Sugar and the sugar Cane in cuba. M. Truy, French consul at Santiago de Cuba, says, according to the Journal of the Society of Arts, London, that the cultivation of the sugar cane in the eastern portion of the island of Cuba is almost entirely confined to the districts of Santiago, Guantanawo, and Manzanillo. This cultivation, although it has experienced some extension of late years, is not in the flourishing condition it was twenty years ago. This falling off is due to the civil war, which ruined many planters and discouraged others. The profits, however, realized for some time past by those planters who had sufficient credit, or confidence in the future, to continue to engage in this industry, have given a stimulus to the cultivation of the cane.
Sugar factories have been established in many parts, particularly in the district of Guantanamo and Manzanillo, old sugar factories have been supplied with fresh plant, and planters, encouraged by high prices rccently realized, have hastened to get their ground ready for cultivation. Part of the products of the province of Santiago is shipped to Spain, and some small quantity is consigned each year to Canada, but the United States absorbs almost the whole of the yield of the island. The Cuba market was some years ago controlled by French merchants, who owned the greater part of the sugar factories of the province, but since the civil war many planters sold their estates, and retired to France.
A few estates, however, are still owned by Frenchmen, at Guantanamo especially. Those known as Sainte Marie, Sainte Cecile, and San Antonio are directed or owned by Frenchmen. All the land in the island is, in general, fit for the cultivation of the cane, an even surface being generally chosen, with a view to facilitate the working and the harvesting. The ground should also be as near the sea as possible, so as to avoid the cost of carriage and transport, which is particularly high in that part of the island, where it may be said there is an absence of railroads. and the carriage roads are in a de plorable condition. If the ground chosen is one that has hitherto been uncultivated, the planter, first of all, clears it in cutting down the branches of the trees and small shrubs with the machete, and burning the larger trees. The expenses of these preliminary operations may be estimated at from four hundred to five hundred dollars per plantation of thirteen hectares (the hectare is equivalent to $2 \cdot 47$ acres).
Holes are then dug at intervals of from three to four feet, and in them are placed horizontally pieces of cane of a length from two to three joints. If the ground has previously been under cultivation, the methods differ. The ground must first of all be plowed, and furrows are then made in which entire canes are stretched $\alpha$. chorros, that is to say, end to end horizontally. The plants are then covered with earth. The sugar cane is frequently planted in the spring, but many planters are of opinion that plantations in Cuba sown in winter give a much better yield. The young plants are allowed to shoot for ten or eleven months if they have been planted in the spring, for fourteen or sixteen months if planted in the winter, and the harvest then takes place. There are in the island several varieties of sugar cane-the white or Otaheite cane, the twisted white cane, the twisted violet cane, and the so-called black cane.
The first two varieties are the only ones cultivated at Cuba. The white cane is prepared for planting in virgin soil, and gives a good yield. The crystalline is eserved for old plantations, it is better adapted to resist the long drought than the white variety. The cultivation of the last three species of sugar canes has
been abandoned on account of their insufficient yield. been abandoned on account of their insufficient yield.
Before the abolition of slavery, the planters themselves culvated their fields. Since that period, however, they have experienced the greatest difficulty in obtaining a sufficient number of hands to harvest their canes. Many planters, in consequence, deemed it advisable to divide their labor between a certain number of colonists, who are bound to cultivate each his plot of ground, to plant the canes, to cut them at harvest tiwe, and to carry them to the factory, where they receive, after the sugar is turned out, a certain proportion of the quantity of the sugar extracted from the canes harvested on their allotments. Cuban sugar is generally prepared for export. The special quality intended for home consumption is clearer and finer than that shipped abroad.

## An Artificial Retina.

An artificial retina sensitive to light in the same way as the average human eye is certainly a great desideratum in photometry; and, according to M. Lion, this may be obtained by the use of a moist film of iodide of nitrogen. A new photometer is based on the employment of this substance. Since the longer the film is subjected to the action of the light rays the greater is the quantity of nitrogen disengaged, the sensibility of
the instrument must continually increase with the
time of exposure. This characteristic forms a decided advantage which the instrument possesses over others; but its significance is wuch diminished by the fact that it appears to take a considerable time before sufficient nitrogen is disengaged to take a reliable reading. In spite of the fact that the chewical action of light is caused chiefly by the non-luminous or ultra-violet rays, it appears that with this substance the luminous rays are wost effective, and that, just as with the human eye, the yellow-greeu rays have the greatest influence. Considering the well-known fact that human eyes differ considerably among themselves, and that partly in consequence of this photometric weasurements are subject to many errors, it would appear that the film of iodide of nitrogen can be regarded as an artificial retina, measuring illumination equally well, whatever its color. If a substance of this nature can be found which may be left to itself without danger, and from whose indications reliable readings way be obtained without the need of waiting some winutes, its applications to photometry would be numerous and import ant; and with this view it seems desirable that the action of light on complicated chemical compounds should be studied further than has hitherto been the case.-The Electrician.

## IMPROVED TELEGRAPH KEY.

We give an engraving of an improved telegraph key recently patented by Mr. Wm. A. J. Kohrn, of 33 recently patented by Mr. Wm.
Franklin Street, San Francisco.
Franklin Street, San Francisco. This improvement accomplishes two important re-
sults. First, the perfect closing of the circuit when the switch is turned; and second, the protection of the platinum points from the accumulation of dust and dirt. The improvement consists mainly in a spring atand a beveled arm projecting from the switch in wardly toward the center of the key frame in position to en-


## moHrN's telegraph Key

gage the spring as the switch is closed, thus forcing up ward the rear end of the key, and causing the contact point carried by the key lever to touch the anvil contact, and to hold the parts in this position until the switch is again opened, when theusual retractile spring attached to the key opens the circuit. Besides closing the circuit through the contact points, it also closes the circuit by the contact of the switch with the anvil tongue.
It will thus be seen that there are two chances of securing a good closure of the circuit, one through the usual switch contact, the other through the points of the key. It will also be seen that as the platinum points of the key are held in contact so long as the key is closed, no dust can enter, and the surfaces will remain clean.

On the Fighting Instinct.
The student of nature is generally, if not universally supposed to be the very incarnation of peace, and a well-developed organ of combativeness is considered decidedly out of place in happy Arcadie.
Nevertheless, the earth is one vast battle ground where all things living struggle for "the survival of the fittest "-that great and inexorable law, from the influevee of which even the proud race of man is not exempt. Among the beasts of the field the law of force prevails. The finest specimens of each class survive and the weaker go to the wall, or, perchance, the Itomachs of their stronger brethren.
I think the Rev. J. G. Wood was the first to draw attention to the extraordinary fighting capabilities of masses of fur and sinew can occasionally become fiends incarnate, veritable subterranean tigers; and with such energy do they attack each other that, utterly ignoring the presence of man, they will rough-and-tum ble at his very feet, their enormously muscular little limbs working convulsively, and bones audibly cracking beneath the pressure of their jaws. No one who
has not witnessed a tonrney of this nature would credit the extraordinary activity and fury which are heredis played, for, unless they are forcibly parted, the battle seldom leaves both combatants in the land of the fiv $\xrightarrow{\mathrm{n}} \mathrm{H}$
ones, when hard up for a dinner, chasing the sualler at a wonderful rate, and devouring thew, without sauce or mercy, when caught and conquered. Curiously enough, the vanquished animal seldom employs against its own species its strongest means of defense-rolling itself up into the well known ball form.
A fight between two hares is a droll sight, appearing much like a jumping watch, the skipping exercise being kept up with trewendous energy and spirit : but a blow from the leg of a hare is no laughing matter for the recipient, who occasionally finds himself knocked out of the world altogether.
The representatives of the order Mustellidse are hard fighters, for a friend of mine once witnessed a duel be tween an old gray rat and a weasel, which lasted nearly an hour, and resulted in the annihilation of the former. The rat fought with great pluck and deterwination, but his antagonist was too much for him, and drew blood at every bite ; while the rat, which displayed the utmost activity, rushing on again and again, failed to make much loppression on the tough hide of the weasel The latter fought in a very undemonstrative manner. appearing to act mostly upon the defenslve; but his sharp teeth played havoc with the firm body of the rat, which finally retreated into a bundle of fagots, fol lowed by the weasel. A great deal of scuffling and squeaking ensued, after which the rat was driven out into the open and there kliled.
Among the Gallinacea, the pheasant may be considered "cock of the roost," for he will boldly enter the farm yard and settle the military-looking barn-doo fowl in a trice
Perhaps none, among smaller birds, wage war more desperately than the domesticated robin. It is said that he is guilty of parricide, the young ones chasing and slaying the parent before twelve months hav passed over their youthful heads. Their first plumage is brown, but afterward red-perhaps a Cain wark t distinguish them for their evil deeds. They follow up their battles with great pertina city, and so frantic and lost to all sense of outer danger do they become, that, on two occasions, I have picked them up and held thew in wy hand, where they lay panting. but still holding on to each othe: with bills and talons. Once, two of these tiny gladia tors fell from a tree under which I was discussing the good fare of a picnic, and, utterly ignoring the situation, finished the argu ment in my lap.
An invalid friend of mine, who is a close observer of nature, has a recollection of two cats, which advanced daily from opposite ends of a long and lofty wall, and, meeting in the middle, fought with great fury, until one or buth were precipitated to the ground below, upon which the fight ceased imme diately, the combatants remounting the wall, and basking peacefully side by side in the sunshine.
On one occasion, lately, a particularly fine Newfoundand dog was sitting on a wooden bridge discussing a bone, when a predatory mastiff came along, and, being nable or unwilling to distinguish between meum and uum, a swart altercation arose. So violent becaul the debate, that both suddenly overbalanced and fell into the streaum beneath. The nearest landing place was a hundred yards down, and to it the Newfound land betook himself without much difficulty, and, after a good shake, was preparing to depart, when he suddenly became aware that the other dog, who was more of a soldier than a sailor, was wildly beating the water and drowning as fast as he could drown. One look wa enough. II went he of the shaggy coat, and, seizing the other dog by the collar, brought his late enemy safely to land. The two dogs then eyed each other with a perfectly indescribable expression for some seconds, then silently and solemnly wagged their caudal appendages, and with dignity departed.
Some will, no doubt, say this was but instinct, and they may be right ; but I prefer to give my four-footed friend the benefit of the doubt.-J. A. Bartlett, in Lngman's Magazine, London, September.

## Read before Signing.

Awong the pithy sayings of a well-known German philosopher and reader occurs the following: "Sign no paper without reading it." In these days of educa tion, enlightenment, and progress, such a caution would hardly seem necessary to any person in the full possession of his faculties; yet it is astonishing how many people there are, including good business men, who attach their signatures to papers or documents whose contents may have a serious bearing upon them selves or their affairs, with scarcely a glance at thei contents. Carelessness in failing to acquaint them selves with the contents of a paper before signing it has worked incalculable harm to thousands of well intentioned people. It is a good thing, therefore, to bear in mind continuously the above quotation, par ticularly with respect to such papers as express or iruply anything in the nature of a contract or a legal obligation.-Trader Revicu.

The Greatent of Telencopenc
The news of the recent arrival from Paris of one of the lenses for the object glass of the 40 -inch telescope that is to be wade by the Clarks, of Cambridgeport, for the University of Southern California, has attracted considerable attention. It do $\epsilon$ not appear to be generally understood that the work of constructing the huge object glass that is to eclipse the Lick telescope has but just begun, and that the most difficult and delicate part of it has not yet been touched. Not one lens only, but a second, must be finished before the object glass is ready. That portion of a telescope consists of two lenses, one of flint and the other of crown glass, which by their different refractive properties correct one another's chromatic errors and produce an image free from confusing fringes of colored light. For two or three years the makers will slowly shape and polish the lenses, until every ray of light that passes through them is brought, as near as human skill can compass
it, to one exactly accordant focus. When the glass is it, to one exactly accordant focus. When the glass is fnished, only some of the rarest
gems will rival it in money value.
But the most interesting questions connected with the making of this huge telescope are: What will it be able to do? how much will its powers exceed those of the greatest telescopes now in existence? and what discoveries in the heavens may be expected from it?
The most powerful telescope now on our planet is that of the Lick Observatory, whose object glass is 36 inches in diameter. The celebrated telescope of Lord Rosse, in Ireland, is much larger, it is true, being no Rosse, in Ireland, is much larger, it is true, being no
less than 6 feet, or 72 inches, in diameter, but that is less than 6 feet, or 72 inches, in diameter, but that is
an instrument of a totally different kind, being a reflecting and not a refracting telescope. In a reflecting telescope there is no object glass, but the image of the object looked at is formed by a concave mirror, which brings the rays of light to a focus by reflection. Lord Rosse's telescope, owing to the vast size of its mirror, receives far more light from a star than the Lick glass does, but the lack of complete reflection from the mirror and the imperfections in the mirror's form more than counterbalance this advantage, so that for most of the purposes of astronomy California's Lick refractor is a far more effective instrument than its giant reflecting rival in Ireland.
So it is with the Lick telescope that the new 40 -inch glass should be compared. It is easy to compare the light-gathering powers of the two object glasses, since these vary directly as the squares of the diameters of the glasses. The square of 36 is 1,296 , and the square of 40 is 1,600 . It appears, then, that while the diameter of the new glass will be only one-ninth greater than that of the Lick glass, its light-grasping power will be about one-fourth greater. This will be a very important gain, if the workmanship upon the new glass is equal to that displayed by the old one, for celestial phenomena, such as faintstarsand nebulæ, that lie beyond
the reach of the great telescope on Mount Hawilton, the reach of the great telescope on Mount Hamilton,
will be readily seen with the aid of its larger rival in will be readily seen w
South Cn California.
Among the discoveries which Dr. Holden has achieved with the Lick telescope is that of the existence of heliacal nebulæ, that is to say, of nebulous masses which, by some wonderful process, have been drawn out into vast spiral coils like the thread of a
screw. These are not insignificant, but so extensive screw. These are not insignificant, but so extensive
that if our own huge solid globe were expanded into a cloud of thinnest vapor, it would be but a speck beside them. The new 40 -inch telescope ought to throw a flood of light upon these strange forms.
Then in astronomical photography, which has made astonishing strides within a few years past, the new telescope may fairly be expected to perform wonders. Its great object glass will grasp forty thousand times as much light as can enter the pupil of an average human
eye, and this light, concentrated upon the extremely eye, and this light, concentrated upon the extremely
sensitive plates which the modern art of photography furnishes, will picture there scenes in the depths o space which no eye has ever heheld or could ever hope to behold in any other way. A marvelous field for re search of this description has, within a few months, been discovered in the constellation of Orion, wher many square degrees of the sky surrounding the Belt of Orion have been found to be covered with a network
of nebulous streaks and patches, amid which shine of nebulous streaks and patches, amid which shine
thousands of stars. How this wonderful region will appear in the new telescope when it has been mounted on its mountain top in the transparent air of Souther California can, as yet, only be imagined.
A popular way of estimating the power of a telescope is by stating how near it will bring the moon. We ob servethat somebody says the 40 -inch glass will make the moon appear only 100 miles away. This, when made without qualification and explanation, is a misleading
statement. The apparent distance of the moon, or any other object, depends upon the magnifying power emother object, depends upon the magnifying power em-
ployed. An ordinary opera glass magnifies three diameters, and apparently brings all objects seen through it three times as near as they actually are to the ob server. There are not a few telescopes now in existence
that are capable of bringing the moon within an apparent distance of only 100 miles. For that purpose it is only necessary to use a magnifying power of 2,400
diameters, the actual distance of the moon being in round numbers 240,000 miles. This effect does not depend upon the size of the object glass, although the clearness of the view does. For telescopes of the best quality a magnifying power of 100 diameters for each
inch of the diameter of the object glass may be used inch of the diameter of the object glass may be used
upon the moon with fairly good effect when the atmosphere is at its very best. By pressing the magnifying power beyond that degree more is loss by the increasing indistinctness and imperfection of the image than is gained by its greater size. Accordingly 100 diameters to the inch may be regarded as the upper limit of magnifying power for a telescope. A 4-inch glass should bear a magnifying power of 400 for bright objects when the atmospheric conditions are suitable. But usually so high a power is found impracticable, owing to the unsteadiness of the air and other causes, and a power of 60 to the inch is, perhaps, about the estimate of best average capacity of an ordinary object glass.
With a very large object glass even this power is generally too great to produce a satisfactory image, so that about 50 to the inch may be regarded as the ordinary limit for a glass 40 inches in diameter. That would mean a magnifying power of 2,000 diameters in the case of this great new instrument, which would bring the moon within an apparent distance of 120 miles. With a power of 60 to the inch the moon's apparent distance would be just 100 miles, and supposing that the full power of 100 to the inch could ever be borne with good effect, which is highly improbable, the moon would appear only 60 miles away. Its features would not, however, be seen as distinctly as if it wer actually at that distance from the eye, for the unsteadiness of the atmosphere and the imperfections of the image, even under the best of conditions, would impart considerable indistinctness to the view. Those who from mountain tops have seen objects of the landscape 60 miles away can accordingly form a more or less vivid idea of the sort of view of the moon's surface that the new telescope would be able to give at the limit of its But
But with a much smaller magnifying power-say 1,000 diameters, which would bring the moon within an apparent distance of 240 miles-far more distinct views of the lunar landscapes could be obtained. Under the very flnest conditions for seeing, such a power might just suffice to reveal a steamship of the size of our larg est transatlantic liners traversing a lunar ocean, es pecially if it emitted a cloud of black smoke. But then we must remember that astronomers are thorougbly convinced that the moon has no oceans, but at the best only dried-up ocean beds. A building as large as some of our huge exhibition halls could be seen as a minute speck. The existence of a large city on the moon would readily be detected by the 40 -inch telescope. In fact if there were any cities there, they would have been discovered long ago with the telescopes already in ex

A great deal of light may be thrown upon some o the vexed questions concerning Mars, Venus, and the other planets by the new telescope. There are very puzzling appearances on their surfaces, some of which seem to demand for their solution but a comparatively slight increase of telescopic power beyond our present limit.
But as to inhabitants of other planets, the 40 -inch lens will leave us as much in the dark, sofar as the pos sibility of seeing them or their architectural monu ments is concerned, as we have ever been. For any such achievement as that we shall have to wait until a genius comes who can invent an instrument for see ing as much superior to the present telescope as an ar light is brighter than a tallow dip.-New York Sun.

## Aerial Navigation.

In a recent number of the Forum Prof. R. H. Thurs ton, director of the schools of mechanical engineering of Cornell University, discusses in an entertaining way the "Problem of Air Navigation." After reviewing many interesting experiments in aeronautics, Pro Thurston thus speaks of the probability of the ultimat solution of the problem:
"The researches of Langley have shown the power demanded for flight to be about 2 per cent of the amount once supposed a minimum. We know that ature's energy can be directly converted into useful power through the production of electricity, as in the gymnotus, and possibly in all animal mechanisms. We know that modern storage batteries are ten times the weight that science indicates to be the limit of perfect efficiency; both steam engines and electric accumu lators have been made light enough and powerful enough to raise their own weight, with something to pare.
The flying lemur, the flying squirrel, the rude sus taining membranes that inventors have constructed have sustained their heavy weights in drifting many yards. Man has imitated such animals. His prede cessors, the bats and the great pterodactyls, have flown
on membranes. Why may not he hope some time to combine the highest products of his inventive geniu in some contrivance which shall enable him to drive
wind and storm; or why not hope to learn from the albatrose and the condor and the eagle the secrets of flight, and, like them, to soar aloft and above the clouds, to glide hour after hour on widespread, motionless wings with the speed of gales that vex the earth below, and as far as the wild goose or the carrier pigeon or the migratory eagle can fly, crossing continents and oceans, as certainly and even possibly as safely as do railway trains or steamships to-day? It would be rash as yet to assert that all this is even possible ; but it would be still more rash to assert the contrary. Man has accomplished hardly less wonderful tasks. Who shall say plished hardly less wonderful tasks. Who shall say
that the limit of his powers of invention and constructhat the limit of his powers of invention and construc-
tion has been reached or even approached? The engineer, like the man of science, has an infinity of oppor tunity still before him. And it is to the combination of scientific knowledge and constructive talent of the engineer rather than to the haphazard operations of the hand and brain of the ignorant contriver of olden time that we are to trust, if at all, for the accomplishment of this, the most stupendous of his tasks. Scientific research, exact computation, precise adjustment of means to well understood conditions, are the lines which lead to flnal success."

## Precions stones of Commerce

Geology has been a revelation to mankind, and has told us wonderful things of the past history of the earth; but geology has secrets of its own that are a hidden from comprehension as the atmosphere of the moon or the belts of Saturn. Certain things have been done, says the geologist, through volcanic action or the agency of fire, and that is as near as he can come to it; so that, after all, we see effects, but know little or nothing of causes.
There is a rock known as amygdaloid, one of the igneous rocks, which in some of the gigantic transfor mations of nature, we will say in cooling from a melted mations of nature, we will say in cooling from a melted
state, formed within itself cavities, from the size of a state, formed within itself cavities, from the size of a
marble or bead to that of the closed hand. Now, as nature abhors a vacuum, she sets to work to fill these cavities, and in doing so she used other materials, and these combinations produced some of what we call the "precious stones of commerce." Exactly how this was done we cannot tell, but we see some hint of the opera tinn in every subterranean cave where stalactites and stalagmites are found. Every student knows that this is the result of dropping water which contains carbonate of lime. The water evaporating leaves a minute particle of lime, which takes something to itself from particle of lime, which takes something to itself from
the earth or atmosphere, and in the course of ages the earth or atmosphere, and in the course of ages
bodies are formed of a most remarkable character. In probably somewhat the same fashion have these cavities been filled in the igneous rocks, and then comes time and storm, and other agencies, earthquakes, per haps, and the rocks are rent apart, and out drops a bead or a bowlder, and a curious man picks it up, and hammers and breaks it, and then he puts a polish on it by some process more or less advanced, and lo! he holds in his hand an agate or an onyx. Many of the stones used in the arts have no other origin, and are deposits of silica, alumina, oxide of iron, and other col ring substances.
It is the color or arrangement of colors that gives the ame, and thus we have agate, onyx, chalcedony, car aelian, sard, chrystaloprase, sardonyx, and others, al members of the quartz family, and all having a family resemblance.
The agate has veins of different shades of color in parallel lines. Sometimes these are very close together as many as fifty to the inch, but this is unusual. When there are alternate bands of color and a transparent medium we have the onyx, but the latter may be obtained by cutting the stone in a different way.
Agates are used chiefly for ornamental purposes, such as cups, seals, rings, handles for parasols, table and mantel ornaments, but the material is so hard that it can only be worked by those who have practiced skill.
The onyx was valued by the ancients for its applica tion to cameos and intaglios-the first an object in relief, the latter a "cut-in" process; and these objects are still made.
Nature produces some very strange forms occasion ally, and agates are found with exact resemblances of moss and other natural objects and figures, which are very curious and often very valuable.-The Great Divide.

## A Substitute for Tobacco.

Many different vegetable substances used as stimu lating beverages in widely distant parts of the world have been shown to contain caffeine as their active principle. Only one substitute for tobacco has, howDub, as yet been discovered. This is the leaves of the Duboisia hopwoondii, a shrub growing in Australia, the leaves of which are chewed by the blacks in the same
way and for the same purpose as tobacco is chewed. The leaves contain an alkaloid, piturine, which is said by certain chemists to be identical with nicotine, but more probably is only closely allied to it. Messrs. Langley and Dickinson have recently shown that the identical.-British Medical Jourral.

