

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, AliT, SCIENCE, MECHANICS, CHEMISTRY, ANI) MANUFACTURES.



THE SUBWAY SOUTH ON TREMONT STREET, SHOWING CROSSLNG OF TRACRS AT DIFFERENT GRADES.


INTERIOR OF THE PARK STREET STATION LOORING 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.]

## stientifir emmerican.

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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. There were seven vessels in the fleet, including the splendid armored cruisers New York and Brooklyn and the battleships Indiana and Iowa, and it had been ar ranged that Mr. Roosevelt, on the dispatch boat Do phin, should meet the squadron, anchored to await him, about thirty miles east of the Virginia Capes, when the squadron maneuvers were to be carried on
for two or three days out of sight of land. It was at Mr. Roosevelt's own suggestion, it is said, that this fleet practice was arranged for and carried out, and its results cannot fail to be highly satisfactory to all who understand how highly imporiant perfect fleet organization is in modern naval warfare.
Immediately upon Mr. Roosevelt's arrival, Admira Sicard, from the New York, which was the flagship signaled the battleship New York to receive the As sistant 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. When Mr. Roosevelt went on the bridge of the Iowa. with the captain of the latter, and the alarm gongs were rung, officers and men were nstantly at their several stations, ready for work, the boats in places where they would least feel the con-
cussion of the heavy guns, and everything in order as it would be in actual war. A target had been placed 2,500 yards a way, and firing at it was at once commenced with an 8 inch gun, to be followed with pro jectiles from the 12 inch guns and the actual service of the entire battery of the vessel. The battleship and her crew are said to have passed splendidly through this first trial at actual cannonading practice; a whale boat was put out of service and some skylights broken, but nothing more serious, while the accuracy of the The Brooklyn, the New York and the Indiana subsequently had sinilar practice, searchlights being used sequently had sinilar practice, searchlights being used
in the evening to pick up supposed hostile torpedo in the evening to pick up supposed hostile torpedo
boats, and there was also a searchlight drill by all the vessels of the squadron. A novelty of the occasion was the release of carrier pigeons from the New York, the pigeons carrying dispatches from the squadron to Nor folk, whence they were telegraphed to Washington.

## 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 prozer medica knowledge to insure that the treatiment 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. In fact, there are no less than forty-three professions and occupations which require some license from the State before they can be conducted; but in the matter of protection from fire the individual has been neglected by the State. It is a popular belief that every man who is able bodied is fit to fight fire, but this is erroneous Fire extinguishment is accomplished as much by mental as by brute force.
Unfortunately, in many of our great cities fire extinguishment is taken up as a recompense for politica support, and the fire department is looked upon as an important center for partisan and political influence That those who regard the fighting of fire as a profes sion are totally opposed to this political influence and corruption is shown by many reports of firemen's onventions, and these brave men deserve all honor for their faithful service and certainly should have a life enure of office.
Remc vals 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 Fire extinguishment is very largely a matter of expe rience, and the longer the fireman holds his position the more efficient he ought to be.
The status of the volunteer fireman is not more sat isfactory. Too many men are enrolled as members of the volunteer fire companies either to escape loca taxation, jury duty, or to secure social advantages, for in small towns the volunteer fire company often par takes of the nature of a social club. In many case fire service may be avoided by the payment of a fine. A State law should be framed which would define the position of the volunteer fireman and his qualifications for enrollment and to provide for severe penalties for non-attendance at fires. The State should also have regular supervision of the fire apparatus. Attentio to these matters would save an enormous fire loss.
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 nearesi 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. In many large cities firemen are instructed in the use of the special apparatus used in that city. No attempt is made to take up the subject of controlling and extinguishing fire as a science. In most cities the rules and regulations must be thoroughly studied by firemen before promotion, and his promotion is only given after examinations at which various questions relating to the saving of life and the control of fire are asked. This now obtains in nearly all cities, but there is no uniform standard. One city may have one set of rules and a city a hundred miles away may have another. The great fire departments of our large cities have a world-wide reputation, and justly so, but even their efficiency, which is conceded, would be increased by the presence of a coniderable number of the rank and file who were versed in the theoretical as well as the practical side of fire extinguishment. The general is always a better soldier for passing through West Point than the soldier who rises from the ranks.
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. It will be seen, from what has already been said, that there is room for a shool of fire extinguishment, either as a State or a na tional institution. A course of six months, with a practical daily drill, would insure the competency of the fireman and fit him to take charge of a fire house while a post-graduate course might be given which would fit the fireman as a battalion chief or fire chief
Such a school should be established in a great city like New York. Here the student of fire extinguish ment would find a paid fire department, maintained at an expense of upward of $\$ 2,000,000$ per annum, equip ped with the latest forms of apparatus. New York would give abundant material forstudy. It has streets in which the traffic is very congested; it possesses high buildings, which have added a new problem to the fighting of fire; it also has an extended river front giving the embryo fireman a chance for studying fires in boats, piers and grain elevators.
Great manufacturing plants, railroad stations, all mportant 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 city would also give an abundant chance for the examination of electrical plants and would enable the student to see how immunity is best obtained from fire caused by electricity, and the handling of a fire with out interference with the traftic of the street and elevated cars.
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. Lectures on chemistry with special reference to combustion should be given and the various methods of building discussed. Papers by prominent fire chiefs could be read, which would be of great value, as many of them are specialists in certain classes of fires. The legal aspects of fire could be treated and the duties of the fire marshal could be discussed, enabling the fireman in the small city or village to give valuable evidence before the courts on the incendiary origin of fires.
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 win dows by the explosive mixture of gas and air. The firemen should be taught to plug gas pipes with soap or pieces of wood. In another city the firemen misjudged the height of the dwelling house, and the short ladder which was run up nearly cost a life. Graduates of a fire school would be taught to gage distances accurately.
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 pres ent 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 lence to the first principles of good mechanical pracbeing prosecuted simultaneously in different sections tice
which extend over almost the entire length of the line, and it is expected the section betwern 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 freelystated 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 warrant; the launching of a few of these machines upon the market.
The idea of a chainless bicycle, as many of our readers vell 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 suibject, 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 varia-
tion in the chain line will not seriously affect the runtion in the chain line will not seriously affect the run-
ning of the chain and sprocket gear, a similar varianing of the chain and sprocket gear, a similar varia-
tion 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 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 righ tly, has shown, re sults 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 care-
fully 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

## 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 notan 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 sacceed 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 spiritual ism. 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 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 unpre judiced 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 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 occasional cases of it for 2,000 years and it is becoming far as observed, it obeys the laws to which every nascent faculty is subject. Many more or less perfect ex amples 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 bel 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 with-
out 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 retir ing-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 in silain groups of muscles are employed in routine orde $\begin{array}{ll}\text { in silent contraction. } & \text { By constant change other groups } \\ \text { are brought into use. } & \text { He has completed a systematiz- }\end{array}$ ed 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 privi leges 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 actor 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 expose 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 eve 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 ex pose 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 disanpearances, optical tricks, miscellaneous stage tricks, conjuring tricks, jug glers' and acrobatic performances, fire eaters and sword tricks, ventriloquism and animated puppets, shadow graphy, mental magic. Book II treats of ancient magic including temple tricks of the Greeks and their miracu lous 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 sub ject of Book V, a great deal of interesting matter is presented, never before brought together in book form, in cluding 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, illu sive and spirit photography, a multiple portrait, multi photography, 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 BrillatSavarin had not a soul above well dressed tripe for upper, 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 con clusions to be drawn from extensive experiments car-
ried out by Dr. P. Solomon, and published in statistical form by the United States Agricultural Depart ment. 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 Ninetysecond 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 diff culties 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 sub jected White Pass is jected. White Pass is th 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 tha it is almost impossible for a novice to carry a pack aver it The main pack back to the White Pas back to thas route is the long stretch o 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 I)yea 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 bowlders 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 carrymore 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 and northeasterly curren. Hence it is quite possible that the gold seekers may reach their destinatunes to their friends. The mail does find its way trom


THE TRANSPORTATION OF BAGGAGE ACROSS THE CHILKOOT PASS.

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 $51 / 2$ feet beam, and $31 / 2$ feet deep. Such a vessel pro pelled by four oars and a single sail hoisted on a rickety mast is calculated to carry five passengers and two ton of goods. If it escapes shipwreck in the rapids, it will answer every purpose, and carry its occupants til they reach the Klondike or are stopped by the ice Travelers who have found their way to Lake Bennet 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 carrie his life in his hand, but the journey really involves no more perils and hardships than hundreds encounte 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.num bers 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 ship ping into Ohio, unless first tested. Weed seeds are car ried and transplanted by birds and animals, by the wind, by currents of wate down streams and ditches, along highways and along railroad right of ways They are sometimes plant ed by foolish persons, and thus a start given them so that others may be afflict ed. Old fence rows furnish a steady and undiminished supply of weed seeds and so do old abandoned cor ners and uncultivated lots The railroad right of ways are the means of furnishing the farmer an inexhaustible supply of ob noxious weed seed; the right of ways being long narrow strips of land adja cent to so many differen farms, will soon seed such adjacent premises. The weeds are often permitted to grow on the right o ways until they go to seed The numerous trains car rying live stock seed the right of ways from one end to the other. This is de monstrated by the great variety of weeds growing around Chicago, where so many railroads center.Hon. D. J. Cable, in pape read before Farmers' In stitute, Harrod, ©hio

## Lucien Biart, who died

 recently, was a talented author, and although he chose to veil his scientifi knowledge in the form o novels, that knowledge was incontestable, says Natura Science. A great love of travel took him, in 1845, to Mexico, where he studied archæology and ethnogra phy. In addition to his nov els, the chief of which ar "Le Roi des Prairies," " Entre denx Oceans," etc. he wrote a volume on the red races for the Biblio thèque Ethnologique, as well as a monograph on the AztecsTHE SAVAGE RIFLE-SMOKELESS POWDER AND EXPANDING BULLETS.
The deadly effect upon game of sinall metal-covered expanding bullets, with high velocity smokeless pow der, has been recently satisfactorily demonstrated with a 0.303 caliber Savage rifle, using cartridges with a 0.303 soft nose expanding bullet. The ırifle and cartridge are manufactured by the Savage Repeating Arms Company, of Utica, N. Y. The flight of the bullet was pany, of Utica, N. Y. The fight of the bullet was several important advantages over the old large caliseveral important advantages over the old large cali-
bers 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 fined by small calibers. If a bullet is omitted from
one of these cartridges and the primer struck, no one of these cartridges and the primer struck, no
explosion of the powder will occur. The rapid twist 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 before and after being fired. This bullet weighs 185
grains. The metal covering is made of a soft light grains. The metal covering is made of a soft light
metal which does not injure or wear the rifling of rifle metal which does not injure or wear the rifing of rife


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 l)ullets, 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 dynamos 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 vas amount of work, and the extra handling of great quan tities of mail matter, as well as promoting quick dis patch. Another improvement, which will be particu larly agreeable to all travelers arriving from abroad has also been planned.
Heretofore letters addressed to passengers on incom ing 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 land ing, 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 accept able 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 diamete 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 ou 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 jew els 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 Carl Carl Engberg, of St. Joseph, Mich. The device is applied on the inside of the foot, and has an upper section made ing 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 arin forms virtu ally 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 a 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 especiall noticeable.

A NICOTINE ABSORBING, SMORE 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 repre sented 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 subbowl 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 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 Fi ir 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-six eenths of an inch wide, the arrangement in either caseaffording a long spiral path for thesmoke 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 he Hamburg line steamship Fuerst Bismarck, which was held since September, 1893, was lowered by forty-one 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 tornage 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, $23 / 4$ inches long, $11 / 2$ inches in diameter ; back bearing, $1 / 8$ inches long, $11 / 4$ inches in diameter ; nose of spindle, $11 / 2$ inches in diameter, 10 threads to the inch. Hole in spindle 916 inch, conforms to Morse taper. Swings over ways $101 / 4$ inches ; swings over rest 7 inches; distance between centers, $321 / 2$ inches. Cone has three sections : $314,43 / 8,51 / 2$, face $13 / 8$. Ratio of back bearing, $71 / 2$ to 1 .

The Origin of the weather Bureau*
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 news papers was directly due to Prof. Joseph Henry, who in 1849 had asked that these weather items be tele graphed for the use of the Smithsonian Institution in order that he and Espy might study the origin, development and progress of Arrerican 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 Smith sonian.
No man ever had a broader appreciation of science for its own sake, and also of science as a means of be nefiting mankind, than Prof. Jeseph Henry, the noble hearted first secretary and organizer of the Smith sonian. His natural gifts and his scientific researche were well known before he was elevated to this posi tion, 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; . 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 tew 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 build ing checked all further work in this direction. But
Henry's agitation of the importance of the subject did
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, Ferre was the only man who possessed clear views of the mechanical problems involved in the movements of he 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 at mosphere. 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 mounspectroscope, has given us such a solid observational basis that we can now begin to handle the problems of nature in a manner that pro mises partially to satisfy the demands of exact science.
If our universities would give dynamic me feorology a prominent place in their courses of study, it would greatly facilitate our future progress and the development of a new race of tudents. In the matter of observations, the most desirable improvement is the invention of some method by which to ascertain the actua condition of the air as to pressure, temperatur and moisture at a considerable height above he ground. When Prof. Moore shall be able to realize his ideal of obtaining, at any moment, the wind and temperature from any altitud up to two miles by means of kites or othe devices, we hope to have a satisfactory solution of this problem, and shall be able to apply th recent development of mechanical ideas to comprehensive studies of the atmosphere.

## Luminous Photographs.

These photographs, according to J. A. Ran dall, 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 decor ated with a luminous picture representing an alche mist at work. "There are several ways of making luminous photographs, the simplest being that of W. B. Woodbury. A sheet of cardboard is coate with a luminous paint and exposed to light unde a glass positive or transparency. On removing the cardboard to a dark room a striking and brillian phosphorescent image is seen, with all the gradations o the positive. The effect may also be produced by ar ranging a series of glass tubes containing a phosphor escent substance behind a thin glass positive. On ex posure 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 re sult.
"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 positble 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 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 be ore 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 print is soon destroyed by this process, for the sulphide
attacks the image. It can be applied to the carbon or attacks the image. It can be applied to the carbon or
other processes not havingsilver as a basis. Moonlight pictures and landscapes give the most striking effect as luminous photographs."

## Sorrespondence.

## 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 historica 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 heen 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 Kirckman, 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.

## Andree'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 $p$
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. Andree 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 signiflcant fact that, notwithstanding the extreme doubt of the safety of Andree, the French are already planning a second attempt to reach the north pole by
balloon. There should be a thorough study of the 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 Andree 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 Artiticial Diamonds.
Consul Germain, of Zurich, says: Diamonds of a Consul Germain, of Zurich, says: Diamonds of a
very small size have been produced artificially hereto fore, 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 are 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 process of the crucibly

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 continua tion 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. Kiements, sent out by the Siberian Geographica Society to the Khengai Mountains of northwest Mon-
golia, found a great glacier on the western slope of the golia, 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 Mino:, predominantly archæological, has been continued by young men of the University of Oxford.

The largest known flower is said to be the Raffiesia of Sumatra, whose diameter is nine feet, and which mells like a piece of putrid beef
On July 8 the Geographical Institute of Lisbon founded in commemoration of the four hundredth an niversary 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 to substitute pulverizers for powder puffs, to cover
the hair cut off with sawdust and have it removed at the hair cut off with sawdust and have it removed at
once, to wash their hands before working on a cusonce, to wash their hands before working on a cus
tomer, 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. Am monium sulphide brought them out again in full dis tinctness. 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 Oak land, has offered to bear the expense of sending Prof Charles Burkhalter, astronomer in charge of the ob servatory, to India to take observations of the solar eclipse next spring. The Buard of Education decided recently to grant Prof. Burkhalter leave of absence from October until May 1 with full pay. Prof. Burk halter 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 ex pects great results.
Emperor Francis Joseph, of Austriá, has given his consent to the union of the two great imperial libra ries at Vienna, the Hofbibliothek and the Kaiserliche Familienfideicommisbibliothek. 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 enor mous 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 cuta neous 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 encourage ment 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. der the Boylston Street mall of the Common at the interSome years ago the horse car system of the city of section of Boylston and Tremont Streets, where the Boston was converted into a trolley system and now Boylston Street station is located, as shown in one of the city is traversed in all directions by electric cars, our engravings. The four track subway extends northand the combined routes of various companies serve erly from this station under the Tremont Street mall to 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 over crowding 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 Tre mont Streets, where they ran at the side of the Public Garden and the Common. The congestion of traffic on these two streets wa very bad, and at times a solid line of car 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 decided upon a subway system under tric cars would be diverted from the surfac 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 ob jections 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 street bove
The subway act was passed in July 1894, by the Legislature of the Common wealth of Massachusetts. There was a per sistent fight made against it by an element of the community which was hostile to the construction June 15, 1896. The subway has been constructed under the direction of a coumission of a commmission of fiv men appointed by he Governor an the Mayor, th Hon. George G Crocker being the chairman. The completed work will cost some thing under $\$ 7,000,000$.
Having now briefly referred to brieny refer whoplan whole, we will
take up our engravings. Many of the salient fea tures of the sub way have been described in the Scientific American for August 31, 1895, and Sep 31,1895 , and Sep-
tember 5,1896, and in the ScIENtific American SUPPLEMENT June 29, 1895, No 017.

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

entrance to the subway in the public garden.

Street and Shawmut Avenue respectively. For a shor 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 Boylson Street station. The incline was illustrated in the Scientific American for September 8, 1896, this engraving showing the retaining walls which were construct ed upon concrete foundations. In this two track subway, in order to avoid lateral pres sure 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 at tention 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 asphal applied in turn to it. This asphalt water proofing was contimued over the roof. The pump chamber in the Public Garden con tains automatic electric pumps by means of which leakage and rain water are discharged into the street sewer. A masonry ventilat ing chamber has been constructed near the Boylson 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 mid
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,
point just below Temple Place, where the tracks eparate 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
 track subway.
Section 2 really consists of the Bolyston 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 fou ornamental buildings of chiseled granite, which somewhat resemble the stations used in Budapest for the underground railway. One of these is in tended for north bound passengers, one for south bound passengers and two for exit. The plan for re ceiving passengers at the sub way stations has been a matter of careful study, the desire of the off ials being to re duce to a mini mum the possi bilities of confu sion incident to a heavy rush o passengers. In the place of the surface ticket of fice, 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 tick ets. As the pas senger passes into the subway he will stop before ne of these of fices and obtain a ticket and re ceive a coupon which he retains until the conduc tor of the ca takes it up. Be tween the ticke offices are pas ages, each o which is wid enough to admit one person at a time. The sub of smooth artifi
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 lookin the outh on the track which urns 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 royston treet track just refred

bOYLStON street station looking south, showing the low level track through the fence.

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 engrav ing, which shows the south bound track divided where he 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 Am. S. C. E. standard, weighing 85 ponnds to the yard, with continuous joints. Each rail is protected by a guard rail, weighing 45 pounds to the yard. The rails are at different levels is a very interesting piece of engi-|feet below the street at Boylston Street, while spiked to oak ties. The ties are laid on broken stone, neering work, and will tend to avoid accidents and that of the north bound cars is only 22 feet below and carefully ballasted with it. Each rail is connected confusion. doubuace. These two subways converge into a by a copper bond. The ordinary overhead trolley sys double barrel subway opposite the new Hotel Tour- tem is used. An inverted wooden trough is fastened to rom the four track portion of Section 1, which is aine, both being brought to the same level before the iron work of the roof, and insulated with sheat north of Boylston Street, and the Park Street sta- reaching Eliot Street, where the two tracks are car- rubber. The trolley wire is supported by special boits


MAP SHOWING ROUTE OF BOSTON SUBWAY.
tion itself, which includes the loop. The station con- ried in a wide single arch subway. At Hollis Street and clips which are insulated. The system used does sists of two island platforms 250 and 275 feet long, the westerly track is depressed and branches into not differ much from that used in Brooklyn, where the respectively, and the platforms vary in width, the another double bell mouth. One side is for the south wires are suspended from the elevated structure. At greatest being 40 feet. Each platform is connected bound Tremont Street cars and the other for the present the current is taken from the underground with the street by two stairways. Loops are pro- south bound Shawmut Avenue cars, while the east feeder, but direct cables to the power station for sup vided so that cars running to Park Street can only be barrel rises until it crosses over the south bound plying current to the subway alone will be added. It sent on the return journey without the necessity of switching. Tracks are also provided for hold ing street cars for the rush hours, and also tracks with pits for making temporary pits ors In our repair. In our engravin the spectator is supposed to be looking north, and sees where the track, mences to turn the loop to return south. At the north ern end of the station, the two outside tracks, after passing around the loop converge into two sepa rate single track subways, which unite and go down Tremont Street tow ard Scollay Square. This part of the work is not com pleted as yet.
Sections 4 and 5, which are almost complete, con sist of two two track in clines, 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 sepa rate single track subways one for the south bound cars at a lower level, 39


GOUTH BOUND TREMONT STREET TRACK PASSING UNDER CURVE TO BOYLSTON STREET.
will be noticed that the subway is a direct continu ation 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 opera tion 600 incandescent and 55 arc lights are used. The are lights are used for light ing the stations. The sys tem of electric block sig als is in process of in tallation, and electric heaters are located in the ticket offices.
The Chief Engineer is Mr. Howard A. Carson The Boston Transit Com missioners are : George G. Crocker, chairman; Charle H. Dalton, Thomas J. Gar gan, George F. Swain Horace G. Allen.

We learn from the Re ue Scientifique that it is proposed to found an ex perimental station in Mad agascar, for the introduction of European cereal and the improvement of local vegetable produce.

## 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. He begins by placing the specimens in alcohol containing a little sulphuric acid. In this way they are sterilized, the albumen is coagulated and the water is replaced by alcohol. He afterward allows the fungi to dry in the air and then places them in oil of vaseline (liquid paraffine) to which five percent of phenol has been added. The fungi thus treated, says M. Tschirch, preserve their form and color admirably and do not change. If the colors are delicate and are capable of being extracted by alcohol, the caps must not be exposed to liquid alcohol, but only to the vapors thereof; after which they are put into the phenic vaseline. Red, however, cannot be perfectly preserved even with these precautions; but for all other colors the process, after a long trial, has proved a complete success.
The Speed of the Camel. -The "ship of the desert" enjoys the reputation ainong many people of going at a rapid gait and of covering great distances in a short time. Chasse et Peche (quoted by the Revue Scientifique) remarks that this is a great mistake. The camel which, according to tradition, carried Mahomet in four bounds from Jerusalem to Mecca, has evidently left no successor worthy of it, since the truth is that the present camels do not make more than about seven miles an hour, and, furthermore, do not keep up this gait for more than two hours at a time. Camel drivers claim that the animals could not do any better than this without danger, since, if they were forced, they might "rupture their hearts" and die at once. The camel, when forced or overdriven, kneels and will not budge under any consideration
'Irees 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; and, it may be added, the question is at present still very obscure.
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. Caspary does not look at the matter in this light; but Von Boss upholds the opinion in saying that the fact is explained by the perfect conductivity of the path thus offered to the lightning, and thinks that the trees oftenest struck are those that
have long roots. Jonesco remarks that, in reality, this has never been proved, and M. Hess adds that the true cause of such divergences results from the want of documents.

The first important data in regard to the question were given by Hellmann, in 1886, in his Beiträge zur Statistik der Blitzschläge in Deutschland. These confirm the common opinion that lightning strikes oaks especially, but seldom strikes beeches. In 1893 Dimitri Jonesco took up the question again from an experimental standpoint. Interposing between the two poles of a Holtz machine pieces of different kinds of wood of the same section and length, he determined the quan tities of electricity that the condensers had to be charged with in order to obtain a discharge. The following are the average corresponding quantities in electrostatic units. The fragments had been cut in January and February :

Linden (Tilia parvifolia)....
Scotch fir (Piuus sylveetris)
White birch (Betula alba)
Silver fir (Picea vulgaris)...
Beech (Fagus sylvatica)....
Along with these researches Jonesco took up a mi croscopic study of the woods utilized, and found that the quantity of oily or resinous matter that they con tained followed the same increasing proportion as thei resistance to the discharges. These researches accord well with the numerical data given by Hellmann. He therefore thinks that this is the true cause of the very marked difference that is observed between the propor tions of the different species struck by lightning. The conductivity diminishes in measure as the proportion of oils increases. Jonesco absolutely rejects the opin ion of Hellmann that the nature of the earth plays an important part in the phenomenon.
The poplar is not mentioned above, but it results from Jonesco's experiments that this tree is one of the best conductors of electricity. It has had that reputa tion for a long time. M. Colladon states that poplars planted near dwellings may, under favorable circumstances, form excellent lightning protectors, owing to their height and their conductivity for the electric fluid.
The Nest-kuilding 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 ac tivity 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. This explanation seems very whimsical, since it is difficult to believe that the young bird in its nest pays such attention to the structure of the latter, and, through the lining, perceives the ar rangement of the materials, and remembers the char acteristic method of manufacture. The construction of the nest must be attributed rather to a hereditary instinct, although the difficulties in the way of this view are also considerable. Mr. A. G. Butler, who discusses this question in a recent number of the Zoologist, has several times observed the fact that canary birds (the progenitors of which were subjected to the artificial life of the cage three hundred years ago), when set at relative liberty in an aviary, construct therein nests that are very similar to those built by their species in a wild state. It is unnecessary to say that this could not be a question of imitation, but one of hereditary instinct.
The Reproduction of the Truffie.-The manner in which the truffie 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. It would seem that the diffusion of the spores is effected by wood mice. M. Grimblot's researches are in a line with the experiments that are now being made by several land owners of Lot and Correze to ascertain whether the diffusion of the spores is not effected through the mestic animals of quick digestion. It is also thought that the moist heat to which the spores are submitted in the intestines of these animals is one of the factors necessary for the development of the spores of this valuable edible fungus.
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 coun try for more lawyers !" We should say so, responds the Legal Adviser. There are now in this "model republic" not less than 90,000 professional lawyers, or one lawyer
to every 800 of the population. In the greater cities, to every 800 of the population. In the greater cities,
the ratio of lawyers to other folk is still greater. In Chicago, for example, a recently compiled directory of lawyers shows that nearly five thousand lawyers are struggling for existence, or one lawyer to every 350 inhabitants. In half a dozen other American cities the ratio of lawyers to laymen is about the same. In other civilized countries the proportion of lawyers to possi ble clients is much smaller. France, with a population of forty millions, has only 6,000 lawyers $-1,000$ more than Chicago-a ratio of 1 to less than 5,000. Germany, with more than $45,000,000$ population, has but 7,000 lawyers-1 to about 6,500. In Great Britain the pro portion of lawyers to other folk is about the same.
Statistics show an amazing increase of annual "crop" of American lawyers in the last fourth of a century. In 3,054 stua schools reported 1,011 stade in 1894 7,600 students. Last year the reported number of law schools had swollen to 85 , and of law students to more than 10,000 . This rapid increase of the supply of lawyers certainly has not been the consequence of an increasing demand. Instead of increasing in the ratio of the increase of lawyers, the business and emolu-
ments of the legal profession have diminished. Mr. Edwards deems it "safe to say that, approximately fifty per cent of the ordinary revenues of the old time law office have been cut off in recent years. Since banking institutions have engaged in the semi-professional occupation of collecting claims and rents, and loaning money, and taking securities, and since the business of conveyancing, which at one time was in separable from a law office, is now no longer the neces sary adjunct which it was, lawyers have found their in come very greatly reduced." Moreover, the functions of the lawyer, obeying the inevitable law of evolution, have steadily tended to specialization and con entration. In Chicago and its environs, for exam ple, the bulk of legal business is transacted by hardly more than one hundred law offices, leaving more than four thousand lawyers to skirmish and forage for a pre carious existence as they can. It is the same in other opulous centers.
One of the fields into which this skirmishing for exist ence is carried by briefless lawyers is the production of more lawyers. The grand army of the legal skir mishers is annually increased by increase of the num-
ber of law schools-establishments not founded to make lawyers so much as to extract from deluded young men who bamboozle themselves with the ambi tion to become lawyers the means of subsistence for superfluous lawyers already made, or half made. The principle on which a prodigious number of these prolific law schools are based seems to be much the same as that of our political system, namely, that the less a man knows of the science and art of administration, the better is he qualified for the administrative service of government. The consequence is a steadily increas ing annual deluge of underdone lawyers cast upon the barren shore of a congested profession to struggle for existence in "ways that are dark and tricks that" are the reverse of elevating to American manhood.

## 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. "As to the physiologi cal functions of hairs," says Dr. Exner, "it is admitted that they are modified sense organs, which have lost all connection with the nerves. It is probable that in primitive man the distribution of the hair upon the body was irregular, and that the length, color, structure and thickness of the hair varied with functions for which it was intended. The hair which has been left upon the body in the process of evolution has been left there for a definite purpose. Certain hairs serve a organs of touch, notably the eyelashes, the bulbs of which are surrounded by a network of nerve fibers and in a less degree the hairs of the eyebrows. Both these serve to protect the eyes; for, being sensitive, they give warning of danger, so that reflex closure of the lids is produced. The eyebrows also prevent drops of sweat from running into the eyes, while the eyelashes keep out dust. . . . In animals the hair serves to maintain and regulate the heat of the body, but in man the hair of the scalp alone serves this purpose. Hair is itself a poor conductor of heat, and retains air also a poor conductor, in its interstices. The fact tha the forehead is not covered with hair Exner explains on the theory that in the contest between the natural ten dency of the hair to protect the head against changes of temperature and the tendency of human nature toward beauty, the latter has prevailed more easily, because the non-conducting properties of that portion of the skull are increased by the air-containing frontal sinuses, and that that portion of the head is easily protect ed from the heat of the sun by inclining the head for ward."

## 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 ext of about 300 B . C. its origin is forgotten and its invention attributed to the creator Brahma. Indian imitations of Greek drachmas prove that the Greek alphabet was employed in northwestern India before the time of Alexander the Great. Knowledge of the art of writing is established for the earliest Vedic period by one of the great works; and the grammarian Panini, who is assigned to the fourth century, men tions Greek writing and the words signifying writer The evidence of the canonical books of Ceylon indi ates that the knowledge of writing was pre-Buddhistic and passages in the Jataka and in the Maha Vagga prove the existence, at the time of their composition, of writing schools and of a wooden slate, such as is stil used in Indian elementary schools. Writing, as a sub ject of elementary iustruction, is also mentioned in an inscription of the second century betore Christ. The palæographical evidence of the Asoka inscription cleariy shows that writing was no recent invention in th third century before Christ; for most of the letter have several, often very divergent, forms, sometimes nine or ten.

The Cramps, Annual Report.
The William Cramp Ship and Engine Building Company, of Philadelphia, makes this report for the fiscal ear ended April 30 :

| Gross earnings . ......................... ............... $\$ 4,500,000$ |  |
| :---: | :---: |
| Proft. | 770,000 |
| General expenses, including interest, taxes, insurance, etc. | 340,000 |
| Profit for year. | \$430,000 |
| Capital stock............. ...................\$4,848,000 |  |
| Bonds and mortgages...................... . 300,000 |  |
| Debt paid off during year. | 995,000 |
| Balance unpaid of Drexel \& Co. notes. | 750,000 |
| Due from United States and others. | 1,675,000 |
| All current debts due. | 1,350,000 |
| Excess of cash and cash items......... ............ \$325,000 |  |
| Total assets of company. | 7,800,000 |
| Total liabilttes, | 6.675,000 |
| Credit and proft and loss. | \$1,125,000 |
| Material on band. | 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 illuproduced upon the spectator after witnessing the illu-
sion 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


Fio. 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 thescene 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 $\mathbf{E}^{1}, \mathbf{E}^{2}, \mathbf{E}^{3}, \mathbf{E}^{4} . \quad \mathbf{F}$ 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 dines, $G$, the spectators see lines, G, the spectators see
through the opening of the 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 $\mathrm{E}^{1}$ and $E^{2}$ are reflected so that they appear to be the walls they appear to be the walls
$E^{3}$ and $E^{4}$. There is another $E^{3}$ and $E^{4}$. There is another
suit of armor at $I$. It is placed suit of armorat 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

* Copyrightted, 1897, by Munn \& Company. From " Magic : stage llusions and Scientific Diversions, including Trick Photography." Just


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 thesilver nitrate solution, as it does at lower levels. prise about 7,500 miles.

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 waterfreed 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 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 im purity can then be ascertained by ordinary methods, purity 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 Zeit schrift. 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 been made for twenty years past at Höchenschwand, a
station in the southern Black Forest, at an altitude of 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 couditions (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 ditions. Cleaning the air by means of ran 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 views of distant mountains, are most likely to be fol lowed by rain. Schultheiss has investigated this ques tion in the case of the Alps as seen from Höchen schwand, 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 tine and does not include large quantities of coarser smoke particles,

The Chilean government telegraph lines now com-

## Bathing: Its Relation to Diseases of the Respiratory Tract.

Chronic catarrhal disease of the nose, throat, bronchi r lung is rarely, if ever, the outcome of one attack of acute inflammation, properly cured. No; we get a history 'in these cases of repeated inflammation, with careless or neglected treatment, each a little more severe than its predecessor and none quite cured before its successor had appeared, gradual extension of the trouble, pathological changes, lesions forming, until finally the disease is chronic, inveterate, and a long course of treatment, operations and a change of climate are necessary to restore the mucous membrane to as nearly as possible its former normal standard. I believe that in the majority of these cases the renewed colds, the exacerbations which render catarrhal diseases so prevalent and so intractable, are due, not so much to the variations in climate as to the imprudences people commit, knowing these changes are liable. The three most prolific favoring causes of respiratory disease are injudicious clothing, superheated homes and hot
bathing, local or general. The last (being my text) I bathing, local or general. The last (being my text) I
am emphatic about, because I find in people who look am emphatic about, because I find in people who look succession of colds, sore throats, or coughs from fall to spring-when I abolish the hot bath and substitute the cold, that they promptly become less susceptible; colds become less frequent or cease altogether and my treatment for any existing chronic trouble shows an efficacy in marked contrast to what it had been accomplishing.
In speaking of cold bathing I do not necessarily mean the full cold bath, for it takes a person of strong reactive powers to take a cold morning plunge in winter with benefit, although robust people and some not so hearty seem to thrive upon their use. I do not think, however, that they are generally to be recommended
My special reference is to the bathing of the face, neck, and chest, night and morning, with cold water. The addition of a handful of salt to the bowl of water greatly enhances the effect and should not be omitted. A washcloth of Turkish toweling should be used, as a sponge gives no friction. The water should be hydrant cold. The face, neck and chest should be briskly but thoroughly bathed and then dried by active friction with a Turkish towel and the bather dress rapidly or retire, as the case may be.
The very activity of the proceeding is in itself healthy exercise, which would doubtless not be taken were it not for this incentive. The circulation is stimulated deep respiration is induced, the arm, back and chest
muscles are developed, the skin is left tingling with a healthy glow, but not the warm, soft, perspiring, sus eptible redness of the hot bath.
We are creatures of custom. The stoker can stand the terrific heat of the engine room becaus he is used to it. The policeman grows hale and hearty pacing the cold streets, because he is so constantly exposed. So it is in this matter of cold bathing. The face, neck and chest become accustomed to cold and dampness by a safe method-the daily cold, salt bath. The skin is thereby stimulated and hardened by a sys tem, so to speak, of daily exposure, so that the sudden contact with lowered temperature, draught or storin
does not shock it; hence no chill, and "colds" are avoided.
The surface soon becomes inured to cold and the perambulating shiverer, the man who invariably sneezed when he stepped from the street car, to whom the fre quent nip of whisky seemed a preventive necessity the man who went cringing along the streets in winter with his head so buried in his overcoat that his best friends could not recognize him out of doors, now dis cards his muffier, turns down his coat collar, holds his head erect.and exposes his face and neck to the blast buoyed up by the crisp air, instead of shrinking from it as before-now fairly reveling in the nipping br
He ceases to be the perennial prey of the laryngolo gist and the wilds of New Mexico shall know him not.gist and the wilds of New Mexico shall know himnot.-
H. Worthington Paige, New York, in the Southern H. Worthington Paige
California Practitioner.

## The Psychogenesis of Fear.

Fear is a psychical condition which has received comparatively scant attention at the hands of psycholo gists, common as are its manifestations and obscure a is its mechanism, says the Medical Press. Transcend ental philosophers regard fear as the automatic stim ulus for a reflex co-ordination of movements intended to protect the organism against impending injury, bu the moment we begin seriously to scrutinize the out ward and visible effects of this condition it become painfully apparent that, far from aiding escape from danger, it is often per se the direct and immediat cause of disaster. Angelo Mosso, in his very fascinat ing treatise on this subject, reiterates Haller's view, that the phenomena of fear common to all animal are not conducive to the preservation of the timid but] rather to their \destruction, it being part 'of the
law of nature, as understood by him, that animals de

## stined to be the prey of others should not be able to

 defend themselves easily.Without committing ourselves to this somewhat brutal hypothesis, it is a matter of common observa tion that fear renders the individual more vulnerable to attack, and, for the time being, subordinates the will to the influence of conflicting and often incom prehensible emotions. It is suggested that the kneel ng attitude universally adopted in prayer is to be as ribed to the physiologic fact that strong emotions cause a sudden trembling of the legs and oblige us to sink to the ground. Darwin, in his "Expression of the Emotions," attributed a preponderating import ance to the will as the cause of expression; but, as the author remarks, what many call free will is only a fatal necessity, an indissoluble chain of causes and ef fects, of physical and mechanical actions ; of automatic and unconscious reactions, in the living machine Hence, in studying the expressions of fear we must look to the reflex nervous apparatus, which alone canlexplain he explosive suddenness of the phenomena of acut ear. Physiologists recognize that stimuli accumulate in the spinal cord, when becomes slowly charged like a Leyden jar, until suddenly discharged by a contac or by some very slight impression. When we have something in the throat which tickles us, the sligh and at first scarcely perceptible irritation by and by be comes intolerable, and in the functions of reproduc ion the repetition of slight stimuli produces 'greate and more and more uncontrollable reflex movements. Such an explosion seems out of all proportion to the momentary and trivial cause, but this is because we overlook the fact that the force has been accumulating until, to borrow an expression from physics, its tension is greater than the pressure of the will. It is, he ob serves, the \{quantity, not the quality, of the stimulus which determines the intensity of the expressions. Prof. Mosso suggests that nature has been unable to find a substance for brain and spinal cord which should be extremely sensitive and yet should never, under the influence of strong stimuli, exceed in it reaction those physiologic limits which are best adapt d to the preservation of the animal. Be this :as it may, fear may be described as a chaotic explosion of emotions due to an irregular, and therefore imper fect, supply of blood to the brain. Every action is preceded, every thought is accompanied, by vasomoto dilatation of the vessels in the brain, the distribution of the area of vascularization being determined either by the controlling area of consciousness or by the re by the controlling area of consciousness or by
percussive influence of some external stimulus.

## RECENTLY PATENTED INVENTIONS.

 Rallway Appliances.Air Brake Alarm Cock.-Adam Mcntosh, Albany, N. Y. This improvement comprises a opening and closing in unison with the opening and opening and closing in unison with the opening and
closing of the signal pipe cock, the auxiliary cock being connected with the alarm and with the signal pipe. The device is of simple construction, and the arrangement is such that the train pipe nozzle cock and the
cock for the sigaal pipe cannot be closed without givcock for the signal pipe cannot be closed without giv-
ing an alarm to the engineer and the conductor of the ing an
Railway Gage Bar.-Peter Olson, Field, Canada. An adjustable tie rod is provided by his invention for connecting the rails of a track, the length of the rod beng adjustable to accommodate it to
the different gages used on curves. It comprises two bars having hooks adapted to engage the onter edge of the rail base, means for drawing the bars inward, while other bars slide upon the first ones and engage with the inner edges of the rail base. With this device the tendency of the rails to spread on curves may be quickly and the ties, the rails being drawn together by driving a wedge.
Railway Signaling. - Georges De Bengy Puyvallee and Joseph Ambroise Meunier, Paris, ray signals on inventors, which comprises the placing of the signals along the line and on the locomotives into mechanical relations with each other, to warn the drivers when the line is blocked, and at the same time keeping a record of such notifications. The invention also enables trains to the line is blocked, to protect their passage from the rear, and to release the signals after passing a sufficient distance.

## Bicycles, Etc.

Bicycle Change Gear.-Bernt T. Nedland and Christian Fredrickson, Westby, Wis. This is a device applicable to any form of bicycles, a beveled gear having concentric rings of beveled teeth being at-
tached to the crank axle, while a shaft with beveled tached to the crank axle, while a shaft with beveled
pinions may be connected or disconnected therewith by pinions may be connected or disconnected therewith by
means of a pivoted lever having segment arms composed of concentric and eccentric surfaces. The shifting device is controlled by a single lever, and it is inpossible to have more than one of the pinions in engagement with the gear wheel at the same time, the change being quickly

Bicycle Handle Bar and Tool andle.-Karle H. Granger, South Weymouth, Mass A flexible or yielding band grip is afforded by this invention, whereby the vibratory movement of the handle bar or handle will not affect the hands, the grip surface con-
sisting of a series of inflatable members preferably placed
in spiral arrangement. The handle section is wrapped
around by tubing at whose inner end is a valve, by which around by tubing at whose inner end is a valve, by which
the tube may be inflated with air, water, or any material which will render the coils elastic. The improvement is also applicable to bicycle pedals, foot cushions, and for many other uses.

## Mechanical.

Crushing and Grinding Mill. Wriliam H. Coward, Erith, England. This mill has a grinding or rubbing action as well as a crushing action, the roller and drum being caused to revolve at different surface speeds, means being provided to enable their relative surface speeds and the distance between their acting surfaces to be varied to suit the material operated on. Improved means are also provided for conveying the material to and repeatedly passing it beneath the
crushing roll, to increase the area of the gage plate when the crushed ore is to be concentrated, and to insure the return to the drum of the grosser particles which may be carried off with the blast when the gage plate is not be carri
used.
SAW
SAw Set.-Henry Neidhardt, Brook-
yn, N. Y. This device comprises a standard which supports an anvil, a pressure lever being pivoted in the
standard and a setting dog which is operated by the pressure lever. A holding lever is also pivoted in the standard and a lever engaging with the holding lever, there being a yielding connection between the latter lever
and the pressure lever. The device may be operated with comparatively little power or
and accurately set the teeth of a saw.
Tool Holder.-John M. Richardson, Daingerfield, Texas. This is a device in which any form quickly and conveniently placed and firmly helf agains turning or moving in any direction. The holder has a slotted socket in which a shank is arranged to enter, the shank having lugs for engagement with the walls of the slot in the socket, a key being shaped to fit the slot. A clip, which may be integral with
latter from leaving the socket..

[^0]a gravity arm normally holding the damper on the
strings, the hammer on its forward stroke releasing the amper and permitting it to move by its own weight out of engagement with the strings. No springs of any
kind are necessary, the entire arrangement being so balkind are necessary, the entire arrangement being so bal-
anced that the slightest touch of the key will actuate the hammer and damper, so that great lightness of
touch is readily acquired by the performer. The improvement is adapted for use with both square and upright pianos, and is designed to greatly increase the power and volume of tone of the instrument.
Sash Holder. - Theodore Martin, Wallaceburg, Canada. This device can be readily at-
tached to a window frame to securely hold either the tached to a window frame to securely hold either the
upper or lower sash as desired, and to form a lock to upper or lower sash as desired, and to form a lock to
prevent the sash being opened. It consists of a crampprevent the sash being opened. It consists of a cramp-
ing cam lever with projecting lug, surrounded by a ing cam lever with projecting lug, surrounded by a
rubber ring on its binding end, while a retaining plate rubber ring on titallel to the lever on the outside of the rubber ring. The retaining plate has at its rear edge a laterally projecting lug extending inwardly toward the lever and in rear of and crimping and pinching the rubber ring on
its rear side, whereby it is more firmly held and preented from slipping in its seat.
Scuttle Cover.-William L. Springer, Chicago, Ill. A cover hinged on the skylight casing, ac with the casing, each stay being formed with torecting it with the casing, each stay being formed with two link
pivotally connected with each other and with the cove pivotally connected link each other and with the cove the cover is closed and to hold the cover in a nearly vertical position when the links are extended. 'The device is strong and simple, and permits the ready opening of the cover to its full extent to form a convenient pas age from within to the roof of a building.
Bedstead.- Augustus E. Strang, Salem, Oregon. An iron bedstead with tubular side rails
and angle iron end rails, according to this invention, is and angle iron end rails, according to this sinvention, is made very durable when the parts are assembled, while it may be readily taken down for transportation. The side and end rails are joined to the posts by nove clamping devices which make the
a very rigid and strong structure.

## Designs.

Suspender End. - William Bloomberg, New York City. The clip forming part of this tapes connected with the body portion of the loop.
Skirt Holder. - Robert M. Steindler, New York City. This design provides an elastic bicycle
kirt holder of neat appearance and ready application.
Game Board.-Roswell A. Dandaraw and George E. Gordon, Rensselaer, N. Y. This board is a series of shorter barriers crossing the main barrier, forming a group of pockets open upon one side.
Parcel Carrier.-John P. Smith,
connection with bicycles, and consists of a central loop and return lateral arms terminating in hooks.
Nort.-Copies of any of the above patents will be
furnished by Munn \& Co send name of the patentee, title of invention, and date send name of
of this paper.

## NEW BOOKS, ETC.

$\underset{\text { Maximum }}{\text { Bridges. }}$ Sy William Cain. New Bridges. By William Cain. New 1897. Yp. 23. Price 50 cents.

The matter which forms the basis of the present book
appeared originally in the Van Nostrand Magazine of appeared originally in the Van Nostrand Magazine of
1878, and was largely concerned with the comparison of 1878, and was largely concerned with the comparison o weights of bridges and their most economical depths.
These subjects have now been practically solved by These subjects have now been practically solved by
bridge engineers and the result has been the elimination of many types of bridge trusses once popular and the re tention of certain leading forms that have proved mos economical and otherwise desirable. The present edi tion of this work confines itself to the discussion of the types most used at present, and the aim has been to aid the student, in presenting the subject in a simple, clear and at the same time thorough manner. It
less prove of interest to all bridge engineers.
A New Work on Mechanical Draw
ING. In 24 parts. By J. G. A.
Meyer. Arnold Publishing Com pany. Price 50 cents.
The fifth and sixth parts of this interesting work on the general principles of machine design are at hand, continuing the illustrated rules and computations for strength and form of general machinery, and with a
practical lesson in steam engine design in each number The Engineer's Sketch Book of MECHANICAL MOVEMENTS. DEVICES, Appliances, Contrivances and and Construction of Machinery FOR Every Purpose. By Thomas
Walter Barber, Engineer. Third edition, considerably enlarged, with 2603, Illustrations, Descriptive Note
and Memoranda. London: E. \& F
N. Spon, Limited. New York: Spon \& Chamberlain. 1897 . Pp. 335 .
Price $\$ 4$. This book cannot but prove of great value to every en ineer and inventor. Every successful engineer is a born
inventor; indeed, the daily work of an engineer in prac tice largely consists in scheming and devising from pre vious experience new and improved processes, method and details for accomplishing them and for simplifying and cheapening the old forms of machinery and the work they produced. In the work of designing machinery, the draughtsman has to rely mainly on his memory for inspiration, and for lack of an idea has frequently to
wade through numerous volumes to find a detail or move ment to effect a particular purpose. His labors, as well as
those of the engineer, would be greatly simplified by the present book, which is indispensable to every draughts
man. It contains 2603 engravings, giving almost every pos mible mechanical movement or contrivance which is liable to be called for in a drawing
The Process Year Book for 1897. Vol London: Penrose \& William Gamble York: G. Gennert. Pp. 127. Price $\$ 1$. This is probably the most beautiful of any of the photographic annuals. It is superbly printed on the fines some of the fiuest work of the year in photo-engraving
and photo-color work. The articles are very practical and photo-color work. The articles are very practical
and cannot fail to be of great use to the process worker. and cannot fail to be of great use to the process worker
The annual is a superb picture book, and shows tha each year process work is obtaining a firmer foothold.
a Practical Treatise on Minera OILS AND THEIR BY-Products. By
Iltyd. I. Redwood. London : E. \&
F. N. Spon, Limited. New York
Spon \& Chamberlain.
N Spon \& Chamber
xiv, 336 . Price $\$ 6$.
This is an important work and devoted particularly to
the Scottish shale oil industry, and will doubtless prove the Scottish shale oil industry, and will doubtless prove of value to the oil manufacturers of the United Statee
The chapters deal with the geology and geographical distribution of oil-bearing shales, the theoretical and practical side of refining, distilling, etc.; ammonia water
the laboratory, etc. There is also a iist of patents relat the laboratory, etc. There is also a iist
ing to the Scotch mineral oil industry.

SCIENTIFIC AMERICAN
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SEPTEIBER, 1897.-(No. 143.)
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No. 3. Ressdence at Scranton, Pa., recently erected fo Mr. Thomas R. Brooks. A unique design. Mr. John A. Duckworth architect Scranton, Mr.
Pa.
Elm Par
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No. 7. Modern cottage at Nyack, N. Y., recently erecte for the Rev. Edward Mitchell, at a cost of
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No. 13. Miscel
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also has
trated.
(7207) D. M. asks: 1. Has the curious behavior of the gyroscope been fully explained? A. Yes, ully and completely by the aid of mathematics. In eneral, it is due to the fact that the disk is rotating in
wo directions at the same time, one as it spins rapidy wo directions at the same time, one as it spins rapidl of support upon the pin. The result is that it makes a here motion of descent like a winding stairway. 2. whom, when, and where was it invented, and what is the meaning of the word? A. No such word is given in the Century Dictionary. "Multiplying glass" and "poly-
scove" are given. All three would imply the same cope" are given. All three would imply the sam
hing-seeing many objects. The name is applied to ling-seeing many objects. The name is applied to glass flat on one side, while the other, at first curved
like a lens, has been ground into facets, or flat places. on looking through it at a candle, for example, as man lights appear as there are flat places. It is used as a toy
If the word you suggest were formed, it should be pelled "multascope"
(7208) W. M. B. asks: Kindly inform me through your paper of the best formula fora develope for lantern slides. Also the method used in coloring
hem. Please mention the best and latest book on the making and coloring of lantern slides. A. Valuable in formation about making and coloring lantern slides is contained in our Scientific American Supplement
Nos. $433,577,594,657,699,961,1062,1082$, and 1116, ice 10 cents each by mail.
(7209) J. W. asks : Does a base ball curve horizontally, i. e., laterallv, after leaving the hand of pitcher, before striking its object 9 . If it does, kindly ex-
plain the cause, whether it is the rotary motion of the plain the cause, whether it is the rotary motion of the
ball or what. A. The ball curves as described. Information on this subject, illustrated by diagrams, etc., will be found in Scientific American, No. 5, vol. 55; also be found
Supple
mail.
(7210) C. A. C. asks: How can I make starch for starching shirts in a steam laundry, so they nough. Also, pe starch alone will not make them stim polish for shirts and collars. A. Information on starch ng will be fornd in SUPPLEMEENT, No. 577; recipes fo glosses (liquid and powdered) are given in the "Selected
Formule" columns of the SUPrLEMENT, Nos. 1127 and 129. Price 10 cents each, by mail.
(7211) B. S. D. asks : Can you inform me whether the method of developing photographic method or not? A. There is no from the ordenan needed; an ordinary metol hydroquinone potash or sod developer will answer. (See our SUPPLEMENT, Nos. 541 714 and 1050. Price 10 cents each, by mail.) Keep the tray covered and as free from any light as possible, only examining progress of image at very brief intervals. 2 What is the simplest way to prepare formic aldehyde A. No simple way. Can be bought from dealers in ph
to. materials in New York City easier than to to. materials in New York City easier than to make.
Of what are ferrotype plates composed, and what is the
process of their manufacture \& A. Ferrotype plates are
made of thin sheet iron, covered with a black made of thin sheet iron, covered with a black, smooth
varnish, which is baked or enameled on. Thes are made in large quantities by manufacturers. The prepared of silver bath, just before exposure in the camera, and it is then immediately developed with a solution of sul phate of iron and acetic acid.

## TO INVENTORS.

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    short depending rear bar ladapted for adjustable connection with a foot or sole piece, pivoted at its front end to the lower end of the standard, the rear end of the sole piece having an upturned portion. The sole piece extends for a considerable distance on a straight line back from the blade, and the latter may be of the sweep form or monldboard for
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