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Quality for life

DynamicArm

Dynamic and powerful

Learning from Nature

The mobility of the human arm is truly impressive: Rotation in the shoulder joint is combined with the ability of the elbow to bend by an average of 150 degrees. Then there is the human hand as a highly sensitive and functional organ for grasping. All of this makes our arm a multi-functional precision tool. Copying this example as closely as possible is one of the greatest challenges faced in the field of prosthetics.







DynamicArm

Dynamic and powerful

The DynamicArm responds to the respective muscle signals. Like the human musculature, it also adapts to various loads automatically. This is made possible by the technology: the prosthesis is myoelectrically controlled and driven by an electric motor.

The DynamicArm can be positioned almost twice as fast as comparable myoelectric elbow joints. You can also lift a load of up to five kilograms with the prosthesis, which corresponds to a weight five times that of the DynamicArm. The movements of the DynamicArm are inconspicuous and fluent because the speed of the elbow joint is controllable even under load. The DynamicArm is very quiet and even noiseless when it swings loosely while walking (free-swing phase). During the free-swing phase, the energy released while extending the arm is stored to support subsequent flexion.

The DynamicArm establishes the foundation for a new attitude towards life: with the greatest possible functionality, a visually and acoustically inconspicuous overall image and natural movement patterns.

Every advancement in technology initially serves to improve functionality. At the same time, the natural appearance of a hand or arm prosthesis is a hallmark of a good fitting.

The development of functional prostheses began about 600 years ago. Movable finger segments could be manually secured in the extended or flexed position. The first mechanical elbow joints could be locked at up to six flexion angles. Watchmakers and armourers produced what were true marvels for the technical possibilities at the time. One of these went down in history: the iron hand of Götz von Berlichingen from the 16th century.



Always in the thick of things

Karl-Heinz

Karl-Heinz never keeps his hands still. When he isn't packing goods at his job with airport catering, the family man works in the house and garden or romps around with his two daughters.

Karl-Heinz lost his left arm in a work accident in March 2001. He was working as a baggage handler at Düsseldorf airport at the time. On the evening of the accident, he called his girlfriend – who is now his wife – to tell her that he would be home a little late. An airplane that had to be loaded arrived at the airport later than expected. When Karl-Heinz finished his work, his colleagues needed help at the rear door of the aircraft. A hoisting platform jammed so that the bed of the truck did not come up to the level of the aircraft door. When Karl-Heinz tried to check what the problem was, the loading ramp fell towards him. The entire load landed on his left arm. It took the fire brigade almost an hour to free him. An amputation was unavoidable. But Karl-Heinz could not be derailed. He received support from the woman who is now his wife. Three times she had to ask him – as they had agreed – whether he would like to marry her. Finally they both said yes. Today they are the proud parents of two daughters. Karl-Heinz hardly ever wore his first prosthesis – a cosmetic device made of silicone – since actively gripping things with the artificial hand was not possible. Finally Karl-Heinz was fitted with his first myoelectrically controlled prosthesis. This was progress since the artificial hand could be opened and closed in order to hold on to things. However, the elbow still had to be positioned with the sound hand.

Immediately after his accident, Karl-Heinz's boss offered him a job that he could do despite his handicap. Since then he has been packing goods in trolleys for onboard sale by various airlines.

But there were still problems. Sometimes his artificial hand gripped too tightly, damaging the packaging of expensive perfumes so they were no longer salable.

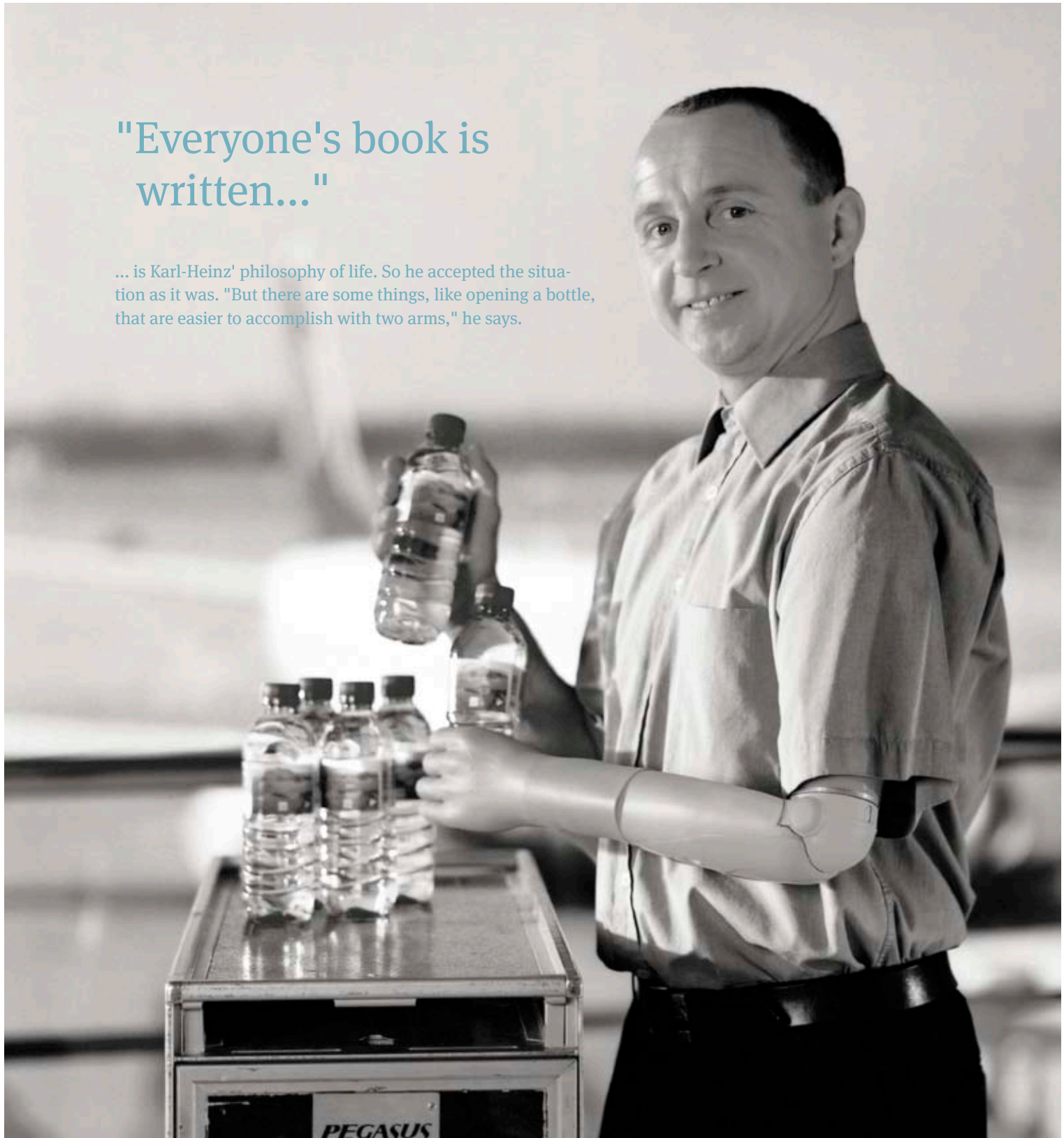
DynamicArm: precise in many situations

That doesn't happen anymore today. In 2004, Karl-Heinz received one of the first fittings with the DynamicArm which was combined with a SensorHand Speed. Since the DynamicArm was still in the trial phase back then, Karl-Heinz contributed practical know-how and his experience as valuable inputs to further development. The child safety lock for the off switch is based on a suggestion made by Karl-Heinz himself. It prevents children from being tempted to use the artificial arm as a toy.

In contrast to his earlier prostheses, Karl-Heinz keeps his DynamicArm "in operation" almost continuously. The lithium-ion batteries stand up to this without difficulty, even on long days. For example when Karl-Heinz renovates the entire kitchen in a day, a recent occurrence. Now Karl-Heinz can even pick up an egg without crushing it. And the perfume packages are no longer damaged when Karl-Heinz packs them into the trolley. The advantages of the DynamicArm are also revealed after doing the family's shopping. Karl-Heinz is able to carry bags with his new arm, so that he no longer has to set them down in order to unlock the door.

"Everyone's book is written..."

... is Karl-Heinz' philosophy of life. So he accepted the situation as it was. "But there are some things, like opening a bottle, that are easier to accomplish with two arms," he says.



Elbow lock

The elbow lock is integrated in the elbow joint. It supports a holding force of up to 230 N.

Forearm

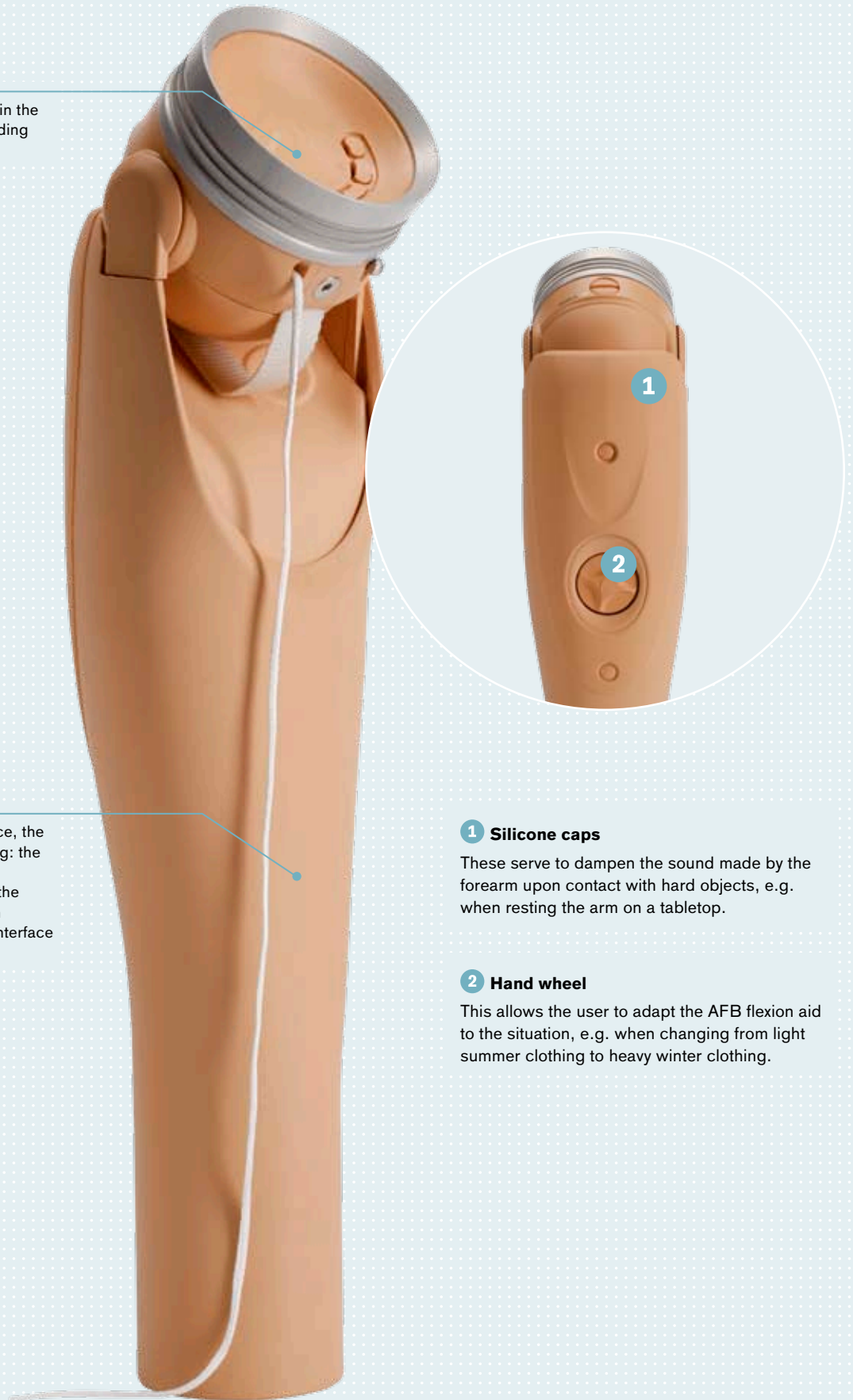
In a minimum amount of space, the forearm contains the following: the AFB flexion aid, the control electronics, the drive motor, the Vario transmission, the Li-Ion batteries and the Bluetooth interface to connect to the BionicLink.

1 Silicone caps

These serve to dampen the sound made by the forearm upon contact with hard objects, e.g. when resting the arm on a tabletop.

2 Hand wheel

This allows the user to adapt the AFB flexion aid to the situation, e.g. when changing from light summer clothing to heavy winter clothing.



DynamicArm

Precise and spirited

The DynamicArm is an electric motor driven elbow joint with an electronically controlled, infinitely variable Vario transmission. This means the gear mechanism, similar to the human musculature, responds almost instantly to various movements and demands while the gear ratio is continuously adapted to changing environmental conditions. It therefore comes very close to the movement pattern of a natural human arm.

Combined with the integrated AFB (Automatic Forearm Balance) flexion aid, the DynamicArm achieves ease of movement and a natural, slightly dampened and entirely soundless free swing. The AFB unit stores energy that is released when the arm is extended, returning it later for controlled flexion support. Electronic sensors supply basic data about the position and load to the integrated microprocessor, which uses them to calculate control data. Your prosthetist adapts the DynamicArm to your individual needs with the help of the special ElbowSoft software and the Ottobock BionicLink Bluetooth interface. The functionality of the DynamicArm allows you to achieve the greatest possible independence in everyday life. It is suitable for both unilateral and bilateral amputees.

What's new:

The DynamicArm is now even more natural and reliable. This is achieved through the following innovations:

- The dark brown elastomer protector in the hollow of the elbow joint has been removed. This results in uniform colouring: all protectors are now the colour of the forearm.
- Maintenance of the DynamicArm by your prosthetist is now only required every 24 months. This is made possible by numerous technical improvements and a new service and warranty concept.
- A powerful Bluetooth module, which provides an optimised connection, permits secure configuration by the technician via a computer.
- The strain gauge compensates for temperature fluctuations even more reliably.

Frequently Asked Questions

How is the DynamicArm controlled?

The user can control the position, force and speed of the prosthesis system via myo-electrodes. The prefix "myo" is derived from the Greek "mys" (muscle). Because of biochemical processes, every contraction of a muscle generates an electrical voltage in the micro-volt range. This voltage can be measured on the skin. With myoelectric arm prostheses, appropriate muscle voltages are detected in the residual limb. These low voltages are amplified and transmitted as control signals to the electronics of the prosthesis. The stronger the electrode signal, the faster the controlled movements – which makes precision control of the entire prosthesis system possible.

What components are compatible with the DynamicArm?

The DynamicArm is compatible with most myoelectrically controlled electric hands and electric grippers from Ottobock. A prosthesis system with particularly high functionality is achieved in combination with the especially responsive Sen-

sorHand Speed, offering maximum everyday independence for the user.

Where can I get the DynamicArm?

The DynamicArm is fitted on site by a prosthetist certified by Ottobock. If you cannot find a certified prosthetist near you, a fitting can also be realised in co-operation between your prosthetist and Ottobock. Please contact the Ottobock branch responsible for your region if you have further questions. For the address, please consult the last page of this publication or visit us on the internet under www.ottobock.com.

Who is the DynamicArm suited for?

The DynamicArm is suitable for virtually all persons with amputations in the forearm and shoulder region as well as disarticulation. It can be adapted to your abilities: persons with strong muscle signals can use the DynamicArm just as well as users who can only generate weak or even no active muscle signals at all in their residual limb.



What are the advantages of the DynamicArm compared to other electric elbow joints?

The greatest advantage of the DynamicArm lies in the dynamic response it enables for physical activities. You can position the arm very quickly. Every movement is harmonious and similar to that of a natural arm, even in the free-swing phase – making the prosthesis hardly noticeable during use. The joint has a very high load capacity: up to six kilograms can be actively lifted. Thanks to the integrated AFB flexion aid, the DynamicArm also consumes significantly less energy during everyday use and is quieter than conventional electric elbow joints.

What is the function of the Vario transmission in the DynamicArm?

With the Vario transmission, your movements become highly dynamic – more dynamic than with any other elbow prosthesis. The DynamicArm automatically adapts to changing loads, so that you can raise and lower it almost like a natural arm. It can be positioned much more quickly compared to other electric elbow joints and is particularly powerful.

What does the AFB principle achieve in the DynamicArm?

The electronically controlled AFB (Automatic Forearm Balance) flexion aid stores energy when the forearm is lowered and then uses it when lifting. This has a noticeable impact on energy consumption by the DynamicArm: even with intensive use, the permanently installed lithium-ion battery guarantees full performance all day.

AFB also ensures a harmonious free swing of the arm, since it supports the patient's arm movement. The resulting movements are natural – without additional energy consumption or bothersome noises.

With compliments from