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?

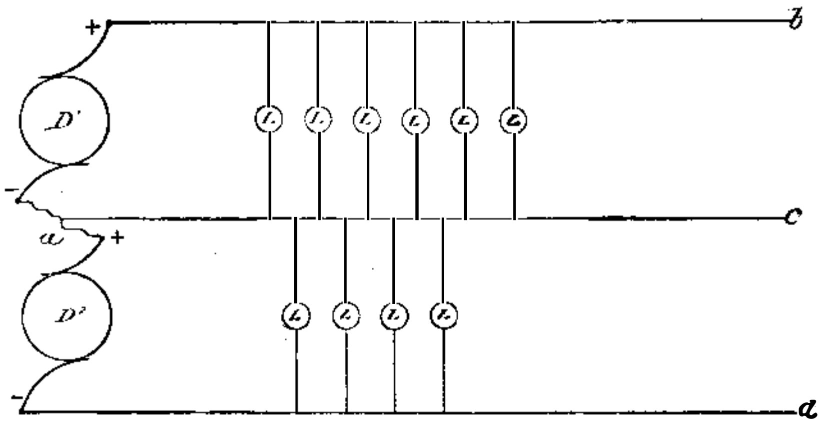
FRANK I. GIVEN.

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.