structing a larger model, which will form one of the attractions of the Exposition of Sciences and Arts that is to be opened next August at the Palace of Industry. —*La Nature.*

PHOTOGRAPHIC NOTES.

Correction of Eikonogen Formula.—We wish to correct a misprint in the first formula under "Various Eikonogen Developers," page 120 of the August 23d number, by substituting 40 for 4 ounces of water. The corrected formula will read:

Sodium sulphite (Merck's c. p. crystals)	2 ounces.
Eikonogen	1 ounce.
Water (distilled or rain water preferred)	40 ounces.

Belitzki's Formula for Removing Hypo from Gelatine Films.—A correspondent suggests a corrected formula which is said to work well:

Water	32 ounces.
Chloride of lime	300 grains.

Add to the milky liquid thus formed a solution of sulphate of zinc:

Sulphate of zinc	600 grains.
Water	3½ ounces.

Shake the mixture well and decant the clear solution. This supernatant solution of hypochlorite of zinc should be kept in a glass-stoppered bottle. One ounce mixed with sixty ounces of water will remove the last traces of the fixing soda. The solution remains active as long as it smells of hypochlorous acid.

The Photographers' Convention.—Among the papers read at the eleventh annual convention of the Photographers' Association, held at Washington, D. C., last month, was an interesting one on the "Automatic Operations of Photographic Apparatus," by Prof. D. P. Todd, Professor of Mathematics in Amherst College. He explained how a number of astronomical photo-instruments were automatically operated at different intervals by air pressure, regulated by valves which were called into action by the air passing through slits in a moving band of paper, very similar in appearance to the square holes and slits in music paper for small organs. By such means different instruments were given different exposures, and plates were automatically changed. Every second of time was utilized, and more exposures were made on one observation than would be possible if done in the old way.

Mr. G. Cramer, of St. Louis, read a paper on "Orthochromatic Photography," making the point that the best results in copying paintings, or colored objects, or in taking portraits of people with red hair and freckled faces, were obtained when the color dye was incorporated in the emulsion, and not when a yellow screen was used. The exposure required was twice as long as with the ordinary plate. Mr. T. C. Roche exhibited prints from orthochromatic negatives of a colored object, which demonstrated clearly their value. Plates thus prepared do not keep as long as those of ordinary manufacture.

Prof. Thos. Taylor, of the Agricultural Department, exhibited and set off, as against the usual magnesium compound, his new smokeless flash light compound, having for its principal ingredient the silky-like fibers of the milk weed plant. While his compound flashed with great rapidity, and could be flashed on a piece of tissue paper without burning it, the light emitted appeared to be more yellow in character and less actinic than the magnesium flash. Negatives were made separately by the aid of both lights.

C. H. Codman & Co., of Boston, were awarded a gold medal for the best photographic appliance. It consisted of a camera stand especially designed for studios. A platform is placed between two uprights hung by chains to coiled flat springs concealed in the top of each upright. The tension of the springs may be easily regulated to correspond with the weight of the apparatus put on the platform. Thus the same is balanced, and may be lowered to within thirteen inches of the floor or raised six feet high at will. In photographing children it is desirable to lower the camera sufficiently that the lens may be opposite their faces, and thus avoid a downward view.

Many varieties of hand cameras, backgrounds, photographic furniture, special exposing devices for bromide paper, lenses, camera shutters, burnishers, trays, and other useful things were on exhibition.

The display of photographs was not large, and consisted mostly of portraits. The grand prize, a bronze group, was awarded to Geo. W. Hastings, of Boston, Mass., for the best photographic representation of Tennyson's poem "Enoch Arden." A number of other prizes were awarded for the best foreign exhibits, retouching, enlargement, marine views, and landscapes.

Combined Celluloid Negatives.—According to the *Br. Jour. of Photo.*, more harmonious photographs can be obtained by making duplicate negatives of a given subject. It says:

"Celluloid films will frequently prove a great advantage for outdoor groups. Apart from the convenience with which an objectionable portrait in one negative can be exchanged for another from a different one, it often happens that a group has to be taken with a background that requires a different exposure from that for the figures; for example, a wedding party or team of cricketers in light costume against a background of dark foliage. Here we have the opportunity of taking one or more negatives, giving the exposure best suited for the figures, and afterward taking another in which the exposure is timed entirely for the background. Negatives thus taken are readily combined, and a harmonious whole secured; whereas, if only a single negative is depended upon, under the above conditions, unless exceptional skill is exercised in the exposure and development, either the background proves too heavy and lacks detail or the figures are too light or chalky.

"It is scarcely necessary to remind our readers when taking group negatives, which may afterward have to be combined, that neither the lighting nor the position of the camera should be altered between the taking of the different pictures, or that the same exposure should always be given; otherwise an incongruous result will necessarily obtain.

"Here is another direction in which celluloid films may prove of utility. In photographing the interior of a cathedral or church, for instance, the exposure necessary for one portion of the building, say the stalls or pews in the foreground, is generally widely different from that required for another, such as the chancel and windows. But one negative can be taken, exposing for the foreground, another with the exposure timed for the chancel, and even a third for the windows. Then, with judgment, the different negatives can be combined to form one harmonious picture."

Another excellent application of the double negative is in photographing a brook or rill under deep foliage. For the brook, expose with the shutter, then make a second time exposure of half a minute, if necessary, to bring out the details of the rocks and foliage. By combining the two negatives a harmonious picture is produced.

Proposed Convention of Amateur Photographers.—The Syracuse (N. Y.) Camera Club has undertaken the organization of a National Association of Amateur Photographers, the object of which, as stated in their circular, "is to diffuse a more widely spread scientific interest in the science of photography and to promote social intercourse among amateurs." Photography is now being practiced so universally, both for pleasure, profit, and in many branches of science, that it seems eminently proper for all thus interested to combine and support a national organization designed to promote the art simply as an art and science. We wish that the movement might be a success, and that under the fostering care of such an association there might be established an experimental "photographic college," where a reliable education in any one branch of photography can be obtained. Amateurs interested in the movement should address Mr. Arthur P. Yates, president of the Syracuse Club, Syracuse, N. Y.

Daguerre's Tomb —While in this country an enduring and artistic memorial has been erected to Daguerre, news comes that his tomb at Cormeil-en-Parisis appears to be quite neglected. Says Leon Vidal about it, in the *Photo. News:* "The cure of this commune has informed the Photographic Society of the fact. The painting executed by Daguerre in the choir of the church requires considerable restoration. The Photographic Society and other photo clubs should cause these restorations to be promptly made, and thus conserve for all time the memory of the discoverer of photography."

Cements of Rubber and Gutta Percha.

In making a cement, one should know pretty thoroughly, says the *Rubber World*, what is to be expected of it before they could advise upon it. For instance, an ordinary rubber cement will hold on a host of different surfaces and with the best of success, except where there is continued dampness. For holding to damp walls, or surfaces where there is a constant presence of moisture, there is nothing equal to Jeffry's marine glue, the formula for which has been published and republished all over the world. It consists of:

1 part India rubber.
12 parts coal tar.
2 parts asphaltum.

The rubber after having been massed is dissolved in the undistilled coal tar, and the asphaltum is then added. This glue, as its name indicates, is oftentimes used for mending articles at sea, or patches, for instance, that are to be laid on surfaces that are to be under water, and it has been found to be a most excellent thing. Of glass cements there are a great many, rubber as a rule being dissolved in some very volatile solvent and some hard drying gum is added.

A gutta percha cement for leather is obtained by mixing the following. It is used hot. Gutta percha, 100 parts; black pitch or asphaltum, 100 parts; oil of turpentine, 15 parts. An elastic gutta percha cement especially useful for attaching the soles of boots and shoes, as on account of its great elasticity it is not liable to break or crack when bent. To make it adhere tightly the surface of the leather is slightly roughened. It is prepared as follows: By dissolving 10 parts of gutta percha in 100 parts of benzine. The clear solution from this is then poured into another bottle containing 100 parts of linseed oil varnish, and well shaken together.

Good rubber cement for sheet rubber, or for attaching rubber material of any description or shape to metal, may be made by softening and dissolving shellac in ten times its weight of water of ammonia. A transparent mass is thus obtained, which, after keeping three or four weeks, becomes liquid, and may be used without requiring heat. When applied it will be found to soften the rubber, but when the ammonia is evaporated it forms a kind of hard coat, and causes it to become both impervious to gases as well as liquids.

Davy's universal cement is made by melting 4 parts of common pitch with 4 parts of gutta percha in an iron vessel and mixing well. It must be kept fluid, under water, or in a dry hard state.

A very adhesive cement, especially adapted for leather driving belts, is made by taking bisulphide of carbon 10 parts, oil of turpentine 1 part, and dissolving in this sufficient gutta percha to form a paste. The manner of using this cement is to remove any grease that may be present in the leather by placing on the leather a piece of rag and then rubbing it over with a hot iron. The rag thus absorbs the grease, and the two pieces are then roughened and the cement lightly spread on. The two pieces are then joined, and subjected till dry to a slight pressure.

A solution of gutta percha for shoemakers is made by taking pieces of waste gutta percha, first prepared by soaking in boiling water till soft. It is then cut into small pieces and placed in a vessel and covered with coal tar oil. It is then tightly corked to prevent evaporation, and allowed to stand for twenty-four hours. It is then melted by standing in hot water till perfectly fluid, and well stirred. Before using it must be warmed as before, by standing in hot water.

A cement for uniting India rubber is composed as follows: 100 parts of finely chopped rubber, 15 parts of resin, 10 parts of shellac; these are dissolved in bisulphate of carbon.

Another India rubber cement is made of: 15 grains of India rubber, 2 ounces of chloroform, 4 drachms of mastic; first mix the India rubber and chloroform together, and when dissolved the mastic is added in powder. It is then allowed to stand by for a week or two before using.

Cement for sticking on leather patches and for attaching rubber soles to boots and shoes is prepared from virgin or native India rubber, by cutting it into small pieces or else shredding it up; a bottle is filled with this to about one-tenth of its capacity, benzine is then poured on till about three parts full, but be certain that the benzine is free from oil. It is then kept till thoroughly dissolved and of a thick consistency. If it turns out too thick or thin, suitable quantities must be added of either material to make as required.

An elastic cement is made by mixing together and allowing to dissolve the following: 4 ounces of bisulphide of carbon, 1 ounce of fine India rubber, 2 drachms of isinglass, ½ ounce of gutta percha. This cement is used for cementing leather and rubber, and when to be used the leather is roughened and a thin coat of the cement is applied. It is allowed to completely dry, then the two surfaces to be joined are warmed and then placed together and allowed to dry.

Cement used for repairing holes in rubber boots and shoes is made of the following solution: 1. Caoutchouc 10 parts, chloroform 280 parts. This is simply prepared by allowing the caoutchouc to dissolve in the chloroform. 2. Caoutchouc 10 parts, resin 4 parts, gum turpentine 40 parts. For this solution the caoutchouc is shaved into small pieces and melted up with the resin, the turpentine is then added, and all is then dissolved in the oil of turpentine. The two solutions are then mixed together to repair the shoe with this cement. First wash the hole over with it, then a piece of linen dipped in it is placed over it; as soon as the linen adheres to the sole, the cement is then applied as thickly as required.

American Machinery at the Iron Gates of the Danube.

The Ingersoll-Sergeant Rock Drill Company, of New York, has just received an order, from the contractors engaged in removing the Iron Gates of the Danube, for a large plant of submarine drilling apparatus. Mr. Bessier, a German engineer, recently visited this country, in the interests of the work on the Danube. He investigated thoroughly our American methods, and decided to adopt them as the best for the purpose. The work extends for twenty miles along the Danube River, and will cost about $5,000,000.

The removal of these obstructions has been attempted many times, one of the Roman emperors having made an effort to remove the rock. Recently an Austrian empress made a similar attempt, but without success. We have every reason to believe that American machinery will do the work economically and well.

THE expenditure for pensions for the year ending June 30, as now officially stated, amounted to $109,357,534. In the previous year we paid $87,644,779.11, while in the year before that we paid $80,288,508.77.

Steel Railway Ties.

Experiment is being made by the Delaware and Hudson Railroad Company to test the adaptability and superiority of steel ties for railroad uses. On a section of the road leading south from Ballston for nearly half a mile, the wooden sleepers have been removed and the track reconstructed with the steel ties. So far they give good satisfaction. As trains pass rapidly over this piece of road, a peculiar buzzing noise is noticeable, also the vibration caused by the wheels upon the rails is observably greater; but it is also the smoothest and pleasantest riding piece of road between Troy and Saratoga. The test of the safety and adaptability of the steel ties is being made under the supervision of A. J. Swift, chief engineer of the road, and they will be adopted or rejected upon his recommendation.

So far he regards the steel ties as a success; but no more will be laid until those now in use have had the test of the winter to see in what manner, if any, they will be affected by ice, frost, and snow, and if they are equally safe in clay and quicksand and gravel. If they stand all these tests, Mr. Swift has no doubt of the steel ties being speedily adopted for general use as the old wooden sleepers need to be replaced. The objection of their greatly increased first cost is fully met and overcome by their durability. Of their greater safety, if they stand the test, there can be no doubt, as by their use it is impossible for the rails to spread or in any other manner to become displaced. They also give to the track the perfect effect of a continuous rail. The steel ties are in shape an inverted "T." They are seven feet long, seven inches wide, and are laid twenty-two inches apart from centers. At either end of the tie is a socket, in which is laid a block of wood, four by five inches square and about sixteen inches long, and upon which the rail is laid and firmly held in place.

AN IMPROVED SWITCH WORKER.

The accompanying illustration represents a device adapted for attachment to street railway cars and similar vehicles, and so constructed that the driver may with one hand, and without interfering with his regular duties, readily open or close a switch in the path of the vehicle, the part of the device contacting with the rails, when released, automatically leaving the switch and taking a position some distance above the track. In a suitable casing, adapted to be arranged vertically over one rail of the track in the end of the car body, is held to slide a bar having a central bore, in which a downwardly projecting switch rod is adjustably secured by a thumb or other screw. The lower end of this switch rod may be simply wedge-shaped, as shown in one of the views, or a beveled wheel may be mounted therein, as shown in the small view. The vertical bar in which the switch rod is secured is normally spring-held at the desired height above the track, but is pushed downward to move the rail by a rack and gear wheel operated by a hand lever within convenient reach of the driver. On the upper end of this bar is a beveled gear, meshing into other gear, and operated

HEITMEYER'S SWITCH WORKER.

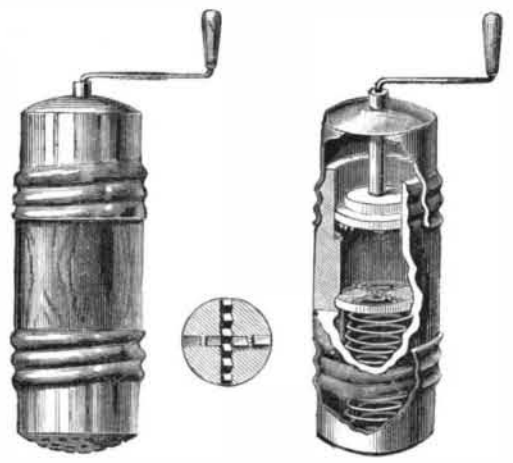
by another hand lever, whereby the vertical bar and its attached switch rod may be turned through one-half of a revolution. By this means the wedge-shaped end of the switch rod, or the beveled wheel thereon, may be turned to engage the switch rail of an open switch when it is desired to close the same.

For further information relative to this invention, address the patentee, Mr. H. G. Heitmeyer, 474 Race Street, Cincinnati, O.

AN iron elevated railway, much like the New York pattern, six miles long, is now in process of construction in Liverpool. The cars are to be worked by electricity.

AN IMPROVED NUTMEG GRATER.

The illustration represents a simple device by which a nutmeg or similar substance may be ground as used and shaken as pepper is shaken from a common pepper box. It has been patented by Mr. Cassius M. Maxson, of Allentown, N. Y. The cylindrical part of the grater may be made of porcelain, glass, wood, or any other suitable material, and decorated to look neat and attractive. The ends are closed with caps, screwed or otherwise fastened on the body, one of the caps being perforated while the other forms a bearing for a small crank shaft, to the inner end of which is secured a



MAXSON'S NUTMEG GRATER.

grinding disk, shown in the small sectional view. The opposite grinding disk has a longitudinal movement upon ribs on the inner side of the body, and is held pressed against the nutmeg, and pressing the latter against the other grinding disk, by a coiled spring. A portion of the teeth in each grinding disk are arranged to cut grooves in the nutmeg, the other teeth cutting off the ridges thus formed, while in the lower disk are openings through which the grated nutmeg may pass to the openings in the lower cap. To insert the nutmeg, this cap, the spring, and the lower disk are removed, the parts being afterward returned to working position, as shown.

Spontaneous Combustion of Hay.

After a series of very careful experiments, Prof. Cohn, of Breslau, has found that the heating of damp hay to a temperature sufficient to cause the spontaneous combustion of it is due to a fungus. He first studied the heat-generating action of *Aspergillus fumigatus*, which has the bad reputation of heating barley in the course of germination and of rendering it sterile. Through the effect of the respiration of the little germ, that is to say, through the combustion of the starch and other hydrocarburets which the diastasic ferment converts into maltose and dextrine, the temperature is raised by about 40°. The heating of the germs to more than 60° occurs only through the intervention of the *Aspergillus*, which acts as a ferment. Under these conditions it reaches its greatest development and produces its maximum action. In this state it rapidly burns the hydrocarburets.—*La Petite Revue.*

Our Latest New Steel Cruiser.

The San Francisco, a sister ship of the Philadelphia, built at the Union Iron Works, San Francisco, had her trial trip in the Santa Barbara channel, on the California coast, on the 27th of August, with results which were extremely gratifying to her builders, as well as to the Bureau of Construction of the Navy Department, after whose plans she was built. The run was for four consecutive hours, during which time the average speed maintained was 19·516 knots per hour. During a portion of the run, however, the water got into the ducts which supply the current of air used in a forced draught, and the fans began to force water into the furnaces. This caused a material loss of speed, and it is claimed that, making a proper allowance for this accident, the average speed would exceed 19·7 knots per hour, which would make the record of the San Francisco higher than that of the Philadelphia. The contract for the vessel provided that the builders should receive $50,000 additional for each one-quarter knot attained over 19 knots per hour, and they therefore earn $100,000 over the contract price, which was $1,426,000.

This is the second vessel of our new navy which has been built upon the Pacific coast, the Charleston having had her trial trip a few months ago, and all the castings made there, and the finish and staunchness of the vessels have been declared to be as perfect as ever went into an American ship. Experts declare that the San Francisco has finer lines than those of any other vessel of the new navy, and that for this reason, and the strength of her boilers, she should also be the swiftest vessel among the new cruisers.

The dimensions of the San Francisco are: Length over all, 328 ft.; length on load line, 310 ft.; breadth, 49 ft.; draught forward, 16 ft. 9 in.; draught aft, 20 ft. 11 in.; displacement, 4,038 tons; horse power, natural draught, 7,500 horse, forced draught, 11,000 horse. The vessel has a protective deck for its full length, sloping down to its sides about four feet below the water line, the sloping sides being two and a half inches thick and the top portion one and a half inches thick. The machinery and all the vital parts of the ship are below this deck, under which, along the sides, the space is used for coal bunkers. The vessel also has a double bottom and many water-tight compartments. She is driven by two three-bladed built-up screws of fourteen feet diameter each, and two horizontal triple expansion engines. She has three hollow masts with two military tops for Gatling guns, and her armament will consist of twelve six-inch breech-loading rifled guns, four Hotchkiss revolving cannon, one one-pounder rifle, and two Gatling guns. She will require a crew of 300 men.

AN IMPROVED BOB SLED.

The illustration represents a novel construction of bob sleds, designed to provide for a uniform movement of both the forward and rear sleds in turning corners, and by which a minimum of strain will be exerted upon the several parts of the sled. It has been patented by Mr. Jesse Yenne, of Egan, Montana. The forward ends of the runners of each sled are pivotally connected by a cross bar, the cross bars having reduced ends seated in essentially dovetailed recesses, whereby the runners are capable of a limited independent longitudinal movement. Upon the upper face of each runner a rave is rigidly secured, of somewhat triangular shape, in the upper flat part of which is an elongated slot or opening. Directly under this slot a plate having a central opening is bolted to the upper surface of the runner, and in each runner, below the opening in the plate, is an essentially dovetail recess, the widest portion of which is at the bottom. In the main bolsters at each end is secured a pin, the upper end of which passes through and slides in the slot of the rave, while the lower end of the pin enters the dovetail recess in the runner. A sand bolster is pivoted upon the main bolster in the usual manner, but when the main bolster only is used, it is made in two sections, the upper surfaces of the raves then passing through recesses in the opposed faces of the bolster sections. The forward end of the reach bar connecting the sleds is connected to the front cross bar of the forward sled, its rear end passing through an opening in the main bolster of the forward sled, and having a slot through which passes the pivotal pin of the sand bolster. Each cross bar of each sled has a rigidly attached tongue, the tongue of the rear sled being attached to the rear end of the reach bar. Upon the cross bar of the forward sled, and also upon its tongue, a block is rigidly fastened with staples, one of which passes through the forward end of the reach. This attachment is designed to facilitate loosening the rear sled should its runners become frozen to the ground, by throwing up the tongue to turn the forward cross bar, and thus force the reach rearward to act as a lever upon the tongues of the rear sled. The construction is such that the bolsters have movement upon the raves and in the runners, while the reach is capable of lateral movement, the peculiar connection between

YENNE'S BOB SLED.

the cross bars and runners being designed to permit the runners of the sleds to run in parallel lines, one in advance of the other.

The Electrical Telegraph.

In 1747 Bishop Watson sent the discharge of a Leyden jar through 10,600 feet of wire suspended on poles on Shooter's Hill, and a plan for an alphabetical telegraph to be worked by electricity appeared in *Scots Magazine* for 1753, which, however, seems never to have been realized. At Geneva, in 1774, a telegraph line was erected by Lesage, consisting of 24 pith ball electroscopes, each representing a letter.—*M. Farrant, Science Gossip.*