mass. For instance, it is not easy at first to conceive the waters of a great river flowing constantly *down* towards the sea, while waves are rolling *up* the very same part of the stream; and while the great elevation, which makes the tide, is travelling from the sea perhaps with a velocity of fifty miles an hour. The motion of such a wave, or elevation, is distinct from any stream, and is of the nature of undulations in general. The parts of the fluid stir for a short time and for a small distance, so as to accumulate themselves on a neighboring part, and then retire to their former place; and this movement affects the parts in the order of their places. Perhaps if the reader looks at a field of standing corn when gusts of wind are sweeping over it in visible waves, he will have his conception of this matter aided; for he will see that here, where each ear of grain is anchored by its stalk, there can be no permanent local motion of the substance, but only a successive stooping and rising of the separate straws, producing hollows and waves, closer and laxer strips of the crowded ears.

Newton had, moreover, to consider the mechanical consequences which such condensations and rarefactions of the elastic medium, air, would produce in the parts of the fluid itself. Employing known laws of the elasticity of air, he showed, in a very remarkable proposition,[6] the law according to which the particles of air might vibrate. We may observe, that in this solution, as in that of the vibrating string already mentioned, a rule was exhibited according to which the particles *might* oscillate, but not the law to which they *must* conform. It was proved that, by taking the motion of each particle to be perfectly similar to that of a pendulum, the forces, developed by contraction and expansion, were precisely such as the motion required; but it was not shown that no other type of oscillation would give rise to the same accordance of force and motion. Newton's reasoning also gave a determination of the speed of propagation of the pulses: it appeared that sound ought to travel with the velocity which a body would acquire by falling freely through half *the height of a homogeneous atmosphere*; "the height of a homogeneous atmosphere" being the height which the air must have, in order to produce, at the earth's surface, the actual atmospheric pressure, supposing no diminution of density to take place in ascending. This height is about 29,000 feet; and hence it followed that the velocity was 968 feet. This velocity is really considerably less than that of sound; but at the time of which

[6] *Princ.* B. ii. Prop. 48.