THE AIR WE BREATHE.

On the evening of Thursday, November 7th, 1889, at the regular session of the Students' Society of the Latter-day Saints' College, a lecture was delivered by Dr. J. E. Talmage, on the subject named above. The Social Hall auditorium was completely filled on the occasion with an attentive and appreciative audience, and the remarks of the speaker were followed with unflagging zeal from beginning to end. The lecture was one of the public treats for which the Faculty of the College in general, and Dr. Talmage in particular, have become noted; namely, an illustrated discourse, one in which every essential point was demonstrated before the eyes of the hearers, as well as explained to their ears. In treating "The Air we Breathe," the lecturer handled his subject in a logical and masterly manner, and the apparatus used was of the best. We are pleased to present to our readers a complete report, with sketches of the instruments employed as taken on the spot by our own artist.

Dr. Talmage said: The air we breathe is essential to our existence; and probably none other argument as to the importance of the subject is requisite. It is an every-day subject indeed; and one of endless instruction. One cannot contemplate the properties of the air without a feeling of profound amazement, at the strange association of simple means and wondrous results. Men and animals die if deprived of air for respiration; the oxygen of the atmosphere being necessary to enter into combination with the waste products of their bodies and to remove such from their system. The plant is no less dependent upon the air for its support; indeed the vegetable fabric has been regarded by scientific investigators as organized air. The explanation is simple; the air contains among other constituents a small amount of carbon dioxide gas —only a cubic inch of the gas in an entire cubic foot of the air, yet sufficient for all natural purposes. The plant absorbs the carbon dioxide, and decomposes it, fixing the carbon in its own tissues, and returning the oxygen in a free and useful state to the air again. But we aim tonight to consider only the physical properties of the air we breathe; the chemical characteristics must be excluded for the present.

It is believed that the earth is surrounded with a layer of air of definite extent. No part of the earth's surface is known at which the proofs of this atmosphere are not strong and conclusive. While walking upon the ground we are in fact moving upon the bottom of the aerial ocean, as crabs might crawl on the sea bed. Owing to its transparency however, the atmosphere is not visible to our organs of sight, and we must adopt other means than trying "to see the wind" of testing its presence. These means are, the performing of careful experiments; which are in reality questions propounded to Nature; the resulting phenomena are her answers, and they are clear.

I have on the table, as you see, a a glass vessel containing water (Figure 1). Upon the water floats a large flat cork to which a bit of candle has been attached, and this candle we will ignite. Here is a bell-jar—open at the bottom, and closed above —an inverted tumbler would do as well for the operation if conducted on a smaller scale. As you observe, I lower the bell-jar over the floating candle, and press downward until the jar is entirely submerged. Yet, as all can see, the floating candle has not risen into the jar, consequently we know the water has not entered the immersed vessel. There is a commonly quoted law, that liquids tend to find their level; and they will succeed too unless the tendency be opposed by a stronger force. In this case, there must be something within the bell-jar which presses downward upon the surface of the water and prevents its rising. That something is the atmosphere.

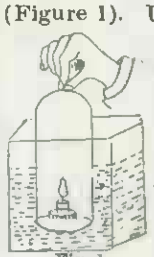

Fig. 1.

A further proof may be made thus. I have here (Figure 2) a large two-necked bottle A, each mouth carrying a perforated cork. A common wide-mouthed bottle would do, if provided with a cork having two holes bored through. Through one cork a funnel tube (B) passes; the end reaching to the bottom of the vessel; in the other cork a bent delivery tube (C) is inserted; this tube terminates beneath the surface of water in a pan and over the end of the tube a bottle (D) previously filled with water is inverted. As I pour water into the large bottle (A) the lower end of the funnel tube is sealed, and the only exit is through the delivery tube (C). As I pour the water, bubbles rise from the end of the tube, and displace the water in the inverted vessel (D). By measurement it can be shown, that just as much water is displaced from D as is poured into B, in other words, as much air is forced out of A as water i poured in. The invisible atmosphere then possesses this property among others, that it occupies a definite amount of space, and prevents other matter occupying the same space at the same time. It is itself therefore a species of matter.

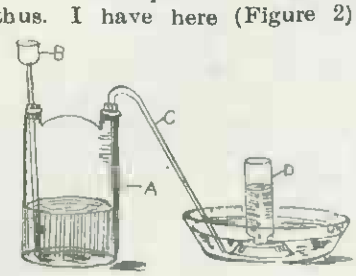

Fig. 2.

Its properties are definite. Here (Figure 3) is an ordinary wide-necked bottle. This I fill with water, and press a piece of paper over the mouth; then while holding the paper in close contact I invert the bottle, and now, lo! I remove my hand from the paper yet the latter still remains over the mouth, and not a drop of water escapes. Evidently there must be some support by which the paper is kept over the bottle mouth, else the weight of the contained water would force the cover away, and would itself escape. We can only ascribe this effect to the upward pressure of the atmosphere against the under side of the paper. The atmospheric pressure must at least be greater than the downward pressure of the water in the bottle.

Fig. 3.

But let us vary the experiment. I take a bottle (Figure 4) similar to the one last used; but over the mouth of this one, a piece of coarse netting has been tied. I fill the vessel with water, by pouring through the netting; place paper over the mouth, and invert the bottle, as before. Now for the variation—I carefully slide the paper away from the mouth, and still the water does not run out. It is frequently said that water cannot be carried in a sieve, but we keep it confined here with a floor of netting for it to rest upon. In this case the surface tension of the liquid forms a film from mesh to mesh of the netting, and the upward pressure of the atmosphere acts upon

Fig. 4.