the valves would not become much hotter than is ordinarily the case in any gas engine.

The drawing shows the piston at the extreme end of its outward stroke, the length of which is in this case, about equal to the cylinder bore.

It is not essential the compression pressure should be as high as 500 pounds (mentioned above), as the charge would be self-igniting at a point considerably below this figure.

The Current Supplement.

The opening article of the current SUPPLEMENT, No. 1568, deals with the Rhodesia railways in South Africa. The article is very fully illustrated. Mr. Houston Lowe presents his views on factors in painting woodwork. The excellent article on the dimensions of the marine steam turbine is concluded. This is by far the most important contribution to the literature of the steam turbine which has thus far appeared. Interesting from the naturalist's point of view, is an interesting article on the manner in which animals feign death. Notwithstanding the tendency of scientific knowledge and general enlightenment to dissipate superstition, some people still believe in the divining rod. The whole subject is discussed thoroughly in an excellent article by George M. Hopkins bearing the title "Unscientific and Scientific Divining Rods." In the industrial progress of this country there is no feature more remarkable and striking than the growing use of concrete building blocks. Mr. S. B. Newberry reviews the subject thoroughly, and gives some helpful suggestions. Lieut. Henry J. Jones continues his discussion of armored concrete. The electric conductivity of a vacuum is the subject of an article by Prof. J. A. Fleming.

BROMELIA FIBER.

BY CHARLES RICHARDS DODGE.

Among the collections of fibers from tropical America, shown at expositions held in our own and foreign countries, has frequently appeared a long, silky vegetable fiber, of a greenish cast of color, and showing great strength, though only an expert might particularly notice the small hanks into which the fiber is made up. When a specimen is unwrapped, however, the fineness of the fiber, and its extraordinary length, become apparent, for six feet is a common length, and I have seen examples that were very much longer. So strong is the fiber that it is difficult to rupture even a few filaments, by direct strain, without cutting into the hands.

I have seen the fiber, in very small quantities, in different portions of Mexico, where it has been sold, locally, as high as one dollar per pound. It is produced from the long, narrow leaves of a "wild pine-apple" belonging to the genus *Bromelia*. The nomenclature of the species is so confused, however, that I hesitate to name it, for the fiber has been variously labeled, in the museums and at expositions, *Bromelia sylvestris*, *B. pita*, *B. pinguin*, *B. karatas*, and *Karatas plumeri*. Its most common names are pita, pinuella, pinguin, and silk-grass, though "pita" is meaningless, and "silk grass" is applied to so many other fibers that the name is worthless. The better names are pinuella and karatas.

In the region of southern Mexico, from Oaxaca to Vera Cruz where the plant grows in great profusion, the fiber is used largely for fine woven textures, where strength and durability are essentials, such as hunting bags and various forms of pouches. It is also used for sewing thread, and was formerly employed for sewing shoes. The fiber is cleaned by hand, and the great length of the thin, narrow leaf, which is armed along its edges with sharp spines, makes it a tedious operation; hence the high price of the fiber.

I have just been informed by a correspondent in Mexico that an effort is being made to clean the leaves of the wild pine-apple by machinery, and some fair examples of the fiber have been turned out experimentally, in small quantities, so that future experiments are looked forward to with interest. The difficulties in the way of machine extraction are largely due to the thinness and the length of the leaf, a machine powerful enough to scrape off the hard epidermis inclosing the fiber layer being too harsh in its action, thus injuring the fiber. The production of well cleaned, unbroken fiber by machinery, and in commercial quantity, would no doubt give our manufacturers a new textile which might enter into some of the present uses of flax, while the peculiar silkiness and the color of the fiber would adapt it to the manufacture of many beautiful woven articles such as fancy bags, and even belts for summer wear. It would doubtless make superior fishing lines, and with further preparation and bleaching there is no saying but that the fiber might be employed in a wide range of woven fabrics of great beauty. Savorgnan, an Italian authority, states that in Brazil and Guiana, where a similar (if not the same) plant abounds, the fine silky fiber is manufactured into many "articles de luxe." In an old work on Mexico a species of Bromelia is referred to which is said to yield a very fine fiber six to eight feet long, "and from its fineness and toughness it is said to be commonly used in belt-making works. It also finds application in the manufacture of many articles such as bagging, wagon sheets, carpets, etc., besides being a valuable material for making nets, hammocks, cordage, and many articles in common use." This undoubtedly refers to the common form of Bromelia which is the subject of this article.

A species of shorter-leaved Bromelia grows in Paraguay and Argentina, producing a somewhat similar fiber, which is known as Caraguata, the product of *Bromelia argentina*. The filaments from this species are rarely longer than four feet, and while the fiber is soft and strong, it does not compare with the pinuella fiber from the region of Oaxaca, Mexico. In "The Capitals of Spanish America," by William E. Curtis, (page 638) a beautiful lace called "Nanduty," made by the women of Paraguay, is referred to. The fibers employed are described as very fine, and as soft and lustrous as silk. "Lopez had his chamber walls hung with this lace, on a background of crimson satin, and the pattern was an imitation of the finest cobweb. It is said to have required the work of 200 women several years to cover the walls." The name "pita" has been given to the fiber used in the manufacture of this lace, and the name, taken in connection with the description of the fiber given above, would seem to indicate that it was derived from a wild pine-apple, or Bromelia.

Bromelia fiber is closely allied to the famous piña, or pine-apple fiber of the Philippines, from which are manufactured such marvelously beautiful textures—such as fabrics fit for ball dresses, and handkerchiefs of gossamer fineness. There is little doubt, with as careful preparation, some of the wild pine-apple fiber might be employed in the same manner.

BROMELIA FIBER AS IT GROWS IN MEXICO.

The plant shown in the illustration was photographed in the old Borda garden of Cuernavaca, Mexico, where it is known as the piñuela. The masses of leaves in front have been broken off, and only those in the center show the full length. In British Honduras the leaves are said to grow from 5 to 15 feet in length.

The rusts of cereals in damp seasons often destroy these crops or greatly reduce the yield and quality of the grain over immense areas, thus causing serious loss and suffering, and often famine. Many species of rusts have been discovered, some more destructive than others. The parasites causing the disease have been in some cases carefully studied, but much of their life history and habits remains yet to be learned. One of the most important facts discovered is that some of the most destructive forms, like the black rust of wheat (*Puccinia graminis*), have several distinct stages, formerly believed to be entirely separate fungi and to have no connection with each other. When De Barry found, however, that the cluster-cup rust of the barberry was a stage of the wheat rust and that the wheat was infected from the spores of the barberry rust a common observation of farmers was explained, namely, that wheat rust is most severe near barberry hedges. Laws were passed requiring the destruction of barberry hedges, and this particular form of wheat rust was then greatly reduced. The investigation also demonstrated that the black-rust stage on wheat could not infect the plant directly, but could infect the barberry, producing the cluster-cup rust of that plant. The spores of the barberry rust were found not to infect the barberry, but the wheat plant, producing first the form known as the red rust on the leaves and developing later on the same plant into the black rust.

Correspondence.

The Coiled Spring Problem.

To the Editor of the SCIENTIFIC AMERICAN:

In the late discussion as to what becomes of the coiled spring's energy when it is dissolved in acid, it has seemed to the writer that one point has been overlooked; namely, that the amount of heat liberated by the oxidation of the iron is so great, as compared with the heat equivalent of the stored mechanical energy, that no calorimetric method would be capable of measuring this additional heat.

A specific case may serve to make this plain. If a spring weighing 500 grammes is dissolved in acid, the oxidation of the iron will liberate 791 large calories (kilogramme-centigrade heat units). Although the writer has no acurate data of the stored energy in a coiled spring of the above weight, yet it would seem that 20 kilogramme-meters would be a rather liberal allowance. This amount of energy is equivalent to 0.0468 large calorie, or less than one ten-thousandth of the heat liberated by the oxidation of the iron.

While as a matter of theory it is apparent that the stored energy of the coiled spring must reappear as heat, yet the foregoing example makes it evident that it would be difficult, if not impossible, to demonstrate the fact. GREENLEAF W. PICKARD.

Amesbury, Mass., January 8, 1906.

Safety on Railroads.

To the Editor of the SCIENTIFIC AMERICAN:

Public sentiment in favor of the block signal has been thoroughly aroused of late, as a result of the alarming frequency with which serious accidents have occurred on our railroads. The general adoption of this form of safeguard is a step in the right direction, and it is to be hoped that it will be made compulsory throughout the country.

While the block signal is capable of a high degree of development, it usually takes the form of a simple visual signal, and as such is open to the serious objection common to all visual signals that it has no power to enforce obedience to its behests. The method of controlling our great modern trains entirely by human agency, depending for guidance upon colored lights and movable semaphore arms, is absurdly primitive and ineffective. The all-important question as to whether the signals are to be obeyed or not depends absolutely on the engineer, who, like the rest of us, is subject to all the frailties of mankind. He forgets and becomes confused; his attention may be distracted at a critical moment; he may sleep or even die at his post, as has actually occurred several times within a few months; he sometimes does what is worse, deliberately "runs" signals to save time.

In view of these conditions, the writer desires again to urge the compulsory use of the automatic stop or "tripper," in connection with the block signal, as the only way in which a strict regard for the latter can be enforced. This must in no way be taken as a suggestion to relieve the engineer of any of his present responsibility. He should devote his entire skill and energy to the safety of his train, but his efforts should be supplemented by automatic devices, which will make it physically impossible for him to pass a danger signal whether he will or not.

The principle of automatism in safety appliances is recognized as an essential in modern mechanical systems, and may properly be regarded as a fundamental principle of safety. How the railroads have been permitted to ignore it in the matter of stopping trains is difficult to understand.

The reprehensible practice in vogue on many roads of regarding block signals, spacing signals, and time fuses as merely cautionary or informatory, and of running trains until the actual obstructions are encountered, deserves severe condemnation. It is a mercenary subterfuge to gain time at the expense of safety, and ought to be treated as such. A certain minimum distance between trains should be preserved in the interests of safety, and nothing should justify any encroachment upon this margin. A train arriving at an opposing block signal ought to be required to stay there until the block is cleared, even if a few minutes are lost in consequence. The saving in time should be effected by keeping the track clear, and not by disregarding danger signals.

The contention of the railroads, that their traffic could not be handled were trains required to stop at block signals, is not worthy of serious consideration. When reduced to plain language, it means simply that the earning capacity of the road would be somewhat diminished if danger signals were always regarded as they should be, and the practice of stealing time at the expense of safety were abandoned.

The block signal should be installed on every railroad, and a proper regard for it should be enforced by the law backed by the automatic stop.

WILLARD P. GERRISH.

Harvard College Observatory, Cambridge, Mass., January 1, 1906.