# Our Shots Make Medalists

*Interviewer: Takamasu Kanji*

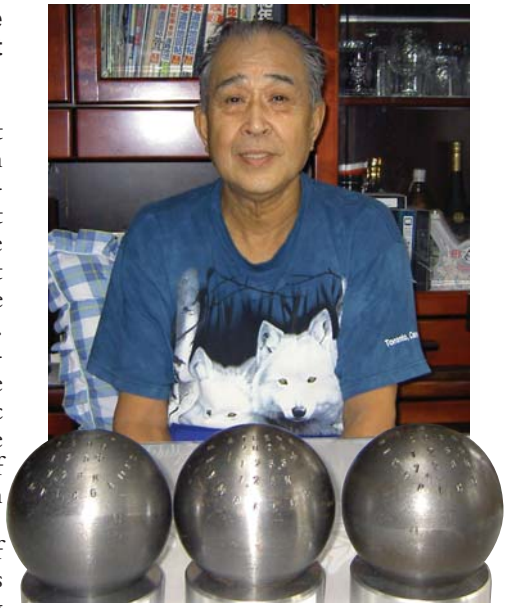
IN track and field at the Olympic Games, Japan swept the medals, winning gold, silver and bronze. Moreover, this has continued through three Olympics, at Atlanta in 1996, at Sydney in 2000 and again at Athens in 2004. Really? What event was that? The shot put!? But Japan didn't even have any athletes competing in the shot put! That's right. It wasn't the Japanese athletes but the Japan-made shot balls that were all selected by the medal winners. But are not the shots used in the shot put just metal spheres? Despite the weight and size being set, why should the world's top athletes all prefer to select Japan-made shots? Television, newspaper, magazine and other media representatives all converged on the manufacturing site. What they found was a small factory through a narrow shopping street on the outskirts of Tokyo, bearing the sign board Tsujitani Industry. The reporters were more surprised to see an aged craftsman operating a manual lathe on cast metal there. The shot balls were actually produced by hand. What kind of secret was he hiding? We interviewed Tsujitani Masahisa, now 73 years old, and as vigorous a craftsman as ever.

**Could you tell us what exactly are the rules for the track and field event called the shot put?**

**Tsujitani:** The shot put event cannot really be considered a major sport within track and field. Since the shot put population in Japan numbers only about 5,000, it is not widely recognized like baseball or soccer. The sport started out in Scotland as stone-tossing, and the British Army used it for training. Nevertheless, it is a traditional sport recognized as an official event from the very start of the modern Olympic Games in Athens in 1896. For the Games, the International Association of Athletics Federations (IAAF) has drawn up detailed rules.

Standing in a circle with a diameter of 2.135m (7ft), athletes toss metal spheres that weigh, for male athletes, 7.260kg (16 pounds) or more, competing for distance on a field that spreads forward at an angle of 34.92 degrees. The method of tossing is very particular, with the athletes starting by pressing the shot against their chin or neck, and then throwing it with one hand. It is against the rules for the hand holding the shot to be lower than the shoulder or pulled backward (IAAF rule 188-1). So the shot put action is not so much a toss as it is a push-out from the shoulder.

While at first glance the shot put appears to be a pure strength event, in fact a high degree of technique is required. Back in the 1950s, for example, the US athlete Parry O'Brien invented the technique of starting out facing 180 degrees away from the direction of the toss to build up speed, and he secured records in the 19m range, double the previous record. Later, a spin put on the sphere extended the record even more. So this event requires an extremely fine balance of muscle strength plus speed, angle of toss and other factors, and new techniques are constantly being developed.



Then, manufacturers of the shots used in the events are required to make a metal heavier than brass within a range of 7.265-7.285kg, shaped into a sphere with a diameter of 110-130mm. In addition to iron or brass, lead or other metals can also be used for the shots, as long as it falls within a 20g weight range and a 20mm diameter range. The men's specifications also include 6kg and 5kg shots for young boys, while women use a 4kg shot, and each of these have correspondingly smaller diameters (IAAF rule 188-2).

**How did you first start making the shots for track and field events?**

**Tsujitani:** I started in 1968 when I received a manufacturing request from a client, Nishi Sports. At the time, the Japan Association of Athletics Federations (JAAF) set the local standard for Japan. Since this was a loose standard that merely stated that the shot had to weigh 7.260kg or more, there were more than 10 companies in Japan serving as suppliers. The situation changed completely in 1986, however, when the JAAF adopted the IAAF standard.

With the weight limited to a narrow range of 7.260kg plus 5-25 grams, those 10-plus companies soon withdrew from the shot manufacturing sector, and our company is now the only one left. With processing becoming more difficult and rejects increasingly common, shot manufacturing was no longer economical.

**Isn't precision in metal processing the norm, with requirements for length in micron units and for weight in one gram or less? Why is control within a 20-gram weight range so difficult?**

**Tsujitani:** It is understandable why you might think that. But when molten metal hardens, hardening to a uniform density for the whole object never happens. Because brass is an alloy of copper and zinc, the difference in the specific weight of the components results in the heavier copper sinking to the bottom and leaving the lighter zinc on top when it hardens. Even where the only metal component is iron, in fact it still contains carbon and other elements, and the rate of shrinkage varies due to differences in cooling speed caused by the air temperature. Some parts are inevitably harder and heavier while other parts are softer and lighter, and the size also varies.

So when the spherical metal lump is removed from the mold, and is then automatically shaped on a numerically controlled lathe, for example, many of the resulting products will either be too light or the size too large and fail to meet the standards, a situation that cannot be profitable for a manufacturer. That is because sports goods are so expensive that hardly anybody uses them. That is the main reason why so many companies quit the sector.

I have taken some foreign-made products and examined them. In some cases, they have bored into the shot and poured in heavy lead. While the shape is a simple sphere, meeting the standard is not simple at all.

**How did you prepare yourself for this work?**

**Tsujitani:** First I studied casting. Kawaguchi City has a concentration of some of the best casting industries in Japan, and since I already had a company in the city for a client, I visited that company frequently over a two-year period to get them to teach me what they knew, and searched for the most suitable metallic composition for shots. I finally settled on a cast iron material called FC 200. This is a smelted cast iron material consisting of 40% of cast iron, 45% of scrap iron and 15% of other steel materials obtained from a smelter.

*Tsujitani grinding a shot*

I also developed a mold suitable for use in processing. For example, the original cast item for making a 7.260kg shot for adult males comes in at about 8.5kg when the lathed part is included. But cast items hardened from the same size mold can vary by as much as 10-100 grams in weight.

To put it simply, I then grind off much of the heavier parts, and carefully finish it so that the final product has a dimension of 125mm.

**What is the most difficult part about grinding the cast item?**

**Tsujitani:** I really struggled to grind so that the center of gravity would come to the center of the sphere. At first, I made my own gravity centering meter consisting of a pair of balances, and monitored the center of gravity position while finishing the sphere to the required diameter and weight. You can't do such an operation very well on a numerically controlled lathe. I have been using the same manual lathe for 40 years, and the number of processes has risen 13-15. I change my grinding method for each individual shot, so it truly is manual labor.

**How far can the center of gravity shifts?**

**Tsujitani:** In the 7.260kg shot, it can shift by about 2mm from the center during the grinding process when the weight is about 10g over. At 60-70g, it is 3mm. When the shots that I make are placed on a level surface, they will not move no matter what their positions are. My Olympic spheres have a center of gravity shift of less than 0.01mm from the center.

Over the long years of doing this time-consuming work, I have learned to tell which direction the material components have shifted by the color of the sphere's surface as I grind it on the lathe, or by the sound of the grinding. Since the heavier areas will be higher density and therefore harder, I hear a higher-pitched sound during grinding, while

Photo : REUTERS.SUN


*Adam Nelson, the Athens Olympics medalist, using one of Tsujitani's shots*

the lighter areas give off a lower sound. So these days I do not use a gravity centering meter at all, but instead I rely on my own eyes and ears to shape the shot so that the center of gravity comes to the center of the sphere.

**Can you really hear the difference for such a slight shift in distance?**

**Tsujitani:** Professors at Tokyo Geijutsu University of Fine Arts and Music saw a TV program about my manufacturing process, and came over to see it for themselves. While most people will think that all grinding sounds on a lathe sound the same, the music teacher could tell by listening that the pitch of the grinding sound was changing ever so slightly according to the hardness of the metal.

**Is the position of the center of gravity an important factor in athletic events?**

**Tsujitani:** When you get to the Olympic medalist class, athletes can tell immediately whether the center of gravity is in the exact center or not just by hefting the shot. Moreover, there are athletes who claim that the shot put distance can vary by one or two meters depending on the position of the center of gravity.

**Is there anything else that you have devised for the manufacturing process?**

**Tsujitani:** After I began manufacturing according to the IAAF standards, I decided to try inserting shallow grooves into the surface of the shot. You know that people have fingerprints on their hands. I put shallow grooves into the surface of the shot at about 1mm intervals so that they hit at 90 degree angles to the fingerprints. When I tested this on the athletes of a college, letting each of them toss shots with grooves and the others without, all agreed that those with grooves were easier to throw.

**When did you start supplying shot puts for the Olympic Games and other international athletic events?**

**Tsujitani:** The Seoul Olympics in 1988 were my first time. But on that occasion, not a single one of the athletes remaining in the final round used my shots. Since I was confident in my craft, this was disappointing. Later, when I asked someone who knew the sport well, he said that athletes in the shot put event have very long careers, and they have a tendency to keep using the shots that they are familiar with.

Of course they do, I thought. But I felt a certain response to my products, even though they weren't used in the final round. Because at that Olympics I had provided 16 shots each for the practice ground and for the competition, and six to eight shots from five different countries that met the judges' qualifications had been set aside for the competition. Athletes do not bring their own shots, but instead choose one that they like from the shots provided. When the competition was over, the 16 shots supplied for practice had all disappeared. I think that the athletes probably had taken them home on the sly. And this meant that they liked my shots.

The next Olympic Games in Atlanta showed that my conjecture had been accurate. At this time, all of the eight athletes remaining in the final round used my metallic-colored shots. Watching the event live on TV, I noted that every one of the athletes was using my shots, which made me very happy.

At the Sydney Olympics, I went to watch the event in person. During the practice and starting rounds, the athletes were trying out various shots. But when it came to the final round, I saw that most of the athletes selected my shots. At both Sydney and Athens, all of the medalists used my shots.

Regarding the grooves in the shot surface, in 2001, the year after the Sydney Olympics, the IAAF made a rule change requiring that surfaces be smooth. (IAAF rule 188-4 "To be smooth, the surface average height must be less than 1.6 micro meter, i.e., a roughness number of N7 or less.")

I was the only supplier who had put in grooves, and slip-prevention coatings were accepted. Frankly speaking, I was a little miffed. Still, after the rule change at the next 2004 Athens Olympics, all of the medalists selected

my shots even without the grooves.

The winner of the shot put event at the Sydney Olympics marked 21.56m, while the top shot at Athens was 21.16m, I have no idea if these numbers were affected by the shot grooves. The world record in the men's shot put is held by Randy Barnes of the United States, at 23.12m, set in 1990. The women's record is held by the former Soviet athlete Natalya Lisovskaya, at 22.63m, set in 1989.

**How many shots do you manufacture at present?**

**Tsujitani:** Around the time everyone was withdrawing from manufacturing, my production was as many as 3,000 shots annually. Now I make about 1,000 shots per year. All the shots are shipped to Japanese sports goods companies, but I really have no idea where they finally end up being used.

**Do you make any other goods for track and field?**

**Tsujitani:** In 1965, I was asked if I would make hurdles for the track and field events. I became all excited and designed and produced the whole thing myself. Even today, many of the hurdles used in Japan's track and field events are made at my company. In addition to shots, I make starting blocks, which I also designed myself, for short-distance races, and batons for relay events. The batons are made of aluminum and lighter than ones made out of wood.

My father made automobile cams. These also use cast parts. I was born in 1933, and the year that I graduated from elementary school was the year that Japan lost the war. I lived in suburbs of Tokyo, which was completely destroyed by aerial bombing. After graduating from junior high school, I went straight to helping out in my father's factory, and worked there while studying nights at an industrial high school, graduating when I was 20.

In those days, I used to read the Japanese version of the Readers Digest magazine. I predicted that someday soon Japan too would have shorter working hours, and that leisure and outdoor life would become popular. I became independent in 1959 at the age of 26, and at first I was making tent frames. They sold well, but even though I was first in the market, three or four years later a major corporation came in and easily took the market away from my tiny little company. So I turned to making heads for golf irons, then tennis racket frames, and then ski stocks, but they all experienced the same fate as the tent frames did.

**Do you like track and field?**

**Tsujitani:** When I was young, I was a pretty fast short-distance runner. When I was a student at night-time high school, Japan had not yet recovered from wartime damage, so we didn't have much in the way of equipment. But the Japan record in the 100m at that time was about 10.8 seconds, and my best record was 11.6 seconds. So I was really happy to receive an order to make hurdles.

In fact, everyone in my family likes track and field. With my wife and children – three sons and three daughters – our entire family of eight goes out to run full marathons together. Surely this is quite rare, don't you think? While the only Sub-3 runner is our second son, I was appearing in both marathons and triathlons until recently. But I guess I pushed too hard and hurt my knee, so right now I am convalescing.

**Do you exclusively focus on manufacturing track and field goods?**

**Tsujitani:** No, I am not just in manufacturing. In 1984 I began running track and field events of my own. At that time, I saw that Japan's population would start to decline, which would mean that the track and field population would also decrease, and hardware manufacture alone would become too narrow a base. As a result, I decided to try my hand at the software side as well.

My daughters have all married and left home. But for a while everyone in the family was working at the company. And all three of my sons still work with me. When my children graduated from school, I had them all first go to work for some other company. After they learned how tough it was to eat at someone else's table, I brought them back to work in the family business. At present, my eldest and second sons work exclusively on running events, while my third son assists in the manufacture of shots and other goods.

**You are often asked to give lectures. What sort of things do you talk about?**

**Tsujitani:** Having received the Monozukuri Nippon Award, (i.e, Japan Manufacturing Award) and been selected as a contemporary master craftsman, I give lectures about 20 times a year around the country on the subject of craftsmanship.

A popular topic is the subject of high tech and low tech. In an incident that apparently occurred recently at Boeing, an attempt to repair an old part ended in failure because they could not find anyone skilled in the handling of a universal lathe. In Japan, as well, we are faced with a crisis, which is the so-called "2007 Problem" when most of the craftsmen capable of handling traditional technologies will retire at once, leaving no one to carry on with the technologies. I emphasize that automation and digitalization are not the only things that are high-tech.

Another thing that I emphasize is not to be afraid of failure, or in all matters it is. Always give it a try. If it doesn't work out, I say, then think about why it didn't work and the reasons for the failure. Fortunately, my lectures have been well-received. JS

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