

# High-Speed Cinematography of Agitation and Mixing Processes (Film Lecture)

PAPER J-5

By WERNER KRAUS

Presented on October 17, 1960, at the Fifth International Congress on High-Speed Photography in Washington, D.C., by Werner Kraus, Leverkusen-Bayerwerk, Farbenfabriken Bayer, Germany.

# Technique of Measurement of Blood Cell Velocity in Transparent Chambers in Animals

PAPER J-6

By P. A. G. MONRO

IF THE blood stream in a small arteriole is examined under a microscope with a flash source of light whose frequency is gradually reduced to a certain rate, the images of the corpuscles show no general direction of movement. This flashing rate is critical for any one blood vessel and is related to the actual velocity of the corpuscles. If the flashing rate is further reduced the *apparent* direction of motion is reversed.

If a cine film is exposed at a gradually increasing (or

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decreasing) frame rate (10 to 100/sec) which passes through this critical flashing rate, and is projected at a constant rate, this apparent reversal of the general direction of blood flow is still evident. The true blood cell velocity may be calculated from the magnification and measurement of blood cell movement over a series of frames exposed at a known rate. Relative changes in blood velocity in different vessels in the same microscopical field are better able to provide information of what occurs in the vascular bed as a result of an experiment.

In this technique a flash cathode-ray tube provides light pulses (of one millisecond order) and is triggered photoelectrically by the rotating shutter of the camera. Time marks at 100/sec are made on the edge of the film.

# Photographic Problems, Techniques and Instrumentation in Sea Animal Locomotion Studies

PAPER J-7

By IRVING REHMAN

PUBLISHED REPORTS OF researches and observations on sea animal locomotion indicate that many sea mammals and fish are capable of achieving high speeds with very small expenditures of energy over long periods of time and with little observable drag. Since the energy requirements for these velocities are far beyond that available from the animals' muscular and vascular systems, the need for accurate data and measurements under controlled conditions of the power requirements to accelerate to maximum speed, maintain top speed, glide and decelerate, was evident in order to determine objectively whether these inordinately great efficiencies were actually being obtained.

A porpoise was trained to perform a number of tasks on command for this research program. Hydrodynamic,

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physiological and acoustic studies of this phenomenon were undertaken by NOTS and also at several associated facilities. High-speed photography (above and under water), underwater schlieren, reflected light, spark, high-powered stroboscopic, and synchronized stroboscopic motion-picture photography were used. Additional techniques using neutral density beads, bubbles and dyes were also used to visualize the flow fields and boundary layer control. Extremely accurate timing data were obtained simultaneously.

Studies of the anatomic structures of the porpoise, whale and some fast-swimming fish demonstrated peculiarities that necessitated physiological studies of vascular flow to ascertain its influence on boundary layer control and flow field. Acoustic data were also taken during the course of these hydrodynamic and physiological tests. A motion picture of the test facility, equipment (timing and photographic, etc.) and some of the results obtained were shown.