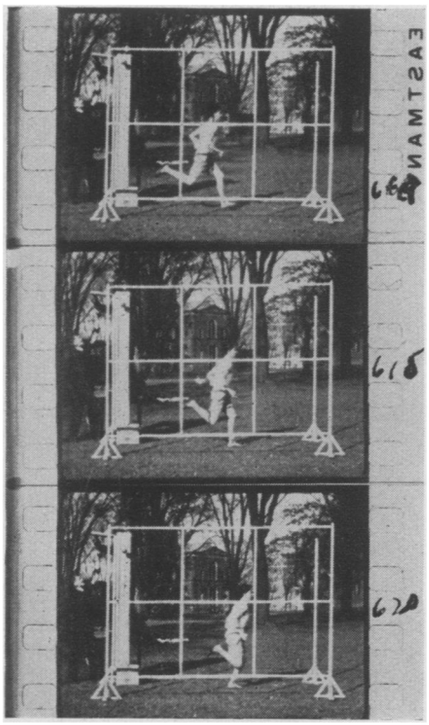

MEASURING A RUNNER'S EFFICIENCY

These three views, chosen five pictures apart so that greater change of position is shown, are among 2,000 taken by Dr. C. A. Morrison. The falling ball on the left is used to time accurately the runner's movements.

ASTRONOMY

More Names Added to Shaw's List of Universe Makers

Scientists in America and Europe Have Assisted Einstein And Developed Worthy Theories of Their Own

ALBERT EINSTEIN may well be, as George Bernard Shaw declared, the "greatest of our contemporaries," but there are other men working in similar or related lines that also may occupy a prominent place in some future history of "universe makers."

Willem de Sitter, the modern Dutch astronomer who has applied some of Einstein's ideas to form a theory of a finite yet limitless universe that differs in important respects from that of the German, is one. Another is Sir Arthur Eddington, leading English student of relativity. Recently Sir Arthur called attention to the works of Father Le Maitre, of the University of Louvain, in Belgium, and at one time connected with the Harvard College Observatory. Le Maitre's idea of a continually expanding universe reconciles some of the chief difficulties of the older ideas.

In America there is Dr. Ludwik Silberstein, of Rochester, who has made studies on the size of the universe that indicate that it may be much smaller than was formerly supposed. Dr. R. C. Tolman, of the California Institute of Technology, has worked out a theory of the universe on the basis of observational results obtained at the neighboring Mt. Wilson Observatory. These were obtained first by Dr. Edwin P. Hubble, and later also by Milton Humason, and showed distant nebulae apparently moving away with tremendous speeds, many thousands of miles a second. Dr. Tolman interprets this as an illusion, due to the structure of space.

Shaw's list of "universe makers" included Pythagoras, Aristotle, Ptolemy, Nicolas Copernicus, Galileo Galilei, Johann Kepler, Sir Isaac Newton and Albert Einstein. Among the names that might be added to this list are the following: Hipparchus, who really invented the theory known under Ptolemy's name; Aristarchus of Samos, who lived from 310 to 230 B.C., and who anticipated Copernicus by suggesting that the earth revolves in a circular orbit around the sun; Eudoxus of Cnidos, who placed the sun, stars and planets on crystal spheres with the earth at the center, providing the foundation for Hipparchus, and lived about 367 B.C.; Thales of Miletus, about 580 B. C., the first known great astronomer, who broke away from the mythological ideas then in vogue, and suggested that the earth was a disc floating in water; Anaximander, of 610 to 545 B.C., the first to recognize that the heavens form a sphere which revolves around the north star; Tycho Brahe, 1546 to 1601, Danish nobleman who proposed that the sun revolved around the earth, but that the other planets revolved around the sun, thus providing a stepping stone from the Ptolemaic theory to the Copernican; and Sir William Herschel, 1738 to 1822, who was the first to make a scientific study of the universe of stars, rather than merely the solar system.

Science News Letter, November 8, 1930

Efficiency of Runner Shown As 23 Per Cent by Movies

AS A MACHINE, the body of a runner doing a hundred yard dash is only 23 per cent. efficient, C. A. Morrison, of Eastman Teaching Films, Inc., told the Society of Motion Picture Engineers at their recent meeting in New York. Mr. Morrison described work that he had done in collaboration with W. O. Fenn in using movies to analyze the mechanical energy expended by the sprinter.

By measuring the oxygen utilized by the runner, physiologists have found that the amount consumed is equivalent to the production of 13 horsepower. High speed motion pictures were made of runners at the University of Rochester. In this way they found that the runner has an output of only 3 horsepower in actual mechanical work so that his efficiency as a machine is rather low.

They measured the displacements of the arms and legs, as they appeared when projected on a screen, from more than 2000 separate pictures, and calculated the velocities of the arms and legs during their swings.

"The results showed that more than half the mechanical work was required to swing them and that 0.7 horsepower was expended to stop them at the end of the swing, making a total of 2.4 horsepower utilized in the arms and legs," they say. "The overcoming of the resistance of the feet making contact with the ground required 0.4 horsepower, while wind pressure and gravity accounted for 0.2 horsepower."

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