APPARATUS FOR ENLARGING MICROSCOPIC SLIDES.

To the Editor of the Scientific American :

In the SCIENTIFIC AMERICAN for February 16, under the title of "An Electric Microscope," I notice that the apparatus there mentioned for exhibiting magnified views of microscopic objects is spoken of as attracting no little attention. Some time since I constructed an instrument with which I have successfully accomplished the same object. In magnifying power I have equaled and even excelled the power mentioned in the article referred to above. For instance, a piece of a fly's eye less than one-sixteenth inch in diameter was exhibited in a bright and well defined picture, 10 feet in diameter. This could have been enlarged very much without impairing the distinctness of the view had space permitted. A bee sting was made to appear more than 20 feet long. The cells of wood were especially attractive, those of pine appearing from 1½ to 2½ inches in diameter. These objects, with about seventy-five more, were exhibited to my school. I have made use of both the calcium light and the electric light, but in the instrument here described sunlight was used.

Fig. 1 is a sectional view of the instrument, which, so far as I know, is different from any plan heretofore adopted. The optical parts are two reflectors, *a* and *b*, supported on two arms each, *j* and *k*, and swinging at the points, *a* and *b*, a convex lens, *c*, a concave lens, *d*, a small condenser, *e*, and the object glass, *g*. The mounted object is placed across the opening in *f*, over which an adjustable diaphragm works, not shown in the figure.

H consists of three tubes, the inner and longest one being rigidly attached to *n*, and placed at an angle to *n o o* equal to the latitude of the place. The tube or ring, *h*, to which the supports, *j*, are attached, revolves about the inner tube by means of a rack and worm screw, *m*, which is turned either by hand or clockwork. By this the reflector, *a*, is made to follow the sun. The ring, *i*, to which the supports, *k*, are attached, may also be turned around the inner tube by hand.

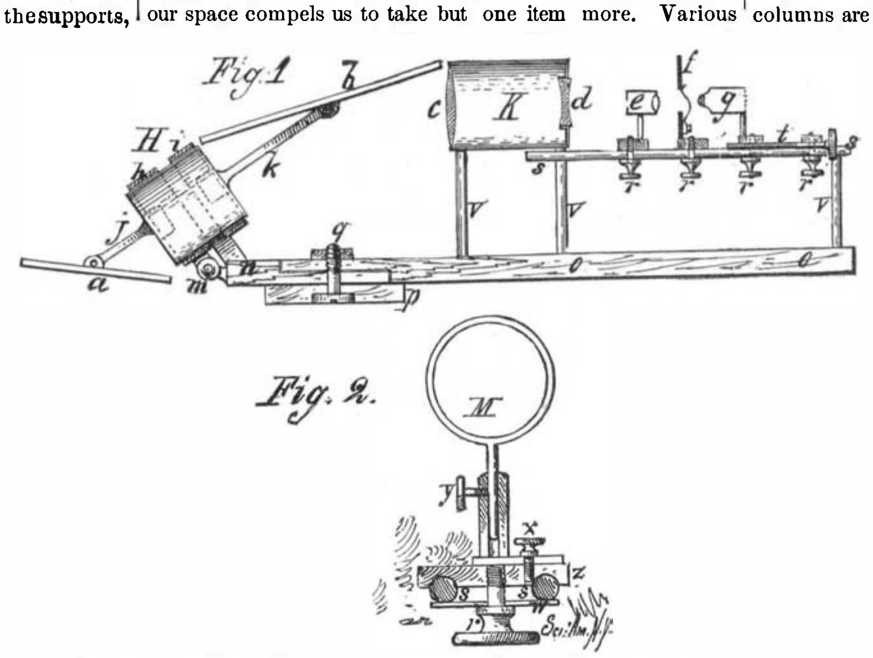
The parts, *e f g*, are supported upon and slid along two rods, *s s*, and are clamped in any position by the screws, *r r r r*; *t* is a screw for fine adjustment of *g*.

The parts, *n o o*, are of wood, 4 inches by ¾ inch, and 22 inches long. They can be turned about the joint, *g*, which is immediately below the center of the reflector, *b*. The piece, *p*, extends 2 inches beyond either side of *n o*, and is screwed fast to a window sill when in use. The three pieces, *p n o*, all turn independently.

The instrument is used as follows: Attach it by the piece, *p*, to a window on the east, south, or west side of a room where sunlight can be reached. Now turn *n* so that the line, *a b*, points toward the pole star, or approximately north and south. Then turn *o o* to point toward the place where the picture is to be shown. The ring, *i*, and reflector, *b*, are next so adjusted that the light is thrown through *c d e g*. After that the only movement required is accomplished by the screw, *m*. Of course the reflector, *a*, must be adjusted to reflect the light through H, parallel to a line, *a b*, but this can be done once and clamped, after which no change is necessary, whatever be the position of the instrument.

Fig. 2 gives a larger view of the part, *e r*, which is almost like *g r*; *s s* are the rods on which a grooved piece, *z*, slides and is clamped by the piece, *w*, and screw, *r*. The lens, *m*, is adjusted in height by the screw, *y*, and sideways by the screw, *x*.

REYNOLD JANNEY.



APPARATUS FOR ILLUMINATING AND ENLARGING MICROSCOPIC SLIDES.

Electricity: its Relation to Vital Power.

In the SCIENTIFIC AMERICAN of March 29, we offered some suggestions on this topic in connection with the fermentation of beer; but in order to study it more carefully we must pass away from the extremely low forms of life, the bacteria, whose presence and potential activity we recognize in the process of fermentation, and look to those of higher grade. Laboratory experiments on various animals—frogs, birds, rabbits, etc., for instance—and clinical observations on human subjects, are at our service, and in considering them it is necessary to premise that when we speak of vital force we are compelled to use the term as being the equivalent of nerve force, for we know nothing else in which to express it. For our present purpose these two may be correctly deemed identical, without discussing the minute biological points involved in such an assertion.

The question then arises: Is there a relation between electricity and nerve force? Have they anything in common? These are questions of almost infinite importance in relation to the welfare of every human being. The electrical conditions of the atmosphere are totally unstable, changing from hour to hour, and if the force which they represent is allied to our own vital force it is impossible to resist the conclusion that the bearing of these fluctuations on the health of the whole human race must be powerful for good or for evil.

It was formerly a common thing to speak of the "electric fluid." This term was used because the mysterious agent could be conducted from one place to another; it would *run* as water does in a pipe; it was produced in one place and ran along to another, following certain substances, which were called conductors. Nerve force does precisely the same thing. It originates only in the nerve cells, minute microscopic objects, which, however, are in many places grouped into such masses—called ganglia—as to be of appreciable size. These, from their color, are called the gray matter of the nervous system, while the cords which we know as nerves, running to every part, are white. These nerves are simply the conductors; they originate nothing, any more than do telegraph wires. Here is the first similarity of nerve force to electricity; it is found in the battery (the nerve cell), and is connected by the wire (the nerve).

The second item of similarity is that electricity directly applied to a nerve produces the same effect as an increase of its own force. The muscles are under the control of the will. My mind, for instance, determines to bend my fore finger; the brain cell sends the message by means of the nerve to the appropriate muscle, and my finger is bent. If now, on the contrary, I apply a battery to that same nerve, the finger is at once bent, without my will, or even in opposition to my will. Apparently I send the *same force* from the battery that the brain sent in the other case, and as I can easily make the battery the stronger of the two, the finger is bent even though I determine that it shall not stir. This is one strong proof of the absolute identity of the two forces.

Still again, in studying the action and functions of the sympathetic nerve or system, it is found beyond question that the direct application of electricity increases the power of action of the part to which it is applied. It is found, on the other hand, by clinical observations, that whatever tends to exalt the nerve force does precisely the same thing; that is, nerve force and electricity produce the same results, as was the case in the previous illustration.

This line of comparison might be much extended, but our space compels us to take but one item more. Various types of fishes possess electrical power, and are in each case provided with special organs for its production. The best and longest known of these electrical fishes is the torpedo, of which we have one species here on our Atlantic coast and another on the California side. The "battery," by means of which they are able to give really powerful shocks, is quite similar in structure in all the species; it is situated well forward on each side. But the only point which interests us at present is that which gives it its special and wonderful power. It is provided with an exceedingly rich distribution of branches from the trigeminal nerve and the pneumogastric. These are ramified upon each cell of the battery, and they alone give it its energy. The nature of this power has been often tested, and it has been found capable of doing whatever the electricity produced in our laboratories, from our ordinary batteries, can do. There are no means of distinguishing the one from the other, they are apparently identical, and yet we know that the power shown by the torpedo is vital; it is simply nerve power.

Why this function should pertain to those two nerves alone is not apparent; inother fishes there is no such. And in other electrical fishes those nerves are not the agents. In the electrical eel of Surinam the battery is quite similar in its structure to that of the torpedo, though differently situated; but the nerve supply comes from multitudes of branches of the spinal nerves, while the trigeminal and pneumogastric are not involved at all, but the electrical power appears to be entirely the same.

It would seem, therefore, that electrical force and nerve force must be identical; but there are, on the other hand, points of discrepancy which must not be neglected. The mode of distribution is widely different. It is a matter of great difficulty to retain electricity after we have produced it. It escapes with exceeding ease, and the most careful insulation will hold it but imperfectly, especially where moisture can reach it. Nerve force, on the contrary, originates among the moist tissues, and passes everywhere freely among them without any tendency to escape from the line of its own moist conductors—the nerves. It is true that this does not disprove identity, for it may be only one feature, as yet imperfectly understood, of one out of perhaps several types of electrical energy; and the same remark may apply to the fact that different nerves, which so far as we know are identical in structure, convey nerve force to totally different types. We have nerves of sensation, of motion, of sight, of hearing—of all the special senses. Are these all only distinct forms of electrical action?

It seems probable that from all these sources of inquiry we may draw the inference that even if electricity is not identical with our nerve force, it is at all events so closely allied with it that electrical changes must surely influence human vitality, either for good or for evil. A.

Grecian Stone Cutting.

A rather interesting observation has recently been made upon the methods of stone cutting employed by the ancient Greeks. Every one knows that the marble blocks of which the Grecian masonry was composed are put together without mortar, and so nicely fitted that in many instances two adjacent stones have, as it were, grown together by the cohesion of their particles, brought into almost absolute contact; a fracture made by a blow upon one passing directly into the other, just as if the two formed a single block. With regard to the fitting of the drums of columns, Mr. Penrose, the most scientific and practical of all investigators of Greek architecture, believes that the desired effect of close fitting was obtained by inserting a wooden pin as a pivot in the drill holes which are always found in the centers of the drums, and revolving each drum upon the one below it, first placing sand between the stones, until a perfect joint was obtained, in the same manner that glass stoppers are ground into bottles, and pieces of metal work of certain kinds fitted to each other. This explanation, which is probably the true one, solves the problem completely so far as the drums of columns are concerned, but throws no light upon the fitting of the other stones of the Grecian buildings, such as the blocks of the entablature, which are found to have joints as close as those of the columns, the edges of each block, for a certain distance back from the face, being polished, while the rest of the joint is slightly sunk, in order to allow the polished portions to be brought into perfect contact. As no sign of a pivot can be discovered on the stones, even if it were possible to revolve them in contact with each other, it is plain that a different process must have been used for fitting them, and an inscription discovered a few years ago gives us some idea of what the process may have been.

This inscription, which seems to have been a sort of official document, answering the purpose which would now be fulfilled by a printed specification, describes the construction of a temple, and stipulates particularly that the joints of every block of marble must be polished with a mixture of oil and vermilion. As vermilion, if the word so translated really refers to the pigment now known under that name, has no polishing quality, it has been suggested that the color was used simply to spread over the joints before trying the stones together. If any inequality existed in the surface of either stone, it would be immediately shown, on separating the stones after a momentary contact, by the transfer of color from one to the other; and the protuberant portion, thus detected, could then be rubbed down by hand to a uniform plane with the rest of the surface. A powder of red chalk is often used by marble cutters for a similar purpose, and it is quite possible that this may have been the only use of the vermilion paint; but there is some difficulty in accounting on this theory for the mixing of oil with the paint, which, if used dry, would be quite as useful for its supposed purpose, and would be much more easily cleaned off the stone. There is no serious improbability in the supposition that the authors of the inscription may have confounded the true vermilion with the red oxide of iron, or crocus, which is a very efficient polishing agent, and if mixed with oil, and applied to the surface of a piece of marble, would serve admirably, both to show where that surface had been brought to coincide with a test plane, and to reduce the inequalities which might on trial be found to exist.—*American Architect.*

The Mullein Plant.

A good deal has been written lately about the mullein plant and its efficiency as a cure for consumption. Extracts and decoctions of this plant (*Verbascum thapsus*) were recently exhibited at the Cork Exhibition, but the judges would not pass any verdict, as the chemical and physiological properties have not yet been investigated. It is, under the synonym of cow's lungwort, popularly looked upon as of value in diseases of the respiratory organs.

In reference to the use of the above, Dr. Quinlan, of Dublin, writes to the *British Medical Journal* that three ounces of the green leaves should be boiled for ten minutes in a pint of new milk. The liquid is then strained, sweetened to taste, and drunk while warm. This dose can be repeated twice or three times a day. This high authority has no doubt of its efficacy as a curative in the earlier, and a palliative in the later stages of pulmonary consumption. Care should be taken to use the leaves of the great mullein, known by its thick, mucilaginous, and wooly leaves.