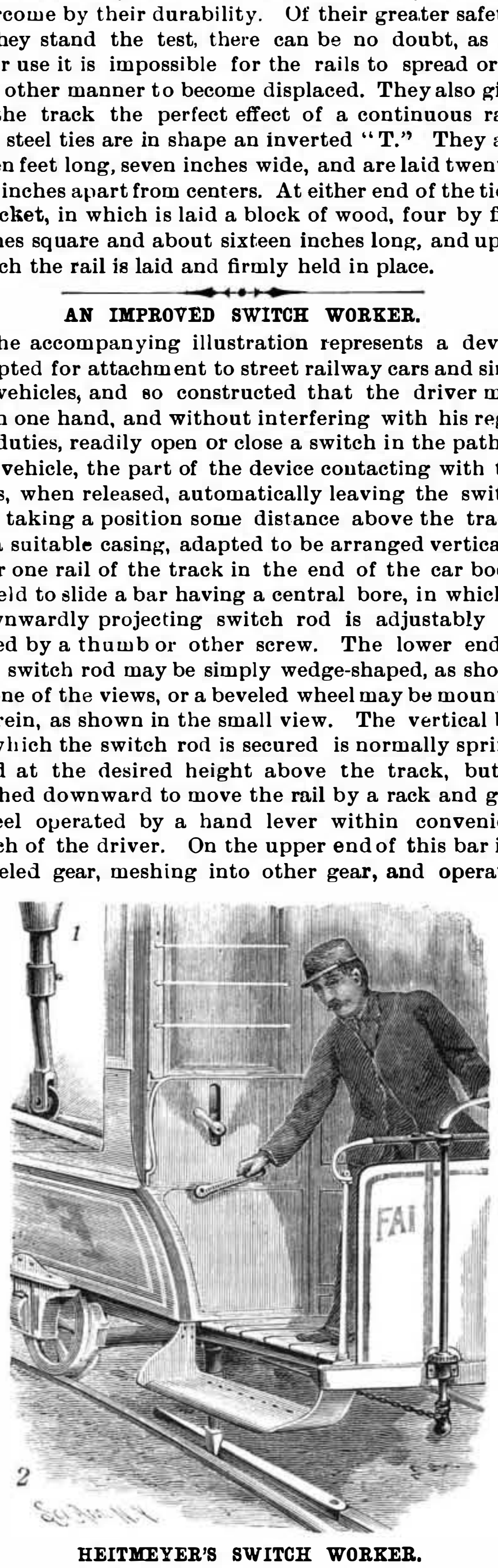
### Steel Railway Ties.

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.

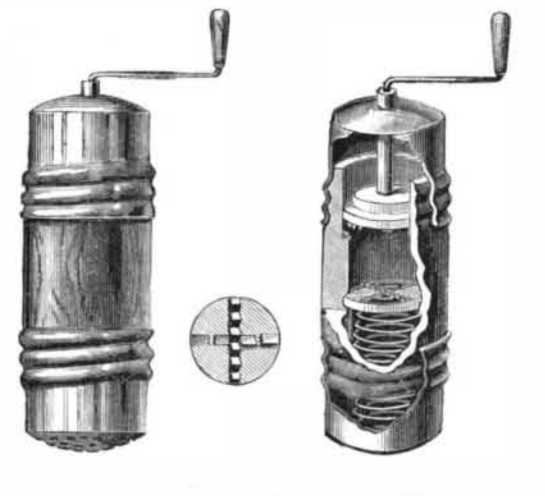
by another hand lever, whereby the vertical bar and its attached switch rod may be turned through one-half of a revolution. By this means the wedge-shaped end of the switch rod, or the beveled wheel thereon, may be turned to engage the switch rail of an open switch when it is desired to close the same.

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.

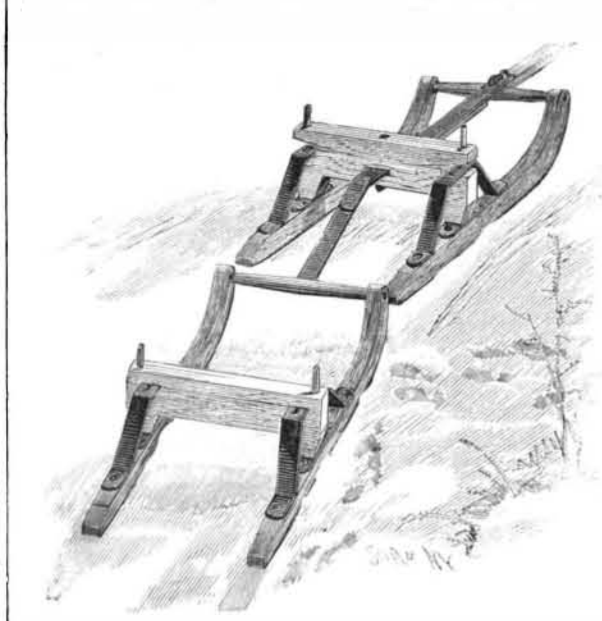
The San Francisco, a sister ship of the Philadelphia, built at the Union Iron Works, San Francisco, had her trial trip in the Santa Barbara channel, on the California coast, on the 27th of August, with results which were extremely gratifying to her builders, as well as to the Bureau of Construction of 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.*

### Electric Launches.

An interesting essay on this subject has lately been contributed to *The Electrical Engineer* by Fred. Reckenzaun, from which we make the following abstract:

Electrical navigation was an experimental fact, not a mere idea, over half a century ago. Being first conceived and demonstrated by Prof. Jacobi in Russia, during 1838, his fascinating achievement was followed up in England by Robert Hunt early in the fifties, by G. E. Dering in the year 1856, and in France by Count De Moulins in 1866. In all these experiments electro-magnetic motors and primary batteries of various descriptions were employed to actuate the propeller. The results obtained, although demonstrating the possibility of electrical navigation, failed, however, to prove its commercial feasibility. With the storage battery in place of the primary battery and a new type of electric motor in place of the old ones, the electric launch entered upon a new era.

Trouve availed himself of these improvements in 1881 in Paris, but also employed a primary battery of his own. His experiments were the first with storage batteries and the last notable ones on record with primary batteries. In 1882 the Electrical Power Storage Company, of London, brought out the launch Electricity, designed by Anthony Reckenzaun. During the years following, electric launch building gradually developed into a distinct branch of electrical industry, especially in England, where the advantages of this class of craft for pleasure purposes have met with such increasing appreciation and favor as to cause the establishment of a series of charging stations along the Thames River (by Messrs. Immisch & Co.), where a whole fleet is in use now, while a regular passenger service by electric boats has quite recently also been introduced at Edinburgh, Scotland.

The storage battery, on account of its superior fitness, is universally employed in connection with electric launches at present.

Since the power required to propel a vessel varies as the cube of the speed, and since the duration of the run varies inversely as the power (rate of delivery), it follows that the *mileage* covered by one charge of battery will vary inversely as the *square* of the *speed*. In practice, due allowance is to be made for the characteristics of the motor and for a falling off in the total output of the battery when pushed to a high rate of delivery. Where a maximum of speed is to be effected, the battery should have a maximum of active surface and a minimum of internal resistance, to facilitate a heavy discharge without an excessive drop of potential. Special care should be taken to render the cells acid tight, by the use of suitable covers, etc. Spilling may also be avoided by preparing the electrolyte in a suitable manner. The jelly electrolyte invented by Dr. P. Schoop offers in this respect a remarkable advantage. It is also advisable to line the battery receptacle with some acid-proof material, preferably an insulator, and to provide a bed for the cells to stand on containing a substance capable of absorbing and neutralizing acid. All wires or cables employed about the boat should have a good acid and salt-water proof insulation.

Where a continuous current incandescent lighting plant exists, current may be derived therefrom for charging purposes; suitable arrangements must, of course, be made in such cases for the proper application of the current, the E. M. F. of which may not always correspond with that of the battery.

Storage batteries, suitable for launch purposes, are, as a rule, capable of receiving their charge at a higher rate and in less time than the employment of most arc light currents would involve; this is one reason why incandescent light currents (continuous, low tension) are preferable. But arc light plants are the ones most frequently met with, and may often be the only source available. It should be remembered, however, that with a high tension current (say 1,000 volts and over) an electric launch, floating in water, would not unlikely prove an inducement to "grounding."

The battery may, of course, be charged either on the boat or may be removed for that purpose. While the former method is ordinarily practiced, it is obvious that in order to avoid delay, a freshly charged battery may be substituted for the exhausted one. With suitable facilities for handling the batteries, such as a hoisting crane, or equivalent device for lifting and lowering the cells into and out of the boat, tables to receive the cells for charging, suitable cell crates with connections and lifting attachments, etc., the work of exchanging the batteries could be effected promptly and efficiently for a whole fleet engaged in continuous traffic.

The operation of an electric launch is the ideal of ease and simplicity. It consists, practically, of turning a switch and—letting her go. The pilot can act at the same time as engineer, for he can start, stop or reverse as easily as he may give a signal for that purpose, and need not wait for a response. Somebody, on noticing the incomparable facility with which an electric launch can be operated, suggested it was a veritable "buggy on the water." It certainly involves none of the jarring which inevitably accompanies a buggy ride on land, and there is no need for "cheering up" or "urging" the animal. Not one of the smallest advantages is the fact that there is no danger of explosion. The most reckless handling of the propelling apparatus would entail nothing worse than its disablement, and as to danger from shock, it is unnecessary to explain its absence here. The run may be continuous or interrupted; a landing may be effected and the boat left without attendance for any desired length of time, and the journey resumed at a moment's notice. Knowing the number of miles or hours the boat can run with one charge, the man in charge will be guided thereby, as is the engineer of a steam launch by his pile of coal, and probably more definitely. The disagreeable features of steam and naphtha launches (aside from their danger of explosion), such as smoke, smell, soot, ashes, dirt, grease, heat, noise and the jerking caused by the reciprocating motion of the engine, are totally absent in the electric launch. The propelling machinery has substantially but one moving part and the motion of that is rotary, insuring smoothness, quietude and ease, and involving but a minimum of wear, while the liability to a breakdown is very remote. There is no necessity for the grimy man with dirty overalls—his place is on shore, at the charging station. The battery, besides doing its regular duty in operating the motor, can, of course, be employed at night to furnish current for interior illumination, side and signal lights, head light—a search light, if you please—or for submarine illumination.

Where a fleet of electric launches is operated, the pro rata cost of plant and expense of operation can be brought within very reasonable limits. Instead of having an engineer for each boat (as in the steam launch), one station engineer can render equivalent service for a number of boats. The fuel item for one station engine need not exceed, and may be even smaller than, the aggregate consumption of several small engines (on steam launches), even allowing for the loss in conversion. The actual running expense would thus compare favorably with that of steam launches. There is another feature which should not be overlooked. In an electric boat, as pointed out before, the propelling apparatus occupies space which would be of little or no use for passengers, while in steam or naphtha boats from one-third to one-half of the entire space is devoted to the machinery, and the best part of the boat at that, crowding out a proportional number of passengers. For a given number of passengers, therefore, the electric launch would be smaller, require less power, and consequently would cost less to run. Under such conditions, it would hold its own even on the point of expense, taken all in all.

The estimate of cost of a fleet of 12 electric launches, each 28 feet long, 6 feet beam, carrying one ton of storage batteries, to run 6 miles per hour for 60 miles with one charge, is as follows:

| | |
|---|---|
| 12 hulls complete, with interior fittings (battery troughs, seats and lockers), fixed roofs, shades, flag staffs, steering wheels, etc. | $6,600 |
| 12 tons storage batteries (cap. 16,240 watt hrs. per ton) at $560 per ton | 6,720 |
| 12 motors, at $400 | 4,800 |
| 12 screw propellers, shafts, couplings, thrust bearings and stuffing boxes | 1,200 |
| Switches, wires, incand. lamps (4 per boat), with fittings | 480 |
| Acid and labor of placing elec. outfit | 1,200 |
| Seat cushions, ropes, boat hooks, tools, pumps, etc. | 300 |
| Total, 12 boats complete, in running order or $1,775 each. | $21,300 |

CHARGING STATIONS.

| | |
|---|---|
| Land and buildings (on suburb. water front) say | $4,000 |
| Steam plant, 60 h. p. complete, erected | 4,000 |
| Dynamo, cap. 40,000 watts, with accessories, erected | 2,000 |
| Charging circuits and appliances, erected | 250 |
| Mooring facilities, tools, etc. | 500 |
| Total cost of station, say | $10,750 |
| Grand total cost of 12 launches with charging facilities and real estate | 32,050 |

ESTIMATED COST OF OPERATION.

It is assumed that each of the 12 launches makes a daily run of 60 miles, divided into 6 trips of 10 miles each (3 round trips), during 5 *months* in the year:

| | |
|---|---|
| 12 pilots at $2.50 per day each, for 5 months | $4,500.00 |
| 1 station engineer, at $3 per day for 5 months | 450.00 |
| 1 station fireman at $2 per day for 5 months | 300.00 |
| 1 station laborer at $1.75 per day for 5 months | 262.50 |
| Coal (4 lb. per h. p. hour, 60 h. p. for 7 hrs. daily), 112½ tons (for 5 months) at $4 per ton | 450.00 |
| Oil, waste, miscell. supplies and incidentals for 5 months, say | 200.00 |
| Labor, etc., putting boats in running order at beginning and storing same at end of season, say. | 360.00 |
| Depreciation, per annum, on boats and propelling apparatus, at 10 per cent on $21,300 | 2,130.00 |
| Depreciation of station machinery and appliances, at 6 per cent per annum on $4,750 | 285.00 |
| Interest, per annum, at 6 per cent, on interest of $32,050 | 1,923.00 |
| Total operat. expense, deprec'n and interest. or $905.04 per boat per annum. | $10,860.50 |
| Total mileage run per boat per month (60 per day) | 1,800 miles. |
| Total mileage run per boat in 5 months | 9,000 " |
| Total mileage run, 12 boats, at 9,000 miles each. | 108,000 " |

Cost of operation, including running expenses, depreciation and interest, as per above estimate, = $10\frac{5}{100}$ cents per boat mile. The boats assumed can seat 20 passengers and over. If an average of only *one-half* of this number is constantly carried, paying fare at the rate of *one cent per mile* each, the receipts will equal the operating expense, depreciation and interest on investment, as above.

The boats, in this instance, run at intervals of about 17 or 18 minutes (allowing for short stops), $1\frac{5}{8}$ miles apart, along the entire distance of 10 miles.

The cost and operating expense of electric launches will, of course, vary with different sizes and speeds, which the conditions and requirements of each distinct case contribute to determine.

### A Terraced Mountain.

During the recent visit of Jesse R. Grant and Chas. J. Whimple to Sonora, Mexico, they were much struck with the sight of a terraced mountain. It was located about fifty miles southwest of Magdalena. The mountain is circular in form, about three-quarters of a mile in diameter and terraced from base to peak. The height of the terrace is from ten to twelve feet, and in many places is built of solid masonry. At many other places it is cut out of the solid rock. The roadway is from fifteen to twenty feet in width, starting at the base of the mountain and coiling itself spiral-like to the peak of the mountain, which is not less than 1,200 feet higher than the base of the mountain. The cost of the construction and cutting out of the solid rock of this terraced road must have been enormous, and the remarkable feature of this wonder is the state of its preservation. Here and there masonry has yielded to the crumbling influences of time, but these are exceptions.

At the base of this terraced mountain is a mighty rock, which has the appearance of having been hewn out of a solid rock, and weighs 100 tons or more. It is placed at the mouth of what appears to be the entrance to this terraced mountain. Here another query is suggested. Does this door to the mountain open the way to mineral treasure or to the shrine of ancient religious devotees? Again, does the terraced road which coils itself to the peak of the mountain lead to the shrine of the ancient vestal virgin who kept eternal watch on the sacred fire which was never suffered to die?

One thing is certain, there is a wide field for those near at home who wander far into Egypt and Persia to study the mysteries of the hidden past.—*Tucson Sun.*

### Progress of the Niagara Falls Water Power Scheme.

Prof. Coleman Sellers was made consulting engineer of the Cataract Construction Company, some six months ago, and is now in England in consultation with some of the most prominent engineers, constituting a commission to decide upon plans for utilizing the water power of Niagara Falls.

Of this international commission Sir Wm. Thomson is the president; Prof. Sellers represents America; Prof. Mascart, France; and Theo. Tourit, Switzerland.

This Cataract Construction Company has secured a large area of land (several square miles) on the Niagara River, beginning a mile and a half above the falls, and all rights of way for carrying a tunnel under Niagara Village to a point below the falls.

The general plan is to construct a tunnel about 27 feet in diameter from a point below the falls to the upper limit of the secured property.

This tunnel will have lateral branches at a depth of about 100 feet from the surface, into which will be sunk numerous vertical shafts at the points where power will be required. A system of surface canals will bring the water of the river to the heads of these shafts, and its action on turbines at the lower ends of the shafts will develop the power, estimated we believe, in the aggregate, at about 150,000 horse power. The amount of water diverted for this purpose will be a small fraction of one per cent of that going over the falls.—*Stevens Indicator.*

### A Luminous Buoy.

Experiments with a luminous buoy invented by M. Dibos have been made at Havre. By improvements, effected since a previous experiment, in the arrangement of the phosphuret of calcium in the apparatus, the inventor has obtained fewer intermissions in the production of the light and a prolongation of the duration. A first buoy, thrown into the channel opposite the semaphore, emitted a powerful light upon coming in contact with the water. During this time a boat left the harbor, and when about a mile and a half out, another of the buoys was thrown into the water, which lit up the sea within a very large radius. The power of the light was such that the men at the lighthouse, two miles and a half distant, saw it clearly with the naked eye. It has, besides, been proved in former trials that the light can be seen at a distance of five and a half miles. The French authorities intend making trials of lighting the channel on the Seine, from the Amfard Bank to where the dikes commence, by means of decked boats with masts about two meters high, on the top of which will be placed a light of this kind.