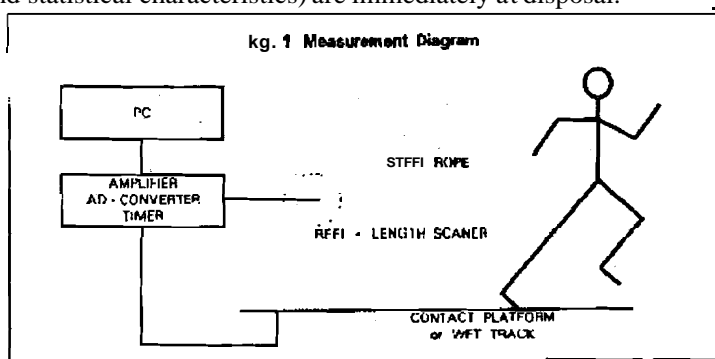


MEASUREMENT OF KINEMATIC PARAMETERS OF RUNNING

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The device (Fig.1) was made for measurement of **kinematic** parameters of **running**. It consists of an amplifier, analogue **to-digital** converter, timer and **mechanic**-electronical scanner of track impulses. Data gained by measurement of time and length are immediately processed by a personal **computer** (ON LINE). Fundamental data (time of measured distance, contact time, flight time and stride length of every step) are processed and together with other derived ones (stride rate, velocity, many indexes and statistical characteristics) are immediately at disposal.



The principle of **measurement** is based on time measurement of connected and nonconnected electrical circuit and at the same time the length of run distances is measured.

There are two ways how to connect electrical circuit - "DRY" and "WET". By "DRY WAY" the contact time of a leg is measured by mean of contact platform which performs **the** function of an electrical switch. By "WET WAY" electrical circuit consists of a **thin** steel rope (pulled by a runner) which is conductively connected to the runner's body, electrodes attached on running shoes and slightly wetted artificial surface.

Measurement of length of run distance is got by mean of a steel rope which is unwinding by a runner. Stride length is determined by mean of electrical impulses of a scanner separately during surface contact and flight.

The final time of measured distance is gained by measurement of stated number of impulses from the length scanner.

TECHNICAL PARAMETERS

"DRY WAY" - The width of a contact platform is 70 cm. The height in connected state is approximately 3 mm, in nonconnected state approximately 5 mm. The error of **measurement** of connection time is maximally 0.3 ms. The weight of contact platform is approximately **1kg/1m**. Maximal measured distance is determined by the **weight** of a rope. Recommended measured distance is maximally 50-60 m. It is possible to measure stride length with exactness of 0.5 cm. The error of length measurement is maximally 0.5 %. Connection of the contact platform is possible by the minimally power of **1.5 N/cm²**, of course beside an elasticating element.

"WET WAY" - Power needed for connection of electrical circuit is practically zero. The errors of time and length measurement are the same how in the "DRY WAY".

APPLICATION

The device can be used as the means of speed abilities testing in sport training of track and field athletes (Fig.2,3).

Fig. 2 Flying Start - Hurdles (5.135s - 40m)

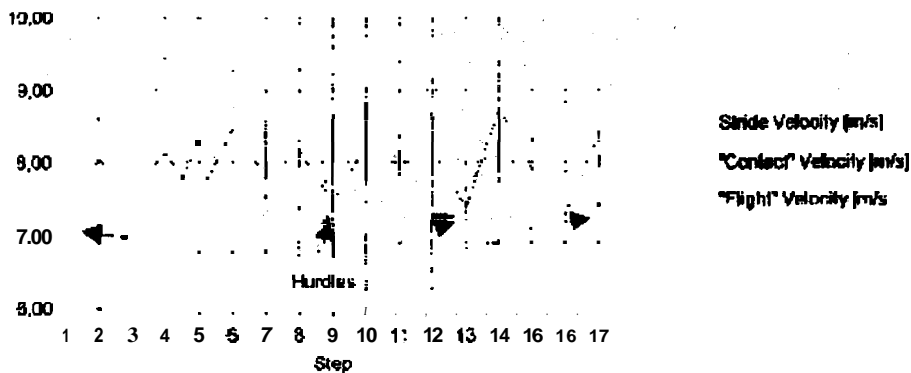
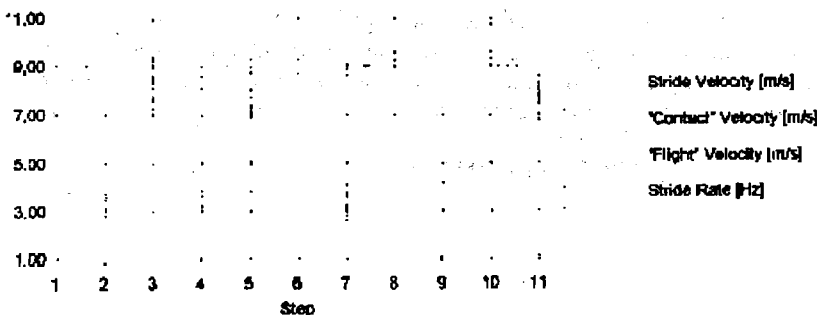
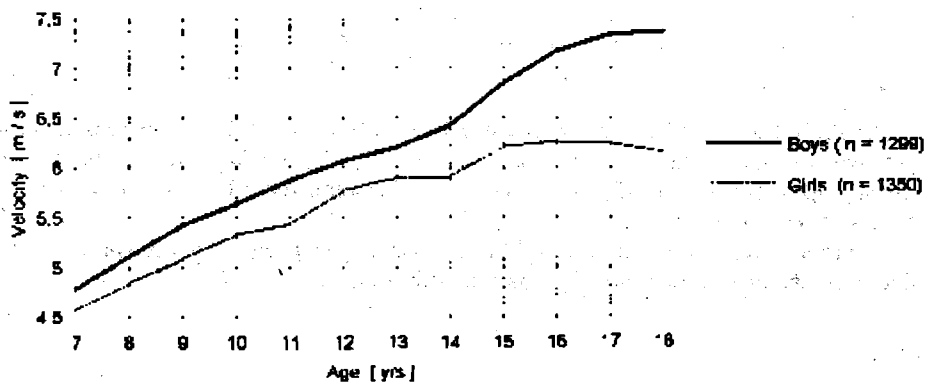


Fig. 3 Long Jump (700 cm)



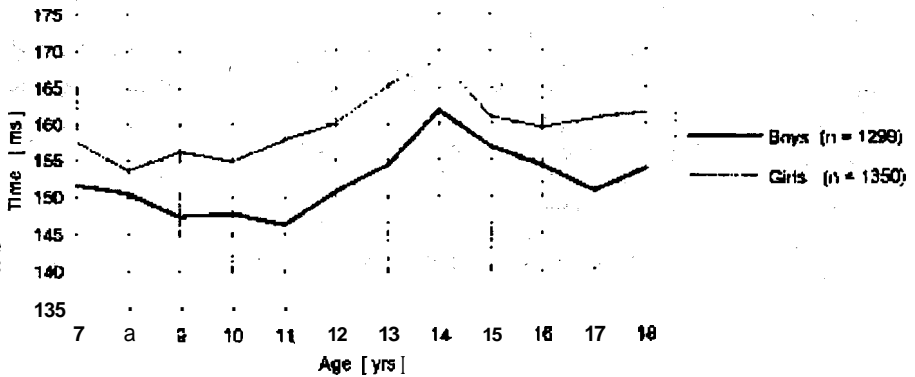
The example of second sphere of its application was measurement of time-and-space parameters of running of Slovak population with the aim to determine their developing characteristics (Fig.4-7).

Fig. 4 Stride Velocity



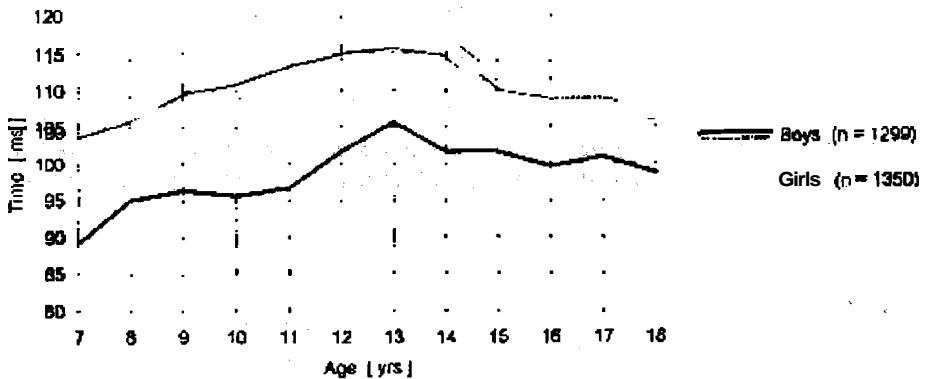
The run velocity (Fig.4) in boys was increasing equally and only in the age of about 14, the results of 20 m flight **run** increased rapidly. In girls, the puberal age was the reason of more swinging results. The velocity became fixed only after the puberal process was finished - about the age of 15. **Thanks** to intersexual differences in body height, the run stride in girls was longer than in boys (Fig.5). The lengthening of the run stride in girls took place in the pre-puberal age and was finished in the age of about 13,5.

Fig. 6 Contact Time



The contact time in boys and girls (Fig.6) was rapidly increasing in the age of 11 - 14 with the peak values in the age of 14. The next development was characterized by the increase of power (increase of the total body weight) followed by the decrease and later on also by the stabilization of the average values of the flight and contact times.

Ag. 7 Flight Time



The flight time (Fig.7) in boys was stabil up to the age of 11, it increased rapidly between 11 and 13, and then decreased again. In girls, the flight time was increasing **lineary** up to the age of 13, then decreasing between the 13. and 15. year of age followed by stabilization.

The total level of contact and flight times was lower in boys even in spite of the fact that both changes were relatively small in both groups.