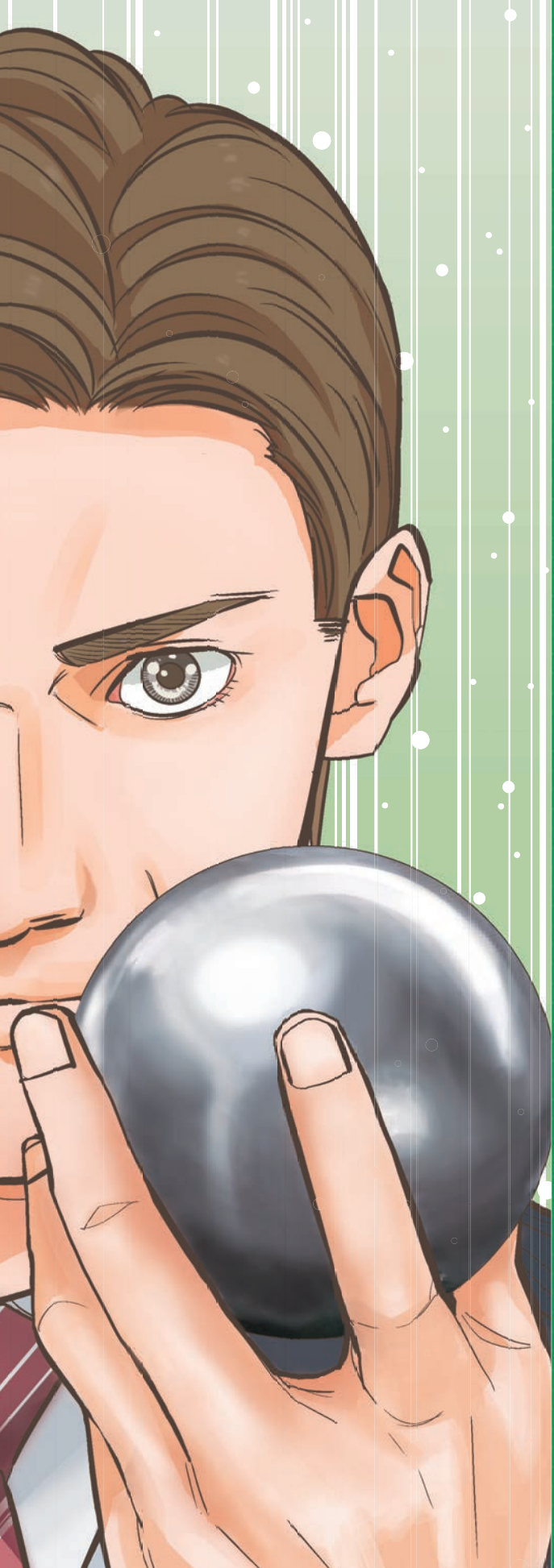


THE PATH TO THE PERFECT SPHERE

Behind the Scenes at NHK's X-Technology "Sugowaza"



Cast of Characters



Thomas Kreis

Employed at Schaeffler's Competence Center of Bearing at the company's head quarters in Germany, and known for his cool-headed, logical decisions and as a leader who is looked up to by many. He fell in love with Japan after an assignment there.



Andreas Bohr

Employed at Schaeffler's Development Ball Bearing at the company's headquarters. He led the competition project with Mr. Kreis as a project leader. A strict taskmaster where his job is concerned, but he also has an extremely polite side, taking the initiative to introduce himself to the opposing team.

Supporting Characters



Dr. Braun

A man who does fine tuning in manufacturing. He does not get much time in this story, but he is said to be quite a character.



Dr. Koch

Runs the simulators and works directly for Kreis. He's both handsome and accomplished.



Dr. Musayev

The specialist in charge of coatings. He has a polite, approachable and optimistic disposition.



Mizoguchi

As director, he's the man in charge. He's bright, honest, but also passionate. This is his first location shoot.



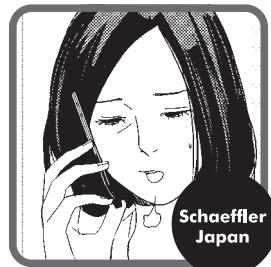
Hara

A veteran cameraman. Willing to brave bitter cold days to get the shot he wants.



Kondo

A veteran soundman with who started about the same period as Hara. He also acts as an assistant and is a wiz at quickly swapping lenses in and out.

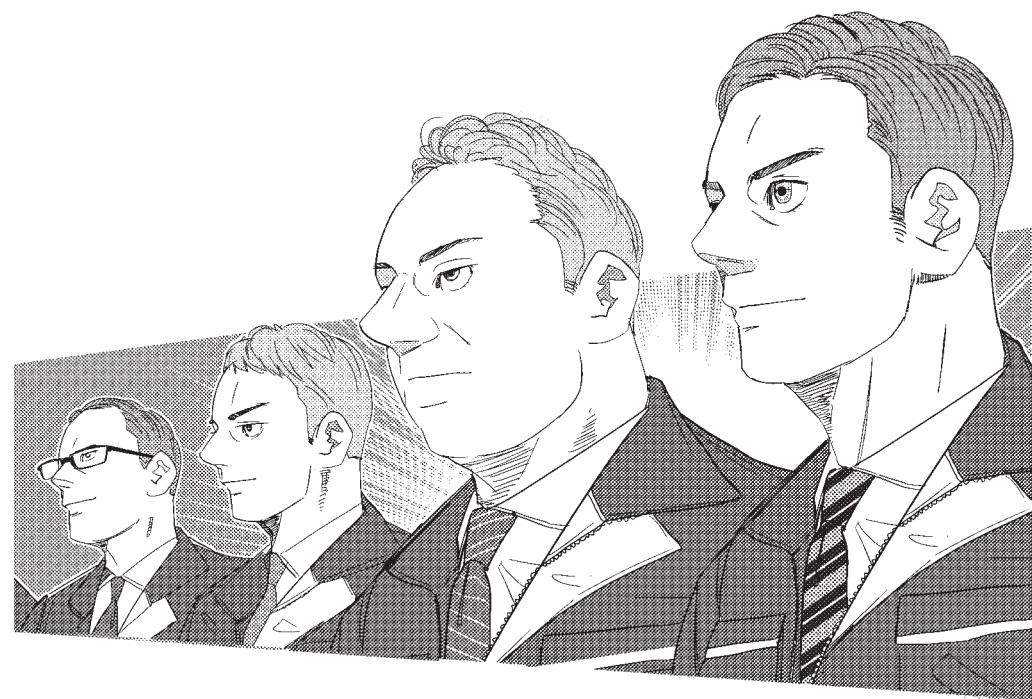


Tomomi Iwase

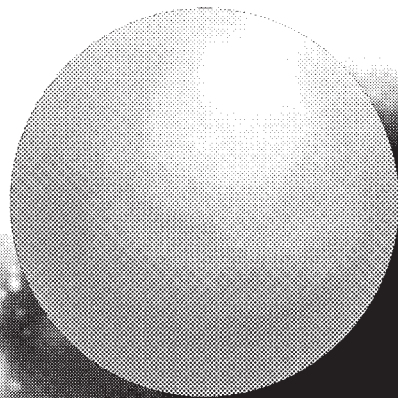
Working for the Japan office of Schaeffler. She spent a month in Germany working directly on this project. She's works to facilitate media relations.

The characters in this drama are real, but names have been altered for privacy reasons.

Chapter 1 Stepping Up to the Next Stage



The "perfect sphere"...

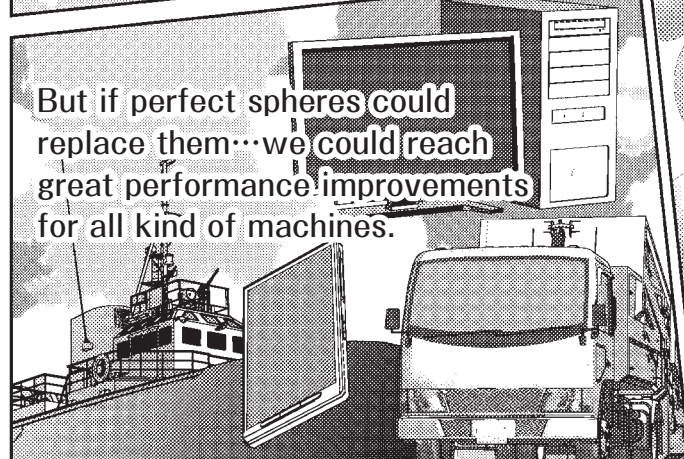


A ball of unblemished roundness with no flaws or imperfections.

Presently, imperfect spheres are used as parts in a vast number of modern machines.



But if perfect spheres could replace them...we could reach great performance improvements for all kind of machines.



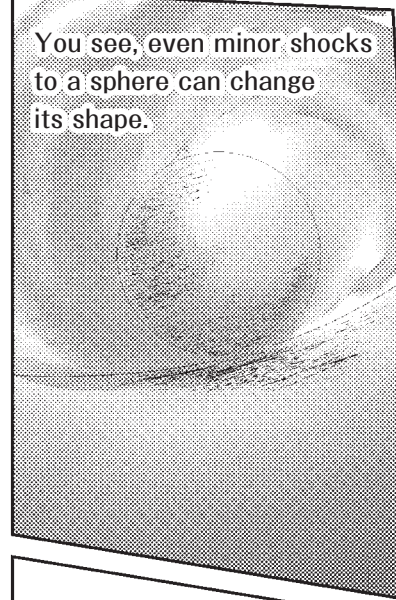
In other words, if we could mass-produce perfect spheres...



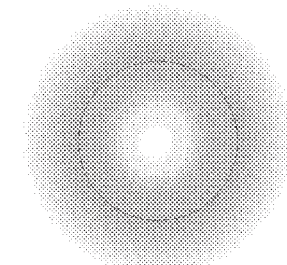
...it could be the catalyst that changes the world...!

But it simply isn't possible.

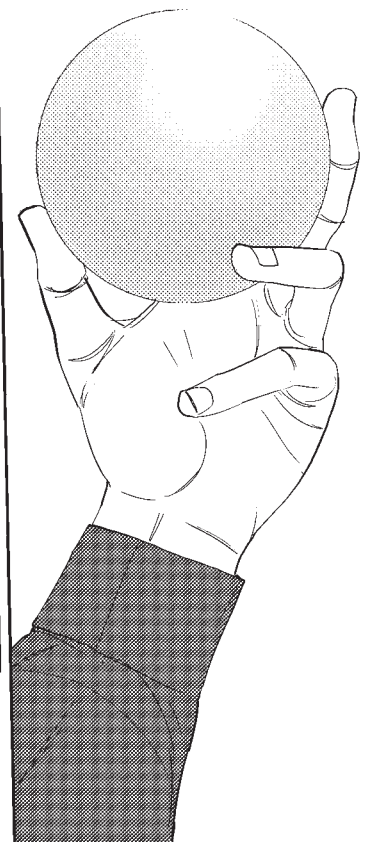
You see, even minor shocks to a sphere can change its shape.



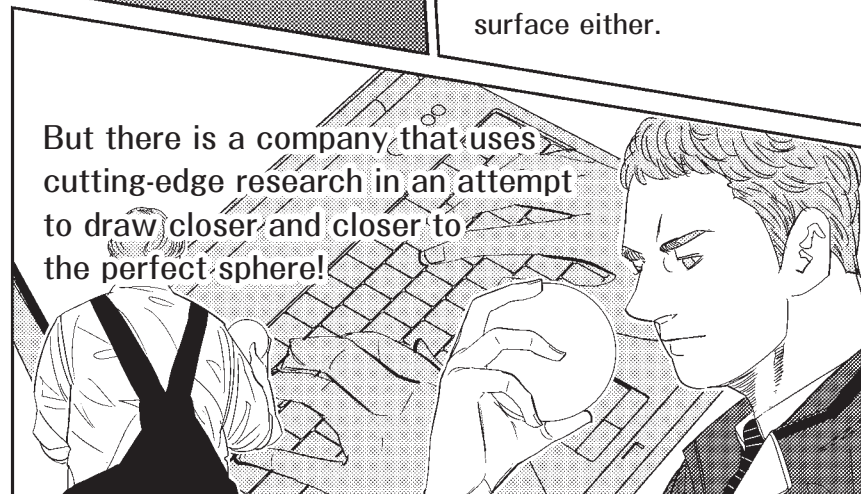
It's no easy task to remove bumps and dents from the surface either.



... Excellent.



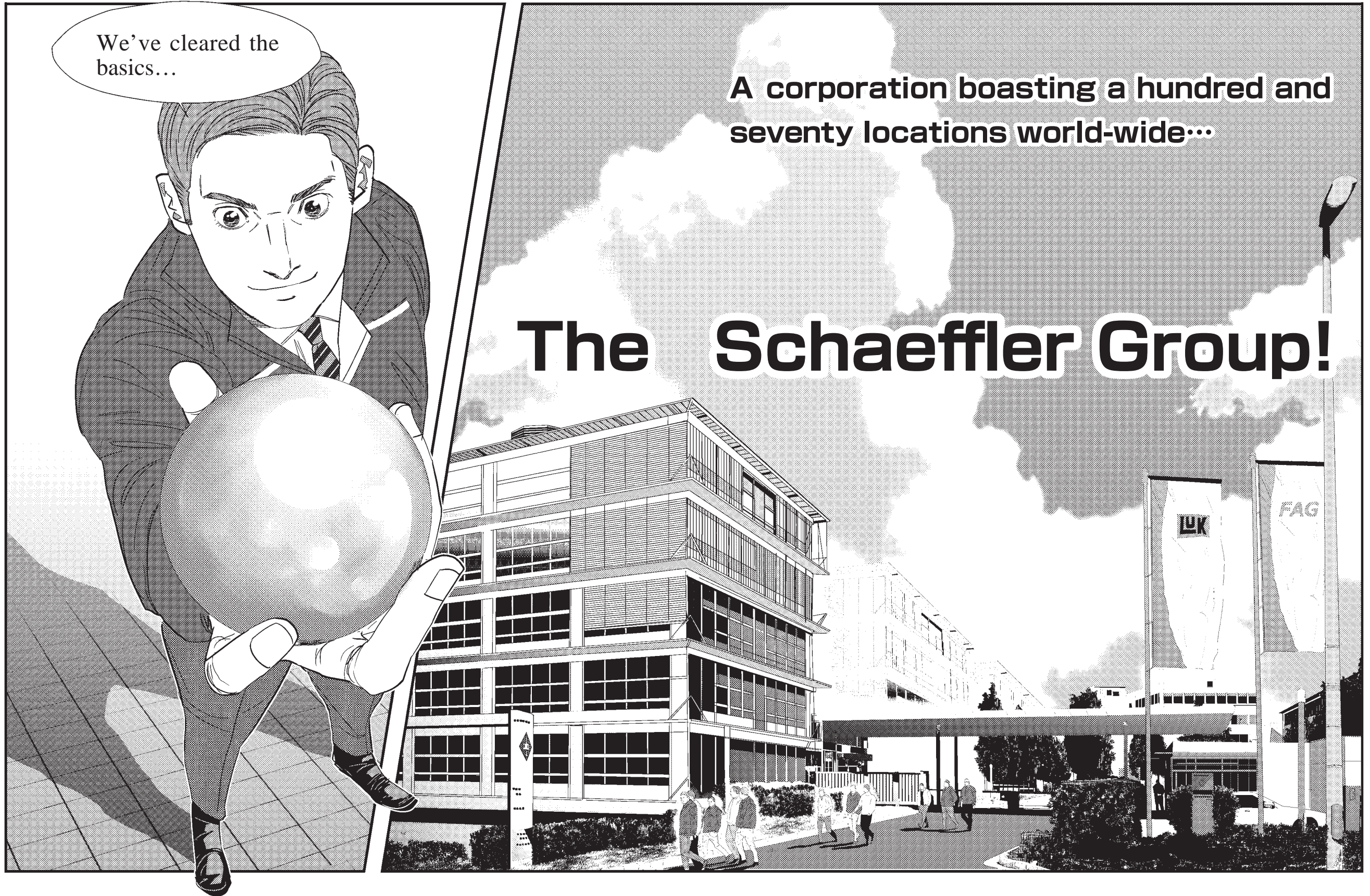
But there is a company that uses cutting-edge research in an attempt to draw closer and closer to the perfect sphere!

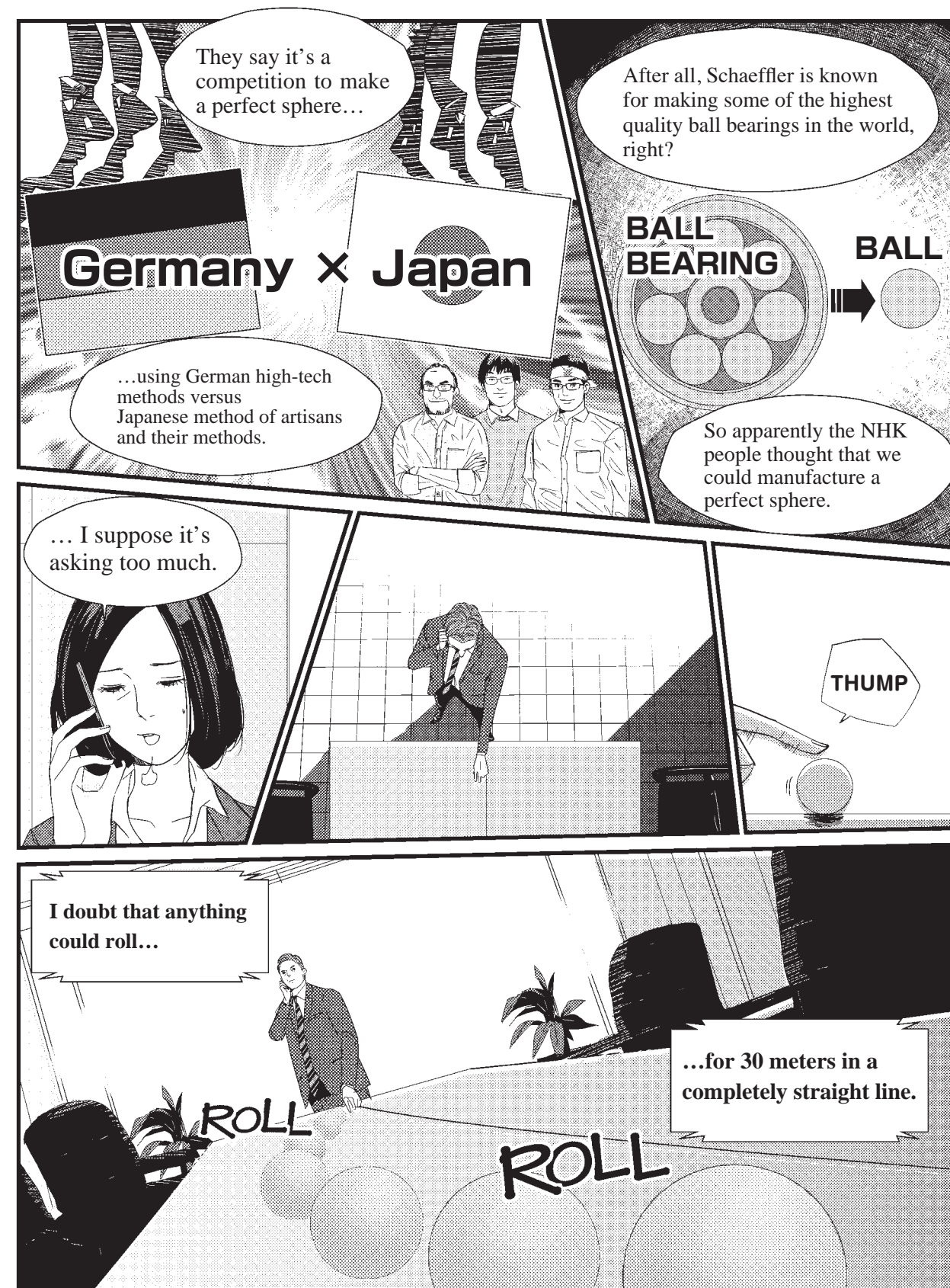


We've cleared the basics...

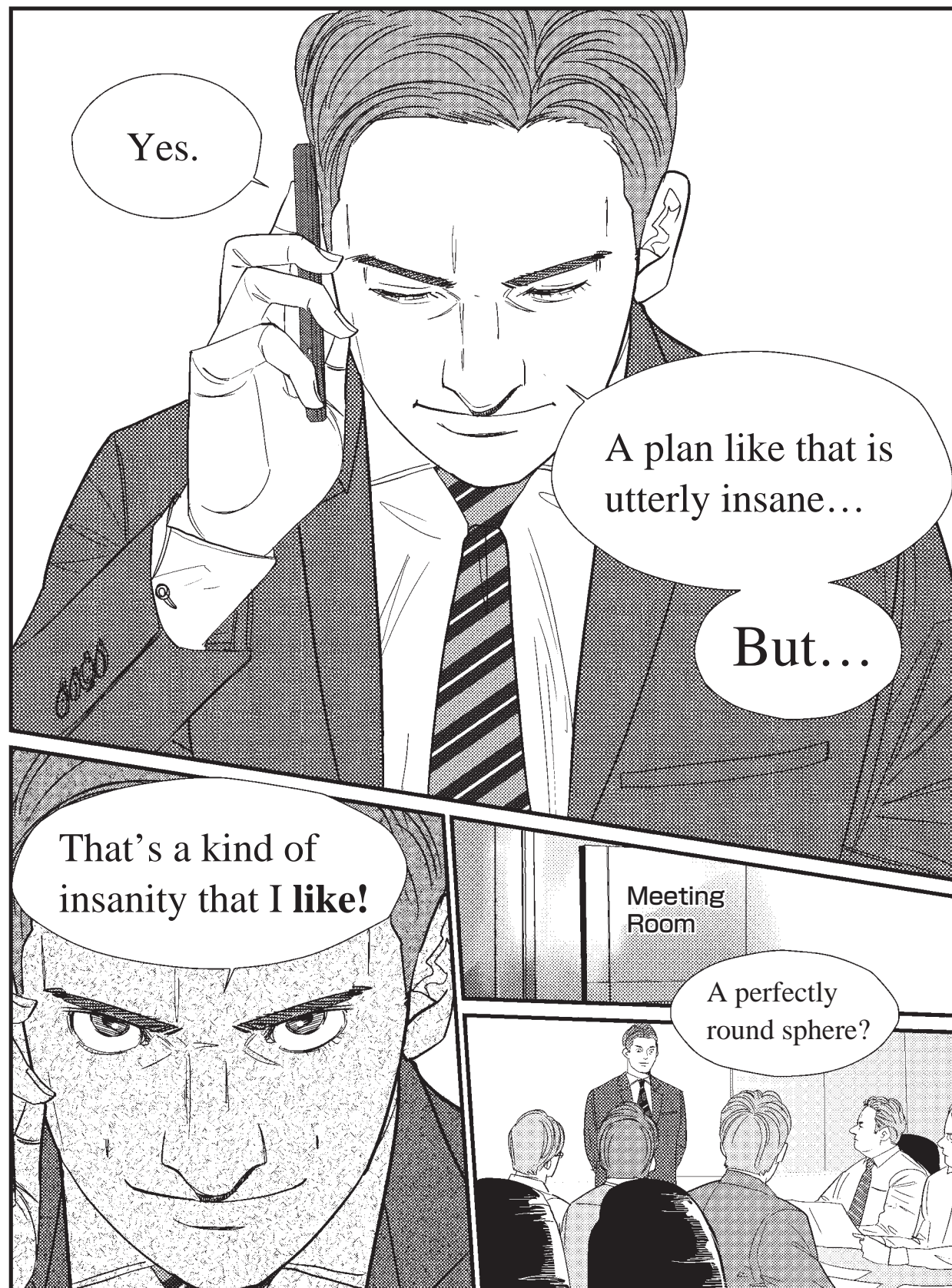
A corporation boasting a hundred and seventy locations world-wide...

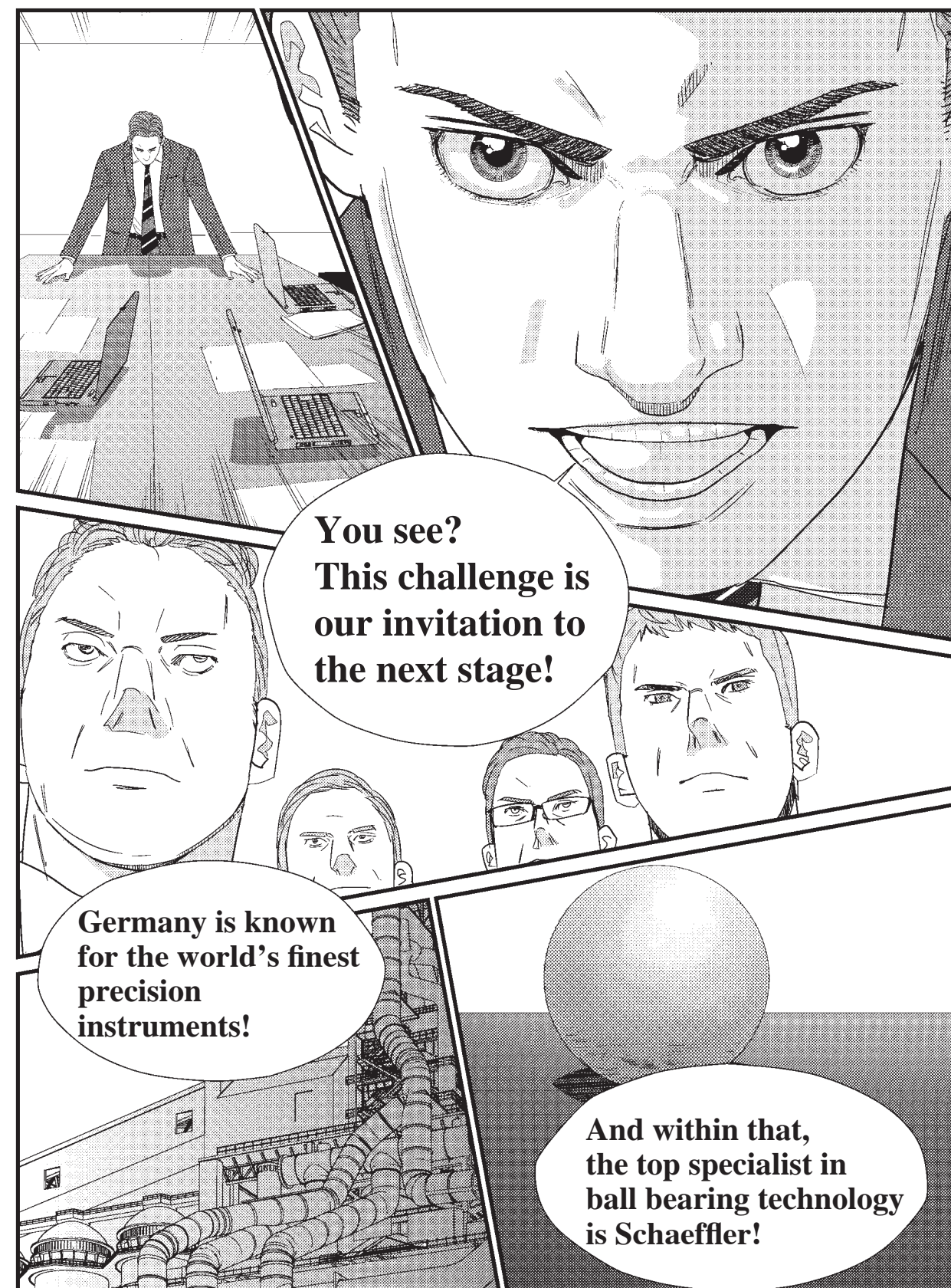
The Schaeffler Group!

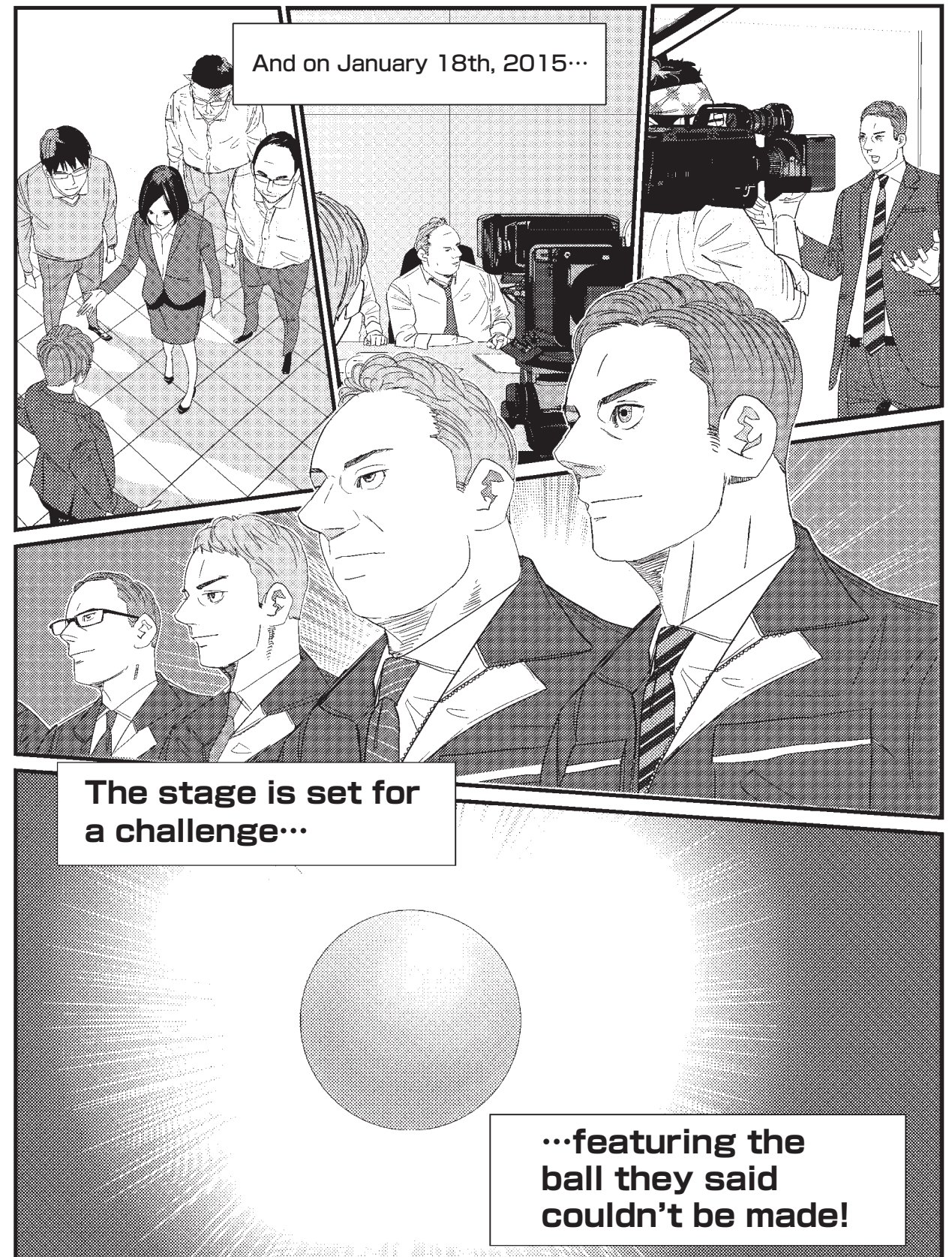




Ball Bearings:
When one places metal balls on the axis of revolution one can reduce the amount of friction caused by the revolutions. The metal balls are called ball bearings.







Chapter 2

The Schaeffler Way

Behind
the Scenes
1

The Schaeffler Ball Grinder



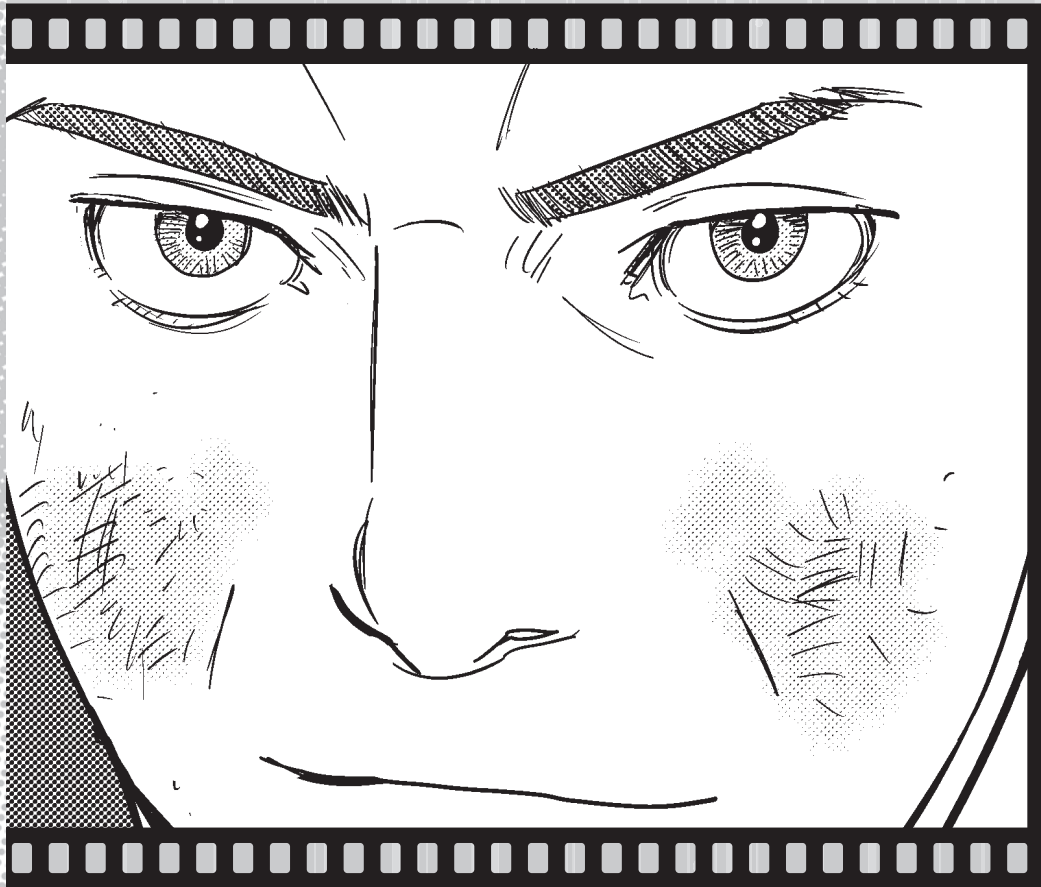
In 1883, Friedrich Fischer developed the first metal-ball grinding machine, and it was this machine that made possible the mass production of high-precision balls. So the ball-bearing industry was said to be born in that same year, 1883.

The inspiration behind the ball-grinding machine is said to have come from the regional dish, German potato dumplings (Kartoffelkloesse) which Fischer and his family got together to roll into balls by hand. Reportedly, the cookware for family-made potato dumplings can be found in nearly any German household even today.



A scene from
the program's
filming.

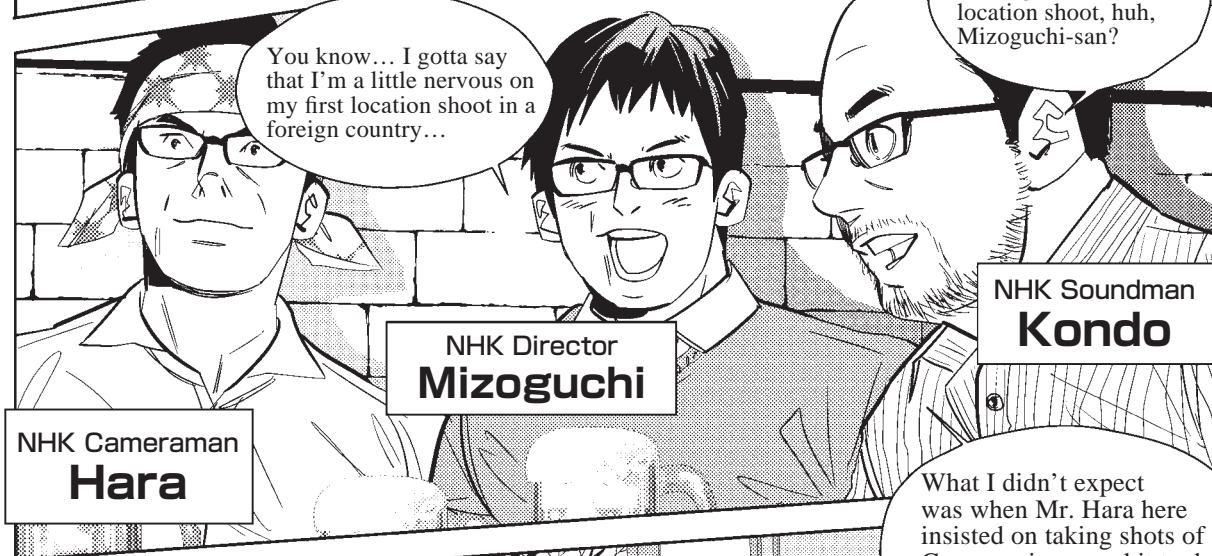
The Kreis family
making potato balls
together.





So...
To commemorate the
start of our location
shoot for the Perfect
Sphere contest...

prost
(Cheers!)



You know... I gotta say
that I'm a little nervous on
my first location shoot in a
foreign country...

You've really been
looking forward to this
location shoot, huh,
Mizoguchi-san?

NHK Director
Mizoguchi

NHK Soundman
Kondo

NHK Cameraman
Hara

What I didn't expect
was when Mr. Hara here
insisted on taking shots of
German views, and it took
three hours in one spot!

You don't
have to tell
everyone, do
you?



But we're happy
you'd go to such
lengths for us, aren't
we, Mr. Kreis?

We couldn't have
asked for more! And
we'll do whatever we
can to accommodate
you...

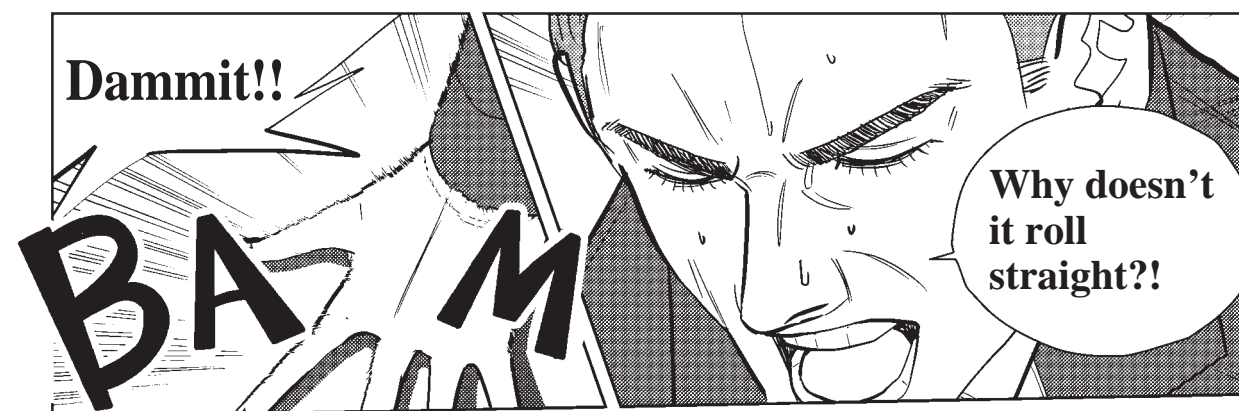
I hope we can
make it a great
shoot!

That goes
double for us!



We'll show you how
we make the perfect
sphere!

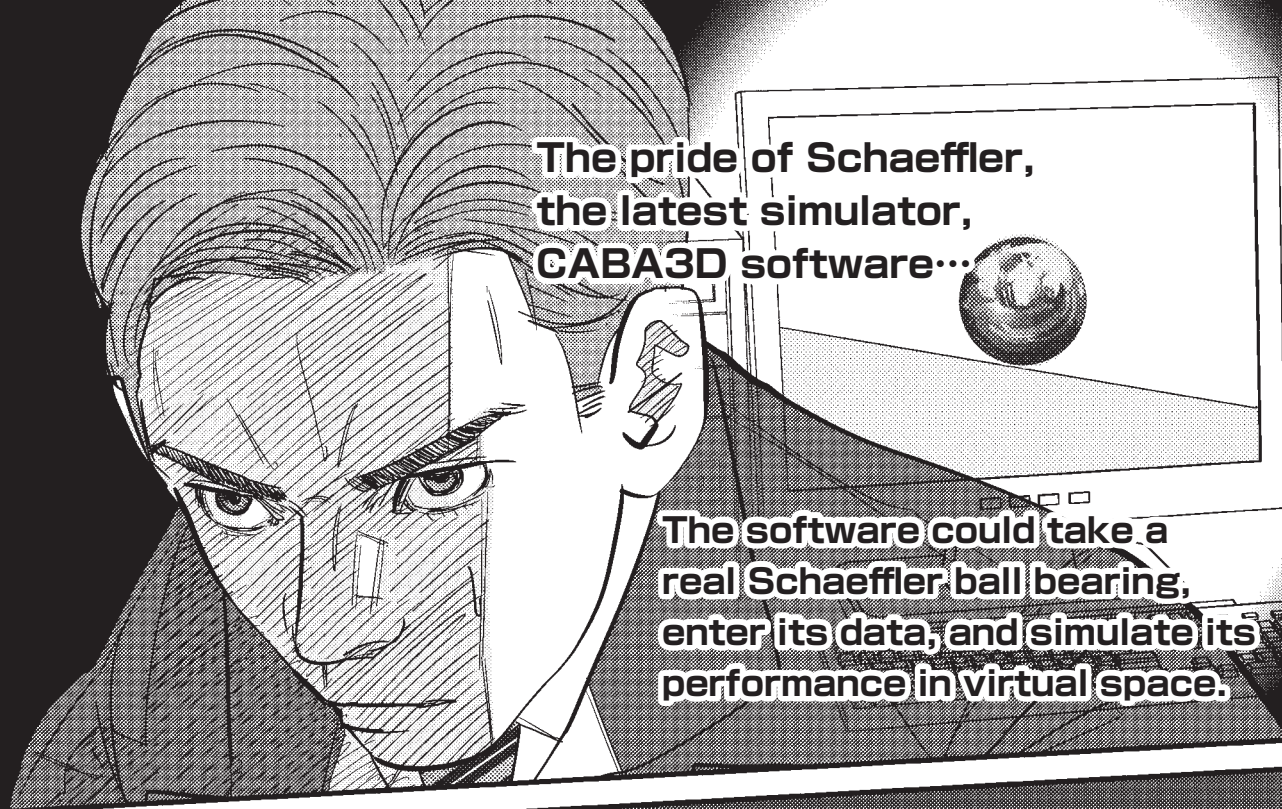
But it was only five days after the
start of this project



Dammit!!

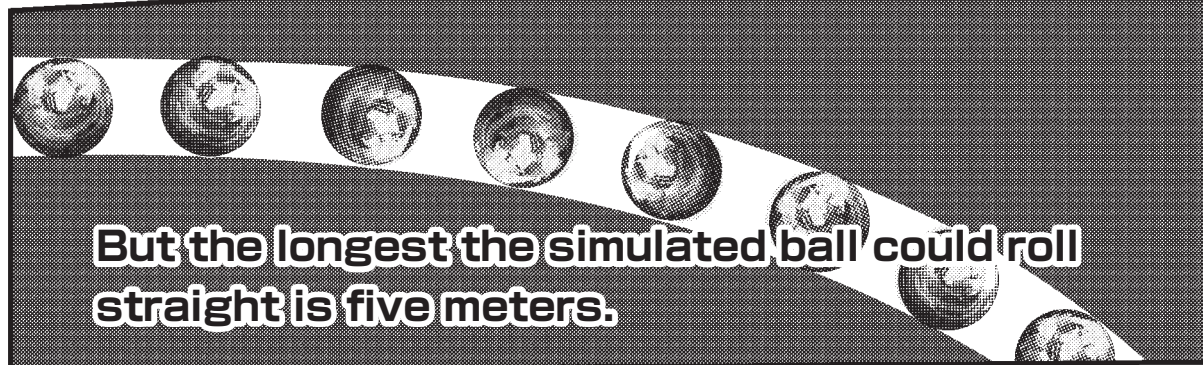
Why doesn't
it roll
straight?!

And the production team was faced with multiple
barriers to manufacturing.

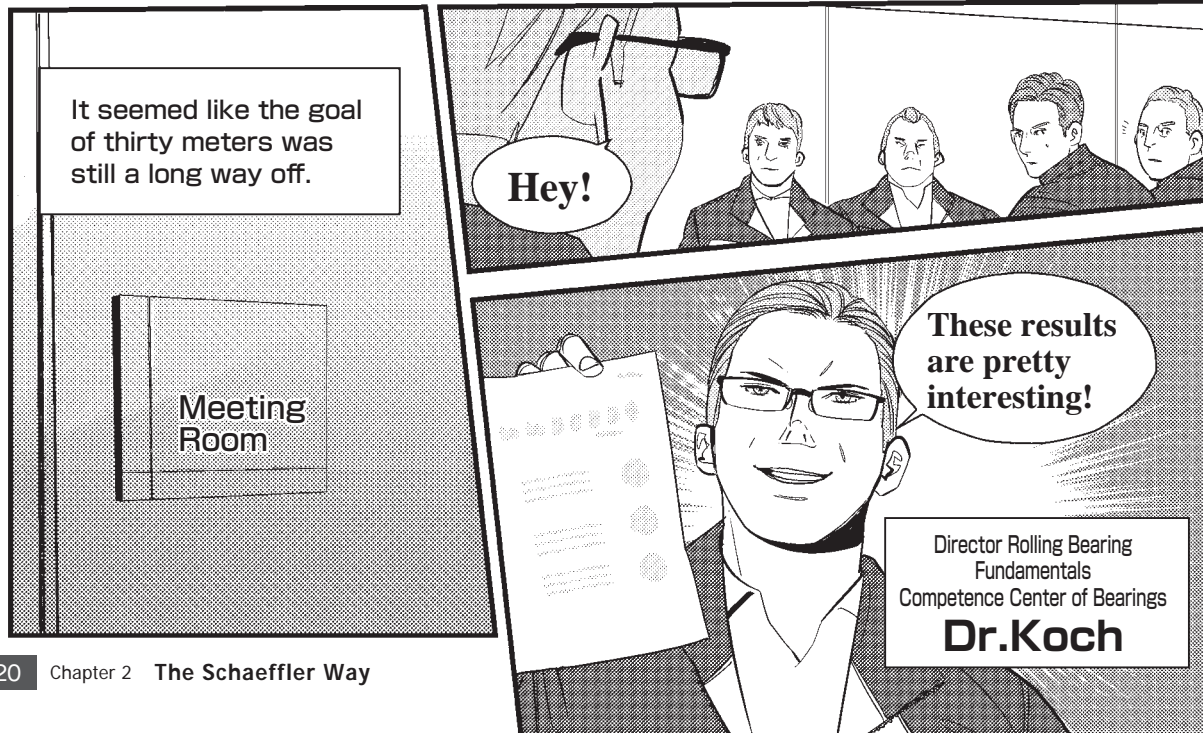


The pride of Schaeffler,
the latest simulator,
CABA3D software...

The software could take a
real Schaeffler ball bearing,
enter its data, and simulate its
performance in virtual space.



But the longest the simulated ball could roll
straight is five meters.

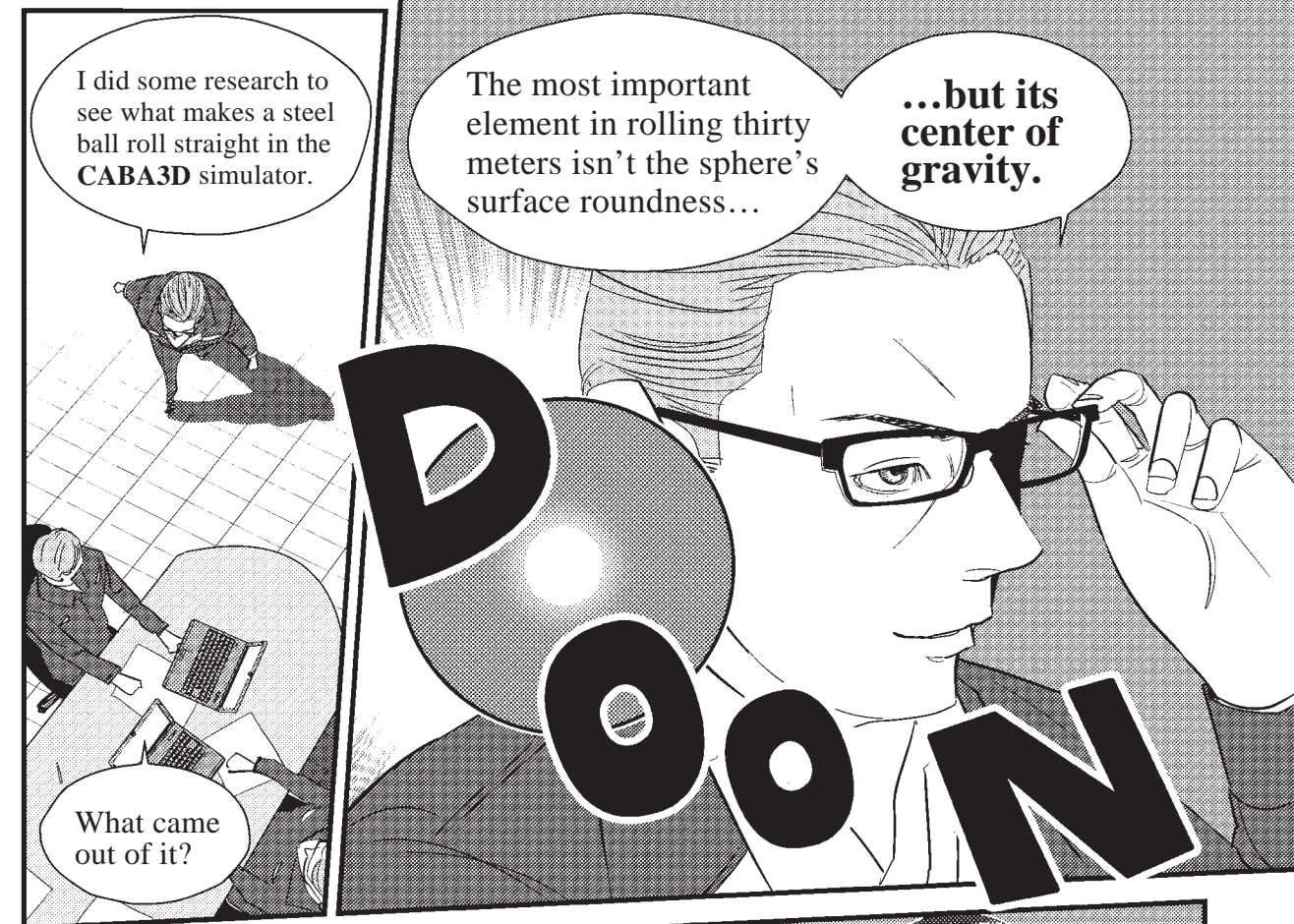


It seemed like the goal
of thirty meters was
still a long way off.

Hey!

These results
are pretty
interesting!

Director Rolling Bearing
Fundamentals
Competence Center of Bearings
Dr. Koch

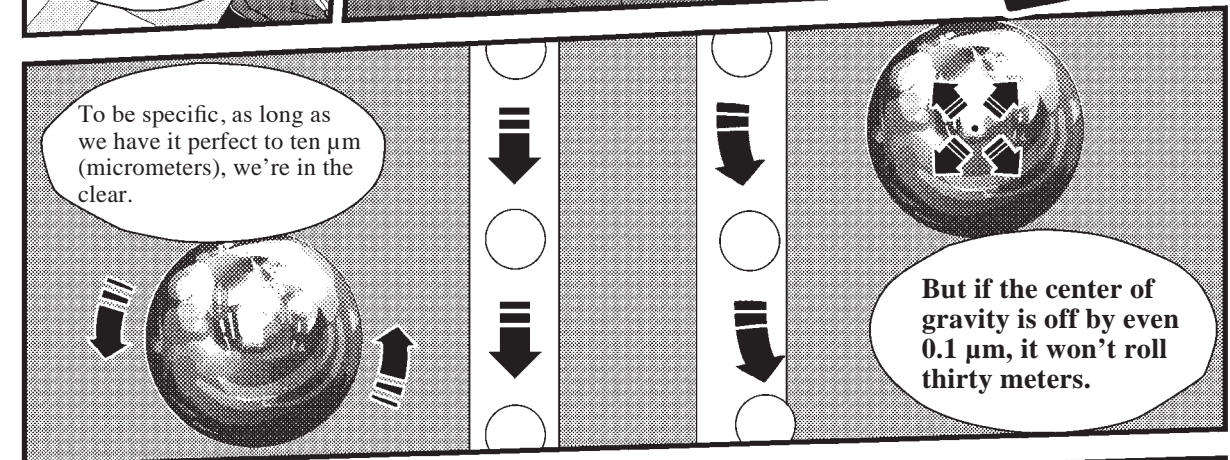


I did some research to
see what makes a steel
ball roll straight in the
CABA3D simulator.

The most important
element in rolling thirty
meters isn't the sphere's
surface roundness...

...but its
center of
gravity.

What came
out of it?



To be specific, as long as
we have it perfect to ten μm
(micrometers), we're in the
clear.

But if the center of
gravity is off by even
0.1 μm , it won't roll
thirty meters.

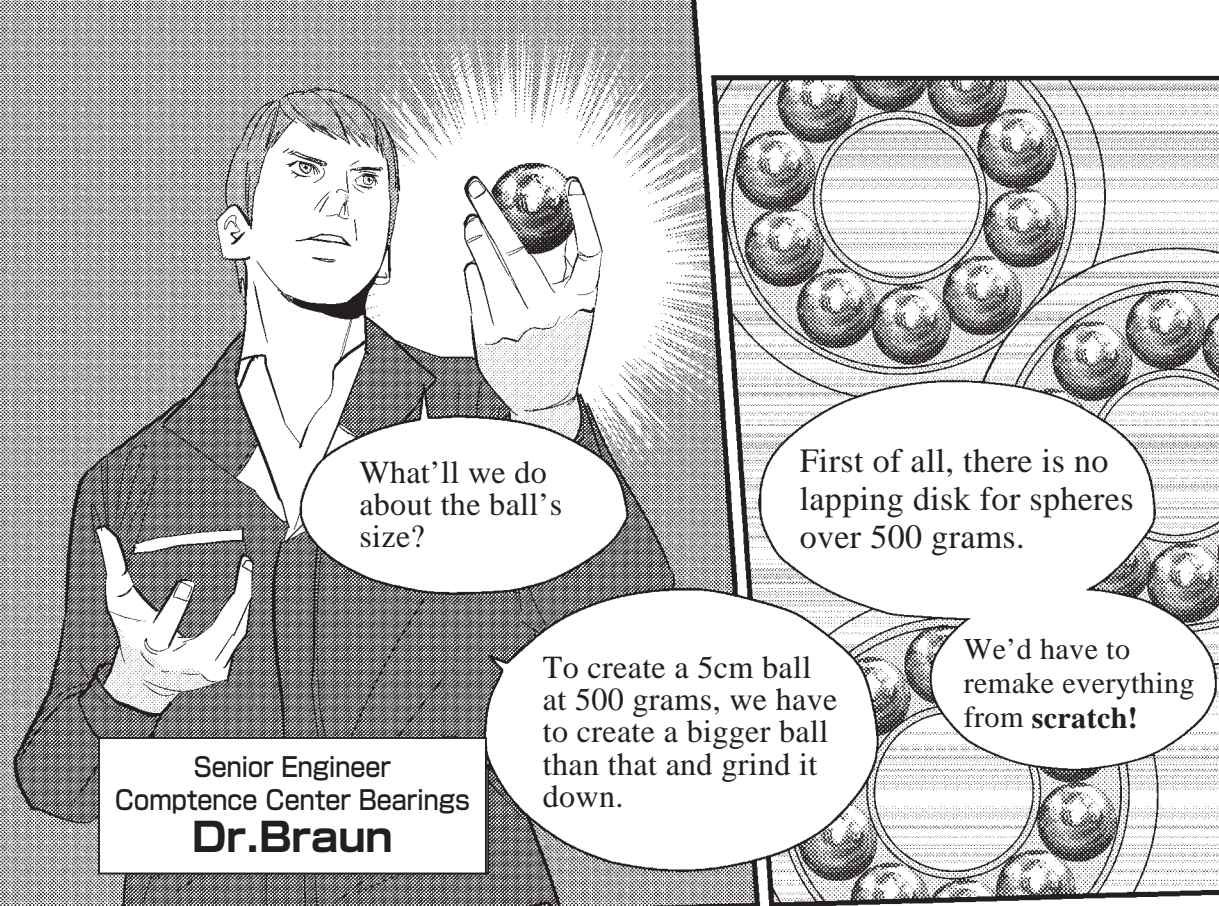


0.1 μm ...

That's going to
incredibly minute
testing!

That isn't our only
problem!

WHOOSH



What'll we do about the ball's size?

First of all, there is no lapping disk for spheres over 500 grams.

We'd have to remake everything from **scratch**!

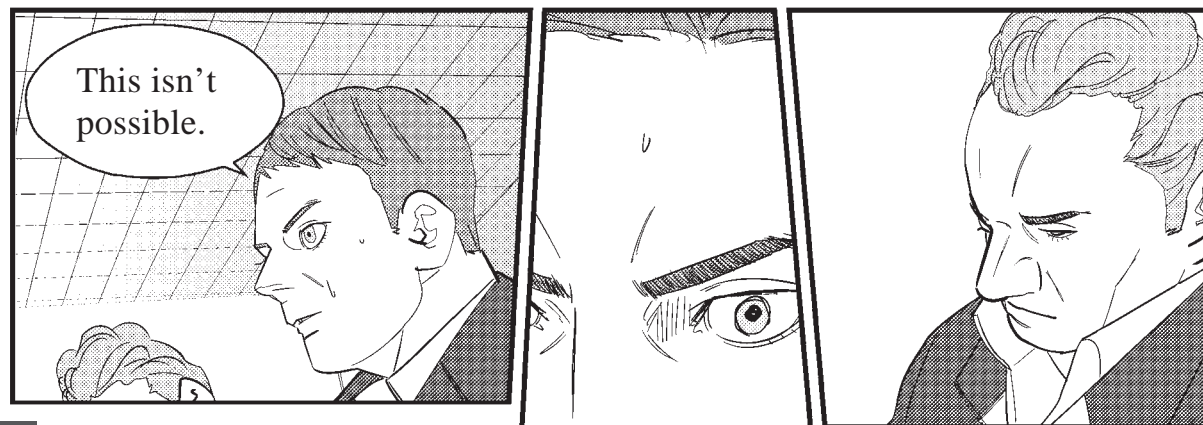
To create a 5cm ball at 500 grams, we have to create a bigger ball than that and grind it down.

Senior Engineer
Comptence Center Bearings
Dr. Braun



.....

On top of that, making a sphere rounder than we already do won't be easy!



This isn't possible.

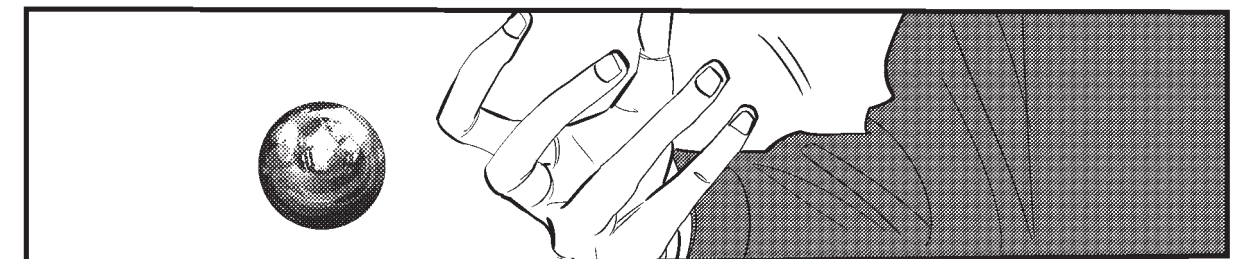


That's plan is going to cost too much!

Then what's your big idea?

That's why I say this plan would...

That would require too many people working on this one project alone...



Andreas...

The company is willing to cover the costs of creating a lapping disk for steel balls of 500 grams.

Wha-?!

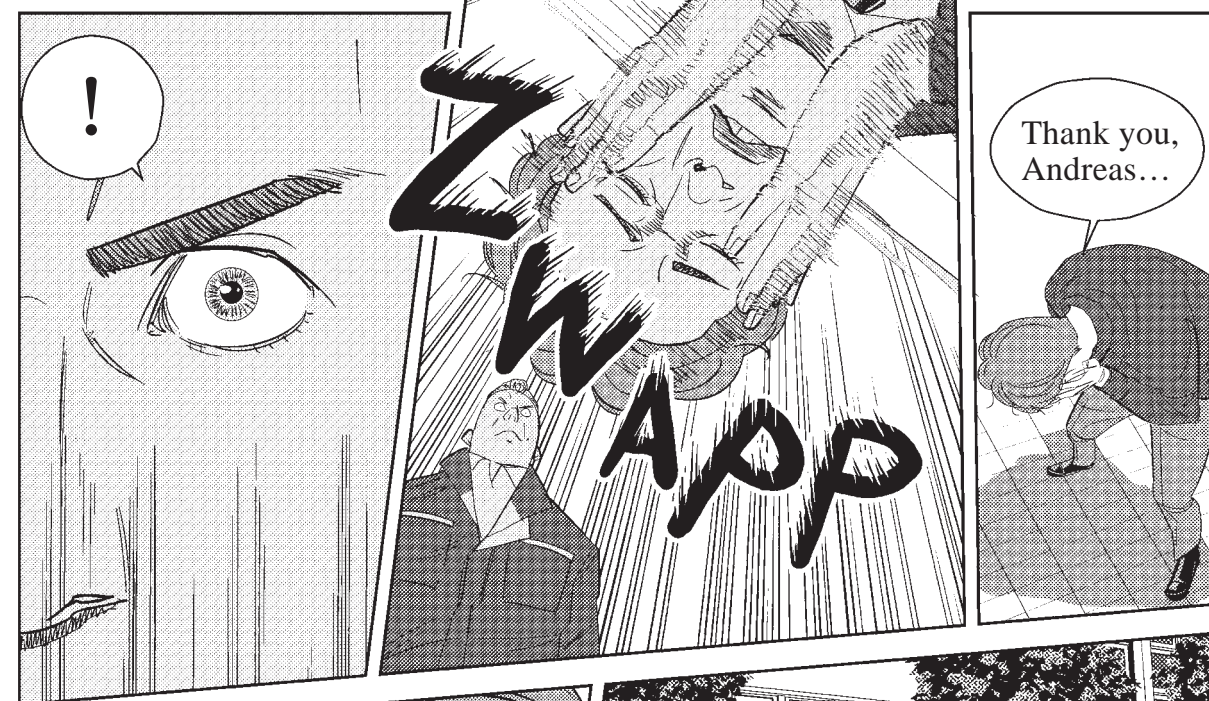
They say they can make one especially for this project.

Andreas?
Weren't you against this whole project?!

But since we agreed, we should see it through.

That's what a professional does, right?

I was at first.



Thank you, Andreas...

And overcoming any further objections, the German factory got down to work.

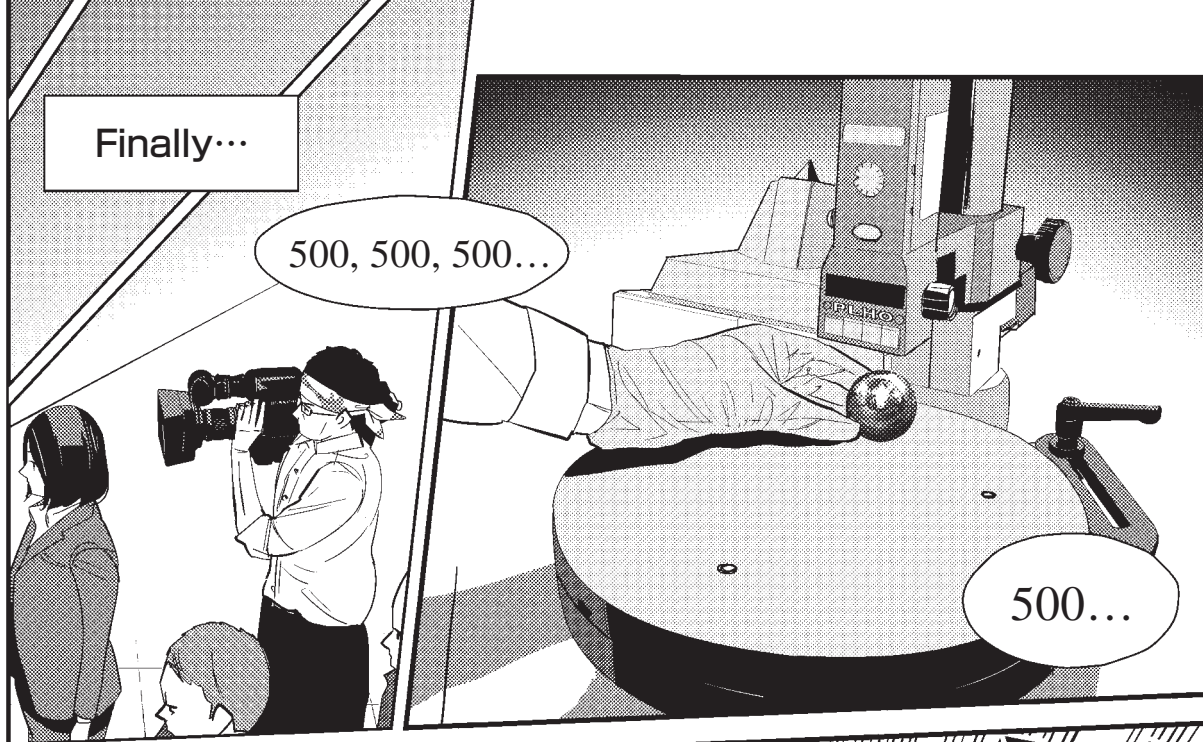
They had a lapping disk prepared for this purpose...

...and they chose slurry made of incredibly fine diamond powder to grind the sphere to the highest of precision.

Over the next two weeks of production...

Let's do it!

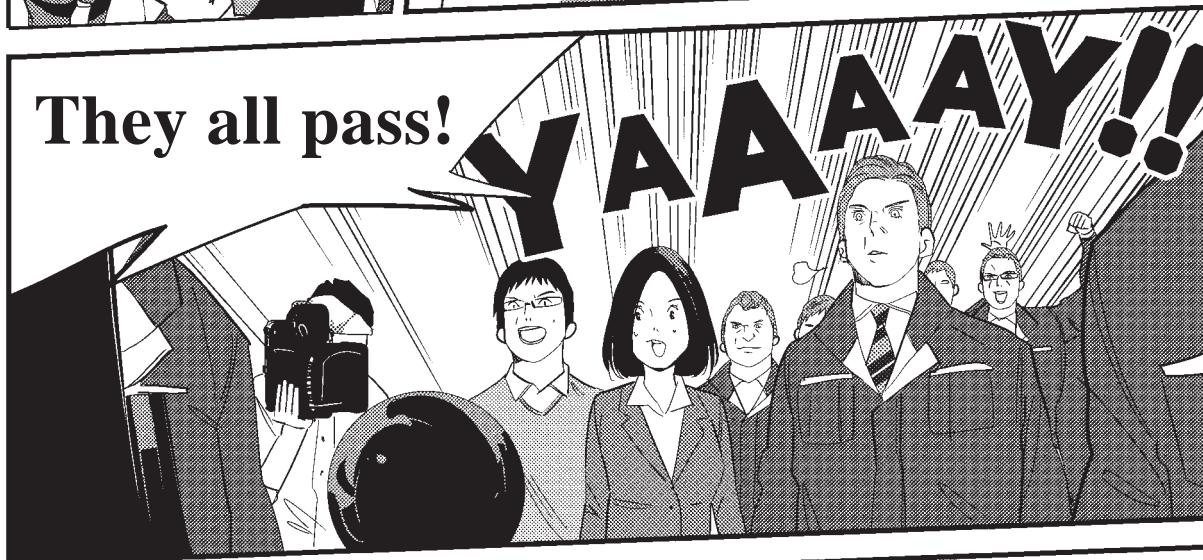
...many people came to their aid.



Finally...

500, 500, 500...

500...



They all pass!

YAAAAAY!!

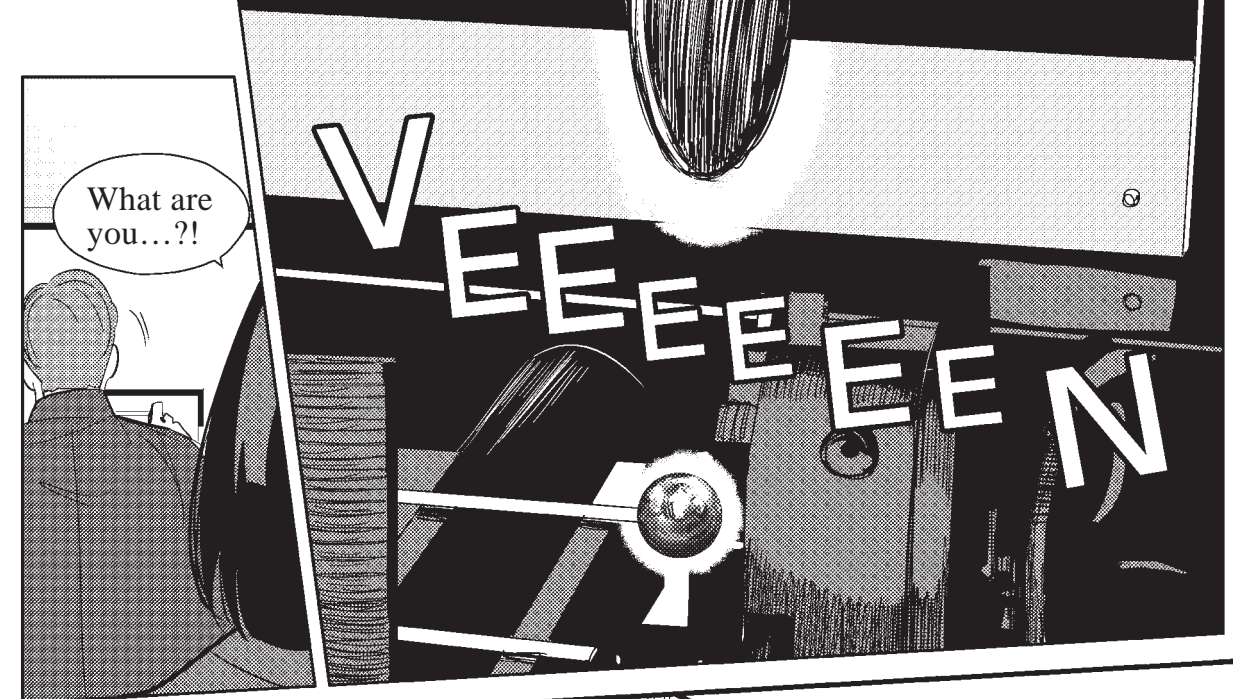


Can we even know if it's center of gravity is in the exact middle of the ball?

We have ways to check!

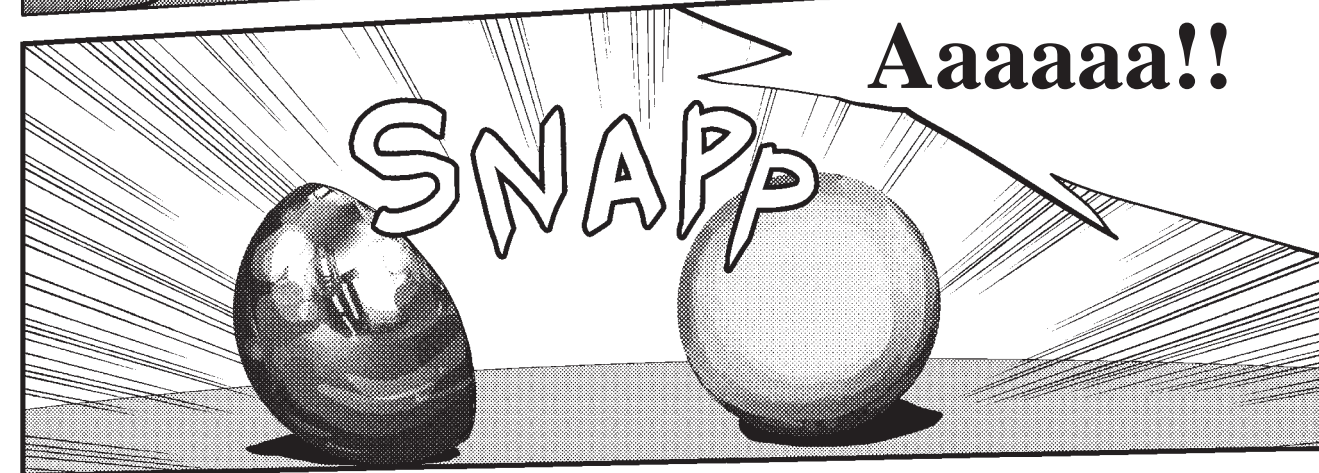
W-Wait, Mr. Kreis!!

Laboratory

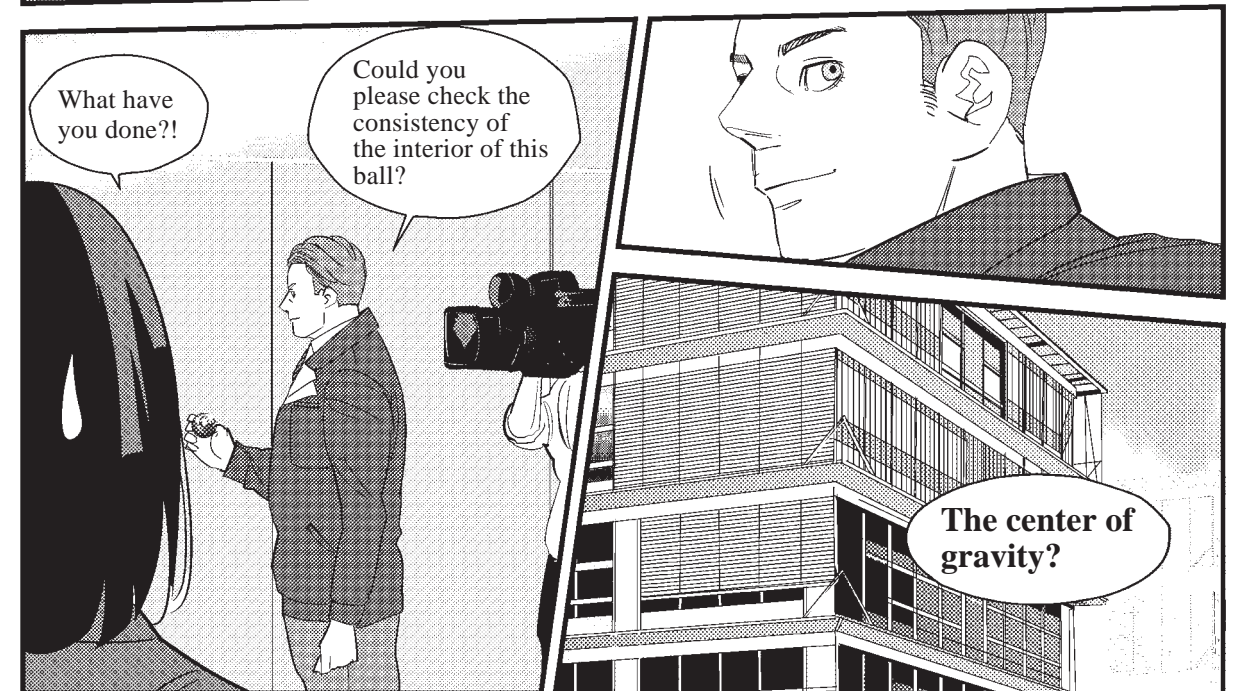


What are you...?!

VEEEEEEEN



Aaaaaa!!



What have you done?!

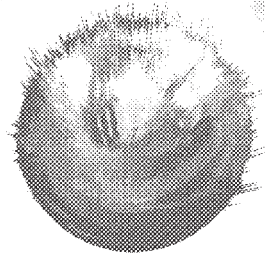
Could you please check the consistency of the interior of this ball?

The center of gravity?

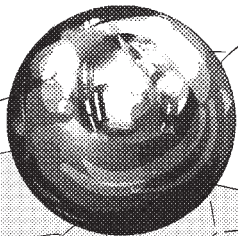
Yes, the way we make normal ball bearings is to first hot-forged them to create their shape...

Then afterwards the metal is tempered through a heat-treatment and cooling process.

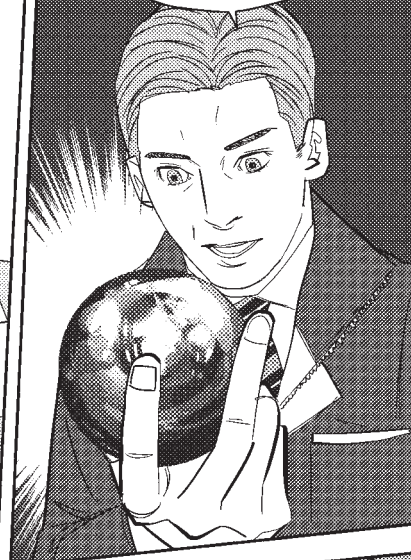
Inconsistencies in the structure can arise in the forging. This can factor into the center of gravity slipping off center.



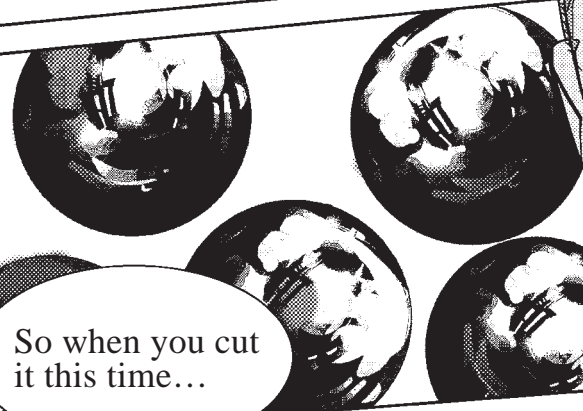
Firing



Cooling



So we choose among the manufactured balls for the ones with the most consistent internal structure.

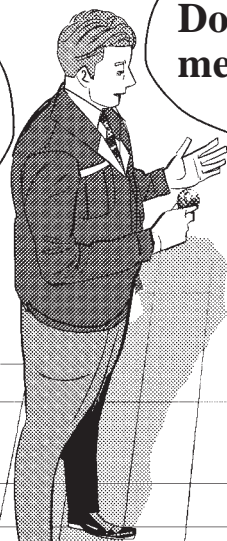


So when you cut it this time...

This ball is simply to test if there were uneven areas in this batch.

We aren't going to split them all.

Don't scare me like that!!



Aside from this, there are a battery of tests to do, like such non-invasive techniques as ultrasound.

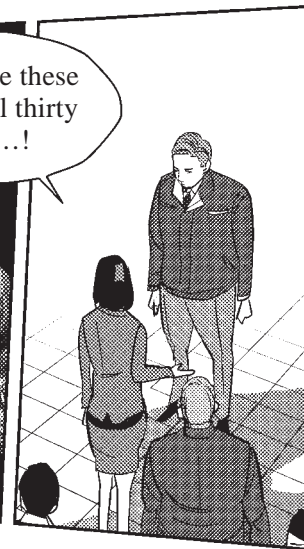


With those, we'll choose the balls that are closest as we have to the perfect sphere.



We did it!

I'm sure these will roll thirty meters...!



No, we aren't done yet.



It isn't like Schaeffer to call ourselves done now, right?



Yes, you're right!

Chapter 3

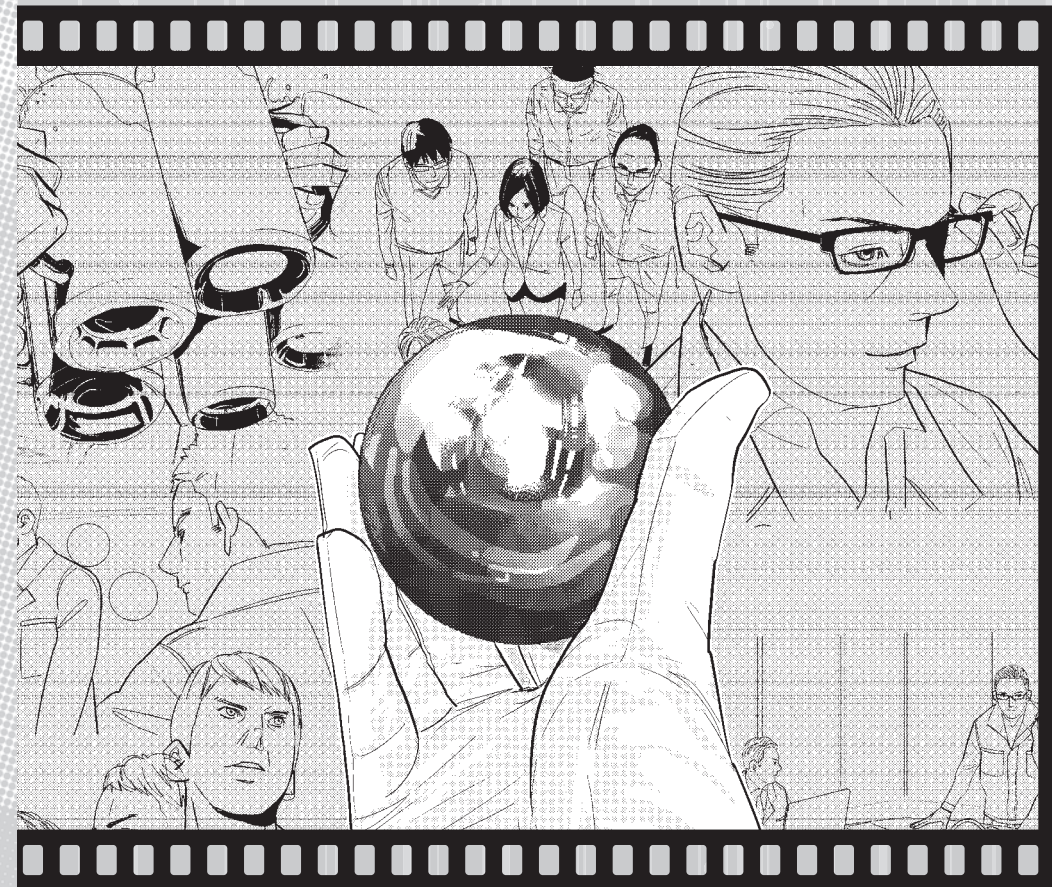
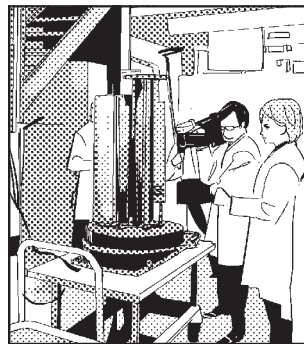
The Competition and Beyond...

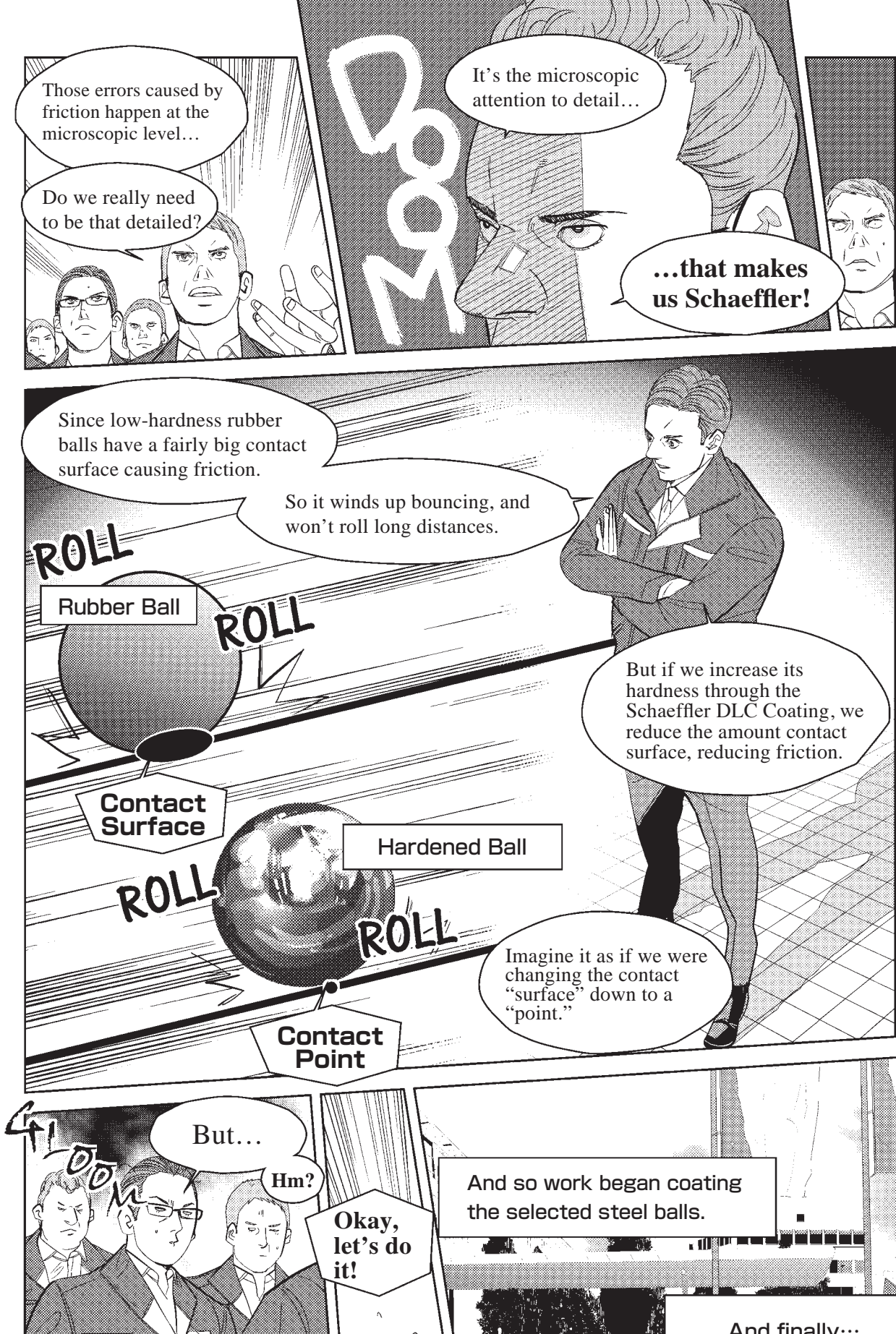
Behind the Scenes 2 Coating Technology

Although Schaeffler commonly coats its steel ball bearings in a DLC (Diamond-Like Carbon) coating, this represented the first time when the company tried to apply the coating uniformly throughout the ball, and it turned out to be quite the challenge.

To apply the coating uniformly, special equipment had to be developed allowing the coating to be applied during constant rotation within a cylindrical chamber.

The actual cylindrical chamber.







We've done everything we can on our end.

The rest is up to you.

Yes...!

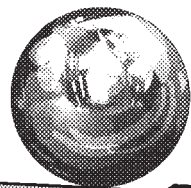
On February 2nd, the very best metal balls and coated balls were selected...

...and February 28th, in Japan...

There was a dry run for the competition.

ROLL

ROLL



ROLL

At a filming rehearsal...

We've got it rolling straight for 15 meters...

That's great! But should we be rolling these during a rehearsal?

It isn't a problem. We have different ones for the actual competition.

Schaeffler's balls are made from a mass-production process that's a combination of production techniques and post-production processing.

So we've ranked the balls in terms of highest precision.

1

2

3

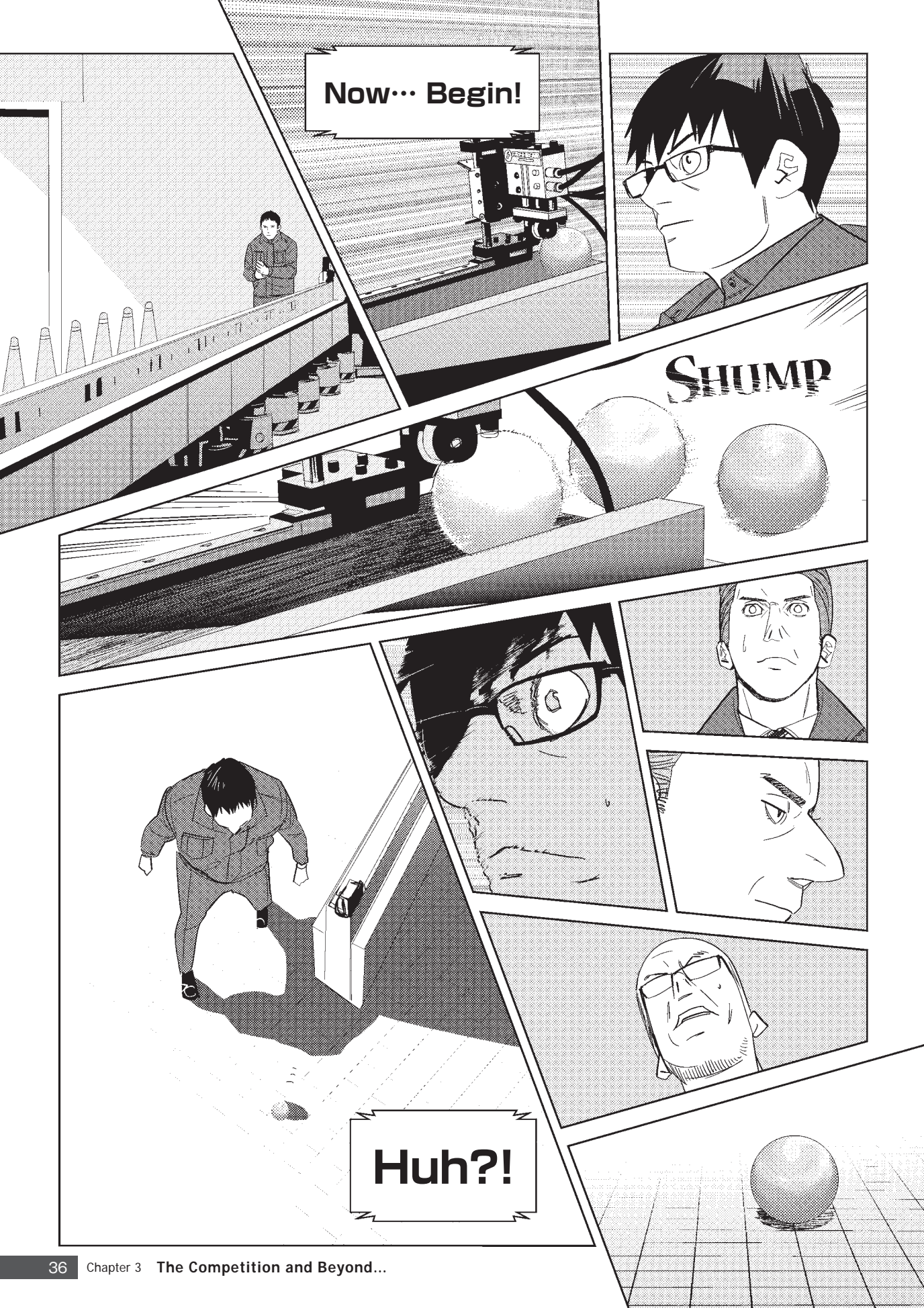
But since our competition are artisans hand-crafting their ball, a real rehearsal is impossible.

It's finally here, the day of the showdown!

The Perfect Sphere competition... And the first challenger is the Japanese team!

So the final competition will be the only competition.

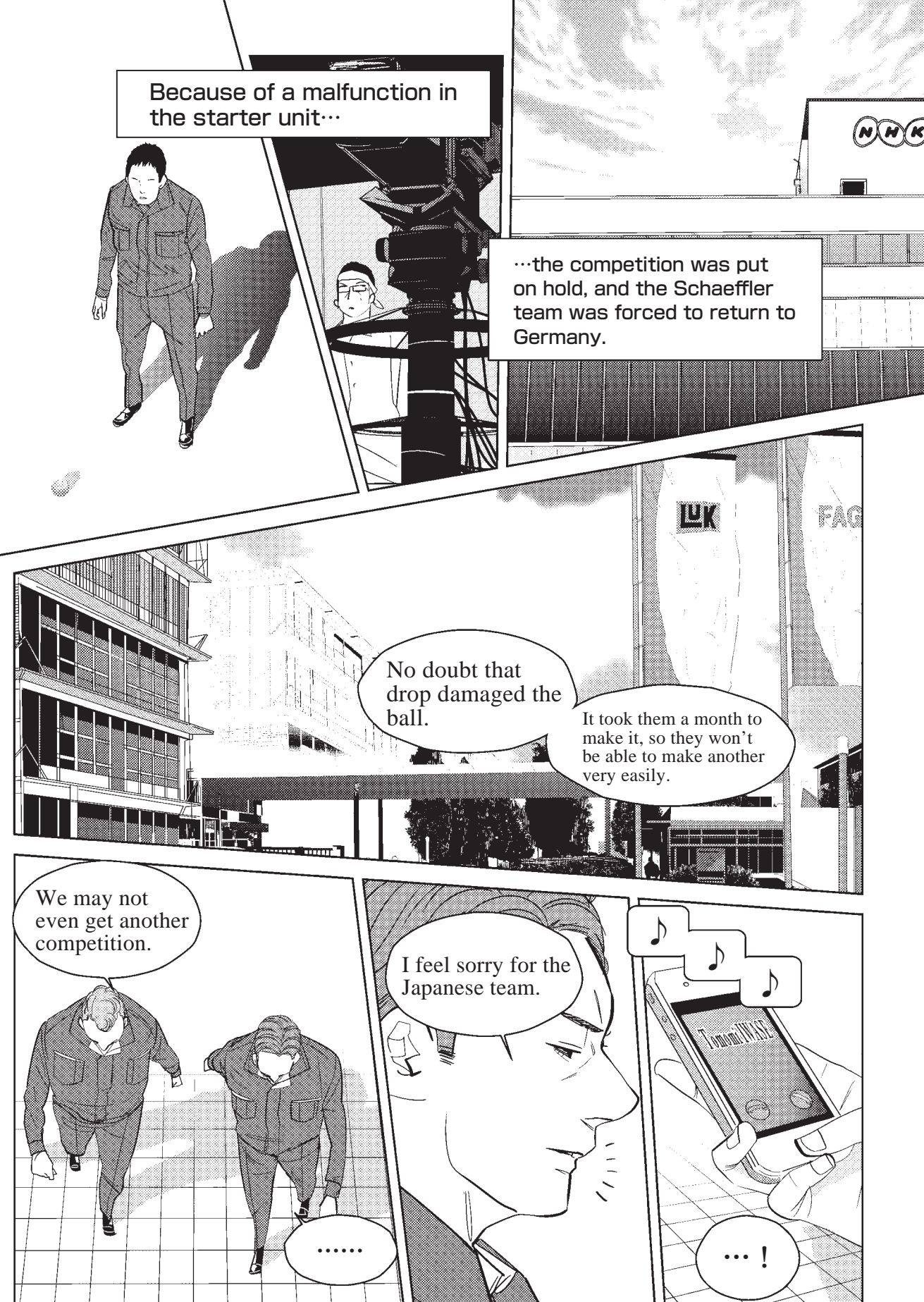
...and brought to Japan.



Now... Begin!

SHUMP

Huh?!



Because of a malfunction in the starter unit...

...the competition was put on hold, and the Schaeffler team was forced to return to Germany.

No doubt that drop damaged the ball.

It took them a month to make it, so they won't be able to make another very easily.

We may not even get another competition.

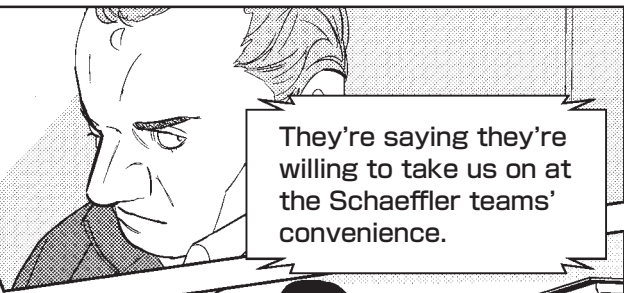
I feel sorry for the Japanese team.

...!

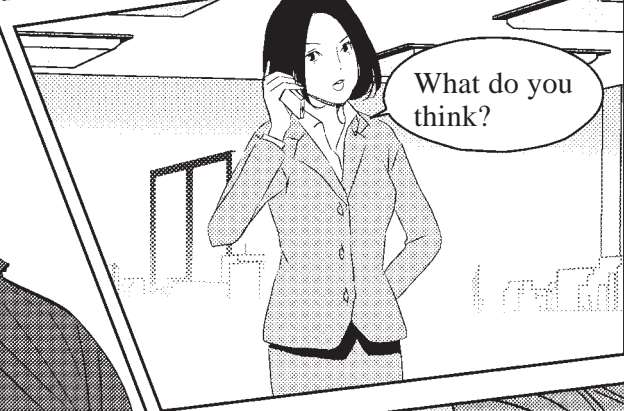
The Japanese team has agreed to a rematch.



They're saying they're willing to take us on at the Schaeffler teams' convenience.



What do you think?



Of course we'll go!

If we refused a team who is trying to reach the same goals we are, we could never look them in the eye again!

But even more than that...

I want to see how far the Schaeffler ball rolls!

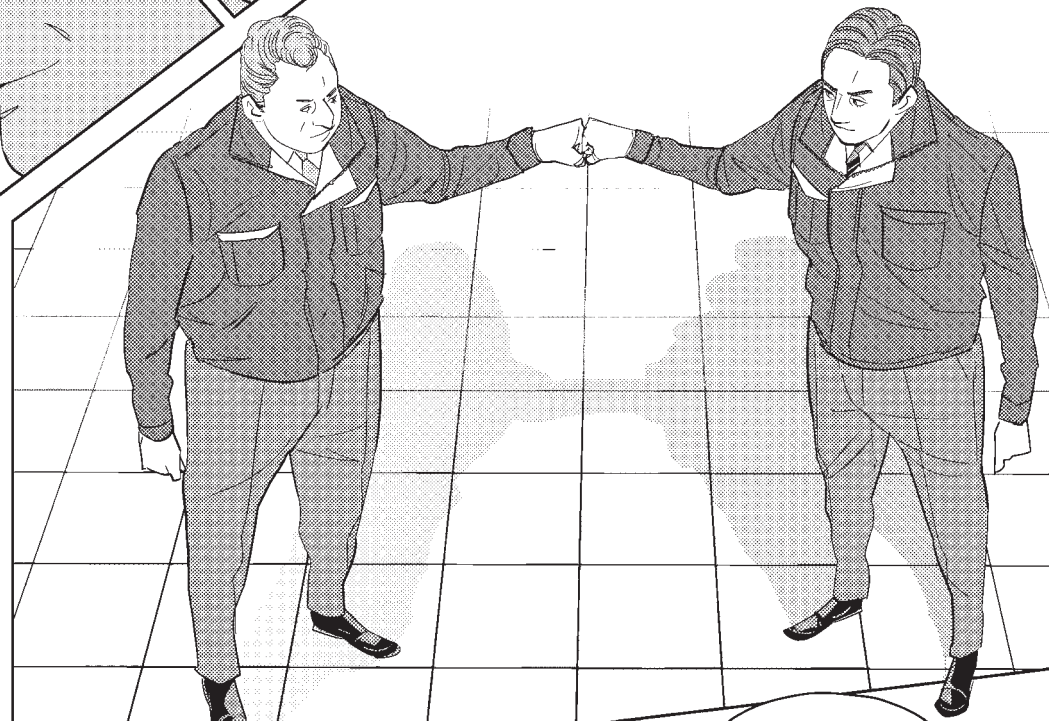
Okay!

I'll let them know!



And so...

THUNK



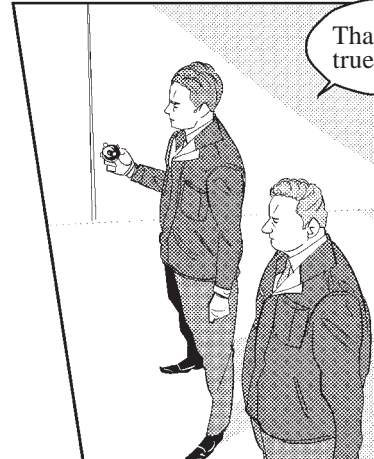
After many unexpected twists and turns...

All that's left is to trust in our process.



The final competition happened on April 19th...

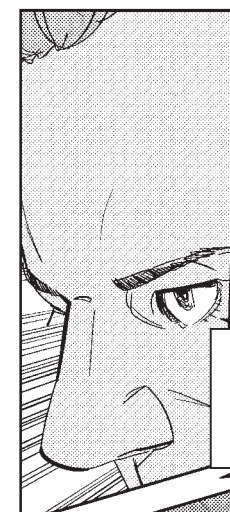
That's true, huh?



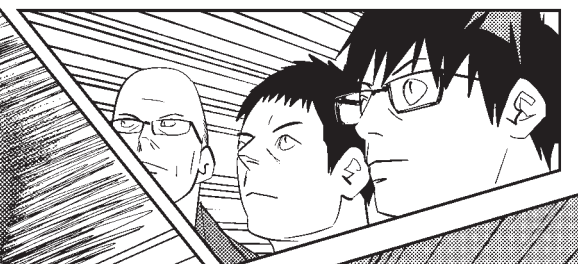


This little ball here...

...holds the efforts of countless people...



15 meters...



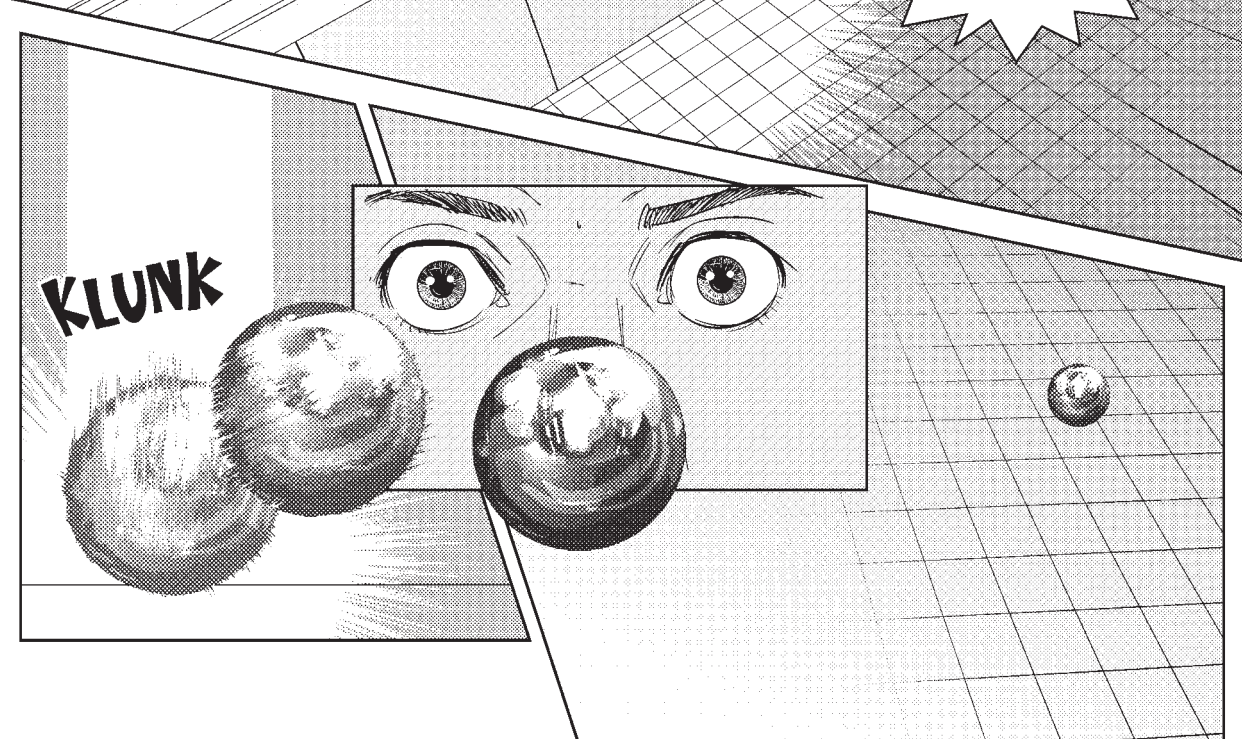
20 meters...!



Now... Begin!!

5 meters...

10 meters...



KLUNK

The Schaeffler team's ball rolled 21.26 meters...

WHOOA



The Japanese team's roll resulted in 30 meters.



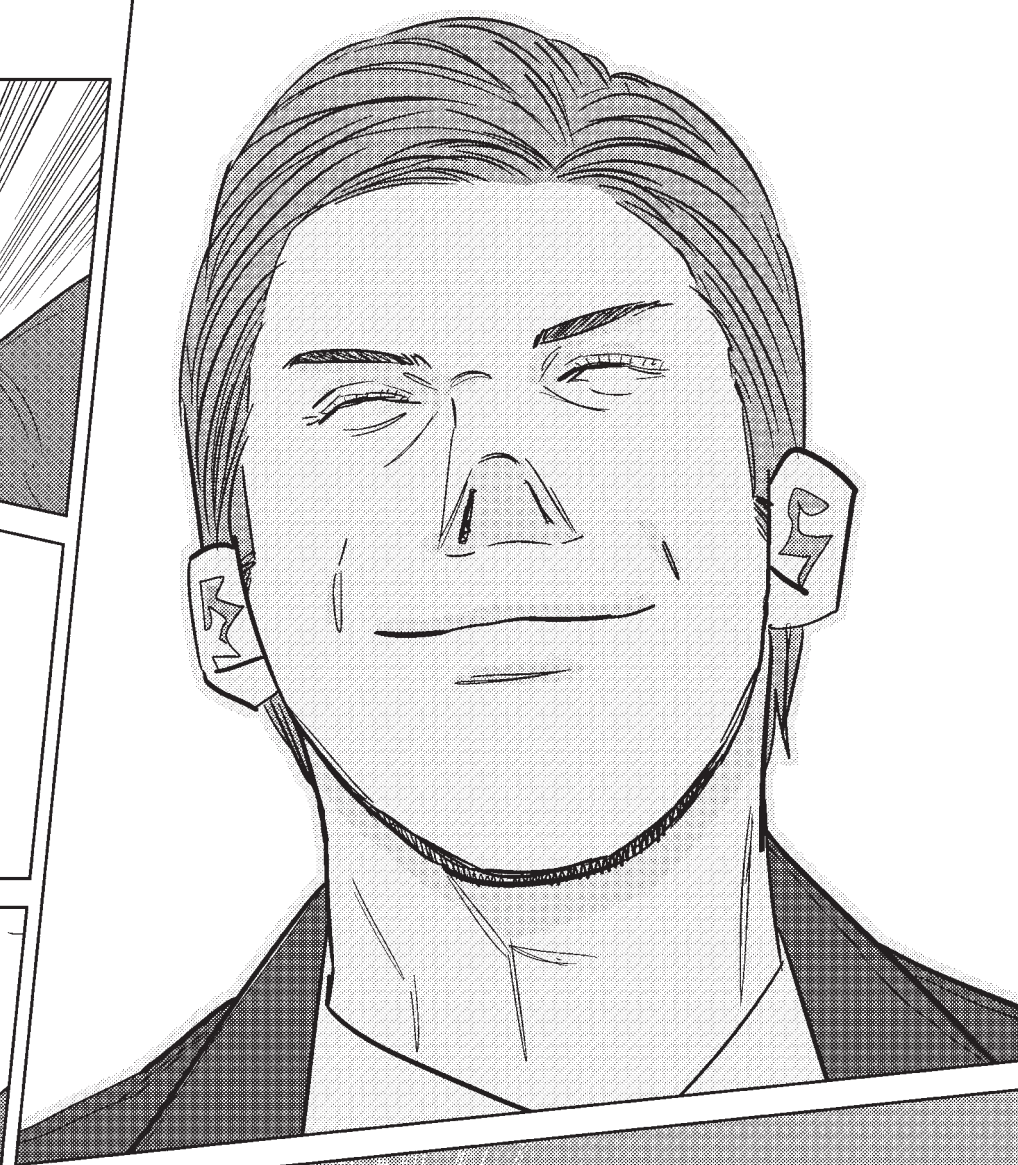
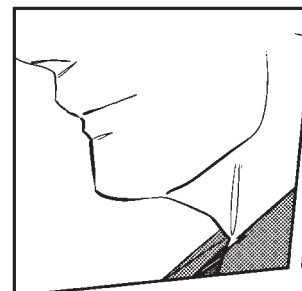
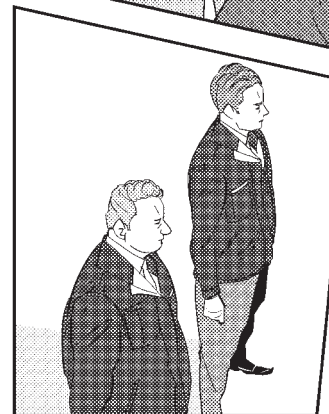
But the German team displayed no disappointment.

Are there any final words from the Schaeffler team?

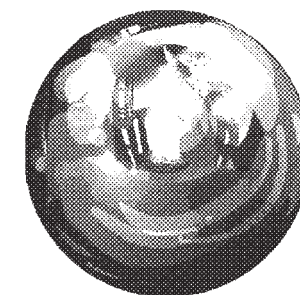
We're proud that our ball rolled more than 20 meters.

And it's our intention to show the world the high quality of German innovation and products in the future as well.

Thank you so much!



And the day when a perfect sphere is manufactured...



...could be any day now. Maybe even tomorrow...

SCHAEFFLER



FAG

Schaeffler Japan Co., Ltd.

Yokohama Business Park
134 Godo-cho, Hodogaya-ku,
Yokohama Japan
240-0005

TEL 045-287-9001

URL <http://www.schaeffler.co.jp/>

