The mechanico-therapeutic institution in Stockholm, established in 1865 / by Gustaf Zander.

Edgar J. Cyriax

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STOCKHOLM.

ESTABLISHED IN 1865

BY

DOCTOR GUSTAF ZANDER.

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THE MECHANICO-THERAPEUTIC INSTITUTION.

THE MECHANICO-THERAPEUTIC INSTITUTION in Stockholm has for its purpose the preservation and regaining of health partly through *exercise of the muscles*, partly through certain *mechanical operations* on the human body. It was established in 1865 by *Doctor G. Zander*.

Its object as well as its principles are the same as those of the common gymnastic institutes, but there is a great difference in the means employed. The latter institutes place the patient in charge of an operator, the gymnast who stretches, bends, or twists the different joints of the patient, while he makes a certain resistance to it, or the operator himself makes resistance while the patient executes the above-mentioned movements. These are called *active movements*. The *passive movements*, consisting of certain mechanical operations on the body of the patient, such as shaking, "chopping," rubbing, etc., are executed by the gymnast, while the patient remains in perfect repose.

Dr. Zander, during his experience as a gymnast, was struck by the difficulty as well of adapting the amount of force to be used by the gymnast exactly to the strength of the patient, as of producing that slow and gradual increase in the use of the muscular power so necessary when employed as a therapeutic agent.

To remedy this defect it occurred to him to *replace the*

gymnast by machines, as these could always be regulated to whatever amount of force was desirable, and consequently a gradual increase of their action very easily produced.

It is this idea which has been carried out by the Mechanico-Therapeutic Institution.

Dr. Zander constructed machines to be worked by most of the different set of muscles; the resistance made by the machine was adjusted to a maximum and mimimum in proportion to the average amount of force generally produced by the respective set of muscles. The maximum and minimum, as well as the intermediate, degrees of force, were indicated by a graduated scale.

But as the muscles act upon levers (the bones), the effect of their action in the various steps of the movement is modified according to the mechanical principles of the lever, so that it generally is least in the beginning and at the end and greatest in the middle of the movement—therefore it was necessary that the resistance made by the machine should be regulated in strict accordance with these principles. The weight to be raised by the muscles was consequently made to act upon a graduated lever, and this latter placed in such a position that the proper increase and decrease of resistance was produced.

Though it might have been more convenient in many of the machines to employ the force of a spiral spring, this expedient was entirely rejected, as the resistance of a spring continually increases, and consequently it might happen that at the end of the movement, when the muscular power is weakest, the resistance made by the spring is strongest—a very dangerous arrangement, which might easily cause overstrain.

The passive movements are very fatiguing to the gymnast, especially as several operations, for instance shaking and chopping, must be executed with a great deal of per-

severance and velocity to produce the proper physiological effect. There must consequently be a great advantage in having these movements executed by machines worked by steam. The intensity of their action can of course be easily regulated.

The apparatus of the Mechanico-Therapeutic Institution of Stockholm consists at present of 67 machines, viz.:—

17 machines for active arm movements.

18 machines for active leg movements.

9 machines for active trunk movements.

23 machines for passive movements.

The passive movements are worked by a steam engine of about five horse power.

By means of these machines the following movements can be executed:—

1. Flexion of the arm (at the elbow-joint).
2. Extension of the arms (at the elbow-joint.)
3. Twisting of the arms (at the shoulder and elbow-joints).
4. Flexion of the arms (at the shoulder-joint).
5. Extension of the arms (at the shoulder-joint).
6. Flexion of the hands.
7. Extension of the hands.
8. Adduction of the arms.
9. Abduction of the arms.
10. Upper and forearm extension of the entire arm directly upwards.
11. Upper and forearm flexion of the entire arm directly downwards.
12. Flexion and extension of the fingers.

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13. Flexion of the legs (at the knee-joint).
14. Extension of the legs (at the knee-joint).

15. Twisting of the legs outwards.
16. Twisting of the legs outwards and inwards.
17. Flexion of the legs (at the hip-joint).
18. Extension of the legs (at the hip joint).
19. Flexion of the feet.
20. Extension of the feet.
21. Adduction of the legs.
22. Abduction of the legs.
23. Hip-knee-foot extension and flexion.
24. Hip and knee flexion.
25. Hip and knee extension.
26. Foot-rolling.

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27. Flexion of the trunk (in the lying position).
28. Flexion of the trunk (in the sitting position).
29. Extension of the trunk (in the sitting position).
30. Extension of the trunk (in the standing position).
31. Twisting of the upper trunk.
32. Twisting of the lower trunk.
33. Lateral flexion of the trunk.
34. Extension of the neck.

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35. Shaking of different parts of the body.
36. Chopping of different parts of the body.
37. Tapping on the head.
38. Kneading of the abdomen.
39. Kneading of the arms.
40. Rubbing of the feet.
41. Rubbing of the hands.
42. Rubbing of the back.
43. Rolling of the trunk.
44. Swinging of the trunk.

45. Balancing of the trunk.
46. Expansion of the chest.

In all 46 different movements, of which most may be modified in various ways to suit different purposes.

The movements being performed with the aid of machines, which never tire and are not subject to illness, as is unfortunately the case with gymnasts, the Institution is able to receive a much larger number of patients than any gymnastic establishment could accommodate. It has thus popularized the science and placed its beneficial influences within the reach of even very moderate means.

The Mechanico-Therapeutical Institution is open from the 1st of October to the 1st of June, 4½ hours daily for gentlemen, and 2–3 hours for ladies. Every patient receives a prescription in which the movements to be performed are enumerated, and the number of the graduated scale of the machine corresponding to the force or the need of the patient is fixed. 12 movements are generally performed daily; after 12 days all or a part of the movements are changed according to the nature of the case treated. Persons who attend the Institution merely for bodily exercise can attain a perfectly harmonious development of their muscular system.

The success of Dr. Zander's invention is best demonstrated by the fact, that since the opening of this Institution the number of patients has steadily increased from 132, in 1865, to 920, in 1876. Of these latter more than 200 were ladies. The establishment is largely attended, not only by those who seek in gymnastics a cure for some particular disease, but also by those who want to find in it a preventive against the evils generated by sedentary life and office work, as well as by school boys and girls who have been considered too weak for taking part in the common school gymnastics.

The complaints which are most frequently treated are chronic heart and lung diseases, catarrhs of the throat, the stomach, and the intestines, constipation, hæmorrhoids, uterine diseases, paralysis, cramp, diseases of the joints, such as anchylosis, sprains, etc., rheumatism, spinal curvatures, deformities, etc.

It is indeed surprising, what a beneficial influence the regular, but weak and varied, exercise of the muscles has on the diseases of the heart. The treatment of such complaints aims at regulating the circulation, and facilitating the action of the heart. About a third of the patients attend the Institution in order to have their heart diseases cured, or at least the symptoms essentially mitigated, and even from foreign countries patients are sent to Stockholm for this purpose.

Even during pregnancy a regular and judicious exercise of the muscles has proved to be very beneficial to the general state of health, and to cause an easier and relatively painless childbirth.

The machines, now exhibited in the Swedish department of the Machinery Hall, are used for the following movements:—

No. 1. *Arm twisting.* Exercises the muscles which twist the arms at the shoulder and elbow-joints.

No. 2. *Hand-flexion and extension.* The machine can easily be adjusted for exercising either the flexor or the extensor muscles of the wrist.

No. 3. *Arm-abduction.* Exercises the muscles which carry the arms backwards. This movement has, moreover, the effect of a gentle expansion of the chest.

No. 4. *Knee-flexion.* Exercises the muscles which bend the legs at the knee-joint.

No. 5. *Leg-abduction.* Exercises the muscles which carry the legs outwards.

No. 6. *Foot-rolling.* Exercises both the extensor and the flexor muscles of the ankle, draws the blood down to the feet, and has a strengthening influence on the ligaments of the ankle-joint.

No. 7. *Trunk-flexion backwards.* Exercises the extensor muscles of the back.

No. 8. *Vibrating machine* for shaking various parts of the body. Shakings are especially valuable as curative agents on account of their well-defined physiological effects. On tired or aching muscles and nerves they have a very refreshing and relieving effect. Pain is often entirely subdued by a single shaking during some minutes. Sensitive persons taking a foot-shaking feel a certain sense of coldness in the feet during the operation, but become soon afterwards warmer than before the movement. When taking a shaking on the os sacrum, one can easily feel that the walls of the rectum and the bladder vigorously contract, especially if they are full. Shaking of the chest or the throat facilitates the expectoration in catarrhs, and the absorption of pleural exudations. Shaking of the back between the shoulder-blades has a specific effect upon the action of the heart; it always makes its contractions less frequent and more effective. Persons suffering from nervous palpitation feel very much relieved after such a movement; the pulse has in one case been observed to fall from 130 to 90. In cases of fatty degeneration of the heart, when its action is very weak and very rapid, the back-shakings, together with such movements as facilitate the action of the heart by lessening the pressure of the blood in the arteries, are invaluable.

No. 9. "*Chopping*" *or rapid* "*Hammering*" on various parts of the body has a more superficial effect than shaking. The movement consists of a number of alternating and rapidly succeeding compressions and relaxations of the

superficial soft parts, draws the blood to the part acted upon, and produces an increased warmth and vitality. It is used as a stimulant and derivative agent.

No. 10. *Foot-rubbing.* The patient puts the soles of the feet against the rapidly revolving, furrowed wheel, a piece of soft chamois being placed between the feet and the rubbing surface of the wheel. The operation has a stimulating and warming effect, and is very efficacious in drawing blood to the lower extremities.

No. 11. *Trunk-rolling.* The patient takes his seat on a sort of saddle fastened to the top of a vertical lever, the lower end of which is made to rotate in larger or smaller circles, the fulcrum being near to the saddle. By this means the saddle is successively inclined in all directions; the angle of inclination being large in proportion to the diameter of the circle, which the lower end of the lever describes. The patient, seated on the saddle, is obliged to use all the muscles round the waist to keep his balance. Moreover, the abdominal viscera are, as it were, kneaded and rubbed against each other and the abdominal walls; which cannot be without a beneficial influence upon the circulation in their bloodvessels, as well as their respective functions. The movement is used not only to strengthen the back and abdominal muscles, but also to cure torpidity, and circulatory disorders of the abdominal viscera.

No. 12. *Expansion of the chest.* The thorax is pulled upwards by means of two levers, while a pad makes a horizontal pressure on the back. The trunk is hereby elongated a few inches, and the spine and the walls of the chest are stretched. After some seconds the machine permits the thorax to sink down, and the movement is repeated seven to ten times. The patient remains perfectly passive, only inspiring during the pulling up, and expiring during the sinking of the thorax. Persons who carry on a se-

dentary life respire very superficially; the walls of the thorax become too stiff, and make the respiratory function laborious; the lower lobes of the lungs partake very little of the respiration. By using the chest expansion, the walls of the chest recover their elasticity, and the patient is made to inspire deeply, so that the air can penetrate to every part of the lungs.