The first experiments were carried out with a disc of sooted glass. The resulting grooves had a thickness of 0.05 mm., despite the fact that the stylus used had very fine points,

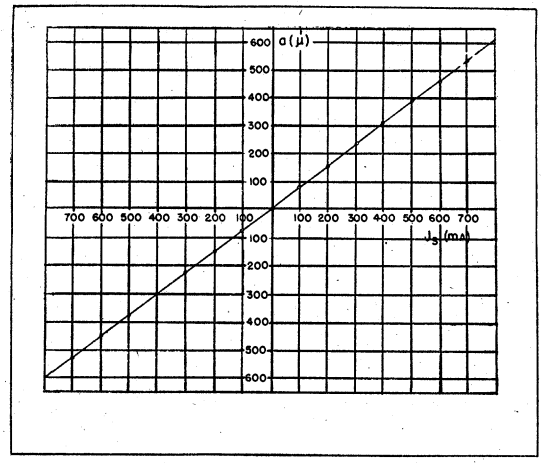

FIG. 5. Amplitude characteristic of the electrodyne recorder.

because the soot was removed in clinging flakes. The requirements which the coating must meet are: homogeneity (no crystal formation), pliability (minimal effect upon the amplitude and frequency characteristics of the recorder), sufficient opacity of very thin layers, and fine tracings during recording.

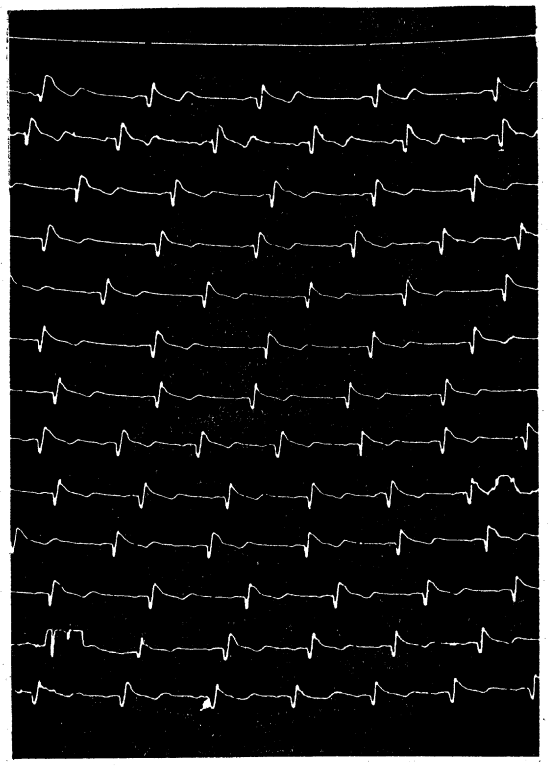

FIG. 6. Photomagnification of a part of an electrocardiac record.

After several trials with pigmented albumin, gelatin, and paraffin coatings, a pigmented and desiccated solution of soap proved most appropriate. The tungsten point mentioned produces a groove 0.01 mm. thick in the soap. At an amplitude of 0.5 mm. the capacity of customary oscillographic methods is exceeded considerably. Not every soap is suitable for this purpose. The best results were accomplished with an American soap; the reason for this is now being investigated.

Discs of plate glass 30 cm. in diameter and 8 mm. thick were used as recording material. The disc should have an absolutely smooth surface, since even fine scratches damage the stylus. The manufacture of recording material is practicable and simple with the standard laboratory outfit. The cost is low, since the discs may be reused indefinitely.

Fig. 6 shows an electrocardiogram obtained with the method described above. The disc rotated constantly at 0.25 r.p.m. so that points on two adjacent grooves lying on the same radius represent events occurring 4 minutes apart.

This new electromechanical method of oscillography, although developed primarily for medical use, may, of course, be applied to other fields. Technical details of its development will be given in a later report.

Experimental Production of Anti-Rh Sera by the Use of Human Erythrocyte Stromata

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It was shown by Landsteiner and Wiener (*3*) that erythrocytes of *Macacus rhesus*, when injected into rabbits or guinea pigs, will produce an antiserum which, after suitable absorption, reacts with 85 per cent of human Caucasian bloods but fails to react with 15 per cent. Later, Gallagher and Jones (*2*) produced anti-Rh sera of the same specificity by the injection of human Rh+ erythrocytes into guinea pigs. Also subsequently, Wiener and Belkin (*4*) demonstrated that the Rh agglutinogen resides in the stroma of the erythrocyte and that it is of a haptene nature.

It had been shown earlier by Witebsky and Heide (*5*) that the injection of rabbits with boiled stromata of type N human erythrocytes produced sera having a high titer of N antibodies and a low titer of species specific antibodies. Calvin, *et al.* (*1*) have shown that the Rh haptene is probably a lipoprotein and is heat labile. We have inoculated guinea pigs with freshly prepared stromata of Rh+ human erythrocytes and produced antisera which, when absorbed with Rh− red cells until they no longer reacted with the absorbing cells, gave reagents that distinguished between Rh+ and Rh− erythrocytes.

The stromata were prepared by lysing Rh+ red blood cells in distilled water. The suspensions were passed through a Sharples supercentrifuge and the lysate discarded. The stromata were repeatedly washed with distilled water and centrifuged until the wash water was free of hemoglobin. With the resulting pale pink, gelatinous residue guinea pigs were immunized by repeated intraperitoneal inoculation. One week or more following the last injection the pigs were bled and the sera separated. After inactivation at 56°C. for 30 minutes the sera were absorbed as indicated above

with Rh− erythrocytes. In this way two antistromata testing sera were prepared.

TABLE 1

COMPARATIVE SPECIFICITIES OF Rh TESTING SERA

Commercial anti-Rh_o	Antirhesus guinea pig	Antistroma guinea pig No. 516	Antistroma guinea pig Sg	No. of cell specimens
+	+	+	+	79
−	−	−	−	20
+	−	−	−	2
−	+	−	−	2
+	−	−	+	2
+	+	+	−	1
+	−	+	+	1
+	+	−	+	1
+	+	−	−	1
Total				109

The specificities of these sera were determined by testing them against 109 blood specimens chosen at random. For comparative purposes simultaneous tests were also performed with commercial anti-Rh_o serum (Blood Transfusion Betterment Association, New York City) and guinea pig antirhesus serum. The results of these tests are summarized in Table 1.

It is apparent that the stromata of Rh+ human red blood cells can serve as a suitable antigen for the production of Rh testing sera in experimental animals. With the particular stromata used in our experiments sera approximating the specificity of human anti-Rh_o serum were produced. The few divergent results noted in the data may be ascribed to the well-known differences in avidity of some red cells for antibodies in the sera or to inherent reactive characteristics of guinea pig serum.

Some of our other experiments, which are not sufficiently developed to report at this time, suggest that Rh subtype sera may be produced experimentally by careful selection of the cells used for immunization and absorption.

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Book Reviews

Principles of radar. (2nd ed.) Members of the Staff, Radar School, Massachusetts Institute of Technology. New York–London: McGraw-Hill, 1946. 12 Chapters. (Illustrated.) $5.00.

This book was originally written for use as a reference text at the M.I.T. Radar School during the war. Although the second edition has been reworked and brought reasonably up to date, there remains some evidence of the high security classification of radar during the war years. This eliminates much of the most recent work on the subject. The book brings together in one place something of all the important wartime radar developments for the use of students and the numerous technical people who have been kept away from radar activity by other pursuits.

The radar art has grown in the last few years to such an extent that it is not possible in this one volume to cover completely all phases of the subject. For this reason the quantitative details which are necessary to an equipment design are missing, and the field of radar test equipment has been entirely excluded. However, a sufficient description of each technique is included to show its field of applicability.

Advantage is taken of the numerous specialists available to M.I.T. by having a large number of contributors, each in his own field. It is surprising that the tones of the various chapters, written by different authors, have been kept as similar as they have.

In a few instances the authors have made that mistake which is too common with technical writers—the procedure of giving the details of operation of a particular circuit or device without first having given both the purpose of the device and an outline of the fundamental concepts upon which its operation depends. The reader thus finds it necessary to read the exposition at least twice. However, on the whole, this kind of thing has been avoided, and the book has been kept reasonably easy to read. The action of multivibrators, for instance, has been well handled to avoid making this relatively simple device seem complicated.

The early chapters cover an "Introduction" to radar; "Timing Circuits," including ringing circuits, blocking oscillators, and pulse-forming networks; and cathode-ray "Indicators," with the many possible circuits for producing sweep voltages or currents. A chapter is devoted to wide-band "Receivers," their noise problems, and the automatic frequency-control systems necessary at the extremely high radio frequencies sometimes employed. Transmitters are covered by three chapters on "Magnetrons," "Triode Transmitters," and "Modulators." The changes required in these components to obtain short, high-power pulses in packages consistent with the low average power are significant. Separate chapters are provided on "Radio-Frequency Lines" and "Wave Guides and Cavity Resonators" in order to outline the many new techniques in these two fields. An especially long chapter on "Radar Antennas and Propagation" is needed to cover adequately the many forms which highly directive antennas may take. A chapter on "Transmit-Receive Devices" points out antenna-switching methods to permit the use of a single antenna alternately for transmitting and receiving. The text is concluded with a chapter on "Synchros and Servo-Mechanisms" to show, very briefly, how antenna position information may be delivered to suitable indicators and computers.