learned doctor observed that the metals which affect the microbes were those that are readily attacked by chemical reagents, while those that resisted such reagents, like gold, had no effect. He concluded that the action upon the organisms was due to the solution of the metals taking place in the jelly.

But what a wide field he has opened!

Here is a world for exploration, with promise of rich reward. You have many readers of an investigating turn of mind. Many of them have their own private microscopes, and bacteria are to be found on every hand in abundance. Metals of some description are on every shelf. Who will be the first to discover that some other metal than cadmium is destructive of the peculiar species of bacteria so prevalent in serious cases of scarlet fever? and then how many diseases, with their peculiar species, there are in this wide world of disease and death!

It may be necessary, in conducting these experiments, to resort to many species of the rarer minerals, and to reduce these species to metals and solutions. But we have the young men who have the ability, the skill, the patience and the time to solve the important problems.

The question may arise where to obtain the metals or minerals. Having given this subject much special study during the past fifteen or twenty years, perhaps I can supply the key whereby any known mineral or metal can be provided when wanted. It is a remarkable fact that when a so-called rare metal is required for commercial use, that somebody, somewhere, will, in a comparatively short time, be able to supply the article.

Take our Welsbach light, manufactured at Gloucester, N. J. When the manufacture was first attempted in the United States, the officers of the Welsbach Company sent out letters in every direction for minerals containing the metals they wanted. They had to experiment some time before they really made much headway; then they concentrated on one or two minerals—one known as monazite. Then the problem: Where can this mineral be found in sufficient quantities to enable the company to supply the growing demand for their manufacture? At first they met with very moderate success—perhaps some people would have pronounced it failure. But they kept on; and now they can purchase all the monazite they require, either from North and South Carolina, or Brazil, with small quantities now and then from other localities.

A number of years ago Mr. Thomas A. Edison wanted one or two rare minerals for his purposes. At first they could not be supplied satisfactorily; but, as the demand grew, the product increased, and now the tip of every phonograph receiver has a sapphire point, and the mineral itself is supplied at fabulously low prices. A party in France wanted zircon for their establishment, and it seemed at first that they never could obtain enough; but a gentleman in North Carolina mined and shipped them 600 pounds, a larger quantity than had ever before been found, and an abundant supply for their purposes. But the uses of zircon have since multiplied. The product has multiplied also, and now it is not an unusual thing to hear of a whole carload of this once rare mineral being shipped.

Returning to monazite—which is a mineral containing cerium, didymium, erbium, lanthanum, thorium and yttrium. Here are rare metals, varying in price from \$10 to \$300 a pound. If any of them should be found wholly efficient in destroying any species of bacteria, there is no doubt that the metal would be forthcoming in any quantity necessary to meet the demand of the medical world. As proof of this I am now mining and shipping to Europe many thousands of pounds of the mineral from which these metals are derived, and have no fear that I shall not be able to fill any order which comes along not exceeding a thousand tons.

Other very rare metals exist in monazite, and also in samarskite—in the latter such rare species as columbium, terbium, decipium, tantalum, argon and helium, some of which are possibly entirely unknown practically to many chemists, as well as those engaged in other sciences.

Euxenite, another very rare mineral, also contains rare metals, such as germanium and uranium, as well as argon and helium. Antidotes of the poisons of these various bacilli cannot be said to have no existence until these various metals have been tried. Then arises another difficulty, to be swept away, if possible—the use of a metal to destroy certain micro-organisms, and the metal itself to be non-injurious to the human body. That this will lead to much experimenting, there is no doubt; but, of course, none of the first experiments should be made on human beings, no matter how aggravated the case.

Referring again to euxenite, samarskite, and the element helium, derived therefrom, when helium has been utilized to produce artificial sunlight—for the sun contains helium—then we will have a light to experiment with far in advance of the electric bulb now placed in the human stomach for the purpose of clinical and other observations; and when helium is put into further practical use, we will also have something to work by in our laboratories that will be akin to sunlight, and thus save many a sweltering and many a headache now caused by modern artificial lights.

Acting upon the discoveries of Dr. Meade Bolton, the searcher for that which will lengthen human life by destroying disease will most likely be guided by the cue, given by the doctor, that the metals most readily attacked by chemical reagents are most effective in the destruction of microbial life. A comparatively short investigation will enable the student or the searcher after this knowledge to make a list of the metals required. Possibly, most of the metals on the list can be obtained at once and with little difficulty. But when the others are desired I would suggest that they be sought through parties skilled in obtaining them, either in the United States or abroad, and I believe it is now conceded that every known mineral and metal has been found in the United States, and by far the largest number in Virginia, North Carolina, western South Carolina, Georgia, Alabama and eastern Tennessee. Only a short time ago, in an area of less than five square miles, I found and classified 138 species of minerals, more than half of them of the rarer varieties. I believe it is possible to make even a longer list, and that the locality I refer to is not the

only place in the United States where so many can be found.

It is quite evident, then, that when an antidote is found, the mineral will be forthcoming in ample quantities to make the antidote effective and widespread.

It seems to the writer that all these medicinal elements for the restoration to health of bacteria-troubled patients is right in the line of advanced pharmacy. Being in that line, why ought not the pharmacists of this country to be first to make efforts in the way where they will naturally travel ere long? I shall watch with keen interest any steps taken by the pharmaceutical world in the direction pointed out in this article.

Harrisburg, Pa., September 12, 1895.

—American Journal of Pharmacy.

THE PHOTOSPHERE.

WE gave a description of this well-conceived apparatus for instantaneous photography at the time of its advent. The structure of this instrument, which is all of oxidized metal, its lightness and its compactness make of it a very practical apparatus always ready to operate, and one required by tourists and explorers, to whom it has rendered great services. Since the above-named epoch, the photosphere has been further improved. The Zeiss objectives, which are remarkably luminous and which completely correct astigmatism, constituted a progress upon aplanetic objectives. The Krauss establishment, which has obtained the right to manufacture these objectives, has

FIG. 2.—THE PHOTOSPHERE PROVIDED WITH ITS REPEATING FRAME.

got up some special types for use in the photosphere. All these objectives are provided with iris diaphragms with ebonite plates that prevent the reflections that occur upon metal ones after a little use. A simple rotary motion given the objective suffices to modify the diaphragm's aperture, which is indicated by a very apparent graduation.

All amateurs who know how much want of success is due to the impossibility of modifying their diaphragm according to the illumination of the object will appreciate this so simple and convenient system. These short focus objectives are always in focus from infinity up to 5 meters. An optional focusing can be effected for nearer objects by using either a ground glass or a graduation that is carried by the apparatus.

The frame of the first model of the photosphere, which was of varnished mahogany, was subject to alteration under the action of heat and moisture, and its method of closing and of maneuvering in the apparatus left much to be desired. This inconvenience has been obviated by the construction of frames all of tempered steel.

Many amateurs now, following in this the fancy of the Americans and English, are desirous of being able to take a series of negatives rapidly without having to change frames or to bother themselves with the operation of the apparatus, which should be automatic. The manufacturer of the photosphere has thought it well to satisfy this new fancy by adopting a repeating magazine frame analogous to that of the "photomelle." The principle of this frame is borrowed from the Hanau-Richard patents, and is the simplest and most rational system; but its being made entirely of metal gives it extreme lightness and strength. The management of it consists simply in pulling out and shoving in a drawer.

The accompanying Fig. 1 gives three different as-

pects of this new frame. No. 1 is a section that shows the interior and allows the operation to be seen. B is a box into which the drawer, A, slides. In this drawer there are twelve plates to be impressed. Fig. 1 (No. 1) represents the drawer, A, which has been drawn out along with eleven plates. The twelfth plate, P, is held in the box and falls at P' when the drawer is pulled out to its full extent.

When the drawer is shoved in, this plate places itself under the eleven others. The second plate, which has now become the first, will, in turn, come into the focus of the apparatus.

Upon pulling out, through its handle, the drawer that contains these plates, there is carried along a curtain, R, that renders it light-proof. A second curtain, R', is maneuvered by hand and closes the magazine when it is desired to carry it alone after detaching it from the photosphere. Fig. 1 (No. 2) shows the mechanism of the counter. Every time the drawer is maneuvered it actuates a lever that causes a numbered disk to move forward by one notch. A figure appears upon the box and designates the row of the plate to be exposed. No. 3 represents the frame closed and No. 4 the same half-opened, as well as the place occupied by the counter.

Fig. 2 shows the photosphere provided with its repeating frame. This magazine frame may be employed concurrently with the ordinary frames and be adapted to the present photospheres without the necessity of any modification.—La Nature.

ON THE PHOTOGRAPHY OF THE RAYS OF SMALLEST WAVE LENGTH.*

By VICTOR SCHUMANN.

PREVIOUS experiments which I had performed with strata of air up to 1 mm. in thickness had shown that the photography of the light rays below the wave length 185μ required the exclusion of air from the track of the rays. Under these circumstances, an essential extension of the spectrum of the air beyond the wave length 185μ seemed impracticable. But according to my most recent experiments, very thin strata of air, such of about 0.1μ in thickness, transmit a great part of the rays of the smallest wave lengths, and strata whose thickness does not exceed a few hundredths of a mm. seem merely to check, but not to quench, the energy of the rays. With the former the photograph extends far beyond 162μ , the locality of the photographic maximum of hydrogen; while with the latter we are able to proceed considerably further. Indeed, according to all appearance, these, if only exposed for a sufficient time, may present no important hindrance to attaining the actual limit of the region of the smallest wave lengths.

From this fact, which I have repeatedly verified, I believe that I can deduce a result concerning the photography of the smallest wave lengths totally unexpected in accordance with my earlier observations. I employ a discharging tube, so constructed that it may be connected air-tight with the exhausted spectrograph in a manner suitable for photographic application, and thereupon, independently of its vacuum, can be filled with any required gas at any given pressure. The tube and the spectrograph, therefore—in an essential contrast with my former experimental arrangement—were not in conductive connection. This discharging tube, differing in form and arrangement from my previous arrangements of this kind, presents, along with other advantages, one which comes exclusively into consideration in the present case, i. e., that the resistance of absorption which the rays encounter by the contained gas can be reduced without difficulty to an extremely small quantity by a decrease of pressure and depth of stratum.

I purpose subsequently to communicate further particulars with my photographs—now in course of execution—of the ultra-violet spectrum of hydrogen.

With such a tube I now obtained, after it has been filled with dry air at a low pressure, the spectrum of the air as an extremely energetic band of efficacy, of a wave length hitherto not attained, which closely approximates, in photographic energy and extent, to the most effective of all the ultra-violet spectra hitherto known, that of hydrogen. For instance, the most effective region of these pictures presents in a length of 34 mm. more than fifty bands, partly resolved into lines shading away toward the red and following upon each other so closely that in their totality they appear to the naked eye as a continuous effective band of varying density. To what constituent of the atmosphere these bands belong future observations must decide.

* Imperial Academy of Sciences at Vienna, Session of the Class of Mathematics and Natural Science, April 25, 1895.—Chem. News.

FIG. 1.—DETAILS OF A MAGAZINE FRAME CONTAINING TWELVE PLATES.