THE THROWING EVENTS: RECENT TRENDS IN TECHNIQUE AND TRAINING

By Peter Tschiene

In this overview on methodological trends in the throwing events, the author, Chief Editor of "Leistungsport", outlines the various parameters involved in the preparation of high-class throwers. Although written in 1988, these principles still apply today. Re-printed with permission from New Studies in Athletics.

The overall development of top level performances in the throwing events in recent years is the result of continued improvements in both technique and training. For the purposes of this overview it is useful, first of all, to distinguish the main areas of development for consideration: Technique - which, as the most important determining factor in the achievement of top level results, must always be considered first and in connection with Technical Preparation, and the areas where the most important changes have taken place in the last few years, i.e. Performance - Modeling, Conditioning and Planning and Periodization of the training programme.

1. Technique and Technical Preparation

Biomechanics leads to early emphasis on technique

1.1 Through biomechanical research, as well as the experience of many coaches, it is now understood that each throwing event has its own typical "structure of velocity and rhythm in movement". For example, the velocity - rhythm structure of a top class javelin throw can be demonstrated by the relationship of the last 4 or 5 strides in the run-up and the final result. The length, duration and frequency of these strides heavily influences the movement of the upper body parts, the release of the implement and, thus, the final performance.

In Table 1 the data on the final 5 strides of the run-up of a 94.44m performance (old specification javelin) by Uwe Hohn (GDR) is given.

This example confirms the model data for the velocity-rhythm structure of the last strides of the run-up for experienced throwers presented by Soviet researchers in 1979 (Table 2).

From this model data, Kuznesov et al. have detected very high correlations between the final result and the times of the last strides of the run-up: .724 - .774 - .892 - .943! Based on this data the following prerequisites, which are considered essential for a 90m performance, are given:

- Length of approach: 40-43m
- Final run-up velocity: 8-8.3 m/sec
- Path of acceleration of the javelin in the final phase: 280-305cm
- V (release velocity): 35 m/sec

Table 1 - The velocity-rhythm structure of U. Hohn's last strides of the run-up (performance 94,4m)

Items	The last strides of the run-up				
	1.	2.	3.	4.	5.
Stride lenght (m)	2,07	1,81	2,13	2,07	1,44 (1,84)
Stride duration (sec)	0,36	0,30	0,26	0,34	0,24
Stride frequency (steps/sec)	2,77	3,33	3,57	2,94	4,17

(Ref. to O. Dmitrussenko, 1986)

Table 2 - Model items of the velocity-rhythm structure of the last strides of the run-up (javelin)

Items	The last strides in run-up				
	1.	2.	3.	4.	(release)
Time (sec.)	0,331	0,259	0,351	0,275	
Stride frequency (steps/sec)	3,021	3,864	2,846	4,253	

(Ref. to Kusnezov, Petrovskij, Schustin, Kiev 1979)

For the new specification javelin it is necessary to slightly increase the angle of release over 35° and the angle of inclination up to 7°.

1.2 Following on from the typically short duration of the last stride, there are three peculiarities in technique which have developed recently among top level throwers. The first is an optimum bending of the right knee without any change before the touchdown of the left foot. The purpose of this (see O. Dmitrussenko 1986) is to transmit the horizontal velocity of the body's center of mass first to the larger muscle groups and then to the smaller muscle groups (shoulder, arm, hand) involved with the throw. The second is that the right leg is not extended (pushed forward) early, as this transmits velocity to the shoulder but not the pelvis and the trunk. The third is that, after watching the technique of world ranked throwers, we note the importance of arm action maximally far away from the vertical line (over the left foot). The purpose (see O. Dmitrussenko, 1986) is to avoid early shoulder activity before pelvis action.

1.3 The methodological consequence of this information for the technical preparation of young athletes is that every young thrower must learn, as early as

possible after specialization, the velocity-rhythm structure of his/her event. This is the number one principle of teaching and learning any throwing event.

Table 3 - Model items of the preparation of discus throwers

Elements	Items	
THROWS	MEN	WOMEN
With shot 7,25/4kg backward	22 - 23m	21 - 22m
With discus 2,5kg	54-56m	
With discus 1,5kg	76 - 78m	55 - 56m
With discus 0,75kg		78 - 80m
SPRINT		
30 meters flying start	3,1 sec	3,4 - 3,5 sec
JUMPS		
Standing long jump	3,40 - 3,50m	2,80 - 2,90m
Standing triple jump	10,30 - 10,40m	8,40 - 8,50m
High jump/Sargent test	95 - 105cm	85 - 90cm
WEIGHTS		
Cleans kg	180kg	
Squats kg	250 - 260kg	170 - 180kg
Bench press kg	220 - 230kg	140 - 150kg

Table 4 - Model items of the preparation of hammer throwers

THROWS	
Weight of 16kg (of 10kg)	20m (24m)
Hammer 18kg (1,00m)	48 - 50m
Hammer 6kg	88 - 89m
Hammer 5kg	93 - 95m
With shot 7,25kg backward	21 - 22m
JUMPS	
Standing long jump	3,40 - 3,50m
Standing triple jump	9,50 - 9,80m
High jump/Sargent test	95 - 100cm
WEIGHTS	
Squats	260kg - 280kg

(Ref.to Vozniak 1984)

Table 5 - Model items of the preparation of javelin throwers

Elements of model	Items	
THROWS	MEN	WOMEN
Shot 4kg both arms	29 - 31m	
Shot 3kg both arms		20-22m
Shot 7,25kg backwards	18 - 20m	
Shot 5kg backwards		18 - 20m
Javelin (standing)	79,50/70$_x$	56-58
Javelin 600g (run up)	105$_x$	new javelin
JUMPS		
Standing long jump	3,50m	2,80 - 2,90m
Standing triple jump	10,30 - 10,50m	8,20 - 8,40m
High jump/Sargent test	100 - 105cm	85 - 90cm
WEIGHTS		
Cleans kg	160 - 180kg	
Squats (full) kg	200 - 210kg	140 - 150 kg
Bench press kg	220 - 230kg	140 - 150kg

Table 6 - Model items of the preparation of shot putters

THROWS/PUTS		
Shot norm. backward	21 - 22m	21 - 22m
Shot 3kg shifting		23 - 23,50m
Shot 5kg shifting		20 - 20,50m
Shot 6kg shifting	23,20m	18 - 18,50m
Shot 8kg shifting	21,30m	
JUMPS		
Standing long jump	3,40 - 3,50m	2,90m
Standing triple jump	9,50 - 10,00m	8,60m
High jump/Sargent test	95 - 100cm	85 - 90cm
SPRINT		
30 meters flying start	3,1 - 3,2sec	3,4 - 3,5sec
WEIGHTS		
Bench press kg	240 - 250kg	140 - 150kg
Squats kg	270 - 280kg	170 - 180kg

(Ref.to Vozniak 1984)

In the first stages of this process it is necessary to use lighter implements because the young athlete lacks power. The early learning of the skills and high speed coordination of the specific movement required for a top level performance is vital because it is nearly impossible to re-learn faulty skills later on when the athlete is mature and has developed more explosive power abilities.

Javelin throwers, for example, must be taught to execute the third to last and last strides faster in relation to the other strides of the run-up.

1.4 At the present time this author does not see any further trends in technique in the Shot Put, Hammer and Discus events, assuming that the new technique for the Hammer developed in the Soviet Union by Bondarchuck is already well known.

2. Performance Modeling

Performance modeling means modeling the training load

In addition to the usefulness of performance models it has become clear that it is nearly impossible to prepare a top class thrower without models, i.e. guidelines, for training. Tables 3, 4, 5, 6 illustrate the training models given by S. Vozniak (1984).

These models are also based on biomechanical research. The most notable points are the throwing exercises with various implements and the jumping tests. These underline the trend towards more “speed” work and a reduction of weight work and performances. Outside of some standard exercises with the barbell, only weights or other resistance exercises which are very similar to certain phases of the throw or directly transferable to the specific throwing motion are used. It should also be pointed out that there are no differences between the training for men and women.

3. Conditioning

Emphasis on Specific Conditioning

3.1 Because of the specific character of functional adaptation in sportsmen it is no longer considered worthwhile spending time on so called “General Preparation”. All exercises which are necessary and transferable to the main movement of the throw must be used in training as “Specific” work. This means, according to Bondarchuck and Vozniak (1984), that there is no longer a difference between general and specific loads because the first will not be used by top athletes except for recovery and regeneration. However this situation is quite different for young throwers.

Figures 1 and 2 demonstrate specific exercises for hammer and javelin throwers respectively.

3.2 An important aspect of top level training is that Technical Preparation and Conditioning are always done together in a single session. The reason for this is that it is becoming more and more evident, and therefore important to understand, that the athlete is always acting in his/her entirety. By separating the two areas of stimulation of the training load the functional adaptation of the athlete will be separate, uneven and unbalanced making the final results poor and uncertain. Technical Preparation and Conditioning work must be transferred

to the competition movement at the same time and reach their maximum levels at the same time in order to gain the best possible results.

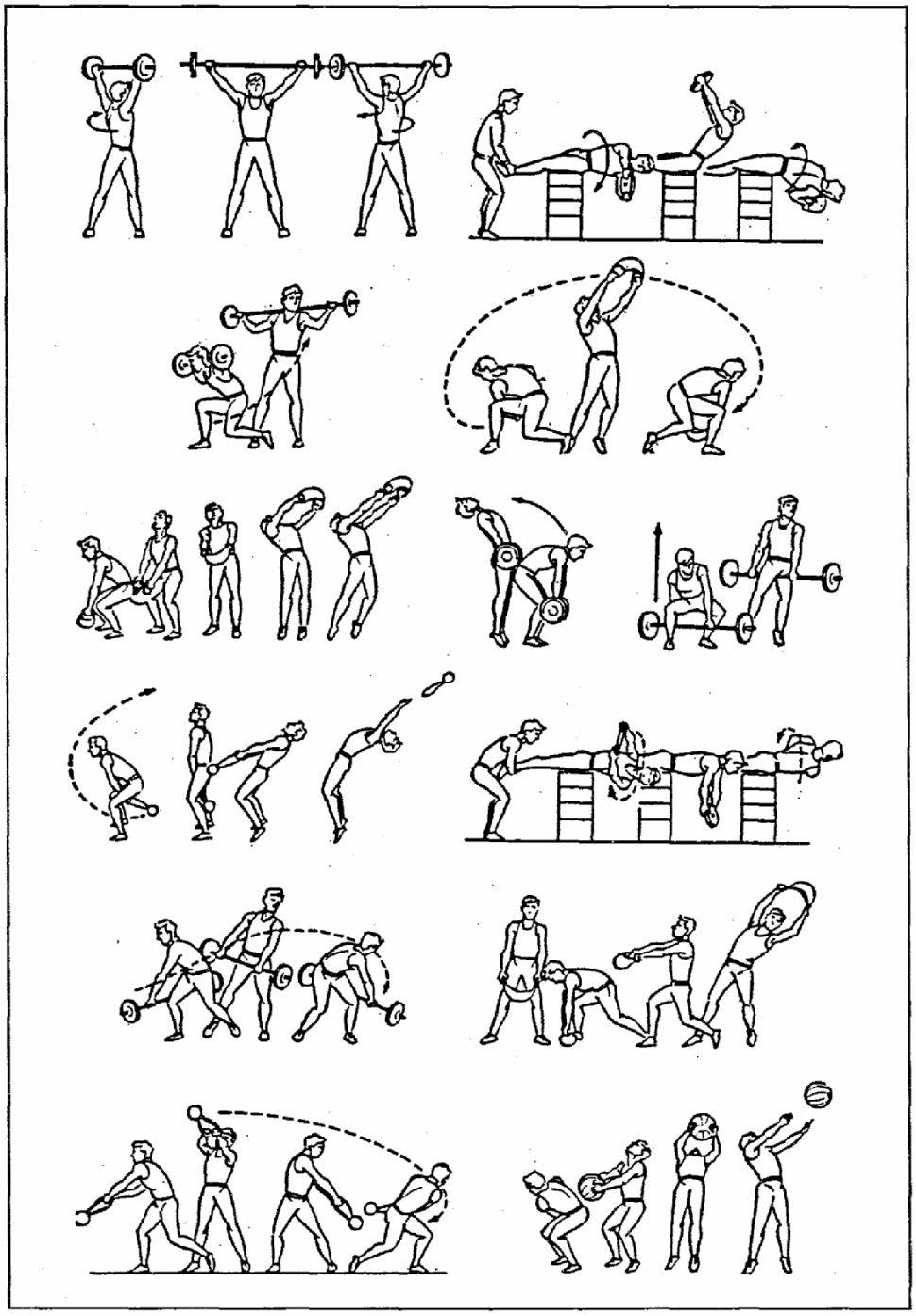

Fig. 1 - Power exercises for hammer throwers

3.3 As examples of the new ideas in the training of throwers I present weekly programmes for the hammer (Bondarchuck, 1985) and javelin (Lusis and Dmitrussenko, 1984, 1986) in Figures 3 and 4 which demonstrate the typical

organization of the daily training load. The reader can easily see that a certain order of programme succession is observed in order to optimize the athlete's functional adaptation. I am sure that this type of organization of training load and programme succession will be the main basis for future improvements of the world records in the throwing events.

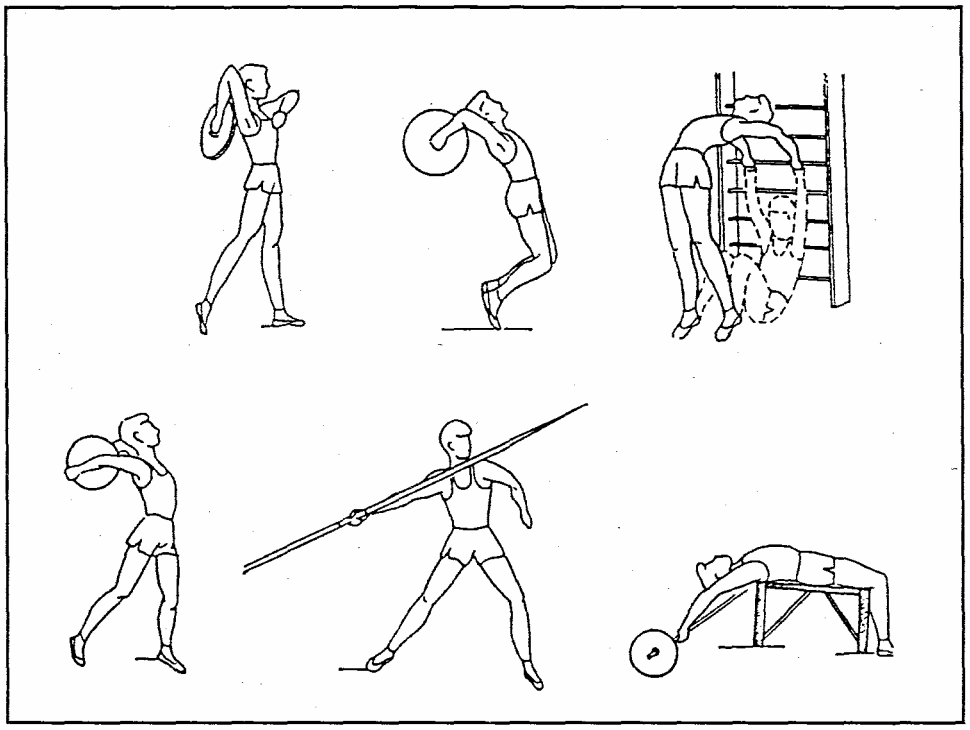

Fig. 2 - Exercises for javelin throwers

Fig. 3 - Weekly cycle of top level javelin throwers (late stage of preparation - 2,5 months) (6 days - 6 sessions)

Monday. Javelin throws with complete approach 40 - 50, weight exercises 6 - 7 tons).

Tuesday. Imitation exercises with light weights 30 minutes, weight exercises 10 tons, Sprinting - accelerations 300 meters, jumps over hurdles 150, hurdling 200 meters.

Wednesday. Throws with stones - technical improvement 100, basket-ball 30 minutes.

Thursday. Javelin throws 50, throws with stones in different kind 30, jumps from standing 30 - 40, weight exercises 3 tons, imitation exercises 20 minutes.

Friday. Recovery.

Saturday. Javelin throws with short run-up 45 - 50, with complete approach 15, hurdling 200 meters, jumps over hurdles 50, sprinting-accelerations 250 meters.

Sunday. Different throws with shot 80, jumps from standing 60, sprinting accelerations 300 meters, special flexibility exercises 20 minutes.

Fig. 4 - Weekly cycle of top level hammer throwers

Variant I (5 days - 10 sessions)

Monday, Tuesday, Friday: *morning session* warming up 10 minutes, throws with light hammer (6 kg) 12, throws with standard hammer 15, throws with heavier implement (9 kg) 10. *Evening session* warming up 10 minutes, weight exercises 10 tons (snatch 1,5 t, twisting 1 t, good morning 1,5 t, half squat 4 t, jumping from half squat 2 t).

Wednesday and Saturday: *morning session* warming up 10 minutes, throws with 16 kg-implement (50 cm) with 1 or 2 turns 30, long jump from standing 15, throws with 16 kg-implement in different kind 50, triple jump from standing 10, *evening session* warming up 10 minutes, weight exercises 5 tons (twisting 2 t, jumps from half squat 1 t, half squat 2 t).

Variant II (6 days - 12 sessions)

Monday, Wednesday, Friday: *morning session* warming up 10 minutes, throws with light hammer (6,5 kg) 10, throws with standard hammer 10, throws with heavier hammer (8,5 kg) 10, *evening session* warming up 10 minutes, weight exercises 8 tons (twisting 2 t, step test on bench with barbell 3,5 t, cleans without splitting 2,5 t).

Tuesday, Thursday, Saturday: *morning session* warming up 10 minutes, throws with 16 kg-implement in different kind 100, long jump from standing 30. *Evening session* warming up, weight exercises 5 tons (twisting 1,5 t, good morning 1,5 t, jumping from half squat 2 t); game 20 minutes.

4. Planning and Periodization

Individualization of the annual training cycle

4.1 Another increasingly essential factor in the improvement of results is the individualization of top level training. It is vital for the coach to understand the response of the athlete to the various forms and loads of training. Bondarchuck has distinguished 7 types of throwers based on their responses to training work within a 2 to 7 month time frame. Each athlete responds to a training stimulus within a certain number of months (type N2 = 2months, N3 = 3 months...). This indicates the length of athlete's individual phase or period of adaptation and top form development or, more simply, his/her "Development" type. One of the main tasks for each coach is to determine the athlete's development type through psychological tests and daily observations on the field.

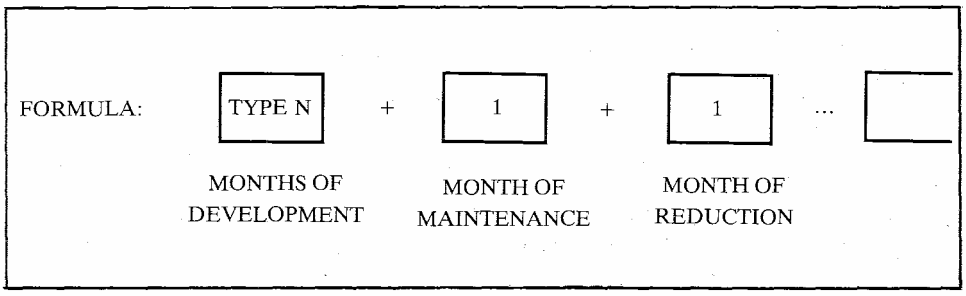

Fig. 5 - The formula of the phases of top form in athletes

Figure 5 illustrates a model of training organization based on the athlete's development type and the phases periods of individual adaptation.

In order for an athlete to reach top form and peak at the time of the most important competitions it is necessary to change up to 50% of the programme at the end of the development period. This means employing different exercises while maintaining basically the same structure and effect as before. The athlete can delay the reaching of top form and peaking if necessary by not changing the exercises employed thereby prolonging the development period.

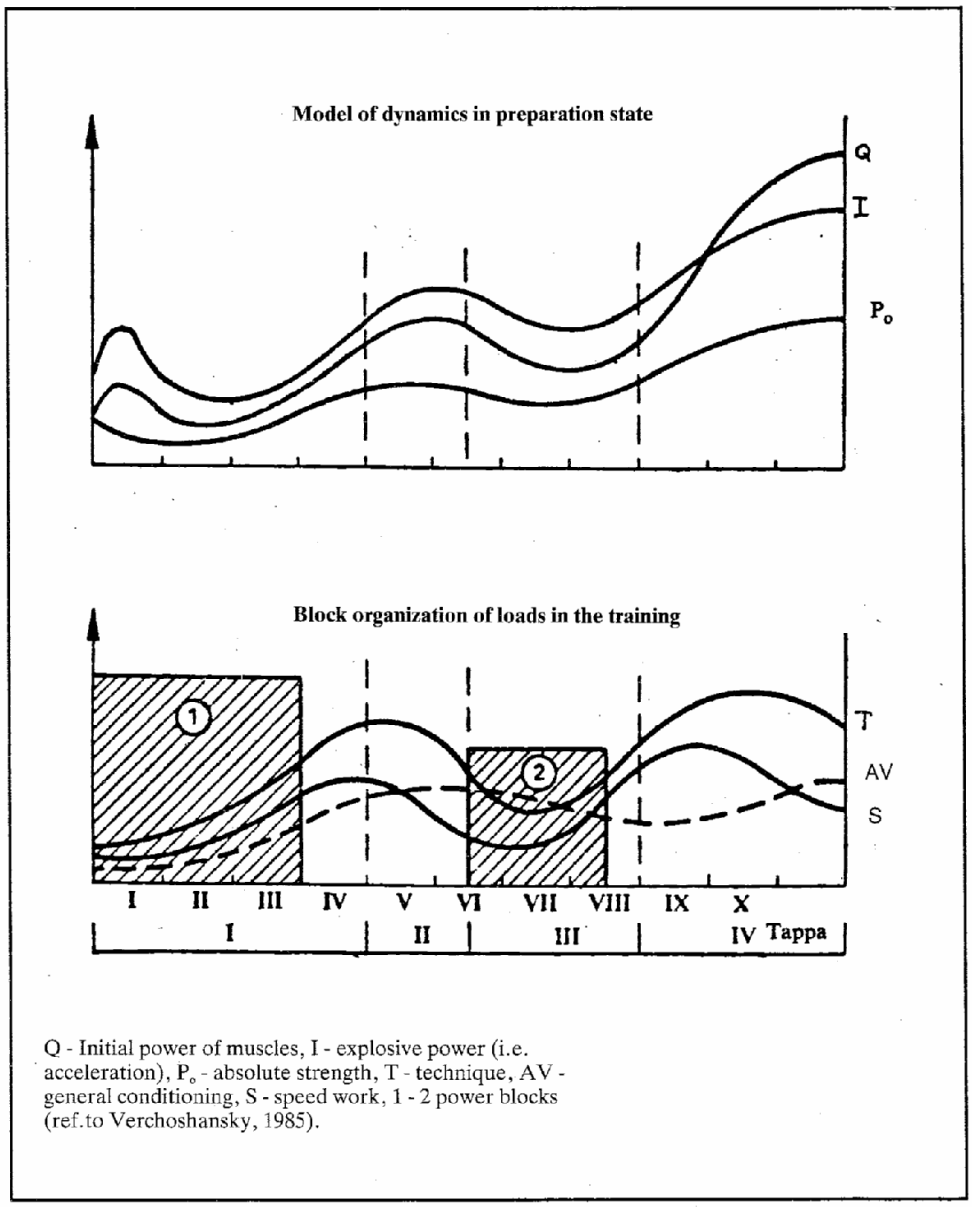

Fig. 6 - The block-organization (structure) of annual training for throwers and jumpers

After reaching top form the athlete enters a period of form maintenance which lasts nearly 4 weeks. If there are no further changes in the programme the athlete will then drift into a period of form reduction which will also last about 4 weeks.

4.2 There is a second model structural schedule being used by some athletes which has been developed by Verhoshansky (1985). This so called “Block Structure” (Figure 6 on the following page) contains a strict concentration of strength and power exercises in 2 or more time blocks of 2 to 2 and 1/ 2 months. Spaced between these blocks are periods for technical and speed development. This structure is based on the optimum model of dynamics in the athlete’s preparation state.

The purpose of this structure is to avoid unnecessary fatigue, by distributing power conditioning year round, and to allow a better transfer of explosive power and increase in velocity level in the special technique.

4.3 At this time, the model put forward by Bondarchuck is more highly regarded as it has the great advantage of proof of its effectiveness in all the major championships since the Moscow Olympic Games and the recent increases of the world record in the hammer throw.

5. Conclusion

In general the main trends in the preparation of top athletes for the throwing events are running in the direction of higher quality both in theory (Satori and Tschiene, 1987) as well as in practical training. The themes of these trends are individualization, use of models of top results, use of models for preparation, changes in training methods and loads to facilitate better adaptation, recognition of the central and dominate role of the competition technique and the increasing importance of competitions (Ivoilov et al, 1986) as an essential stimulus for improved results.

REFERENCES

1. DMITRUSSENKO, O.: Javelin throw - the modern technique (Russ.). Liogkaja atletika. Moscow 1986, N. 6.

2. KUSNEZOV, V., PETROVSKY, V., SCHUSTIN, B.: Model items of athletes in track and field (Russ.) Kiev 1979.

3. BONDARCHUCK et al.: The athletic throws (Russ.) Kiev 1984.

4. VOZNIAK, S. in BONDARCHUCK (3).

5. DMITRUSSENKO, O., LUSIS, J. in BONDARCHUCK (3).

6. BONDARCHUCK, A.: Hammer throw (Russ.) Moscow 1985.

7. VERCHOSHANSKY, J.: Programming and organization of the training process (Russ.) Moscow 1985.

8. SATORI, J., TSCHIENE, P.: Die Fortentwicklung der Theorie des Trainings (progress in the theory of training). In “Leistungssport” Frankfurt/M 1987, N. 2.

9. IVOILOV, CUKSIN, SCHUBIN, LEVITJAN: The preparation of sportsmen by a very frequent participation in competitions (Russ.). In “Teorija i praktika fiziceskoi kultory”, Moscow 1986, N. 11.