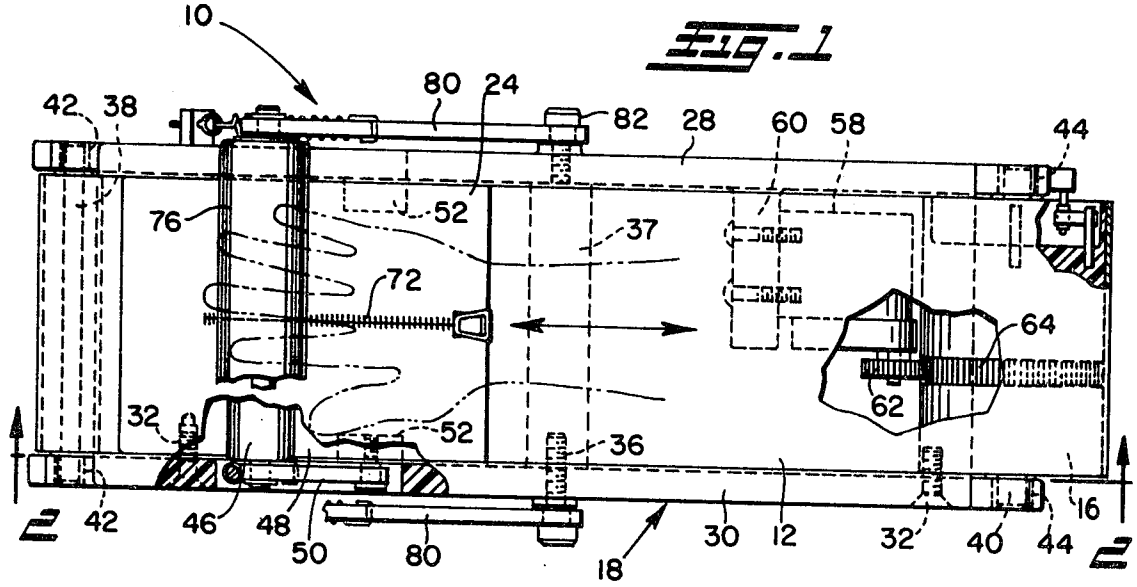
Sept. 20, 1971 V. F. SUKLE 3,605,733

THERAPEUTIC DEVICE

Filed Oct. 10, 1969

Fig. 1



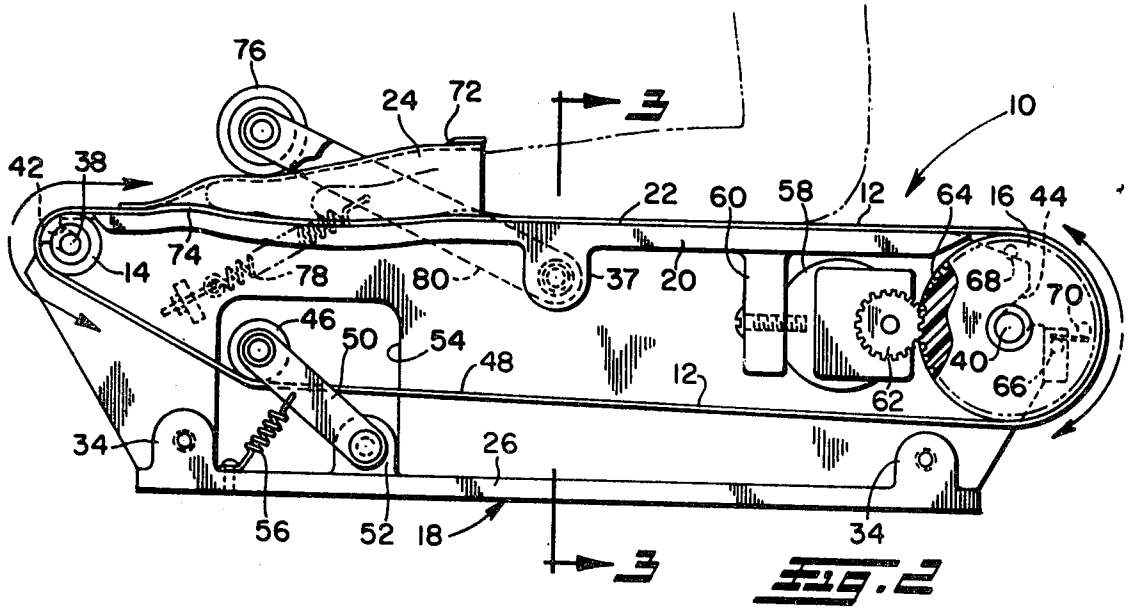


Fig. 2

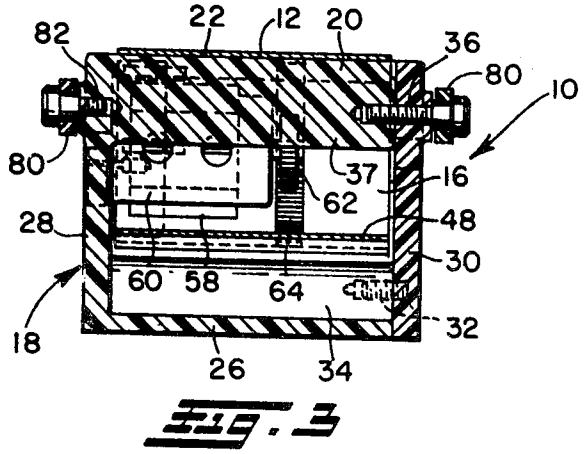


Fig. 3

INVENTOR.
VINCENT F. SUKLE
BY
Oberlin, Maky, Donnelly & Renner
ATTORNEYS

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THERAPEUTIC DEVICE

Vincent F. Sukle, 26210 Columbus Road,
Oakwood Village, Ohio 44146

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ABSTRACT OF THE DISCLOSURE

A theraupeutic device for exercising the hand and arm. The device comprises a continuous belt extrained over a pair of spaced apart rolls, and a hand engaging glove is affixed to the belt. A firm supporting surface is provided beneath the belt upper run, and the belt is positioned initially so that the glove is on the upper run and the patient's lower arm is supported by the surface. The belt is driven in a reciprocating manner causing the glove and patient's hand to curve around one of the rolls and return, this movement also exercising the elbow and shoulder of the patient.

The supporting surface may be provided with an undulating portion which is traversed by the glove, the device including means to press the glove into engagement with said portion to further exercise the hand.

BACKGROUND OF THE INVENTION

The present invention relates to therapeutic devices, and more particularly to a device for exercising the hand and arm of individuals whose ability to move them is impaired.

The invention is particularly applicable to a therapeutic device for exercising stroke patients having paralysis in the hand and arm, and will be described with particular reference thereto, although it will be apparent that the invention has other applications.

Devices for exercising the hands or limbs of a patient are known. It is an object of the present invention to provide an improved such device, and in particular to provide a therapeutic device which exercises the elbow and shoulder of a therapeutic patient as well as the patient's hand.

It is further an object of the present invention to provide a therapeutic device particularly suitable for patients suffering from such disabilities as paralysis of the hand and arm caused by a stroke, and arthritis in the hand and arm.

It is also an object of the invention to provide such a device which is portable and which can be easily set upon a table or like surface.

It is another object of the invention to provide such a device which is inexpensive, simple in construction, and versatile or adaptable to use by different patients.

To the accomplishment of the foregoing and related ends, the invention then comprises the features hereinafter fully described, the following description and the annexed drawing setting forth in detail illustrative embodiment of the invention, this being indicative, however, of but one of the various ways in which the principles of the invention may be employed.

In such annexed drawing:

FIG. 1 is a plan view of a therapeutic device in accordance with the concepts of the present invention;

FIG. 2 is an elevation view of the therapeutic device of FIG. 1 taken along line 2—2, with a side plate of the device removed; and

FIG. 3 is a section view taken along line 3—3 of FIG. 2.

Referring to the drawing, the therapeutic device **10** comprises a continuous belt **12** which is entrained over

a pair of spaced apart rolls, an idler roll **14** in the front of the device and a drive roll **16** at the rear of the device. The idler and drive rolls are supported by a casing **18** having a generally flat, firm arm supporting upper surface **20** beneath the upper run **22** of the belt. A hand engaging glove **24** is affixed to the belt upper run.

Referring to FIG. 3, the casing **18** is a generally hollow member having a flat bottom **26** adapted to seat upon a table top or other surface, the upper arm supporting surface **20**, and a side **28** which is integral with the upper surface **20** and bottom **26**. A removable plate **30** is fastened to the casing across the side opposite the side **28**. This plate is held to the casing by means of a pair of lower screws **32** threaded into bosses **34** (shown in FIG. 2 in which view the plate is removed) integral with the bottom **26**, and an upper screw **36** threaded into boss **37** (FIGS. 2 and 3) integral with the arm supporting surface **20** and on the underside of the same.

Both the front and rear sides of the casing are open to receive the idler roll **14** and the drive roll **16**, and also to permit movement of the continuous belt **12** around the rolls. The rolls are supported on shafts **38** and **40**, respectively, which extend through the rolls, both shafts having protruding ends which are engaged in slots **42** and **44** formed in the front and rear ends of the side **28** and removable plate **30**. The ends of the shafts of the idler and drive rolls are held in the slots by the tension in the continuous belt **12**.

To maintain tension in the belt, a tension roll **46** is provided extending across the width of the belt and bearing against the lower run **48** of the belt. A pair of arms **50** support the tension roll at opposite ends of the roll, the arms being pivotably supported by means of bosses **52** on opposite sides of the bottom **26** of the casing. Windows **54** are provided in both the sides **28** of the casing and in the removable plate **30** to accommodate movement of the roll **46**. Tension springs **56** extend between the arms and the bottom **26** of the casing to maintain the prerequisite tension in the belt **12**.

The drive for the belt comprises a reversing drive motor **58** mounted on a protruding boss **60** extending downwardly from the arm supporting surface **20** of the casing. The motor is provided with a drive gear **62** which engages gear face **64** on the drive roll **16**. Preferably the drive roll is plastic, and the gear face **64** is recessed into the surface of the roll and molded integral therewith. In this way, there is no wear of the gear face on the belt.

It is desired that the belt reciprocate in a periodic manner, and this is accomplished by means of a reversing limit switch **66** mounted at the rear of the casing on side **28**. The limit switch is engaged alternatively by upper and lower pins **68** and **70** (FIG. 2) mounted on one end of the drive roll. The lower pin **70** trips the reversing switch for counterclockwise rotation, and the upper pin **68** trips the limit switch for clockwise rotation, after about 270° of counterclockwise rotation of the drive roll. The pins are approximately 90° apart to obtain this rotation of the roll.

The glove **24** is fixed to the upper run **22** of the belt in any known manner, such as by stitching the glove to the belt, on by bonding it with an adhesive. The glove need not be of any particular design, but preferably is contoured to the shape of the hand, and is provided with an upper zipper closure **72**. The glove may be either a molded resilient pocket, or it may be contoured and shaped to receive the fingers of the hand and to spread the fingers as shown in FIG. 1. Preferably, the glove should grip the full hand and at least part of the wrist of the patient in a manner to hold the patient's arm against the upper run of the belt and in a position so that it is supported by the surface **20**.

The diameter of the drive wheel, and locations of the limit switch pins **68** and **70** are such, with relation to the spacing of the glove **24** from the idler roll **14**, to cause the glove to traverse a portion of the upper surface **20** of the casing and to curve around the idler roll a substantial distance. In this respect, it is noted that the idler roll **14** is of substantially less diameter than the drive roll to cause substantial bending of the fingers and hand.

Preferably, the arm supporting surface **20** is humped at **74** close to the idler roll. A pressure roller **76** bears against the upper surface of the glove exerting a downward force on the glove in a vertical plane slightly to the rear of the hump. Spring **78** (FIG. 2) acting on arms **80** supporting the roller **76** provides the biasing downward force. The arms **80** are pivotally connected to boss **37** by means of screws **36**, **82**, screw **36** also being employed to hold the removable side plate **30** onto the casing.

The purpose of the hump and pressure roll is to flex the fingers. This activates the sensory perceptor nerves in the fingers which cause a reflex in the finger muscles.

Although the invention is not limited to particular dimensions or materials, in a particular example, the drive roll is about four inches in diameter and made of a plastic material. The motor for the drive roll is a high slip motor having a fixed speed of about 20 r.p.m. with a one inch diameter pinion (gear **62**) providing about forty-nine in. oz. torque, or about six pounds pull on the belt. The belt is of nylon, and has a travel of about nine inches in each direction. About three revolutions of the pinion turns the belt drive roll three quarters revolutions.

In operation, the patient's fingers are caused to be alternately straightened and bent, as well as flexed by hump **74**, and the patient's arm is moved back and forth with swinging at the elbow and shoulder.

Advantages of the invention should be apparent. For one, the device provides an improved oscillating motion for preventing atrophy and shrinkage of musculature in the hand and arm, at the same time activating the sensory perceptor nerves of the fingers.

In addition, the device is portable, and easily set on a table top or other surface. The device is inexpensive to manufacture, is easily maintainable, and can be used readily by different patients. For instance, to remove the belt and replace it with another, having for instance a different sized glove, it is a simple matter to remove the plate **30**, withdraw the belt and replace it.

Other advantages will be apparent to those skilled in the art.

I, therefore, particularly point out and distinctly claim as my invention:

1. A therapeutic device comprising
a continuous movable belt;
a pair of spaced apart rolls supporting said belt, the belt defining an exposed run;
hand engaging means affixed to said run; and
means to drive said belt in a reciprocating manner, the travel of said belt being sufficient that the hand engaging means is curved around one of said rolls.

2. The device of claim **1** wherein said hand engaging means is a glove.

3. The device of claim **2** in which said glove is zippered and contoured to hold the hand and wrist of an individual using the device.

4. The device of claim **1** including an arm supporting surface beneath said upper run.

5. The device of claim **4** wherein said arm supporting surface includes a humped portion adjacent said one roll, further including roller means extending across the upper surface of said hand engaging means in the proximity of said humped portion, and means biasing said roller means toward said supporting surface.

6. The device of claim **5** wherein said arm supporting surface and bottom of said casing are integrally formed, further including at least one removable side plate by which the belt can be readily removed and replaced.

7. The device of claim **4** further including a portable casing, said casing comprising a substantially flat bottom adapted to be set on a table top or like surface, said arm supporting surface being substantially parallel with said bottom.

8. The device of claim **5** wherein said arm supporting surface except for said humped portion is relatively flat.

9. The device of claim **1** wherein said one roll is an idler roll, the other roll being a drive roll, the idler roll being of substantially lesser diameter than the drive roll.

10. The device of claim **1** further including tension means engaging said belt.

11. A therapeutic device comprising
a casing;
a continuous belt movable in said casing;
spaced apart idler and drive rolls supported by said casing around which the belt is entrained, said rolls establishing a belt exposed run;
an arm supporting surface beneath said run;
means to drive said drive roll to reciprocate said belt, the distance of travel of the belt being sufficient for the hand engaging means to curve around said idler roll;
the idler roll being substantially smaller in diameter than the drive roll;
said supporting surface including a hump portion adjacent said idler roll;
means across the top of said hand engaging means in the proximity of said hump portion; and
means biasing said last mentioned means in the direction of said supporting surface.

12. A therapeutic device according to claim **11** wherein said casing is portable including a bottom adapted to be seated on a table top or like surface, said arm supporting surface being generally parallel with said bottom; said housing including a removable plate along at least one side by which said belt is removable and replaceable in said casing.

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LAWRENCE W. TRAPP, Primary Examiner

U.S. Cl. X.R.

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