been regarded as veins of segregation, a most unlikely, almost inconceivable origin, and Prof. G. P. Merrill has suggested that they represent a sort of "pulling out" action, whereby the serpentine has been drawn out into these mineral threads. The serpentine is clearly an alteration product, and is doubtless formed from the change of diorite, an intrusive rock composed of tirclinic feldspar and hornblende, with possibly a large admixture of chrysolite (olivine). This rock has been invaded by later dikes of white granulite or granite, much of which I saw at Thetford, where the association of the chrysotile or asbestos with this later intrusive has been commonly observed. That there is any causal connection seems doubtful. The asbestos may, I think, be regarded as the alteration of previous seams of fibrous hornblende, retaining the position of the antecedent mineral; and these fibrous hornblende separations have themselves been formed by movements in the original pasty or semi-consolidated (crystalized) diorite.

Great dumps resembling small hills are pushed outward into the lowland to the west of the village of Thetford, and when, as in some cases, the available area is disappearing for mining, the dumps, which still retain a great quantity of asbestos of the smaller and poorer grades, may be worked over, and will furnish employment for years.

The price of asbestos has declined, partly owing to improved methods of preparation, increased production, and competition. A further use for some of the less marketable grades of asbestos has been discovered in its adaptability to form a "holder" in cement, in place of hair. This use now consumes a large quantity.

The mines are worked by French workmen, and this desolate and lonely spot of rugged hills, distinguished by the one long, straggling street of humble white houses, the white spire of the church, the broken hill country around the excavations, and its vivacious population forms a curious picture, and leaves on the visitor a series of strange and interesting impressions.

THE EXPIRATION OF THE EDISON AMERICAN THREE-WIRE PATENT.

On the 20th of March the patent No. 274,290 issued on March 20, 1883, to T. A. Edison, expired by limitation. This is the fundamental American patent corresponding to the famous Hopkinson patent in England for three, five, or multi-wire systems, with any number of conductors, and which was regarded as a patent of the greatest possible value. It was a strongly drawn patent, showing that the inventor had an inkling of the conditions which would exist during the life of the patent, the drawings showing several modified arrangements for balancing which have since been either used or proposed, such as the use of the storage battery and the third brush on a commutator delivering from its positive and negative ends the full voltage between the outer conductors. The patent claims strongly the compensating conductor or conductors in the following words: "What I claim is a system of electrical distribution having translating devices arranged in multiple series, the compensating conductor or conductors connecting the translation-circuits with the source of energy substantially as and for the purpose set forth." Owing to the general interest of this patent, we give a short description of the three-wire system taken from "Experimental Science."

In the three-wire system a saving of 25 per cent in copper is made. Two dynamos, D^1 D^2, are required. The negative terminal of dynamo, D^1, is connected with the positive terminal of the dynamo, D^2, by the wire, a. These conductors are connected with the two dynamos as follows: Conductor, b, is connected with the positive brush of dynamo, D^1; conductor, c, is connected with the wire, a, and conductor, d, is connected with the negative brush of dynamo, D^2, a number of lamps, L, are connected with the conductors, b, c, and lamps, L^1, are connected with the conductor, c. d. The central conductor, c, acts as a return for the first dynamo and a lead for the second dynamo. When the number of lamps between the conductors, b, c, and c, d, is equal, no current passes along the conductor, c, either from or toward the lamps or dynamos, and under these circumstances the conductor, c, might be disconnected from the dynamos without in any way affecting the results; but when the two groups of lamps differ in number, the difference of current will be carried by the central or compensating conductor.

When two dynamos are combined on this plan, these conductors take the place of four connected up according to the two-wire system.

According to The Engineer the daily total of water supplied to London during last November was 201,281,664 gallons for a population estimated at 6,015,144, representing a daily consumption per head of 33·46 gallons. A large precentage of the water was obtained from the Thames.

Correspondence.

Balanced Cantilever Crane.

To the Editor of the Scientific American:

In your description of the "Electric Balanced Cantilever Crane," page 85 of Scientific American, February 10, 1900, you do not state why, when the load is at either end of the crane, the whole machine does not topple over. I am a regular purchaser of the Scientific American and as this is the first question I have asked you I trust you will see fit to answer. The question is: Why, when the load is at the end of the balanced cantilever crane, does not the entire machine topple over in that direction?

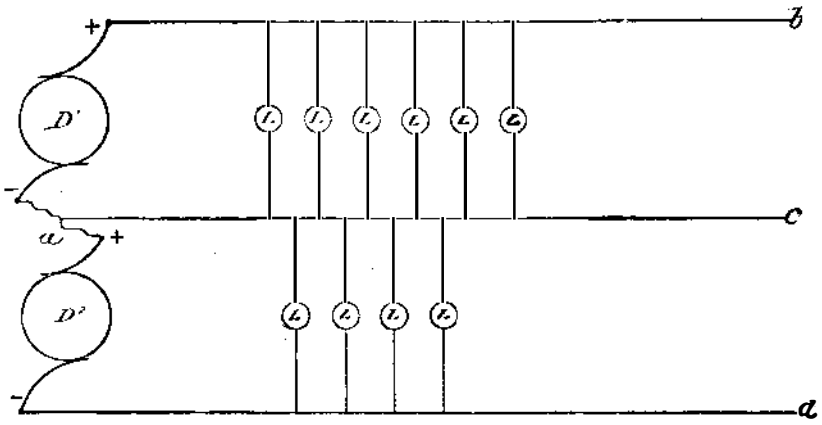
Frank I. Given.

Hillsboro, N. M., February 20, 1900.

[Replying to the appended inquiry of Mr. Frank I. Given.

The reason the cantilever does not topple over when the load is at either end of the crane is that the machine itself has stability enough to prevent this; i. e., when the load is at the extreme end of the cantilever the center of gravity of the whole machine plus the load is still quite a distance inside of the base or pier of the machine. The tendency to topple over is further counteracted by the traveling counterweight which is attached to the trolley moving line and which travels on a track immediately above the trolley track. This counterweight is so placed that it moves from the center toward one end of the cantilever at the same time and at the same speed as the trolley with the load travels toward the opposite end of the cantilever.

A further leverage is obtained in the case of heavy loads by adding to the counterweight, and by also placing it half way out on the arm of the cantilever when the trolley is at the center, thereby causing the counterweight to be at the extreme end of the cantilever when the trolley itself is half way out toward the other end.—W. F.]



EDISON THREE-WIRE SYSTEM.

Ship Propulsion by Liquid Air.

To the Editor of the Scientific American:

Having read the interesting article on Liquid Air by Hudson Maxim, in your issue of March 17, it seems to me that he has not fully considered the subject. He says, in the first place, "it would require boilers for the evaporation of liquid air," his only ground for this assumption being that it now is necessary to have boilers and furnaces for the boiling of water; but water boils at 212° and air at —340°, and while water has no tension until a temperature of 212° is reached, liquid air confined is at the temperature of surrounding matter and at 60° has a tension of 3,000 pounds. If liquid air were to be used at a tension of 250 pounds nothing would be needed to heat the air; on the contrary, it would have to be cooled to avoid a much greater pressure. Mr. Maxim also says that "liquid air cannot be re-condensed like water," which is true, but it may be recondensed by using other means of condensation, and instead of 40,000 tons of liquid air being required to propel the S. S. "Teutonic" across the Atlantic five tons will be sufficient if re-condensed. It is unfortunate that such claims have been put forward by the promoters of liquid air enterprises, who have no method of utilizing the same except by exhausting it, and consequently wasting it. But the subject of condensing and re-using it and other expansive gases for motive power is being carefully investigated and a point has been reached and we may be safe in predicting that the operation of a high-pressure condensing gas engine will realize the expectations which Mr. Maxim now derides.

George H. Gillette.

New York, March 20, 1900.

The New United States Cruisers of the "California" Type.

To the Editor of the Scientific American:

I beg to make a few suggestions in reference to the new armored cruisers of the "California" class I understand that they are to be about 12,000 tons, a speed of 22 knots, an armament of four 8-inch rapid-firers, and sixteen 6-inch guns. Does this not seem rather light when we consider that the new Japanese cruisers of 9,750 tons displacement (2,300 tons less than the "California" class) are only inferior in gun power by two 6-inch guns.

Why not build ships of the "Bendetto Brin" type of the Italian navy? Her speed of 21 knots is greater than that of the cruisers "Rossia," "Rurik," "Bismarck," "New York," "Dupuy de Lôme," which range from 19 to 21 knots in speed, and equal to the new armored cruisers of the "Cressy" and "Montcalm" classes of the English and French navies. The "Brin's" armament of four 12-inch B. L., four 8-inch R. F., twelve 6-inch R. F. is superior to that of the British "Canopus" by four 8-inch R. F. The armor is the same in thickness as the "Canopus," but excels it in quality (being Kruppized) and speed about 2½ knots greater. To sum up the strong points of this magnificent ship, we find (1) her armament is greater than that of any warship yet designed. 2. Armor equal to that of the average battleship. 3. A speed equal to that of the majority of armored cruisers. 4. Large bunker capacity of 2,000 tons. The cost of our new cruisers is limited to $4,000,000. Ships of the "Brin" class could easily be built for that sum. The "Maine," though designed for an armored cruiser, was, for all purposes, a battleship. No armored cruiser and few battleships could engage the "Brin" type of ship with any hope of success.

Robert F. Wood.

New York, March 14, 1900.

The Excavations of Ur.

An expedition is now being formed to excavate Ur, and it will be under the direction of Dr. E. J. Banks, who was recently United States Consul at Bagdad. The work will be undertaken for the benefit of the Smithsonian Institution. Ur lies half way between the ruins of Babylon on the Persian Gulf, says The Outlook, and is six miles south of the River Euphrates. Ur was a great city long before the time of Abraham, and according to the book of Genesis, Abraham was born there as was also Sarah. The Hebrew people emigrated from Ur to Syria. The great temple Gish-shir-gal, the home of Sin, or the moon god, is the best preserved of any of the specimens of Babylonian architecture which still stand. The British consul, Mr. Taylor, made some excavations a half century ago resulting in the discovery of the inscriptions of the King Nalonidus which speak of the crown prince the Belshazzar of the Bible. The most modern town in Babylon is Nasaria and it is only half a mile away from the ruins, and the inhabitants are beginning to dig bricks from them, destroying the tablets and defacing the inscriptions. The present appearance of Ur is that of three stories of an ancient temple rising 70 feet above to plain; surrounding the temple is a group of mounds half a mile in diameter. The ruin of the city is called, in the Bible, Ur of the Chaldeans. The estimated amount required for the complete excavation of Ur in two years is $50,000.

The Use of the Divining Rod in the Search for Water.

At last the divining rod is to be scientifically investigated. A commission has been appointed in France to study all apparatus and methods employed by sorcerers, water seers, and wizards, who use the divining rod, mineral rod, exploring pendulums, hydroscopic compasses, and the other instruments which go by a host of other fanciful names. The French engineer, M. Brothier de Rollière, is the president of the commission. He will procure divining rods of all kinds, including books, reviews, journals, reports of experiments, together with the names and addresses of the inventors of the alleged devices. All the facts and documents may be sent to M. de Rollière, care of Cosmos, 8 Rue François Premier, Paris, France. It is to be hoped that the findings of this commission will, once for all, settle the question of the divining rod, not only for the discovery of water, but also minerals. In England, particularly, the water diviner plies his lucrative profession without legal interference, and, strange to say, his dupes are often town authorities. The whole business is akin to that of fortune teller, the spiritualist, or any other charlatan, and it is strange that the exponents of such systems are allowed to openly pursue their avocations undisturbed by fear of prosecution. At present the victims are the only ones punished.

The Estate of an Inventor.

That inventors very often leave large estates is shown by the fact that Prof. D. E. Hughes, F.R.S., the inventor of the Hughes printing telegraph and other important electrical appliances, left an estate valued at $2,365,000. The greater part of it was left to hospitals in London. A considerable sum was also left to various scientific institutions. The hospitals will receive about $2,000,000.

Science Notes.

The German army authorities are now experimenting on a cotton stuff as a material for balloons. It is treated with rubber before being used. The fabric is said to have great strength, and is better than silk which is apt to generate electricity.

A consignment of vegetables grown on the farms of the Cuban Industrial Relief Commission have arrived and they have met with high favor. The potatoes are said to be superior to the best Bermudas as they have not the insipid sweetness of the Bermudas and are more mealy.

Unvulcanized India rubber is by no means waterproof. Rolled plates of rubber were found to be capable of taking up in two hours from 8 to 35 per cent of water at 60° centigrade, the absorption increasing with the degree of compression, and a piece of best Para rubber kept under the water at 50° was nothing but a mass of slime in two months.

In an English contemporary we find the following advertisement of a shooting school: "40 acres in extent. Gun fitting a specialty. Instructions in the art of shooting. Patent try guns and targets. Most realistic coverts. Practice at driven birds, high pheasants, etc. Any number of sportsmen can be accommodated. Experienced gun fitters and instructors always in attendance."

The way in which the Indians made soapstone dishes is said to be as follows: With a hard implement, probably a flint, they cut a circle on the stone which was to become a dish and then chipped away and down on the circumference of this. They then fashioned the outside to the shape they desired, while it was still attached to the rock itself. Finally, they split it off at the bottom and hollowed it out, and the dish was completed.

Gas liquor has been turned to a very useful account at Cuzzies, in France. Beet root would not grow in the fields because they had become infested with a beet root parasite, but with one application of the gas liquor 15 tons of beet root per acre, with 14 per cent of sugar, four splendid crops of cereals were obtained, and in another set of trials using gas liquor only, four successful crops of more than 24 tons to the acre and a fifth of over 16 tons were secured.

The New York Times will publish an American newspaper on the grounds of the Paris Exposition. It will appear in its usual form and will be printed on a large, latest improved web-perfecting press and a complete printing office, including a battery of type-setting machines, will be installed in the center of the American Annex to tke Building of Liberal Arts and Mechanical industries. It will be gratuitously distributed at the place of production and it will be the only paper published on the Exposition grounds.

M. Ach, in the Zeitschr Instrumentenk, describes an interesting apparatus for the registration of vertical movements. The vertical motions of the center of gravity of a ship at sea are recorded photographically by means of an aneroid barometer carrying a mirror instead of a pointer. The limit of accuracy of the records obtained is about 1 m., which corresponds to an ordinate of about 2 mm. on the curve. Greater accuracy can be obtained by using a micrometric eye piece. The apparatus is suspended by a double cardani suspension.

The project for building a new façade to the cathedral of Milan which has been at the point of execution for fourteen years, is receiving so much opposition that it is not impossible that it may be abandoned. The old façade struck a discordant note, but many of its details were very fine. As the bequest which was to pay very largely the cost of the construction of the façade was to revert to the great hospital at Milan if the construction was not begun within a certain time, it is probable that the Milanese public will not regard the loss of a new façade a very serious matter.

An ingenious arrangement to prevent over-crowding of both elevators or stairways is in use in the offices of the International Correspondence School, Scranton, Pa. The time of entering and leaving the building is regulated by clocks on each of the five floors. On the lower floors the clocks are set correctly but on the upper floors they are a few minutes slow so that the employes on the lower floors are at their works before those on the upper floors are due and of course those on the upper floors do not leave their desks until several minutes later, thus avoiding all confusion.

It is possible that Sierra Leone will be a good source of supply for India rubber. The native collectors in their endeavor to increase the yield of rubber are now frequently bleeding the roots of the tree as well as the body. This is said to be fatal to them, and at the same time the rubber gathered from this source is of inferior quality. It is suggested that this inferior root rubber should be refused altogether by buyers in the local market and in turn by the foreign markets, in order to prevent the destruction of the forests. Unfortunately the demand for raw rubber prevents this being done. The government and officials are fostering a plan for planting rubber trees and vines in the colony.

Engineering Notes.

It is proposed to establish Chinese commercial schools in England which would be assisted by the government, and which would train young men for service in the Chinese export trade.

Plans for the reclamation of the meadows near Newark, N. J., are being considered, and thirteen plans were submitted. The plans were sent in by experts and engineers from all parts of the country.

The power plant of the Paris Exposition has a chimney 289 feet high, 26 feet is below the surface of the ground and 263 feet is above the ground. The foundation rests upon an oak piling capped with a concrete block 59 feet in diameter and 5 feet thick. Upon this is built a truncated cone of masonry 54 feet in diameter at the base and 42 feet in diameter at the top, and 18 feet 6 inches high. Into the hollow space in its interior opens the tunnels conveying the smoke and gases from the various boiler plants. Above the ground line, the chimney consists of a pedestal 52½ feet high, a shaft 177 feet high and a capital 33 feet high. The chimney is built of white brick ornamented with bands, lozenges, crosses, etc., in red, black and enameled brick. On the whole the smokestack is most excellent from an architectural point of view.

The New York and Ottawa Railroad will be completed during the present year, and will be one of the most important routes between the United States and Canada. This road now runs from Cornwall to Ottawa (about 57 miles). and from Hogansburg to Tupper Lake (about 65 miles), and the intention is to extend it 60 miles to North Creek, and there connect with the Delaware and Hudson and New York Central at Albany. This line gives a direct connection from Ottawa to New York, Boston, Saratoga, Adirondacks, Lake Champlain, Massena (where millions are being spent in making a canal from the St. Lawrence to Grass River), and other points. The run from Ottawa to New York will be made in about ten hours—one and one-half hours less than the time from Montreal to New York. The placing of the northwestern portion of New York, Massachusetts, and Connecticut in such close touch with the Dominion, especially with the Province of Ontario, cannot but produce good results to both countries and largely increase the trade between the United States and Canada.

Consul General Mason, of Berlin, under date of February 13, 1900, sends the following translation from the Fränkische Curier, Nuremberg, February 6, 1900:

The Bavarian State Railway Administration has addressed a letter to the locomotive manufacturers, Maffei & Krauss, at Munich—from whom it has received heretofore its entire supply of locomotives, and who have been naturally surprised by the order for locomotives from America—stating that these machines are imported from Philadelphia solely for the purpose of enabling the many details of construction wherein they differ from German locomotives to be studied, and, so far as may seem advantageous, adopted in the future construction of engines for the Bavarian State railways; for the newly imported machines show, as the general direction further explains, in many respects important variations from the construction which is usual in Germany, especially in respect to the boiler, cylinders, and frame construction, dimensions of the axles, valves and valve gearing, the couplings and buffers, while, on the other hand, other parts are not as carefully worked out as is customary in German locomotives. The general direction will, therefore, give the Bavarian locomotive builders full opportunity to familiarize themselves with the construction of the American machines, and invite the makers to have them carefully studied by their engineers.

The plans for the improvements in the Red River, about fifteen miles from Winnipeg, call for a dam across the Red River 800 feet in length, a canal 1,900 feet in length, one set of locks 215 feet in length, and dredging in the river for a distance of some 400 feet. says The Canadian Engineer. The lock will be 215 feet long, 45 feet broad and the solid concrete will be 38 feet deep, giving the locks a high water depth of 30 feet, while at low water the depth will be 11 feet. The gates of the lock will be of steel. The approach to the locks will be by a canal from a point on the west bank of the river, a distance of 1,500 feet. The canal will be 100 feet wide, and have a depth of 11 feet. The distance to the canal from the river will be partly wooden crib work, filled in with stone and will be 290 feet in length. The canal extends 400 feet north of the lock to the river, which will be dredged to a depth of 9 feet for about 100 yards. The dam to regulate the river will extend from the east side of the locks 800 feet, to a point on the east bank of the Red River. It will be of concrete, granite faced, 32 feet at the base and 18 feet 5 inches at the top. The dam is provided with seven piers and two abutments, and also with sluice gates. The piers and abutments can be used as the base of a service bridge and from this could be worked a system of shutters and movable frames, by which the height of the dam could be increased 12½ feet. The bridge and shutters, however, will form a separate contract.

Electrical Notes.

It is stated that the authorities at Scotland Yard are now engaged in subjecting a police electric lamp to practical tests, to ascertain if it will stand the necessary wear and tear of the service.

A French inventor, M. Mercadier, states that he has solved the problem of sending a number of despatches simultaneously on a single wire. Messages have been transmitted between Paris and Pau. Twelve independent message currents were sent on the circuit at once in either direction, making a total of twenty-four telegrams.

The Rhodesia telegraph system, including trans-continental line, consists of 2,635 miles of lines with 3,163 miles of wires, says The Western Electrician. The police telephone system consists of 251 miles of telephone; exchanges have been opened at Salisbury and Bulawayo. There are sixty-two telegraph offices in Rhodesia.

The temperature of electric incandescent lamps recently formed the subject of a communication to the Paris Academy of Sciences by M. P. Janet. The variation of the resistance of the lamp as a function of the difference of potential at the ends of the filament is measured, and also the variation in the resistance of a cooled lamp as a function of the time. From these, with the weight of the filament, the temperature can be deduced, assuming that the filament is composed of pure carbon. Four lamps gave concordant figures, namely, 1610°, 1630°, 1620°, and 1720° Cent.

Zinc plating on iron acts quite differently from iron plated with other metals, such as nickel, silver or copper. Zinc protects the iron electrically by virtue of the fact that in the presence of moisture a galvanic couple will be formed between the zinc and any exposed parts of the iron, which will cause hydrogen to be formed on the exposed iron, and this tends not only to keep rust from forming, but will also reduce any rust which may have been formed. To successfully plate iron with zinc is, therefore, much more important than to nickel-plate it, but unfortunately, it is much more difficult. The following recipe from the Zeitschrift fuer Elektrotechnik may, therefore, be of interest: The bath should have a specific gravity of 1·135, or contain about half a pound of zinc sulphate per quart of water. Its current density should be about 0·1 to 0·2 amperes per square inch, and the solution should be kept stirred. The articles must be very carefully cleaned before plating, and the bath should be replenished with a mixture of zinc dust with about twice its weight of powdered coke, suspended in a bag.

W. J. S. Lockyer in Nature discusses the possibility and probability of the objective existence of dark flashes. He remarks at the outset that many apparent dark flashes as seen by the eye are probably due to retina fatigue, and so have only a subjective existence. Photography also may be deceptive, owing to the phenomenon of photographic reversal. A. W. Clayden, in 1899, put forward the following explanation of the apparent dark flashes shown by photography. If the lens be covered the moment after a flash has occurred, the developed image is always bright. If, however, after the flash has passed, the plate be exposed either to the continued action of a feeble diffused light or to the powerful glare arising from one or more subsequent flashes. then, on development, the image of the original flash will probably come out black. The present author then proceeds to test this explanation as applied to a number of very striking photographs exhibiting bright and dark flashes. He also took photographs of sparks from an induction coil with and without subsequent exposure to light reflected from burning magnesium. The examination of all these cases leads to an entire corroboration of Clayden's hypothesis.

In a recent number of The Journal of The Franklin Institute a paper, by Messrs. R. B. Williams and J. H. Klinck, on a "Photometric Comparison of Illuminating Globes" is given in full. The authors experimented with great care on a large number of globes and reflectors used in connection with the Welsbach gaslight. In order to ascertain what these actions were, the authors made photometric measurements at different angles in a vertical plane for the same light, with and without the globe or reflector. In this way polar curves were obtained by which the actual efficiency of the globes was calculated. As an example of the result when using a Holophane globe, the area of the curve above the horizontal line was decreased from 12·58 to 7·92, while the area of the curve representing candle-power below the horizontal line was increased from 11·15 to 12·72. The mean spherical candle-power of the light without the globe was 46·46, while it was decreased by the globe to 41·28. This gives the efficiency of the globe as 87 per cent. This efficiency must be considered together with the fact that the light given off below the horizontal line was actually increased, and that this light is the more useful. Similar curves are given off for enclosing globes of different shapes, and for a large number of reflectors. The curves obtained are most valuable for reference, and make it clear how important it is to select the right globe for a given situation.