

**A TEXT-BOOK ON SOUND:
THE
SUBSTANTIAL THEORY OF
ACOUSTICS. PP.155-236**

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A 'TEXT-BOOK ON SOUND:

The Substantial Theory of Acoustics,

ADAPTED TO

The Use of Schools, Colleges, etc.,

BY REV. J. I. SWANDER, A. M. D. D.

(Being the 10th Chapter of His Book, entitled, "The Substantial Philosophy.")

CAREFULLY REVISED BY

A. WILFORD HALL, Ph. D., LL. D.,

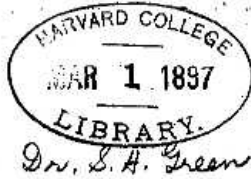
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PREFACE.

IN presenting this Text-Book on Sound to the student of physical science it is requisite that it should be prefaced by a brief explanation. Some ten years or more ago we became convinced that the views of scientists concerning the nature and character of the physical forces were essentially weak and erroneous, and after considering the matter seriously for a year or two, accompanied by numerous experimental investigations, we resolved that every form of natural force, or, in other words, that every phenomena-producing or sensation-producing cause in Nature must of necessity be a real objective existence, or an actual substantial entity, as much so as are the grossest material objects with which our sensuous observation brings us into contact.

This new departure from the generally received mode-of-motion theories of the text-books involved so much reconstruction in physical philosophy that we were at first appalled at the magnitude of the task we had assumed, provided we should decide to persist in our revolutionary crusade against modern scientific theories. Suffice it to say that, after the most careful consideration of the various questions involved in the premises, we were forced to the decision that either

all the forces of Nature, or phenomena-producing causes, were modes of molecular motion, or else that they were all but different forms of substance variously graduated in the scale of physical existence, commencing at the highest plane of the material substances as observed around us. As all our reasoning and experimenting had forced us to the belief that no mechanical or sensuous effect could be produced in Nature without the intervention of a substantial cause of some kind, we were driven irresistibly to the latter general conclusion as stated above, namely, that the forces were all substantial entities, which led at once to the general classification of all the phenomena-producing causes in the universe into material and immaterial substances.

At this point in our analysis of the problems involved, we struck the key-note to the whole subject in the single question of the nature and phenomena of sound. Either *sound* must be included in the category of the substantial forces or phenomena-producing causes, or else there would be a spanless chasm in this new Substantial Philosophy which would break up its continuity, and totally vitiate the symmetry of our proposed revolutionary work in physical science. Hence our attention was instantly concentrated upon this single paramount phase of the discussion as the key to the situation.

It was not a very startling position to assume that light, heat, electricity, gravity, magnetism, cohesion, life, mind, soul and spirit, might be considered real entities or objective existences in some form or character, since different philosophers at different ages of the world had variously questioned the non-entitative nature

of many of these phenomena-producing causes. But not so with *sound*. The whole scientific world without one exception were united, and had been for centuries, in regarding this form of physical force as an indisputable mode of motion and nothing else. Hence, should we succeed in showing all the other forms of natural force to be real entities or substantial existences, and should we leave *sound* out of the category, a mere novice in the discussion of science would at a glance see that our whole grand attempt at a new and harmonious system of natural philosophy must be set down as a logical abortion.

This, then, explains why so much space and critical labor were given up to the sound discussion in the "Problem of Human Life," in which our new departures in physical science were first given to the public.

Of course, in that first attempt to show the fallacy of the wave-theory of sound as universally taught, and to outline the substantial theory of acoustics, we are free to admit that many minor errors in expression, and some in calculations, found their way into the generally correct arguments and positions of that monograph. Dr. Henry A. Mott, Ph. D., LL. D., of New York, one of the brightest and best posted scientific investigators in the United States, and who has, after the most careful consideration of the entire matter, unqualifiedly indorsed the Substantial Philosophy, including the substantial theory of sound, expresses his astonishment that the whole question of acoustics was so thoroughly and correctly presented in that early treatise in the "Problem of Human Life," with so few errors to take back, considering the

fact that the author had not one line of previous discussion *pro* or *con* in that direction with which to guide his pen or aid him in steering clear of mistakes. How noble and magnanimous is this view of the case in a great scientific investigator, rather than stopping to carp at some trivial error in language or mistake in calculation, thereby ignoring all the great truths and arguments of the monograph, as has been the case with so many previous reviewers of that work since its first publication!

This brings us to the present formulation of the sound-theory, as presented in the following concise questions and answers, covering, as they do, the whole subject of acoustics from beginning to end. When Dr. Swander wrote us, some four months ago, that he was at work on a volume to be entitled the "Substantial Philosophy," in which he purposed to formulate every branch of that subject in different chapters, and that *sound* would occupy the tenth chapter of the book, he requested us to assist him in the way of suggesting and correcting matter for the various questions and answers of that special chapter on acoustics. We gladly consented to do so, and we have to say, for the credit of Dr. Swander's generous estimate of our original labors on this branch of physics, that he did not demur to a single suggestion we made involving the scientific aspects of the discussion as presented in his eighty-nine questions and answers.

In consideration for such assistance on our part Dr. Swander voluntarily gave us this tenth chapter of his book as our own personal property, to be published and sold as a *text-book on sound* for the use of schools and colleges. As such we now offer it to teachers and

students, believing as we do that in the midst of all the prejudice which is naturally called forth against scientific innovations by the routine work of a professorship in setting forth the accepted theories of science, there still remain, with a vast majority of professors and students, an abiding willingness and even anxiety to receive new truth in science and philosophy how much soever it may cross the paths of previous investigators.

We request, therefore, that teachers, into whose hands this little work shall chance to fall, shall not lay it aside till they have critically examined and considered every question, answer, and foot-reading it contains. If after carefully comparing the various solutions of sound-problems as set forth in the substantial theory with those of the current doctrine of acoustics, the reader shall candidly and without prejudice decide that the wave-theory presents the more reasonable view of acoustical science, we cheerfully submit, believing that the truth upon the subject, in whatever direction it may lie, will ultimately prevail.

A. WILFORD HALL.

NEW YORK, 23 Park Row, Jan. 1, 1887.

As a further and concise embodiment of the substantial theory of sound, preparatory to an intelligible understanding of the succeeding pages, we add the following brief statement of its cardinal features as furnished to the Cleveland (Ohio) *Plain Dealer* at the request of its editor, and as copied into the *Scientific Arena*, Vol. 1, page 45: