from a normal location of the line of road, we can find some good reason for it.

The construction aimed at on the West Shore Road at the deep holes was rock fill of sharp rock from the excavations. This construction has three advantages over a protected earth filling: 1. The sharp rock, by its sharpness and weight, gets a grip of the mud bottom, and the mud slope, however much lubricated by the water, has little or no effect as a smooth surface in sliding the mass out into the river. Where rock fills went out during construction, it was generally, as nearly as could be ascertained, because of the mud layer in which the rock fill had obtained a grip being too weak to sustain the increasing weight. The rock fill did not so much slide on the top of the mud as did both rock fill and mud layer upon the underlying rock.

2. The rock fill requires no protective wall. It is stable in itself and cannot be overthrown or eaten away by the water.

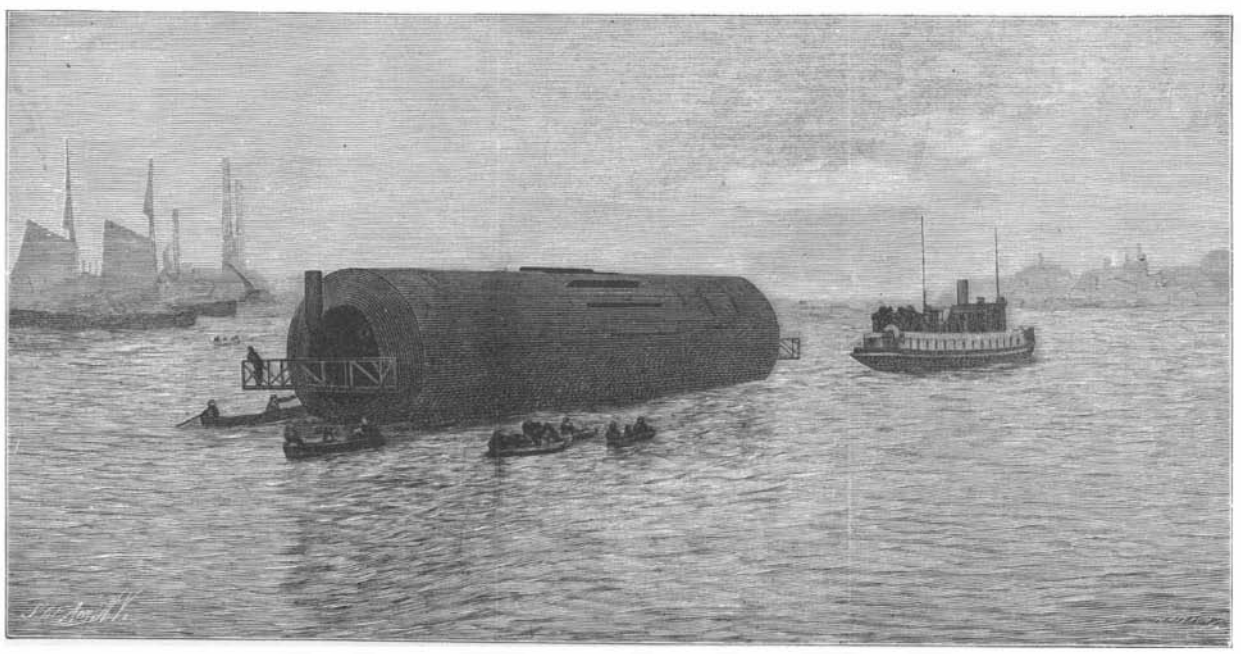
3. The interstices are in time gradually filled by the river deposits, and the whole cemented together into one mass. A rock fill grows more stable with age.

Where such a fill cannot be carried by the underlying mud slope, this is shown promptly during construction. With each month that it remains in place, it settles more into the mud, because more cemented together, and increases in staying power.

The writer's object has been to show the limited extent and number of the difficult places. It is for the company and not the writer to define the cause or causes of the accident at Highlands, so far as the original construction and location are concerned. A test of nearly half a century with ordinary conditions, and of half a dozen years with modern heavy trains, would seem to be almost a final test.

THE LATEST ROLLER BOAT.

It is difficult to account for the inspiration which has led such men as M. Bazin in France and Mr. Knapp in Canada to attempt to make vessels travel a rolling, instead of a gliding, motion. Wherever the inspiration may have come from, its results, so far, have not been encouraging. The Bazin boat picked up the water with its wheels and sunk itself to the hubs with a persistence which looked like an indignant protest against the attempt to take a ship from its native element and make it move over, instead of through, the sea. The water clung so tenaciously to the wheels that they failed altogether to rotate with speed commensurate with the odd twenty or thirty knots an hour which had been freely predicted; and when, in despair, the inventor placed more powerful motive power in the boat, she sank so deeply as to put record-breaking speed out of the question.



THE TRIAL TRIP OF THE KNAPP ROLLER BOAT.

Though the Bazin boat was a failure, it did not deter Mr. Knapp from a costly experiment in the same direction. In looking at his boat, as shown in the accompanying illustration, it must be admitted that, while the roller boat idea was old, the present application of it is decidedly novel.

Mr. Knapp abandoned the idea of making the wheels separate from the boat, if such it could be called, and formed the boat and wheels in one; so that the boat may be said to do its own rolling.

The vessel consists of a huge cylinder 22 feet in diameter and 110 feet long, the ends tapering somewhat suddenly to a diameter of 15 feet. The ends are open and through them admission is gained to the interior of the "ship." At each end of the cylinder is laid a series of steel tracks, which extend in a complete circle entirely round the shell to which they are firmly bolted. Upon each set of tracks is mounted a platform, the platform being carried on flanged wheels, which enable it to maintain a level position during the rotation of the outer shell. On each platform is located a separate boiler and engines, the engines being geared to the supporting wheels. The smokestacks will be noticed protruding from the ends of the cylinder.

Now it will be seen from the foregoing description that, if the cylinder were held stationary, the engine platforms would revolve. On the other hand, if the platforms are stationary, the cylinder will revolve. When the engines are started, the platforms begin to climb the inside of the shell, and the shell being free to revolve, the platforms roll the shell around beneath their wheels. On the outside of the shell are bolted 16 paddles or floats, 15 feet long and 8 inches deep, which are not placed radially to the cylinder, but are slanted so as to hold the water and drive the cylinder forward over the sea.

The boat carries two large tail boards, or rudders, which are located one on each side below the platforms.

The trial trip was made on October 21 at Toronto, where the boat had been constructed, at Polson's shipyard. Our illustration shows the marine curiosity as it was being towed out to the trial course. When the engines were started, the inventor and builder, who elected to watch the experiment from the deck of a ship of normal construction, had the satisfaction of seeing the cylinder make six revolutions a minute, and slowly forge ahead over the water. The speed was six miles per hour, and though the boat rolled, its trials did not give any reason to expect that the marine greyhounds of the future will move over instead of through the sea.

Science Notes.

Prof. J. A. Brashear has just completed the second photochronograph, which he has made for the government, for testing the velocity of cannon balls. The new apparatus has many improvements over the old one and has met all the expectations of the government experts. But one lever is used to fire the gun, start the tuning fork to vibrate, open the main shutter, and release the electric connections which throw a beam of light on the photographic plate, which rotates 1,500 revolutions per minute.

M. Porché has recently submitted to the Paris Academy of Sciences a method of overcoming the difficulty of keeping the subject still while taking a radiograph. He proposes to use a fluorescent screen, and, instead of taking a radiograph directly on the plate, to photograph the shadow on the screen. An extremely sensitive plate is required, and this plate must be protected from all other rays emanating from the Crookes tube except those which actuate the fluorescent screen. The results depend essentially on the rapidity of the sensitive plate.

Preparations are being made to observe the total eclipse of the sun on January 22, 1898, which will be best seen in India, says The English Mechanic. On the coast, in the vicinity of Bombay, the duration of the total phase will be a little more than two minutes, and the time available for observations decreases to a hundred seconds as the central line is followed through Bengal to the Northwest Provinces. The meteorological conditions will probably be more favorable in the neighborhood of Bombay, and the majority of the most suitable stations will be reached from the west coast, though some of the observers will probably go to Calcutta as a starting point for Buxar and Ghazipur. Sir J. Norman Lockyer and Mr. Fowler will, it is stated, be stationed near Ratnagiri, on the Bombay coast, while the astronomer royal (Prof. Turner) and Dr. Common will take up a position where the shadow track crosses a point on the Great Indian Peninsular Railway. Mr. Newall will go to Wardha by the railway from Bombay to Nagpur, and he will use a large slit spectroscope for determining the speed of rotation of the corona. The Southern Mahratta Railway offers free passes to all observers, and the other railways will make considerable reductions in the fares. The length of the path across India is about a thousand miles, and the width of the shadow fifty miles, so that there is ample opportunity for observation, even in the short time of approximately two minutes. The observations made by the professional or official observers will be made in relation to the results of previous eclipse expeditions; but any observations made independently will obviously be of considerable value.

High Tension and High Altitudes.

"Alpine misadventure is a wide word, and includes victims to pathological conditions unrecognized by the victims themselves, whose sudden fall into a crevasse or mountain torrent is set down to 'loss of balance,' 'misplaced footing,' or one or other of the many mishaps besetting the mountaineer, when syncope due to cardiac lesion was the real cause. In August, 1894, The Lancet pointed out this 'error in classification,' when Baron Paccoy, who had for two days been acting as guide to the Queen of Italy, stumbled and fell into a crevasse on the Lyskamm, not, as was at first thought, by inadvertence in walking, but by instantaneous heart failure occurring at the dangerous spot in question. May not this account for the strange disappearance of Mr. Cooper at Zermatt, now being investigated at the instance of our Foreign Office by the cantonal authorities? May he not have fallen into the Visp when suddenly overtaken by the syncope not unusual in a septuagenarian beside a rushing, brawling mountain stream? The hypothesis is well worth entertaining, strengthened as it is by the circumstances under which, on Sunday, July 11, the burgomeister of a Westphalian town met his death on the Furka Pass. This gentleman, with his wife and a young Italian officer as compagnon de voyage, left Andermatt on the morning of that day for the Rhone Glacier. Everything went well till they came within sight of the object of their journey, when the burgomeister, rising in the carriage to get a better view, had barely uttered, 'Oh! C'est magnifique!' when he dropped down dead. The great altitude, the rarefied air, the high tension—conditions inseparable from Alpine ascents—were too much for a 'chronic sufferer from weak heart,' and he collapsed accordingly. Now, had this syncope occurred at a difficult spot of the Rhone glacier itself, had it supervened on the edge of a crevasse into which the victim fell, would not the incident have been classified as 'accident due to misadventure'—to one or other of the merely pedestrian risks encountered by every Alpine climber? The whole question opens a series of considerations very gravely present to the Swiss medical faculty, in view of the multiplication of such engineering enterprises as the Jungfrau Railway, for example, which will shortly be 'ballooning' passengers of all ages and bodily conditions to a height of over 12,000 feet above the sea level. At a congress of the said faculty, held some time ago at Arona, the perils and the precautions incidental to such railway development were fully discussed, and an impressive warning was given to the traveling public not to venture on rapid ascents above the snow line without previous sanction on the physician's part. To no section of that public is the warning more immediately addressed than to the British, who, after the exhaustion of the London season or a nine months' spell of work, professional or other, are found thronging every Swiss mountain inn, and in sheer holiday exultation qualifying by every kind of imprudence for some such fate as comes under the all too elastic heading of 'Alpine misadventure.'"—Lancet.

Operating Warship Turrets by Electricity.

On November 5 a trial was made of the electrical equipment for the turning of the large turrets of the United States cruiser Brooklyn, at the Brooklyn navy yard, which was very successful. The trial lasted two hours. The great turrets were moved in all directions, rapidly and at slow speed, and so accurately that the guns could be quickly trained on the target, much easier than with compressed air or hydraulic power. The apparatus is so simple and works so satisfactorily that the turrets of the battleships Kearsarge, Kentucky, Illinois, Alabama and Wisconsin are to be equipped with the same mechanism. The power is derived from the dynamos used for the electric lighting of the ship.

A Silver Medal Awarded to the Scientific American at the Brussels Exposition.

We take much pleasure in announcing that a silver medal has been awarded to the SCIENTIFIC AMERICAN display at the Brussels International Exhibition. Notification of the award was sent to the United States Consulate by Mr. Thomas Wilson, Commissioner General of the United States to the Exposition, and was promptly forwarded to this office by Colonel George W. Roosevelt, the present consul.

By Rail to Hudson Bay.

The project of building a railroad from Winnipeg to Hudson Bay, with a view to connecting the road with a line of steamers, the whole forming a new grain route to Europe by way of Hudson's Straits, has long been familiar. But while that scheme is still under consideration, a rival enterprise has lately appeared in the proposed extension of the Quebec and Lake St. John Railway from its present terminus to James Bay, which forms the southernmost part of Hudson Bay.

This project, of course, has no new grain route in view, but a plea of special interest just now is made for it as a possible route from Eastern Canada to the Yukon gold fields, says the New York Sun. For this purpose there would be water travel by Chesterfield Inlet and English River as well as by Hudson Bay. In addition, it is hoped that the fisheries, the timber and the minerals of the Hudson Bay region may furnish support for the proposed new road.

The existing railway, it appears, is 190 miles long, extending to Roberval, on Lake St. John, while the distance thence to James Bay would be nearly twice as great, a considerable part of it through a hilly region, but the beginning and nearly or quite all of the northern half lying in comparatively level territory. To the cost of construction would be added that of aiding people to settle on the line of the road, and also of shipping outfits for carrying on the fisheries in Hudson Bay. But these expenditures would bring returns in traffic, and if the great inland sea could be reached in a couple of days and nights from Quebec, there might be some tourist travel, prompted by the facilities for going without discomfort so far north.

On the other hand, a glance at the map suggests that the route to the Yukon by way of Hudson Bay must be tedious and precarious. When, by rail across the continent and by steamer thence to Dyea, people from Eastern Canada can arrive so near the Klondike region, the effort to cross the enormous untraveled area between Hudson Bay and the Klondike could hardly be tempting. Yet there is no saying how much of the continent to the north of us may yet be redeemed and this Hudson Bay project, like the one which seeks a new highway for the wheat of the Saskatchewan region, may some day be carried out.

The Deep Cypress Swamps.

These swamps, lying along the streams in Missouri, are, writes Mr. W. Trelase, director of the Missouri Botanic Garden, in Garden and Forest, most remarkable in their interest.

Except in seasons of great flood, the water of these sunken lands varies little in its general level, and the cypress knees correspond approximately in height with this level for many miles, rising so close together between the trees that only a native can find passageway between them for a dugout canoe. In such a canoe, with an experienced guide, barring the discomfort of the tailor's seat which must often be effected, one can pass with pleasure for hours silently between the trees, now startling a great turtle into a quick plunge from its sunning place on an emergent log, or in turn be startled by the quick call and splashing flight of a pair of mallards, and again recoiling as one's elbow almost brushes against a large water snake—a water moccasin, as it is here called—lying afloat on a snag; drinkable the water scarcely is, but it lacks the turbidity of the larger streams, and, stellate with Cabombaand Jussiæa, and often for miles carpeted with a dense layer of beautiful Azolla with intermingled Lemna, Spirodela, Wolffia, and Wolffiella, it presents a delightful appearance not soon to be forgotten. But the novice who dips into it, or the botanist whose zeal leads him to gather its choice surface coating with incautious hand, is quite likely to learn that in the latter are certain small hemiptera, whose pungent thrust is no less painful than the sting of a hornet, though happily not so serious or lasting in its effects. Here the Nelumbium is at home, and in season its great dew-studded leaves, with the curious bronzed lens of their lower surface conspicuous in the slanting light, and charming creamy flowers, form an almost impenetrable jungle in the waterway. But most marvelous of all are the masses of Polygonum, which, rooted perhaps ten or fifteen feet below the surface, finally emerge, making a tangle on which, in hip boots, one may wade with as great security as on the more solid land. The trees of the deeper water are chiefly cypress (Taxodium) and tupelo (Nyssa aquatica), the greatly dilated bases of which rival anything of the kind that I have ever seen. Not infrequently within the hollow trunk of some old tree may be seen a perfect forest of young knees from its younger neighbors, or even from its own roots, providing the aeration which these would otherwise never get in this region of perpetual water. Now and then old cypress stubs, with gray bark and large branches emerging from the giant trunks close to the water level, stand in marked contrast with the tall, clean stems of a later generation, suggesting the doubtful hypothesis that the strip of land on which they grew has sunken locally below the general level of the stream.

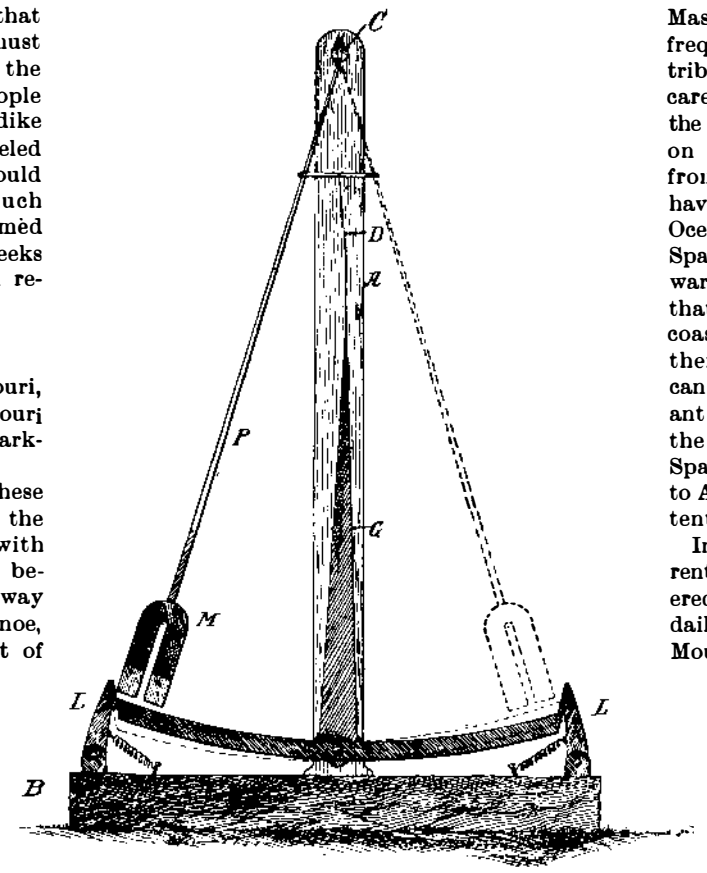
Correspondence.

"Perpetual Motion" Again.

To the Editor of the SCIENTIFIC AMERICAN:

I send you the following, which may be something new on the subject of "Perpetual Motion" so called. If you think it would interest your readers, you are at liberty to publish it. It is with a great deal of interest that I have read your articles on perpetual motion in THE SUPPLEMENT, the earnest search and labor to attain the object thus far being futile. It occurred to me a good many years ago (this being the first time I have offered it for publication, however) that the only way out of the difficulty would be to enlist the aid of the two well known laws, namely, gravitation and magnetic attraction. I put my brains to work and evolved the machine that I submit to you a sketch of, which I hope to make plain enough to be understood. Before going further, would say that I am not sure that it is a failure, as I never gave it more than a crude trial, but I believe that, like all others when tested, it will lack that requisite that all others have lacked—self motion.

My plan consists of a base, B, in the center of which is placed a brass or other non-magnetic material post, A A, near the top of which projects a pin, C, which serves as a support for the pendulum, P, having a permanent magnet, M, attached, which serves a dual need, namely, weight and attraction. Pivoted on the post, A, near the bottom, is a soft iron strip bent to conform to the arc which the pendulum describes in its



A "PERPETUAL MOTION" MACHINE.

motion back and forth. The pendulum is supposed to be started by giving it a full swing, it striking the latch, L, releases the iron strip, so that the magnet can attract it to itself, which it does, and the motion is transmitted to near the upper end, to pendulum, which gives it an impulse to other side, where the operation is repeated. The upper end of rod, G, is made flexible, so that when the latch on left is released, the iron strip attracted upward, it is latched down at the right, thus applying the force to the pendulum gradually, through spring, D; the magnet having the iron in its field of attraction at all times, it is thought, would not interfere with its motion, but let it swing freely under a tension all the time, due to magnetic attraction and gravitation. Whether it would lose its motion by gradually leaving the iron as it passes from side to side is a question I will let some one else solve, if they wish.

G. W. FRANCIS.

Reading, Pa.

Efflorescences in Bricks and Sandstones.

Efflorescences from the materials of our buildings are not ornamental, nor do they render the stones more durable, says The Trade Journals Review About their causes and prevention we are pretty much at sea. Contractors are occasionally required to use stones free of niter; nitrates have, in reality, little to do with the matter, and it is generally sulphates which cause the trouble. Some years ago, the Association of German Architects invited memoirs on the question. The general conclusion seemed to be that prevention was very difficult, and that time would bring its cure. A dissertation by Hans Günther, communicated in abstract in Dingler's Polytechnisches Journal, is not quite so resigned. Günther has evidently made a very careful and painstaking study of this uninteresting subject. The trouble may come from the clay, the water employed during the various stages, the ashes and pyrites of the coal, and from the mortar. The pyrites of the coal may certainly cause mischief, especially because modern practice is in favor of continuous ring kilns, which work with plenty of oxygen; while in the old periodical kilns the atmosphere was frequently reducing, so that little sulphuric acid was formed from the SO_2. The presence of sulphuric acid, we learn incidentally, favors the production of red colored bricks, for it decomposes the yellow iron-lime silicate. But the author attaches more importance to the pyrites in the clay, and to chemical interaction between brick and mortar. He has very fully gone into this inquiry. He found, e. g., that certain bricks remained quite smooth when piled up, and became soon covered with efflorescences when used with a mortar which proved perfectly harmless to other bricks. Almost all clays contain pyrites, which, in the presence of magnesia, give rise to immediate efflorescences; in the presence of lime, only after decomposition with the alkalies of the mortar. That the sulphates are the chief culprits he established beyond doubt. We may mention that the case is different in lavatories where ammonia is constantly liberated and slowly converted into nitrates. As a remedy, Günther suggests to admix baryta, as carbonate or chloride, which would bind the sulphuric acid. The sandstone blocks of the handsome new Town Hall at Hamburg suffer from this trouble.

The Migration of Things and of Memories.

In the minds of some students, says Prof. O. T. Mason, in Science, the question of migration of forms is frequently confounded with that of the migration of tribes. It must not be forgotten by those who are carefully studying the origin of industrial forms on the western world that there were daily mails delivered on the American shore from the eastern continent from the remotest antiquity. The United States navy have been dropping bottles overboard in the Atlantic Ocean, at the Azores, in deep water along the coast of Spain and from the Madeira and the Canaries southward along the coast of Africa. All of these bottles that have been recovered have been found on the coast of South America, on the Antilles, and some of them as far west as the mouth of the Rio Grande. It can be inferred from this, therefore, that every buoyant object which has been dropped into the ocean during the present geological epoch by prehistoric or historic Spaniards, Portuguese, or Africans has found its way to America and been stranded somewhere between the tenth parallel south and the thirtieth parallel north.

In the northern part of the Atlantic Ocean the currents run the other way, and the mails have been delivered from America to Europe. In the Pacific Ocean the daily mails delivered on the west coast of America from Mount Saint Elias southward have proceeded from about the twentieth parallel north, in the vicinity of the Malay Peninsula and Archipelago, thence have traveled through the China Sea and the Japanese Sea to pick up objects designed for the western hemisphere. In the southern hemisphere the mails travel the other way, and materials consigned to the ocean current company were taken from Chile and Peru to be delivered upon the Easter Island and the various groups of Polynesia, some of them reaching as far as Melanesia. In addition to these great mail services of the Pacific, there was a narrow strip of service called the "counter-current," between the equator and the tenth parallel north, the articles consigned to it being delivered on the west coast of Central America.

In the Arctic Ocean the mails proceeded from west to east, passing up through Bering Strait, across the pole, and finding their way first to East Greenland and then around Cape Farewell to the southwestern shores of that great island. The Arctic current from Baffin Land and northward brought the mails from the Eskimo area southward even as far as Charleston, South Carolina. The consequence of such uninterrupted communication cannot be overestimated. All who have studied the arts of primitive races know how quickly their plastic minds respond to a congenial suggestion. It would not even be necessary for a Chinese or Japanese vessel to bring a single living teacher to take part in the pedagogic work of instructing the west coast tribes in eastern Asiatic arts.

The recent example of throwing a stick which drifted from Port Clarence, south of Bering Strait, and was picked up on the shores of West Greenland by Dr. Rink, is one of an interrupted series of communications between one of those great mailing stations and another. A second element in technical pedagogy has not been emphasized by any modern writer, and yet it cannot be overlooked; and that is the survival of industrial processes and productions in the myths and traditions of wandering tribes; so that one of them, having passed over a long area where a certain kind of activity was not demanded, and coming again to a place where the conditions are favorable to its revival, changed a song or an ancient tribal memory into an actual fact again.