SCIENTIFIC AMERICAN

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

Vol. LXVI.—No. 17. ESTABLISHED 1845. NEW YORK, APRIL 23, 1892. $3.00 A YEAR. WEEKLY.

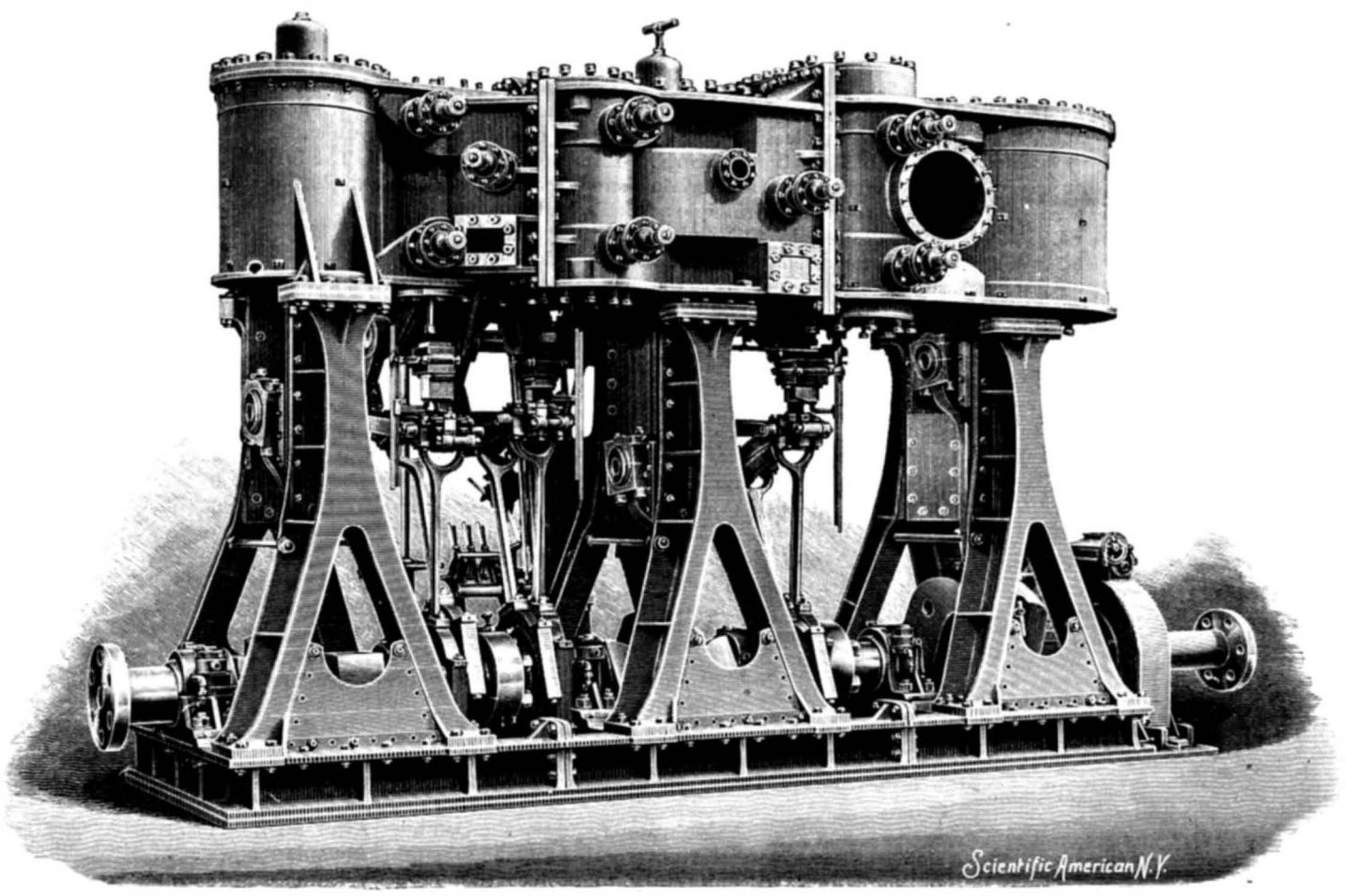
ENGINES OF THE MONTEREY.

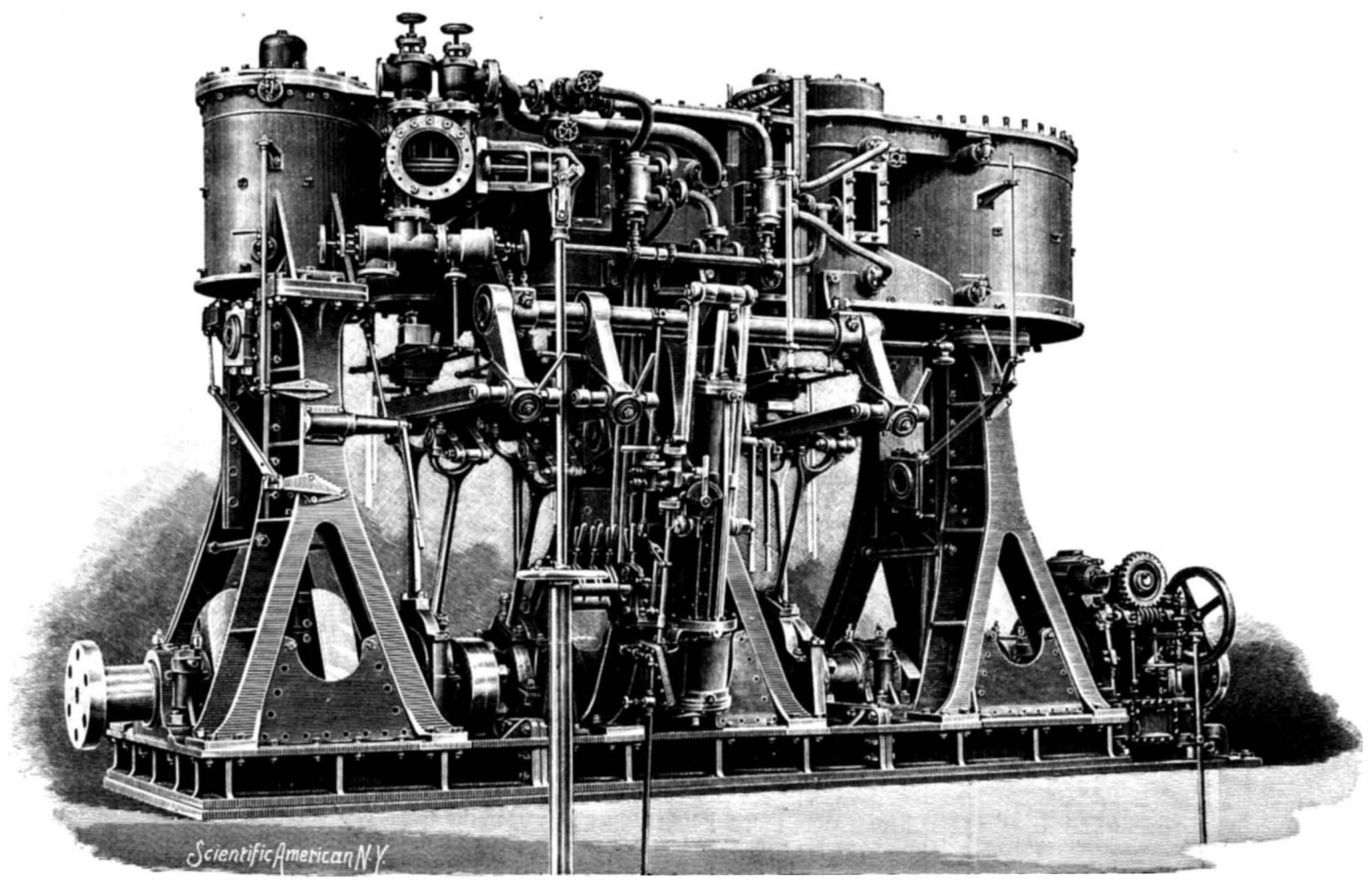
The pair of twin-screw vertical triple-expansion engines shown in the illustration were designed for the United States armored coast defense vessel Monterey, now approaching completion at the Union Iron Works, San Francisco. The first armor plate of the water line belt was put in place on the vessel only a few days ago, it being of American manufacture, of a grade of nickel steel which has withstood the severest tests, and the great twelve and ten inch guns which form the principal portion of her armament are all substantially finished, so that this splendid vessel will soon be practically ready for service.*

The engines will have 5,400 indicated horse power, with 150 revolutions per minute and a steam pressure of 160 pounds. The cylinders are 27, 41, and 64 inches diameter, respectively, and 30 inches stroke. The high pressure cylinder is forward in each engine, and has one piston valve 14 inches in diameter, the intermediate pressure cylinder having two of 14 inches and the low pressure cylinder two of 20 inches, all worked by Stephenson double-bar links. The cylinders are supported by cast steel inverted Y frames secured to cast steel bed plates. The crank shaft is of forged steel, in three interchangeable sections, with 4 inch axial holes through shafts and crank pins. The journals and crank pins are 11 inches diameter. The line, thrust, and propeller shafts are 10 inches in diameter with a 4 inch axial hole. The screw propellers, of manganese or aluminum bronze, are three-bladed, and are 10 feet

(Continued on page 263.)

* For illustrated description of the Monterey see SCIENTIFIC AMERICAN of December 19, 1891.





TRIPLE EXPANSION ENGINES OF THE NEW UNITED STATES ARMORED COAST DEFENSE VESSEL MONTEREY,

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
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MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

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NEW YORK, SATURDAY, APRIL 23, 1892.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 851.

For the Week Ending April 23, 1892.

Price 10 cents. For sale by all newsdealers.

A PROPOSED CONGRESSIONAL RESOLUTION RELATING TO PATENTS.

Representative Stout, of Michigan, has introduced in the House a resolution on the subject of the Bell telephone patents. A preamble to the resolution recites that the original patents of the American Bell Telephone Company will soon expire; that the company has been and is now the owner of certain devices, upon one of which, the Berliner transmitter, an application for a patent was filed in 1877 and the patent not issued until November 17, 1891, and that it is alleged that the final adjudication of those pretended rival claims has been delayed by the owners for the purpose of giving another term to an enormously lucrative patent. The resolution, therefore, requests the Committee on Patents to ascertain "whether any modification of the patent law is necessary to protect the public against undue monopoly, and report by bill or otherwise."

It is true, as set forth above, that soon after the Bell Telephone Patent was granted, March 7, 1876, another application for a patent for a telephone was made by Emile Berliner, to wit, on June 4, 1877, covering ground almost as broad as the Bell patent. This application of Berliner was sold and assigned to the Bell Co., was then kept back and held pending in the Patent Office for over fourteen years, and then issued, to wit, on November 17, 1891. So that the Berliner patent will run for seventeen years from that date.

Notwithstanding the clearest proofs that Phillip Reis, of Germany, had invented and put in successful operation an electric telephone in 1860, or sixteen years prior to Bell, but differing in form from Bell's; notwithstanding that an electric sound receiver, working on the very same principle as Bell's, had been invented and patented in this country by Royal E. House, in 1868, the Supreme Court of the United States upheld the Bell telephone patent in the broadest possible manner, and by its judgment practically debarred all other persons from making, using, or selling an electric telephone. Thus was created by judicial act one of the greatest monopolies of modern times. The Bell patent expires next year, March 7, 1893; but its holders are calculating that the new Berliner patent will practically give them an extension of their monopoly for fifteen years longer, or until the year 1908; and if the Supreme Court should be as willing to sustain the Berliner patent as it did the Bell patent, then the public will be cornered again and subjected to this prolonged corporate squeezing.

Bell's original patent consists substantially in connecting two diaphragms electrically in such a manner that when one diaphragm is spoken to, the other diaphragm will correspondently vibrate, thus producing in the ear the sensation of sound. The same thing was done by Reis and House and is done by means of the new Berliner patent; but the Berliner apparatus is different from Bell's, and for transmitting the voice is better than Bell's.

The Congressional resolution requests the Commissioner of Patents to ascertain whether any modification of the patent law is necessary to protect the public against undue monopoly, etc.

By undue monopoly we suppose is here meant such transactions as the holding back of the Berliner patent so as to spring it upon the public about the time the Bell patent expires, with a view to extend the telephone monopoly.

For the benefit of all concerned, we will suggest a couple of little amendments to the patent laws, which will not only prevent all such tricks as the above, but will save the Patent Office and inventors a world of trouble, put an end to vexatious delays in the grant of patents, and stop the expensive litigations, now rendered necessary in many cases, in order to obtain a patent.

The present statute relating to official examinations reads as follows:

"Sec. 4893. On the filing of any such application and the payment of the fees required by law, the Commissioner of Patents shall cause an examination to be made of the alleged new invention or discovery; and if on such examination it shall appear that the claimant is justly entitled to a patent under the law, and that the same is sufficiently useful and important, the Commissioner shall issue a patent therefor."

Our suggestion is that the above section be amended so as to read:

"Sec. 4893. On filing of any such application and the payment of the fees required by law, the Commissioner of Patents shall cause an examination to be made of the papers relating to the application, and if on such examination the papers are in proper form and the invention claimed is for a useful purpose, the Commissioner shall issue a patent therefor."

The effect of this slight amendment would be to dispense with the present system of official examinations into the novelty of the invention, and place that duty where it more properly belongs, namely, upon the applicant or his agent. When the present patent laws were enacted in 1836, such examination by the applicant was well nigh impossible, because the patents were not printed. But now they are printed, are easily accessible to the public, and examinations may be readily made by any skilled person.

This proposed change would relieve the Patent Office from a vast amount of labor, enable it to issue patents promptly to every applicant, prevent the holding back of cases on legal or technical grounds, and prove of the highest advantage to the public and to inventors.

The adoption of the above amendment would involve the repeal of the section relating to interferences, which reads as follows:

"Sec. 4904. Whenever an application is made for a patent which, in the opinion of the Commissioner, would interfere with any pending application, or with any unexpired patent, he shall give notice thereof to the applicants, or applicant, and patentee, as the case may be, and shall direct the primary examiner to proceed to determine the question of priority of invention. And the Commissioner may issue a patent to the party who is adjudged the prior inventor, unless the adverse party appeals from the decision of the primary examiner, or of the board of examiners in chief, as the case may be, within such time, not less than twenty days, as the Commissioner shall prescribe."

The repeal of this section and the doing away of novelty examinations would put an end to the expensive legal proceedings which the Patent Office is now obliged to carry on, and relegate the same to the courts, which is the proper place for such adjudications. The repeal would also render it impossible for any powerful Bell monopoly to keep an undue grasp upon the public.

The further advantages of these simple amendments we shall take occasion hereafter more fully to discuss.

THE SEVEN AGES OF OUR WORLD.

In a recent issue of the SCIENTIFIC AMERICAN we fully illustrated a scientific lecture entitled "A Trip to the Moon," which was given at the Carnegie Music Hall, in this city, for several weeks in succession.

This interesting lecture has been followed by another entitled "The Seven Ages of Our World, or from Chaos to Man," which is illustrated in much the same way. The lecturer began his discourse by stating the general belief of astronomers and physicists, which is to the effect that the earth must have existed at one time in a state of vapor, that is, it was merely a nebula, that gravitation asserting itself drew the nebulous particles nearer and nearer together until finally the matter assumed the shape of a sphere, that being the form which permits of the nearest approach of every particle of a mass toward the center of attraction.

The first scene, entitled Chaos, when first presented, is merely a mass of rushing vapors, accompanied by surging and seething sounds, indicating great activity in the chaotic mass. Gradually, and while weird colors play upon the vapor, it subsides, showing a globe with an unstable crust. The first land then appeared. After an interval, representing millions of years, the Devonian age was illustrated by a scene in which were volcanic eruptions, electrical displays in the form of lightning, and all of the seething, rumbling sounds which accompany a volcanic eruption. After another interval representing a few millions of years, a magnificent scene was presented, representing the carboniferous age, in which huge moss and rush-like plants were seen.

This was followed by a scene representng the formation of coal. The dense poisonous gases upon the earth at this age having been largely absorbed by vegetation, the supply of carbon in the atmosphere was so far diminished that it was insufficient for the support of these gigantic plants; consequently, they decayed and fell, forming the foundations for the coal beds which have been discovered in the more recent days of civilization. Next was presented a Permian landscape, which was followed by another scene representing the age of reptiles, and showing the monsters of the Jurassic time. Some of the creatures shown, the lecturer said, must have weighed 20 tons. Many remains of the larger reptiles of this age have been found in the western portion of our own country. Then followed a landscape of the Cretaceous era and a view at the bottom of a chalk sea. Then the audience was presented with a view representing the dawn of the modern world, showing a scene which the lecturer said might well be located in Central Park or some of the environs of the city.

In the illustration of the age of glaciers, which followed, was shown and the lecturer described the manner in which the huge mammoths were entombed in crystal ice. Then was given an illustration of the homes of the first men, the lake dwellers.

The last scene of the series represented the age of civilization, showing architecture in a high state of perfection, engineering works and modern dwellings. In this and in all of the other scenes the artistic work is very effective, and the mechanical and light effects are striking and sometimes startling.

The discourse delivered by Mr. Garrett P. Serviss was not only extremely interesting and entertaining, but highly instructive.

Car Coupler Legislation.

A correspondent to the *Railroad Gazette*, while discussing the prospective coupler legislation, calls attention to the fact that most of the bills provide that it shall be unnecessary to go between the cars either to couple or uncouple. He points out that it is necessary, with the M. C. B. couplers now generally in use, to go between the cars to open one of them when two with closed knuckles are approaching each other. He acknowledges that there are a number of couplers in which provision is made for opening them on the side of the car, but as it is desirable to reduce the number of parts to the smallest possible, the point might be covered by adding a clause to the law "making it illegal for the trainmen to go between the cars equipped with M. C. B. couplers while either portion of the train is in motion."

The correspondent's object in making this suggestion is good, for he thinks that it would make the trainmen more careful and would relieve the railroad company from any liability in a suit for damages. We think, however, that if any one will carefully consider the matter he will have some doubts as to the advisability of making the act illegal, and thus giving the railroad company security against a suit for damages. Some railroad companies have rules which compel the men to steer the link with a stick when coupling cars. Who ever saw a switchman make use of one of them? He knows that he cannot do his work in the time required, and he therefore discards the stick to save his position. The probability is that when all cars are equipped with the M. C. B. type of coupler the trainmen will have to open these knuckles when the car is in motion, either from the side of the car or stepping in between the tracks, or they will be unable to perform the amount of labor the railroad company thinks each man should do in a given time. The result would be that to get his work done and keep his position the switchman would have to go between the cars. In the meantime the law would give the company immunity from damage suits in case he is injured in so doing. This is not the right way to save the lives of trainmen.—*Railway Master Mechanic.*

Photographing Bullets.

An interesting lecture on this subject was recently delivered at the South Kensington Museum by Professor C. V. Boys.

His apparatus consists essentially of a box adapted from an old packing case, lined with black cloth, in which the photographic plate is exposed, of a condenser formed of a plate of glass about a foot square, of a smaller condenser in the form of a bottle, to act as a starter of the spark, and of a simple system of wire circuits and knobs to give the spark which throws the shadow of the bullet on the plate, and thus takes the photograph.

The bullet enters and leaves the box by two holes, covered with paper to exclude the light, and in passing the plate the bullet touches the terminals of two wires, composed of thin lead wire, thus partly completing the circuit; a small flash passes from the smaller condenser, causing a larger flash to pass between the knobs of the plate condenser inside the box, and this flash, lasting less than one millionth of a second, takes the photograph of the bullet, no lens being employed. A wet string in the circuit of the small condenser has a powerful effect in damping the electrical oscillations.

Before proceeding to these details Mr. Boys showed experimentally that an electric spark is chiefly concentrated in two points of light on the knobs, the intermediate path contributing little to the illumination except by phosphorescence and electrical oscillation. This was evident from the double image taken when both knobs threw their light on the photographic plate, but by screening off all but one knob, a clear, distinct image thrown by a single point of light is obtained on the plate and no lens is required. The suppression of the lens is important, as Mr. Boys also demonstrated by photographs that a lens absorbs about 90 per cent of the light.

The first photograph taken was of a pistol bullet, flying about 700 feet a second. This was fairly clear, and a curious obscurity about the base, which seemed at first due to the imperfection of the apparatus, was revealed in the second photograph as due to the wad sticking to the base of the bullet.

But the interest began with the photographs of bullets fired from the modern magazine rifle, with velocities of 2,000 f. s. and over, far exceeding the velocity of sound. Here was seen revealed most clearly and distinctly the front and rear waves of condensation and rarefaction, with the *vena contracta* of the trail of following vortices, exactly like what we see on looking down from a bridge at a screw tug on the river.

A perceptible difference could be detected between the angles of opening of the front and rear waves, which could only be due to the superior speed of propagation in air of the front wave of condensation, an interesting phenomenon in acoustics hitherto unsuspected. In some cases pieces of paper torn out by the bullet could be seen flying in rear, each accompanied by its trail of waves, which met and coalesced, and were reflected on the sides of the box.

By substituting aluminum for lead bullets, Mr. Boys was able to obtain velocities of over 3,000 f. s., which showed no defect of clearness of image, but the angles of the wave fronts were considerably modified. The wires appeared on the photographs close to the bullet, showing the exact instant at which the spark passed—a cloud at the end of the wire first touched being the image of the dust into which the lead wire was pulverized by the contact of the bullet. Similar photographs were shown of the passage at various stages of a bullet through a sheet of glass, the air waves set up by the lateral vibrations of the glass being very distinct, and affording a very clear idea of the lapse of time in the phenomenon.

There should be no difficulty in the application of this method of photography to the largest projectiles of heavy guns, and much valuable information would thus be obtained concerning the velocity, the resistance of the air, and the degree of steadiness of the projectile.

The photographs showed generally that the bullets had not had time to settle down to a steady flight, but were variously tilted across the path. By boring some holes across the axis of the bullet, the angular position at the photographic instant was determined by the hole which allowed the light to pass through it on to the plate. In this way Mr. Boys was able to infer that the bullet must have received some 3 per cent of its velocity after leaving the muzzle, at which point the turning effort of the rifling must have necessarily ceased. Mr. Boys interested the sporting members of his audience, at the conclusion of his lecture, by a brief account of his experiments on the photographs of small shot. No photograph was ready to be shown, but he mentioned that this method would reveal the essential difference between the cylinder and the choke-bore gun, not only in lateral dispersion—which can be measured at present on paper screens—but also in the longitudinal dispersion.—*The Engineer.*

John Calvin Moss.

This widely known photo-engraver died at his home in New York City, April 8, aged 56 years. He was one of the first of those who made a practical success of photo-engraving, among many who entered the field about the same time. He first worked at the printer's trade, afterward becoming a photographer, and at twenty years of age commenced experimenting on the etching of plates. In 1871, he was interested in the Actinic Company, and subsequently in the Photo-Engraving Company, which he left in 1880 to form the Moss Engraving Company, which has made a great business success of the photo-engraving process. The first "process" pictures, as they were called, were very faulty, principally from the low relief obtained, which made them especially difficult to print in ordinary type forms, but by years of experiment and hard work this method of making pictures has been brought to such a degree of perfection as to practically supersede the more laborious hand engraving for quite a number of purposes. Mr. Moss was married when he was 19 years of age, and his wife fully sympathized with him in his artistic tastes, actively aiding him in all his long course of experiments.

Starving Rats on a Wrecked Steamship.

A correspondent of the Newcastle *Chronicle* describes a striking scene he witnessed in the breaking up of the Gothenburg City, on St. Mary's Island, coast of Northumberland. I was one of a party that went on board that ill-fated vessel a few days before she broke up, and saw a sight to be remembered. I shall never forget it. To all appearance, as we approached her, the vessel might have been sailing comfortably out of harbor, save for the absence of any apparent life on board of her. But we had no sooner put foot on deck than we were immediately attacked in such a manner that such of us as had got on board had to make tracks for the rigging, while the rest fell back into the boats. Rats! I never saw so many in my life, and never hope to again. Great, hungry, lanky, lean-looking rats, many of them with their tails chewed off, swarmed up from below in never-ending thousands, squeaking and squirming over one another in a manner sickening and horrible to behold, particularly to those of us up in the rigging. At last we cut off some loose ropes, knotted them into convenient lengths, and so armed we descended and attacked the rodents, and eventually succeeded in beating a passage to our boat. Any one would have supposed that they knew by instinct the impending fate of the vessel, for they no sooner saw us over the side than they began to swarm down the ropes and try to enter the boat, and it was only with difficulty we were able to beat them off before casting the boat clear; and they squeaked in a horrible manner in their anguish and mad frenzy as we rowed away from the vessel's side. They were too far both from the island and the mainland to swim ashore. They could not feed on the timber and coal, and so that was washed ashore to warm the shins of the coast folk. While every other part of the vessel seemed to go to splinters, the deck-house, strange to say, came ashore on the island intact.

Ventilation.

The ventilation of school rooms, churches, theaters, public halls and apartments, should be chiefly secured by outlets near the ceiling, for here is where foul air primarily accumulates. An excellent article, by Dr. William Henry Thayer, of Brooklyn, N. Y., is given in a recent number of the *Sanitarian*. We abstract as follows:

Carbonic acid is much heavier than atmospheric air. But the air expired from the lungs, with 8½ per cent of carbonic acid, is so much expanded by the animal heat that it is lighter than the atmosphere, and consequently rises to the ceiling.

Aeriform bodies possess the property of diffusing themselves through each other's masses to an unlimited extent; there is no point at which they become saturated.

Carbonic acid gas, although fifty per cent heavier than common air, will be gradually diffused through the atmosphere, at whatever temperature. In the case of the air that is expired from our lungs, surcharged with carbonic acid, it rises at once in an active current to the highest part of the room, because it is expanded by its higher temperature to greater lightness than the air of the room. From the neighborhood of the ceiling it is very gradually diffused through every part of the room, but remains in excess at the top as long as the supply continues.

Dr. Edward Turner, in his "Elements of Chemistry," says: "There is no real foundation for the opinion that carbonic acid can separate itself from the great mass of the atmosphere, and accumulate in a low situation, merely by the force of gravity."

Dr. Neill Arnott, in his "Elements of Physics," says: "In a very close apartment ventilation must be expressly provided for by an opening near the ceiling, through which the impure air, rising from the respiration of the company, may pass away."

Walter N. Hartley, in his "Air in its Relations to Life," says: "All the foulest air is near the ceiling; in fact, it is so bad there that unless an easy outlet be provided, it becomes perfectly poisonous."

In 1869 Dr. R. Cresson Stiles, Assistant Sanitary Superintendent of the Metropolitan Board of Health, made a report on the qualities of the air of public buildings. He analyzed the air of public schools, hospitals, theaters, and churches, to ascertain the proportion of carbonic acid contained in it, and in some buildings measured the amount at different heights—near the floor and near the ceiling. His results varied with the different conditions of the rooms as to ventilation and air currents; but he says: "Air taken from near the ceiling was always found more highly charged with carbonic acid than that in the lower portions of a room, and the difference was often very marked. . . . In the hall of the Hamilton Literary Association, on the occasion of a meeting of the Kings County Medical Society, about eighty persons present, air taken within a foot of the ceiling, after three hours' occupation, gave 3·1 parts of carbonic acid per 1,000, while that taken at the same time within three feet of the floor gave one part per 1,000."

Dr. E. H. Bartley, chemist of the Brooklyn Health Department, made analyses of the air of St. Ann's at different heights, at a time when it was filled by the congregation.

The showing was, under the edge of the gallery, 19 parts of CO_2 in 10,000 of the air, while on the gallery, immediately over the place where the first sample was taken, about 40 in 10,000.

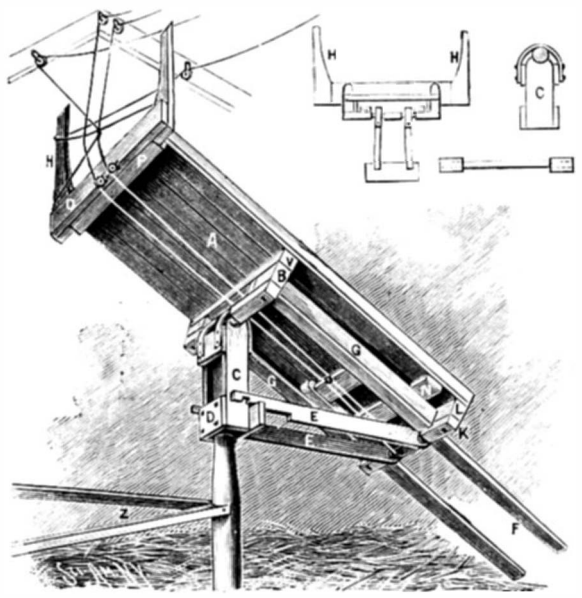
The carbonic acid in the air of our rooms resulting from respiration, in the limited amount in which it exists after diffusion, is not the sole or the chief injurious and dangerous element of that atmosphere. The organic matters which are contained in the expired air are more prejudicial to health; but as they are proportioned in amount to the accompanying carbonic acid, this gas "is taken as a convenient index to the amount of the impurities."

The conclusion, from all the evidence adduced, is that the carbonic acid gas of respiration and illumination will eventually be equally diffused through the atmosphere, although retained at the upper part of a room so long as the high temperature continues; and that it never, under any circumstances, is precipitated in excess to the lower part of the room.

One's ordinary perceptions may be trusted for the extremes of atmospheric conditions of a room; one perceives at once the difference between a very foul atmosphere and a very pure one. The hall of the Brooklyn Institute—burned last year—when occupied, impressed one on entering as having a delightful atmosphere. It was about twenty-five feet high, and ventilated by large openings in the ceiling over two chandeliers. The only objection to such an arrangement made by well informed people is the waste of heat. But when we take into consideration the immediate comfort and the prospective advantage to the health of the occupants, it is no waste; it is a little more fuel, but it is a great deal less sickness.

AN IMPROVED HAY STACKER.

The construction shown in the illustration is designed to be erected in a mow or shed, or in a barn, or wherever hay or straw is to be stacked, the device receiving the hay or straw directly from the fork, and being manipulated from the wagon to distribute the load to any side of the stack as desired. The improvement has been patented by Mr. Thomas Collins, of Overton, Bradford County, Pa. At the center of the space to receive the stack is erected a post, on the upper end of which is swiveled a platform, A, upon ears, B, pivoted



COLLINS' HAY STACKER.

to a frame, C, D representing detachable portion of the frame to facilitate the erection of the stacker where space is limited. The platform and its extension frame, F, are held at any desired inclination by rack or toothed arms, E, pivoted one to each side of the platform at its front end to a crossbar, K. The platform has slideways, G, on its under surface, L, N, O, P representing connecting pieces, and Z braces for the main post. The sectional figures illustrate details of construction. The extension frame of the platform is adapted to be manipulated by two ropes or cables, by which the frame is extended or withdrawn, other cables being provided by which the frame and platform are rotated upon the central post to deposit the hay or straw delivered by the fork directly to any side of the stack. All the cables lead to the wagon when it is in position to discharge its hay. The device is designed to symmetrically build up a stack without the assistance of additional laborers in distributing the hay or straw as placed.

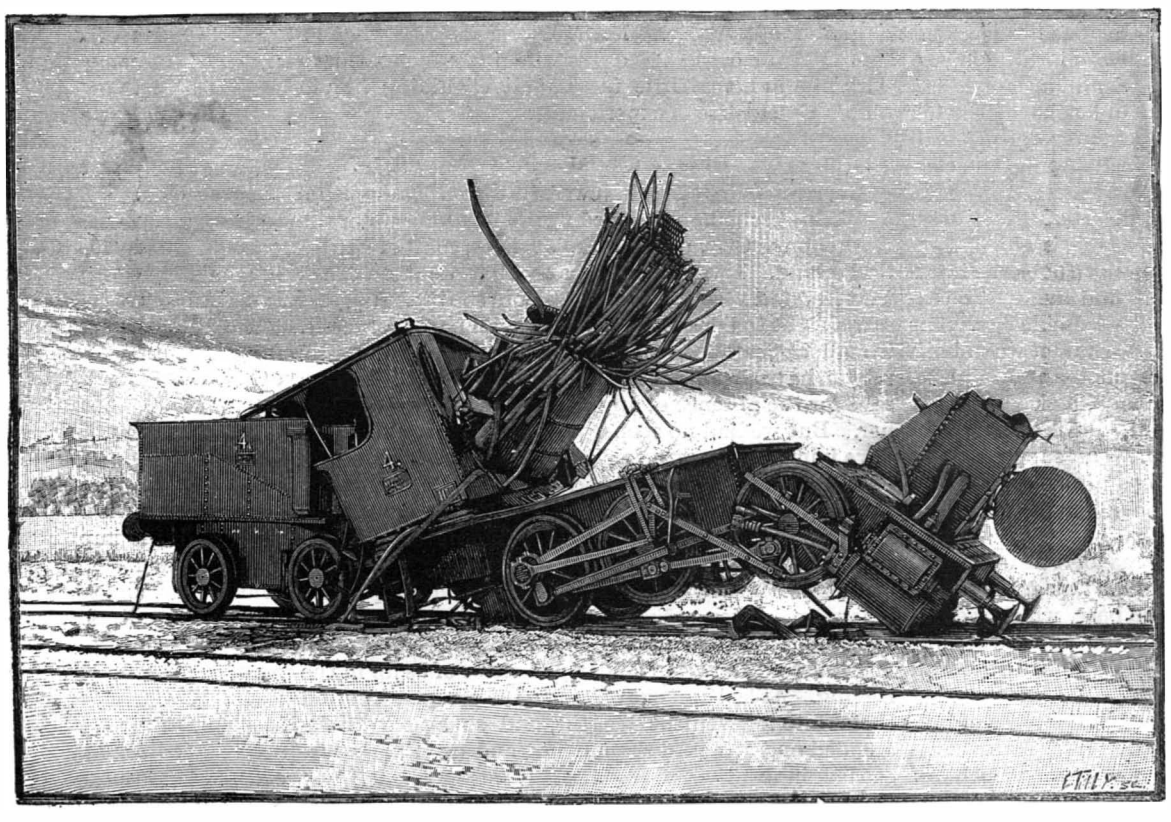
EXPLOSION OF A LOCOMOTIVE.

The explosion of which our engraving shows the curious results occurred on the 14th of January, at Soosmezo, in Hungary, on the railway from Buda-Pesth to Bucharest.

Locomotive No. 4, whose boiler exploded, had just pulled a freight train into the station and was standing upon the track, when a terrific detonation occurred that shook the earth and air with such force that all the windows of the neighboring village were broken. The greater part of the cylindrical body of the boiler, as well as the smokestack, had been projected into the air, and pieces weighing 1,500 pounds had been thrown to a distance of two hundred yards. The frame of the engine, broken under the stress, was bent in two near the earth, while the boiler tubes, remaining adherent to the fire-box, were exposed to view like the entrails of an open cadaver.

Strange to say, the accident caused no loss of life, the engineer having left the platform, while the fireman, engaged in oiling the mechanism, escaped with a few non-fatal wounds.

The inquest that was immediately held gave no precise results, but appears to have demonstrated that the boiler plates had been weakened through oxidation.—*L'Illustration.*



EXPLOSION OF A LOCOMOTIVE BOILER AT SOOSMEZO, TRANSYLVANIA.

THE total number of newspapers published in the world at present is estimated at about 47,000.

Learn a Trade, Boys.

A correspondent in the *Sewing Machine News*, quoting from the *Ladies' Home Journal* an article on the value of a trade, makes some remarks of his own which are practical and pertinent to the subject.

I remember years ago, when I was a very young man, writes John Coates in the *Journal*, meeting John Roach, the great ship builder, in his ship yard at Chester, Pennsylvania. I remember, too, what he said then about the value of a trade to the average boy.

"Young man," he said, laying his great, broad hand on my shoulder, and looking at me earnestly with his keen, steel-blue Irish eyes, "next to a clear conscience, a trade is as good a thing as any young man can have in this country. You can carry it with you all your life long; you have to pay neither rent nor taxes upon it, and it will help you around a sharp corner when most other things will fail."

I have never forgotten that utterance from a man who started in life—after landing in New York from Ireland—as helper to a machinist, who became the leading ship builder of his time, and who, up to the hour that he was stricken with a fatal illness, could take the place of any of his workmen, whether it was a man driving rivets or an expert putting together the most delicate parts of a steamship's machinery.

Something very like what John Roach said I heard another great man, who is now dead, say. This was Peter Cooper, a man of whom American boys cannot know too much, and whom they certainly cannot too much admire.

"If I had my way," said the venerable philanthropist, on the occasion to which I refer, "I would give every boy a trade. Then I would have him stick to it, love it, and be good to it. If he does, it will be good to him."

To which the writer in the *Sewing Machine News* adds:

To an observing and interested person how sad is the spectacle, and how forcible is the fact, which ought to be food for serious reflection to every American citizen, that very few of our American boys ever learn a trade, and as a result almost everywhere the leading mechanical positions are filled by men of foreign birth.

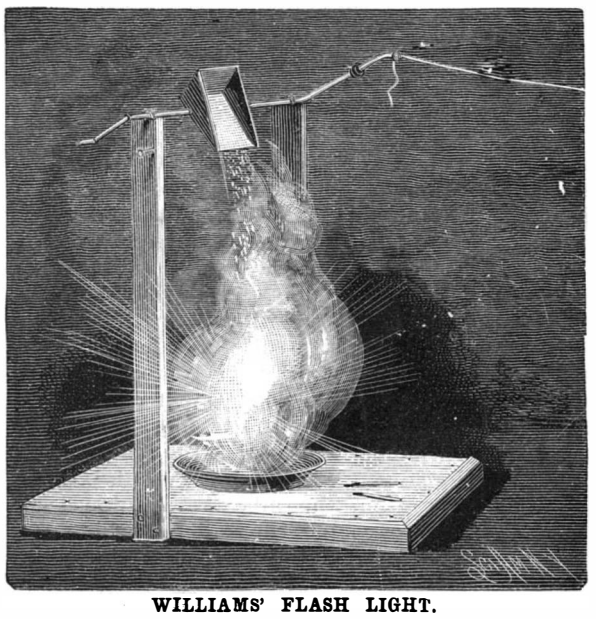
Why is this? Is it because our boys are less able? Is it because there are no facilities for learning trades in this country? To the last question the argument may be advanced that the trade unions lay too many and too heavy restrictions regarding the number of apprentices which will be employed or allowed. Argument admitted and the point taken granted. But the bottom cause is Young America's "don't want to." He would rather stand behind a counter in some store, or canvass for some agency, or work in some factory at piece work, where he can earn more money, *at first*, per week than if put to learning a trade.

This would all be very well provided he could be sure that such employment would last as long as he needed to work for a living. We all know that no substantial building exists, or can exist, without a good foundation, therefore let us encourage our boys to learn trades. Where there are trade schools, take advantage of them, and every city should have one or more. Teach them that work is honorable. That it is no disgrace to lay brick. That it is not unmanly to be seen on the street carrying a kit of plumber's tools with a clear conscience. Though the work be dirty, the money is as clean as that gained in any other way.

Encourage them to learn trades and afterward to rise in them. Having a good common school education for a starter, their native smartness will enable them to master their trades, and by avoiding all unclean or unsteady habits, they need have no fear for the future, for their services will always be in demand.

NEW FLASH LAMP.

To a block of wood about six inches wide, I nailed on either side uprights about 12 inches high and an inch wide. Across the top of these uprights, and held



WILLIAMS' FLASH LIGHT.

in position by small staples, is a stout iron wire. At the center of this wire is fastened a tin dish, shovel-shaped, for holding the flash powder. One end of the wire is bent at right angles up, and the other end down. To the upper arm is attached the string or thread by which the lamp is operated. On the outside of the upright, next to the lower arm, is driven a nail, against which this arm of the wire bears, and thus prevents the powder dish from turning backward. Directly below this dish, on the block between the uprights, is placed a dish containing a piece of asbestos soaked in alcohol. When all is ready powder is placed in the upper dish, the asbestos lit and the string pulled. The cup containing the powder is suddenly turned over, precipitating its contents into the flame below.

By this means the powder is thrown into the flame, which I find gives a better result than with other lamps. Another advantage is that pure magnesium powder can be used. DE WITT B. WILLIAMS.

World's Fair Notes.

A communication has been received from the British Commission asking for space to exhibit the rifle calibre guns manufactured by the Maxim-Nordenfelt Gun Company. The company wants to erect a building 30 by 15 feet to exhibit its guns in practice. One end of the building will be filled with sand bags, into which the projectiles of the guns will be fired. It is claimed that the arrangements are such as will insure perfect safety, and will be reproductions of a similar exhibit recently given at the Royal Naval Exposition in London. The request was referred to Chief Willard Smith, of the Transportation Department, as the exhibit, if allowed, will come under the head of naval and marine display.

A very complete and doubtless an eye-opening diamond exhibit will be made by Cape Colony, South Africa. The exhibit will include 10,000 carats of uncut stones, a large quantity of very fine cut and polished ones, together with all that is necessary to show the process of mining and washing. For this it will be necessary to transport to Chicago 100 tons of pulverized blue earth, 50 tons of unpulverized earth, and a complete washing machine, which will be operated by natives. The exhibit will also include a unique collection of crocidolite, special diamondiferous products ostrich feathers, fleeces, etc. It is reported that a Bushman and Hottentot in native dress will accompany the exhibit.

AN IMPROVED MAGAZINE HAND CAMERA.

Light, compact hand cameras capable of holding several plates or films for quick, easy working are those now mostly preferred by photographers. Our illustrations show an instrument of this description which contains many desirable advantages. It is the result of much study and invention, by a practical amateur photographer, Mr. F. A. Hetherington, by profession a mechanical engineer, who, finding it so useful in his own work, induced others to join him to further its introduction to the photographic world.

In taking a picture with the camera only two movements are required: first, the releasing of the shutter; second, the rapid changing of the exposed plate. Fig.

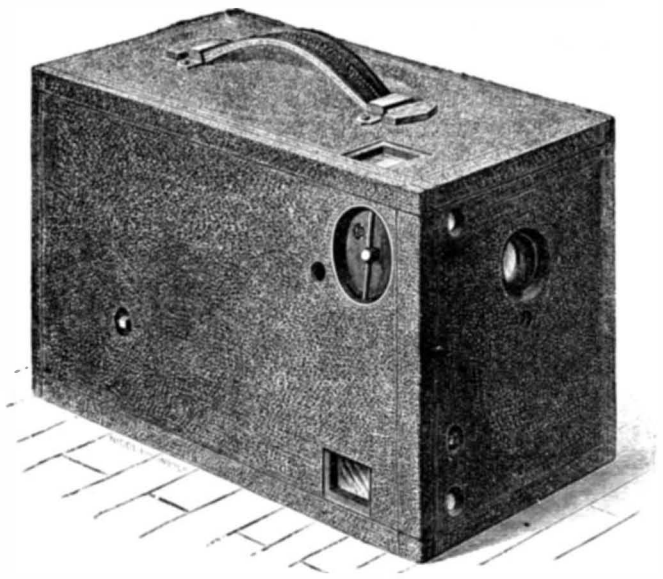


Fig. 1.—THE EXTERIOR.

1 is an exterior view. The box is neatly covered with black pebbled leather. On the front is seen the lens aperture, which, when not in use, is closed by a felt cap. All of the manipulations are performed by means of a key something like a clock key. One key aperture is on the side of the camera for operating the plates, while of the two on the front, one regulates the diaphragm plate and the other serves to turn the shutter for time exposures. Two finders are provided for taking the picture either way on the plate. On the side is the focusing dial and the smaller aperture near it for recording the number of exposures. There are no doors in the camera.

The top of the camera, having the handle attached, is constructed to slide out lengthwise and ordinarily is locked in position by the upper finder, fitting into a recess cut on the under side of the cover. To obtain access to the interior for the purpose of inserting or removing plates, it is only necessary to depress the top finder with the thumb and with the other hand slide out the cover. It will be observed that there are no projecting parts. A tripod screw plate is recessed in the bottom of the camera for holding on a tripod when time exposures are desired to be made.

The shutter and its propelling spring are secured to a vertical sliding lens board, just inside of the front end of the camera, and can be easily removed for examination. The shutter is exceedingly simple, consisting, as shown in Fig. 2 (which is a front view), of a vulcanite disk having two apertures, rotated, as shown by the arrow, continually in one direction. It is therefore always self-setting. Thus one of the additional manipulations (the setting of the shutter) usually found in hand cameras is avoided. It is propelled by a clock spring and gear on the rear side of the shutter board, as seen in Fig. 3.

The shutter release lever, shown on the right of Fig. 2, operates in a reverse way to those in general use; that is, by drawing the lever to the right the shutter is held until the lever, on release of the finger, is pushed back to its original position by the spring. This movement releases the small pin stop on the face of the shutter and allows the latter to rotate one-half a revolution, until the next stop on the shutter strikes the release lever. A movement of this kind is desirable in preventing the sudden side motion sometimes given to a camera in releasing a shutter.

The pivoted hook shown in the recess in the top of the shutter board drops into a notch on the periphery of the shutter when the latter is turned slowly around by a key applied to the center, and holds the shutter open for time exposures in the usual way. As the shutter moves in one direction, after several exposures the spring becomes weaker. To bring it back to its former tension, the half-circular cam against which the shutter release lever rests is rotated from the other side of the board until it permits the lever to fall back out of line with the stops on the shutter. Then the latter is rotated freely in the opposite direction by the fingers or by the key attached to the center, which quickly winds up the spring. One winding will answer for thirty-six exposures before there will be any appreciable difference in the speed. The lever shown on the left is for regulating or retarding the speed of the shutter, its shaft passing through the shutter board as shown at A, in Fig. 3, and, attached by a spring to a brake, bears against the periphery of the spring-propelled shutter wheel. Moving the lever to the extreme left (Fig. 2) reduces the shutter to its slowest speed.

The key slot to the extreme left operates the diaphragm plate, seen on the other side more clearly in Fig. 3, by the bent wire spring arm, at right angles, passing through the lower end of the vertically-sliding diaphragm plate. A guide, with slight notches in its edge, arranged on the outer face of the wheel casing, enables the operator when working the diaphragm key on the outside to tell, by the friction of the arm while passing over the guide, when the apertures in the diaphragm coincide with the center of the lens.

The lens is held by, and slides in or out, in a brass tube. It is moved for focusing by an eccentric strap attached to a shaft running to the side of the camera, its crank (shown just beneath the finder) engaging in a slot or guide on the inner face of the focusing disk. The location of this disk is seen in Fig. 1. The lens and shutter compartment is separated from the magazine by two sliding vulcanized rubber divisions, as shown.

The magazine consists of a series of metal plate holders or carriers hinged together at their base by links something like a chain, a rod running lengthwise under each carrier and the ends projecting beyond about an eighth of an inch, traveling in slots in metal plates as shown just above C in Fig. 3. The slots at a certain distance from the rear turn at right angles downward. The operation is similar to the old fashioned revolving stereoscope. When a carrier is turned down, the others are advanced forward.

As shown, half of the plates have been exposed, and turned down. Each carrier has a notch in its edge in which two arms attached (one on each end) to an actuating key shaft engage; these arms are kept down upon the horizontally placed carriers by a spring, C, on the shaft. To change a carrier from a vertical to a horizontal position, the key is placed in the key slot and turned backward, which raises the two arms until they slide by and catch the back of the carrier. Then, by reversing the key, the carrier rotates downward. A special stop at the same time darts through an opening in the side of the camera, and holds the advanced carrier firmly in the focal plane. While a carrier is moving downward, its corner engages with a star indicator wheel having a friction bearing plate at its center and figures on one side, which are visible on the outside through an aperture in the case of the camera and show the successive number of plates exposed. Each metal holder is flanged back, so that it overlaps and protects the following plate from light.

To return the carriers from a horizontal to a vertical position, the key-actuating shaft is turned back as far as it will go and a special catch, B, drawn upward. This locks the shaft and permits each carrier to be drawn back by the hands and enables any particular plate to be selected for development. When the carriers are all thus drawn back, the catch, B, is pushed down, after which they can only be operated by the key. The actual operation of the camera is very simple and quick. It is made of the best material and workmanship, is light, compact and certain in its working. We have used it with much success.

After one lot of plates have been exposed, it is a very simple matter in a closet or changing bag to remove them and insert fresh ones. The camera was awarded a medal at the New York Joint Exhibition of Photographs in 1891. It should be a most useful companion to any desiring to do good work with the least inconvenience. It is manufactured by Hetherington & Hibben, after Mr. Hetherington's patents, at Indianapolis, Indiana, the trade agent for New York being Mr. A. L. Simpson, 66 Broadway, New York.

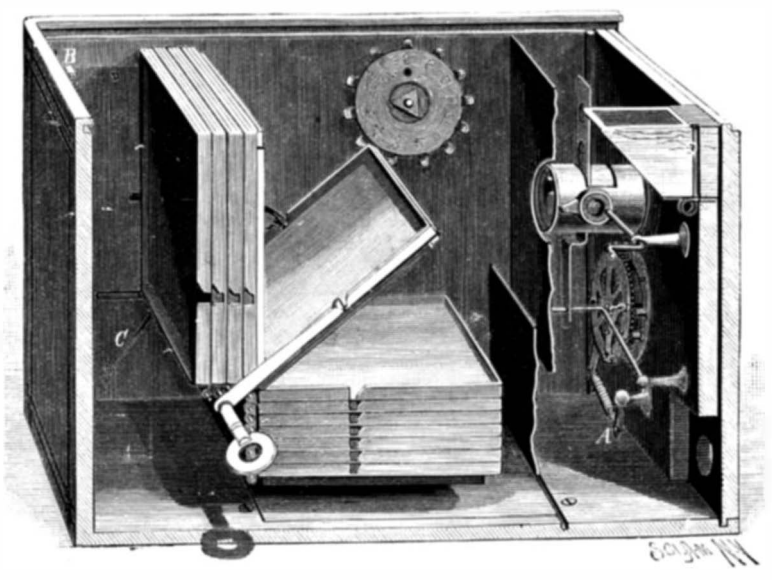


Fig. 3.—THE INTERIOR.

THE HETHERINGTON MAGAZINE HAND CAMERA.

Relation of Voltaic Electromotive Force to Molecular Velocity.

In a recent research published in vol. viii., p. 63, of the Proc. Birm. Phil. Soc., 1892, it is shown by means of an extensive series of sixty-four tables of measurements of *mean* volta electromotive force that the *dilution* of the liquid of a voltaic cell by means of water or

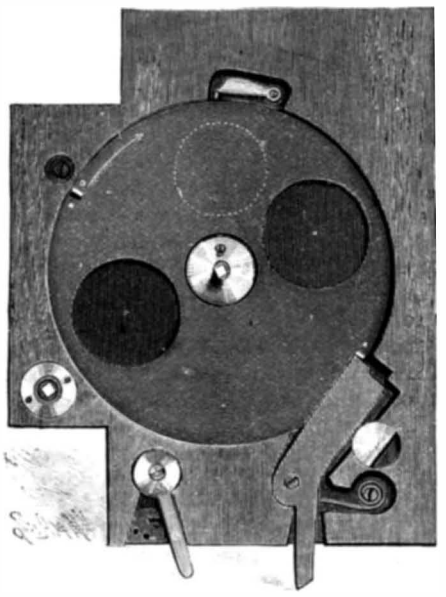


Fig. 2.—THE SHUTTER.

alcohol, the *liquefaction* of either the positive or negative metal of the cell by means of mercury, the *dilution* of either of these amalgams by means of mercury, the *dilution* of one solid metal by means of another in an alloy, is universally attended by an increase of *mean* electromotive force of the diluted and diluting substances, and consequently also of the *actual* electromotive force of the diluted one, provided that in all cases no chemical union or other chemical change occurs in the mixture. The manifest explanation of this extensive general result is that by the act of solution or dilution the molecules of the active substance are separated farther apart, and consequently acquire increased velocity of motion. In proportion, however, as chemical union occurs, the gain of electromotive force diminishes and is converted into a loss, and the loss is larger in proportion as the chemical union is stronger. The method enables chemical compounds in alloys, amalgams, and electrolytes to be distinguished from mere mechanical mixtures.—*G. Gore, F.R.S.*

Flared Coal Tar for Waterproofing.

According to the *Revue des Travaux Publics*, the use of coal tar as a means of rendering masonry impervious to water is much favored in France. There are two ways of preparing the tar for this use—boiling and flaring. The former method is suitable for surfaces intended to be exposed to the atmosphere, while the latter is appropriate for surfaces to be covered up by masonry, earth, etc. By adding to the coal tar a paste made by dissolving India rubber clippings in benzine, a coating may be obtained which is still more resistant, elastic, and durable. For roofs the heat-absorbing quality of these black varnishes may be overcome by dusting them with any permanent white earth before they are quite dry. For masonry to be covered up, the use of flared tar is highly recommended. This is prepared by boiling the tar in a caldron, and filling a bucket two-thirds full from it. The tar is then lighted at the surface, and allowed to blaze for 15 or 20 minutes, being constantly stirred the while with an iron rod. When a drop from the blazing bucket upon cold stone has the consistency of thick soup, the flare is extinguished by covering down the bucket with an iron lid. The tar will then be reduced to one-third its original bulk, and it must be spread as rapidly as possible upon the work with a cod-tail brush of vegetable fiber—care being taken to dip often, so as to prevent its cooling and hardening prematurely. If the flaring process is prolonged beyond the proper moment, the result is a brittle product like sealing wax. When the flare is stopped at the right time, the resultant tar adheres very firmly to any surface, and can be immediately covered up with earth. It has a skin both hard and tough, underneath which is a viscous layer about 1-25 of an inch thick, which preserves its integrity for any length of time.

HARVARD University had its beginning at Newtown, afterward Cambridge, Mass., in 1636.

Internal Combustion Engines.

At a recent meeting of the Engineers' Club of Philadelphia, Mr. Paul A. N. Winand presented some figures as to the cost of power in using internal combustion engines.

"The attendance in gas and oil engines is probably not more than in the engine part of the steam engine, and in the newer styles of gas engines, working without slide valve, the amount of lubrication is also about the same, and in a comparison between the two classes of engines, these items can be omitted.

"Considering the question of cost of power in a general way, that is, independent of any combination with other apparatus, gas and similar engines are often cheaper to run than steam. Illuminating gas costs generally from $1.00 to $1.50 a thousand. As shown in the Society of Arts trials, a gas engine of about ten horse power can be run with 22·6 cubic feet of gas per brake horse power. Better results than this have been obtained, but at this figure the cost is 2·2 to 3·3 cents per horse power. This is about equal to 13 to 19 pounds of coal at $3.50 a ton. Nevertheless, it is mostly cheaper than steam for powers up to fifteen horse power, especially when the plant is run spasmodically. When a gas engine is used to make incandescent electric light, 22 cubic feet of gas will be used for about nine 16 candle power lamps, or 140 candles. The same amount of gas burned as such would give only about 90 candles. The number of lamp hours per year will decide as to whether it is cheaper to burn gas directly or not.

"In actual work a gas or oil engine keeps more nearly to its original economy than a steam engine, because a steam engine will run with valves and pistons in bad order, while a gas engine refuses to go if the supply of gas is not about properly adjusted.

"In an official statistical inquiry as to the economy of power, made by the authorities of Birmingham, the fuel consumed was much higher than might be expected from published results of tests, on non-condensing engines being not below 9·6 pounds, with an average of eleven pounds of coal per horse power hour.

"Oil or gasoline can be used with about the same efficiency as gas. One gallon of oil is about equivalent to 180 cubic feet of illuminating gas, and, accordingly, it takes about one-eighth of a gallon per horse power hour. This, at 5 to 10 cents a gallon, is equivalent to 7½ to 3½ pounds of coal at $3.50 per ton.

"With natural gas 15 cents per thousand, one horse power costs about one-fourth of a cent, as it takes only about 16 cubic feet per horse power hour, and it would take three to four times as much gas firing under a boiler for the same power. Using the coal in a producer to make gas and then using it in the gas engine for power is one way of running a gas engine plant. The efficiency of a gas apparatus is from 70 to 80 per cent. With such an apparatus, a consumption of 0·935 pound of coal has been attained in France, and even 0·883 recently per horse power hour in England."

Mr. Strong—One of the most interesting papers I have read on the subject of the cost of power was by Sir William Thomson, in 1881. In this paper the sources of power were divided into four, which were wind power, falling water, tidal energy, and coal. The first two of these are due directly to the sun's heat, and, what might at first appear strange, the first of these has had more to do with the comfort and progress of this world than any other power, and it is probable that the time will come again when wind power, in connection with some such apparatus as the storage battery, will again do the work of the world.

Tidal energy and water power he regarded as insignificant. The burning of coal he also considered as one of the sources of power which was derived from the sun's energy.

Prof. Elihu Thomson read a paper in Boston recently, and said that the hope of the electrical engineer was in the steam engine, or that the mechanical engineer would produce cheaper power than by the steam or gas engine.

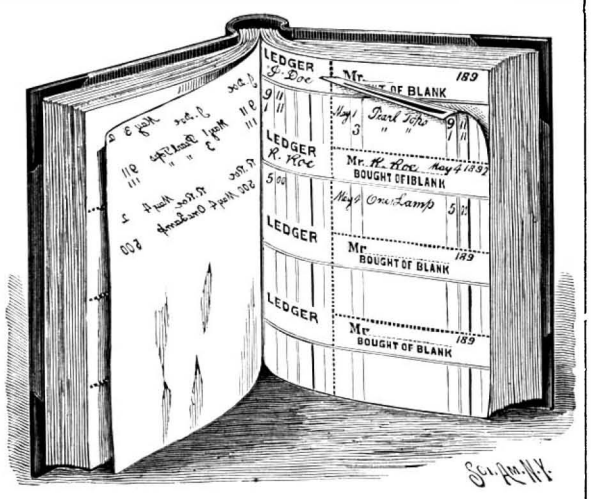
Clark says that it is possible to use 40 per cent of the energy in the coal through the gas engine, while the best steam engine only uses 13 to 14 per cent.

The difficulty in the way of introducing producer plants and gas engines is the first cost and the difficulty of starting the engines, but this latter difficulty will probably be soon overcome, and the gas engine will then supersede the steam engine in many cases. We have been engaged in designing an engine which is to make a horse power on 13 pounds of water, and in the boiler we expect to carry 180 pounds pressure, allowing the gas to escape at 250°, and evaporating 12 pounds of water to a pound of coal.

NITROUS acid as a disinfectant had been proposed some years ago because of its peculiar property of being an oxidizing as well as a reducing agent. H. Borntrager employs the following combination containing 20 per cent sodium nitrite: One part sodium nitrite and one part gypsum are melted together; after cooling the mass is powdered and preserved in well-stoppered receptacles. Two parts sodium bisulphate and one part gypsum are also melted together and, after cooling, powdered. Both powders are now mixed and preserved in dry and tightly-stoppered containers. If this powder be thrown into water or substances to be disinfected, a uniform evolution of nitrous acid takes place, which rapidly destroys foul odors.—*Pharm. Centralhalle.*

A COMBINATION ACCOUNT AND BILLING BOOK.

A book which combines within itself three books, such as used in mercantile business, is shown in the accompanying illustration, and has been patented by Mr. James E. Depue, of Oakland, Cal. The combination embraces a general ledger, a sales book or personal ledger, and a billing book, and is designed to lessen



DEPUE'S LEDGER, SALES AND BILLING BOOK.

the labor of the book-keeper, and facilitate the keeping and rendering of accurate accounts, while doing away with a multiplicity of books. The book contains two classes of leaves bound together, main or entry leaves and intervening transfer or copying leaves, whereby a press copy may be taken of the writing on the main leaves. Each of the latter has its inner end portion ruled to form a column of ledger spaces, the front portion of the sheet having, opposite each ledger space, a space corresponding to the leaves in a sales book or a billhead book, ruled to enter the usual items of account, dates, charges, etc., each of these spaces also bearing a special number printed in copying ink. This outer portion of each main leaf is designed to be detached when desired, for presentation as a bill or memorandum, and this portion of the sheet is therefore separated from the ledger spaces by a vertical row of perforations, to facilitate its ready removal, a press copy of the account being previously taken on the copy or transfer leaf. The latter, remaining bound up in the same book as the main sheets, shows the general ledger account from the inner portions of the main sheet, and the personal ledger or itemized accounts from the outer portions, and may also be detached for presentation to customers if required, a bill being thus ready to detach and present to a customer at any time.

A DESK INK BOTTLE.

An ink bottle particularly adapted for use on school or other desks is shown in the accompanying illustration. It is provided with a simple, convenient, and

HALL'S INK BOTTLE.

reliable attachment, affording means for the secure connection of the filled bottle with an aperture in the desk, the orifice in the bottle being flush with the upper surface of the desk top and the body of the bottle being hung in the desk. The aperture in the desk is made of a size suitable to receive a cylindrical thimble with a radial flange, which, when seated on the desk top, retains the thimble in place. The neck of the bottle has an exterior thread loosely fitting a thread within the thimble, so that the parts are readily secured together in place as shown. The neck of the bottle is designed to be closed by a cork, and a laterally swinging cover, as shown, may be used if desired.

This improvement has been patented in the United States and Great Britain by Mr. William F. Hall, Box 247, Rapid City, South Dakota.

How Society is Indebted to Invention.

In the "Relation of Invention to the Conditions of Life," in the *Cosmopolitan Magazine*, Mr. G. H. Knight says:

With each step in industrial progress not only is the greater the number who can be warmed, fed, and clothed and the better are their life conditions, but in default of such progress a vast majority would not have lived at all. It is to industry guided by scientific methods, and to science that concerns itself with practical applications of its discoveries, that we are indebted for such magical arts as that which makes light itself depict for posterity the very features and expressions of the life it once illumined; for the kindred art whereby scenes in the most remote regions are made to pass in realistic panorama before the pleasantly cheated vision; for the instrument which, having analyzed the sunbeam and revealed the chemical constituents of distant constellations, becomes, in the hands of the metallurgist, the means of determining the precise instant at which to arrest the process of "conversion" in the Bessemer steel manufacture. It is to invention that society is indebted not alone for the refinements, but for every necessary of modern life; for food, clothing, and shelter; for the arts of spoken, written, and printed speech; for the means of flashing the very voice to a listener in a distant city, or catching the fugitive, tremulous tones and storing them for the delectation of generations yet unborn; for music, poetry, and the plastic arts; for locomotion by land, by sea, and even through the circumambient air; for the gift of soothing with healing wings the bed of anguish; for the ability from this tiny speck of earthly life to sound the abysses of time, thought, and space.

Wormy Tobacco.

In answer to a communication of Mr. E. L. Moore, of Glidden, Texas, relating to insects damaging stored tobacco, Prof. C. V. Riley says:

The question relates to the so-called cigarette or tobacco beetle (*Lasioderma serricorne*). This is a cosmopolitan insect, which feeds, all over the world, on a number of stored food products, and which, curiously enough, seems to have a preference for pungent stuffs, such as pepper, tobacco, etc. It has even been recorded as feeding upon Persian insect powder, probably, however, after this useful insecticide has lost some of its power through partial exposure to the air. In this country it has done considerable damage in tobacco factories, particularly from Baltimore southward. The female beetle lays her eggs in exposed tobacco, and from these there are hatched small white larvæ, which feed extensively for some weeks, afterward transforming to pupæ and issuing again as perfect beetles in from two to five months after the eggs were laid. Every precaution should be taken in factories to leave as little exposed tobacco about as possible, particularly at night, as the insects fly by preference at this time and lay their eggs. The factory windows should not be left open, and persons engaged in rolling cigarettes and cigars should cover their tobacco at night, while all waste tobacco should be swept up carefully and placed in some closed receptacle. Where a lot of tobacco has once become infested, the only remedy consists in steaming it thoroughly. The application of any of the insecticide substances cannot be recommended, as their use would injure the tobacco and might prove dangerous to those who subsequently used it.

Smoke Turned into Money.

In his inaugural address to the North-East Coast Institution of Engineers and Shipbuilders the other day, Mr. Wigham Richardson referred to the chemical treatment of smoke. He said: "We know how the heated nitrogen and the carbon oxides, which used to be belched forth from the blast furnaces, are now used to raise steam in the boilers which supply the blowing engines; but Mr. Ludwig Mond, of the firm of Brunner, Mond & Co.—the same who has introduced the Solway process for making soda, and in so doing has hit many of our friends so hard—has, as I understand, gone much further. He burns his coals with artificial draught, and, conveying the gases into a chamber, he washes them with water spray, which causes every particle of soot or smoke to be deposited, and at the same time condenses and recovers the ammonia (a product of nitrogen and hydrogen), as well as the sulphurous fumes. I trust that I have not misunderstood Mr. Mond's figures; but I gather that to get an equal efficiency of steam-raising power he has to burn 125 tons of coal in place of 100 tons, and for every 125 tons of coal burned he recovers four tons of sulphate of ammonia. The fuel, if cheap (say $1.25 a ton), will cost $155, and the sulphate of ammonia at $60 a ton is worth $240. If results such as these can be attained the doom of smoke is sealed."

A Sixty Thousand Volt Transformer.

Before a recent meeting of the Old Students' Association of the City and Guilds of London Institute, Messrs. H. B. and W. F. Bourne showed some remarkable experiments with a 60,000 volt (4 horse power) transformer. The transformer used was one having a ratio of 800 to 1, the insulation consisting of paper and oil. By the aid of this transformer Messrs. Bourne were enabled to show that many substances which are usually regarded as excellent insulators afford facilities to the passage of the current. For instance, a discharge was shown across the surface of a sheet of ebonite many times longer than the sparking distance in air. Slate, too, was shown to be a partial conductor, two slate pencils acting perfectly as the carbons of an arc lamp. A block of salt about the size of a brick, when slightly damped, allowed the current to pass freely through it and play over its surface in a brilliant yellow flame.

The experiment shown by Mr. Tesla, since repeated by Messrs. Siemens, of a sheet of glass interposed between two flat terminals was also exhibited. A blazing network of threads of fire darted over the surface, a small hole being finally pierced, the edges of the perforation being melted and the hole filled with liquid glass, through which the current found its way. In the case of a specimen of good rubber-covered cable with bare copper wire wound over a small portion and acting as a concentric cable, the dielectric when subjected to 20,000 volts soon heated, owing not to conduction but to absorption currents, and soon broke down and caught fire, the rubber being quite softened by the heat in 15 minutes. Messrs. Bourne had a good deal to say about oil insulation, and it has been found that the heating due to absorption currents is very much less in liquids than in solids. There seemed to be very little to choose between different kinds of oil, those having a high specific inductive capacity apparently heating the most.

An interesting experiment with two different oils was shown. Colored castor oil was poured into a glass beaker and a layer of paraffine oil floated above it. Flat ended electrodes were connected to the transformer, and the surface of the castor oil was seen to rise or swell in the center. It was suggested that this was due to the tendency for the capacity of the system to increase, the specific inductive capacity of castor oil being greater than that of mineral oil. It was found that the sparking distance in oil was greatly diminished by the presence of dust or other impurities.

Transformation of a Cable Road.

Building cable railways in cities and then replacing them with the more efficient electric system is a costly experiment, as the following from the St. Louis *Globe-Democrat* will show:

In about thirty days the curtain will go down upon the last act of that magnificent but costly experiment which was formerly known as the St. Louis Cable and Western Railway. For three weeks workmen have been busy tearing down and removing the great wheels and cable machinery which have stood in the old power house at Channing and Franklin Avenues since 1888. It will take a month to complete the work. When it is done the last vestige of the equipment of the old road will have disappeared, except a few cars in the car house beyond Vandeventer Avenue. It will be remembered only as a victim of the relentless progress of electricity, which has driven it out and replaced it.

The road was not only the first one in the city to be operated by one of the new methods, but it was, in some respects, unique. This was particularly true of the iron conduit through which the cable ran. At the time when it was laid, cast iron was worth about three times as much as its present price. The projectors of the road believed that they could find a cheaper material. They therefore conceived the novel idea of using wrought iron. In carrying it out, rails were melted and forged into the shape of the yokes, joined sections of which formed the conduit. The plan proved expensive in the end. Over 3,000,000 pounds of iron went into the conduits and tracks. It cost somewhere in the neighborhood of $150,000. The other day it was sold by weight to Col. Hirsch for about $30,000. It was fit for nothing but to be shipped away, melted up, cast into pigs and billets, and sold again as raw material. But the road had, for the time, the distinction of being the only one in the world with a wrought iron conduit.

While it was run on the cable system the road used more cables than any system of equal length in existence. This proved another very costly feature. The life of a cable on most roads averages about nine months. The Cable & Western Company found it necessary to put a new one down every five months. Each cable weighed from thirty to forty tons. The average price was 12 cents a pound. Thus, the cost of cables alone reached about $20,000 a year, to say nothing of the cost of transporting and laying them. The number of very sharp curves in the line served to wear out the cables with distressing rapidity. Each cable is composed of a number of interwoven strands of fine wires not more than a sixteenth of an inch in diameter. The strain on the curves was too much for these. When the cables wore out, they, too, were useless, except as old steel. They were sold to the iron dealers for 3 cents or 4 cents a pound.

When electricity proved successful as a motive power and proved so much cheaper as a means of operating, it became evident that the only method of successfully running the road would be by discarding the cable system and adopting the electric. In this respect the road is also unique. It is the only one in the world which has been completely torn up from end to end and replaced with an entirely new equipment. At the present time the only things used on the road that were used under the cable system are the two engines which ran the cables and now run the dynamos, with the help of two new ones. For some time after the transformation of the road the immense drum wheels, fly wheels, and other machinery lay idle in the Channing Avenue power house. Under the new system it was useless. Finally it was sold to the original builder, the Walker Manufacturing Company, of Cleveland, O. Under its direction the work of removing it is going on. The great weight of the pieces necessarily renders it very slow. The great fifty-ton fly wheel has to be handled with the utmost care, notwithstanding the fact that it is cast in four pieces. The immense drum wheels have been partially moved with a derrick and pulleys. The outer rims, in which the cables formerly turned, have been carefully removed. The framework, upon which the machinery rests, contains hundreds of tons of iron, which will be packed upon cars and shipped to Cleveland.

Although the machinery was sold at a figure far below its cost price, it is still in remarkably good condition, and will probably be utilized elsewhere for the purpose for which it was originally designed. The thirty-nine old cars of the cable company, stored in the Vandeventer Avenue car house, will probably get into active use during the coming summer. The officials of the road state that they expect a 50 per cent increase in their business during the heated months, and they expect to be obliged to put on at least a part of the cable cars. Such as are not used will be sold, and then there will be nothing upon the streets to remind St. Louis people that the pioneer cable road of the city ever existed.

Experiments with Celluloid.

A correspondent recently forwarded us three varieties of articles made from the material known as celluloid, viz., an imitation ivory dice box, an imitation tortoise shell hairpin, and a variegated pattern of a toy bouncing ball. In view of the possible dangers arising from the use of buttons, hairpins, etc., made of this material, we have submitted the above to experiment, and the results are perhaps of sufficient interest to justify record. The articles were, without exception, highly inflammable. On applying a light they burst instantly into a brilliant smoky flame like that produced when camphor is ignited. It was not difficult to blow the flame out, but dense fumes continued to be given off which were quite as inflammable as coal gas, and, on placing a light in the stream of smoke at a distance of six inches above the material, a bright flame instantly ran down and reignited the article.

Portions of the three articles were next placed on paper at a distance of eighteen inches, in front of a red-hot fire, where the temperature was ascertained to be 100° C. (212° F.) Beyond the softening of all the pieces, and a slight swelling of the tortoise shell and toy ball sections, no signs of ignition could be observed. The paper on which the articles were resting was then placed about twelve inches from the fire, where the thermometer showed a constant temperature of 110° C. (230° F.), *i. e.*, ten degrees above boiling point. In ten minutes the pieces of thin celluloid, of which the ball was composed, swelled out, emitted dense fumes of camphor, and charred, without, however, showing any sign of flame, while the paper was only blackened and scorched. In fifteen minutes precisely a similar occurrence happened to the hairpin, the imitation ivory being as yet unchanged. Another hairpin and a fresh piece of the toy ball were then placed along with the yet unfired ivory specimen within six inches of the fire. The piece of toy consumed rapidly away in little over a minute, apparently without flame, and the hairpin followed suit in about three minutes. The paper upon which they lay was charred only, not actually ignited. The imitation ivory showed slight swelling under these conditions, but not until the temperature was raised to 145° C. did it puff up and give off abundant smoky fumes of camphor, as in the previous experiments. In no case could it be said that the combustion was accompanied by flame, nor was the paper upon which the articles were resting actually ignited; it was only scorched and charred.

The difference exhibited by the ivory specimen in susceptibility to the influence of heat may possibly be accounted for by the fact that, first, it is more dense, and, secondly, it contains a fair amount of zinc salt. On ignition the ash was found to consist almost entirely of zinc oxide.

The addition of this metallic salt serves probably to make transparent celluloid opaque and to give it the appearance of ivory. The tortoise shell pins contained no zinc, and yielded very little ash at all; and while in the toy ball, which was of variegated pattern, the white opaque spots contained the metal, none was found in the clear portion of the material. All the specimens emitted a strong odor of camphor on rubbing, and more especially the tortoise shell and transparent variety. Ether also dissolved out camphor from each of the specimens.

It would appear from these experiments that celluloid is, generally speaking, not so dangerous as might be supposed, although, in view of the testimony recently furnished by Professor Boys, F.R.S., of the inflammability of buttons made of this material, there are exceptions; but probably these exceptions depend upon a variation in the composition of the celluloid, some preparations, perhaps, containing more pyroxylin, and accordingly less camphor, than others. The manufacturers of celluloid would in any case do well to give their attention to this matter, and by adopting a process which will secure greater certainty in the composition and character of this beautiful material, or by incorporating with it some substance which will render it practically non-inflammable, rid it of the one quality which at present would seem to render its general use not quite safe.—*Lancet.*

World's Fair Progress.

The number of men at work on the grounds and buildings at Chicago is now 5,000.

Mrs. Potter Palmer, President of the Board of Lady Managers, has undertaken to erect, equip, and maintain a building 90 × 150 feet, wherein babies and younger children can be left when their mothers are viewing the sights of the fair. Nurses, attendants, games, etc., are to be provided.

It is proposed to run from New York to Chicago, at the time of the dedication of the exposition buildings, ten special trains, ten minutes apart, each train to have elaborate decorations and music. It is believed that fully 5,000 people will want to make the trip.

Workmen have begun raising trusses to support the roof of the Manufactures Building. These trusses will be the largest in the world. There will be 22; each will cover a span of 688 feet. Over the center of the roof, inside, to the ground floor, will be a distance of 206 feet. Each truss weighs 200 tons. A total of 6,000 tons of steel will be used in the roof of the building.

The Reichstag has passed to a second reading a bill granting a supplementary credit of $500,000 for the German exhibit at the World's Fair.

The fountain which is to stand at the foot of the main basin in Jackson Park is projected to be the largest in the world. It was designed in Paris by Sculptor McMonnies, of New York. A force of modelers and blacksmiths are working on it night and day. The idea is an apotheosis of modern liberty, Columbia assuming the shape of a triumphal barge guided by Time and heralded by Fame. There will be eight standing figures, representing the arts, science, industry, agriculture, and commerce. Eight mammoth sea horses will form a circle directly in front of the fountain, and their nostrils will spurt great streams of water. They will be mounted by stalwart young men as outriders, to represent commerce. The design of the basin is circular, 150 feet in diameter and flanked on each side by columns 50 feet high, surmounted by eagles.

Many States are preparing to appropriate more money than they at first intended. The aggregate is now $3,180,000. Maryland and New York have voted respectively $60,000 and $300,000; New Jersey has added $50,000 to its appropriation of $20,000; Iowa has added $125,000 to the $50,000 already granted; and Massachusetts has doubled the $75,000 previously appropriated. Minnesota will supplement its $50,000 by $100,000 raised by subscription, nearly three-fourths of which has already been raised. Minnesota will spend $25,000 on a State building.

Creosote in Tuberculosis.

After nine years of experience with small doses of creosote (half a grain daily), Dr. Julius Sommerbrodt, in 1887, expressed himself as inclined to the belief that in the first stages of tuberculosis of the lung creosote can cure. After using larger doses (1 to 2 grains daily) lasting cures were recorded in long-continued and severe cases, and after continuing his observations he reports (*Berl. klin. Wochenschr.*, October 19, 1891) that creosote, in large doses (1 to 4 grains per day), is, for countless cases, unsurpassed as a curative agent in tuberculosis of the lung. For a patient over 10 years his minimal dose is 1 grain daily and his maximum dose 4 grains daily. He has never found bad results from his largest doses. The excipient is of importance. He prefers to give it with cod liver oil in gelatine capsules, containing one grain of creosote. It keeps best and is best absorbed and best taken in this form. His patients have no other medicine. It usually takes two or three months before its influence is very noticeable. Great numbers of his patients have taken five, ten, twenty thousand capsules *continuously* without a bad symptom, and with excellent appetites, and this in itself is an answer to the objection that it injures the stomach.

THE "ELECTRIC" GIRL.

"Electricity is a mysterious agent, therefore everything mysterious is electric." Such is the logic of the masses, rightly observes Mr. Nelson W. Perry in an article in which he exposes the somewhat crude processes employed in an exhibition made recently, at Paris and London, of a girl called "magnetic" or "electric," and possessing, according to her manager, an inexplicable and unknown supernatural power, although it is a question of a simple application of the elementary principles of the laws of mechanics, chapter of equilibrium.

This logic of the masses has already given birth to electric belts, hair brushes, tooth brushes, tripoli and book covers. To this logic of the masses, the logic of the scientist responds, almost under the same form: "All cows have tails, but all animals possessing tails are not cows." The conclusion is that the "electric" girl is electric only in name. If the exercises that she performs provoke the astonishment of a certain portion of the community, it is because the spectators are not, at a distance, in a situation to observe the artifices employed in each of the exercises, or to find a natural explanation of them in the known laws of mechanics. We propose to point out here a certain number of such artifices and to describe a few of the experiments, utilizing for this purpose the data furnished by Mr. Perry, as well as those resulting from our own observations.

Fig. 1.

Fig. 2.

The first exercises of the kind under consideration date back to 1883. They were presented by Lulu Hurst, of Georgia, and were the subject of a description by Prof. Simon Newcomb published in *Science*, Feb. 6, 1885. The success of those exercises, then unexplained, was prodigious, and Lulu Hurst soon had many imitators.

Miss Abbott, of London, and Miss Abbett, of Paris, are, we believe, the most recent and the first in Europe. They give the same exhibition and have even greatly improved upon and varied the experiments of their initiatrice Lulu Hurst. All these exercises tend to the same end, *i. e.*, to make it believed that there is a supernatural and incomprehensible force, electric or magnetic, by putting in opposition, under equivalent or *apparently* equivalent conditions, athletes or very robust men and a frail or delicate little girl, who triumphs over them in every experiment.

One of the experiments consists in having a man or several men hold a cane or a billiard cue horizontally above the head, as shown in Fig. 1. On pushing with one hand, the girl forces back two or three men, who, in unstable equilibrium and under the oblique action of the thrust exerted, are obliged to fall back. This first experiment is so elementary and infantine that it is not necessary to dwell upon it. In order to show the relative sizes of the persons, the artist has supposed the little girl to be standing upon a platform in the first experiment, but in the experiments that we witnessed this platform was rendered useless by the fact that the girl who performed them was of sufficient height to reach the cue by extending her arms and standing on tiptoes. Next we have a second and more complex experiment, less easily explained at first sight.

Two men (Fig. 2) take a stick about three feet in length, and are asked to hold it firmly in a vertical position. The girl places her open hand against the lower end of the stick, in the position shown, and the two men are invited to make the latter slide vertically in the girl's hand, which they are unable to do, despite their conscientious and oft-repeated attempts.

Mr. Perry explains this exercise as follows: The two men are requested to place themselves parallel with each other, and the girl, who stands opposite them, places the palm of her hand against the stick and turned toward her. She takes care to place her hand as far as possible from the hands of the two men, so as to give herself a certain leverage. She then begins to slide her hand along the stick, gently at first, and then with an increasing pressure, as if she wished to better the contact between the stick and her hand. She thus moves it from the perpendicular and asks the two men to hold it in a vertical position.

This they do under very disadvantageous conditions, seeing the difference in length of the arms of the lever. The stress exerted by the girl is very feeble, because, on the one hand, she has the lever arm to herself, and, on the other, the action upon her lever arm is a simple traction. When she feels that the pressure exerted is great enough, she directs the two men to exert a vertical stress strong enough to cause the stick to descend. They then imagine that they are exerting a *vertical* stress, while in reality their stresses are *horizontal* and tend to keep the stick in a vertical position in order to react against the pressure exerted at the lower part of the stick.

There is evidently a certain vertical component that tends to cause the stick to descend, but the lateral pressure produces a sufficient friction between the hand and the stick to support this vertical force without difficulty. Mr. Perry performed the experiment by placing himself upon a spring balance and assuming the role of the girl, with two very strong men as adversaries. All the efforts made to cause the stick to slide in the open hand failed, and the excess of weight due to the vertical force always remained less than twenty-five pounds, despite the very determined and sincere stresses of the two men, who, unbeknown to themselves, were exerting their strength in a *horizontal* direction.

Fig. 3.

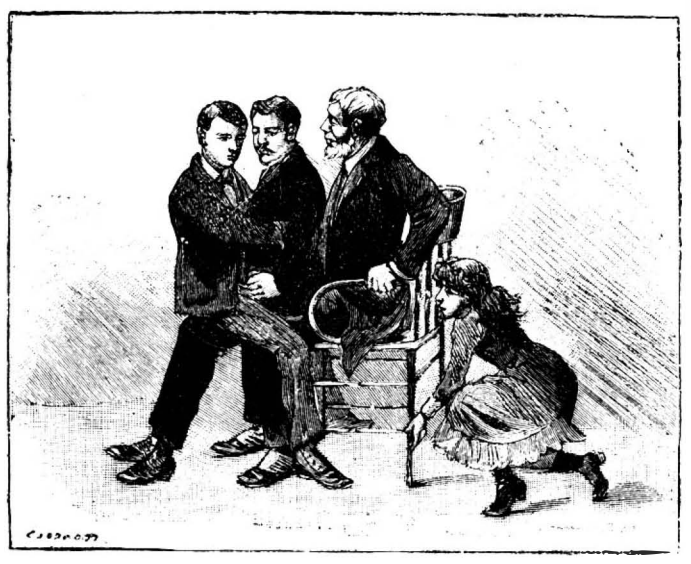


Fig. 4.

In the experiment represented in Fig. 3, and which recalls to mind the first one (Fig. 1), the two men are requested to hold the stick firmly and immovable, but the slightest pressure upon the extremity suffices to move the arms and body of the subject. Such pressure in the first place is exerted but slightly, and the stresses are gradually increased. Then, all at once, when the force exerted horizontally is as great as possible, and the men are exerting their strength in the opposite direction in order to resist it, the girl abruptly ceases the pressure *without warning* and exerts it in the *opposite direction*. Unprepared for this change, the victims lose their equilibrium and find themselves at the mercy of the little girl, and so much the more so in proportion as they are stronger and their efforts are greater. The experiment succeeds still better with three than with two men, or than with one man.

In the experiment represented in Fig. 4, where it concerns the easy lifting of a very heavy person, the trick is no less simple. Out of a hundred persons submitted to the experiment, ninety-nine, knowing that the experimenter wishes to lift them and cause them to fall forward, grasp the seat or arms of the chair, and, in endeavoring to resist, make the whole weight of their body bear upon the feet. If they do not do so at the first instant, they do so when they are conscious of the attempts made by the girl to raise the seat, and they help therein unconsciously. The experimenter, therefore, needs only to exert a horizontal thrust, without doing any lifting, and such horizontal thrust is facilitated by taking the knees as points of support for her elbows. As soon as a slight movement is effected, the hardest part of the work is over, for it is only necessary for the girl to cease to exert her stresses in order to have the chair fall back or move laterally in one direction or the other. At all events, the equilibrium is destroyed, and, before it is established again, it requires but little dexterity to move the subject about in all directions without a great expenditure of energy. The difficulty is not increased on seating two men, or three men, upon each other's knees (as shown in Fig. 4), since, in the latter case, the third acts as a true counterpoise to the first, and the whole pretty well resembles an apparatus of unstable equilibrium, whose center of gravity is very high and, consequently, so much the more easily displaced.

All these exercises require some little skill and practice, but are attended with no difficulty, and, upon the whole, do not merit the enthusiastic articles that have given the "electric" or "magnetic" girl her European reputation.—*La Nature.*

Aluminum Soldering.

The following methods of soldering aluminum are recommended by the Neuhausen Company. For sheet aluminum an iron-tin solder may be used with a flux composed of resin, neutral chloride of zinc, and grease. The metal should not be cleaned or scraped unless it is absolutely necessary to do so, in which case alcohol or essence of turpentine should be used for the purpose. For 5 per cent aluminum bronze tin solder may be employed, but this is not possible with the 10 per cent alloy, in which case the company recommends a preliminary copper plating. If it is difficult to dip the ends to be plated directly into the solution, pieces of blotting paper soaked in a solution of $CuSO_4$ may be laid on them and a current passed. The flux mentioned above may be used.

Another solder which is recommended is one consisting of copper 56 parts, zinc 46 parts, and tin 2 parts, applied with borax. Some tests made at Neuhausen showed that with these solders plates of aluminum soldered together, edge to edge, required a tractive effort of from 16½ to 18 tons per square inch to pull them asunder; if the edges overlapped, 22¼ tons per square inch were required. Pieces of cast aluminum bronze, if placed in sand moulds, can be joined together autogenously by running in some of the molten metal. If this operation is properly carried out, the joint is indistinguishable from the rest of the casting. Thin cylinders of aluminum are made in this way by bending the sheets round end to end, and soldering with molten aluminum.

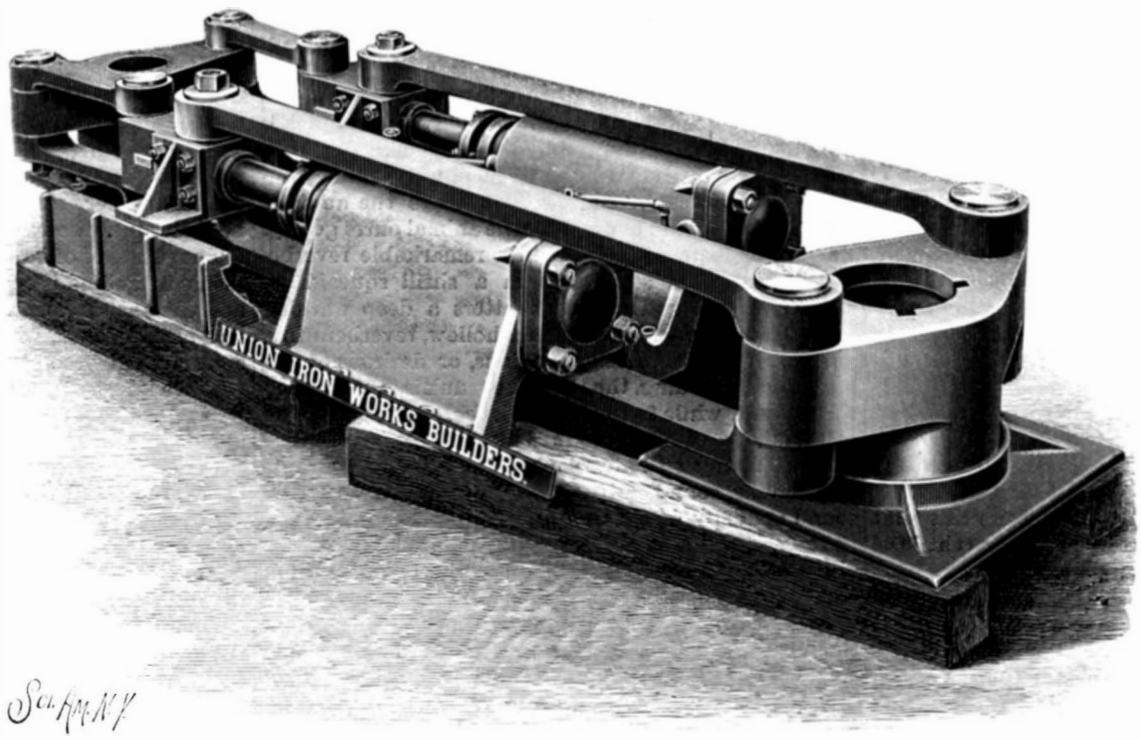
ENGINES OF THE MONTEREY.

(*Continued from first page.*)

6 inches diameter, the starboard one being right and the port left handed.

The condensers are cylindrical, of composition, and have about 3,850 sq. ft. of cooling surface in each. The circulating pumps are centrifugal, with a capacity of 5,000 gallons per minute each, and connections for working as wrecking pumps. Each condenser has two vertical single-acting air pumps, 14⅜ inches diameter by 15 inches stroke, driven by a compound engine with a fly wheel at each end of shaft. There is a valve in the exhaust pipe from each low pressure cylinder, to shut off the connection to the condenser and permit it to be used as an auxiliary condenser when the main engines are stopped. The engines are fitted with starting valves, a steam-actuated throttle, and a combined steam and hydraulic reversing gear, so that they can be handled with ease, and there are the usual auxiliary engines.

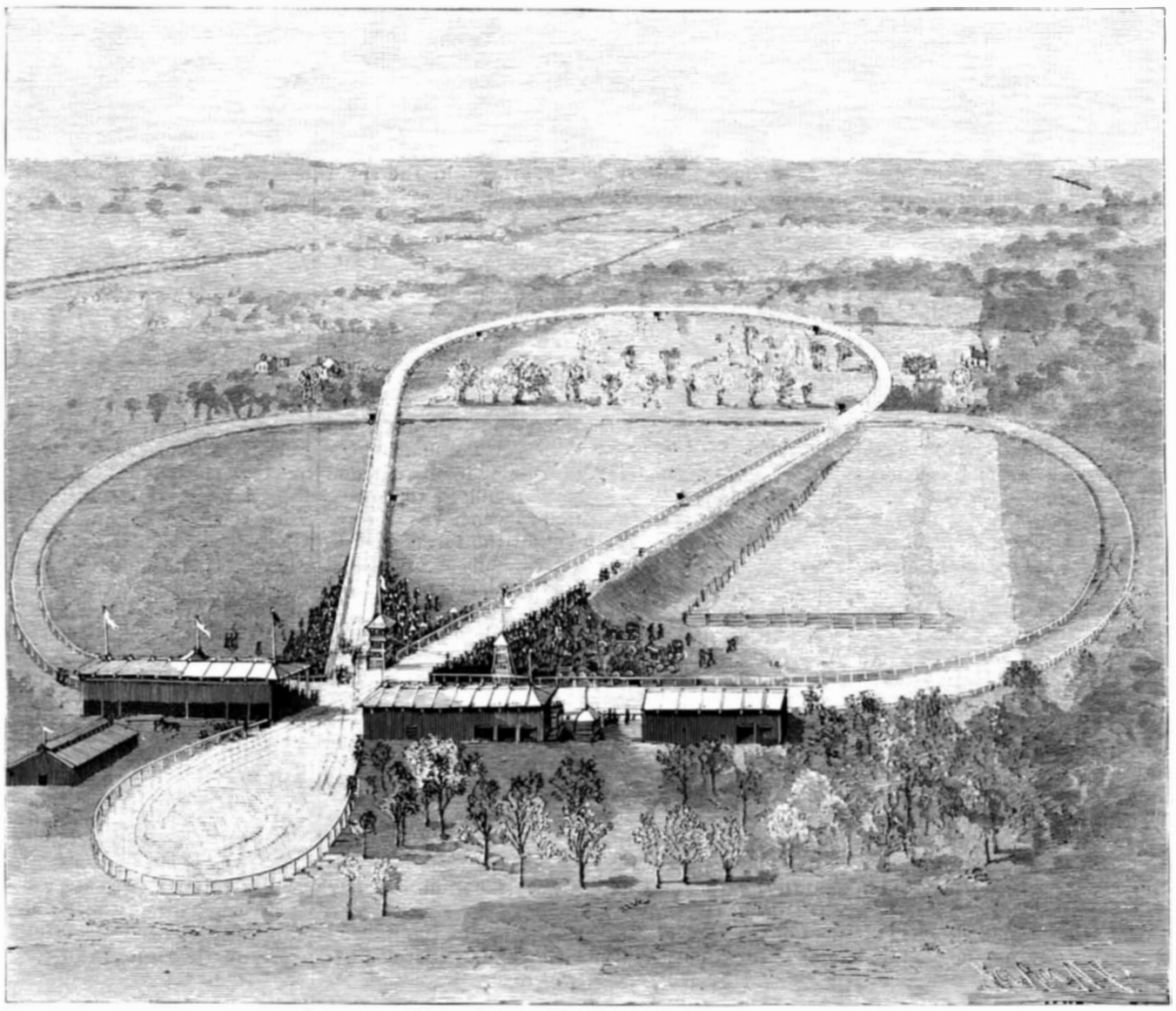
In order to reduce the weight of the machinery to the lowest limit the engines have been made as light as possible, and about three-fourths of the required boiler power is supplied by coil or tubulous boilers. Four boilers of the latter class, to give a collective horse power of 4,500, were contracted for with Charles Ward, of Charleston, West Va., after careful trials. The two cylindrical boilers with which the vessel is also to be supplied are fitted to work at 160 pounds, and are designed to give sufficient steam for ordinary uses, for propelling the vessel at ten knots speed, while the coil boilers enable steam to be raised in less than half an hour in sufficient quantity to give seventeen knots. The total weight of the boilers is reduced about one-half by this combination of the two systems.



STEERING GEAR OF THE MONTEREY.

THE STOCKTON, CALIFORNIA, RACE TRACK.

Our illustration presents an effective comparison of the kite-shaped and the ordinary oval race track. Each track is a mile long, the start and finish on the kite-shaped track being just before the crossing of the tracks toward the small loop, the mile covered by the large loop being divided into eighths. The kite-shaped track at Stockton was opened last year, and some of the world's best trotting records were made thereon during the season. Sunol made the world's record of a mile in 2:08¼; Palo Alto made the world's stallion record of a mile in 2:08¾; Arion made the world's record for two-year-olds of 2:10¾, and Frou Frou for yearling champions of 2:25¾. The kite-shaped track is conceded by horsemen generally to be 2 to 3 seconds faster than the oval track, the straightaway dash at the start being a third of a mile, and there being also one-third of a mile of straight track to the finish. The view of the race from the grand stand is not as good, however, the relative positions of the horses not being so well defined and their action not so readily distinguishable, as they are, for so large a portion of the race, going almost directly away from or coming almost directly toward the observer.



THE KITE-SHAPED RACE TRACK, STOCKTON, CALIFORNIA.

Dangers of Arsenical Soap.

As several cases (one fatal) of poisoning by arsenical soap have come to my notice, I think a few words on its dangerous properties might not be amiss.

The common white arsenic of commerce (oxide of arsenic) when mixed with some animal matter, as the fat in soap, fat skins, or any other albuminoid substance, forms one of the most, if not the most, dangerous poisons known, the ptomaine of arsenic, as follows: All flesh and fats after a short exposure to air begin to decay. One of the products of decay is a cadaveric alkaloid, called a ptomaine; the decay sufficient to form ptomaine might not be noticeable.

Now when you make arsenical soap you probably take some cheap soap that has been made out of half putrid fat, mix your arsenic with it and cork it up. Now this corking up seems to favor the formation of the ptomaine, or keep it from evaporating, as it has always been noticed that matter that has been exposed to the air and then closed up contains more ptomaine than those just exposed to the air. This ptomaine as soon as it forms unites with the arsenic and forms ptomaine of arsenic.

The poisonous qualities of arsenic and the ptomaine of arsenic might be compared to 1 and 100, besides which the following must be considered: That there is no antidote for the ptomaine, while peroxide of iron, or iron rust, is one for arsenic; that it is volatile and can be inhaled, while arsenic is not; that it can be absorbed through the pores, while the little arsenic it would be possible to absorb would act only as a tonic, while the ptomaine acts only as a virulent septic poison in all cases; that the lye in the soap favors the entrance of the poison by softening and more or less removing the epidermis of the skin.

Many taxidermists have remarked the effects of arsenical soap. I find the following by Maynard:

"It is a fact to which I can bear painful testimony that they are, especially when applied to greasy skins, poisonous to the extreme. I have been so badly poisoned when working on the skins of some fat water birds that had been prepared with arsenical soap as to be seriously ill."—*The Oologist.*

Multum in Parvo.

The electric railway plant at Ottumwa, Iowa, contains some distinct and quite novel features. The plant not only generates the power for the operation of the electric cars, but also supplies electric light for the city and furnishes steam heat to those desiring it, the exhaust steam from two 150 horse power engines supplying most of the steam used for that purpose. The steam is carried in mains of 10, 8, 6, 5 and 4 inches in diameter, according to the number of customers probable on the line. These pipes are wrapped with asbestos boards and incased in pine logs bored out, leaving an air space surrounding the pipe; the logs being tapered at the ends and driven solidly into each other. These mains aggregate about 2¼ miles in length and are placed about 5 ft. below the surface.

The system requires an initial pressure of 16 pounds, which produces a pressure of from 8 to 9 pounds at the extreme limit. This of course throws a back pressure on the engines, but as they are of ample power to do all the work required of them, no difficulty is experienced from this cause. In weather in which the exhaust steam does not supply sufficient heat live steam is automatically turned into the mains and retained at the proper pressure. The *Railway Review* says this is the third year that this plant has been in operation and it has proved very satisfactory to all parties connected with it.

Natural History Notes.

An Albino Lobster.—A curiosity was recently found in a boatload of lobsters that was brought from New Brunswick waters to Eastport, Me. The strange crustacean was like all the others except in color, being of a bluish-white—one of the rare and remarkable albino lobsters. It was packed carefully in seaweed and sent to Washington, where it is to become a part of the exhibit of the United States Fish Commission. Only one other white lobster has been taken in these or any other waters, it is believed, and that specimen was captured some time ago by a fisherman at Welchpool, Campobello, N. B. The Eastport specimen was twelve inches in length, and as lively as any lobster in the lot.

Artificial Coloration of Birds.—The distinguished naturalist Dr. Sauermann has published in the *Gazette de Francfort* a series of very curious observations touching the artificial coloration of birds. The fact is recognized, says he, that Canary birds fed on Cayenne pepper insensibly change color and pass from yellow to red. Cayenne pepper, in addition to a tinctorial substance, contains an irritating principle and an oily matter. When these two latter principles are extracted through maceration in alcohol, the pepper loses its coloring property upon the plumage of the birds; but if olive oil be added to the product of maceration the coloring action reappears. It is inferred from this that the oily part of the pepper is the necessary vehicle of the color. Experiments made upon wholly white hens have given an identical result. These hens possess the property of foreshadowing a change in the temperature by a very marked change of tint. The yolk of their eggs is of a very bright red. The same experiment has been tried with the root of the alkanet (*Anchusa tinctoria*), with the result of a production of violet red.

The Generation of Oxygen by Plants has been studied by Henri Jumelle (*Compt. Rend.*, cxii., 1462) at very low temperatures, and he finds that carbonic acid is decomposed at low temperatures, at which respiration has completely ceased, by plants the vitality of which is not affected by a high degree of cold. Thus the assimilation of atmospheric carbonic acid gas is effected in the light at —35° and —40° C. by *Picea juniperus* and other coniferæ, and by lichens like *Evernia prunastri.*

The Comb of Scorpions.—Messrs. Brongniart and Gaubert recently presented a paper to the French Academy of Sciences on the pectiniform organ of scorpions, the function of which has up to the present been considered enigmatical, and which Mr. Blanchard, in 1853, supposed to play a part during coupling. Some direct observations by Mr. Andre Mares having fortified this hypothesis, Messrs. Brongniart and Gaubert proceeded to a study of the anatomy of the comb, which was found by them to constitute, in addition, an exciting organ. In fact, from the nerve that traverses the comb start branches that run to each tooth of the comb, on reaching the extremity of which the nerve is completed by a ganlion formed of a bead-like string of cells, each provided with a large nucleus. The nerve fibrils pass between these cells and terminate, each of them, in a conical eminence. They are provided with a large nerve cell before reaching the external edge of the chitinogenous layer, which is very thick at this point. According to the authors, it results from this structure that the combs of scorpions serve also as organs of touch. In walking the animal is capable of moving them, and makes use of them to ascertain the nature of the ground.

Life among Birds.—The distinguished German biologist, Weismann, has pointed out that there is less exact knowledge on this subject than might be expected, considering how many in number are the ornithologists and the ornithological societies. Small singing birds live from eight to eighteen years. Ravens have lived for almost one hundred years in captivity, and parrots longer than that.

Fowls live from ten to twenty years. The wild goose lives upward of one hundred years, and swans are said to have attained the age of 300. The long life of birds has been interpreted as compensation for their feeble fertility and for the great mortality of their young.

From the small island of St. Kilda, off Scotland, twenty thousand young gannets and an immense number of eggs are annually collected; and although this bird lays only one egg per annum, and is four years in attaining maturity, its numbers do not diminish. Obviously, as Weismann observes, such birds must reach a great age, or they would long ago have been exterminated.

Language of Elephants.—The language of the elephant is as well understood by the East Indians and those who have to do with the animal as if the communication were made in their own tongue, though, curious to relate, the sounds in India and Ceylon have different meanings attributed to them. When enraged an elephant utters a shrill cry through the trunk, which may be taken as a warning. A sportsman engaged in hunting elephants had approached a large tusker, when he found to his chagrin that he had dropped his ammunition, so that he could only lie concealed and feast his eyes upon the huge animal. His disappointment was partly compensated for by observing the elephant informing the herd that danger was lurking near it. Communication was made in the following way: The tusker was feeding, and moved slowly around until it suddenly came below the concealed sportsman, when, with its wonderful scent, it immediately recognized the presence of its enemy. Then it stopped feeding, raised the tip of its trunk cautiously, and, in a low, suppressed, but penetrating tone, uttered with its lips the sound "prut," which it repeated so that it somewhat resembled the twittering of a bird. The sound would hardly have been noticed had not the sportsman been near at hand; but it was immediately understood by the herd, which moved quickly but silently away, followed by the sentinel.

Pleasure is often expressed by elephants in an excruciating squeak, far from pleasurable to the auditor. When satisfied and contented, the animal purrs gently. Fear finds expression often in a remarkable reverberating roar, and sometimes in a shrill squeak. A thoroughly enraged elephant utters a deep warning sound in the throat, and often a hollow, reverberating, rumbling sound. When suspicious, or desirous of giving a slight warning, the tip of the trunk is tapped upon the ground, while from the trunk there issues a volume of air which at times sounds like a sheet of tin being rolled. Young or baby elephants express their wants by singular sounds uttered by the throat. Another sound made by wild elephants is produced by striking the sides forcibly with the trunk. That elephants use these and other sounds as methods of communication or as language there can be no doubt.

The Migratory Locust and its Changes of Color.—Such is the title of a memoir presented to the French Academy of Sciences by Mr. Blanchard in the name of Mr. Kunckel d'Herculais. The varied colors that locusts exhibit have been attributed to distinct local varieties. The author of the memoir shows that these colors are successively exhibited by the same individual at various periods of its development, and that they succeed each other at the same time as the moultings. They are connected with the properties of special pigmentary substances which are modified under the influence of the light, and with other external causes. The young are greenish-white, but under the influence of light they become brownish and change to black. At the second moulting rosy colorations appear, especially upon the sides of the body; at the third, the rosy tints augment; and at the fourth they predominate, but give place to yellow tints. The same is the case after the fifth and sixth moulting, and the adult insect appears in a livery of the most delicate rose color. Upon the whole, says the author, it may be stated that in the periods that precede and succeed moulting the pigment of the insects is of a rose color, and that this pigment changes tone, passing successively through various shades to finally reach yellow. The appearance of the yellow tints of the young and adults is, therefore, in reality a consequence of aging. What is worthy of remark, and what well shows that these modifications in the color of the pigments are the expressions of histolysis and histogenesis taking place at the time of moulting and metamorphosis, is that after each of these phases the acridians void rose-colored excrements. The tegumentry exuriæ left after each moulting are colorless in all the parts that are not black; the black spots or markings are alone indicated. The action of light is manifest. Young migratory locusts reared in the shade never acquire the bright lemon yellow tints of their fellows reared in bright sunshine. It is to be noted that the yellow or adult acridians submitted to rapid desiccation by fire or immersed in alcohol become red again. We have here a phenomenon of dehydration which causes the primordial tints to reappear.

Time Sense in Animals.—Time sense is very highly developed in domestic fowls and many wild birds, as well as in dogs, horses and other mammals, which keep an accurate account of days of the week and hours of the day, and have, at least, a limited idea of numerical succession and logical sequence. A Polish artist, residing in Rome, had an exceedingly intelligent and faithful terrier, which, as he was obliged to go on a journey, he left with a friend, to whom the dog was warmly attached. Day and night the terrier went to the station to meet every train, carefully observing and remembering the time of their arrival, and never missing one.

Meanwhile he became so depressed that he refused to eat, and would have died of starvation, if the friend had not telegraphed to his master to return at once if he wished to find the animal alive. Here we have a striking exhibition of time sense as well as an example of all-absorbing affection and self-renunciation likely to result in suicide.

Mexico to Build the Tehuantepec Ship Railway.

It is reported that the government of Mexico has made a contract with Mr. E. L. Corthell, the well known engineer of Chicago, Mr. Hampson, formerly of Fairfield, Ia., and Mr. Stanhope, an English resident of the city of Mexico, to complete the railway across the Isthmus of Tehuantepec, between the Atlantic and Pacific oceans, which was begun by an English company some time ago. The government has two millions of dollars in hand for this work, which it is said will be given to Mr. Corthell and his associates as a subsidy, together with the right to organize a company, issue securities, and build the terminals, and the two harbors for the largest class of vessels. Mr. Corthell has been in the employ of the Mexican government for several years, and is just completing the extensive jetties at the harbor of Tampico.

Military Ballooning.

A new impetus to ballooning will doubtless result from the following successes of the Germans on the Russian frontier, given in reports telegraphed from St. Petersburg to the New York papers. We think it is probable there is considerable exaggeration in the statements here made as to the special movements and navigation of the balloons.

The presence of balloons over the forts and encampments in Poland is becoming more frequent than ever, and this fact is causing much indignation among Russian army officers, who are helpless to prevent military secrets from becoming known to the German officers, who are known to be taking observations from a height that places them beyond the reach of any bullets aimed at them. One of these balloons from the German frontier recently appeared at Kovno. It hovered above the fortress there until the officer in command became so greatly exasperated that he ordered some of the soldiers to fire at the balloon and, if possible, to bring it to the ground, but the soldiers were unable to hit the big silken bag.

The range was too great, and the powder burned in the attempt was useless. The Germans continued their observation, in no way bothered by the firing, and when they had concluded they returned whence they came. The impression grows stronger daily that the Germans have at last solved the long-studied problem of aerial navigation. These balloons that have appeared over various places in Poland are under perfect control. They move in any desired direction, and the wind currents have no perceptible effect upon them. In fact, in at least one instance, it is known that the balloon sailed directly against a strong wind. Some of the observers accounted for this on the ground that the upper current in which the balloon moved was in an opposite direction from the current nearer the earth.

This argument was rendered fallacious in a very short time by the balloon stopping over the military camp at Dombrowice, and then maneuvering to obtain positions from which the camp could be studied in detail. The motive power employed and the means adopted for steering are utterly unknown, but all the facts in connection with the appearance of these balloons go to show that they are under absolute control. The possibilities of a perfect system of aerial navigation are thoroughly understood by Russian officers, but they are absolutely helpless to guard against them. It is the fact of this utter helplessness that renders their indignation more deep and bitter.

A few nights ago the inhabitants of Warsaw were startled by an intensely bright light that fell from the sky upon the city. All eyes were turned upward, but nothing could be seen save a path of light that ended in a small focus. Many people in their excitement thought it was a comet in close proximity to the earth, and were greatly frightened. Suddenly the ray of light swept in another direction, and when their eyes became accustomed to the darkness that followed, they could see far up in the sky a balloon. Then it dawned upon the people that it was an electric search light that had caused the brilliant illumination, and that the Germans were continuing their observations of the Russian defenses with its aid. The balloon remained over the city until 1 o'clock in the morning, when the light was extinguished, and the balloon, heading westward toward the frontier of Prussia, disappeared.

Later another balloon was seen over the Proushkorff railway station. It remained stationary for a time, and then started in the direction of the fort works near Kelets, where it hovered awhile, when it returned across the frontier.

Reports of similar occurrences have been received from Sosnovitzy and other places along the frontier. The balloons come from Prussian Silesia in the night time and project the rays of powerful search lights in every direction. The balloons, which were at a great height, remained stationary sometimes for the space of 40 minutes, and would then proceed in any desired direction. There is no doubt that the steering apparatus, whatever it is, is admirably adapted for its purposes, for the balloons apparently answer to it as readily as does a vessel to her helm.

Russian officials hold that with manageable balloons the whole system of warfare will be changed. It is self-evident that none of the present fortifications would be able to withstand an attack from above them. Shells could be dropped with almost unerring certainty, and no city could defend itself from an enemy far up in the air beyond the reach of any missile. Even modern cannon, with their great range, could not at present be used against balloons, for the reason that gun carriages have not been made that will allow of a perpendicular elevation.

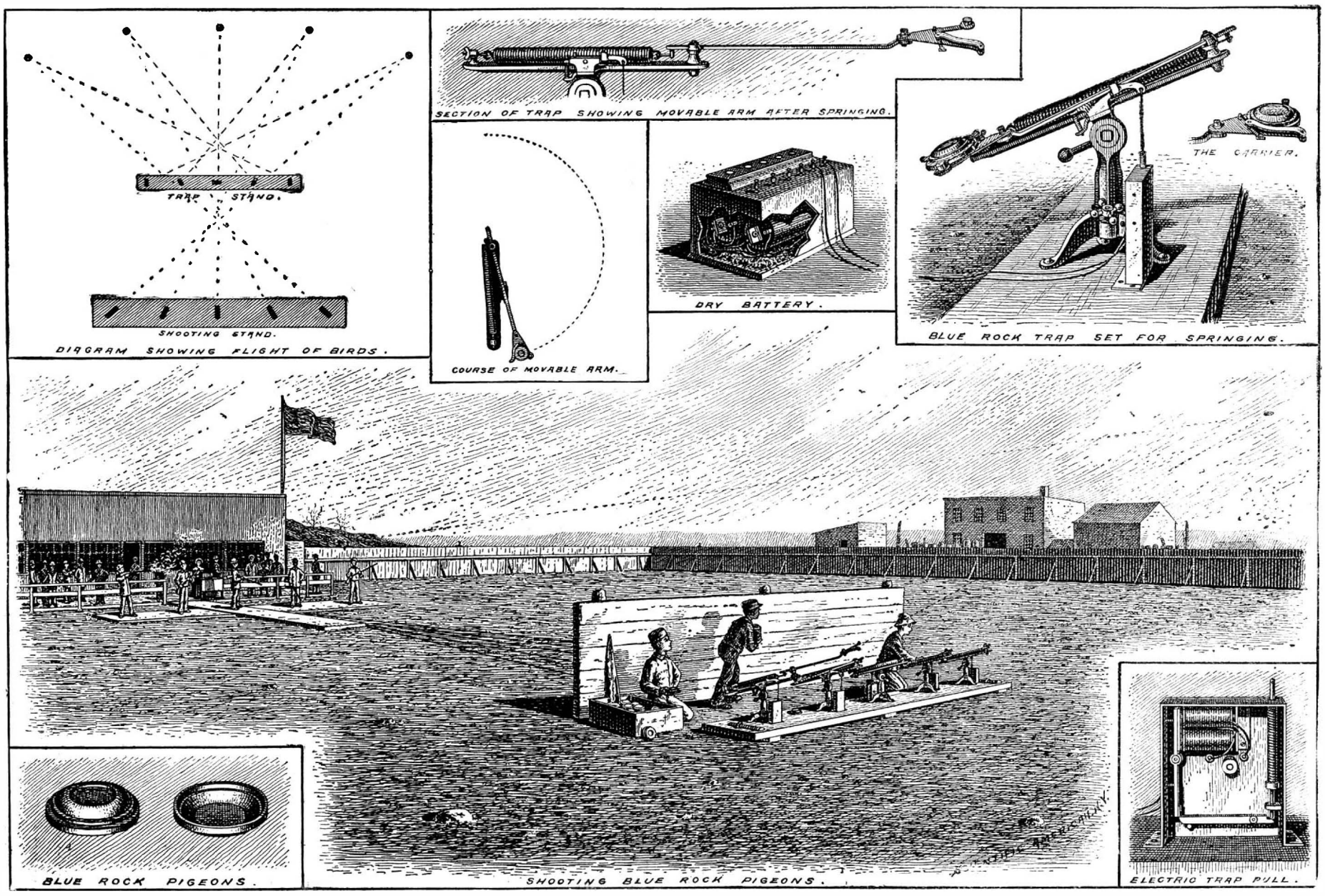
ELECTRIC SHOOTING PULL.

Trap shooting is becoming a great sport in this country, and gun clubs are springing up in almost every State. The old way of pulling the traps with ropes is gradually being dropped and the new electric pull substituted in its place. With the old way the ropes would very often get entangled, causing a great deal of delay. With the electric pull the trap is sprung instantly as soon as the shooter calls out "Pull!" The traps are made mostly of cast iron, about 1 foot in height. The elevation arm, containing the trigger, spring, and swinging arm with carrier, is about 2½ feet in length. This arm can be placed at almost any elevation, being connected by means of a movable bolt to the circular head of the upright post of trap, which rests in a ball socket in the base or stand of trap and can be turned also at any angle. The spring is of steel and is 1½ inches in diameter and about 9 inches in length, and has a pressure of about 250 pounds.

The traps are set and the birds placed in the carriers by boys. The trigger is connected to the electric trap pull by means of a leather strap which is fastened to a bolt passing down through the top of the battery box, the lower end of the bolt resting on one end of a releasing lever. The other end of lever passes just under the edge of the lever at the side which connects with the battery. When the current is on, the top of side lever draws toward the battery, releasing the bottom lever and causing the bolt with the spring attachment to drop down, pulling the trigger of the trap with it and letting loose the swinging arm which throws the bird into the air. The electric pull is connected to a dry battery on the platform behind the shooters' stand, which is about 20 yards from the traps. The shooters and traps are numbered 1, 2, 3, 4, 5. When No. 1 is ready to shoot he calls out "Pull!" The party in charge of the dry battery touches electric button No. 1, and No. 1 trap throws its bird in the air. Traps No. 1 and 5 throw their birds at an angle of about 30 degrees, traps No. 2 and 4 about 15 degrees, and trap No. 3 straight ahead. Shooters Nos. 1 and 5 shoot at the birds that fly at the greatest angle. Nos. 2 and 4 shoot at the next angle, and No. 3 straight ahead. The birds will fly about 60 to 70 yards from the traps, and to a height of about 150 feet. The shooters fire at the birds as soon as they show themselves above the wooden screen, before they get too far away. This screen is made of heavy planking, to protect the boys attending the traps from flying shot.

The birds are made of a mixture of clay and coal tar, and are very brittle. The shooting surface when the bird is in the air is about 4¼×1½ inches. The birds are 4¼ inches in diameter and 1 inch in height and ⅛ of an inch in thickness. They weigh about 3 ounces each. The birds are saucer shaped and fly with the convex side up. The tops of the birds are painted a bright yellow, giving the shooters a spot to aim at before firing.

The carrier is V-shaped, having on one side a raised slot, in which the flange on the bottom of the bird rests. On the other side is a movable arm, with a spring attachment. The bird is held firmly in place by the aid of the spring and rubber button on the end of arm. The sudden stoppage after the trap has been sprung forces the bird out of the carrier. The shooters generally use 12 gauge shells loaded with No. 7 trap shot. The clay birds cost $8 per thousand. The traps weigh about 5 pounds each and cost in sets of 5, with electric apparatus, $53. Single traps cost $11.



THE ELECTRIC SHOOTING PULL.

Skinning and Mounting an Ostrich.

BY OLIVER DAVIE.

In the month of January, 1891, three days of my time were consumed in the skinning and mounting of an African ostrich which had died at the winter quarters of Sells Bros.' menagerie. I had long desired to try my hand on the giant of birds, and this one finally offered ample opportunity. The bird was a male and weighed one hundred pounds, and was undoubtedly in poor condition.

In the skinning and dissection of this specimen I learned more of comparative bird physiology than any opportunity had presented for years.

Its being the connecting link between the birds and quadrupeds, I saw at once how rudimentary the wish bone is, while the shape of the breast bone is like that of a turtle's back, and placed far up in front. Its enormous crop, powerful gizzard, the immense muscles and tendons of the legs, calculated no doubt for the support of the bird in running long distances, and, on the whole, the peculiarly shaped contour of the naked trunk or body, were subjects which naturally gave rise to the careful study and the comparison of similar parts in the structures belonging to those of the less powerful of the feathered tribes.

After taking some notes and sketches of the four or five remaining ostriches of the group, I carted the dead specimen to my workshop, where I proceeded to skin it. An incision was begun high up on the breast and continued to the vent. A cut was then made on the breast directly across to each leg and continued down on the inside of the leg out over the heel, thence down over the back of the tarsus clear down under the foot to the end of the large toe.

Lifting the skin along the breast and on the legs the knee joint was laid bare and severed, the thigh remaining attached to the body. All the muscles and tendons were removed from each leg when skinning proceeded, in the usual way, over the back and down the neck. The head being too large to pass through the skin of the neck, the vertebræ were accordingly severed as close to the head as possible; the head being skinned through an opening made on the back of the head and down the neck for about eight inches.

A center board was now made exactly the shape of the contour of the body, and a large square hole was cut in each end of this board. These openings are made in order that in laying the tow on to build out the manikin, it can be more firmly secured by sewing through from one side to the other with needle and twine. The next thing to be done was to lay the skin on the floor, and to arrange the legs in the stepping position I had previously decided upon. This being done, a heavy piece of annealed wire was used in obtaining the exact position of the legs, following closely and neatly every bend in the joints, clear down to the sole of the foot. From these patterns my blacksmith made, from round, half-inch iron rods, their counterparts in shape. The ends were threaded and provided with nuts and washers, and the ends which were to pass through the center board were bent the proper angle and length, so as to make the thickness of the body, which was obtained by blocking out on each side. The neck was made over a heavy iron wire which was fastened to the center board, and the whole manikin was covered with clay and modeled to represent the natural body of the bird. Before finally placing the skin on this artificial structure it was thoroughly poisoned; twice with arsenical soap and once with a paste made with an arsenical solution and common whiting. I used clay in forming the muscles about the head and in many places about the body, legs, and feet which required peculiar shapes. Having seen a number of mounted ostriches, I noted that in most of them, and especially in those where the attitude was that of running, the feet were made to lie perfectly flat on the ground, whereas, according to my observations, the ostrich walks or runs on the ball of the foot, as it were. In my specimen I avoided this fault by having the iron rod fit closely into the big toe, while the bend which went into the platform came out about the middle of the sole.—*The Taxidermist.*

THIN belts, as wide as possible, give by far the best results working vertically. A thick vertical belt will not hug the pulleys.

RECENTLY PATENTED INVENTIONS.

Engineering.

JET PROPULSION.—Erwin J. Meister, New York City. This invention provides an improvement in apparatus for piston propulsion in propelling vessels by forcing a current of water through the hull of the vessel and ejecting it at the ends. The stroke-regulating mechanism comprises a double crank shaft with slotted levers pivoted above the cranks, sliding boxes pivoted to the cranks sliding in the levers, and operative connections between the free ends of the levers and the piston rods of the engines, affording means for giving to the water pistons an irregular stroke, so that they will have a quick outstroke, enabling the water to be ejected with great force, and comparatively slow recovery, preventing excessive suction.

Railway Appliances.

TRAMWAY SWITCH. — George A. McMenimen, East Cambridge, Mass. This is a simple, practical device, affording means to direct a moving car from a main track to a side track, by manipulation from the car, or to enable an operator on the car to throw the switch as desired. The shifting rail is moved by a handle bar or by foot pressure operating standards guided in staple loops on the outer side of the car platform, the standard being held elevated by a spring, and there being a tapered foot block on the lower end of each standard.

Electrical.

MINING PICK AND DRILL. — John Fish, South Bend, Ind. A drive pulley is fixed rigidly on the extended armature shaft of an electric motor, and a supporting arm hung loosely thereon bears at its outer end a drilling device and operating pulley, while an endless belt extends from the driving pulley to the operating pulley at the outer end for working the drill. The electric motor may be of any preferred type, and the machine may be used as a mining drill or pick, as desired, the adjustability of its parts permitting it to be used in any position in which it may be required to drive a cutting.

LIGHTNING ARRESTER. — Edward G. Miller, Wilkinsburg, Penn. This invention consists in a helix provided with a mercury switch at the bottom, and furnished with a movable core or armature for displacing the mercury, while combined with the helix and the circuits is a series of carbon blocks arranged in a line with narrow air spaces between them. The device is for electric light circuits, to convey the charge to the ground, thus preventing it from reaching the dynamo, while also extinguishing any arc that might be formed by the passage of the lightning.

ANNUNCIATOR.—William C. Dillman, Brooklyn, N. Y. Two patents have been granted this inventor for annunciators for use in connection with speaking tubes, and which are operated by a current of air passing through the tubes, to announce when a person is at one end of the tube and wishes to talk with a person at the opposite end. The device is very simple and inexpensive, and may be easily applied to an ordinary speaking tube, when it may be readily operated by the breath to momentarily close a circuit in which an electric bell is included, thus ringing the bell and attracting attention to the tube, and also breaking the circuit quickly, to avoid excessive ringing of the bell and exhaustion of the battery.

MUSICAL INSTRUMENT. — Charles E. Guerre and Gaston H. Martin, Rouen, France. The case of this instrument has a sounding board and a keyboard, each having electrical contacts, and a bell or sonorous body mounted to vibrate on the sounding board having electrical contacts, there being an electric battery and vibrating and damping electro-magnets in the circuit of the battery, and electrical connections between the keyboard, the electro-magnets and the sonorous body. As the circuit is successively closed and opened by touching the keys the electro-magnets are alternately energized, one causing the bell to vibrate and the other arresting such vibration, thus giving forth a succession of musical sounds.

Mechanical Appliances.

PIPE CUTTER AND THREADER. — George W. Bowman and John C. Godfrey, Red Cliff, Col. This machine is adapted to be readily applied to different sizes of pipes, without removing the pipes from the places in which they are secured, the machine to be operated by one or more men, and being capable of quick adjustment to either cut a pipe off or cut a thread upon it. It has a separable hub, the parts having registering dovetail recesses which a locking key fits, while a slide block mounted on the locking key is provided with a cutter, there being a screw for adjusting the slide block and a ratchet mechanism for turning the hub.

WINDING BOBBINS, ETC. — Junius A. Murphy, New Orleans, La. This invention relates to means for causing a bobbin to traverse the flier in winding cord or yarn on the bobbin, automatically controlling the traverse movement of the bobbin, so that the cord or yarn will be wound in parallel or close coils throughout. A rotary feed screw has a fixed speed relatively to the flier and a nut thereon has a fixed speed relatively to the bobbin spindle, there being connections between the bobbin spindle and nut, whereby the changing relations between the spindle and flier will result in a difference in speed between the screw and nut.

Miscellaneous.

PUZZLE. — James A. McDougall, Pittston, Pa. This invention relates to that class of puzzles in which a board or box with movable devices and goals is designed to be held in one's hand and so manipulated as to direct the movable devices to their respective goals. The devices are loaded or have a preponderance of weight at one end, and a ball or marble is used to propel and direct the loaded devices to their proper places. The board has goals representing points distant from the World's Fair, and in playing the devices represent passengers starting to visit the fair.

PUZZLE.—Daniel V. Brown, New York City. This puzzle comprises a two-part separable case, one part of which closes within the other and has a transparent top, while a series of lettered blocks are held within the case, so that when correctly arranged they will spell a name reading spirally from the center to one corner on one side, and another name reading in the opposite direction on the other side.

TYPEWRITING MACHINE.—George M. Beerbower, Washington, D. C. This invention relates more particularly to an improved action, whereby the operator may depress a key, make an impression, and allow the weight of the hand to rest upon the key while others are depressed without danger of the type interfering with one another. The typebar is pivotally supported in the bearing yoke and provided with an outwardly projecting finger, a pitman rod having an inwardly extending shoulder to engage the finger, while a pin or stud arranged in the yoke is adapted to engage the upper end of the pitman, to the lower end of which the key lever is rigidly connected.

GRAIN CONVEYER. — Henry M. Hastings, Cooksville, Ill. The conveying of grain from the warehouse to the interior of the car by mechanical means is provided for by this invention, it being designed to obviate the necessity of any one entering the car during the operation of loading. In the conveyer trough leading from the warehouse to the car is journaled a spiral conveyer, operated by a sprocket chain from a main drive shaft driven by steam or other power, and connected with the outer end of the conveyer is a reversible elevator chute for discharging the grain to either end of the car, whereby the loading operation will be entirely mechanical.

WATER-TIGHT SKYLIGHT. — Albert Danzer, Hagerstown, Md. This invention provides a skylight designed to embody the elements of simplicity, cheapness, and effectiveness, and which can be conveniently handled and easily put in position. The supporting frame consists of wooden end timbers on the inner face of which are held side troughs formed of galvanized iron bent up, the inwardly projecting flanges serving as end supports for the glass sections. Cap plates fit over the upper face of the frame timbers, the inner ends of the plates being turned down and fitting against the glass, holding it in place, the invention also embracing various other novel features.

BRICK KILN. — William Sercombe, Hamworthy, Poole, Dorset County, England. Nearly parallel arches are connected at the ends to form a continuous arch, which is also adapted to be divided into chambers, a hot air flue extending centrally between and above the arches, and branch damper-controlled flues extending from the main flue and above the several chambers of the arches, while vertical openings extend through the roof of the arches and intersect the ends of the branch flues, the vertical openings having removable covers to close the entrance to the arches. The heat of the chambers is designed to be so equalized that all will be burned of equal hardness, while perfect combustion will be effected, and the waste heat escaping from chambers which are cooling will be utilized for drying green bricks in other chambers before firing.

STREET SWEEPER. — Mary S. Kjellstrom, New York City. Two brushes are mounted below the converging sides of a triangular frame, with pinions on the rear ends of their shafts meshing with bevel gear wheels on an axle provided with track wheels, while a ground wheel is journaled in the forward end of the frame. From the geared connection of the brushes with the wheels the brushes will sweep the dirt from between the tracks of a railroad, or the surface of any other road if used independently of a car, and deposit the refuse in two rows at the sides of the machine, the brushes being adjustable for height, and being adapted to thoroughly clean all the surface passed over.

BROOM HEAD.—John O. King, Altamont, Kansas. The main portion of this broom head consists of a sheet metal box flattened on the sides, and of suitable width to receive the broom corn or other splints, the top wall of the broom head being secured upon the handle by means of tacks. The lower end of the handle is secured at its terminal end to a stay loop, formed of a single piece of bent wire rod, whereby the head box is also stiffened. When the splints are fully entered in the head box they are first temporarily secured by clamping, the construction being afterward completed by two or more rows of stitching.

LAMP WICK RAISER.—Harry H. Hipwell, Long Island City, N. Y. This is a novel device for use in connection with tubular lamp wicks, a flat bracket plate being curved slightly edgewise to allow it to lie close to the lamp wick, a sleeve projecting at one side from the plate, and spaced star wheels being rotatably supported on the plate to engage the wick, while a shaft adapted to be revolved in the sleeve of the bracket frame carries a star wheel at its lower end, meshing with the spaced wheels.

MILK TESTER. — Ralph Messenger, Unadilla, N. Y. This invention provides a simple construction of frame adapted to hold in perfectly secure and water-tight position a number of milk tubes, the upper ends of which have gauge marks to show the amount of cream rising to the top. The milk of each cow, in testing, is to be placed in a separate tube, the frame and tubes being submerged in cold water if necessary to cause the cream to rise quickly.

MAGAZINE TACK HAMMER. — Andrew T. Lewis, East Portland, Oregon. The handle of this hammer has a magazine communicating with a chamber in the head, there being tack-receiving racks, in the magazine, spring cushions at the sides of the racks, and a lever connected with one of the racks to give it a longitudinal movement, the mechanism being designed to feed the tacks one by one to the striking face of the hammer, and release a tack the moment it is introduced into the surface in which it is to be driven.

PENCIL SHARPENER.—Mary E. Worn, Philadelphia, Pa. This device consists of a block formed with a longitudinal recess in its upper side, in which are removably fitted two round threaded cutters, in mesh with each other, the threads of the cutters being quite fine and having a keen edge, thus forming a solid abrading surface against which the pencil is rubbed. A removable cap fits the top edges of the block, and a partial rotation of the cutters presents a new cutting surface.

TOUCH REGULATOR. — Ferdinand C. Light (Eddins and Lighte, P. O. box 596), Charlotte, N. C. This is an attachment for musical instruments, such as pianos, organs, etc., to enable the performer to change the feeling of the touch, making it either hard or soft. A shaft is journaled in the frame of the instrument, and springs secured to the shaft have their free ends resting upon the keys in rear of their pivots, an adjusting rod pivotally connected with the shaft projecting through an opening in the front of the key board.

MAGAZINE CAMERA.—Arnold L'Eplattenier, Brooklyn, N. Y. This invention provides a compact, simple and inexpensive camera box, designed to retain in series securely separated a number of sensitized plates or films, expose them one at a time, remove the photographed plate by gravity to a dark chamber, move another plate of the series into focus registered correctly, and simultaneously indicate the serial number of the impressed plate or film, the unfixed negative being perfectly protected from light or contact with other objects.

ICE FREEZING CAN. — Albert Smith, New York City. This can is constructed externally with an air chamber or chambers on or throughout its bottom and two of its opposite sides or ends, and with its other two opposing sides left uncovered or exposed. Such cans are to be used for making ice by immersing the can containing the water to be frozen in brine or other freezing agent, the object being to produce clear cakes or blocks of ice free from a white or impure center or core.

WAVE POWER MOTOR.—Alfred Rosenholz, Wardner, Idaho. A suitably constructed vessel is anchored at its ends to be free to rock sidewise, and weighted arms are mounted to swing within the vessel, main shafts to be turned by the rocking motion of the weights, the shafts being connected with air compressors in the vessel whereby dynamos are operated, and cables leading from the dynamos through the anchors and then to the shore. This motor is designed to be simple and durable in construction, and to be located at any desired distance from the shore to receive the full force of the waves.

COACH DOOR LATCH.—James M. Orr, New York City. This latch is so formed that it may be attached to any vehicle door, the outer end of the latch being flush with the free edge of the door, while the construction is simple and inexpensive, and the latch may be quickly and easily removed for cleaning or oiling when desired. The bolt of the latch and the socket in the door casing are also so shaped that the latch will not have vertical or lateral play, the bolt of the latch being thus prevented from rattling and a tie connection being at all times maintained between the bolt and the socket.

COMPOUND COOKER. — Charles McConalogue, Red Jacket, Mich. This invention provides a simple, inexpensive and convenient cooker which combines a fry pan, a broiler, and a steamer for meats and vegetables, so that the parts of the complete device may be interchangeably assembled as required. The fry pan forming the base of the device is of cast metal, and has a central draught tube, while the steamer, fitting in the top of the fry pan, also has a central tube, forming a continuation of the draught tube, but slightly separated therefrom. A broiler is also adapted to be fitted in the fry pan, with a gridiron adapted to be supported a short distance above its bottom.

BELT.—Charles Scherer, Brooklyn, N. Y. This is a ladies' waist belt, designed to be very ornamental in appearance, and to combine strength and durability with economy of material and labor in manufacture. The band has longitudinal cuts extending nearly throughout its length, forming narrow strips, which are spread apart at their central portion and secured to a transverse shield, the ends of the band being provided with fastenings.

DISPENSING DEVICE. — Martin Itjen, Jacksonville, Fla. This is an improvement in apparatus for dispensing beer or other beverages by weight instead of measure, the apparatus being made to weigh from half a pint to a gallon, according to requirement. A graduated scale beam, provided with a weight adjustable along its scale, is arranged in front of the ice box in which is kept the beer or other article to be drawn, the bucket or receptacle to be hung on the front end of the beam, beneath the faucet. The device is designed to save the time of the vender and better satisfy the customer with his measure.

FIGURE TOY. — Robert A. Chapman, Glymont, Md. This is a toy of the class in which movable figures representing human beings are employed. It is preferably made in the form of a wagon, so that the apparatus will properly work as it is drawn over the floor or a table, black and white figures then moving alternately toward and away from a box at one end of the wagon, while figures within the box rise and present arms, there being also other performing figures, besides onlooking figures.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention and date of this paper.

NEW BOOKS AND PUBLICATIONS.

SHEPARD'S OFFICE AND POCKET TRIAL DOCKET. Nebraska edition. Prepared and arranged by Warren Pratt, Esq., of the Kearney Bar. George J. Shepard, Kearney, Nebraska.

A PRELIMINARY REPORT ON THE COAL DEPOSITS OF MISSOURI. From field work prosecuted during the years 1890 and 1891. With 131 illustrations. By Arthur Winslow, State Geologist. Published by the Geological Survey of Missouri. Jefferson City. 1891. Pp. 226.

This work, although only of a preliminary character, speaks well for the manner in which the Missouri State survey is conducted. Its elegant form and numerous sectional views of coal deposits alike testify to the work put upon it from a publisher's and editor's standpoint as well as from that of a geologist.

THE IRON FOUNDER. A comprehensive treatise on the art of moulding. By Samuel Balland. Illustrated with over three hundred engravings. New York: John Wiley & Sons. 1892. Pp. viii, 382. Price $2.50.

The best praise we can give this timely book is that it is too exhaustive to lend itself to a review within our limits. The entire subject of making moulds for all kinds of castings is fully treated, the personal aspects of the subject, such as the apprentice system, are not neglected, and a chapter near the end treats of pattern making. Yet the book is mainly a founder's manual, not a pattern maker's, and will we believe prove of great use to many workmen and others who are interested in the technique of this art.

MANULITO, OR A STRANGE FRIENDSHIP. By William Bruce Leffingwell. Philadelphia: J. B. Lippincott Co. 1892. Pp. 320.

WHY BAND SAWS BREAK. Sixteen reasons, and how to avoid them. By Joshua Oldham. New York: M. T. Richardson. 1892. Pp. 90. (No index.) Price $1.

This book in its first 46 pages treats of the titular subject in very graphic style; the rest of the work is devoted to topic of saws, their history, manufacture and use. The manual we believe will meet with acceptance from the large clientage of users of saws, as many useful hints are embodied in it.

The Sawyer's Own Book, of Emerson, Smith & Co., Beaver Falls, Pa., has considerable useful information for all who use saws, compressed in a very small space. Although the primary object of the publication is to advertise the saws made by the firm, it has been considered that this object would best be obtained by printing in connection therewith valuable facts touching the use of saws, and this little book has consequently passed through many editions.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

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

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

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

INDEX OF NOTES AND QUERIES.

(4246) F. C. L. asks: 1. Why does it grow colder as you go higher? A. At higher elevations we are further removed from the heat-radiating surface of the earth, and less protected by the atmospheric envelope of the earth. 2. Does copper wire contract and expand the same as steel wire? A. Copper when heated from 32° Fah. to 212° expands 1-582 of its length; steel expands 1-846 its length. 3. Is there anything that will remove ink from paper so it cannot be seen and not harm the paper? If so, what is it, and how applied? A. Mix equal parts of oxalic and tartaric acid and dissolve as needed in a little water. Apply, and take up the ink and eraser with a blotter. Alcohol will remove the stains of aniline. Red ink can sometimes be removed with alcohol. 4. If a dynamo and motor were belted together and started, would the result be perpetual motion? If not, why not, and how long would they run? A. The power required to run a dynamo is always greater than that developed by a motor driven by the current, consequently such an arrangement as you propose would not run at all. 5. Which is the cheapest—cable or electric railroad? A. Taking the cost of construction and maintenance together, we think there is little difference.

(4247) A. M. asks: 1. Will you kindly inform me, through your paper, regarding the following? What is the best compound to use with three Fuller compound batteries, and will they be sufficient to light a three candle power incandescent light (or must I have four) with thirty feet feet No. 18 copper wire? A. The formula for the solution is as follows: Bichromate of sodium is dissolved in water to saturation; to this solution slowly add one-fifth of its weight of commercial sulphuric acid. Three cells of Fuller battery will hardly be sufficient; use four or five. 2. How can I light a gas jet entirely by electricity, and what amount of E. M. F. will be needed? A. For information on electric gas lighters we refer you to SUPPLEMENT, Nos. 213 and 446.

(4248) F. E. F. writes: How much H_2SO_4=sulphuric acid theoretically can be produced from one pound of sulphur? Can you give me a formula from the atomic weights to figure the same? A. The atomic weight of sulphur is 32, the molecular weight of sulphuric acid is 98. Hence we have the proportion 32: 98: : 1: x; giving us x=3·0625 pounds sulphuric acid from one pound of sulphur.

(4249) J. R. M. asks whether the magnesium light is yet available for burning for two or three hours, and its intensity as compared with the lime light, and its comparative cost? A. The magnesium light is used to some extent for continuous illumination in a lamp which feeds the ribbon or wire forward as rapidly as it is burned, but its action is uncertain, and it does not compare with the lime light or the electric light. As to cost, we think the expense of running such a light is considerably more than that of the lime light.

(4250) J. G. asks: 1. On how long a line will the Bell telephone receiver, described in SUPPLEMENT, No. 142, transmit and receive articulate speech? A. Two or three miles, if the line is hung adjacent to telegraph or electric line wires. 2. Would it articulate more clearly if the magnet, bobbin, and diaphragm were increased one-half? A. We think not. 3. Has the patent expired on the above receiver? A. No. 4. What size and kind of wire is best for a telephone line four miles in length? A. No. 12 galvanized iron or steel wire. 5. Through how many ohms resistance will a Leclanche cell ring an ordinary wood box bell? A. Fifty or more.

(4251) W. H. J. writes: Please explain the trolley system of electric street railway. The wiring is what confuses me. Why is it that the car nearest the generator does not short circuit the others? Also the method of lighting them? A. The resistance of a motor is such as to permit it to take only the amount of current required for running it. The rest of the current goes on for distribution among the other motors. The current for lighting is taken from the circuit in the same manner.

(4252) J. H. O. says: A discussion arose recently as to the value of a contrivance in common use as a ventilator. The same consists of a sheet of tin, usually occupying the place of a pane of glass, out of which is cut a circular hole, within which is a wheel of tin, with flanges set at an angle. The wheel revolves when a current of air passes through it. Does the wheel in any way favor ventilation? Would a hole of the same size without a wheel serve as well? A. The wheel adds nothing to the force of the draught; rather lessens it. Its only value is as a diffuser. By its action the air is spread out, so that it does not become dangerous to health as a direct draught upon a person.

(4253) J. I. C.—Tin plates wholly made of American metals are at present manufactured to a limited extent in this country.

(4254) H. S. R. asks: What solution should zinc be treated with to render its surface suitable for pasting labels on? A. Clean the zinc with with caustic potash (lye) or ammonia.

(4255) G. H. H. asks: 1. Is there a solution or liquid whose specific gravity is 2·25? A. A solution of mercury iodide in potassium iodide or a solution of cadmium boro-tungstate are the best. 2. Would soluble glass be poisonous to butter if the butter were put in a package lined with the soluble glass or would it give it any bad taste? A. It would not be poisonous, but might slightly affect its flavor where in contact with it.

(4256) W. A. H. asks: Is clay considered an ore since the discovery of aluminum? A. No.

(4257) W. S. writes: I inclose a piece of the twig of a fruit tree (cherry I believe) infected with scale. Will you have the kindness to describe in answer to correspondents, the best means of eradicating the affection? A. Reply by Professor C. V. Riley: In reply to the letter of Mr. William Shackelford of The Dalles, Oregon, I will state that the insect which he sends is the San Jose scale (*Aspidiotus perniciosus*). This is one of the worst pests of deciduous fruit trees on the Pacific coast. Many experiments have been tried against this insect by my agents in California, with the result that the most satisfactory has been found to be a wash made as follows:

Resin	30 lb.
Caustic soda (70 per cent)	9 "
Fish oil	4½ pts.
Water to make	100 gals.

At twice the dilution it will be safe to apply it to foliage, but it will not then be so effective. This preparation should only be applied during winter or during the dormant period; applied in the growing season, it will cause the loss of foliage and fruit.

(4258) W. B. asks: 1. The name of the river whose bed is not land, but water, and the name of a large river north of China, which river must be some relation of Shakespeare's Othello. A. The Gulf Stream and the Amoor we suppose are the rivers meant, Othello being the Moor of Venice. 2. What language is spoken in the Argentine Republic and in Brazil? A. In Brazil, Portuguese. In the Argentine Republic, Spanish is the official language, but owing to a large influx of Italians a great deal of Italian is spoken. 3. Where can I get a good book, not too expensive, on North American entomology? A. We recommend and can supply you with the following books relating especially to the subject you refer to: "Entomology for Beginners," by Packard, price $2. Packard's "Guide to the Study of Insects," price $5.

(4259) W. N. asks: Can common stove pipe be used instead of Russian iron in making a motor? A. Yes.

(4260) R. H. P. asks: 1. Can you tell me of any process by which India ink marks may be removed from the person without injury or a scar? A. India ink being composed of finely divided particles of carbon cannot be removed by any chemical means. Try a piece of pumice stone. 2. I wish to construct a plunge battery of nine cells, connecting five cells together and have the other four so I can turn them on one at a time. A. You will find description of plunge batteries in SUPPLEMENT, Nos. 157 and 792. 3. Would nine cells 4×5 with zincs and carbons 2¾×5 be suitable to use in electrolysis? A. They will answer if connected in parallel. Larger cells would be better.

(4261) H. H. B. asks: 1. How many 25 volt 16 candle power lamps could I run at one time with dynamo in SUPPLEMENT, No. 600? A. 16. 2. Can the motor described in SUPPLEMENT, No. 641, be run as a dynamo? If so, how much power would it have? A. The motor was not made for use as a dynamo. It would, however, yield a small current if used that way, probably enough for one or two 3 candle lamps. 3. Would it work better with a Gramme or Siemens armature? A. The Gramme armature is preferable. 4. Could 8 light dynamo be run as a plating machine? A. Yes, with the changes described in SUPPLEMENT, No. 793.

(4262) H. D. W. asks whether a block of charcoal made from pulverized charcoal would have the same or nearly the same capacity for absorbing and condensing gases as a similar block made from the natural wood? A. It would depend on how the dust was agglomerated. Any paste or sirup used for the purpose would interfere unless the mass was subsequently carbonized.

(4263) H. W. L. asks: What is the composition of the substance known as "Frankfort black" in England, and also where it is procurable in America? A. Frankfort black is a high grade of bone black. You may order it from a wholesale dealer in artists' materials.

(4264) J. G. R. asks: 1. What will take red stains from red woolen underclothing out of fine white muslin? A. By a mixture of equal parts of chloroform and ether; if this does not remove the stain, it will probably resist all other applications, though javelle water might be tried. 2. Will a ball keep its weight in a space where the air is pumped out, the same as in a space filled with air? A. Yes. 3. In pumping the air out of a space, will the pump need more force, when the air is nearly pumped out, than in the beginning? A. Yes.

(4265) C. L. R. asks: Would it be practical to run induction coil described in "Experimental Science" (Hopkins) with dry batteries? If so, how many? A. It can be done by allowing 4 cells of dry battery connected in parallel for each cell of bichromate.

(4266) G. A. B. asks: 1. What is the difference between the pitch and loudness of tone? A. The pitch is determined by the number of vibrations per second, while the loudness or intensity depends on the extent of the vibrations. 2. What causes a gun barrel to become hotter shooting a blank cartridge than a loaded one? A. If the increased temperature is a fact, it must be due to difference in the rate of combustion under different pressures.

(4267) F. A. S. asks (1) how to make the solder used for connecting the filaments and leading-in wires in incandescent lamps? A. The filaments of incandescent lamps are secured to the wires by means of electric soldering, by copper as the material for forming the connection, or by means of carbon. 2. Also some phonograph company that sell their machines? A. We understand that the phonographs are not sold, but leased.

E. A. B. asks for the table for the removal of spots and stains.—R. L. M. asks for the dimensions of drawings intended for the patent office.—C. C. W. asks for the composition used by toy manufacturers in moulding dolls' heads.—N. P. H. asks for the solvent power of glycerine.—B. B. S. asks how hams are cured.—T. R. L. asks for remedy for headaches.—C. R. O'B. wants the composition for hektograph sheets.—C. W. H. wants information about indicator diagrams suitable for a beginner.—H. P. J. wants information on catechol and paramidophenol developers.—N. H. S. wants a table for doses of medicine, called a posological table.—G. M. B. says: What is the composition of common painter's putty?—P. W. S. says: Can you give me formulas for the following inks—vanadium, invisible yellow, silver and autographic?—J. McA. asks how to bend glass tubes.—J. J. W. asks: What is the composition of fuller's earth?—J. T. asks: Of what is glaire composed?—E. D. W. asks: Can you give me reliable receipts for etching glass?—T. J. asks: What process is used in staining pool balls, and how are they striped?

Answers to all of the above queries will be found in the "Scientific American Cyclopedia of Receipts, Notes and Queries," to which our correspondents are referred. The advertisement of this book is printed in another column. A new circular is now ready.

Replies to Enquiries.

The following replies relate to enquiries recently published in SCIENTIFIC AMERICAN, and to the number therein given:

(4205) H. D. H. writes: Your reply to question No. 4205, in your paper of March 26, seems a little behind the times, being based upon the law of Newton, which law only holds true of bodies falling in vacuum. On page 303 of the Smithsonian report for 1889 you will find given, from F. H. Wenham, June, 1866, the fall of bodies in air to be "limited by the weight of air set in motion in a given time." Professor Langley, in his researches in aerodynamics, SCIENTIFIC AMERICAN, February 13, 1892, proves that a body in motion displaces a body of air equal to its greatest diameter transverse to the line of motion, multiplied by the distance traveled in a given time. Accordingly take a cannon ball weighing one pound, and three inches in diameter, falling say fifteen feet in one second in a perpendicular line, and the same ball when projected 1,060 feet per second. In its vertical fall it overcomes a weight of air equal to the area of its greatest circle, about seven inches, by the distance it falls, fifteen feet, equal to 1,260 cubic inches, but when projected horizontally must overcome the weight of three inches, multiplied by one thousand feet, multiplied by fifteen feet, equal to 6,480,000 cubic inches of air, to come to the ground in the same time and as the impulse projecting it acts only horizontally, it is impossible for it to come to the ground in the same time.

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For which Letters Patent of the United States were Granted

April 12, 1892.

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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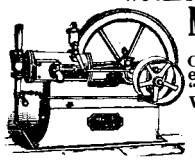

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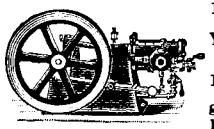

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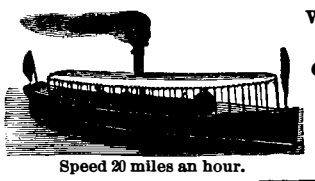

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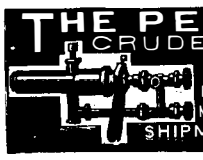

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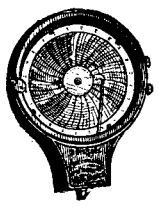

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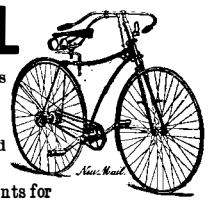

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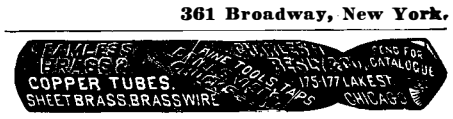

PRINTING INKS
The SCIENTIFIC AMERICAN is printed with CHAS. ENEU JOHNSON & CO.'S INK, Tenth and Lombard Sts., Philadelphia, and 47 Rose St., opp. Duane, New York