connects the ship of the linear drive **11** to the orthosis **16-23**, **28-37** and **38-52**, that is to say to the following elements: upper arm rotation module, elbow rotation module, forearm rotation module, and connecting pieces. These parts can be made of aluminum, for example, in order to reduce their weight while at the same time ensuring sufficient stiffness.

[0022] FIG. **2** shows in more detail the elements that are connected to the jib and that guide the upper arm **5** of the patient **4** and the forearm **6** of the patient **4**. The hand **7** (or wrist) shown schematically in FIG. **1** is freely movable. However, it is also possible to provide a handle (not shown in the drawings) connected to the forearm orthosis. An upper arm cuff **10** connects the upper arm **5** of the patient **4** to the orthosis; the forearm cuff **9** connects the forearm **6** of the patient **4** to the orthosis, and the wrist cuff **8** connects the part of the patient's forearm **6** near the wrist to the orthosis. All the cuffs are advantageously made of a skin-compatible material and can be pulled tight preferably with the aid of a velcro-type closure. A cuff is understood as any customary securing element with which part of an arm, or an article of clothing surrounding an arm, can be fixed to another object.

[0023] FIG. **2** now shows, in an exploded schematic view, the other mechanical features of the system according to the invention. The same features in all the figures are identified by the same reference numbers. The jib **12** is secured on the vertical linear drive **11**, and a second drive **26** is mounted on the jib **12**. This second drive **26** with vertical axis of rotation permits the rotation of the patient's arm in the horizontal plane. The now schematically depicted second drive **26** is usually composed of a DC motor, a digital encoder, and a "harmonic drive" gear that is free of backlash. The use of other drives is also possible, for example brushless direct-current motors and planetary gears. Its main axis arranged parallel to the spindle of the linear drive **11** is connected to a force sensor **27** that measures six degrees of freedom. This force sensor, in brief a 6-DOF force sensor **27**, measures the forces and torques that occur and sends the detected signals to control electronics. This means that the force sensor **27** also measures the horizontal force with which the first drive **25** (see FIG. **3**) drives the ball spindle, which can be a commercially available DC motor encoder and a ball spindle drive. The reference number **25** designates the drive located in the linear module **11**. The force sensor **27** also measures the torque delivered by the second drive **26** and, after a transformation of coordinates, the torque delivered by the third drive **29**, as will be explained in more detail below. The force sensor **27** can be designed, for example, as a system of several strain gauges for all six axes.

[0024] The second drive **26**, coupled via the force sensor **27**, drives the upper supporting connection **13**. The upper supporting connection **13** connects a supporting connection **14** to the force sensor **27**. The supporting connection **14** can rotate freely about the horizontal axis, corresponding to a passive degree of freedom. The supporting connection **13** can be formed by a shaft mounted on two ball bearings.

[0025] The supporting connection **14** connects the upper arm rotation module, in particular the outer half-cylinder **16** thereof, to the force sensor **27**. A supporting connection **14** made of aluminum is again advantageously chosen for reasons relating to the weight of the material and its stiffness. The supporting connection **14** preferably has a length adjustment mechanism (not shown in the drawings), which permits a length adjustment of the supporting connection, such that the system can easily be used for patients **4** with different arm. lengths. As in the illustrative embodiment depicted here, the supporting connection **14** can be composed of three round rods, which can be recessed to a greater or lesser extent into the aluminum body (top and bottom) of the supporting connection **14**.

[0026] The lower supporting connection **15** connects the supporting connection **14** to the upper arm rotation module and, like the upper supporting connection **13**, is advantageously composed of a shaft mounted on two ball bearings. In functional terms, this is a hinge joint obtained with the aid of two ball joints.

[0027] The upper arm rotation module is formed in particular by an outer half-cylinder **16** and an inner half-cylinder **17**, the function of which will be explained in more detail with reference to FIG. **5** and FIG. **6**. A connecting rail **18** connects the upper arm rotation module **16**, **17** to the fourth drive **32**, namely the elbow drive. The connecting rail **18** is here composed of four round rods, which are arranged at irregular intervals through ca. 180 degrees about the hollow space defined by the half-cylinders **16** and **17**.

[0028] A third drive **29** is arranged on the outer half-cylinder **16**, parallel to said connecting rail **18**. A torque sensor **28** is arranged in front of said third drive **29**, and an encoder **30** for the third axis is arranged behind it. The encoders mentioned here for the various axes serve as signal transmitters for the control electronics for establishing the position and for feedback and control of the drives. The torque sensor **28** of the third axis measures the torque delivered by the third drive **29** and is advantageously formed by a strain gauge. The third drive **29** delivers the torque for an internal and external shoulder rotation, as will be explained below. The third encoder **30** measures the position of the third axis and is advantageously an optical encoder.

[0029] The connecting rail **18** from the upper arm to the elbow is fitted into the elbow half-cylinder **22** which is located near the upper arm and on which there is a fourth drive **32** with a torque sensor **33** for the fourth axis and with an encoder **31** for the fourth axis. The axis of rotation of this drive, crosses the axis of symmetry of the upper arm rotation module centrally and at right angles. The forearm cuff **9** is secured on the half-cylinder **23** of the elbow located near the wrist and engaging in said elbow half-cylinder **22** near the upper arm. The half-cylinder **23** near the upper arm is connected via the connecting rail **19** and via the torque sensor **37** to the outer half-cylinder **20** of the forearm rotation module.

[0030] The forearm rotation module is composed of the inner cylinder **21**, which rotates in the outer half-cylinder **20** and thus permits the pronation/supination of the forearm. For this purpose, a fifth drive **35** is provided on the outer half-cylinder **20** and forms a unit together with a torque sensor **36** of the fifth axis and with a fifth encoder **34**.

[0031] The torque of the fifth drive **35** can be measured redundantly both with the torque sensor **36** and also with the torque sensor **37**. The sensor **27** measures the torques of the drives **25**, **26** and **29**.

[0032] FIG. **3** now shows an illustrative embodiment of an assembled system according to the invention in a schematic perspective view. The linear drive **11** contains the first drive **25** that drives the ball spindle (not shown) with which the jib **12** is moved up and down. It will be seen from FIG. **3** that, by means of the second drive **26**, the outer cylinder **16** of the upper arm rotation module can be arranged, by simultaneous vertical adjustment by the jib **12**, in any desired orientation and height with respect to the position of the linear drive **11**