Nov. 1, 1938. S. G. SVENSSON 2,135,018

APPARATUS FOR THE TRAINING OF THE MUSCLES

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Fig. 1.

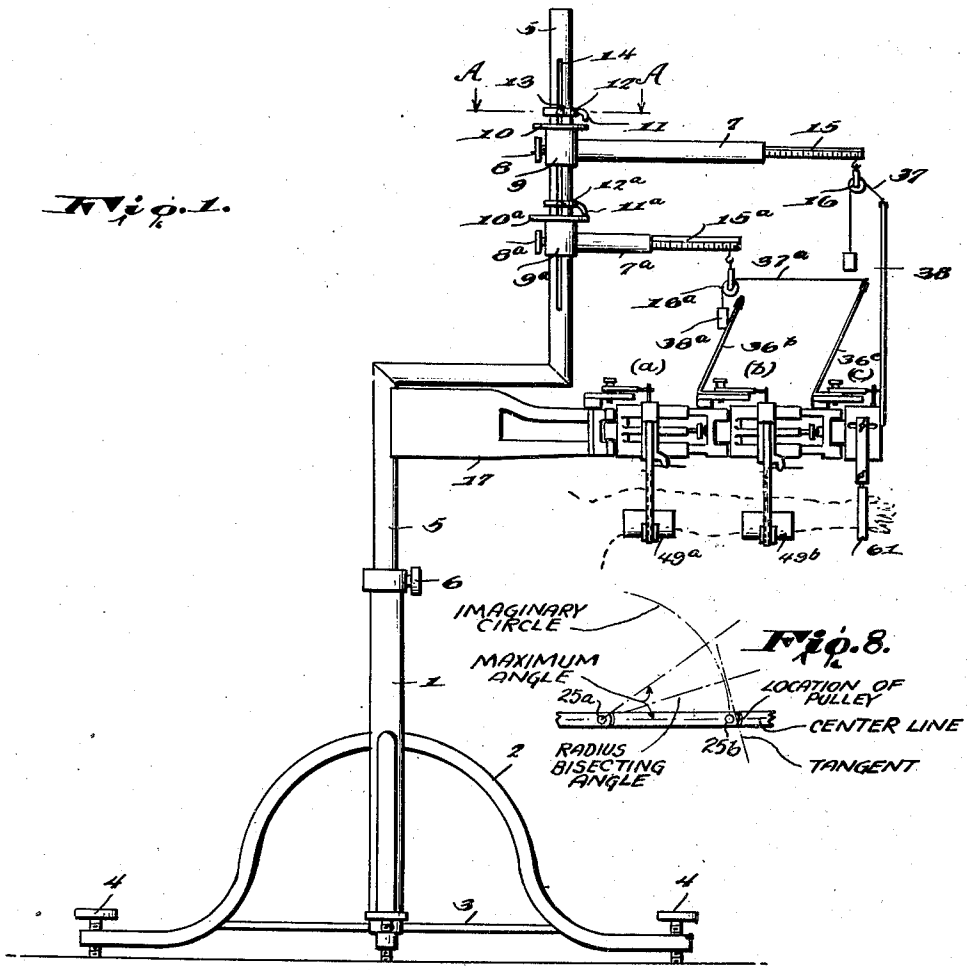

Fig. 8.

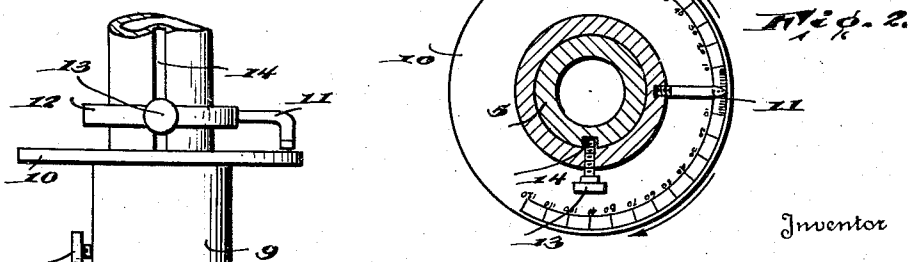

Fig. 2.

Fig. 3.

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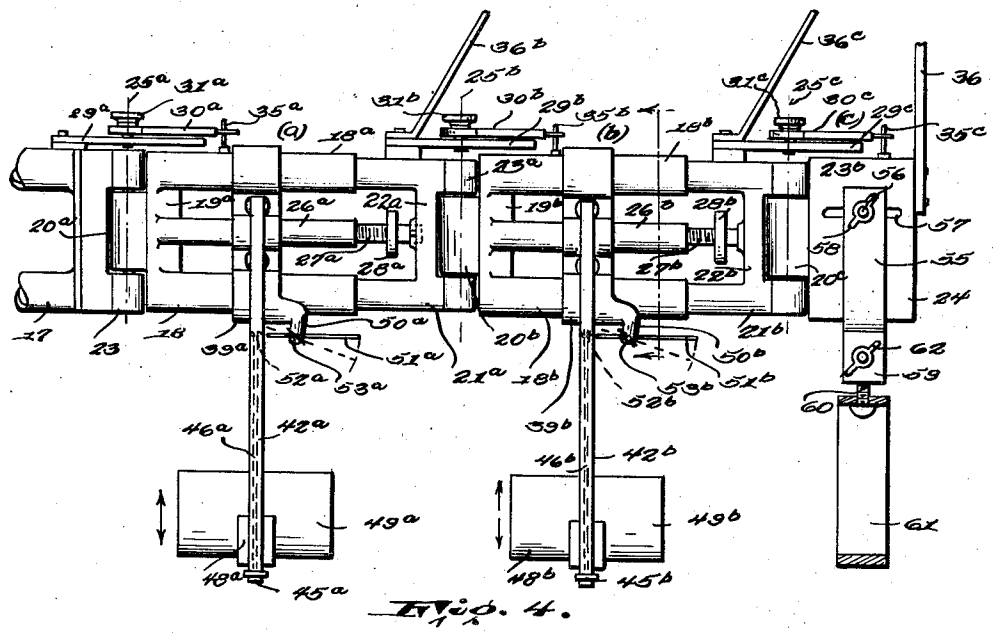

Fig. 4.

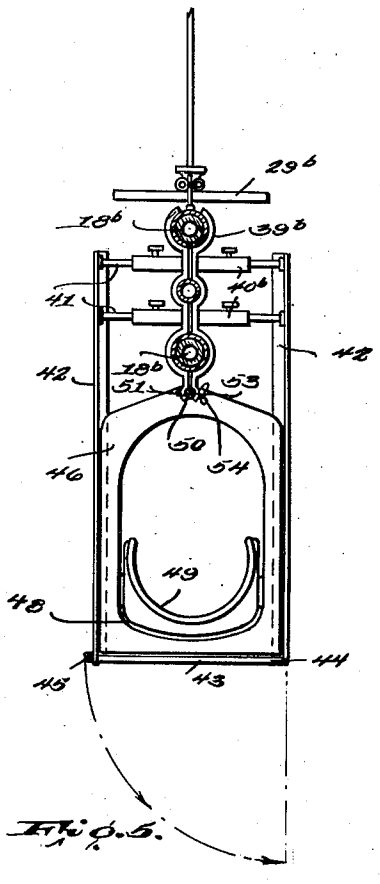

Fig. 5.

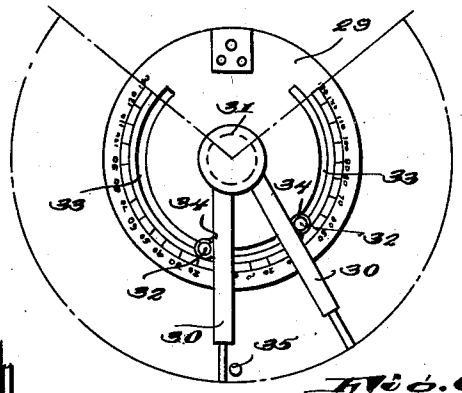

Fig. 6.

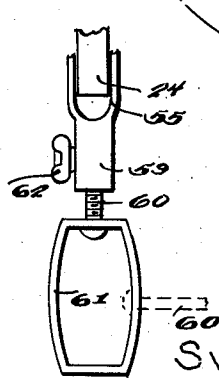

Fig. 7.

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APPARATUS FOR THE TRAINING OF THE MUSCLES

Sven Gustaf Svensson, Buenos Aires, Argentina

Application October 22, 1936, Serial No. 107,091

8 Claims. (Cl. 272—80)

This invention relates to an apparatus which concerns the training of the muscles, specially adapted for those lesions that have been caused by infantile paralysis, and other diseases of the muscles; and is essentially a new type of apparatus that permits one to effect in a very simple and easy manner a perfect periodic control of the physical movements of patients and convalescents from muscular diseases, allowing at the same time, by means of the exercise derived from the repeated use of this apparatus, the training of the muscles affected by these diseases.

The invention has in view other objects which will be understood in the course of this specification, and will be made prominent in a special way in the appended claims.

In order that this invention may be clearly understood and put into practice with the greatest ease, it has been represented by the accompanying diagrams, in which:—

Fig. 1 is a full side view of this new kind of apparatus for muscle training, which is the object of this invention.

Fig. 2 is a sectional plan at A—A of the supporting column of the apparatus in which can be clearly seen the arrangement of the circular scales used for regulating the angular position of the arms;

Fig. 3 is a detailed side view of the indicator represented in Fig. 2;

Fig. 4 is a side view of the principal arms of the apparatus.

Fig. 5 shows a front view of the arm used for holding the patient's limbs (arm or leg);

Fig. 6 is a plan view of the graduated scales which regulate the main arms of the apparatus—and the radial indicators limit the extent of the movement—and

Fig. 7 is a front view of the stirrup in which the patient's foot or hand lies.

Fig. 8 is a diagram for determining the position of a pulley.

The same parts shown in different diagrams bear the same reference numbers throughout.

The principal support is a combination of the vertical pipe 1 with two or three legs 2 strengthened by cross-braces 3 or any other arrangement. Legs 2 are provided with levelling screws 4.

The whole apparatus can be raised or lowered by the movement of pipe 5 in column 1, and can be secured in any position by means of screw 6. Raising or lowering can be effected by mechanical or other means. The upper part of column 5 has two revolving horizontal arms 7, 7a, which may be secured in any desired position by tightening screws 8—8a; or by any other adequate means.

On the clamping members 9—9a of these arms are graduated scales 10—10a reading from 0° to 120° in either direction. Fixed indicators 11—11a are attached to the rings 12—12a respectively, provided with screws 13 which engage in a slot 14 in column 5; the indicator can thus be made to slide up and down the column to conform to the position of the arm. Sliding graduated rods 15—15a are provided in the arms, with suitable means for securing them in any position; at the outer ends of these rods are sheaves 16—16a the object of which will be described below. In the lower section of column 5 there is a heavy supporting arm 17 made of structural steel or sheet steel suitably joined to provide a rigid structure, and at the end of the rigid arm 17 are the articulated sections a, b and c, attached by vertical hinges (Fig. 4). The articulated sections a and b are constructed of parallel tubes 18a and 18b, and joined together by T-shaped irons to which are attached the hinge parts 20a—20b.

An extensible sliding member consisting of tubes 21a—21b, working within tubes 18a—18b, and joined at their outer ends by cross-pieces 22a—22b, preferably made of T-iron is attached to the matching parts of the hinge 23a—23b, which together with 20b and 20c are joined together by the hinge pins 31b—31c.

The outermost hinged part is comprised of a heavy plate 24 attached to hinge 20c. Similarly, section a is hinged to the fixed arm 17.

In order to adjust the lengths of the extensible sections a and b, screws 27a—27b with knurled heads 28a—28b are provided and work in tubes 26a—26b.

The outer ends of these screws are supported in suitable holes in the crosspieces 22a—22b.

Referring to Figures 1, 4 and 6 it will be seen that graduated scales 29a, 29b and 29c are provided at each hinge to establish the angularity of the articulated sections a, b and c.

The discs are slightly raised to prevent fouling in the section next ahead.

Above the circular scales 29a, 29b, 29c are a pair of radial arms 30a, 30b, 30c, which are employed to limit the angular movement of the articulated sections a, b and c. These radial arms centered on 31a, 31b, 31c, can be adjusted angularly to any desired position by reference to the fixed circular scales 29a, 29b, 29c, graduated from 0 to 130° in either direction. The arms may be fixed in any position by means of screws and

wing-nuts **34**; the screws engage in circular slots **33**.

A fixed stop **35***a*, **35***b*, **35***c*, limits the angular movements of sections *a*, *b* and *c* between the aforesaid radial arms. A slender vertical rod **36** is attached to the outer part of section *c* while similar, but inclined, rods **36***a* and **36***b* are fixed to the inner position of discs **29***b* and **29***c*. A cable **37** is attached to the upper extremity of the rod **36** and is guided around grooved pulley **16**, and at its free end is attached a counterweight **38**. Similarly, a cable **37***a* may be attached alternatively to the upper ends of inclined rods **36***a* or **36***b*. This cable passes over grooved pulley **16***a* and at its free end is attached a counterweight **38***a*. On sections *a*, *b*, *c* are provided stirrups formed as follows: Shaped strips of metal **39** are clamped to pipes **18** and **26** of sections *a* and *b*, by means of suitable screws or similar means (Fig. 5). Horizontal tubular supports **40** are fixed to these strips and these are provided with extensible sliding rods **41** at their outer ends. These sliding rods support in turn a frame consisting of uprights **42** and cross-bars **43** hinged at one end **44** and normally kept in position by pin **45** or other suitable means. Within this frame is arranged a plate of sheet metal **46** capable of vertical adjustment within the upright guides **42**. A large aperture **47** in plate **46** permits the passage of the patient's limb, which is supported in the long curved sheet metal rest **49** held in turn on a shorter curved support **48** fixed to part **46**.

Plate **46** can be adjusted vertically in guides **42** by means of a small lever **51** hooked into the hole **52** in this plate.

This lever has a fulcrum **53** which is formed by projecting pieces from clamps **39**. A bolt with a wing nut **54** is provided in the fulcrum. By loosening this nut, and raising or lowering lever **51**, plate **46** can be lowered or raised to any desired position and there held by re-tightening the wing nut **54**.

In the outermost articulated section *c*, another and different stirrup is suspended. This stirrup is comprised of a U-shaped support **55** which embraces plate **24** and is held in position by a bolt **56** and wing nut **58**. This support **55** can be moved in or out in a horizontal slot **57** and fixed in any desired position by tightening the bolt **56** and nut **58**.

At the lower end of the U-shaped support is a tubular extension **59** in the vertical hole of which is slidably mounted a rod **60** supporting a specially shaped ring **61**, as shown in Fig. 7. The position of ring **61**, relative to the extension **59**, can be adjusted and fixed by means of thumb-screw **62**.

Method of using the apparatus

The patient's arm or leg is placed within the stirrups **49***a*, **49***b* and **61** of each of the sections *a*, *b* and *c* of the main arm of the apparatus. To effect this, the patient should be placed lying down on his side or back, or assuming any other convenient position, on a table placed longitudinally, transversely or obliquely with regard to the sections *a*, *b* and *c*, according to whether an arm, or a leg, of the patient is to be subjected to treatment.

In the case of an arm, the position of the stirrups is arranged as shown in Fig. 1. The position of hinges **25***a*, **25***b*, **25***c* should coincide with the articulations of the arm at points corresponding with the shoulder, elbow and wrist of the patient. The length of the sections can be adjusted by means of screws **28***a* and **28***b*. Stirrup **49***a* supports the arm, **49***b* the fore-arm and **61** the hand. Stirrup **61** can be so arranged as to support the hand with the palm lying either in a vertical or horizontal plane, according to particular groups of muscles to be subjected to treatment. Alternative supporting possibilities of ring **61** are shown in Fig. 7. To place the arm and fore-arm of the patient, in the stirrups **49***a* and **49***b*, pins **45** of cross-bars **43** must previously be removed.

The cross-bar **43** must be swung out of position and, unhooking lever **51**, the plate **46** can be removed from its frame, and the patient's arm inserted. Plate **46** is replaced in position and secured by reversing the operations. After the stirrups have been adjusted to the correct height, the arm and fore-arm of the patient are accommodated within the stirrups **49***a* and **49***b*, and the hand is inserted within the stirrup **61** so that the palm lies in a vertical, or a horizontal, plane according to the treatment required. If the articulation of the shoulder is to be subjected to exercise, the radial arms **30***b* and **30***c* should be closed together at the zero position on the scale (Fig. 6), thus locking the pins **35***b* and **35***c* and preventing any movement of hinged sections *b* and *c*. The radial arms should be secured in this position by means of the respective wing nuts **34**. Sections *b* and *c* will be in a rigid straight line. Radial arms **30***a* are secured in their extreme positions and, thus, only hinge **25***a*, corresponding to the patient's shoulder, is free to rotate. Then, cable **37***a* should be unhooked from the rod **36***b* and hooked on to the rod **36***a*. At the same time the horizontal revolving bar **7***a* will be lowered until the cable is perfectly horizontal.

To commence the exercise, the bar **7***a* and the graduated rod **15** must be placed approximately in the required position, first noting the extent of movement of the limb without the counterweight.

To do this, one of the radial arms **30** is secured at the zero position and the other radial arm is left free, and during the articulation of the limb the locking pin **35** of the hinged arm will push this radial arm—as seen in Fig. 6—and should then be secured in that extreme position. The maximum angular movement can be read from the scale.

To determine the position of pulley **16***a*, the following method is used referring to Fig. 8. With centre **25***a* and radius equal to the distance between centres **25***a* and **25***b*, an imaginary horizontal circle is drawn. At the point of intersection on the circumference of the imaginary circle and the radius which bisects the angle of maximum movement, as shown on the circular scale, a tangent is drawn and continued to meet the normal centre line of section *a*; this point coincides with the position of the pulley.

In practice it is better to place the pulley slightly further away from the column, which allows a free movement of the mechanism. Replacing the bar **7***a* and the rod **15***a* in position, and securing them, the apparatus is ready for use.

The position of the fixed indicator **11***a* and the length of the sliding rod **15***a* should be noted, and the patient should be caused to move his arm towards the side required. The patient should now exert his strength to move his arm in the stirrups **49***a*, **49***b* and **61** and thus move sections *a*, *b* and *c* tending to raise counterweight **38***a*.

Heavier counterweights should be supplied as the patient proceeds gaining in strength, and as the treatment proceeds.

The position of the fixed indicator **11** on scale **10***a*, and the radial arms on scale **29***a* should not be altered until the patient's strength increases. A similar procedure should be followed for exercising the elbow or the wrist. In the first case, the movement of the hinges **25***a* and **25***c* is stopped, as has previously been described. As before, the approximate position of the bar **7***a* and the rod **15***a* must be determined, as already shown.

The patient will only be able to move the two sections *b* and *c* about hinges **25***b*, overcoming the action of the counterweight **38***a*. In the latter case, to exercise the wrist, the movement of sections *a* and *b* at hinges **25***a* and **25***b*, is stopped and only section *c* is allowed to move, cable **37***a* is removed while cable **37** and its pulley is hooked on to the end of rod **15**, lowering bar **7** until the cable stretched between pulley **16** and rod **36** is horizontal. To determine the position of bar **7** and extensible rod **15**, similar means are employed to those used in the preceding cases; after which bar **7** is secured in position by screw **8** or its equivalent. Taking note of the position of the indicator **11** on circular scale **10** and of the bar **15**, these should be kept for future reference.

A further use of this apparatus, in addition to the control of physical development, is the re-training of the muscles the function of which may have been impaired by disease. To secure good results, a systematic use of the apparatus must be made, and as the patient's strength increases, the weight of the counterweights **38** and **38***a* must be correspondingly increased.

What I claim is:—

1. New apparatus for re-training the muscles of the human body, preferably adapted to cases of lesions produced by infantile paralysis and other muscular diseases, comprising in combination: a main arm adequately connected to a supporting frame provided with means for varying the height and angular rotation thereof, the said main arm being formed of three independent sections hinged to each other and to the fixed support, on pivot points located at horizontally spaced positions; extensible means permitting a variation of the distances between the said pivot points; means to lock individually each one of the said sections and to adjust the angle of rotation of each of them relative to its neighbour sections; graduable means designed to oppose gradual resistance to the rotatory movement of the said sections; and supporting means for the suspension and adjustment of the patient's limb at the main arm of the apparatus.

2. New apparatus for re-training the muscles of the human body, preferably adapted to cases of lesions produced by infantile paralysis and other muscular diseases, as claimed in claim 1, wherein the two central sections of the main arm are formed of pairs of elements sliding with respect to each other, provided with screw-, rack- or other convenient means to effect longitudinal displacement of one element relative to the other.

3. New apparatus for re-training the muscles of the human body, preferably adapted to cases of lesions produced by infantile paralysis and other muscular diseases, as claimed in claim 1, wherein at a point coinciding with each of the pivots of the sections of the main arm, is provided a disc fixed to one of said sections and carrying at its centre two small rotatable arms provided with means for locking the arms to the disc in any of their angular positions, the said arms acting as stops of a movement limiting rod secured to the adjacent section of the said main arm.

4. New apparatus for re-training the muscles of the human body, preferably adapted to cases of lesions produced by infantile paralysis and other muscular diseases, as claimed in claim 1, wherein at a point coinciding with each of the pivots of the sections of the main arm is provided a disc fixed to one of said sections and carrying at its center two small rotatable arms provided with means for locking the arms to the disc in any of their angular positions, the said arms acting as stops of a movement limiting rod secured to the adjacent section of the said main arm, and wherein the fixed disc of each of the sections of the main arm is provided with two angular scales, drawn symmetrically in opposite directions, from a common zero position to an approximate angle of 140°.

5. New apparatus for re-training the muscles of the human body, preferably adapted to cases of lesions produced by infantile paralysis and other muscular diseases, as claimed in claim 1, wherein at the upper end of the supporting frame of the main arm, are adapted extensible and conveniently graduated arms provided with means for altering the height and angular displacement thereof, the free end of each of these arms carrying a grooved pulley around which passes a cable or the like provided at one of its ends with an adequately weighted counterweight, the other end of said cable being secured to the end of one, or other, of small rods rigidly mounted on each of the rotatory sections of the said main arm.

6. New apparatus for re-training the muscles of the human body, preferably adapted to cases of lesions produced by infantile paralysis and other muscular diseases, as claimed in claim 1, wherein at the upper end of the supporting frame of the main arm are adapted extensible and conveniently graduated arms provided with means for altering the height and angular displacement thereof, the free end of each of these arms carrying a grooved pulley around which passes a cable or the like provided at one of its ends with an adequately weighted counterweight, the other end of said cable being secured to the end of one or the other of small rods rigidly mounted on each of the rotary sections of the said main arm, and wherein each of the said arms is rigidly connected to a small disc provided with two angular scales drawn symmetrically from a common zero position to a convenient angle in both directions, there being adapted in combination with said scales a fixed pointer provided with means permitting axial displacements thereof relative to the supporting column of the said arms.

7. New apparatus for re-training the muscles of the human body, preferably adapted to cases of lesions produced by infantile paralysis and other muscular diseases, as claimed in claim1, wherein the central sections of the main arm are provided with supporting means capable of being dismounted and formed of a double, displaceable, clamping ring from which is suspended a rectangular frame closed at its lower portion by means of a rotatable crossbar, the said frame and cross-bar being provided with extensible means to vary the dimensions thereof, there being adapted also at the inner portion of the said frame a displaceable plate conveniently guided in a vertical direction, and forming a central aperture at the lower edge of which is adapted a curved

support for the patient's limb, the said plate being suspended from a lever device provided with means for retaining the plate in any of its positions in a vertical plane.

8. New apparatus for re-training the muscles of the human body, preferably adapted to cases of lesions produced by infantile paralysis, and other muscular diseases, as claimed in claim 1, wherein the outermost section of the rotatable arm carries fixed thereto an annular support graduable in height and conveniently adapted to a sliding support, provided with means for securing it to said section.

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