poor are crowded in their palm-shacks as you never saw them crowded before, or through the more scattered huts that cling to the side of the hill that overlooks Yauco—wherever you meet the people you find two types, I might say two only. There are those of pure Spanish blood, natives of Spain, some of them, that have not yet returned, and their pure-blooded descendants. Such are most of the proprietors of estates, the merchants, the men of property and position, those that make society. While there is no color line drawn in church or school, nor any visible to the careless observer, one learns that there is a social line drawn. Only white people will be seen at the principal social functions. Others are not invited nor expected to attend the receptions given by high officials. Until our troops came only white people were, by unwritten law, allowed to be in the plaza on Sunday and Wednesday evenings, when the band played and, as in a sort of cattle show, the marriageable young girls in their handsomest array walked bareheaded forward and back between rows of admiring swains. Many of these white men, the best of them, have been educated in the United States and speak English.

But the great mass of the people are of mixed blood and appear to have reached, in the course of more than four centuries, a nearly fixed type. One sees very few black people, and these mostly late comers, from St. Thomas and Antigua, who speak English. There are possibly a dozen very old persons said to be pure Indians on the island. I heard of one such. But the working people are of one color, a light brown, with regular features, nose not flattened, and with hair black and perfectly straight or slightly wavy. They seem to me to be more Indian than negro, and with as much white blood as of the Indian and negro combined. They are rather small in stature, thin and lithe, erect, and the women show a fine carriage. There is none of that cowed, cringing manner which we sometimes notice among our own negroes. They are alert in body and mind, not lazy, and the children are quick to learn. But there is not one schoolhouse on the island, the schools are in the houses where the teachers live, and for three-fourths of the people no school privileges are provided. Of course, they are ignorant. They are not vicious, not given to drunkenness nor to crimes of violence; they are simply untaught and have not really learned enough to be discontented with a lot which we would call a spiritual hell in a material paradise. They can only starve on their wages, and their food is bananas and other fruit which will supply no rich blood. It is no wonder that they are anæmic as well as ignorant. They live in a fair degree of social morality, if we can call those married who live together and rear their large families with no church sanction of marriage, for three-fourths of the unions have been blest with no ceremony. The people desperately need both religious and intellectual education. American Christians must give them this. They are not brutes, they are not inferior naturally. Their educated men, both white and colored, are fine people, who excel in intelligence and courtesy. They can make good citizens of our republic.—The Independent.

LAND TENURE IN RUSSIA.

THE chargé d'affaires ad interim at St. Petersburg, Mr. Peirce, writes, under date of November 15, 1898, in regard to the shortage of crops in Russia. This is partly to be ascribed, he says, to the thriftlessness of the peasant class, which thriftlessness has been variously attributed to climatic influences, to intemperance, to administrative methods, to the former condition of servitude, to the mir or communal system of land tenure, etc. The last named cause especially, Mr. Peirce thinks, would be sufficient to explain a general lack of self-reliant industry among the people. He continues:

The land of the peasantry is not generally owned by them individually, except in certain districts of the Baltic provinces, of Little Russia, and of Poland, but is held by them in communities or mirs, in which each tax-paying individual has a share and for the taxes of which he is responsible. The taxes due to the government are assessed upon the number of "souls" in the community, and upon the same basis is allotted to it a certain quantity of land. This land is sold, not given, to the mir, and payment therefor is made by amortization from a certain proportion of the taxes. For these taxes the mir is held strictly and rigidly responsible, but it is permitted to collect the amount from the individuals of the community as it may see fit—of course, within certain restrictions. The mir, therefore, constitutes a community having a considerable degree of self-government. It elects its officers by popular vote and regulates its own financial affairs, in which it is not molested by the imperial government so long as it continues to make its full tax returns. To each "soul" is allotted by the authorities of the mir a certain proportion of land of three separate sorts, viz., cultivable, pasture, and marsh or meadow, according to his ability to work the land productively in the interest of tax payments. Thus a man who has a horse is given more land than he who has not, while one who has able-bodied children—sons or daughters—is given more than the man who has no one to help him in his cultivation, the incapacitated being given nothing, but supported by the community. In these allotments the ownership of the land does not pass to the individual; he is simply given the usufruct for a certain term, and the duration of that term varies in different mirs from one year to ten or even more—from three to five being the most usual—with a general tendency to increase the length of the period. In this allotment the individual has no option. He may argue his case before the board of officers of the mir; but he must, perforce, assent to accept the allotment of land made him, together with the share of taxes devolving thereon. In general, it is said that these apportionments are made in a spirit of equitable fairness, but that abuses do exist is not surprising. It occasionally happens, for instance, that a peasant having a reputation for expertness at some trade which brings him custom from the neighboring large proprietors or from other points outside the limits of the commune, by means of which he earns money in excess of what his labor in the fields could produce, has fastened on him an excessive proportion of communal land and consequent taxes.

While in the more productive districts, and especially in the black earth belt, the effort on the part of the individual is to secure as much land as possible, in the northern and other unproductive districts the peasant tries to shirk his communal responsibilities by presenting reasons why he should be allotted the minimum of land.

Not infrequently the peasant seeks employment in the cities, either for the entire year or, what is still more common, for the winter months only. This may happen owing to one or more of several causes. He may be sent by the head of the family to which he belongs to earn money to assist in paying the joint share of their communal taxes, his allotment of land being, if the absence is during the summer season, operated by the other members of the family, or he may, upon his own account, desire to add a little to his income, or even, finding his land unprofitable, he may abandon its cultivation to seek a livelihood in the city; but whatever may be the cause of his absence from the mir, he does not escape his responsibility for the taxes. For, while the central government permits the mir to collect the taxes from the individual, it also assists it in so doing by keeping track of him, and by returning him to the mir, in case of his failure to remit his share, and even by inflicting punishment when the resources of the mir in that respect fail to compel him. Still further, the complaint of the head of a family to the mir that an absent member is not remitting his share of the taxes on the family allotment may cause the delinquent's arrest and return to his commune.

Individuals who misbehave themselves in the city may also be sent back to their mir by administrative process. Thus I have myself seen an insolent and intractable servant brought at once to perfect submission by the threat of reporting him to the police and requesting his return to his commune. To render possible this control of the individual requires a very careful system of enregistration. Thus, on taking up a new habitation, every sojourner and inhabitant in a city must be duly inscribed in the books of his police district, and for such enregistration the proprietor of the house is held accountable. As it not infrequently happens that the peasant or "mujik" knows no other

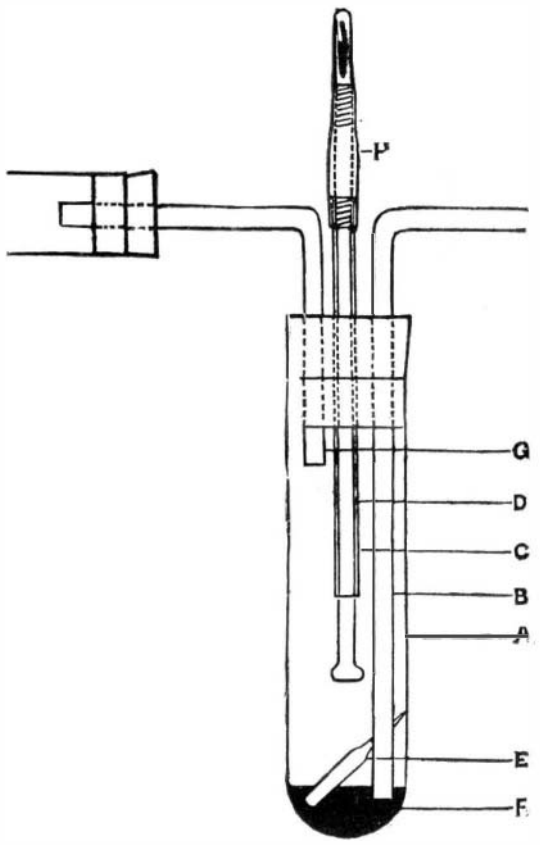

FIG. 1.

than his baptismal name and that of his father, and sometimes not even the latter, the difficulty of keeping track of individuals can be imagined. Ivan Ivanovitch (John, son of John), of such a mir, may be, and not infrequently is, the sole designation he can give himself, and perhaps, even, he can only say that he is John, son of a soldier. But the name of the mir to which he belongs is inscribed on his passport when issued to him, and without this document he is not permitted to remain in any city; nor, indeed, is it easy for him to find any abiding place.

It will be seen, therefore, that the mujik is closely bound to the soil through the medium of his mir. But further, the mir is obliged to take care of him. It can, while he is able to labor, force him to pay his share of the taxes; but if he becomes incapacitated, it must at least keep him from starvation.

The house of the mujik does not stand in the middle of his little farm, but in the village street, and this building, with its small surrounding lot, belongs to him or to his family; but the productive land lies sometimes versts away from the village and consists of a long, narrow strip, or perhaps several of such strips, apportioned with a view to giving to each "lot" an equal share of the best and of the poorest soil.

The inevitable result is that the mujik, feeling that, at the end of a period more or less brief, his allotment will be subject to a redistribution, in which, if he has improved it by careful cultivation, expending upon it time and money with an eye to the future, the greater part of it will probably be taken from him, puts into his land only such cultivation as will give him, for the existing season, the best returns, without expending upon it capital or labor of which he is not to enjoy the full fruits. Hence he plows but the top of his soil, not only to save labor, but that his manure may be consumed by his own crop and not by a future one. He has no attachment to the soil to which he belongs, but which does not belong to him, and he is devoid of that self-reliant independence which characterizes the agricultural classes of other countries. If we add to this the absolute fatalism with which the mujik regards every event of life, whether of good or evil fortune, we have, it would seem, a combination of temperament and surroundings well calculated to develop thriftlessness.

In those parts of Little Russia, the Baltic provinces, and Poland, where the mir system does not exist, not only is the peasant more animated and cheerful, but much greater thrift prevails.

It is now some months since the attention of the Emperor was directed to the unfortunate condition of things existing in many of the agricultural districts, and he has directed, not alone that material aid from his privy purse be liberally extended, but that full and exhaustive reports upon the entire condition of the peasant in the various parts of the empire be furnished him, with a view to discovering the exact state of affairs, and, if possible, the true causes to which are to be attributed the alleged distress, with a view to its intelligent amelioration.—United States Consular Report.

ESTIMATION OF CARBON AND HYDROGEN IN VOLATILE ORGANIC LIQUIDS.

By F. W. STREATFEILD, F.I.C., and LEWIS EYNON.

IT is well known that, in the estimation of carbon and hydrogen in liquids that boil or vaporize at a low temperature, many practical difficulties are met with. When the substance contained in a glass bulb is manipulated within the combustion tube very great care must be taken to prevent too rapid expulsion of the liquid from the bulb, otherwise failure results from incomplete combustion and backward diffusion. Again, when the substance is contained in a small sealed tube outside the combustion tube, a great deal of experience and dexterity is required in breaking the ends of the tube and preventing loss.

Having occasion recently to undertake the estimation of the constituents of some volatile organic liquids, we have devised the following little apparatus, which, we believe, will greatly simplify operations of the kind here under consideration. Reference to Fig. 1 will, we hope, render the construction of the apparatus evident.

It consists of a moderately large test-tube, preferably made from thick glass tubing fitted with a caoutchouc stopper pierced with three holes. Through one of these a glass tube passes; this is connected with the air or oxygen supply, and just dips under the surface

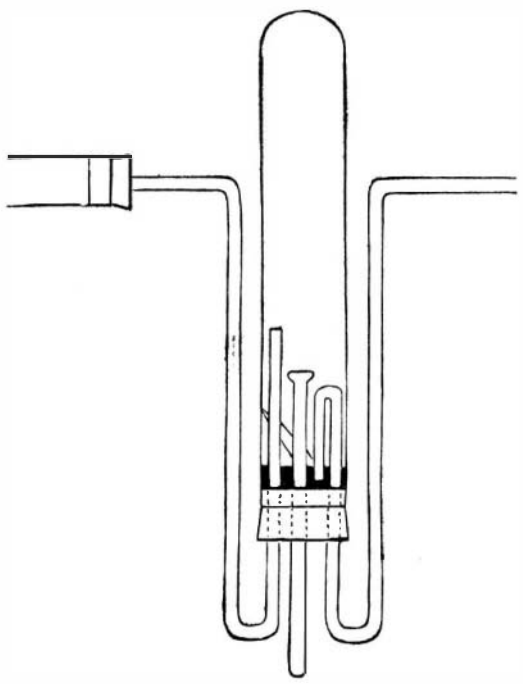

FIG. 2.

of some mercury placed in the tube. Another glass tube connects the apparatus with the combustion tube. The third hole carries a glass rod bent over or flattened at one end. The glass rod may be made to slide in a glass tube, supported and made airtight by a piece of well fitting caoutchouc tubing, as shown in the sketch.

The method of using the apparatus requires little or no explanation. The substance, contained in a sealed thin glass bulb, is placed in the test-tube, the stopper inserted, and the apparatus connected to the combustion-tube. Everything being in order, the glass tube is broken by pressing down the rod, and the vapor slowly and carefully expelled by the current of air or oxygen. Toward the end of the operation the apparatus may be surrounded with hot water contained in a beaker. It will be seen that, by means of the mercury trap, there is little or no possibility of the vapor of the substance diffusing backward, and, if the current of air be carefully regulated, complete combustion results, provided, of course, there is a good length of copper oxide in the combustion tube.

In cases where, owing to the nature of the vapor, the caoutchouc fittings may be attacked, we propose the following modification (see Fig. 2); it consists, as will be seen, in simply inverting the test-tube and bending the air supply tube over on itself, so that the end of the tube dips under the surface of the mercury which covers the caoutchouc stopper.

Of course a more elaborate apparatus might be constructed by fusing the entrance and exit tubes into the sides of the test-tubes.

We append the following results obtained with the apparatus in the combustion of petroleum ether:

	Carbon.	Hydrogen.	Total.
1.	83·57 per cent.	16·44 per cent.	100·01 per cent.
2.	83·337 "	16·578 "	99·915 "

We regret that we are unable to publish further results, as, unfortunately, our work has been interrupted. We venture, however, to submit the foregoing, incomplete as it is, hoping it may be sufficiently interesting and suggestive to induce others to experiment with our apparatus.—Chemical News.

AUTOMATIC INTERRUPTER UPON HIGH TENSION CIRCUITS.

HIGH tension and alternating current distributions have the advantage of supplying subscribers through the intermedium of transformers, which, in most cases, are placed in the subscriber's house. The high tension circuit enters the cellar, wherein is located a transformer. The apparatus is placed under lock and key, and the distributing company alone has charge of it. A low tension distributing circuit enters the occupied portion of the house, and the subscriber is therefore shielded against the various inconveniences that might attend the use of high tension. But if, for a moment, we examine the interests of the distributing company, we shall see that the transformers will be constantly connected with the primary circuit coming from the works, and that they will always be consuming a certain amount of power even when idle, and during the day a certain amount of energy. The figures may be feeble in installations of lighting, but they will be entirely otherwise with electric elevators, which consume from two to three horse power, and with electric motors used for different purposes, and the power consumed by which will be scarcely less than that just mentioned. There is therefore good reason for taking into consideration the expense thus produced. We are able to illustrate this subject by some figures that have been kindly furnished us by M. Langlade, engineer in chief of the sector of the left bank of the Seine at Paris. An elevator transformer consumes on an average, when idle, 210 watt-hours per hour. If it operates but one hour a day, there will be an idle period of twenty-three hours. The consumption, at the end of the day, will therefore have been $23 \times 210 = 4{,}830$ watt-hours. In reckoning the net cost (actual expenses alone included) at 0·02 of a franc per hectowatt hour, we find, after twenty-four hours, an expense in pure loss of 0·966 of a franc per elevator or motor, and, at the end of the year, a total loss of 365 francs.

It would hence be of interest to find an apparatus that would permit of suppressing the transformer when the elevator or motor was not running, and of re-establishing it when the contrary was the case. It was with such an object in view that the Compagnie Française d'Appareillage Electrique constructed the apparatus which we are about to examine. The automatic interrupter of which it is a question is placed upon the primary circuit of the transformer. It is closed while the elevator is ascending and opened while it is coming down. So, too, it is closed when a motor begins to run and open when it stops. These operations are performed automatically through the intermedium of a local electric circuit controlled by the elevator or the motor itself.

The interrupter, properly so called, is formed of a silver plated copper rod, of which the two extremities are bent back, as shown in Fig. 1. This rod is carried by a movable insulating piece which, in the figure, is seen raised. Beneath there is a block of insulating material, which is provided with terminals to the right and left. Upon the terminal to the left, in front, is fixed a small strip of silver plated copper, and upon the other terminal, in the rear, there is fixed a similar strip. With this last named terminal there is connected a cable of the primary circuit, which, to the left, traverses an ebonite tube, *G*. To the right of the small base there is another terminal in front of which there is a small cup, *F*, filled with mercury. With this terminal is connected another cable that makes its exit from the tube, *H*. When the bent silver plated copper rod descends, it bears upon the two strips above mentioned, while, at the same time, the two extremities enter the mercury cups. The junction of the two cables is thus assured through the contact of the strips and through the mercury.

The stationary piece around which the rod carrying the metallic rod is movable is provided with a guide in which slides the extremity of a rod, *E*, movable around an axis and fixed at *D* to another rod.

The pieces that collectively serve to establish the contacts enter a glass containing castor oil, in which breaks are obtained without sparks.

At the upper part of the apparatus, at *D*, there is a rod, which is movable around a central point and carries an electromagnet, *C*, at one of its extremities. Its other extremity is connected with the piece, *E*, of which we have already spoken. At *A* and *B* are two other electromagnets which, as well as *C*, are supplied by local batteries. The electro, *C*, always preserves its pole, but the electros, *A* and *B*, change their extreme pole according to the direction of the current sent from the exterior. At the starting or stopping points of the elevator there are, in fact, commutators that either do or do not send the current of the local batteries into the circuits of the electromagnets.

It is now very easy to understand the operation of the apparatus. Fig. 1 shows the interrupter open and the primary circuit cut off. If, at any point whatever, we close a commutator in order to send the current into the electro, *A*, so as to form a pole of a character contrary to that which it possesses, the electro, *C*, will be attracted to the electro. *A*. The pieces, *D* and *E*, will be set in motion and the metallic piece will fall and bear against the strips of copper and enter the two mercury cups, and the primary circuit will be closed.

We can, in the same way, very easily perform the contrary operation for opening the interrupter. By means of the commutators already mentioned, we send the current from the local battery into the electromagnet, *B*, when there will be immediately formed a pole of a contrary character which will attract *C*. The rod that supports this latter pole will be immediately set in motion and carry along with it the jointed rod, *E*, and the latter in turn will raise the piece that carries the metallic part. The small rods will be drawn from the mercury at *F*, a spark will leap in the castor oil, and the circuit will again be opened.

Fig. 2 shows the installation of the automatic interrupter upon the primary circuit of a transformer in a compartment arranged especially for the purpose in a cellar, and upon the system of the sector of the left bank of the Seine at Paris. At *A* may be seen the exterior cable, which, at *B*, enters the circuit breakers of the company. A wire makes its exit at the left and traverses the interrupter, *C*, placed against the wall, through which it passes in order to join the second wire upon the primary circuit of the transformer, *D*. The wires of the secondary circuit make their exit in front and run upward in order to supply the house.

This automatic interrupter is employed in numerous installations in the sector of the left bank of the Seine, as well as in the sector of the Champs Elysées. Up to the present it has given very excellent results, and there is every reason to believe that it will render genuine services in the distribution of electric energy through transformers.

For the above particulars and the accompanying illustrations we are indebted to La Nature.

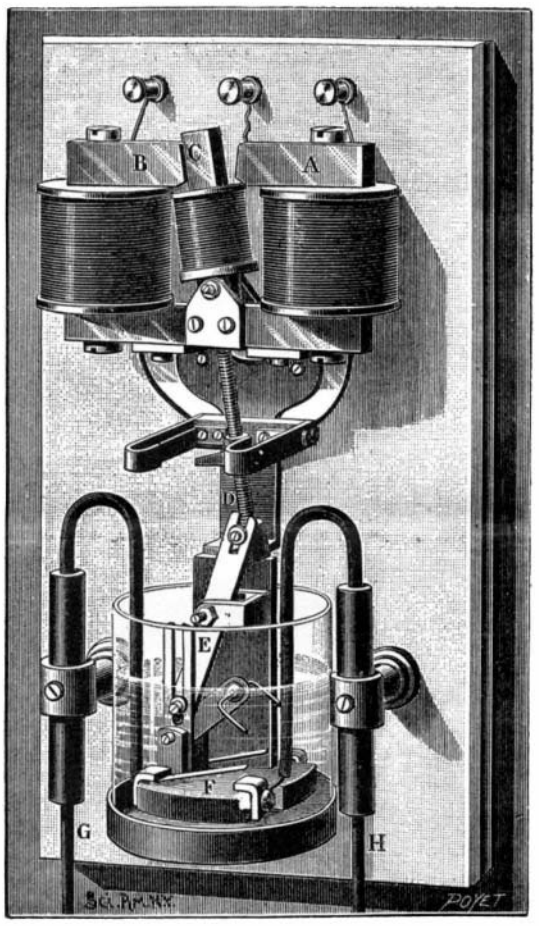

FIG. 1.—DETAILED VIEW OF THE AUTOMATIC INTERRUPTER.

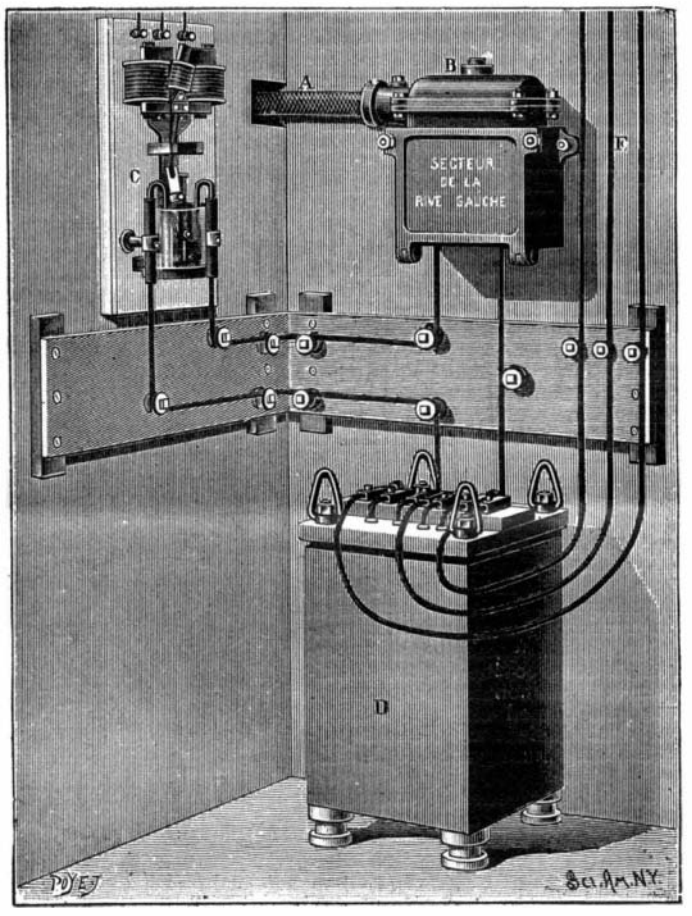

FIG. 2.—INTERNAL VIEW OF A COMPARTMENT CONTAINING A TRANSFORMER AND INTERRUPTER.

ARITHMETIC AMONG THE ANCIENT EGYPTIANS.

THE mighty engineering works of the ancient Egyptians make us think of them as expert mathematicians. We are surprised, therefore, when the methods set forth in their recently translated manuscripts make them out rather clumsy at arithmetical calculation. This is explained by a contributor to Der Stein der Weisen (which is translated by The Literary Digest) by the fact that the nobility and the priesthood kept their knowledge secret. We translate below what he has to say on the subject :

"Almost all ancient civilized peoples had this common peculiarity—they did not understand perfectly how to make use of their theoretical knowledge. This depended partly on the fact that this knowledge, mathematics for instance, was a formal secret cult, and that the acquirement of it was allowed to a small number of initiates only, while the common, practical man was only instructed in it so far as was deemed proper by the high priests of its mysteries or so far as it was clearly understood by them.

"That the Babylonians, Hindoos, and especially the Egyptians, has made great progress in geometry, is not to be doubted. But this progress was the secret possession of the highest castes, who had kept themselves more or less apart from ordinary people. Hence the enormous difference between the state of mathematics as revealed in the great priestly and royal edifices and as shown in some specimens of the usage of common life and in commerce.

"In his book on the great pyramid Piazzi Smyth has written much that has been justly criticised, and his numbers and dimensions savor of the ultra-mysterious. On the other hand, his book has done such good service in the way of exact measurement that it may be quoted as an authority. Here, for instance, we find the fact that the sarcophagus of Khufu is in cubic contents, measured on the outside, exactly twice as large as its inner space, a case that shows that in the rational methods of the Egyptians, which they incorporated in their large buildings, a way of solving the problem of the duplication of the cube had already been discovered.

"How was it, now, with the common technical and mechanical calculations? In the Rhind papyrus, translated by Eisenlohr (Leipsic, 1877), we have a collection of practical examples—the ancient Egyptians seem not to have made theoretical deductions from these. In these examples we of the present day find an unfortunate clumsiness. For instance, if one wishes, according to the methods of this papyrus, to find out how many times 7 is contained in 77, he must use the following table of factors of 7 :

— 1	7
— 2	14
4	28
— 8	56
16	112, etc.

"Those numbers are marked with dashes whose sum on the right is 77, and the sum of the corresponding numbers on the left is the answer. The ancient Egyptian calculators seem to have used entirely multiples and submultiples of 2. Thus, to divide 19 by 8 the following table of factors was used :

1	8
— 2	16
½	4
—¼	2
—⅛	1

"As $16 + 2 + 1 = 19$, the quotient sought was accordingly $2 + ¼ + ⅛$, or $2⅜$.

"Fractions with numerators greater than unity seem not to have been employed. It may be imagined then that an x in the numerator of an algebraic equation might drive a popular Egyptian calculator to despair. For the solution of such a simple equation (to us) as $x + \frac{x}{5} = 21$, the Egyptian would have to consult no less than five tables of factors.

"Whenever a fraction occurred whose numerator was greater than unity, it was split into a sum of fractions all of which had unity as numerator. This seems to have a close connection with the arrangement of Egyptian measures. The writer has an Egyptian ell