THE USAGE DESCRIPTION
OF CRYOGENIC CHAMBER IN MEDICINE

WHOLEBODY CRYOTHERAPY CHAMBER
(-110°C do -160°C)

Arctica series

European Patent Protect: No. 1465564
USA Patent Protect: No. 1 465 5 64 B1
An original solution, using a phenomenon of coolness retention and direct injection of liquid air into cryochamber, notified in the Europe Patent Office, provides an opportunity for widening the range of interventions offered so far in well-known cryo-chambers solutions.

The possibility of enriching the atmosphere in the cabin with oxygen, up to 24-26%, creates better conditions for biological regeneration of persons who are exposed to great strains and who need special conditions of regeneration (e.g. sportsmen after exhausting training). The nitrogen-oxygen atmosphere allows the cryotherapy of the whole body, including face receptors which have a huge influence on feeling coldness and processes of thermoregulation in the patient's body.
The cabin for cryotherapy treatment can be built as a one, two or four-person treatment cabin isolated with the foamglass which are mounted on the wood bearing construction. The inside of the cabin is lined with poplar wood. Between the wooden layer and the foamglass layer there is a system of spraying devices which sprays cryogenic liquid air. The cabin is closed by the two sided swinging door.

A novelty in the construction of cryotherapeutic cabin is the location in the hollow below the level of the operative floor which allows the use of the coolness retention effect and advantage of direct liquid air injection into cryochamber. The slope of the stairs is mild and the steps are wide which enables the patients who are less fit to enter the cabin without problems and can be treated as adaptation area.
The staff is able to observe the patient constantly due to the fact that the cabin is well lit and that the ceiling is transparent. This makes cryochamber very comfortable especially for patients who afraid small rooms.

The temperature is controlled by a digital temperature meter also the atmosphere composition is measured by the oxygen concentration meters. These values are shown on the display of the console and computer controller.
The working temperature depends on the efficiency of the flow of the cryogenic liquid which is regulated automatically by a treatment assistant. The working temperature ranges from -100°C to -150°C. The use of the cryogenic liquid air amounts from 90kg to 120kg per working hour.
One of many very important problems in balneology is the contagion by microorganisms, especially mycosis is the nightmare of health resorts. Ozone generators are used to sterilize the devices after the whole day of treatments. The ozone half-life decomposition, which lasts about 1 hour, causes that the next day of treatment device is totally disinfected.

Simultaneously ozone, which is heavier than air, remains in the lower part of the device and does not enter the treatment room where the cabin is located.
Preparing the patient for the treatment includes:

- blood pressure measurement before the treatment,
- respirations training in the chamber, where the patient has to breathe with the nose slowly and not deeply through the surgical mask which is done by the physiotherapist,
- verify that the patient is not perspiring (can not be perspiring),
PREPARING THE PATIENT FOR THE TREATMENT

- instructing about the treatment dress – the patient should be dressed in a swim suit (for women two-piece swim suit is preferred), socks, gloves and ear-protectors, the surgical mask; clothes should be made of natural materials.

The treatment should be conducted by a physiotherapist who should observe the patient the whole time. The treatment should be stopped if the following symptoms appear: the patient becomes pale (whitening of skin), livedo, the symptom of the so-called orange-skin and patient’s pains. The patient has to be instructed that he must call the service if he observes one of above-mentioned symptoms.
MEDICAL BACKGROUND

The oldest mentions of the utilization of cold temperature for treatments can be found on a papyrus from about 2500 years BC. Firstly, one used cold water, snow, ice for chilling. In medical care coldness is used, for more than hundred years, to do local and whole body treatments. Local treatments used (and still use):

- elastic or plastic bags with special gel or filled with cold water with ice or with crumbled ice,
- moist scarf chilled to -12°C,
- gauzes wetted in icy water with salt in plastic bags,
- viscose sponges soaked in saline and then frozen to -20°C,
For entire body treatments of persons having high temperature with the aim of reducing it, wrappings with moist sheets cooled in refrigerator are used. Technical progress has given new possibilities, which led to the synthesis and industrial production of diethyl ether, ethyl chloride, dry ice etc. The radical change in cooling external surface of body happened in the last twenty five years, when a Japanese professor Yamauchi started to used liquid nitrogen (boiling temperature -196°C). In Poland cryotherapy with liquid nitrogen is realized from the beginning of the 1980s.

**Biological influence of cold first of all depends on:**
- temperature differences between coldness source and the body,
- the amount of heat and the speed with which the heat is taken away from the body,
- length of exposition to coldness.
Directly under the skin there is a layer of terminal aqueous vapor and standing air, which creates a thermal buffer opposing to the environment temperature. Together with the progressive lowering of skin temperature the following phenomena happen:

- stimulations of cold receptors,
- decreasing of the activity of thermoreceptors,
- vasmotor changes
- extinguishing of local catecholamines releasing,
- changes of nerves refraction time until the blockades of nervous activity,
- decreasing of metabolism.
The cold works on the human body in two phases. Firstly, it causes the narrowing of vessels in the skin and in the subcutaneous tissue, which is the body’s defensive reaction to the heat loss. In spite of this reaction certain lowering of tissue temperature takes place. The decrease of metabolism follows because of the reduction of the blood flow and of the tissues supply in oxygen and trophic components. In the second phase of the cold activity blood vessels widen which causes the tissues congestion (only in the area where the cold works). If blood vessels are healthy and react correctly to cold, one should not to be concerned with permanent narrowing of blood vessels. It is known that during the moderate exposure to cold blood vessel diameter alternates between narrow and widen, which assures sufficient blood flow. This is the so-called Lewis reaction.
Depending on the cooling factor the temperature of the skin may drop even to -2°C. The lowering of temperatures of deeper layers of tissues is not proportional to the temperature of cryogenic liquid used during the treatment.

The heat exchange speed depends on:

- difference of temperatures,
- heat conduction of tissues,
- heat capacities of the thermal energy carrier (e.g. cryogenic liquid) and heat capacities of tissues,
- sizes of heat surface exchange,
- time of exposure to the cold.
The mechanisms of heat loss by the body during cold influence includes conduction, radiation and convection. The parts of the body which are not covered give back heat to the environment in room temperature mainly through radiation. If the temperature of the environment drops the heat loss through radiation increases. When the temperature of the environment goes up, the greater part of heat loss is through evaporation of aqueous layer covering the surface of the skin and through the sweat evaporation.

Depending on the temperature of cryogenic device and the time of chilling after 2-6 minutes after the treatment there follows the widening of blood vessels causing blood flow even four times greater. Such a state can last 2 - 4 hours after the treatment. Temperature of skin reaches its normal value - after about 15-20 minutes, and even exceeds it by 0,5°C. It depends on the activities of inflammatory process in the ill people with rheumatoid inflammation of joints. Healthy persons return to the normal temperatures after 50 minutes.
Coldness used for therapy works in the following ways:

- **anaesthetizes**, which is caused by the decrease of the conduction in nervous fibres, stopping the nocireceptors in the skin, partial or entire C fibres blocks and the decrease of releasing mediators of pain. This effect occurs 3 minutes after the influence on the tissues by nitrogen vapours at the temperature -110 to -118°C. This effect lasts 3 to 4 hours.

- **decreasing of inflammatory processes**, which explains the decrease of metabolism activity of the cells which are inflamed, decrease of enzymatic reaction which equals the decrease of mediators activity of inflammation and the decrease of local blood supplies of inflamed tissue.
leads to the changes of muscles tension. Short rubbing e.g. with ice enlarges the muscles tension. The treatment at the temperature of 0°C lasting longer than 10 minutes or the activity of the cryogenic device at the temperature of -160 to -180°C longer than 1 minute results decrease of muscles tension which is caused by the decreased activity of: bursa nuclearis, vinculum nucleare and the decrease of gamma motoneurons activity. This is also caused by the analgesic activity of such treatment.
Indications for the curative use of coldness are very extensive:

- **acute and chronic diseases of joints and articular cartilages** e.g. rheumatoid joints inflammation, Bechterow disease, Reiter syndrome, lichen erythematousus, gout, infectious joints inflammation,

- **chronic illnesses of joints**: as e.g. joints degeneration, secondary inflammation of joint degeneration, periarticular omarthritis (periarticular shoulder inflammation),

- **back pain syndromes**: e.g. low back pain [lumbalgia] (after eliminating the possibility of kidneys disease), sciatic neuralgia, the state after nucleotomy,

- **soft tissues rheumatism** such as tendinitis or tendovaginitis,
- **results of accidents and other injuries** e.g. torsions, dislocations, muscles stretching, scald, swellings after injuries, Sudeck disease,

- **surgical diseases** as e.g. contractures in joints, swellings after breast, hand, jaws operations, scars pains, empyema of the bones, fistulas, local infections, hemorrhoids, itch of anus, acute superficial inflammation of veins, bleeding from nose, acute states of abdominal cavity inflammation.

- **neurological diseases** such as: spastic hemiparesis and paraparesis, the brain and the medulla disseminated inflammation, myasthenia, Parkinson disease, pains of different reasons, anterior poliomyelitis, acute nerves inflammation.
The main indications for whole body cryotherapy: protracted diseases of joints: first of all rheumatoid joints inflammation, Bechterew disease, psoriatic arthropathy, lichen erythematosus, soft tissues rheumatism, collagenoses. One should emphasize that cryotherapy can also be used in the fits of paroxysmal tachycardia, diabetes, varixes of lower limbs, systemic lupus erythematosus, systemic sclerosis.

The contraindications to local cryotherapy: cryoglobulinaemia, cold agglutination or haemolysis, cold haemoglobinuria, urticaria (sensitiveness to coldness), hypersensitiveness to coldness, Raynaud disease (not certain), trophic disturbances, dyasaesthesia, considerable anaemia, neoplasms, frostbites, distempers of tissue mikrocirculation (e.g. in arteries obliterative atheromatosis, diabetes, in protracted venous insufficiency),
The main contraindications to the whole body cryotherapy: serious heart diseases and diseases of circulatory system e.g. circulatory insufficiency, arrhythmia, the state after myocardial infarction, hypertension, diseases of lungs. First treatments in cryo-chamber last 1/2 minute, which is gradually lengthened. The patient has to be properly prepared and instructed for the treatment.
After a few minutes after the cryotherapy treatment the following effects appear:

- widening of vessels and closing of arterial-venous fistulas lasting for 3 to 4 hours,
- decrease of muscle spasticity (when is it present),
- decrease of swelling - a few hours' long congestion active in the tissues on which cryotherapy is executed enables better metabolism and elimination of accumulated metabolites, and also improves circulation in a lymphatic vessel,
- stimulation of immune system,
- decrease of morning stiffness.
After a series of treatments there follows:

- increase of the range of joints movability,
- increase of muscular power,
- increase of exercise tolerance,
- decreasing the pains
- decreasing the use of antiphlogistic and analgesic drugs.

As far as the construction of such types of treatment device is concerned it is possible to modify the atmosphere composition inside the cabin:

- the air atmosphere
- the oxygen - nitrogen atmosphere
In order to protect the patient from the influence of the atmosphere used inside the treatment cabin, a ventilation system of the upper part of the cabin was installed. Such a solution enables keeping around the patient’s head air atmosphere.

The efficiency of the ventilation system is regulated by staff according to the atmosphere composition of the cryogenic cabin.

The atmosphere composition is measured by the oxygen concentration meters. These values are shown on the display of the console.
ARCTICA CLASSIC Plus
for 4 person (main chamber & prechamber)

CE 0044

Metrum CryoFlex
www.metrum.com.pl
ARCTICA CLASSIC Plus 2
for 6 person (main chamber & two prechambers)
ARCTICA CLASSIC Mini for 2 person (main chamber)
ARCTICA CLASSIC Mini 2
for 2 person (main chamber & prechamber)
DIPLOMA

Eureka! 2006

CryoFlex Poland Sp. z o.o.
monit. Wiesław Protak

pour l’Invention - for the Invention - voor de uitvinding - für Erfindung
Refrigeration and Cryotherapy Equipment

Bronze medal

THE PRESIDENT OF
THE INTERNATIONAL JURY

THE PRESIDENT

THE WORLD EXHIBITION
OF INVENTION, RESEARCH
AND INDUSTRIAL INNOVATION

ZŁOTY ESKULAP

Producent: CryoFlex-Poland sp. z o.o. Błostec Leszczyński

Międzynarodowy Salon Medycyny
SALMED 2006

Procesor: Centralny Biuro Zdrowia

Pomocnik Medyczny dla Rehabilitacji

Złoty Eskulap

Międzynarodowe Targi Poznańskie

Pomocnik Medyczny dla Rehabilitacji

Złoty Eskulap
Ul. Zielna 29
05 - 082 Blizne n.Warsaw
POLAND

tel. +48 22 33 13 750
fax +48 22 33 13 766

export@metrum.com.pl
biuro@metrum.com.pl