DEVICE FOR UPPER LIMB KINETHOTERAPY

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Abstract: In this paper a powered therapeutic devices providing for the rehabilitation of the upper limb after injury and illness is presented. The device guides the patient's limb through a series if desired exercises to rehabilitate multiple muscle groups. A comparative study of different devices is done. Based on the functions of upper limb, the structure of the proposed device is presented. Two applications are being emphasized: one for passive movements and the other one, for active movements.

1. KINETHOTERAPY – COMPONENT OF REHABILITATION

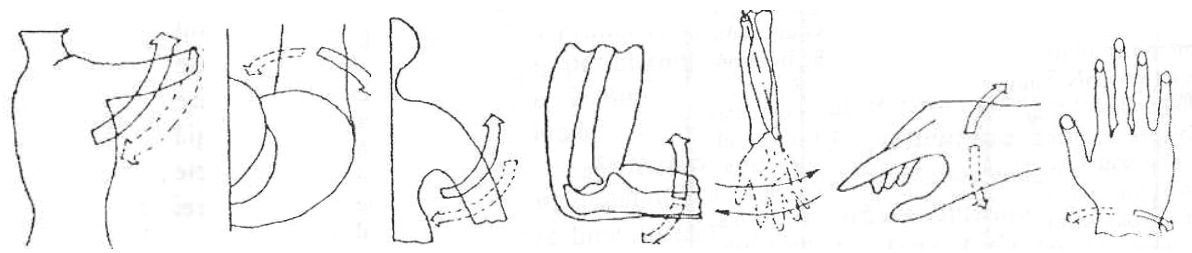
Kinetotherapy promotes motion as a basic element of rehabilitation treatment. Kinetotherapy aspects are varied, including: walking, running, gym, games, training – using specialized equipment, hidrokinethoterapy, [6], [8].

The passive mobilizations are those movements impozed to a patient's articulation by an exterior intervention, without its neuromuscular system to be involved. The active mobilizations or movements are the ensemble of exercises performed by the patient, voluntarly putting in function his/her neuromuscular system. Active movements may be assisted, free – without exterior restistance or active movements against a resisting force.

Kinetotherapy is an important part of *rehabilitation,* which is a complex medico-social assisting process that has as objective the reintregration of disabled in family and society. Its specific ways of action concern the achievement of optimal values for the morpho-functional capacity, psychical status, professional training, and social status. The other components of Rehabilitation Engineering are prosthetics, orthotics, mobility aids, walk assist devices, sensorial augmentation systems, [5].

2. COMPARATIVE STUDY OF SOME KINETHOTERAPY DEVICES FOR UPPER LIMB

The anatomic basic and specific movements of the hand positioning bio-system are the backward-forward arm's projection; the inner-outer arm's rotation; the arm's abduction-adduction and the forearm's flexion-extension (Fig.1 a, b, c, d)



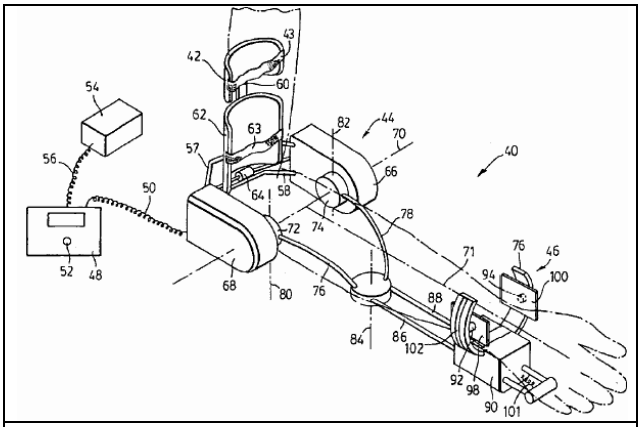
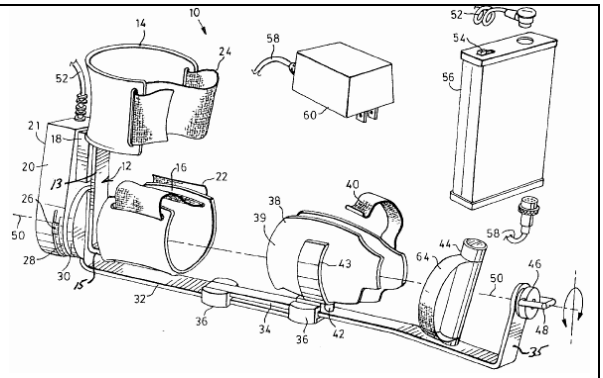
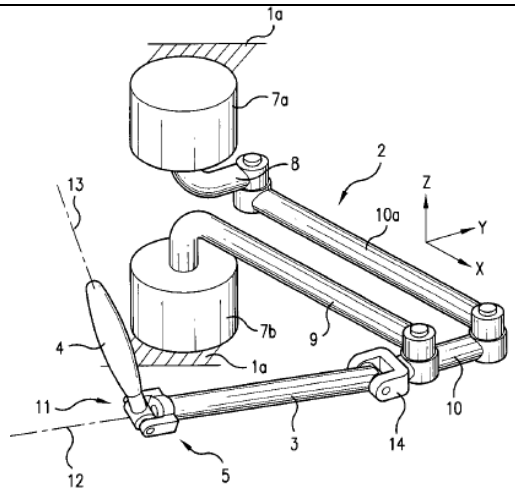
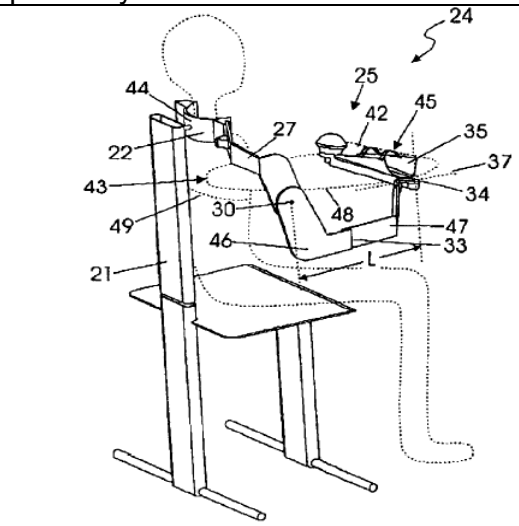
a ***b*** ***c*** ***d*** ***e*** ***f*** ***g***

Fig. 1 The anatomical movements of the shoulder and elbow jointsl

forearm's pronation – supination, hand's abduction – adduction, hand's flexion – extension (Fig. 1 e, f, g). Prehension, that is gripping of different objects, like in a tweezer has the following basic anatomic movements: the thumb's flexion–extension and abduction–adduction and the 2-5 fingers flexion–extension and laterality movements [1].

In table 1 some devices for kinetic treatment of the joints of the human upper limb are presented, according to [9].

Table 1 Devices for kinetic treatment of upper limb

	
The above figure relates to a therapeutic mobilisation and positioning device of joints having a control device that measures the force through the deformation of an elastic component. Elbow and wrist are the target joints and flexion-extension and pronation-supination are the assisted motions.	The continuous passive motion device includes an upper arm support suitably fixed to a drive actuator and a adjustable forearm support. Various cuffs are provided so a patient can secure the limb to the device; so pronation –supination is passively created.
	
The device is equipped with a controller for the sensing of the position of the handle at the end of an arm in the X and Y directions and in Z direction through a hinge which permits the arm to rotate upwardly. The joints of the device may be actuated to provide haptic feed-back.	In figure is a therapy and training device for the shoulder joint with a trunk base having two shoulders extensions on a rotational joint base. It has a modular structure and can produce passive motions of the shoulder and elbow.