taken in less than one minute after the apparatus is filled with the gas to be analyzed. The atmosphere analyzed is in no way changed by the process of analysis, and no solutions are required. Continuous indicating or recording of CO_2 concentration is possible in some cases where extreme accuracy is not required. It is possible in such cases to control automatically the CO_2 concentration at any desired value by the use of a thermal conductivity cell together with an electrical recorder-controller of a commonly used variety.

A thermal conductivity apparatus of general laboratory utility can easily be assembled from standard laboratory electrical equipment, following descriptions in various references already cited. A useful apparatus for general use was described by the writer.[10] While designed particularly for the determination of fuel gas/air ratios, it can be used for many thermal conductivity measurements of high accuracy by substituting a high sensitivity reflecting galvanometer for the less sensitive pointer galvanometer.

CRANDALL Z. ROSECRANS

THE AXIS OF THE HUMAN FOOT

PREVIOUS workers on the human foot have held divergent views concerning the position of the axis of the foot. Attempts have been made to compare the human foot with that of even-toed forms, in which the axis lies between the second and third digits, or with the odd-toed types, with the axis coinciding with the third digit. The latest view is that of Morton,[1] which maintains that the functional axis of the foot of the human and of apes differs from that of other mammals in that it lies between the first and second digits.

No doubt the difficulty of determining the axis of a structure as complicated as that of the human foot is responsible for this confusion. The position of the axis of the ungulate foot can be ascertained by sheer morphological observation. With the human foot such observation has led to no definitive solution of the problem.

Fortunately, it is now possible to determine the position of the axis of the human foot by experimental procedure. Recently one of us[2] published a description of a new method by means of which the distribution of pressure in the human foot at any instant can be recorded cinematically as a pattern of dots, the area of the dot varying with the pressure being exerted. For details of the method and samples of the results the original article may be consulted. We have now calibrated the variation in area of dot with variation in pressure. By the method of moments it has been possible by extensive calculation to determine, for the step illustrated in Fig. 2 of the article mentioned, the position of a resultant force having the same effect as the various discrete pressures recorded.

The position of this resultant must lie on the axis of the foot, if the axis, as is usually considered, represents the line of functional symmetry of the foot. It would be more accurate to refer to a plane of symmetry and to say that the resultant lies in the line of intersection of this plane with the horizontal.

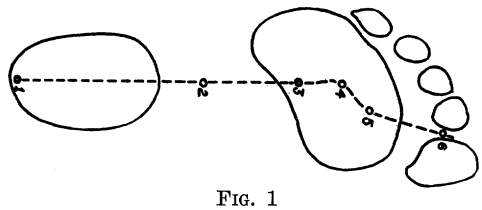

FIG. 1

The accompanying diagram (Fig. 1) illustrates the position of this resultant at successive moments in the course of one step, the path of the resultant being indicated by a dotted line. The position of the axis at any moment can be approximately determined by drawing a tangent to the dotted line through the position of the resultant at the moment under consideration.

Until the step is half completed, the axis passes through the center of the heel and along the medial border of the third metatarsal. As the heel is lifted and the metatarso-phalangeal joints dorsi-flexed, the axis becomes directed definitely inward, at the conclusion of the step lying between the first and second digits. By visualizing the successive positions of the foot in space, it is possible to follow the changes in position of the axial plane.

The position of this functional axis varies with the degree of toeing in or out and may very well vary with the structural condition of the foot. A comparison of the human foot with that of the chimpanzee is nearing completion. A detailed report of our findings will be published as soon as supplementary measurements by another method have been accomplished.

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