Project Type Synthesis Homework

Your Name

October 17, 2025

Abstract

Briefly summarize the purpose and key findings of this document.

Contents

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

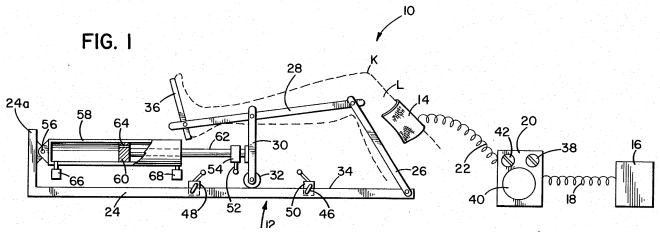

Figure 1: US4509509A apparatus illustrating adjustable thigh/calf supports and drive linkage.

1.3 Mechanism kinematics

2 US4549534A: Leg Exercise Device

2.1 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.

2.2 Images

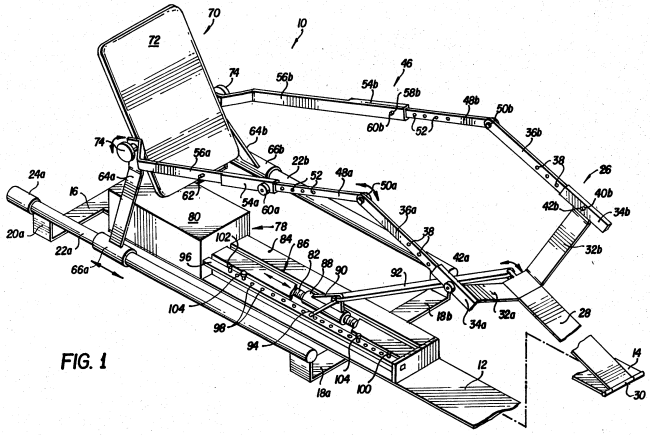

Figure 2: US4549534A leg exercise linkage aimed at repeatable passive motion.

2.3 Mechanism kinematics

3 US4566440A: Orthosis for Leg Movement with Virtual Hip Pivot

3.1 Description

Introduces a *virtual hip pivot* to better replicate natural hip–knee kinematics during knee motion, reducing shear and improving alignment. The orthosis geometry helps maintain consistent joint axes throughout the CPM cycle.

3.2 Images

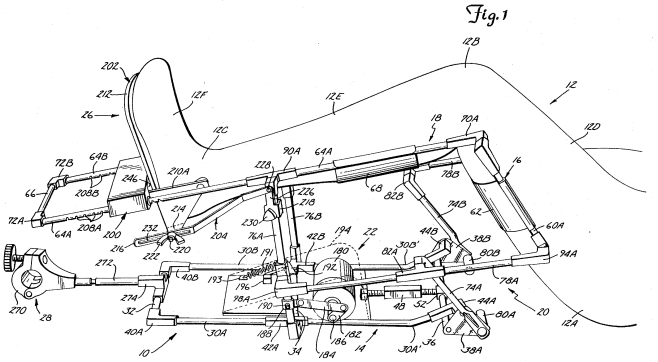

Figure 3: US4566440A orthosis showing geometry for a virtual hip pivot.

3.3 Mechanism kinematics

4 US4974830A: Continuous Passive Motion Device

4.1 Description

Programmable CPM with quick-adjust femoral and tibial cradles and mechanical end-stop management. Emphasizes user-friendly ROM adjustments and reliable actuator control for consistent therapy dosing.

4.2 Images

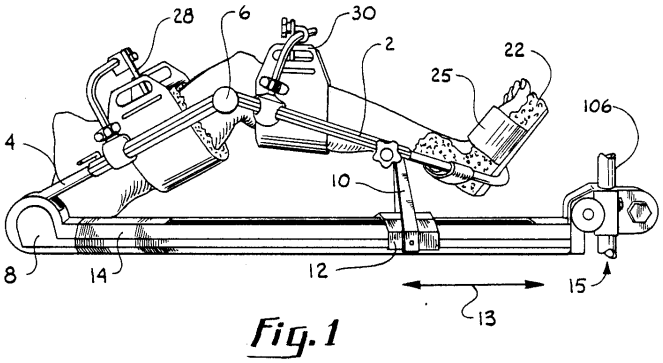

Figure 4: US4974830A CPM with adjustable cradles and end-stop control.

4.3 Mechanism kinematics

5 US5333604A: Patella Exercising Apparatus

5.1 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.

5.2 Images

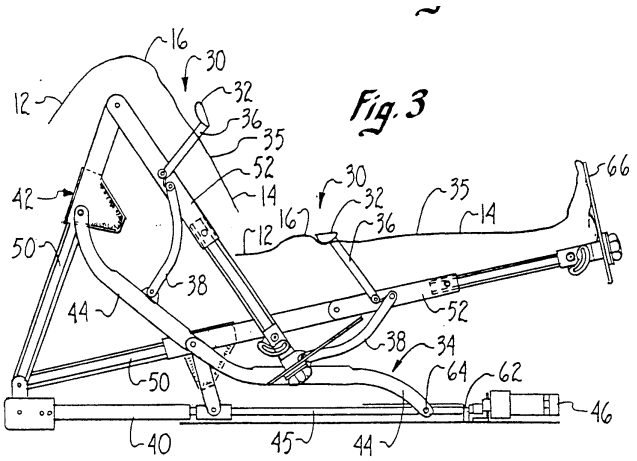

Figure 5: US5333604A apparatus for targeted patellar motion and tracking.

5.3 Mechanism kinematics

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

6.1 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.

6.2 Images

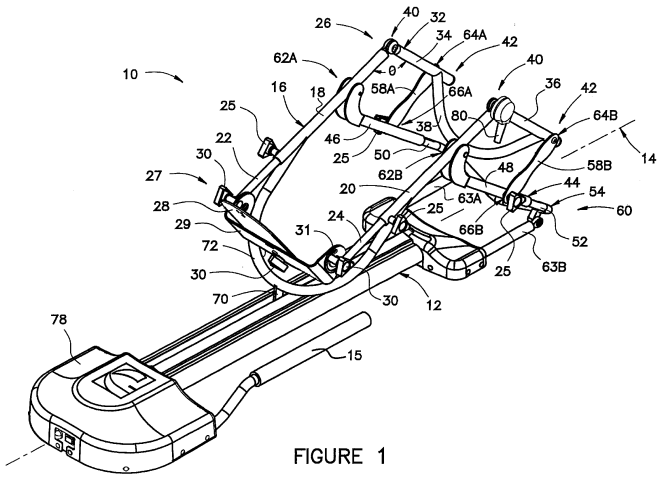

Figure 6: US6267735B1 CPM featuring an adaptive comfort-zone deadband.

6.3 Mechanism kinematics

7 US6325770B1: Device for Producing Continuous Passive Motion

7.1 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.

7.2 Images

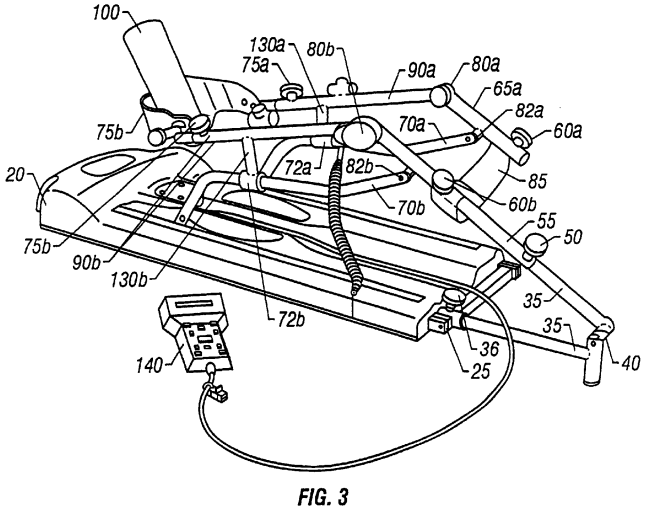

Figure 7: US6325770B1 transmission tuned for knee-like motion paths.

7.3 Mechanism kinematics

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

8.1 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.

8.2 Images

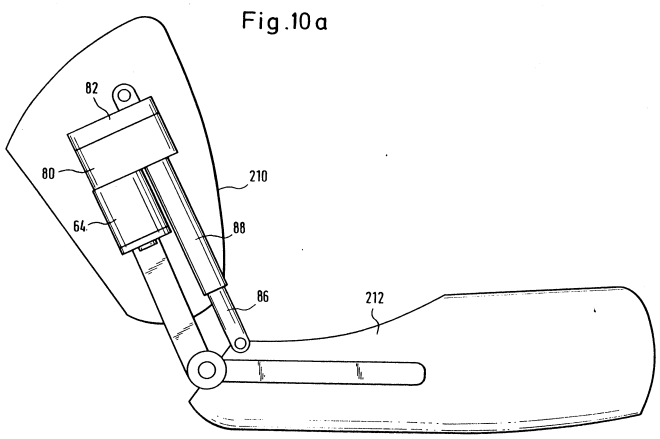

Figure 8: US5252102A apparatus with integrated electronic ROM sensing.

8.3 Mechanism kinematics

9 US4492222A: Knee Exercise Machine

9.1 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.

9.2 Images

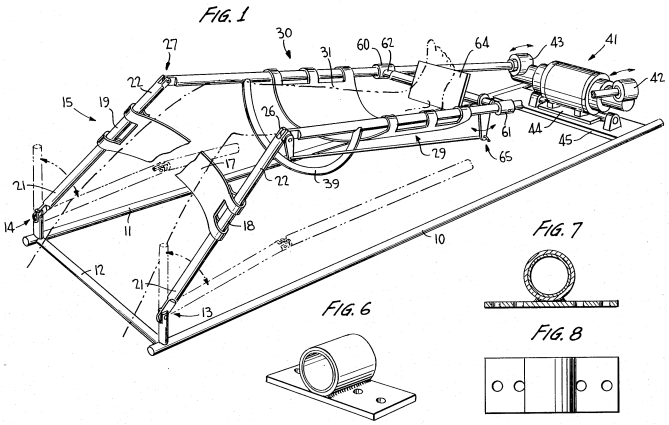

Figure 9: US4492222A knee exercise machine with adjustable axis alignment.

9.3 Mechanism kinematics

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

10.1 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.

10.2 Images

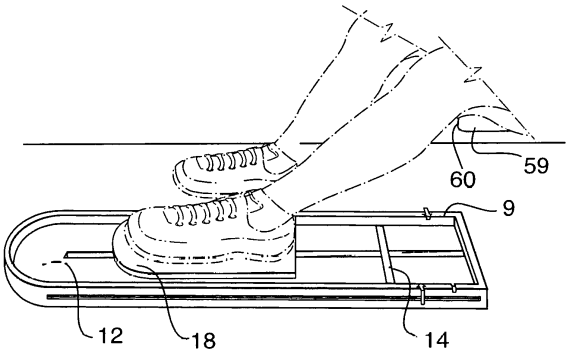

FIG. 8

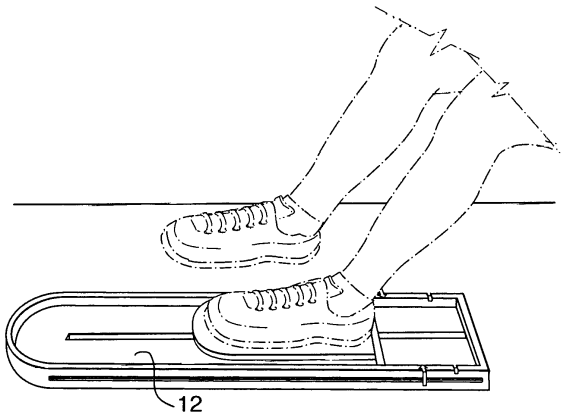

FIG.9

Figure 10: US10272291B2 modern therapy platform for knee flexion/extension.

10.3 Mechanism kinematics

11 US4603687A: Continuous Passive Motion Orthopedic Device

11.1 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.

11.2 Images

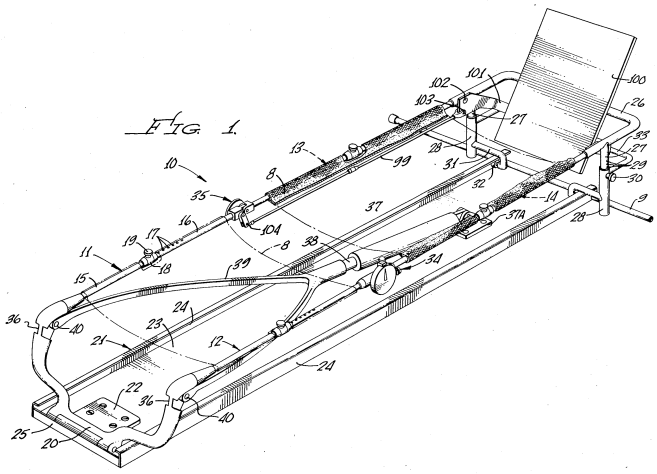

Figure 11: US4603687A CPM with counterbalanced arms and alignment aids.

11.3 Mechanism kinematics

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

12.1 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".

12.2 Images

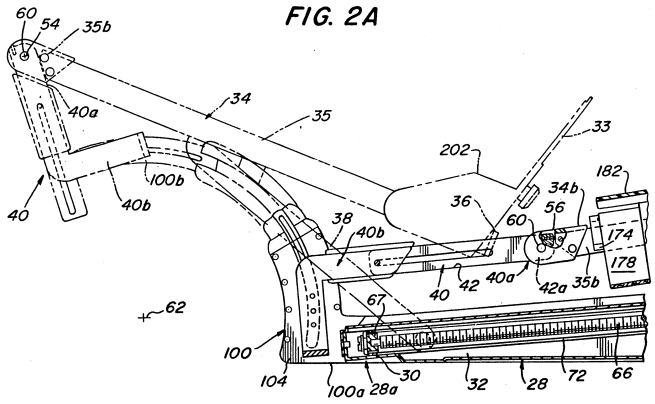

Figure 12: US5239987A device adapting to the knee's shifting rotation center.

12.3 Mechanism kinematics

13 US4546763A: Continuous Passive Motion Method and Apparatus

13.1 Description

Claims both apparatus and therapy parameters, including programmable cycle timing, dwell at end range, and progressive ROM. Focuses on protocolization of CPM dosing alongside reliable mechanical delivery.

13.2 Images

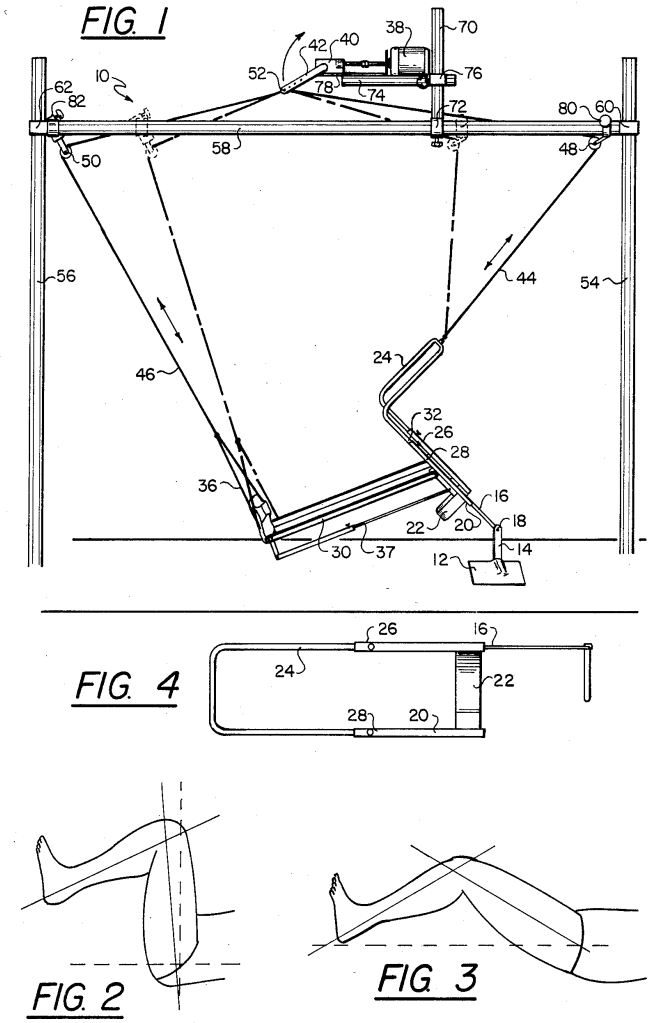

Figure 13: US4546763A apparatus and protocol emphasizing programmable CPM dosing.

13.3 Mechanism kinematics

14 US4637379A: Device for Imparting Continuous Passive Motion to Leg Joints

14.1 Description

Mechanical device designed to provide continuous passive motion specifically targeting leg joint mobility. Emphasizes controlled articulation of knee and hip joints through automated motion cycles to maintain joint flexibility and prevent stiffness.

14.2 Images

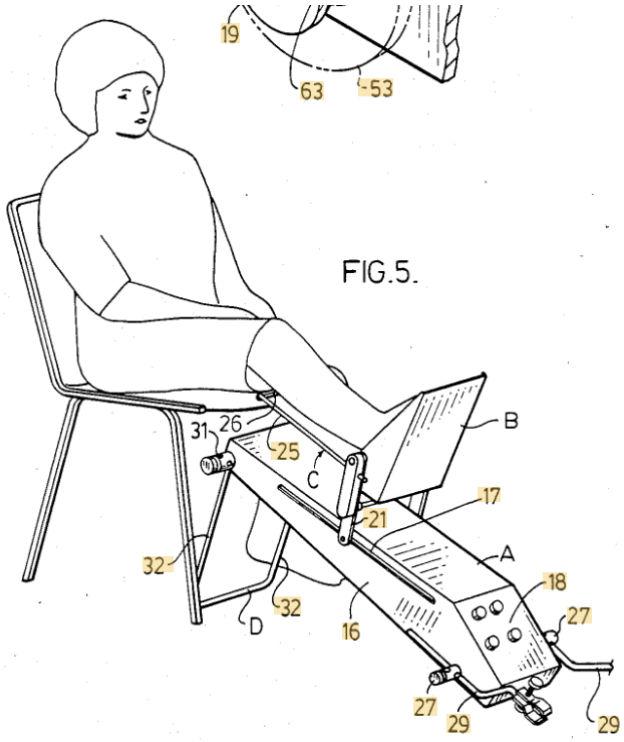

Figure 14: US4637379A device for continuous passive motion of leg joints.

14.3 Mechanism kinematics

15 US4665899A: Apparatus for Articulating the Knee and Hip Joints

15.1 Description

Dual-joint articulation system that simultaneously addresses both knee and hip joint motion. Designed to maintain proper biomechanical relationships between adjacent joints during passive motion therapy, ensuring coordinated movement patterns.

15.2 Images

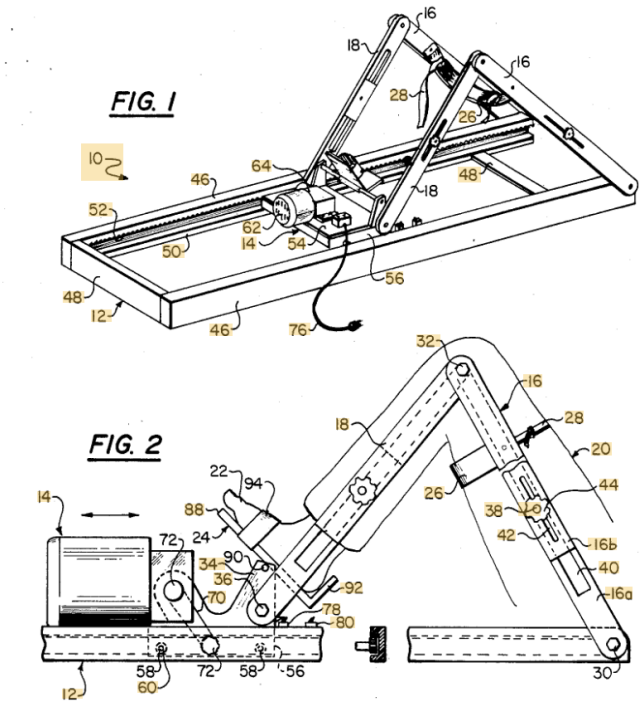

Figure 15: US4665899A apparatus for coordinated knee and hip joint articulation.

15.3 Mechanism kinematics

16 WO2011119902A1: Continuous Passive Motion Device

16.1 Description

International patent application describing a modern continuous passive motion device with enhanced control systems and patient comfort features. Represents contemporary approaches to CPM therapy with improved user interface and adaptive motion profiles.

16.2 Images

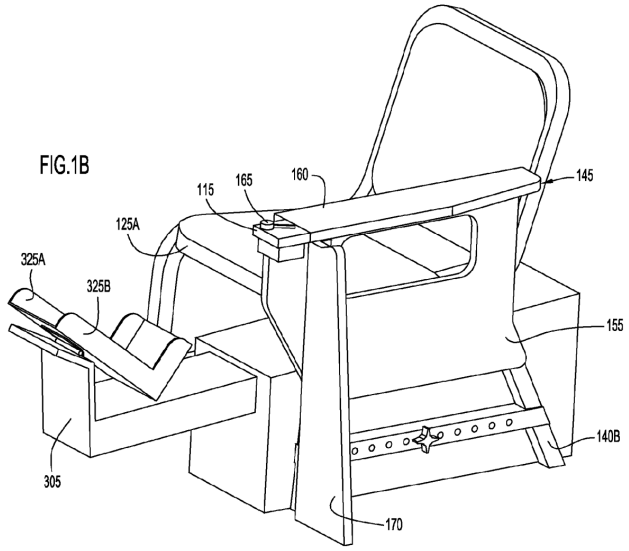

Figure 16: WO2011119902A1 modern continuous passive motion device.

16.3 Mechanism kinematics

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.