Correspondence.

A Simple Home-made Condenser.

To the Editor of the SCIENTIFIC AMERICAN:

A method I use for coating the inside of Leyden jar condensers may be of interest to some of your readers. After getting the bottle chemically clean, I siphon into it, carefully and to the proper height, one of the usual silvering mixtures, leaving the siphon in place until the exhausted liquid is to be drawn off and avoiding any effect upon portions of the glass not meant to be silvered. After drying and before sealing up, I run in some shellac varnish, flowing it about the upper parts of the flask, and then heat to drive out all moisture. Besides its other advantages, this method does not restrict one to the choice of wide-mouthed flasks, and so makes it easier to secure glass of the proper thinness, resistance, and specific inductive capacity.

(Rev.) I. J. KAVANAGH, S. J.

Loyola College, Montreal, June 16, 1904.

The Shrinkage of Great Salt Lake.

BY CHARLES ALMA BYERS.

Statistics indicate that Great Salt Lake, the Dead Sea of America, is doomed—that it is gradually drying up. The opinion now almost universally prevails among scientists that this mysterious body of water, located at an altitude of 4,210 feet above sea level and 1,000 miles inland, and which has but a single rival, the Dead Sea of Palestine, is certain within the course of a half century to disappear from the map. Some scientists, who have made a careful study of the fluctuations of the lake for the past several years, even declare that it will be dried up within a quarter of a century.

Various statistics of climatic conditions, including precipitation records, are complete for Utah back to 1863, with scattering accounts for many preceding years, and it has been possible from these data, although the problem is far from being a simple one, to arrive at these and other conclusions—conclusions so well founded, as shall herein be shown, that the predicted destiny of the lake can not well be disputed.

The lake is subject to annual fluctuations, which, up to the first of July of each year, give a rise of water level usually amounting to about twelve inches; after July first it begins to fall, and the fall is invariably greater than the preceding rise. We have statistical proof that this has been going on for 35 years. In the meantime, however, in addition to the lake's annual fluctuations, there have been wet and dry cycles which temporarily affect the lake's level to a very great extent. During one of these wet cycles the level may rise several feet, but, like the annual rises, it always fails to reach the mark set by the preceding one. In drawing conclusions these facts must necessarily be taken into consideration.

From the close of the year 1886 to the close of 1902, sixteen years, there has been a total fall of 11½ feet. While this is considered alarming, measurements show that the shrinkage has been even more rapid during the past three years than for any other like period in the sixteen, the average fall being 1 foot per year—that is, 1 foot after deducting the preceding annual rise. At this ratio, in forty years the level will be a corresponding number of feet below its present standard, which means that the lake bottom will practically be a dry, salt desert. The water in what is known as the north arm is now a little less than 40 feet deep, and this is considered the deepest portion of the lake.

This is one way of reckoning the time until the Great Salt Lake will cease to be. Here is another:

Sixteen years ago, in 1886, the area of the lake's surface was estimated at about 2,700 square miles. Taking 20 feet as the average depth at that time, we have 1,505,433,600,000 cubic feet as the contents of the lake. To-day, according to recent surveys, the lake has an area of about 2,125 square miles. Multiplying this number by 11½, the number of feet in depth of the water that has disappeared and not been replaced, gives 669,778,400,000 cubic feet as the quantity of water less than what it had sixteen years ago; or, leaving 835,655,200,000 cubic feet as the lake's present contents. At this ratio of decrease in quantity in less than twenty-five years the lake will be waterless.

This latter reckoning, however, is valueless unless it be proved that the water disappears entirely by other means than evaporation, for the quantity consumed in this way will depend largely upon the area over which it is spread. It is also made less reliable on account of it being impossible, owing to the fluctuation in the volume of water incident to climatic variations and conditions, to get at the real dimensions of the lake. And again, much more than 669,778,400,000 cubic feet of water has disappeared in the last sixteen years, for the reason that the lake has been gradually growing smaller in area and that no estimate was included of the water that covered the area now completely dry. As to evaporation being a cause for the drying up of the lake, that theory, with others, will be considered later.

To show the effect of cycle fluctuations and how the lake is steadily shrinking despite temporary rises, a chart has been prepared indicating the action of the level for the past forty years, commencing with 1863. The level then stood at two feet above the zero point. For the four years following the precipitation was very great. In consequence of this the level went up at almost the rate of two feet a year until 1868, when it stood at 13½ feet above zero—the highest level on record. Then there was a turning point, and in the next five years there was a drop of 7½ feet. Again there was an increase in the precipitation and the lake's level rose until in 1875 it reached 12½ feet above zero.

It is from this year forward that the real shrinkage of the lake becomes evident. A steady decline has been in progress since then, and only once has there been a rise of any consequence. It began in 1883 and continued until 1886, when the level registered at 9 feet above zero. Now the precipitation preceding this rise was only 1 inch less than that which preceded the rise of 1875, yet there was a difference of 3½ feet in the two water levels.

In 1900 the greatest fall on record was registered, and during the year the level went down nearly 4 feet. This occurred despite the fact that the rain chart shows that the precipitation for five years preceding this time was above the normal. The lake now stood at 1 foot below zero. During 1901 it fell only 2 inches, but again in 1902 it took another downward leap, reaching 3½ feet below zero. In June of the past year, 1903, the season at which, according to previous records, the level usually stands at the highest point, it was 3 feet 9 inches below zero, and still falling. The annual rise this year amounted to about 1 foot as usual, and yet it is more than 2 feet lower than it was this time last year. The precipitation this year, too, has been much greater than it was last. It is therefore seen that the total fall from 1886 to June of the present year amounts to 11 feet 9 inches—a fall that has occurred despite normal precipitation.

Such has been the history of the rising and falling of Great Salt Lake since the white man has become its observer. Its actions before that time can only be summarily told by the lake's surroundings; and a geological investigation of the nine mountainous islands within the lake and of the higher elevations inclosing it, discloses evidence that once the level approximated about 600 feet above the present surface. This evidence is in the nature of ancient water marks on the sides of the elevations.

Observers of the lake have assigned three causes for the shrinkage of its water. They are evaporation, irrigation, and that there is a subterranean outlet. There are ardent advocates of each of these theories.

As to there being a subterranean outlet to the lake, evidence in support of the theory is not very plentiful, yet many think it probable because there are other lakes not far distant which have underground outlets; also because of there being mysterious "sinks" for some of the rivers across the line in Nevada. Because the water mysteriously disappears they think this is a likely reason. Then, too, a few years ago the owner of Antelope Island had a sailing vessel go down in the lake with two hundred sheep on board as though it sank in a maelstrom. None of the sheep ever appeared on the surface.

The evaporation theory is somewhat in contradiction of the subterranean outlet theory. It is thought that if the lake had an outlet of any kind the water would not contain as much salt as it does, whereas if the water disappeared by evaporation all solids which found their way into the lake would naturally remain. Of course it is but natural for a great deal of water in any lake to disappear by evaporation, and as this body of water is situated where the atmosphere is very dry, a much larger quantity is certain to evaporate than would elsewhere.

The supporters of the irrigation theory have more evidence to produce. When Brigham Young and his followers invaded Utah in 1847, they found the soil to be suitable for farming in every way except that it lacked water. They, being largely of the farming class and in a new country, had to till the land, and to do so, in the following year, 1848, they began to irrigate their new farms. This system grew only very gradually and slowly for several years—in fact, until about 1880, or a little later. In the meantime the lake was seemingly not affected, for it went up and down according to wet and dry cycles. About this time, however, irrigation was begun in the State on a very extensive scale. The effect is seemingly shown in the wet cycle of 1886, when the lake failed to rise in proportion, as determined by preceding wet cycles, to the precipitation. It lacked 3½ feet. The steady growth of irrigation continued, and in 1899 there was irrigated land amounting to 609 square miles, which was double the amount under irrigation ten years previous. Meantime the level of the lake went down; and as much greater irrigation facilities are now being planned, the decline of the lake is expected to be proportionately greater. Therefore it seems that the lake's shrinkage will soon be averaging even more than a foot a year.

All the water that is used for irrigating purposes in Utah Valley comes from the streams that empty into Great Salt Lake. The principal ones are the Jordan, the Weber, and the Bear rivers, the first named being the outlet of Utah Lake. There are several smaller streams, or creeks, and the water of some of them is completely sidetracked for irrigation before it gets out of the mountains, leaving the lower portions of the creek beds entirely dry. It is in this way that the feed streams have been tapped, which naturally caused the flow into the lake to be greatly reduced—so much, in fact, that the precipitation has very little effect apparently on the lake's level.

This theory seems the most probable, and especially so since the water of the lake should not disappear more rapidly either by an underground outlet or by evaporation now than it did years ago; which it is evidently doing. In summary, it seems that, owing to the decrease in the water that reaches the lake caused by extensive irrigation, the atmosphere absorbs more water than the lake receives from its feed streams. Thus have scientists evidence to support their declarations that the lake will gradually dry up.

Electrical Notes.

A series of wireless telegraph receiving stations is about to be organized round the French coast by the French Minister for Posts and Telegraphs, to be used by private as well as government vessels.

The electric traction experiments on normal-gage railways, made since August 15 of last year by the Union Elektrizitäts Gesellschaft, Berlin, with their high-tension single-phase alternate-current system on the Niederschönweide-Spindlersfeld line, have resulted in the electrification of this line. Trains comprising two motor cars and three trailers have been run since June 1. The motor cars are placed at the ends of the trains. No increase of the speed is contemplated for the present moment, the intention of the railway department being to obtain trustworthy data as to the working cost of the new system.

At the meeting of March 22 of the Elektrotechnischer Verein, Berlin, Mr. E. Ruhmer delivered an address on the importance of selenium for the electrical industry. After giving an historical sketch of the discovery of selenium by the Swedish scientist, Prof. Berzelius, Mr. Ruhmer briefly explained the properties of the various modifications of this body. The sensitiveness to light characteristic of the crystalline modification has been utilized in connection with the design of the so-called selenium cells, consisting mainly of a selenium resistance prepared after a special process, so as to afford the highest sensitiveness to light. As by the increase in the conductivity of selenium, due to illumination, the current intensity in a circuit is altered, these devices will act in a way quite similar to an electric cell proper. Mr. Ruhmer showed by some interesting experiments the fluctuations in the intensity of a current traversing the selenium cell, as produced by variations in the luminous intensity. A glow lamp connected in series with a selenium cell was, for instance, shown to give a dark-red light while the selenium cell was in the dark, while an intensely white glow was noted as soon as the cell was exposed to the action of light. The action of extremely rapid fluctuations in the luminous intensity was illustrated with the aid of a rotating disk, having circular rows of holes, through which a selenium cell was illuminated. The cell was connected to a battery and a loud-speaking telephone, which, with the alternating illumination and darkening of the cell, would yield a loud sound, heard throughout the hall. As regards the numerous practical applications of selenium, the selenium photometer, serving to measure luminous intensities, and the electric telephotographic apparatus designed by Prof. Korn for the transmission of handwriting, pictures, and photographs, were discussed at some length. Selenium ignition devices, lighting automatically gas or electric lamps at the fall of night and extinguishing them at daybreak, were shown, and the application of selenium cells to wireless (optical) telephony was finally described in detail. In connection with the latest experiments made by the author between Berlin and Grünau, a transmission of language, by means of rays given off from a projector, was secured over a distance as high as 15 kilometers (9.31 miles). The first experiments made in this direction outside of a laboratory were Herr Ruhmer's well-known Wannsee experiments.

Prize in Chemistry.

A prize of 1,200 marks ($285.60) is offered by Prof. Van t' Hoff, of Berlin, for a collection and systematic arrangement of the entire literature with reference to catalytic phases. Competitors are requested to forward their work up to June 30, 1905, to the Zeitschrift für Physikalische Chemie, of Leipzig.