gradual slope that the automobile can go on high gear right up to the buildings themselves with a very considerable load, and this without any expense whatever for road construction. The high elevation to the west of the observers' quarters cuts off the strong west winds of the afternoon, and as there are no winds at all, or scarcely perceptible ones, during the first four hours after sunrise, the observers occupy a most fortunate position compared, for instance, with the mining camp at Chuquicamata, where the wind blows very hard a large portion of the time. Furthermore, the soil, although absolutely barren of vegetation, seems to have elements of such a physical and chemical character that even in the afternoon, when the wind is high, scarcely any dust is carried by it.

From the observers' quarters a walk of from 5 to 10 minutes leads to the cave at the top of the mountain, some 300 or 400 feet higher up, where the spectrobolometric apparatus is installed. By means of wiring, it is arranged so that the storage batteries may be charged from the shop near the observers' quarters, and also so that the observer may throw in the bolometer battery current from his couch as soon as he wakes without having to go up the hill for that purpose. It is only necessary, in short, to go up the hill twice during the day: once for the series of observations, and again at 8:30 p. m. to signal by means of a small searchlight the weighted mean solar constant value to Calama, from whence it is forwarded by telegraph, at the cost of the Argentine Government, for use by the Weather Bureau at Buenos Aires.

Mr. Moore's installation of the spectrobolometric outfit in the cave was a very happy thought, for which he ascribes credit to his brother, Mr. E. B. Moore. The temperature there is almost invariable, a circumstance which leads to the utmost freedom of the spectrobolometer from drift. This freedom is indeed so complete that a steel straightedge laid from end to end of the bolometric curves almost invariably bisects all the marks produced by the insertion of the shutter in front of the slit to get the zeros of radiation. It is seldom indeed that a "drift" exceeding 2 millimeters occurs in these plates. The extraordinary character of these two statements may be better understood when it is said that computation shows that on these plates a change of position of one-tenth of a millimeter corresponds to one-millionth of a degree relative change in temperature of the two bolometer strips. Sometimes a so-called "battery curve" is made, that is to say, a curve representing the position of the galvanometer when no radiation is falling upon the bolometer, and such curves often show no more than 8 or 10 occasions, during the whole time of 7 minutes required for a complete bolograph of the solar spectrum, when the bolometer strips change relative temperature by as much as one-millionth of a degree, and none of changes as great as a hundred-thousandth of a degree. These conditions would have been a joy to the late Prof. Langley, who used to tell the writer that in his observations on Mount Whitney and at Lone Pine the galvanometer spot would drift off of a scale a meter long in a minute of time.

## STRUCTURE OF COMPOUND DEPRESSIONS.

By H. FICKER.

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The pressure changes at the earth's surface during the passage of a depression are only partly accounted for by the spreading of cold waves of polar origin in the lower troposphere, and their interaction with warm equatorial currents.

Both mountain and aerological observations indicate that pressure changes are large even at high levels, and the author pictures three layers of the atmosphere as each playing a distinct part—(1) the lower half of the troposphere where cold polar and warm equatorial currents interact, (2) the lower half of the stratosphere where "cold" equatorial and "warm" polar currents interact, (3) the upper troposphere where there are no marked horizontal tmperature gradients.

The essential feature of the hypothesis is that the effects in the stratosphere are regarded as thermal rather than dynamical. The ensemble is termed a "compound depression" and most depressions are of this type. The pressure wave recorded by a barograph at the surface is compounded of that due to (1) and that due to (2) which is transmitted unchanged by the intermediate level (3). The depressions in the stratosphere and lower troposphere, though related, in general move with different velocities, and this may produce a variety of different curves at places at the surface.

This and other consequences of the hypothesis are considered in some detail.—*M. A. G.*