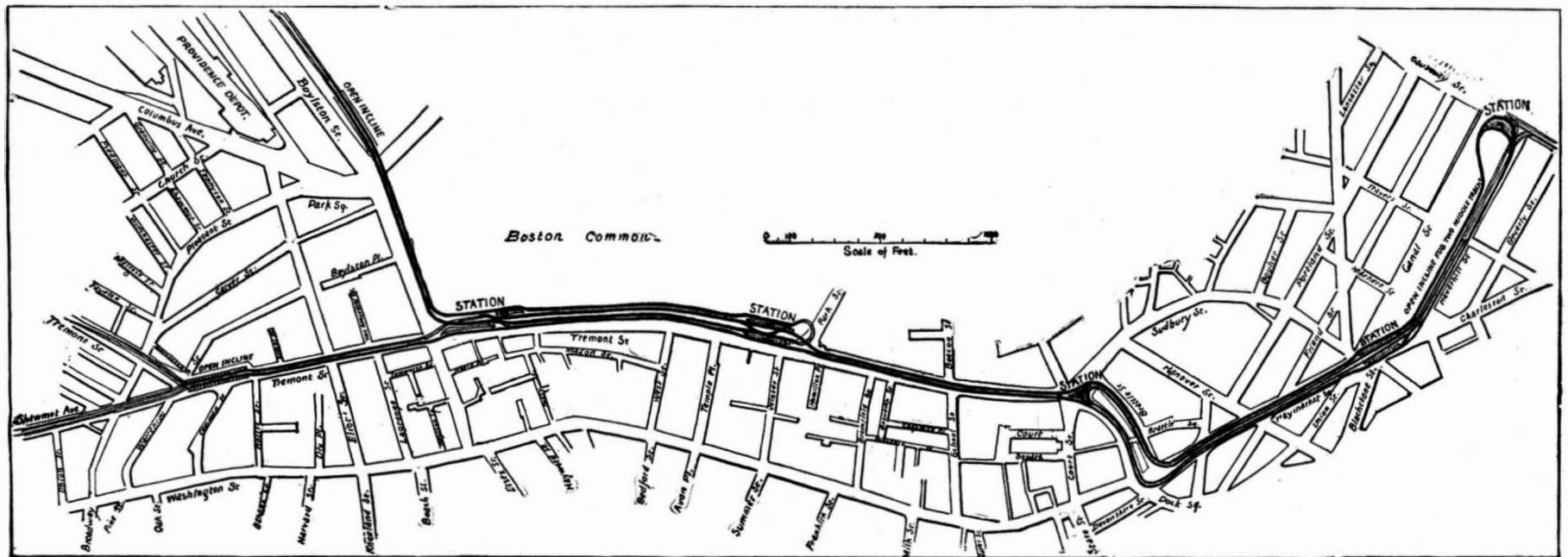
BOYLSTON STREET STATION LOOKING SOUTH, SHOWING THE LOW LEVEL TRACK THROUGH THE FENCE.

feet below the street at Boylston Street, while that of the north bound cars is only 22 feet below the surface. These two subways converge into a double barrel subway opposite the new Hotel Touraine, both being brought to the same level before reaching Eliot Street, where the two tracks are car-

ried in a wide single arch subway. At Hollis Street the westerly track is depressed and branches into another double bell mouth. One side is for the south bound Tremont Street cars and the other for the south bound Shawmut Avenue cars, while the east barrel rises until it crosses over the south bound

Shawmut Avenue subway to carry the north bound street cars without the necessity of crossing at grade. This represents a most interesting piece of engineering work, and the different grades of the tracks are well shown in our engraving, which shows the south bound track divided where the Shawmut Avenue cars pass under the north bound Tremont Street cars. This section of the subway is not quite completed as yet. Refuge niches will be seen in the side walls.

The track used throughout the subway is the An. S. C. E. standard, weighing 85 pounds to the yard, with continuous joints. Each rail is protected by a guard rail, weighing 45 pounds to the yard. The rails are and carefully ballasted with it. Each rail is connected by a copper bond. The ordinary overhead trolley system is used. An inverted wooden trough is fastened to the iron work of the roof, and insulated with sheet rubber. The trolley wire is supported by special bolts



MAP SHOWING ROUTE OF BOSTON SUBWAY.

tion itself, which includes the loop. The station consists of two island platforms 250 and 275 feet long, respectively, and the platforms vary in width, the greatest being 40 feet. Each platform is connected with the street by two stairways. Loops are provided so that cars running to Park Street can only be sent on the return journey without the necessity of switching. Tracks are also provided for holding street cars for the rush hours, and also tracks with pits for making temporary repairs. In our engraving of the Park Street station the spectator is supposed to be looking north, and sees where the track commences to turn the loop to return south. At the northern end of the station, the two outside tracks, after passing around the loop, converge into two separate single track subways, which unite and go down Tremont Street toward Scollay Square. This part of the work is not completed as yet.

Sections 4 and 5, which are almost complete, consist of two two track inclines, and the four and two track subways run up Tremont Street to the Boylston Street station. It consists of two two track inclines, a short length of two track subways which finally run into two separate single track subways, one for the south bound cars at a lower level, 39

and clips which are insulated. The system used does not differ much from that used in Brooklyn, where the wires are suspended from the elevated structure. At present the current is taken from the underground feeder, but direct cables to the power station for supplying current to the subway alone will be added. It will be noticed that the subway is a direct continuation of the surface trolley lines, no change being made in either the motive power or the method of furnishing the current to the cars.

The subway is lighted throughout by both incandescent and arc lamps. In the portion now in operation 600 incandescent and 55 arc lights are used. The arc lights are used for lighting the stations. The system of electric block signals is in process of installation, and electric heaters are located in the ticket offices.

The Chief Engineer is Mr. Howard A. Carson. The Boston Transit Commissioners are: George G. Crocker, chairman; Charles H. Dalton, Thomas J. Gagan, George F. Swain, Horace G. Allen.

WE learn from the Revue Scientifique that it is proposed to found an experimental station in Madagascar, for the introduction of European cereals and the improvement of local vegetable produce.



SOUTH BOUND TREMONT STREET TRACK PASSING UNDER CURVE TO BOYLSTON STREET.

Natural History Notes.

Preservation of Fungi.—At the last meeting of the Société Helvétique des Sciences Naturelles, M. Tschirch presented a memoir upon the method employed by him for preserving specimens of fungi with their natural form and color.

The Speed of the Camel.—The "ship of the desert" enjoys the reputation among many people of going at a rapid gait and of covering great distances in a short time.

Trees and Lightning.—The immunity of certain trees to lightning stroke has been recognized for a long time, and has often been verified, but the cause of the phenomenon has given rise to various interpretations;

Ciel et Terre gives some information upon this subject borrowed from a memoir by M. Hess published in the Mittheilungen der Thurgauer Naturhistorischen Gesellschaft:

Pechuel-Loesche, taking as a basis some observations made in the vicinity of Jena, in the valley of the Saale, expresses the opinion that when trees send their roots down into very damp earth they are more subject to lightning stroke than their neighbors, even when the latter are taller.

The first important data in regard to the question were given by Hellmann, in 1886, in his Beiträge zur Statistik der Blitzschläge in Deutschland.

Table listing tree species and their lightning strike counts. Linden (Tilia parvifolia) 55, Scotch fir (Pinus sylvestris) 50, White birch (Betula alba) 45, Silver fir (Picea vulgaris) 50, Beech (Fagus sylvatica) 17.5, Oak (Quercus pedunculata) 12.5.

Along with these researches Jonesco took up a microscopic study of the woods utilized, and found that the quantity of oily or resinous matter that they contained followed the same increasing proportion as their resistance to the discharges.

The poplar is not mentioned above, but it results from Jonesco's experiments that this tree is one of the best conductors of electricity.

The Nest-building Instinct.—There is a goodly number of instincts, says the Revue Scientifique, upon the subject of which we know but very little, and, when it

becomes a question of explaining certain forms of activity of animals, naturalists and psychologists remain equally perplexed. Does the bird build its nest instinctively or through imitation? The theory of imitation has often been defended, and it has been said that although many birds in the first reproductive season lose some time in grouping the elements of their nests without succeeding in constructing anything worthy of the name, this is due to the fact that the remembrance of the nest in which they first saw daylight is still confused and uncertain.

The Reproduction of the Truffle.—The manner in which the truffle is reproduced has been a puzzle to botanists, who have generally confined themselves to theories in regard to the question. A recent communication to the Academie des Sciences by M. Grimblot throws an interesting light upon the subject.

The opinion has long been held that the spores of the common mushroom will not develop unless they have passed through the intestines of a horse or cow.

The American Lawyer Crop.

Mr. Percy L. Edwards, in the Michigan Law Journal, avers that the advent of the law school "has furnished ample relief to the once aching necessity in this country for more lawyers!"

Statistics show an amazing increase of annual "crop" of American lawyers in the last fourth of a century. In 1870, the law schools reported 1,611 students; in 1885, 3,054 students; in 1891, 6,106 students; in 1894, over 7,600 students.

One of the fields into which this skirmishing for existence is carried by briefless lawyers is the production of more lawyers. The grand army of the legal skirmishers is annually increased by increase of the number of law schools—establishments not founded to make lawyers so much as to extract from deluded young men who bamboozle themselves with the ambition to become lawyers the means of subsistence for superfluous lawyers already made, or half made.

The Use of the Hair.

An article by Dr. Exner in the Vienna Klinische Wochenschrift is abstracted in the Boston Medical and Surgical Journal. He states his belief that the bodies of our ancestors were totally covered with hair, and that its present disappearance is due to the fact that its absence was regarded as a beauty, and hence that, in the choice of mates, preference was always given to those that had the least of it.

Antiquity of Writing.

It is observed by Dr. Bühler, in his book on Indian palæography, that a very remote period is indicated for the beginning of writing by the fact that in a Jain text of about 300 B. C. its origin is forgotten and its invention attributed to the creator Brahma.

The Cramps' Annual Report.

The William Cramp Ship and Engine Building Company, of Philadelphia, makes this report for the fiscal year ended April 30:

Financial table showing Gross earnings \$4,500,000, Profit 770,000, General expenses 340,000, Total assets of company 7,800,000, Total liabilities 6,675,000, Credit and profit and loss \$1,125,000, and Material on hand 250,000.

**"METEMPSYCHOSIS."\***

"Metempsychosis" is the name of an illusion which was the joint invention of Messrs. Walker and Pepper, of London. It was devised by the former gentleman, and the latter assisted in perfecting it. It is probably the most mystifying of any of the optical tricks. It has of late years been shown in America, by Kellar, under the title of the "Blue Room." The first effect produced upon the spectator after witnessing the illusion is that he has been dreaming, or seeing ghosts or spirits, for it seems utterly impossible for man to accomplish the wonders produced by it.

Our first engraving shows the stage set as an artist's studio. Through the center of the rear drop scene is

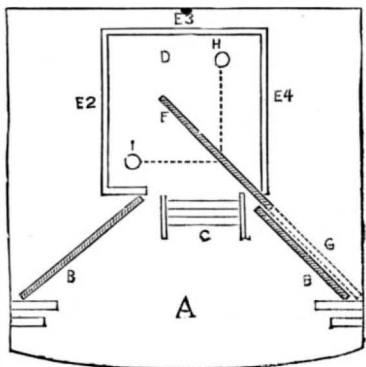


Fig. 2.

seen a small chamber in which is a suit of armor standing upright. The floor of this apartment is raised above the level of the stage and is approached by a short flight of steps. When the curtain is raised a servant makes his appearance and begins to dust and clean the apartments. He finally comes to the suit of armor, taking it apart, cleans and dusts it, and finally reassembles it. No sooner is the suit of armor perfectly articulated than the soulless mailed figure deals the servant a blow. The domestic, with a cry of fear, drops his duster, flies down the steps into the large room, the suit of armor pursuing him, wrestling with him, and kicking him all over the stage. When the suit of armor considers that it has punished the servant sufficiently, it returns to its original position in the small chamber just as the master of the house enters, brought there by the noise and cries of the servant, from whom he demands an explanation of the commotion. Upon being told, he derides the servant's fear, and, to prove that he was mistaken, takes the suit of armor apart, throwing it piece by piece upon the floor. This is only one of the countless effects which can be produced by this interesting illusion.

The working of the illusion will be understood by reference to the diagram, Fig. 2. At A we have the proscenium opening; B B are two flats of scenery which close in the scene from the front wings to the steps, C, which in their turn lead up to the small chamber, D, at the back, in which all the changes occur. The walls of the chamber are lettered E<sup>1</sup>, E<sup>2</sup>, E<sup>3</sup>, E<sup>4</sup>. F is a large mirror extending from floor to ceiling, and capable of being wheeled back and forth on a truck or carriage. When this mirror is withdrawn, as seen at the dotted lines, G, the spectators see through the opening of the chamber to the rear wall. The suit of armor is marked H. Now, if the mirror be pushed across the chamber, both the armor, H, and the rear wall disappear, and the walls of the chamber at E<sup>1</sup> and E<sup>2</sup> are reflected so that they appear to be the walls E<sup>3</sup> and E<sup>4</sup>. There is another suit of armor at I. It is placed so that, when it is reflected in the mirror, it will occupy the exact position of the other suit of armor, H. When the mirror is shoved forward and hides the suit of armor,

H, an actor dressed in a similar suit enters behind the glass by a secret door, removes the dummy armor, and assumes the same place himself. All this time the suit of armor at I is reflected in the mirror, so that a suit of armor is always visible. The mirror is now drawn back, and the suit of armor which the actor wears is seen. When the servant now dusts the armor, it suddenly seems to become endowed with life and chases

him around the room; and when it again mounts the steps in the smaller room, the mirror is shoved forward, the actor making his escape in time to place the first suit of armor where it formerly stood. Now the mirror is again drawn out, revealing the sides of the room, E<sup>3</sup> and E<sup>4</sup>, and, of course, exposing the suit of armor, H. If the walls, E<sup>1</sup> and E<sup>2</sup>, and the armor, I, are correctly placed as regards reflection, he can pass the mirror to and fro at will, without any change being detected, as the reflection takes the place of the reality, and we suppose we are looking at the real object.

As the edge of the mirror passes the suit of armor a hard line is to be seen, a distinct vertical line, which would seem to wipe out the object as it passes. To avoid this, the inventors hit upon a novel and purely ingenious expedient. They etched vertical lines in the silver back of the glass at the end which first passes across the field of view, beginning with thick silvered spaces close together, and tapering, with the lines farther apart as shown in our diagram, Fig. 3. It can thus be seen that the reflected article gradually appears instead of coming suddenly into view, and when the mirror is moved away the real article gradually appears.

In order that the edges of the glass may be better disguised as it moves forward or backward, the edge is cut or ground into steps, as shown in Fig. 4.

By the apparatus described above, many changes can be made, as a living man appearing in a previously empty chair, flowers growing on an empty bush, a change of a man into a woman, a painted picture into a living one, etc. In some effects a table is employed, to all appearances the common square kitchen table. A person is seen sitting at the table, which is empty; suddenly there appears before him a large dish of oranges or a meal. This is arranged by providing the table with a slot which runs diagonally from corner to corner. This allows the glass to travel through it, and thus shuts off one-half of the table. Articles are placed on the table, behind the glass, which is now withdrawn, leaving them to be seen upon the table. The slot in the top of the table is covered with sheet rubber or other material.

**Simple Test for Noxious Gases in the Air of Mines.**

For detecting deleterious reducing gases such as carbonic oxide, methane, etc., in the air of mines, A. Mermet finds a dilute solution of potassium permanganate, containing a little nitric acid, highly efficient, the effect of these gases being to decolorize the permanganate solution. The reaction goes on more rapidly when the solution also contains silver nitrate, one part of carbonic oxide per 500 to 5,000 parts of air decolorizing the liquid in from one to twenty-four hours. The reagent is prepared as follows: Silver ni-

1 cubic centimeter of the permanganate solution, and 1 cubic centimeter of pure nitric acid are mixed and made up to 50 cubic centimeters with distilled water freed from organic matter. The reagent must be used immediately. To collect a sample of air from the gallery of a mine, a flask is filled with pure distilled water and emptied in the gallery, the air entering the flask by displacement. When the air is dusty the flask should be fitted with a paraffined cork with two tubes, one for the outflow of the water and the other filled with cotton wool to filter the ingoing air. The bottle must then be closed by a glass stopper, since the organic matter in cork would decolorize the reagent and spoil the test. A second flask being filled with normal air,

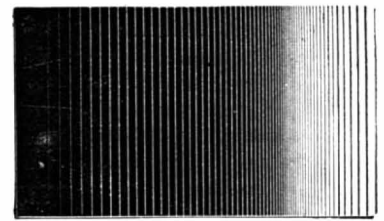


Fig. 3.

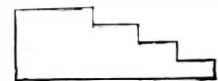


Fig. 4.

some of the reagent is poured into both and they are then placed side by side on a sheet of white paper. After some time the impure air will decolorize the liquid, whereas that in the flask of normal air will retain its original rose color. This decoloration is more rapidly effected in proportion as the quantity of reducing gases is greater. The actual nature of the impurity can then be ascertained by ordinary methods, but sulphur, if present, reveals itself during the initial reaction by combining with the silver salt to form sulphide, which turns the reagent brown.—Colliery Guardian.

**Dust and the Clearness of the Air.**

The effect of atmospheric dust in altering the visibility of distant mountains is discussed by Herr Schultheiss in a recent number of the Meteorologische Zeitschrift. Science (April 16) condenses his results as follows: Observations on the visibility of the Alps have been made for twenty years past at Höchenschwand, a station in the southern Black Forest, at an altitude of 1,000 meters (3,280 feet) and commanding, under favorable conditions, an extended view of the Alps as far as Mont Blanc. Three degrees of visibility are noted,

designated respectively as 0, 1, and 2, the latter figure denoting the greatest clearness of view. A careful study of the records and of the weather conditions prevailing at the times of observation reveals the fact that the visibility is best under anticyclonic conditions (the presence of an area of high barometer). . . . There is a descending movement of the atmosphere, and as the upper strata are cleaner and purer than the lower, this process results in causing greater clearness of the air and hence a higher degree of visibility. Ninety per cent of all the cases in which the view of the distant Alps was clear are found to be associated with such . . . conditions. Cleaning the air by means of rain seems to be the controlling factor in the majority of the other 10 per cent of cases. Naturally, as anticyclones are more frequent and longer lived over central Europe in winter, the visibility is greater in winter and less in summer. There is a common belief, here as well as in Europe, that very clear days, which give very good



Fig. 1.—"METEMPSYCHOSIS."

trate solution: Two or three grammes of silver nitrate crystals dissolved in 1 liter of water. Potassium permanganate solution: 1 liter of distilled water boiled with a few drops of pure nitric acid (free from hydrochloric acid), a little permanganate solution being added until the liquid becomes rose colored, in order to destroy any organic matter which may have found its way into the water, as dust, etc. When cold 1 gramme of potassium permanganate crystals is dissolved in the water and 50 cubic centimeters of nitric acid added to it. For use 20 cubic centimeters of the silver nitrate solution,

views of distant mountains, are most likely to be followed by rain. Schultheiss has investigated this question in the case of the Alps as seen from Höchenschwand, and finds that a very clear view is seldom closely followed by rain. He also finds that the dust in the atmosphere at 1,000 meters is very fine and does not include large quantities of coarser smoke particles, as it does at lower levels.

THE Chilean government telegraph lines now comprise about 7,500 miles.

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