

1

FORD MOTOR COMPANY  
JOHANSSON DIVISION  
A CENTURY OF PROGRESS  
CHICAGO ILLINOIS  
1934

History of the Measurement of Length

STANDARD OF LENGTH

Linear Standards originated naturally from parts of the human body. The length of the forearm from elbow to middle finger-tip was the ancient Sumerian and Egyptian unit of measurement, called the Cubit, the symbol of which was the figure of a forearm. There were various cubits differing somewhat in length, but two were of outstanding importance, the Royal Egyptian Cubit averaging 20.62 inches and the Olympic Cubit of 18.24 inches, of which there is now no known specimen, but its length has been recovered from measurements of the Greek Parthenon. Col. Belajew, the Russian metrologist, has shown the relationship between the two cubits, i.e. "the area of a square on the Olympic Cubit equals that of a circle whose diameter is the Royal Egyptian Cubit". The Olympic Cubit was sub-divided into 2 spans (of about 9 inches), 6 palms (3 inches), 24 digits ( $3/4$  inch).

At a later date, two-thirds of the Olympic Cubit became the "Foot" which was sub-divided by the Greeks into 12 thumbnail breadths. The foot unit passed to Rome and so to Britain where its division of twelfths or "unciae" became "inches". In Britain the Roman Foot became merged with the Anglo-Saxon measures which also contained the Fathom or length across the two arms outstretched, equal to 4 cubits or 6 feet. Under the Norman kings, half-a-fathom or one arm outstretched from the middle of the body was found to be a more convenient length, particularly for measuring cloth, the most important trade. Thus, the Yard of 3 feet arose, and a bronze yard bar was kept as the Standard of Reference in the King's Exchequer, first at Winchester and later at Westminster. Very few of these old Exchequer standards have survived. Queen Elizabeth's Yard remained the standard from 1558 to 1824 when it was superseded by Bird's Standard Yard of 1760 which was destroyed by the fire at the Houses of Parliament in 1834. When the new imperial standards to replace them were completed in 1855, two copies of the yard were presented to the United States, arriving in this country in 1856.

Later these copies were compared with the accepted 36 inches of the Troughton scale and finally they were accepted by the Office of Weights and Measures as the standards of the United States. On July 28, 1866, Congress passed the act legalizing the metric system as the standard for the United States.

CUBIT

First known measurement. About 20 inches. Length of forearm from point of elbow to end of the middle finger.

DIGIT

Breadth of finger. From .72 to .75 inch.

PALM

Width across an open hand at base of fingers. About 3 inches.

INCH AND FOOT

Three barley corns taken from center of ear, placed end to end equals 1 inch. (Edward II - 1324)

Foot ranged from 9-3/4 inches to 19 inches.

YARD

King Henry I decreed the distance from the point of his nose to the end of his thumb was the lawful yard.

ROD - 16th Century

Lawful rod was length of left foot of 16 men lined up as they left church on Sunday morning.

IN 1851

Sir Jos. Whitworth invented first measuring machine using end standards, capable of detecting differences of one millionth of one inch.

VERNIER CALIPER

The first and original vernier caliper as far as is known was invented by Jos. R. Brown in 1851. One thousandth of one inch could be measured with this instrument.

MICROMETER CALIPER

Systeme Palmer patented in France 1848 was original micrometer Sheet Metal Gage made by Brown and Sharpe in 1867.

1882

The Rogers-Bond Universal Comparator used for the transfer and comparison of line measure standards.

METRIC GAGE BLOCKS

First set produced by Carl Edvard Johansson in Eskilstuna, Sweden in 1899.

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### WHAT IS ONE MILLIONTH PART OF AN INCH?

1. One Millionth (.000001") part of an inch is to one inch as one inch is to 15.78 miles.
2. One Millionth (.000001") part of an inch is 3000 times finer than a human hair, which is approximately three thousandths (.003") of an inch thick.
3. The Gage Maker works to an accuracy of One Ten-Thousandth (.0001") part of an inch, but this is 100 times greater than One Millionth (.000001") part of an inch.
4. The average newspaper is printed on paper that is approximately three thousandths (.003") part of an inch thick, and this is three thousand times greater than One Millionth (.000001") part of an inch.
5. One Millionth (.000001") part of an inch is to one inch as One-Sixteenth (1/16") part of an inch is to One Mile.
6. One Millionth (.000001") part of an inch is to a human hair as a human hair is to 9 inches.
7. One Millionth (.000001") part of an inch is forty-six thousand (46,000) times finer than the thickness of a new dime.

### WORLD'S STANDARD OF MEASUREMENT

In 1923, Mr. Henry Ford acquired the manufacturing rights for the Western Hemisphere and established Mr. Johansson and his associates in a modern laboratory at Dearborn, Michigan. There the unparalleled precision of Johansson Gages became readily accessible not only to the Ford Motor Company, but to the entire manufacturing and scientific world. These gages are accurate within eight, four or two millionths part of an inch.

The demands of civilization in its onward march for higher ideals are such that practically everything we use in our everyday living is directly or indirectly dependent on Johansson Gage Blocks - a product of the Ford Motor Company.