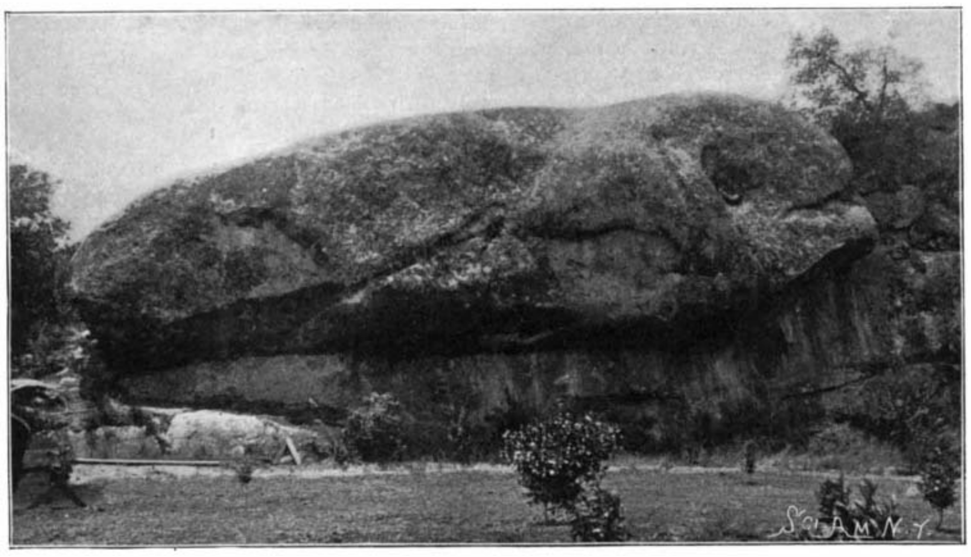
NATURAL EFFIGIES.

At Conchise, Ariz., the passenger on the Southern Pacific Railroad is shown a wonderful face, formed by the summit of a mountain range. It is called the face of Sleeping Conchise, a famous Indian chief, and is said to be held in more or less reverence by the Indians who have seen it. The profile is remarkable, doubtless several miles in length, and from certain localities a perfect face gazing upward with wonderful dignity.

In almost every portion of the country strange faces or forms are found, but none are more remarkable than the stone whale here shown. Nearly twenty years ago the writer heard of this natural curiosity, his informant urging him to go and see the whale high in the mountains. Vertebræ of these huge creatures were not uncommon on the summit of the Coast Range Mountains, and the writer had seen the skeleton of a whale dug into when a street was being opened in the city of Los Angeles; indeed, remains of these animals were found in various portions of the State, hence the story of the whale in the mountains did not result in a long trip at that time, and the natural effigy was not seen until many years after, when making a coaching trip from Los Angeles to Santa Barbara. One afternoon, after crossing a little stream in Ventura the coach rolled out into a country road and came to a standstill by the side of the whale, an effigy so remarkable that it was easily seen how the early natives were attracted by it and had legends referring to it. The whale is a conspicuous landmark, and stands on the Los Angeles, Ventura and Santa Barbara highway, pointing to the east and attracting the notice of all who pass that way.

CHARLES F. HOLDER.



A STONE WHALE IN A MOUNTAINOUS REGION OF CALIFORNIA.

THE D. O. MILLS EXPEDITION TO THE SOUTHERN HEMISPHERE.

BY W. W. CAMPBELL, DIRECTOR OF LICK OBSERVATORY.

It is well known that the observed positions and motions of celestial objects are influenced not only by the motions of the bodies themselves, but also by the motions of the observer. Neglecting minor disturbances such as latitude variations, precession, nutation, etc., the observer's motion is made up of four principal components:

1. That due to the rotation of the earth on its axis. The elements of this diurnal component are well known, and it can be eliminated completely from an observation. 2. That arising from the revolution of the earth around the common center of mass of the earth and moon. This monthly component is small and readily allowed for. 3. That due to the annual revolution of the earth around the sun. The form of the earth's orbit is well known, but there is at present an uncertainty of from one-quarter to one-half of one per cent in the assumed value of the solar parallax, or in the absolute value of the semi-major axis of the earth's ellipse. This introduces a slight uncertainty in the observer's speed which is troublesome in a few cases. It is hoped that as a result of recent observations of the planet Eros, we shall be able to eliminate the greater part of this uncertainty. 4. That due to the motion of the solar system as a whole. The elements of this motion are not well known. In fact, a better knowledge of them constitutes one of the most pressing problems in astronomy, and it is to contribute to the solution of this problem that the Mills expedition to Chile has been organized.

More than one hundred years ago, Sir William Herschel, from a consideration of the proper motions of the few stars previously observed, came to the conclusion that the solar system is moving in a straight line approximately toward the constellation Hercules. This was one of the shrewd guesses for which Herschel is justly famous. Later solutions have been made by other astronomers every few years, using the steadily increasing number of observed stars. Their results confirm the approximate correctness of Herschel's guess as to the point toward which the solar system is moving, as this point has been located by all of them either in Hercules or in Lyra. Nevertheless, the various solutions arrived at leave an uncertainty of at least ten or fifteen degrees as to the direction of the motion.

Our knowledge of the speed of the solar system has been much less satisfactory. Herschel had essentially no information as to the distances of the stars, but by making certain assumptions he was led to the conclusion that the speed of the solar system was probably in the neighborhood of ten miles per second. Other discussions of the question have led to the assignment of values ranging from as low as five miles to as high as twenty-five miles per second. The weakness of the solutions arises from our very imperfect knowledge of the stellar distances.

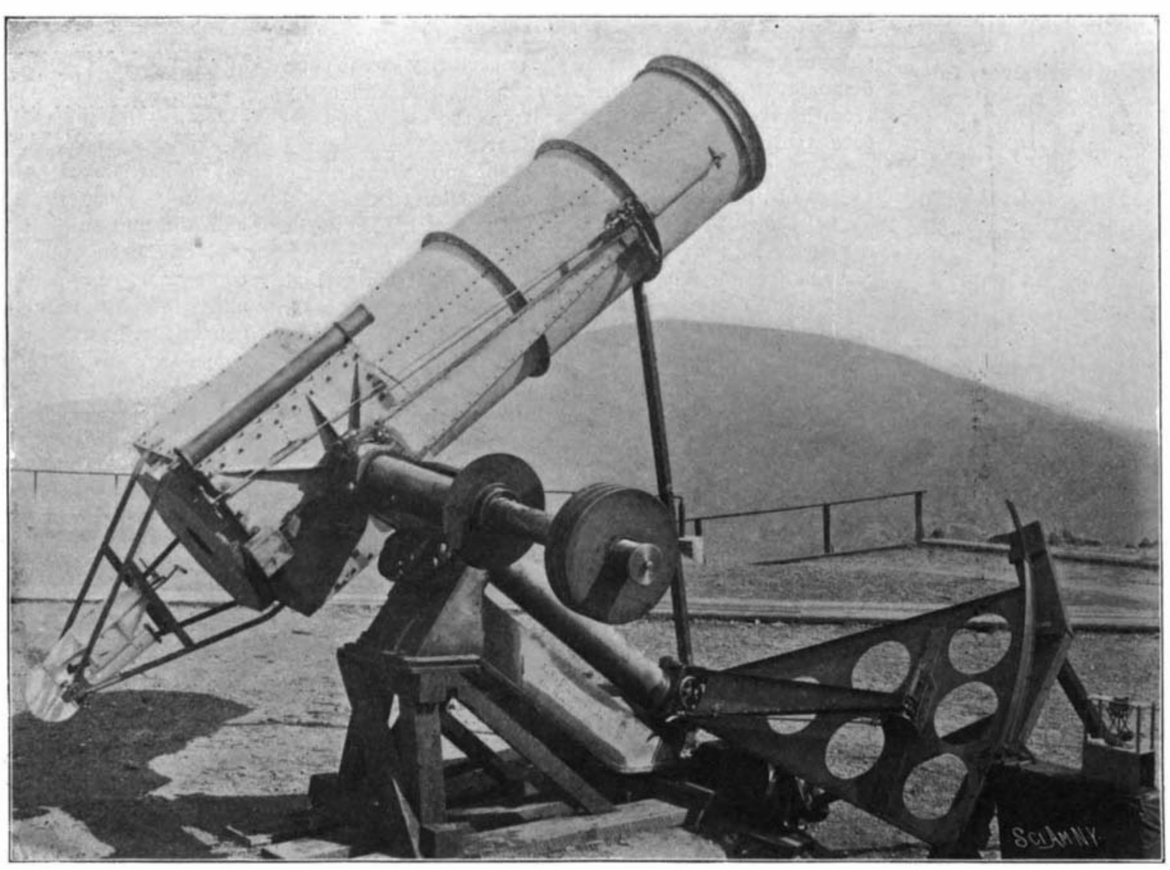
The development of the spectroscopic method of measuring stellar velocities in the line of sight has placed in our hands a means of making decided improvements in our knowledge of the solar motion, as this method is entirely independent of stellar distances. The method is exceedingly simple in theory, but extraordinarily difficult in practice. The displacements of the stellar spectra due to their velocities of approach and recession are on so slight a scale that the errors of observation may easily exceed the magnitude of the quantities to be observed. Fortunately the thorough understanding of the problem, reached through bitter experience in the past fifteen years, has made it possible at the present time to measure stellar velocities with a high degree of accuracy.

The velocities of some four hundred of the brighter stars have in the past six years been measured with the Mills spectrograph attached to the great Lick telescope. These stars are situated between the North Pole and 30 deg. south declination, and are distributed more or less uniformly over this section of the sky. The results have been combined in an attempt to determine the elements of the stellar motion. It is evident that while the individual stars have their individual motions, yet if the solar system is moving toward a given point in the sky, the stars in that portion of the sky will on the average appear to be moving toward the solar system; and that the stars in the opposite portion of the sky will appear to be moving away from the solar system. Conversely, if the velocities of the stars in all parts of the sky be known, it is possible by mathematical analysis to determine a point such that the stars within a concentric area will have the maximum velocity of approach toward the solar system, and the stars in the corresponding opposite area will have the maximum velocity of recession. The solution referred to led to the result that the solar system was moving approximately in the direction of the southern boundary of the Lyre with a speed of 12½ miles per second.

There is no doubt that the result for speed is close to the truth; but it is reasonably certain that the direction of motion is somewhat in error. The weakness of the solution lies in the fact that the observed stars are not distributed uniformly over the *entire* sky. The region from 30 deg. south declination to the South Pole is not represented at all. This deficiency in the observed data affects the direction of motion vastly more than it does the speed.

It has for many years been my desire to organize a spectroscopic expedition to the southern hemisphere, for the purpose of extending the observations to the South Pole of the sky. The problem under solution, and the needs of such an expedition, were recently brought to the attention of Mr. D. O. Mills, who most generously provided funds for constructing the apparatus, for employing the astronomers, and for meeting all general expenses.

The telescope recently constructed for this purpose is shown in the accompanying illustration, set up on Mount Hamilton for adjustment and trial. It is a reflector of the Cassegrain form. A parabolic mirror of silver-on-glass will be mounted in the extreme lower end of the tube. This mirror, now rapidly approaching completion, is 37¼ inches in diameter and 5⅞ inches thick. The accurately polished surface is 36¼ inches in diameter. There is a hole 5 inches in diameter in its center. The rays of light from the star would be brought to a focus 17½ feet above the mirror; but a hyperbolic convex mirror 9¾ inches in diameter is to be placed 4½ feet inside the focus, just within the upper end of the tube, to receive the converging beam of rays from the large mirror and reflect them back through the hole in its center. The rays will thus be brought to a focus about 12 inches below the lower end of the telescope tube, exactly on the slit of a powerful spectrograph. The spectrograph is shown supported by a steel truss. In theory it resembles the Mills spectrograph now in use at the Lick Observatory; but in reality it embodies many new departures in design. Hitherto the conventional spectrograph has been supported entirely from its upper extremity, the entire instrument projecting out into space "at arm's length," so to speak, thereby inviting injurious flexure effects. The present instrument is supported at two points in such a way that strains in the supporting truss cannot by any possibility induce strains in the spectrograph.



THIRTY-SEVEN-INCH MILLS REFLECTING TELESCOPE AND SPECTROGRAPH.

The telescope is mounted equatorially in the usual way. Motion is communicated to the instrument, however, in a somewhat unusual manner. The large sector on the right carries a groove in its edge accurately turned to the arc of a circle; and attached to the lower point of the arc is the clock cord. This follows in the groove to a point on a level with the clock, where the cord can be seen running to the winding drum. The