

Project Type Synthesis Homework

Your Name

October 15, 2025

Abstract

Briefly summarize the purpose and key findings of this document.

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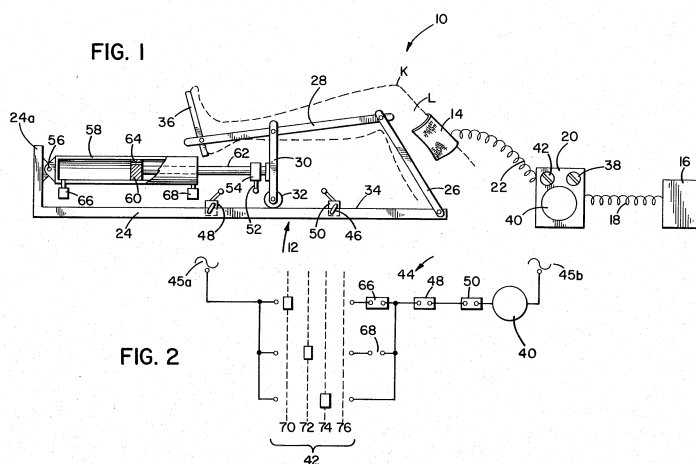
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1 US4509509A: Apparatus for Treating the Joints of the Human Body

1.1 Description

Early CPM concept emphasizing adjustable thigh and calf supports driven by a motorized linkage to provide controlled flexion/extension. Focuses on modular supports and variable range/speed settings to accommodate different patient anatomies and therapy progressions.

1.2 Images



U.S. Patent
Apr. 9, 1985
4,509,509

Figure 1: US4509509A apparatus illustrating adjustable thigh/calf supports and drive linkage.

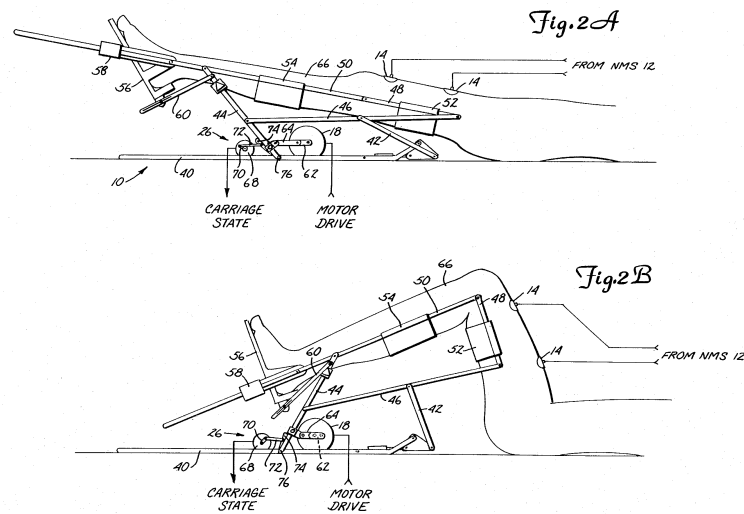
1.3 Mechanism kinematics

2 US4520827A: NMS Aided Continuous Passive Motion Apparatus

2.1 Description

Integrates neuromuscular stimulation with CPM so electrical stimulation can be synchronized with passive motion. Aims to reduce atrophy and enhance neuromuscular re-education while maintaining safe, programmable knee motion profiles.

2.2 Images



U.S. Patent Jun. 4, 1985

Sheet 2 of 2 4,520,827

Figure 2: US4520827A concept combining CPM with synchronized neuromuscular stimulation.

2.3 Mechanism kinematics

3 US4549534A: Leg Exercise Device

3.1 Description

Compact leg exercise mechanism configured for passive knee cycling with an emphasis on home-use practicality. Utilizes a simple linkage and foot support to provide repeatable, low-load flexion/extension with minimal setup.



3.3 Mechanism kinematics

4.1 Description

6

1. 1. 1.

5.2 Images

U.S. Patent Dec. 4, 1990 Sheet 1 of 8 4,974,830

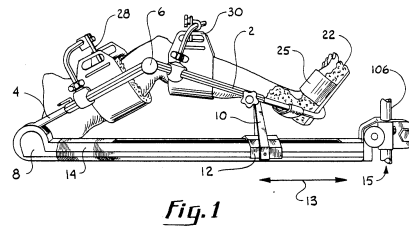


Fig. 1

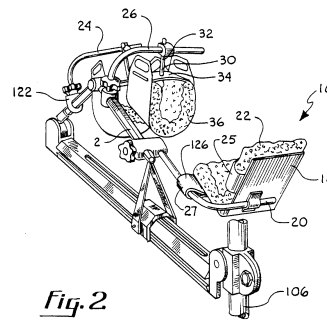


Fig. 2

Figure 5: US4974830A CPM with adjustable cradles and end-stop control.

5.3 Mechanism kinematics

6 US5203321A: Passive Anatomic Ankle–Foot Exerciser

6.1 Description

Lower-limb passive motion device centered on anatomically aligned pivots and adjustable motion limits. Although focused on the ankle–foot complex, its design principles for alignment and controlled arcs inform knee CPM alignment strategies.

6.2 Images

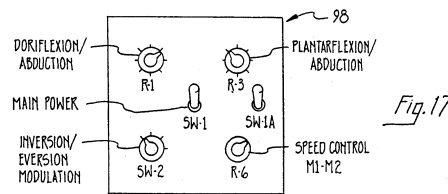
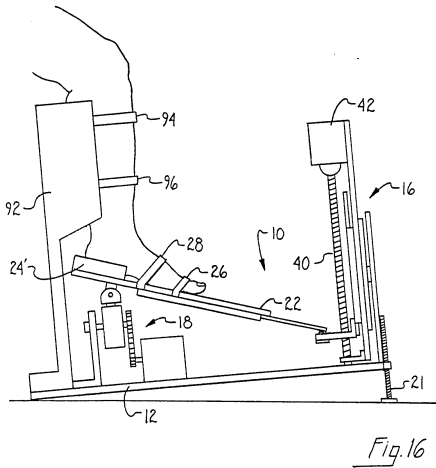


Figure 6: US5203321A passive device emphasizing anatomical pivot alignment.

6.3 Mechanism kinematics

7 US5333604A: Patella Exercising Apparatus

7.1 Description

Targets patellar tracking and anterior knee mechanics, providing controlled patellar motion and load pathways. Highlights isolated patellofemoral mobilization that can complement tibiofemoral CPM to address maltracking concerns.

7.2 Images

U.S. Patent Aug. 2, 1994 Sheet 1 of 4 5,333,604

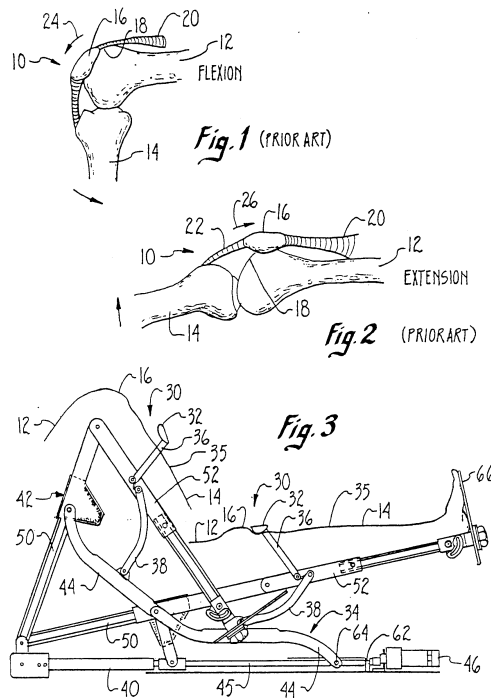


Figure 7: US5333604A apparatus for targeted patellar motion and tracking.

7.3 Mechanism kinematics

8 US6267735B1: Continuous Passive Motion Device Having a Comfort Zone Feature

8.1 Description

Implements a *comfort zone* deadband that avoids painful end ranges by adapting speed or reversing before irritation thresholds. Designed to increase tolerance and session duration while preserving therapeutic ROM gains.

8.2 Images

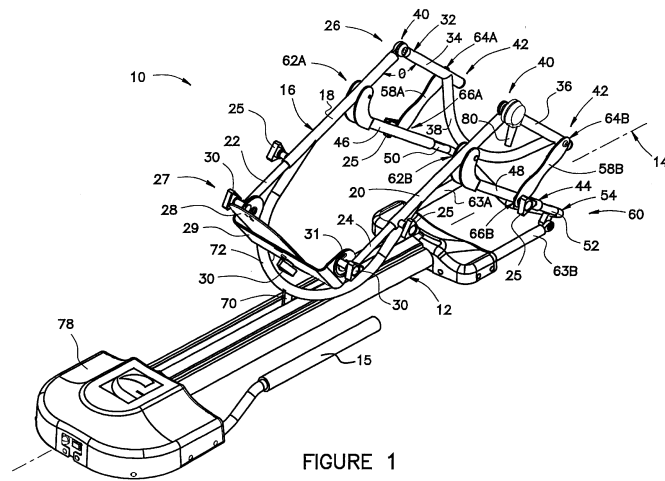


FIGURE 1

U.S. Patent

Jul. 31, 2001

Sheet 1 of 5

US 6,267,735 B1

Figure 8: US6267735B1 CPM featuring an adaptive comfort-zone deadband.

8.3 Mechanism kinematics

9 US6325770B1: Device for Producing Continuous Passive Motion

9.1 Description

Mechanical drive (e.g., cam/gear) tuned to follow a knee-like path, aiming for physiologic tibiofemoral motion. Focuses on smooth kinematics and robust transmission to reduce backlash and improve comfort.

9.2 Images

U.S. Patent Dec. 4, 2001 Sheet 2 of 2 US 6,325,770 B1

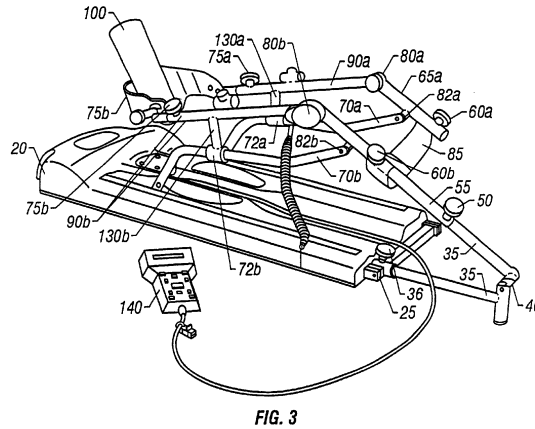


Figure 9: US6325770B1 transmission tuned for knee-like motion paths.

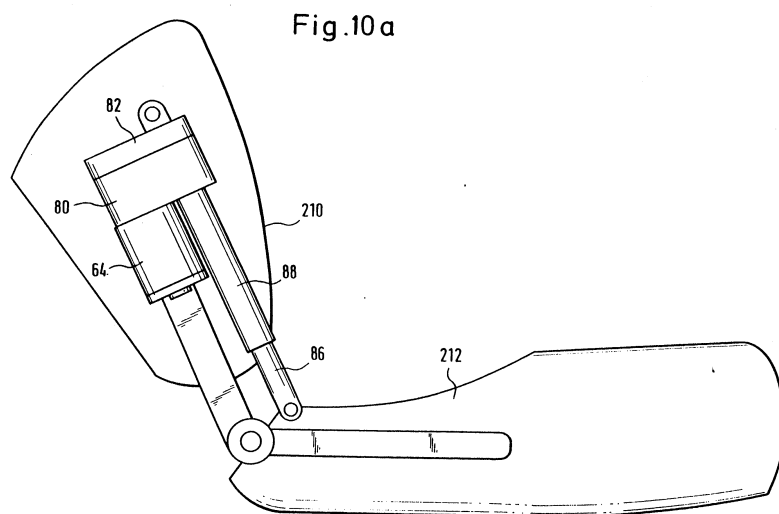
9.3 Mechanism kinematics

10 US5252102A: Electronic Range of Motion Apparatus for Orthosis/Prosthesis/CPM

10.1 Description

Integrates electronic ROM sensing and feedback into an orthotic/CPM framework. Enables measurement-driven progression, alarms for unsafe limits, and data logging for clinical assessment.

10.2 Images



U.S. Patent

Oct. 12, 1993

Sheet 16 of 19

5,252,102

Figure 10: US5252102A apparatus with integrated electronic ROM sensing.

10.3 Mechanism kinematics

11 US5280783A: Continuous Passive Motion Device for Full Extension of Leg

11.1 Description

Prioritizes achieving and maintaining full knee extension with adjustable extension bias and end-range control. Useful for post-operative protocols where extension deficits are common.

11.2 Images

U.S. Patent Jan. 25, 1994 Sheet 3 of 3 5,280,783

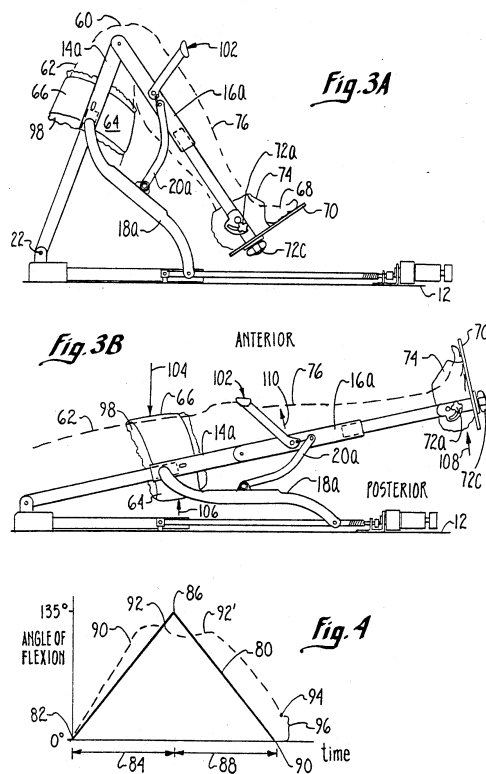


Figure 11: US5280783A CPM emphasizing controlled full-extension capability.

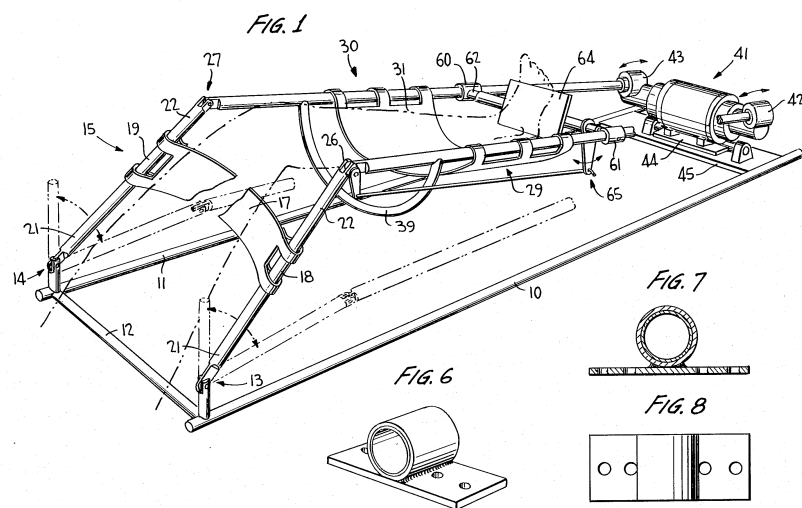
11.3 Mechanism kinematics

12 US4492222A: Knee Exercise Machine

12.1 Description

Adjustable axis alignment between femoral and tibial supports with a stable footplate to promote consistent knee pivoting. Emphasizes structural simplicity and robust construction for repeated clinical use.

12.2 Images



U.S. Patent Jan. 8, 1985

Sheet 1 of 4

4,492,222

Figure 12: US4492222A knee exercise machine with adjustable axis alignment.

12.3 Mechanism kinematics

13 US10272291B2: Knee Flexion and Extension Therapy Device and Method of Use

13.1 Description

Modern therapy platform with modular brace interfaces and sensor-ready architecture for tracking compliance and motion. Highlights portability and user-centric controls to support clinic-to-home continuity.

13.2 Images

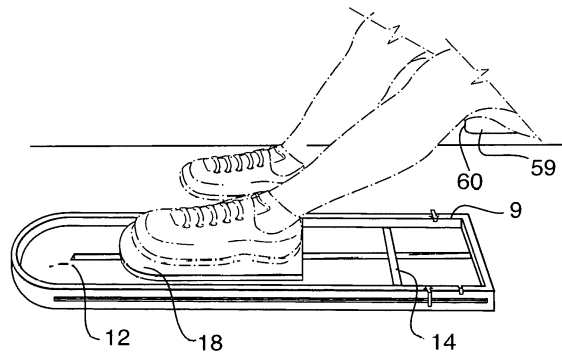


FIG. 8

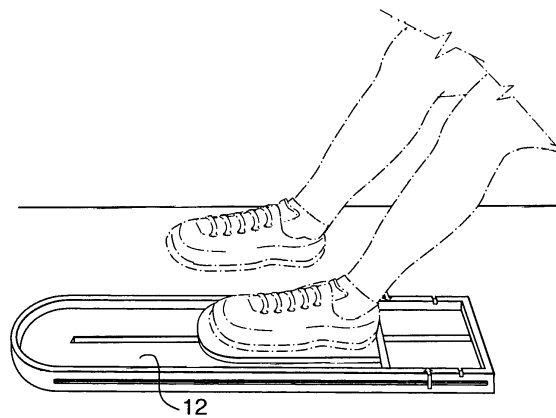


FIG. 9

Figure 13: US10272291B2 modern therapy platform for knee flexion/extension.

13.3 Mechanism kinematics

14 US4603687A: Continuous Passive Motion Orthopedic Device

14.1 Description

Counterbalanced support arms with a motorized actuator and alignment aids to minimize off-axis loads. Designed for steady, repeatable cycles with straightforward mechanical adjustments.

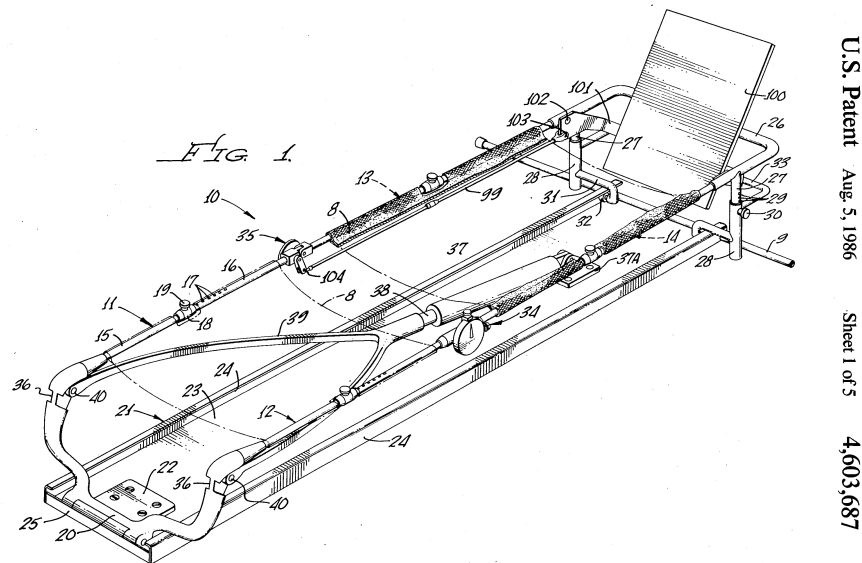


Figure 14: US4603687A CPM with counterbalanced arms and alignment aids.

14.3 Mechanism kinematics

15 US5239987A: Anatomically Correct Continuous Passive Motion Device for a Limb

15.1 Description

Axis-following mechanism intended to accommodate the knee's migrating instantaneous center of rotation. Reduces misalignment-induced shear by adapting the motion path to a more anatomic "J-curve".

15.3 Mechanism kinematics

16.1 Description

18

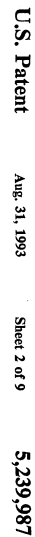


Figure 15: US5239987A device adapting to the knee’s shifting rotation center.

16.2 Images

U.S. Patent Oct. 15, 1985 Sheet 1 of 3 4,546,763

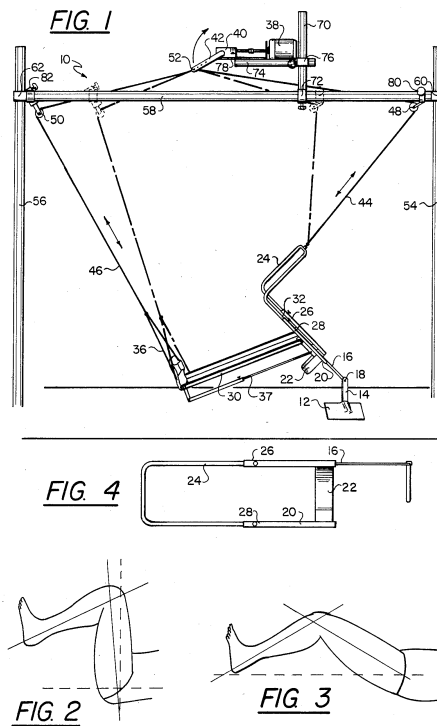


Figure 16: US4546763A apparatus and protocol emphasizing programmable CPM dosing.

17 Methods

Describe your approach, models, assumptions, and methodology in detail.

18 Results

Present results, figures, and tables. For example, include an image like in Figure 17.

Figure 17: Example figure caption.

19 Discussion

Interpret the results, discuss limitations, and relate to prior work.

20 Conclusion

Summarize key takeaways and outline future work.