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ULTRASONICS APPLIED TO ELECTRODE REACTIONS

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OBJECT OF THE STUDY

The problem is the use of ultrasonics produced by magnetostriction as a means of studying phenomena at the interface between electrode and electrolyte.

RESEARCH DURING THE PERIOD

At the outset of the second year of the project, it was necessary to secure a replacement for the research assistant, It was fortunate that a man of excellent qualifications and experience was available. Naturally, however, the new man was completely unfamiliar with the project and equipment, even in the form in use at that time. Moreover, to quote from the last report: "It must be pointed out...that during the period [the last month of the preceding period] many...observations, both photographic and visual, showed distinctly ambiguous, erratic and unexplainable results as well as a lack of reproducibility under supposedly identical conditions.

Such observations mean that there must be present several disturbing factors of a totally unknown nature which at times exert a pronounced influence on the results. Before this method can be relied upon to furnish results justifying definite conclusions, the causes of these spurious effects must be located and eliminated.

In this connection the present complex assembly involving many separate components, has evolved gradually as the need for a greater variety of measurements and control of conditions has become evident. Each separate unit of this assembly should be restudied, redesigned, and relocated if necessary, to improve its functioning both alone and in conjunction with

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other components. There are already strong indications of a disturbing interaction between some of the elements of the system and of unsatisfactory operation of individual units. In addition to gaining familiarity with the status of the project and the nature of the equipment the new man started the work with these recommendations.

New equipment received during the period included: (1) a Dynagage for the determination of amplitude of vibration of the magnetostriction tube, (2) a research-type d-c amplifier, and (3) a constant-voltage transformer as a power supply for the oscillator.

Preliminary tests with the Dynagage showed it to be in satisfactory operating condition. For the intended purpose, however, it will be necessary to design and mount a suitable pick-up unit for the end of the magnetostriction tube.

During the first two months of this period, extensive tests both by the operator and by the Detroit distributors showed the new d-c amplifier to be defective and it was returned to the manufacturer. In the meantime the distributors loaned the project a similar unit for temporary use.

As a result of an extensive testing program with this amplifier incorporated into the assembly, it was concluded that much higher precision and stability should be attainable in the measurements than have been realized heretofore.

In order to achieve these results, it was necessary to redesign the measuring circuits, taking particular care to attain the maximum possible in magnetic and electric shielding of each component. Another improvement is the use of a new instrument incorporating in one unit the potentiometer with a high-impedance preamplifier.

The constant-voltage transformer referred to above was incorporated as an additional safeguard to eliminate any undesirable effects due to variations of line voltage. This unit was surrounded by a suitable shield and installed in an adjacent room.

To house the various critical components of the measuring and electrolyzing circuits, in accord with the tests mentioned in the previous report, a large panel box has been constructed. In individual sections of it, each separately insulated and shielded, have been mounted (1) the potentiometer and pre-amplifier; (2) the switch gear, meters and potential divider, which serve the various purposes of controlling the electrolyzing current and permitting selection of the potential combination to be measured; and (3) the variable source of electrolyzing current. Shielded leads have been used throughout. In this connection some structural modifications of the potentiometer were found advisable. Additional circuits have been built into the

permanent unit which considerably extend its usefulness and which should serve all phases of the project now foreseen. Most of the necessary components for the construction were available in the laboratory. Since no meters of the proper specifications were readily available, however, two were purchased and adapted to the purpose by the construction of suitable shunts.

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