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R.H. Goddard: A Method of Reaching Extreme Altitudes

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THEORY OF THE EXPERIMENTS IN VACUO

The expressions for the velocity of the expelled gases are easily obtained for the two types of motion of the suspended system that were employed; namely, simple harmonic motion produced by a spring, and direct lift.

Simple Harmonic Motion

Results obtained with simple harmonic motion (slightly damped, of course) were naturally more accurate than with direct lift, as it was impossible in the latter case to eliminate friction. The theory, for simple harmonic motion, in which account is taken of friction is described in Appendix B, p.73. The spring was one made to specifications, particularly as regards the magnitude of the force per-cm.-increase-in-length by the Morgan Spring Company of Worcester, Mass. Care was taken to make certain that, in no experiment was the extension of the spring reduced to such a low value as not to lie upon the rectilinear line part of the calibration curve.

Direct Lift

The theory of the motion, in this case, has already been given under Appendix A, p.72. In this case it might be assumed that a correction could be made for friction by multiplying the displacement s, by some particular decrement, $^{[d1/d2]}$ obtained in the experiments with simple harmonic motion, that might reasonably apply. This, as will be shown below, was found to give results in good agreement for the two types of motion, if the direct lift was about 2 cm; but not if it was much larger. It was found that very little

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