Oct. 30, 1962 J. L. MAY 3,060,926

THERAPEUTIC TABLE

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Fig. 1.

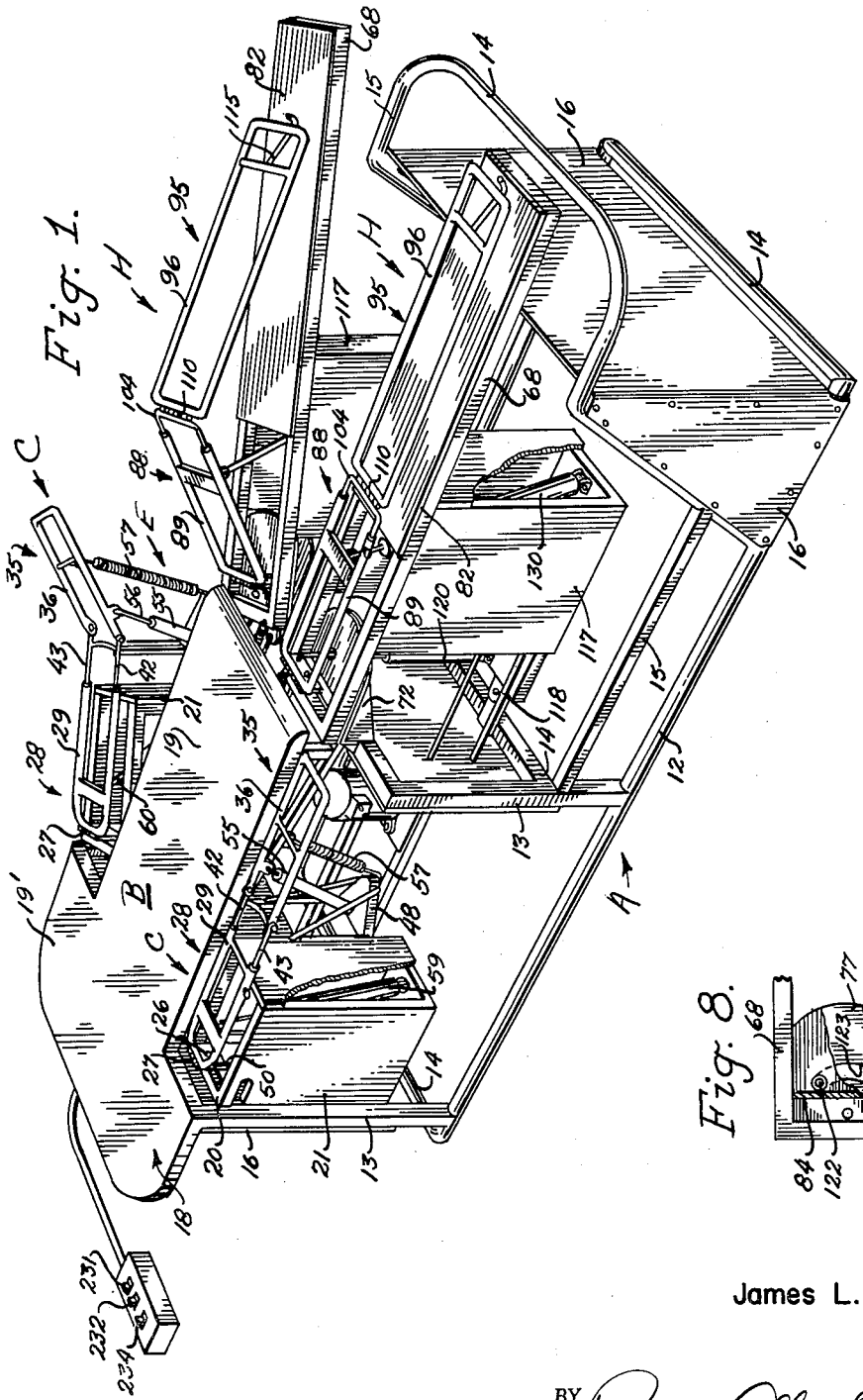

Fig. 8.

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THERAPEUTIC TABLE

Filed Feb. 6, 1961 5 Sheets-Sheet 2

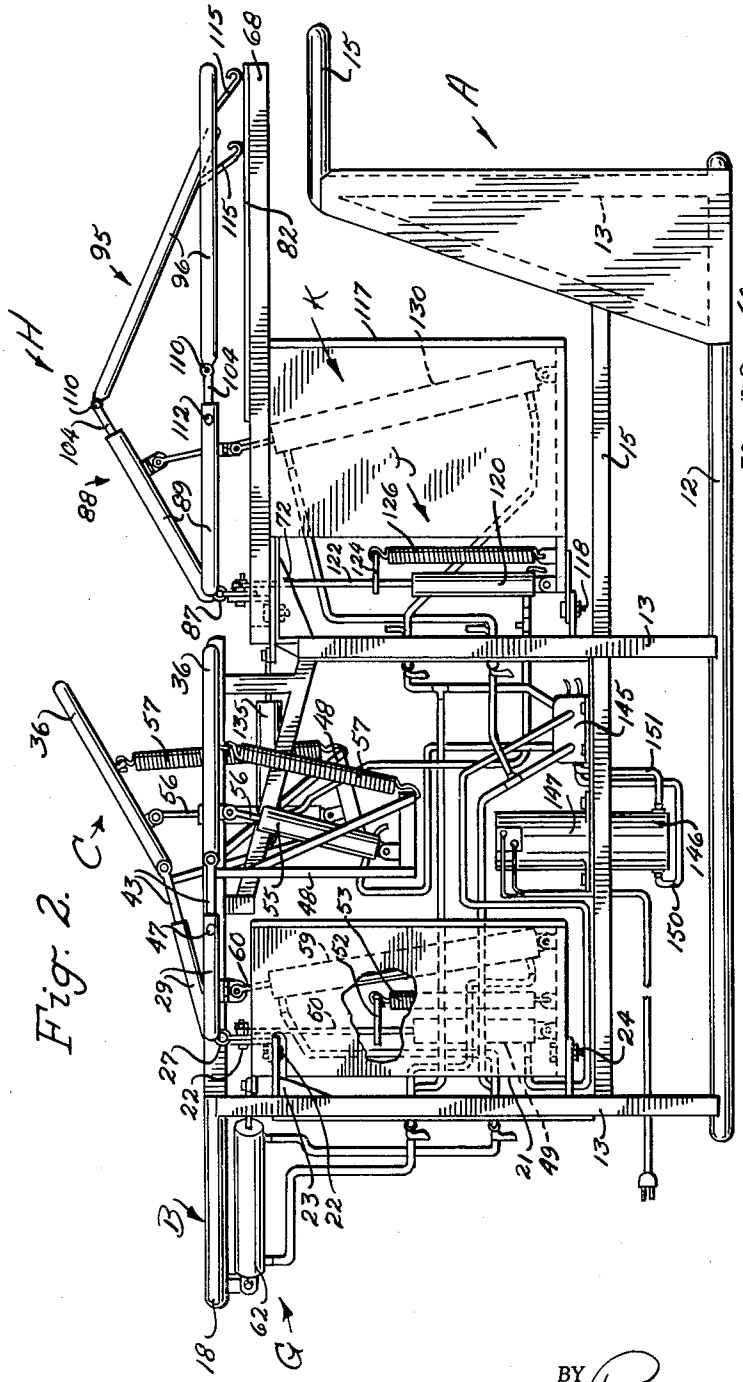

Fig. 2.

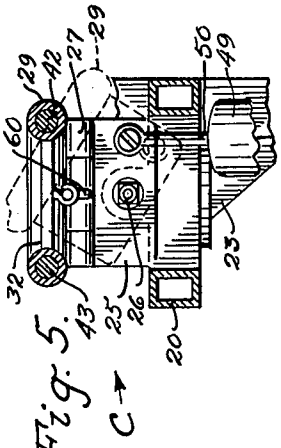

Fig. 5.

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THERAPEUTIC TABLE

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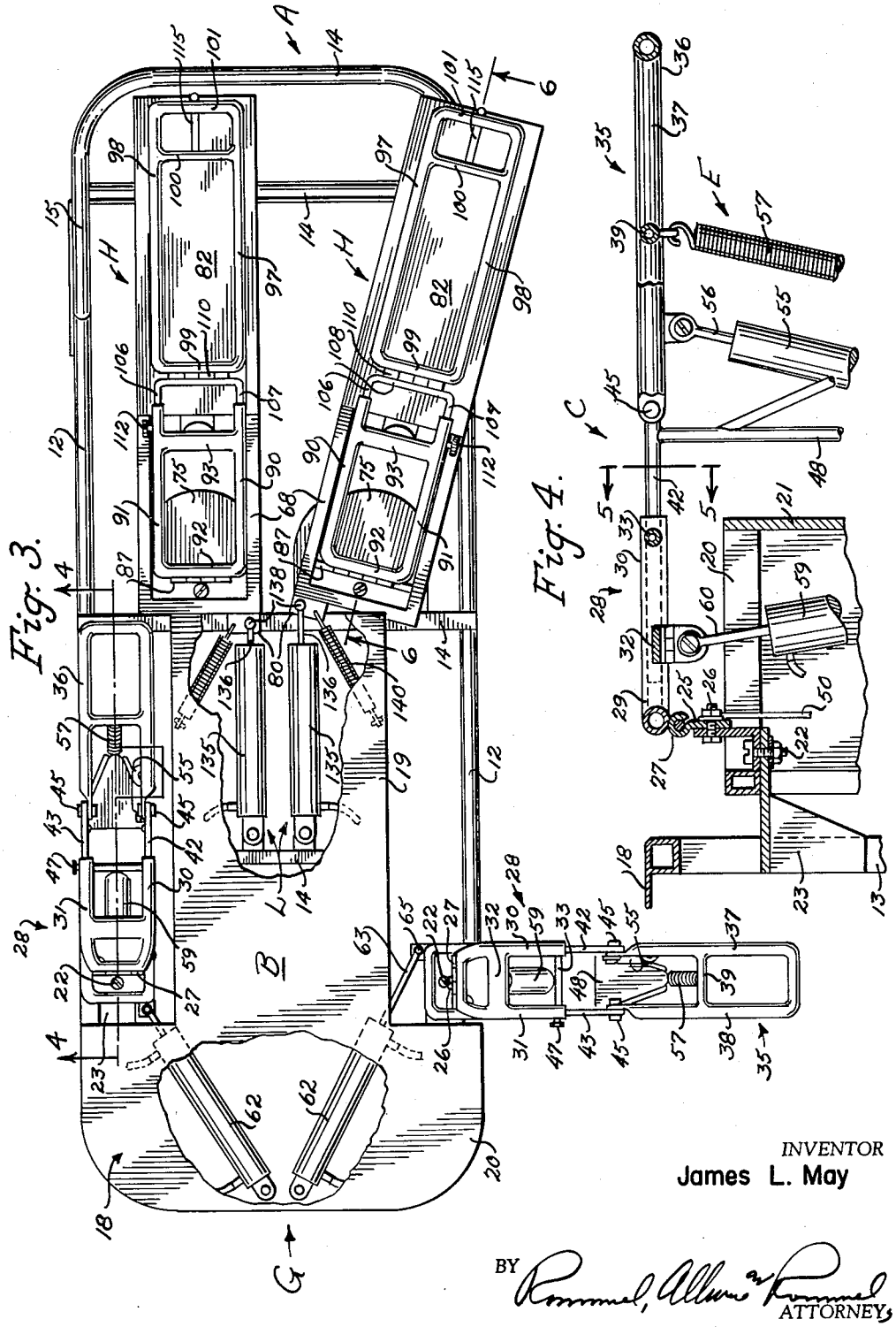

Fig. 3.

Fig. 4.

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THERAPEUTIC TABLE

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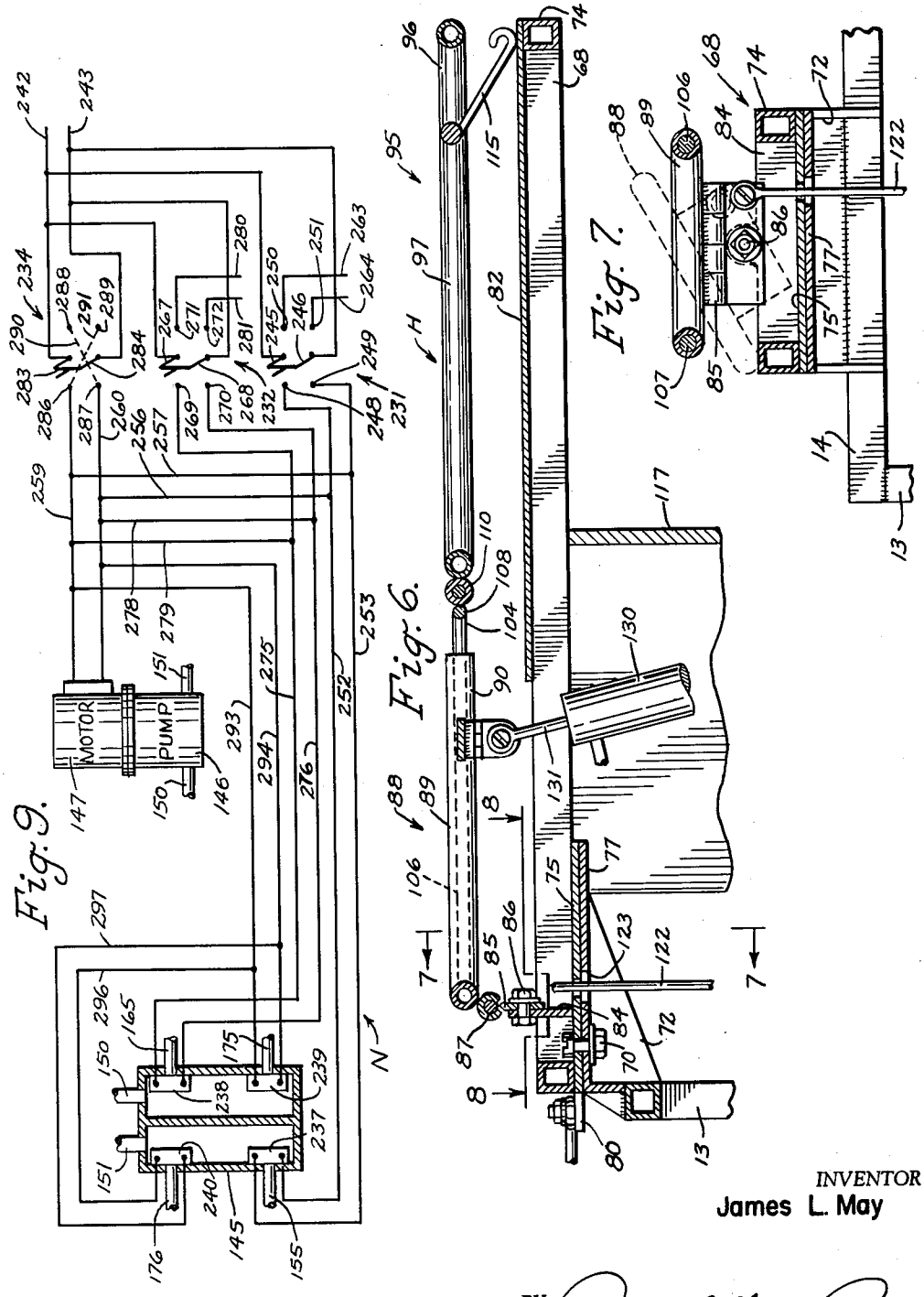

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THERAPEUTIC TABLE

Filed Feb. 6, 1961 5 Sheets-Sheet 5

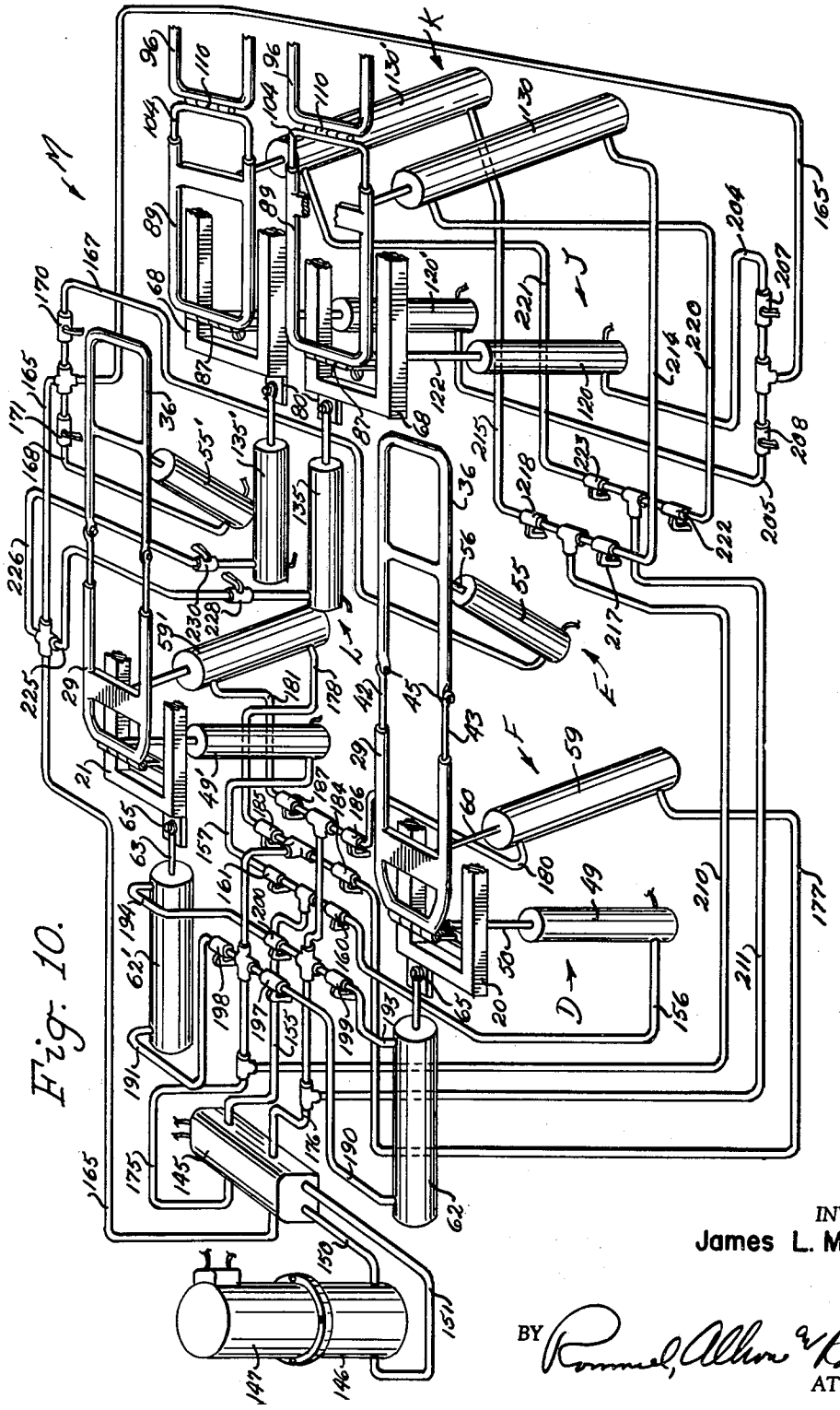

Fig. 10.

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United States Patent Office 3,060,926 Patented Oct. 30, 1962

3,060,926

THERAPEUTIC TABLE

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Filed Feb. 6, 1961, Ser. No. 87,229
14 Claims. (Cl. 128—25)

This invention relates to improvements in therapeutic tables.

The primary object of this invention is the provision of an exercising and traction table that will aid in recovery from diseases and illnesses such as polio, muscular dystrophy, cerebral palsy, multiple sclerosis, bursitis, rheumatism, arthritis, spinal meningitis, congenital deformities, breaks, sprains and others, wherein mechanical movement of the extremities is a prerequisite or aid to recovery.

A further object is the provision of a therapeutic table having separable operable sections for independent movement of the various extremities of the body.

A further object is the provision of a therapeutic table having independently operable portions for exercising the lower extremities of the body, which portions will provide passive movements of flexion and extension in the knee joint, preventing contractual deformities and maintaining a range of motion at this joint; and exercising of the hip joint, providing hip flexion, hip extension, hip abduction, hip adduction, hip external rotation, and hip internal rotation, thus aiding in stretching contractual deformities and increasing the range of motion in the hip joint in all planes of motion.

A further object is the provision of independently operable sections for the upper extremities of the body, providing passive movements of flexion and extension in the elbow joint, for stretching contractual deformities and maintaining a range of motion at this joint; and providing a passive exercise for the shoulder joint, including shoulder abduction, shoulder adduction, shoulder internal rotation, shoulder external rotation, shoulder flexion, and shoulder extension, aiding in the stretching of contractual deformities and the maintenance of the desired range of motion in all planes at this joint.

Other objects and advantages will be apparent during the course of the following detailed description, taken in connection with the accompanying drawings, forming a portion of this specification, and in which drawings:

FIG. 1 is a perspective view of the therapeutic table, with portions thereof broken away.

FIG. 2 is a side elevation of the table.

FIG. 3 is a top plan view of the table, with portions thereof broken away.

FIG. 4 is an enlarged longitudinal sectional view through one of the arm supports, taken substantially on the line 4—4 of FIG. 3.

FIG. 5 is a transverse sectional view through one of the arm supports taken substantially on the line 5—5 of FIG. 4.

FIG. 6 is an enlarged longitudinal sectional view through one of the leg supports, taken substantially on the line 6—6 of FIG. 3.

FIG. 7 is a transverse sectional view of one of the leg supports, taken substantially on the line 7—7 of FIG. 6.

FIG. 8 is a fragmentary plan view of a portion of one of the leg supports, taken substantially on the line 8—8 of FIG. 6.

FIG. 9 is a schematic diagram of the electrical circuit.

FIG. 10 is a schematic diagram of the hydraulic system.

In the drawings, wherein for the purpose of illustration is shown a preferred form of the invention, and wherein similar reference characters designate corresponding

parts throughout the several views, the letter A may generally designate the main frame of the therapeutic table, the frame A supporting a torso support means B; arm support means C, each of the arm support means C having rotative means D, forearm lift means E, upper arm lift means F, and arm extending means G; leg support means H having rotative means J, lift means K, and extending means L; a hydraulic system M provided for the operation of the various elements; and an electrical control system N for the controlled operation of the independently operable sections of the table.

The frame A preferably includes a base 12 having mounted thereon upright supports 13, lateral supports 14 and longitudinal supports 15 for supporting the torso support means B, arm support means C, leg support means H and the various mechanism of the table. Panels 16 may be provided upon the frame A for decorative purposes. It is to be noted that such panels should be applied in a manner so as not to interfere with movement of the arm support means C and leg support means H.

The torso support means B preferably includes a somewhat T-shaped plate 18 having a longitudinally extending portion 19 for supporting the main torso and a laterally extending portion 19′ for supporting the head and shoulders. The torso support means B will be provided on the uprights 13 at a height convenient to the patient and the operator of the therapeutic table, with the arm support means C and the leg support means H mounted in juxtaposition thereto for receiving the upper and lower extremities of the body.

An arm support means C is preferably provided to each side of the torso support means B, in juxtaposition thereto for receiving each of the arms of a patient. These arm support means C are independently operable and, in most instances, only one of the arm support means will be operated at a given time. The structural characteristics of each of the arm support means C are identical, except for their hinged interconnection with the frame A, one arm support means being designed to be extended to the left side and the other to the right, and therefore only one of the arm support means will be described, identical reference characters being applied to the other.

Each of the arm support means C preferably includes an arm supporting frame 20 and a first support 21 movably connected, as by means of a pin 22, to a bracket 23 mounted upon one of the uprights 13 of the frame A. The left hand arm support means C will be movably connected to a bracket 23 so that it can swing arcuately outwardly to the left hand side of the table and the right hand arm support means C movably connected to the other bracket 23 so that it can swing arcuately outwardly to the right hand side of the table. A hinged interconnection 24 may be provided at the lowermost portion of the support 21 for cooperating with the hinged movement of the arm supporting frame 20 about the pin 22 providing a double hung framework for supporting the arm.

Mounted upon the first support 21 is an arm supporting bracket 25. This arm supporting bracket 25 is movably interconnected to the first support 21 as by pin 26, so that the arm supporting bracket 25 may be arcuately rotated from side to side with respect to the first support 21. The uppermost portion of the arm supporting bracket 25 is provided with a hinged interconnection 27 that cooperates with the upper arm support means 28 so that the upper arm support means 28 may be raised and lowered with respect to the first support 21.

The upper arm support means 28 preferably includes a U-shaped tubular cradle assembly 29 having extended leg portions 30 and 31 and transversely extending braces 32 and 33. This upper arm support means 28 may, of course, be suitably padded and provided with suitable

straps for maintaining the upper arm in juxtaposition with respect thereto, as is well known in the art. For the purposes of clarity the same has been shown in its skeleton form.

Secured to the upper arm support means **28**, and extending outwardly therefrom, is forearm support means **35**. The forearm support means **35** preferably includes a substantially U-shaped tubular cradle assembly **36** having extended leg portions **37** and **38** and a transversely extending brace **39**. Rods **42** and **43** are secured to the extended leg portions **37** and **38**, respectively. These rods **42** and **43** are movably connected to the extended leg portions **37** and **38**, as at **45** and are telescopically received within the extended legs **30** and **31**, respectively, of the upper arm support means **28**, so that the forearm support means **35** may be extended or contracted with respect to the upper arm support means **28**, dependent upon the length of the arm of the person being treated. A set screw **47** may be provided upon the upper arm support means **28** for locking the forearm support means **35** in the desired position with respect to the upper arm support means **28**. The forearm support means **35** may be suitably padded and suitable straps for attachment of the forearm and hand may be provided, as is well known in the art.

A second support **48** is suspended from the bars **42** and **43**, to beneath the forearm support means **35**, for supporting the lift means E for the forearm, as will be subsequently described.

The rotative means D for the arm support means C preferably includes the arm supporting bracket **25**, movably interconnected to the first support **21**, the pin **26** being provided substantially centrally of the arm supporting bracket **25**, and a hydraulic cylinder **49** mounted within the first support **21**. The hydraulic cylinder **49** is provided with an extended shaft **50** that is interconnected to the bracket **25** to one side of the pin **26**. It will thus be seen that as the shaft **50** is reciprocated, in accordance to the direction of movement of the piston of the hydraulic cylinder **49**, that the bracket **25** will be rocked from side to side, about pin **26** (as shown in FIG. 5), thus providing rotational motion to the bracket **25** and to the upper arm supporting means **28** and forearm supporting means **35** that are interconnected thereto.

Inasmuch as the hydraulic cylinder **49** may be single acting, as shown in the drawings, the same will be capable of exerting only a clockwise rotative force upon the bracket **25**, and there is therefore required to be some means for rotating the bracket **25** in a counterclockwise direction. In order to provide the counterclockwise rotative effect I have provided a bracket **52** that is secured to the shaft **50**, and a spring **53** interconnected at one end thereof to the bracket **52** and at the other end thereof to the first support **21**. This spring **53** exerts a compressive force, so that when the cylinder **49** is actuated, exerting a rotative force, and when the desired degree of movement in a clockwise rotative direction has been reached, a valve is opened to permit bleeding of the cylinder **49**, and the spring **53** will operate to exert a counterclockwise rotative force upon the arm supporting bracket **25**. Of course it is obvious that if a double acting cylinder is used, the spring **53** becomes unnecessary.

Forearm lift means E preferably includes a hydraulic cylinder **55** mounted upon the second support **48** and having a shaft **56** interconnected to the forearm supporting means **35**; and a spring **57** is secured at one end thereof to the forearm supporting means **35** and at the other end thereof to the second support **48**. In the drawings I have shown the cylinder **55** as being only a single acting cylinder, so that the cylinder will act to arcuately raise the forearm supporting means **35**, with respect to the upper arm supporting means **28**, about the pivotal axis **45** and, when the desired degree of lift has been reached, the valve is open for the bleeding of the hydraulic

cylinder **55**, and the compressive action of the spring **57** will serve to lower the forearm support means **35**. It is obvious that a double acting cylinder might be provided, eliminating the necessity for the compressive spring **57**.

The upper arm lift means F preferably includes a double acting hydraulic cylinder **59** mounted within the first support **21** and having a shaft **60** interconnected to the upper arm support means **28**. A double acting piston is herein provided in order to insure sufficient power for the raising and lowering of the upper arm supporting means **28**.

The arm extending means G preferably includes a double acting hydraulic cylinder **62** that is secured at one end thereof to the frame A, the cylinder **62** having a shaft **63** that is secured to one side of the first support **21** as at **65**. A double acting cylinder is herein provided in view of the high degree of force that will be required in order to extend and retract the entire arm supports.

It will be obvious that the rotative means D, lift means E, lift means F, and extending means G may be operated independently of one another for providing the desired degree of motion to the shoulder and elbow joints.

This construction of the arm support means C provides: By means of lift means E, passive elbow flexion, stretching contractures of the elbow extensor muscle groups, including the musculature prime movers termed the biceps brachii, the brachialis, and the brachioradialus; and passive elbow extension, stretching out the contractures of the elbow group (flexor), including the musculature of the triceps and anconeus. By means of lift means F, flexion at the shoulder joint, bringing the arms up in the anterior plane to the overhead position, for remedying contractures of the shoulder extensor group, including the anterior deltoid, conacobrachialis, and the long head of the biceps to the 90 degree position, and from a 90 degree position to 180 degree position (overhead) the serratus anterior and upper and lower trapezius; and shoulder extension, serving to stretch out contractures of the shoulder flexors, aiding in treatment of the posterior deltoid and latissimus muscles, with some remedial effect upon the tenes major. By means of rotative means D, through internal rotation provided by the cylinder **55**, rotating the arm in toward the body, stretching out the contractures of the external rotator group, primarily the subscapularis muscles; and external rotation, providing rotation of the arm away from the body, accomplished by the compressive action of the spring **53**, stretching out contractures of the internal rotator group, primarily the infraspiratus and tenes minor muscles, and to a lesser degree the supra spiratus. By means of extending means G, shoulder abduction, by extension of the shaft **63**, taking the arm laterally away from the body, stretching the contractures of the adductor group, affecting primarily the supra-spiratus and the deltoid (primarily the middle fibers); and shoulder adduction, by retraction of the shaft **63**, bringing the arm laterally in toward the body, stretching contractures of the abductor group, principally the pectoralis major, latissimus, and tenes major.

Various combinations of movement may be provided to cause motion of the arm in virtually any plane desired from simple internal or external rotation, elbow flexion or elbow extension, as shown in the uppermost portion of FIG. 3, or elbow flexion or extension, internal rotation or external rotation, while in the position of shoulder abduction, as shown in the lowermost portion of FIG. 3. Shoulder adduction, flexion and extension may, of course, be provided at any step, as desired.

A pair of leg support means H are preferably provided at the end of the longitudinally extending portion of the torso support means B in juxtaposition thereto for receiving each of the legs of a patient. These leg support means H are independently operable and, in most instances, only one of the leg support means will be operated at a given time. The structural characteristics of each of the leg support means H are identical, except for their hinged

interconnection with the frame A, one leg support means being designed to be extended to the left side and the other to the right, and therefore only one of the leg support means will be described, identical reference characters being applied to the other.

Each of the leg support means H preferably includes an elongated leg supporting frame **68** that is movably connected, as by means of pin **70**, to a bracket **72** that is mounted upon one of the cross pieces **14** of the frame A. The left-hand leg support means H will be movably connected to a bracket **72** so that it can swing arcuately outwardly to the left-hand side of the table and the right-hand leg support means H movably connected to the other bracket **72** so that it can swing arcuately outwardly to the right-hand side of the table.

Each supporting frame **68** preferably includes a polygonal channel member **74** having at one end thereof a plate **75** that cooperates with and rests upon plate **77** of the bracket **72**, providing longitudinal rigidity to the brake supporting frame **68**. The plate **75** is provided with an ear **80** extending outwardly therefrom, for interconnection of the leg extending means L, as will be subsequently described. A plate **82** is secured to the uppermost portion of the channel member **74**, extending for a substantial length of the leg supporting frame **68**, for cooperation with the leg supporting cradle, as will be subsequently described.

Mounted upon the leg supporting frame **68**, and interconnected to the plate **75**, is a vertically extending plate **84** to which is movably connected a leg supporting bracket **85**, as by pin **86**. Such construction is provided so that the leg supporting bracket **85** may be arcuately rotated from side to side with respect to the leg supporting frame **68**. The uppermost portion of the leg supporting bracket **85** is provided with a hinged interconnection **87** that cooperates with the upper leg support means **88** and provides means for raising and lowering the upper leg support means **88** with respect to the leg supporting frame **68**.

The upper leg support means **88** preferably includes a U-shaped tubular cradle assembly **89** having extended leg portions **90** and **91** and transversely extending braces **92** and **93**. This upper leg support means **88** may, of course, be suitably padded and provided with suitable straps for maintaining the upper leg in juxtaposition with respect thereto, as is well known in the art. For the purposes of clarity, the same has been shown in its skeleton form.

Secured to the upper leg support means **88**, and extending outwardly therefrom is lower leg support means **95**. The lower leg support means **95** preferably includes a substantially U-shaped cradle assembly **96** having extended leg portions **97** and **98** and transversely extending brace portions **99**, **100** and **101**. This lower leg support means may be suitably padded and provided with a foot support and straps for maintaining the leg in juxtaposition with respect thereto as is well known in the art.

A substantially U-shaped rod **104** having extended legs **106** and **107** and an interconnecting portion **108** extending between the legs **106** and **107** is mounted upon the upper leg support means **88**, the legs **106** and **107** being respectively received within the tubular extended legs **90** and **91** of the upper leg support means **88**. Secured to and interconnecting the rod **104** and the lower leg supporting means **95** is a hinge means connection **110**. The telescopic reception of the legs **106** and **107** within the extended legs **90** and **91** of the upper leg support means **88** permits extension of the lower leg support means **95** with respect to the upper leg support means **88** so that the same may be adjusted according to the length of the leg of the person being treated. A set screw **112** may be provided upon the cradle **89** for locking the rod **104** in position. The hinged interconnection **110** is positioned to be placed beneath the knee of the person being treated, such hinge duplicating the hinged action of the knee joint, so that upon hinged movement of the upper leg support means **88** with respect to the lower leg support means **95**, the knee joint will be exercised, as will be subsequently described.

A skid **115** is mounted upon the cross brace **100** of the lower leg support means **95**, which skid **115** rests upon the plate **82** of the leg supporting frame **68** and maintains the lower leg support means **95** in juxtaposition with respect thereto.

Secured to the leg supporting frame **68** and depending downwardly therefrom is a support **117**. This support **117** is positioned to swing with the leg supporting frame **68**, and a hinged interconnection **118** may be provided at the lowermost portion thereof, for cooperating with the hinged movement of the leg supporting frame **68** about the pin **70**, providing a double hung framework for supporting the leg.

The rotative means J for the leg support means H preferably includes a hydraulic cylinder **120** that is mounted within the support **117** and provided with an extended shaft **122** that is interconnected to the bracket **85** adjacent one side of the pin **86**. It will thus be seen as the shaft **122** is reciprocated, in accordance to the direction of movement of the piston of the hydraulic cylinder **120**, that the bracket **85** will be rocked from side to side, about pin **86** (as shown in FIG. 7) thus providing rotational movement to the bracket **85** and to the upper leg supporting means **88** and lower leg supporting means **95** that are interconnected thereto. The plate **77** is provided with an arcuate slot **123** so that a rotative force may be applied when the leg is extended in a position away from the longitudinal axis of the table.

Inasmuch as the hydraulic cylinder **120** may be single acting, as shown in the drawings, the same will be capable of exerting only a counterclockwise rotative force upon the bracket **85**, and there is therefore required to be some means for rotating the bracket **85** in a clockwise direction. In order to provide the clockwise rotative effect I have provided a bracket **124** that is secured to the shaft **122**, and a spring **126** interconnected at one end thereof to the bracket **124** and at the other end thereof to the support **117**. This spring **126** exerts a compressive force, so that when the cylinder **120** is actuated, exerting a rotative force, and when the desired degree of movement in a counterclockwise rotative direction has been reached, a valve is opened to permit bleeding of the cylinder **120**, and the spring **126** will operate to exert a clockwise rotative force upon the leg supporting bracket **85**. Of course it is obvious that if a double acting cylinder is used, the spring **126** become unnecessary.

Lift means K preferably includes a hydraulic cylinder **130** mounted upon the support **117** and having a shaft **131** interconnected to the upper leg support means **88**. The cylinder **130** is preferably double acting inasmuch as it must supply the entire force necessary for exercising the knee joint. Upon actuation of the cylinder **130**, an extension of the shaft **131** therefrom, the upper leg support means **88** will be raised, raising the hinged interconnection thereto of the lower leg support means **95**, thus raising the end of the lower leg support means adjacent the knee of the person being exercised, the skid **115** sliding along the plate **82** and supporting the other end of the lower leg support means adjacent the foot of the person being exercised.

The leg extending means L preferably includes a hydraulic cylinder **135** that is secured at one end thereof to the frame A, the cylinder **135** having a shaft **136** that is secured to the ear **80** of the plate **75**, as at **138**. In the drawings I have shown the cylinder **135** as being only a single acting cylinder, so that the cylinder will act to arcuately move the leg support means H outwardly from the longitudinal axis of the table. In order to arcuately move the leg support means H back toward the longitudinal axis of the table I have provided a spring **140** that is connected at one end thereof to the frame A, and at the other end thereof to one side of the ear

80. Thus, the cylinder 136 is actuated to arcuately move the leg support means H outwardly from the longitudinal axis of the table until the desired angle of movement has been reached, whereupon a valve is opened for the bleeding of the hydraulic cylinder 135, and the compressive action of the spring 140 will serve to move the leg support means H back toward the longitudinal axis of the table. It is obvious that a double acting cylinder might be provided, eliminating the necessity for the compressive spring 140.

It will be obvious that the rotative means J, lift means K and extending means L may be operated independently of one another for providing the desired degree of motion to the hip and knee joints.

This construction of the leg support means H provides: By means of the rotative means J, through external rotation provided by the cylinder 120, rotation of the leg in an outward direction, stretching out the contractures of the internal rotator group, primarily the musculature including the piriformis, obturator internus and externus, gemellus superior and inferior, and the quadratus femoris; and internal rotation, providing rotation of the leg in toward the body, accomplished by the compressive action of the spring 126, stretching out contractures of the external rotator musculature including the tensor fascia lata and the gluteus minimus. By means of the lift means K, passive knee flexion, stretching contractures of the knee extensor muscle groups, including the musculature prime movers termed the vastus medialis, vastus intermedials, vastus lateralus, and rectus fermoris (quadraceps); and passive knee extension, stretching out the contractures of the flexor muscle groups including the musculature of the biceps femoris, semitendonosis, and semimembranous (hamstring group). By means of extending means L, hip abduction, by extension of the shaft 136, taking the leg laterally away from the longitudinal axis of the table, stretching the contractures of the hip abductor group, effecting primarily the gluteus medius; and hip adduction by compressive action of the spring 140, bringing the leg laterally inward toward the longitudinal axis of the table, stretching contractures of the adductor group, principally the adductor magnus, adductor longus, brevis pectinius, and the gracilis.

Various combinations of movement may be provided to cause motion of the leg in virtually any plane desired from simple internal or external rotation, knee flexion or knee extension, as shown in FIG. 2, or knee flexion or extension, internal rotation or external rotation, while in the position of either hip abduction or adduction. Hip adduction, flexion and extension may, of course, be provided at any step as desired.

The hydraulic system M preferably includes the hydraulic cylinders 49, 55, 59, and 62 of the arm support means, hydraulic cylinders 120, 130 and 135 of the leg support means, various valves for the actuation of these cylinders, a manifold 145, and a pump 146. For purposes of clarity in the description of the hydraulic system, and in FIG. 10 only, the various hydraulic cylinders effecting movement of the left arm and left leg will be given a prime connotation.

The hydraulic pump 146 is reversibly driven by the electric motor 147, conduits 150 and 151 leading from the pump 146 to the manifold 145.

Conduit 155 leads from the manifold 145 for supplying hydraulic pressure to the cylinders 49 and 49'. The conduit 155 is "teed" into conduit 156 leading to hydraulic cylinder 49 and conduit 157 leading to hydraulic cylinder 49'. A valve 160 is provided in conduit 156 and a valve 161 provided in conduit 157 so that the hydraulic cylinders 49 and 49' may be independently operated.

Conduit 165 is provided leading from the manifold 145 and provides hydraulic pressure to the cylinders 55, 55', 120, 120', 135 and 135'. Conduits 167 and 168 are "teed" into the conduit 165 for providing hydraulic pressure to the cylinders 55 and 55', respectively, a valve 170 being provided in the conduit 167 and a valve 171 being provided in the conduit 168, for selective operation of the hydraulic cylinders 55 and 55'.

Conduits 175 and 176, leading from the manifold 145 provide hydraulic pressure to the double acting cylinders 59, 59', 62, 62', 130 and 130'. Conduits 177 and 178 are "teed" into the conduit 175, providing one conduit leading to each of the double acting cylinders 59 and 59', respectively, and conduits 180 and 181 are "teed" into the conduit 176, providing a conduit leading to the other port of each of the cylinders 59 and 59', respectively. Valves 184, 185, 186 and 187 are provided in the conduits 177, 178, 180, and 181, respectively, for independent control of the flow of fluid therethrough.

Conduits 190 and 191 are "teed" into the conduit 175, for supplying hydraulic fluid to one of the ports of each of the cylinders 62 and 62', respectively. Conduits 193 and 194 are "teed" into conduit 176, leading to the other port of each of the cylinders 62 and 62', respectively. Valves 197, 198, 199 and 200 are provided in the conduits 190, 191, 193 and 194, respectively, for selective control of hydraulic fluid to the cylinders 62 and 62'.

Conduits 204 and 205 are "teed" into the conduit 165, leading to hydraulic cylinders 120 and 120', respectively. Valves 207 and 208 are provided in the conduits 204 and 205, respectively, for selective feeding of hydraulic fluid to the cylinders 120 and 120'.

Conduits 210 and 211 are "teed" into conduits 175 and 176, respectively, providing reversible feeding of hydraulic fluid to the double acting cylinders 130 and 131. Conduits 214 and 215 are "teed" into the conduit 210 for feeding hydraulic fluid to one of the ports of each of the cylinders 130 and 130', respectively. Valves 217 and 218 are provided in conduits 214 and 215, respectively, for selective feeding of hydraulic fluid to the port of each hydraulic cylinder with which the particular conduit interconnects. Conduits 220 and 221 are "teed" into the conduit 211 for feeding hydraulic fluid to one of the ports of each of the hydraulic cylinders 130 and 130', respectively. Valves 222 and 223 are provided in conduits 220 and 221, respectively, for selective feeding of hydraulic fluid to these cylinders.

Conduits 225 and 226 are "teed" into the line 165 for feeding hydraulic fluid to the cylinders 135 and 135', respectively. Valves 228 and 230 are provided in the conduits 225 and 226, respectively, for selective control of hydraulic fluid to the cylinders 135 and 135'.

The electrical control system N preferably includes a switch 231, which controls the actuation of hydraulic cylinders 49 and 49'; switch 232 that controls the actuation of hydraulic cylinders 55, 55', 120, 120', 135 and 135'; and reversing switch 234 that controls the actuation of the double acting hydraulic cylinders 59, 59', 62, 62', 130 and 130'. Solenoid valves 237, 238, 239 and 240 are provided in the manifold 145 for controlling the flow of hydraulic fluid through the conduits 155, 165, 175 and 176, respectively. Each of the single acting hydraulic cylinders, 49, 49', 55, 55', 120, 120', 135 and 135' are provided with solenoid valves therein (not shown) as is well known in the art for such single acting cylinders. Lines 242 and 243 are provided for conducting electrical current to the circuitry.

Switch 231 includes blades 245 and 246 connected to the lines 242 and 243, respectively, and contact points 248, 249, 250 and 251. Assuming that it is now desired to actuate cylinder 49, for internal rotation of the right shoulder joint, valve 160 is manually opened and switch 231 is closed so that the blade 245 contacts the contact point 248 and the blade 246 contacts the contact point 249. Current will now flow through the lines 242 and 243, through blades 245 and 246, to contact points 248 and 249, through lines 252 and 253 to the solenoid 237, opening the valve for flow of fluid through the conduit 155, the current also flowing through lines 256 and 257,

into lines 259 and 260 that lead to and actuate the electric motor 147, pumping fluid through the conduit 151 for discharge through the conduit 155 and thence to the hydraulic cylinder 49. When the desired degree of internal rotation has been attained, and it is desired to begin external rotation, switch 231 is manipulated so that blades 245 and 246 contact the contact points 250 and 251, respectively, causing current to flow through the lines 263 and 264 leading to the solenoid valve in cylinder 49, opening this valve and permitting drainage of hydraulic fluid back through the conduit 156, into conduit 155, and thence to the manifold 145, the spring 53 providing pressure upon the cylinder to cause such flow of fluid. Inasmuch as valve 161, leading to hydraulic cylinder 49' has remained closed throughout this operation, this cylinder will not be effected by the manipulations above described. It is obvious that if actuation of hydraulic cylinder 49' is desired, valve 160 can be closed and the valve 161 opened, permitting actuation of hydraulic cylinder 49' in the same manner as above described with respect to hydraulic cylinder 49.

Switch 232 is similar to switch 231, including blades 267 and 268 interconnected with lines 242 and 243, respectively, and contact points 269, 270, 271, and 272. Assuming that it is now desired to actuate the cylinder 55, for elbow flexion, valve 170 is opened and switch 232 is thrown so that the blades 267 and 268 contact the contact points 269 and 270. Current then flows through the lines 275 and 276, to the solenoid 238, opening the valve for flow of fluid through conduit 165. Current also passes from the lines 275 and 286 through the lines 278 and 279 to the lines 259 and 260 leading to the motor 147, actuating the motor and pumping fluid through the conduit 150, into the manifold 145 for discharge through the conduit 165. When the desired degree of elbow flexion has been reached and it is desired to return the cylinder to its rest position, switch 232 is thrown so that the blades 267 and 268 contact contact points 271 and 272, respectively, causing current to flow through lines 280 and 281, leading to the solenoid valve in the cylinder 55, opening this valve and permitting the fluid therein to return through the conduit 165 to the manifold 145, the fluid flow being provided by means of the compression of spring 57, and thus lowering the forearm support means 35 to its rest position. It is obvious that like operations of the switch 232 will operate cylinders 55', 120, 120', 135 and 135', dependent upon which of the manually operated valves 170, 171, 207, 208, 228 or 230 are opened or closed.

The switch 234 includes a pair of blades 283 and 284, primary contact points 286 and 287, secondary contact points 288 and 289, and current reversing lines 290 and 291. Assuming that cylinder 59 is desired to be actuated, valves 184 and 186 are opened and the switch is thrown so that blades 283 and 284 contact the primary contact points 286 and 287, respectively. This permits current flow through the lines 259 and 260 for actuation of the motor, causing pumping of the hydraulic fluid out through the conduit 150, into manifold 145. Lines 293 and 294 are connected to lines 259 and 260 and lead to the solenoid valve 239 and open this valve for flow of hydraulic fluid outwardly through the conduit 175. Lines 296 and 297 are connected to the lines 293 and 294 and lead to the solenoid valve 240, and open this valve for flow of fluid in through the conduit 176. The operation of the device in this direction extends the shaft 60 and raises the upper arm support means 28. When it is now desired to lower the support means 28, blades 283 contact points 288 and 289, respectively, which will reverse and 284 are thrown into contact with the secondary polarity flowing through lines 259 and 260, reversing the motor 147, causing pumping of fluid out through the conduit 151 and thence through conduit 176. Attachment of lines 259 and 260 to the solenoids 239 and 240 will obviously retain these valves in an opened position for flow of hydraulic fluid. Actuation of any of the other double cylinders 59', 62, 62', 130 or 130' is apparent from the above description dependent upon which of the valves 185, 187, 197, 199, 198, 200, 217, 222, 218 or 223 are opened and which of these valves are closed.

It is obvious that double acting cylinders may be provided throughout the apparatus for operation of the various parts, and electrically operated valves may be provided in lieu of the mechanically operated valves shown and described, and that many other variations with respect to both the hydraulic and electrical circuits may be employed. The particular hydraulic and electrical circuit shown and described are for illustrative purposes only.

Various changes may be made to the form of the invention herein show and described without departing from the spirit of the invention or the scope of the following claims.

I claim:

1. In a therapeutic table, the combination of a frame, arm supporting frame means, means for movably supporting said arm supporting frame means on said frame, arm support means, means for movably supporting said arm support means upon said arm supporting frame means, leg supporting frame means, means for movably supporting said leg supporting frame means on said frame, leg support means, means for movably supporting said leg support means upon said leg supporting frame means, means mounted upon said arm supporting frame and interconnected to said arm support means for reciprocable rotation of said arm support means with respect to said arm supporting frame means, means mounted upon said arm supporting frame means and interconnected to said arm support means for reciprocably raising and lowering said arm support means with respect to said arm supporting frame means, means mounted upon said leg supporting frame means and interconnected to said leg support means for reciprocable rotation of said leg support means with respect to said leg supporting frame means, and means mounted upon said leg supporting frame means and interconnected to said leg support means for reciprocably raising and lowering said leg support means with respect to said leg supporting frame means.

2. The combination as specified in claim 1 wherein said arm support means includes upper arm support means and forearm support means, and means for movably interconnecting said upper arm support means and said forearm support means, said means mounted upon said frame and interconnected to said arm support means for reciprocably raising and lowering said arm support means with respect to said frame being interconnected to said upper arm support means, and means mounted upon said upper arm support means and interconnected to said forearm support means for reciprocably raising and lowering said forearm support means with respect to said upper arm support means.

3. The combination as specified in claim 1 wherein means is provided upon said frame and interconnected to said arm support means for laterally moving said arm support means outwardly and inwardly with respect to the longitudinal axis of said frame.

4. The combination as specified in claim 1 wherein said leg support means includes upper leg support means and lower leg support means, means movably interconnecting said upper leg support means and said lower leg support means, and means for supporting said lower leg support means upon said leg supporting frame means at the opposite end thereof from interconnection with said upper leg support means, said means mounted upon said frame and interconnected to said leg support means for reciprocably raising and lowering said leg support means with respect to said frame being interconnected to said upper leg support means and providing impetus for the

movement of said upper leg support means with respect to said lower leg support means.

5. The combination as specified in claim 1 wherein means is mounted upon said frame and interconnected to said leg support means for laterally moving said leg support means outwardly and inwardly with respect to the longitudinal axis of said frame.

6. A therapeutic table having a frame, arm supporting frame means, arm support means, means for movably supporting said arm support means upon said arm supporting frame means, means for movably supporting said arm supporting frame means on said frame, means mounted upon said frame and interconnected to said arm supporting frame means for lateral movement of said arm supporting frame means outwardly and inwardly with respect to the longitudinal axis of said frame, means mounted upon said arm supporting frame means and interconnected to said arm support means for reciprocable rotation of said arm support means with respect to said arm supporting frame means, and means mounted upon said arm supporting frame means and interconnected to said arm support means for reciprocably raising and lowering said arm support means with respect to said arm supporting frame means.

7. A therapeutic table as specified in claim 6 wherein said arm support means includes upper arm support means and forearm support means, said means mounted upon said arm supporting frame means and interconnected to said arm support means for reciprocably raising and lowering said arm support means with respect to said arm supporting frame means being interconnected to said upper arm support means, means for movably supporting said forearm support means with respect to said upper arm support means, and means mounted upon said upper arm support means and interconnected to said forearm support means for reciprocably raising and lowering said forearm support means with respect to said upper arm support means.

8. A therapeutic table having a frame; leg supporting frame means; means for movably supporting said leg supporting frame means on said frame; leg support means, said leg support means including upper leg supporting means, lower leg supporting means, and means for movably interconnecting said upper leg support means, and said lower leg support means; means for movably mounting said upper leg support means upon said leg supporting frame means; means for movably supporting said leg supporting means on said leg supporting frame means; means mounted upon said leg supporting frame means and interconnected to said upper leg support means for reciprocably raising and lowering said upper leg support means with respect to said leg supporting frame means; means mounted upon said frame and interconnected to said leg support means for laterally moving said leg support means with respect to the horizontal axis of said frame; and means mounted upon said leg supporting frame means and interconnected to said leg support means for reciprocable rotation of said leg support means with respect to said leg supporting frame means.

9. A therapeutic table as specified in claim 8 wherein said leg supporting frame means includes a supporting plate for said lower leg support means, means mounted upon the opposite end of said leg support means from said interconnection with said upper leg support means for slidably supporting said lower leg support means upon said supporting plate, said lower leg support means having said last mentioned means riding upon said supporting plate when said means mounted upon said supporting frame for reciprocably raising and lowering said upper leg support means with respect to said supporting frame is actuated.

10. In a therapeutic table, the combination of a torso supporting frame, arm supporting frame means, means for movably supporting said arm supporting frame means on said frame, arm extending means mounted upon said frame and interconnected to said arm supporting frame means for lateral movement of said arm supporting frame means with respect to the horizontal axis of said frame, power means for the actuation of said arm extending means enabling the passive shoulder joint abduction and adduction of a person positioned upon said frame, rotative means mounted upon said arm supporting frame means for providing rotative movement of said arm supporting frame means, and power means for the actuation of said rotative means enabling the passive internal and external rotation of the arm of a person positioned upon said frame.

11. In a therapeutic table, the combination of a frame, leg supporting frame means, means for movably supporting said leg supporting frame means on said frame, means supported upon said frame and interconnected to said leg supporting frame means for providing hip joint abduction and adduction to a person positioned upon said frame, leg supporting means movably mounted on said leg supporting frame means, and means mounted upon said leg supporting frame means and interconnected to said leg support means for providing internal and external rotative movement of said leg support means.

12. A therapeutic table having a frame, arm supporting frame means, hinge means for supporting said arm supporting frame means upon said frame for lateral horizontal pivotal movement with respect to said frame, arm support means, said arm support means including upper arm support means and forearm support means, means for pivotally connecting one end of said upper arm support means to said arm supporting frame means for reciprocable rotation with respect to said arm supporting frame means, hinge means interconnecting said upper arm support means to said arm supporting frame means for vertical reciprocation of said upper arm support means with respect to said arm supporting frame means, said forearm support means including shaft means telescopically received within said upper arm support means for longitudinal extension of said forearm support means with respect to said upper arm support means, means for fixedly securing said forearm support means in extended relationship with respect to said upper arm support means, forearm cradle means hingedly connected to said shaft means for vertical reciprocation with respect to said upper arm support means, means mounted upon said frame and interconnected with said arm supporting frame means for lateral movement of said arm supporting frame means with respect to said frame, means mounted upon said arm supporting frame means and interconnected with said upper arm support means for vertical reciprocation of said upper arm support means with respect to said arm supporting frame means, and means mounted upon said shaft means and interconnected with said forearm cradle means for vertical reciprocation of said forearm cradle means with respect to said upper arm support means.

13. A therapeutic table having a frame, leg supporting frame means mounted upon said frame, hinge means interconnecting said leg supporting frame means with said frame for horizontal lateral movement of said leg supporting frame means with respect to said frame, a supporting plate mounted upon said leg supporting frame means, leg support means mounted upon said leg supporting frame means, said leg support means including upper leg support means and lower leg support means, means interconnecting said upper leg support means with said leg supporting frame means for reciprocable rotation of said leg support means with respect to said leg supporting frame means, hinge means interconnecting said upper leg support means with said leg supporting frame means for vertical reciprocation of said upper leg support means with respect to said leg supporting frame means, said lower leg support means including lower leg receiving cradle means, shaft means telescopically received within said upper leg support means for extension and retraction of said lower leg support means with

respect to said upper leg support means, means for fixedly securing said lower leg receiving cradle means in extended relationship with respect to said upper leg support means, hinge means interconnecting said lower leg receiving cradle means with said shaft means so that said upper leg support means can be vertically reciprocated with respect to said lower leg receiving cradle means, and a skid mounted upon said lower leg receiving cradle means and riding upon the uppermost surface of said supporting plate, means mounted upon said frame and interconnected with said leg supporting frame means for horizontal lateral movement of said leg supporting frame means with respect to said frame, means mounted upon said leg supporting frame means and interconnected with said upper leg support means for rotative reciprocation of said leg support means with respect to said leg supporting frame means, and means mounted upon said leg supporting frame means and interconnected with said upper leg support means for vertical reciprocation of said upper leg support means with respect to said leg supporting frame means.

14. A therapeutic table having a frame, arm supporting frame means, hinge means for supporting said arm supporting frame means upon said frame for lateral horizontal pivotal movement with respect to said frame, arm support means, said arm support means including upper arm support means and forearm support means, means for pivotally connecting one end of said upper arm support means to said arm supporting frame means for reciprocable rotation with respect to said arm supporting frame means, hinge means interconnecting said upper arm support means to said arm supporting frame means for vertical reciprocation of said upper arm support means with respect to said arm supporting frame means, said forearm support means including shaft means telescopically received within said upper arm support means for longitudinal extension of said forearm support means with respect to said upper arm support means, means for fixedly securing said forearm support means in extended relationship with respect to said upper arm support means, forearm cradle means hingedly connected to said shaft means for vertical reciprocation with respect to said upper arm support means, means mounted upon said frame and interconnected with said arm supporting frame means for lateral movement of said arm supporting frame means with respect to said frame, means mounted upon said arm supporting frame means and interconnected with said upper arm support means for vertical reciprocation of said upper arm support means with respect to said arm supporting frame means, means mounted upon said shaft means and interconnected with said forearm cradle means for vertical reciprocation of said forearm cradle means with respect to said upper arm support means, leg supporting frame means mounted upon said frame, hinge means interconnecting said leg supporting frame means with said frame for horizontal lateral movement of said leg supporting frame means with respect to said frame, a supporting plate mounted upon said leg supporting frame means, leg support means mounted upon said leg supporting frame means, said leg support means including upper leg support means and lower leg support means, means interconnecting said upper leg support means with said leg supporting frame means for reciprocable rotation of said leg support means with respect to said leg supporting frame means, hinge means interconnecting said upper leg support means with said leg supporting frame means for vertical reciprocation of said upper leg support means with respect to said leg supporting frame means, said lower leg support means including lower leg receiving cradle means, shaft means telescopically received within said upper leg support means for extension and retraction of said lower leg support means with respect to said upper leg support means, means for fixedly securing said lower leg receiving cradle means in extended relationship with respect to said upper leg support means, hinge means interconnecting said lower leg receiving cradle means with said shaft means so that said upper leg support means can be vertically reciprocated with respect to said lower leg receiving cradle means, and a skid mounted upon said lower leg receiving cradle means and riding upon the uppermost surface of said supporting plate, means mounted upon said frame and interconnected with said leg supporting frame means for horizontal lateral movement of said leg supporting frame means with respect to said frame, means mounted upon said leg supporting frame means and interconnected with said upper leg support means for rotative reciprocation of said leg support means with respect to said leg supporting frame means, and means mounted upon said leg supporting frame means and interconnected with said upper leg support means for vertical reciprocation of said upper leg support means with respect to said leg supporting frame means.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,060,926 October 30, 1962

James L. May

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 6, line 49, for "become" read -- becomes --; column 9, line 31, for "286" read -- 276 --; line 68, after "blades 283" insert -- and 284 are thrown into contact with the secondary --.

Signed and sealed this 26th day of March 1963.

(SEAL)
Attest:

ESTON G. JOHNSON
Attesting Officer

DAVID L. LADD
Commissioner of Patents