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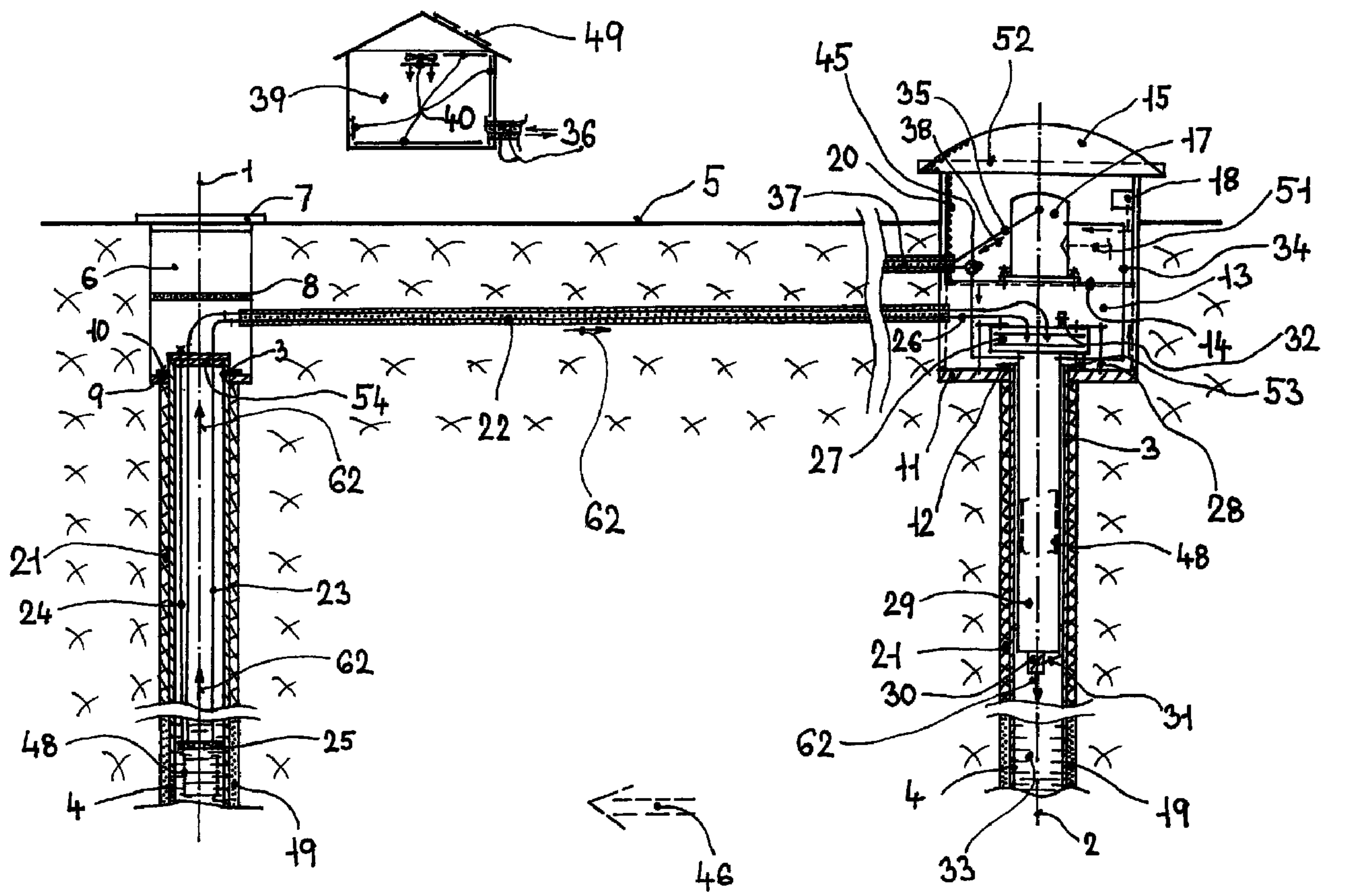
(54) Titre : SYSTEME DE POMPE A CHALEUR ET PROCEDE POUR POMPER DES LIQUIDES
(54) Title: HEAT PUMP SYSTEM AND METHOD FOR PUMPING LIQUIDS

FIG.6



(57) Abrégé/Abstract:
A heating system with a heat pump uses as a source of heat energy of a water, which consists of at least one integral and/or connected tubing (23, 22, 26) leading from the source drill hole (1) and/or well into the disposal drill hole (2) and/or well, during

(57) Abrégé(suite)/Abstract(continued):
which the tubing is connected via a heat exchanger and/or an evaporator to heat pump generator and at least one suction and pumping chamber (27) of such construction is offering a flexible change of its volume, where the movement and flow of water through tubing from the collecting site is achieved by a suction effect and vacuum in chamber (27), and at least one outlet opening (30) is in the bottom part of the chamber (27) and/or exchanger (29), which can be realized as a controllable-type valve, and/or sliding door, and/or flap through which the cooled water flows out preferentially into the drain parts (33) of the drill hole (2) and/or well, and the heat energy of the water which flows out and/or flows through the exchanger of the heat pump evaporator is collected directly, and/or by way of operative medium of the compressor (17), the heat energy for heating and/or for cooling is further transferred into the selected heating system (40) within the premises (39), and the medium of the compressor circuit circulates through collecting vessel (42), dehydrator and filter (41), controllable valve (44) and at least one throttling element (45).

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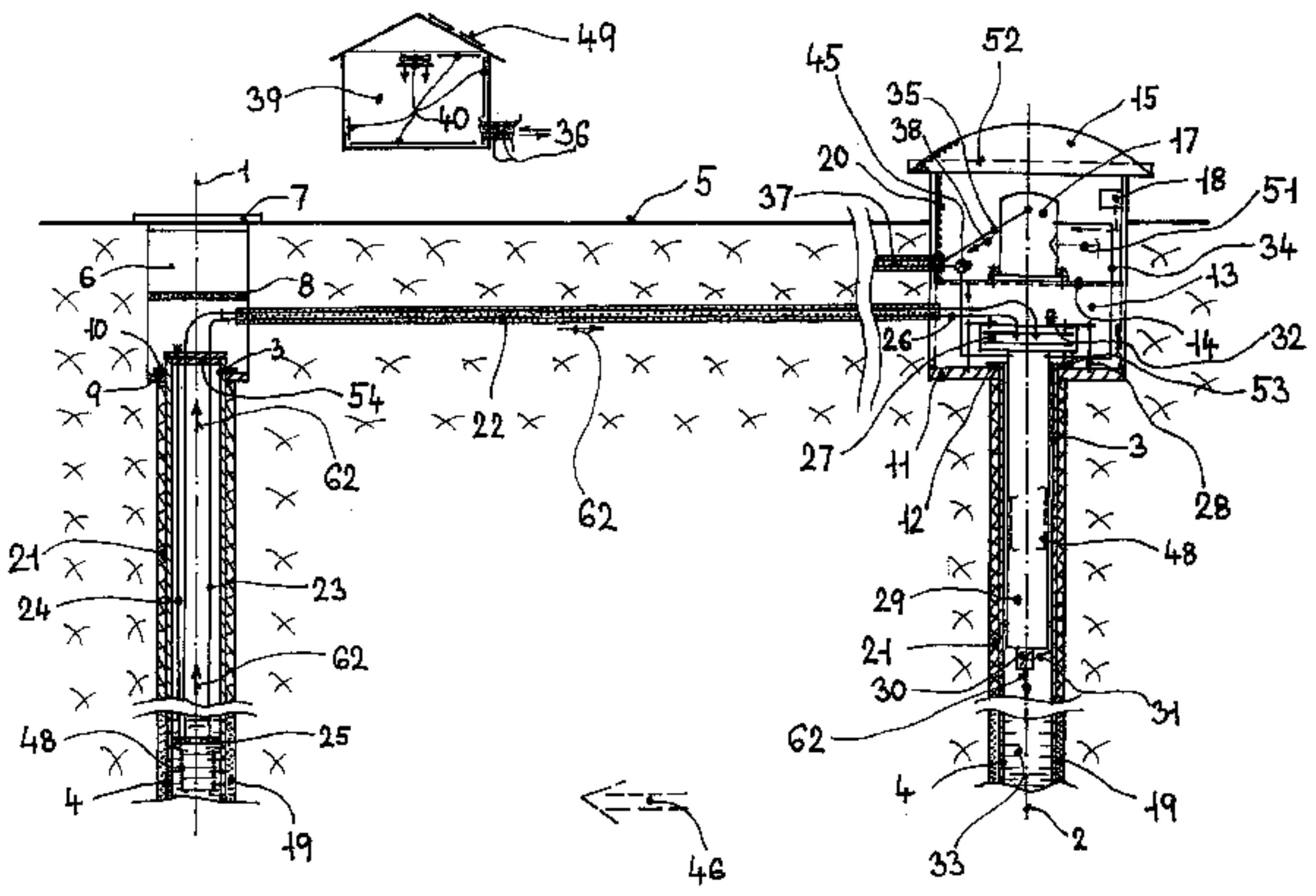

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HEAT PUMP SYSTEM AND METHOD FOR PUMPING LIQUIDS

TECHNICAL FIELD

The submitted invention describes a heating system with a heat pump that collects heat energy from water, which is pumped from the location of its occurrence by way of pumping equipment. In this situation underground water is preferentially used as a source of heat energy for heat pumps; the water is either from a drill hole and/or from a well.

According to this invention the heating system with heat pump serves to heat homes, flats, buildings and other areas. Water that is pumped by gravitational pumping equipment can simultaneously be used to supply the house. Implementing this type of heating system is possible in those situations in which there is an adequate water source.

During thermodynamic heating with a heat pump, natural renewable heat energy from a selected primary source is normally collected and over-pumped to the secondary side of the system where produced heat and/or cold is given and utilized for the heating and/or cooling of space and/or for the heating of water. Heat pumps that utilize heat energy from underground water are generally considered the most heating cost-effective. Thanks to the constant temperature of underground water it achieves a stable heating output throughout the year and a higher coefficient of performance COP than other heat pumps.

Gravitational suction pumping equipment and the gravitational suction pumping method that is being presented serves mainly to pump underground water from drill holes, to pump surface water, to pump liquids in various applications and generally to secure a flow of liquids through tubing and for the creation of a liquid gradient.

Gravitational suction pumping of liquids according to the submitted invention eliminates the consumption of direct forms of electrical energy in the course of the pump cycle. Various electric pumps utilize fed-in electricity from distribution networks or electricity produced by alternative sources as a direct form of electric drive. Various pumping systems in which liquid movement has been secured by pressure media, gas or liquids, where air is the most common, utilize an indirect form of electric drive. The pressure pumping action in the pumped liquid is predominantly created by a compressor with electric drive. According to this invention the gravitational suction pumping of liquid method eliminates the disadvantages that accompany the structure of current pumps as well as securing an adequate pumping performance for the application in question. In the course of pumping there is no consumption of paid-for energy.

BACKGROUND ART

Current thermodynamic heating systems or in other words heat pumps collect so-called low-potential heat from the air, from the soil, ground or from a water. Heat pumps collecting heat from air whose temperature changes every day is the least economic. For operation they consume the most electrical energy for the drive of refrigerant compressors and for the drive of evaporator fans. These pumps work with a significantly variable compressor load. Geothermic heat pumps that collect heat from the soil are operationally more economical while those heat pumps collecting heat from underground or waste water are considered the most economical. Each type of heat pump can be also equipped with solar support, which shifts the efficiency of the system while maintaining the differences of the specific preferential effect of the selected primary source. Currently the most economical heat pump, which collects heat from underground water, is based on the pumping of water while pumping effect is maintained by electric drive. Electrical energy for the drive of water pumps can be produced in a variety of ways. The consumer most commonly buys his electricity from a distribution network. There are also alternative ways of producing electrical energy from renewable sources, such as the sun and wind, where this electricity drives a special submersible pump. The production of electricity from solar radiation is based on the utilization of photovoltaic effects. The production of wind electricity is implemented by the transformation of wind energy to electricity in a wind power station system. The main disadvantage of these renewable forms is their inconsistency. Photovoltaic layers require light and a wind power station needs wind. Another disadvantage is the price the investor must pay and the time needed for a return in investment. Investing into pumping equipment of underground water with electricity produced by the mentioned renewable sources significantly increases the cost of the actual system with a heat pump.

A disadvantage of traditional pump systems is its consumption of electricity, which is normally paid-for energy, and the moving parts within the pump system, which can wear out in time. With time various constructions of pump equipment have been developed; for example pump equipment based on so-called pulse pumps that have two closures within the pump chamber that respond to the pressure of the surroundings. By opening one of the closures a certain amount of pumped liquid is extruded into outlet tubing while the necessary amount of pressure enters the pump chamber when the second closure is opened. The pressure effect of liquid outside the pump chamber can be natural or created. The natural pressure effect of water includes effect created by the energy of falling water or as a result of its own pressure in an underground groundwater body which can be drilled.

Subsequently, the external invocation of pressure in the pumped liquid is currently resolved by supplying pressurized air or other media to the pump chamber. Air most commonly exits with the pumped liquid into the outlet transport tubing after the chamber piston is opened. The advantage is a smaller number of moving parts. The disadvantage is the necessity of inducing further pressurized media in order to maintain the lift of pumped liquid. Paid-for electrical energy, which drives the compressor, is needed to invoke the necessary pressure of pumped liquid. Placing an electric compressor on the surface secures the invocation of pressurized effect of medium for the travel of pumped water or liquid.
Another solution is positioning two or more pistons at a distance from each other on a common suspender. The suspender runs from the drill hole to the surface where it is attached to a manual or motor drive, which invokes lifting and the release of pistons within drill hole tubing. Side tubing is connected to the section or sections between the pistons in order to transport pumped liquid to the surface. A disadvantage is the necessity of permanent participation of drive with each pumping lift leading to a higher consumption of energy when securing the pumping cycle.

Other well-known equipment includes micro-pumping equipment; in this case heating bodies invoke the energy for the movement of liquid by heating gas in the pump chamber above the level of pumped liquid. Appropriately positioning cooling within the pump chamber structure invokes a difference in temperatures and pressures above a level, which brings on the rotation of gas within the chamber. Liquid flows into the chamber by way of an inlet and flows out by an outlet. Other pumping equipment heats liquid in a membrane-divided pump chamber. The necessity of subsequent supply of heat energy and the small pumping power range are considered its disadvantages.

Electric submersible pumps are used in those heat pump systems that collect heat energy from pumped underground water in order to heat premises thanks to their ability of achieving an adequate flow. These submersible pumps are appropriate for pumping thin and non-aggressive liquids that do not contain solid particles or fibers. The pumps normally have 3-phase motors with an encased rotor, a cover to prevent the intrusion of sand, bearings greased by the pumped liquid and a membrane for the leveling of pressures. They secure the water flow within the evaporator where heat energy from the water is transferred to the cooling circuit of the heat pump. The electric input of the equipment for pumping water, or to be precise for maintaining lift and flow, is attributed to the total input of the system and therefore decreases the COP of the heat pump and the efficiency of the entire heating system. The heating system selected to transfer the produced heat also influences the efficiency of the entire heating system. The transfer of heat, which does not have any demands for further electric input within the heating system, is the most efficient in energetic terms. Electric input in heating systems is associated with the drive of fans or the drive of liquid-circulating pumps.

In order to achieve a heating output of 10kW, the current technical status of heat pumps with underground water utilize water pumping equipment that can secure water flow of about 2,3 m^3/hour while using a so-called low-temperature heating system with a temperature gradient of 30/35 °C to transfer the produced heat. Traditional low-temperature heating systems are equipped with at least one electric circulating pump offering a total electric input of up to 200 W. Electric submersible pumps that secure the requested water flow have a specific consumption of electrical energy of E_S=0,17 kWh/m^3 when crude water is pumped from a depth of 10 to 15 m. This kind of electric input plays a significant role in long-term operations thereby influencing the COP of the heat pump and efficiency of the entire heating system. The temperature of underground water in Central Europe is about +8 to + 12 °C.

When pumping crude water from a water source, usually from a drill hole, the water traditionally flows through a plated, channeled or tubed evaporator of the heat pump, which is located inside the houses. Besides the consumption of electricity needed to secure the flow, another disadvantage is the necessity of regularly cleaning the heat pump evaporator channels due to mineral deposits resulting from water flow. Traditional heat pump evaporators are most commonly produced of stainless steel or copper; each manufacturer determines the characteristics of pumped water with respect to the risk of corrosion and development of deposits. These systems also have increased demands on water filtration and the electric pumps can be infiltrated by sand and impurities stemming from the drill hole. For this reason each type of evaporator and water pump has maximum allowable values available: the sand content in 1 m^3 of pumped water, the size of suctioned particles, water temperature, water pH, and ratio of Fe, NH_3, Cl, H_2SO_4, Mg and salt. Traditional pumping equipment with moving parts within its construction can operate for a shorter time; the equipment's life cycle is also limited.

The mentioned problems and disadvantages of heat pumps containing an open circuit of pumped water can be resolved by a heat pump system with the outside and/or inside location of the thermodynamic compressor generator as well as with an outside and/or inside location of gravitational suction pumping equipment in accordance to this invention. This system of heat production and the pumping of water are more efficient, are operationally more economic and offer an easier construction.

Gravitational suction pumping on its own serves to pump underground water and/or other liquids from ground drill holes, to pump surface water, to allow for the pumping of liquids in various applications and the flow of liquids within the tubing.

DISCLOSURE OF THE INVENTION

The method of gravitational suction pumping of liquids and gravitational suction equipment

The essence of pumping equipment according to this invention lies in the invocation and maintenance of the pumping effect by way of gravitational force expressed by $F_G = F_g + F_o$, which has gravitational origins. Gravitational force is the resultant of gravitational $F_g = m.g$ and centrifugal $F_o = m.r.\omega^2$ forces. With the exception of the Earth's poles $F_G < F_g$ applies. This simply means that as a result of the influence of gravitational forces on bodies in close proximity to the Earth's surface, these bodies fall in a vertical direction. In precise calculations Corriolli's force can still be considered for very long trajectories with movement from the north to the south. A so-called weight is used if a body with a mass of m influences a support plate or suspender. Weight is of the same size and direction as gravitational force but differs in its point of action. Weight G = m.g in which g is again gravitational acceleration. In the current geographical latitude and altitude the value of gravitational acceleration is 9,81 $m.s^{-2}$ and this value decreases 3.10^{-6} $m.s^{-2}$ with each meter. Gravitational poles are considered homogenous in those bodies having little trajectory movement on the Earth's surface; in this case changes in gravitational acceleration in the location in question are neglected. The homogenity of the gravitational poles is adequately fulfilled on the Earth's surface. According to the Law of Movement gravitational force is simply expressed as $F_G = m.g$.

According to this method, the pumped liquid is collected in the pumping chamber of a partial or completely elastic construction, where the amount of collected liquid and the elastic pumping chamber can be expressed as a body of mass m. According to this method, free of charge physical effect is secured by the actual pumping process in which the elastic parts of the pumping chamber undergo elongation. The pumping chamber is firmly secured and/or hung while the elongation, or to be precise the elastic enlargement of its volume, invokes a vacuum and suction in the top part of the chamber in which liquid is sucked via the tubing from its primary collecting site. After opening at least one opening in a part of the pumping chamber, this pumped liquid flows out while maintaining the suction effect in the top part of the pumping chamber. The advantage is the simple construction of this kind of pump, as it is possible to utilize the no charge effects of gravitational forces to maintain the lift of liquid pumped from the collecting site. In general two conditions must be respected for liquid to flow within the system – there must be driving power and there must be hydraulic continuity of all system parts.

The development of driving power can be described in the following way. Fastened tubing of a certain length is non-permeably closed on the top end. A piston is located inside the tubing to which a weight of mass m is connected below the other open end of the tubing. The gravitational force of m.g. influences the piston when resistance and friction is neglected. At the beginning, the piston's movement is described as steady accelerating movements. A vacuum creates behind the piston. At a certain point the piston is stopped according to the size of mass m. In simple terms, the developed vacuum force equalized the gravitational force at a mass of m.g. In this way the first predisposition of the flowing of liquids was achieved as driving power was created.

The suction effect for the flowing of liquids can be easily described by the following example in which the liquid enters the mouth of the transport tubing. Tubing is led into the collecting space below the level of pumped liquid. It is directed upwards above the level and is bent after reaching a certain height and the desired direction. A suspender is fixed to the piston, which is in the top part of the tubing. The suspender is led via the pulley; a weight of a mass of m is connected to the end of the suspender. Following the hanging or loosening of the weight, the effects of gravitational forces take effect starting with the mass of the weight via the pulley to the piston. The gravitational force of m.g. influences the piston, resistances and frictions are neglected. The liquid follows the movement of the piston and weight to a certain distance within the tubing. Separation occurs after a certain distance and after a certain time; in other words the liquid ceases to follow the movement of the piston and weight. This occurs after a decrease in pressure on the piston according to the degree of pressure of suctioned vapors.

The creation of the suction effect is influenced not only by the weight but also by the mass of the collected liquid. If the pumped liquid is collected in an appropriately fixed container, the volume of the liquid in the container creates the gravitational force. The magnitude of the gravitational force of weight is given by the product of $m.g = V.\rho.g$ where m is the mass of the liquid and g is the gravitational acceleration. The liquid mass m is given by the product of the liquid volume in the container V and the density of the liquid ρ. In the bottom part of the container there is an openable closure or outlet tubing with the same kind of closure. In the example a container of a cylindrical shape, which is filled with liquid, is firmly attached. A balloon or elastic bag is non-permeably attached at the top part. After the bottom closure is opened suddenly, the liquid inside the container flows out. A vacuum and therefore a suction effect creates in the top part of the container after a certain amount of liquid leaks out; the bag is pulled into the container. In this way the vacuum suction effect is created. After the opening is opened, the actual weight of the liquid serves to create a vacuum and suction effect.

The speed of liquid flow within the system is v = V/S.t where t is time the volume of liquid V takes to flow via a cross-sectional surface S perpendicularly to the flow direction. This speed is also called flow density or flux density.

In order for flow to occur, the second condition concerning the hydraulic continuity of all parts must be respected as well; this occurs as a result of the leading in of at least one end of connected tubing below the level of pumped liquid and another end into the top part of an elastic pump chamber and filling all of these parts with the pumped liquid. The driving power is developed as a result of a dynamic effect in which the elastic bottom part of the pump chamber is released for free fall; prior to this the chamber contains a smaller volume. The top part of the pump chamber is attached. The gravitational force is created by the mass of the elastic top part of the pump chamber and the mass of the pumped liquid, which is in the chamber.

All forms of resistance, friction and mainly the stiffness of the elastic parts of the pump chamber, which can be introduced as the stiffness of protracted and/or compressed elastic body, work against the effects of gravitational forces. The stiffness of elastic bodies is expressed by the ratio of the magnitude of forces acting on the elastic body or to be precise on the body of mass m to the difference in lengths of the elastic body before and after protraction and/or before and after compression. The stiffness of the elastic body is a material constant, which determines the resistance of the elastic body against changes in its shape and size. Elastic parts of the pump chamber will have elastic properties, which will comply under the given conditions.

According to this invention the pumping equipment is completely filled with the pumped liquid. The pump chamber is in the status and position having a smaller and filled-up volume. Sudden loosening leads to an increase in volume and to the creation of suction effect or in other words to the creation of a vacuum in the top part as well as leading to the sucking of a certain amount of liquid into the pump chamber while maintaining the suction effect. Opening at least one closure at an appropriate location in the filled-up body of a pump chamber leads to the flow of liquid out of the pump chamber. The liquid starts flowing from the collection site via the transport tubing into the construction of the pump body; it then flows out through the opened opening. After a certain time, it is possible to designate the flow by way of pumping equipment as relatively steady when the necessary vacuum is maintained. Liquid is being sucked at one end and flows out at the other end by way of over-pumping. There is waste disposal space below the outlet closure. Above the level of the pumped liquid there is atmospheric pressure or the liquid is over-pressured. The overpressure at underwater drill holes could have been created by the saturation pressure under the firm closure or after sealing off the drill holes.

The amount of time to maintain the desired suction effect depends on the quality of the hermetic design of the entire sector of transport tubing, the construction of the pump chamber including inlets, outlets and with the setting of all fittings, control elements of the pumping system. The suction effect is also influenced by the pumped liquid, which always contains a certain amount of gases and impurities and overcomes the friction and resistance it faces on route from the collecting site to its opening. In order to maintain the desired suction effect and pumped liquid flow, the impulse invoking the suction effect will be repeated in very long intervals. As the amount of external energy needed to reinvoke the suction effect is very small with respect to the amount of over-pumped liquid, the pumping equipment is significantly more effective that the current systems. It is energetically more efficient than pumping equipment with a constant influx of pressurized air and/or with the filling of pressurized reservoirs for subsequent pumping. These systems require either to be in constant operation by way of compressor or to operate in short intervals – in each case there must be a significant increase in the amount of supplied external energy. If electricity is utilized to invoke the suction effect in pumping equipment according to this invention, it can be supplied from the distribution networks and/or it can be produced in an alternative way.

Invoking an impulse to produce and maintain the suction effect in an the elastic pumping chamber is possible in these ways or in these combinations: by utilizing mechanics of elastic bodies, and/or motor drive with an electromotor or with a combusting motor, and/or the effects of compressed gas by a compressor, and/or hydraulic effects, and/or magnetic forces, and/or heat effects, and/or pyrotechnic effects, and/or chemical effects, and/or wind effects, and/or human power. The example found in this invention describes the design of the heat pump with underground water, which is sucked by a suction chamber; as a result of gravitation, water flows around and through an evaporator where heat is released to the refrigerant and the initial pumping effect of the suction chamber is created by a pressurized effect from the outlet of the refrigerant compressor system.

The initial impulse to invoke sucking within the pumping chamber is most commonly provided by electric remote control and/or mechanical influence, and/or by hand-manually.

According to this invention, the entire pumping equipment including a pumping-suction chamber consists of at least one transport tubing that is led into the pumped liquid whereas this tubing further consists of at least one integral continuous sector of tubing, which is straight or shaped in some places and can have at least one closeable branching and/or opening and/or T-piece, and other control elements within the tubing including a backflow valve and/or closure and/or sensor for measuring flow and/or pressure and/or temperature; there is at least one voluminous body or in other words pumping-suction chamber is directly and/or via a suction head attached to the transport tubing and/or onto this branching. At the requested magnitude and direction, the elasticity of the construction of this pumping-suction chamber allows for a change of its volume. The volume of the aspirating chamber is completely/or partially filled with the pumped-sucked liquid, which flows via the transport tubing from the location of its leading in the collecting site. The movement and flow of this liquid via transport tubing is created and secured by suction effect or in other words vacuum, which is created preferentially in the top part of the pumping-suction chamber thanks to gravitational forces, or more precisely terrestrial gravitation, which changes the shape and volume of at least one elastic part of the pumping-suction chamber. The pumping-suction chamber and/or transport tubing is firmly anchored and/or hung and/or propped at least at one location. Before liquid pumping is started, the pumping-suction chamber contains a smaller volume. The initiating impulse leads to the invocation of an impulse; during this time the chamber changes its volume due to the creation of vacuum and suction. In the bottom part of the pumping-suction chamber preferentially, there is at least one opening, and/or opening with a controllable valve-like closure, sliding door or flap, and/or tubing from which the liquid pumped from the primary collecting site freely flows out of. In constructional terms, the chamber's walls are made of elastic material, and/or the walls of the elastic part of the chamber can contain at least one elastic element, and/or this plastic element can be inside, and/or outside its own walls and the location of the actual pumping-suction chamber.

In several cases, extension of the elastic belt is equivalent to the compression of ideal gas and unloading is equivalent to its expansion. The simplest construction for invocation of the aspirating-suction effect can be produced from an elastic bag. There is a closeable outlet. If the bag is elastic enough, the weight of the liquid will bring on extension and to invocation of suction effect in the top part. The weight of the liquid in the bag can be increased by using materials with a higher density for the body of the bag. For example the density of metals is eight times higher than that of water.

Other examples of elastic construction of suction chambers are when one part of the volumic tank is rigid and the other is elastic or when the elastic part is positioned between two rigid parts. The elastic part of a pumping chamber can be of varying stiffness. If the elastic part is positioned between two rigid parts, the bottom rigid part could be considered heavy due to consisting of a material of a higher density than that of the pumped liquid.

It is also possible to create an elastic construction of the suction chamber by inserting springs between two mutually moving but firmly connected rigid parts with led in transport tubing and with a bottom closeable opening. The bottom moving part can also considered heavy, as its material is of a higher density.

The elastic materials used in the structure of elastic parts of pumping-suction chambers are mainly materials and/or their combinations based on natural rubber or synthetic rubber or elastic sandwich materials stemming from multi-layers of the same material or different materials, structures with carbon fibers, with fiberglass, elastic materials such as metals in springs, and other materials. For these purposes an elastic structure can be developed by way of a gas spring and/or liquid spring.

When used to pump water from drill holes and according to this invention, at least one pumping-suction chamber can be located in waste disposal drill holes, and/or in the suction drill hole, and/or inside the premise being supplied, and/or on the premises, and/or only outside above ground level, and/or submerged below ground level. The gravitational suction pumping method being presently introduced operates independently mainly to pump underground water and/or other liquids from terrestrial drill holes, as well as pumping surface waters; the method allows for liquid to be pumped in various ways, for liquid to flow through tubing as well as allowing for the creation of a liquid gradient. The principle of gravitational suction pumping of liquids is also evident from the examples of its uses and from the figure section of this invention.

When water is pumped from drill holes, there is at least one suction tube led into some sort of weight; for example into a flange at an installation depth of 0.5 to 1 meter below the depth of the dynamic water level, which is referred to as a so-called safety reserve. In order for there not to be seepage of air into transport tubing when there is an undesirable decrease in water level in the drill hole, a water-level switch and water-level electrodes can be installed in the source drill holes to ensure early alarm detection and if the heat pump generator is included in the system to allow it to be switched off. Suction tubing with weight is lowered into the drill hole on a steel or plastic cable whose end is attached in the drill hole head with the help of a cable connecting device. After this the pumping drill hole is secured and sealed. Up to its connection to the pumping-suction chamber, transport tubing is led through a frost protection zone and/or is heat insulated.

According to this invention, an advantage of the pumping equipment is that traditional pumps with complicated constructions, with electromotors whose motors are encapsulated and with bearings or with air compressors are not used. Another benefit is the very small consumption of external energy that is only supplied for the primary creation of suction at the start of the pumping cycle or in other words when the equipment is started. According to this invention, another advantage is the fact that the movement of pumped liquid via transport tubing into the elastic suction chamber takes place only due to territorial gravitation or more precisely due to no charge gravitational forces. Another advantage of this kind of pumping equipment is the fact that externally paid energy is not utilized during pumping. Another advantage is that it is usually possible to utilize only one elastic pumping chamber with simple construction when implementing the movement of pumped liquid. Another advantage is the fact that pumping equipment according to this invention is more resistant to impurities contained in crude underground water. Another advantage is the movement of the elastic structure of pumping chambers without other moving parts and pistons within the pumping equipment. Another advantage of utilizing its own refrigerant compressor system to invoke a start of suction is that it is not necessary to set any other external automatic drive. Other advantages and assets will be experienced by experts in the field, who read about the other connections and specification in detail and who comprehend them.

Geothermal heat pump with undergroundwater system

The submitted invention describes a heat system with a geothermal heat pump that collects heat energy from water, which is pumped from the place of its occurrence by pumping equipment. According to this invention, the described vacuum suction-pumping equipment with at least one suction chamber is preferentially used to define pumping equipment. The construction of the described heat pump also allows for the use of all of the traditional types of water pumps including electric submersible pumps or pumping with the use of air compressors. In this case underground water from drill holes and/or wells is preferentially utilized as a source of primary heat energy for the heat pumps.

According to this invention, the thermodynamic generator is preferentially located in submerged and openable casing, which is outside and located above the drain or in other words waste disposal drill hole into which at least one elastic suction chamber and at least one refrigerant evaporator of heat pump have also been lowered. The refrigerant evaporator will be in the pumping chamber and/or can be under the chamber in the bottom part of the drill hole casing and/or can be above the pumping chamber.

According to this invention, other advantageous locations for heat pumps with outside casing could be above the source drill hole or between drill holes or outside of drill holes outside the house or as an interior heat pump found inside the premises.

Heat energy of water over-pumped from source drill holes or wells into waste disposal drill holes or wells can be increased by a heat exchanger of the solar collector circuit, which according to this invention is installed preferentially into the waste disposal drill hole or to be precise into the pumping chamber and/or into the evaporator. A solar heat exchanger can also be installed into a source drill hole and/or into a source and waste disposal drill hole simultaneously. A solar heat exchanger can also be installed through horizontal part of the tubing between drill holes. The water temperature, which is usually about + 8 to + 12 °C in drill holes within Central Europe, can also be increased by additional solar heat. In this way the performance and COP of the heat pump system is increased.
Another exchanger of the house's cooling/heating circuit could be installed into the source drill hole, and/or into the waste disposal drill hole, and/or the well. With respect to the temperature of the water, natural cooling of the house in the summer could be provided.

According to this invention, the outside casing of the heat pump is preferentially constructed as casing lid and a weight-bearing plate on a container; the weight-bearing plate is either straight or centrally embedded into its exterior container, which together with the lid makes a partially embedded casing. The casing however can also be fully embedded under the terrain level. The weight-bearing plate is positioned on the sealing of the edge of the bottom part of the casing. Along the circumference of the plate, there is a second piece of sealing where there is a removable lid of the casing. The lid, weight-bearing plate and bottom part of casing are clammed together with at least one screwed connection. Thanks to the sealing above and below the weight-bearing plates, a casing for the heat pump generator is created, which is divided by the weight-bearing plate into two voluminal parts. These parts can be created as mutually water-proof and water-proof against the surroundings. The shape of the lid is preferentially of a ball cap shape but it can be of another shape as well. In terms of the ground plan the profile is preferentially round but can be of another shape including an angular or complicated shape.

The bottom submerged part of the casing is preferentially positioned above the casing of the drain drill hole or in other words a well; the casing and drill hole lead into the bottom of the bottom part of the skeleton. The intersection of the drill hole casing and casing bottom is water-proofed against the seepage of rain water from the surroundings. By removing the lid and weight-bearing plates, access into drill hole and/or well is possible. In this way another parts of the system are also reached.

At least one system refrigerant compressor is located on a weight-bearing plate, which is positioned in the bottom part of the outside casing. Other important components of the heat pump system can be found on the plate as well including electric distribution feeding and control as well as equipment control to invoke suction effect in the pumping chamber. The entire casing is covered with a lid containing heat and sound-proof insulation.

A variety of profile-shaped designs of removable weight-bearing plates is possible. Examples include the shape of a container or an inverted container with its bottom up. There is at least one compressor with other important components of the refrigerant circuit, electric feeding and control circuits found on the plate.

After removal of its lid, the interior weight-bearing plate with its main components is removable from the casing in case of the need for servicing at a workstation. It is naturally possible to have casing without weight-bearing plates in which the compressor is propped against the removable part and/or anchored to the bottom of the casing and/or curbing. The entire casing including the top lid is water-proof and closable via sealing and screws; it can also be constructed with ventilation.
Transport tubing insulated by water-proof insulation leads from the casing into the premises where it is connected to the selected heating system and/or to the water-supply distribution. According to this invention, the heat pump utilizing the heat energy of water is preferentially connected to direct condensation types of heating systems where selected operative medium of the compressor is directly condensed or in other words liquefied. It is certainly possible to connect the heat pump to a traditional warm-water heating system when a condenser of refrigerant circuit is utilized; when in the heating regime, the water filling from the heating system is fed into the circuit via circulation liquid pump for heating. According to this invention, this type of condenser can be located within the outside casing of the heat pump and/or can be located inside the premises. It is also possible to connect the condensation system directly to the fan. The air circulating within the premises is heated up by the produced heat from the outlet from the compressor via heat-carrying ribbing of the exchanger.

According to this invention, a heating system with a heat pump that utilizes the energy of water also has other functions such as heating up water to supply premises and/or heating up water for swimming pool, and/or cooling down for the cooling of premises. The heating up of water is most commonly done by way of a tubular heat exchanger located inside a boiler or on its outside surface or by way of a plate heat exchanger and/or by way of heating up the casing on the boiler surface due to direct utilization of operative medium of the compressor and/or heated up furnace water.

In the pumping-suction chamber there is at least one opening, which is ended with a controllable closure via which water flows out in the direction of the well's waste disposal. At least one transport tubing leading from the source drill hole, in which the pumped water is collected, leads into the top part of the suction chamber or into the space above the suction chamber.

If the control circuit of the heating system assesses that a supply of heat is necessary for the premises, the compressor starts up. Refrigerant of the refrigerant circuit of the heat pump is released into the evaporator where the refrigerant vaporizes and collects heat energy from the water, which is cooled. The evaporator is preferentially produced from at least one metal tube. At least one evaporator tube is straight and/or is shaped and/or is twisted into at least one spiral. The surface of the tubing can be smooth or shaped in various ways. The composition of the material is preferentially metal and metal alloy or plastic and a mixture of plastics and/or a combination of metal and plastics. There can be various constructions of the evaporator. An elastic pumping-suction chamber is preferentially in the drain drill hole. To shorten the length of supply tubing to the direct evaporator, the heat pump system is preferentially located in the casing directly above this drill hole. At least one compressor of the system is supplied by electricity from distribution networks and/or by electricity produced by an alternative source.

An advantage of heat pumps utilizing the heat energy of water with pumping equipment for the pumping of water according to this invention is that traditional pumps with electromotor or air compressors powered by electricity are not used. Another benefit is the very small consumption of external energy that is only supplied for the primary creation of suction effect at the start of the pumping cycle or in other words when the equipment is started. The movement of pumped liquid from its collection site via transport tubing into the elastic suction chamber and into disposal water space of drill holes takes place only due to territorial gravitation or more precisely due to no charge gravitational forces. When pumping one's own water, the consumption of external energy is not consumed and the heating system with heat pump works with a high COP, as the total electric input of the heating system is decreased.

By eliminating traditional water submersible pumps with electric input and when connecting the heat pump according to this invention to a direct condensation heating system, a thermodynamic heating system with the highest COP is created.

Another advantage is the possibility of increasing the COP by the connection of a system with an internal heat exchange between condensed refrigerant and the refrigerant that is suctioned by at least one compressor.

Another advantage is the possibility of further increasing the COP by supplying heat from the solar system into drill holes and/or into the source drill hole and/or into transport tubing and/or directly into a system with heat internally transferred from condensate into refrigerant vapor, which is suctioned by the compressor.

Another advantage is the fact that pumping equipment according to this invention is more resistant to impurities contained in crude underground water. It is not necessary to position the plate exchanger in front of the evaporator due to sedimentation, regular cleaning and maintenance.

The advantage of positioning a thermodynamic generator directly above the drill hole is the shortening of all leads to the direct evaporator of the primary refrigerant circuit. It is then advantageous to implement an automatic start of the suction-pumping cycle of the sucking chamber.

Another advantage is the possibility of simple expansion of the collecting system that collects heat from undergroundwater to include a direct evaporator and/or indirect collectors that collect heat from the soil and are installed preferentially in the horizontal layers of non-frost border in proximity to the drill hole surroundings. Vertical installation of such collectors is certainly possible. When the source drill hole does not guarantee an adequate water supply or heat energy for a heat pump system with the planned heating performance, than such installations are possible.

Utilization of the potential energy of pumped water for the production of electricity

According to this invention the potential energy of pumped water and/or liquid, which moves from the location of its collection site via transport tubing and via the elastic pumping-suction chamber, can also be utilized for the production of electricity thanks to the suction effect created by gravitation. Pumped water and/or liquid flows out of the chamber by way of an opening, closable valve and/or tubing, which can be narrowed and/or ended with a nozzle; it further flows thanks to gravitation through a generator of electricity where electricity is produced. To ensure the flow of water and/or liquid, a liquid gradient produced by vacuum gravitational pumping-suction equipment according to this invention is utilized.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1a illustrates a cylindrical container of a smaller diameter that is filled with liquid; the outlet opening on the bottom is closed and a non-permeable elastic bag is attached to the top end of the container. The container is fixed vertically. Action of force F created by the mass of liquid m is illustrated.

Figure 1b illustrates the same container seen in figure 1a with the exception of the fact that its bottom outlet opening had been suddenly opened. A certain amount of the liquid has leaked out and the weight of the liquid has created a vacuum or in other words suction in the top part resulting in the drawing in of the elastic bag into the body of the container.

Figure 2 again illustrates the cylindrical container with a fixed top air-proof lid to which a pressure gauge has been installed. There is a piston inside the container, which has a weight attached to its cable. Action of force F as a result of the weight m is illustrated. Loosening leads to movement of the piston with a vacuum developing above it. The container is firmly fixed. The created effect can be viewed on the pressure gauge.

Figure 3 illustrates bent tubing submerged in the suctioned liquid. Inside the horizontal part of the tubing there is a piston with a weight that has been attached via a suspender and pulley. Action of force F created by the mass of the weight m is illustrated. The piston moves to the distance x at which point the suctioned liquid that followed the movement of the piston is separated. The acceleration of piston a is illustrated as well.

Figure 4 illustrates vacuum pumping-suction equipment with an elastic pumping chamber. Bent tubing is submerged in the suctioned liquid. The system is filled with liquid. An elastic bag or a suction chamber, which is firmly underlaid, is hung on the tubing. The suction effect is created by the loosening of the bag brace. The weight of the liquid leads to the outflow of the liquid. Liquid is simultaneously sucked from its collection site.

A spring secures changes in chamber volume of the neighboring suction-pumping chamber. In other constructions pumping-suction elastic chambers with a bottom closure may also exhibit an exterior spring. Other constructions could offer the elastic part being positioned between two fixed parts. There is a closure on the bottom of the fixed part.

Figure 5 illustrates a container of any shape in a horizontal position. There is a closable outlet opening on one end. There is another opening inside the body of the container that is non-permeably closed by an elastic membrane. The container has experienced a sudden opening of the outlet opening allowing for some of the liquid to leak out; the liquid created a vacuum or suction that is visible in the cross-section with the membrane. Suction of the elastic membrane into the body of the container subsequently follows.

Figure 6 illustrates a heating system with an outside heat pump and with gravitational suction pumping of water according to this invention. Heat energy is collected from underground water, from geothermal subsoil and/or from solar collectors. To simplify installation and shorten all tubing, a heat pump generator with at least one compressor and other important components is located in the collecting section above the drain drill hole on a removable plate, or to be precise in a removable container under the lid of the skeleton, in case of the need for servicing at a distant workstation and/or for accessibility of pumping-suction chamber(s) and evaporator(s). The heat pump evaporator is preferentially located in the drain drill hole or waste disposal drill hole and/or well below the generator. Other constructions allow the heat pump evaporator placing in the source drill hole and/or between drill holes and/or within or outside the heat pump casing. The arrows illustrate the movement of the pumped water from one drill hole to another or to be precise from the source drill hole via at least one transport tubing into the elastic suction-pumping chamber and via the evaporator into the drain drill hole. A dashed arrow illustrates the movement of water in the subsoil preferentially from the soakage drill hole to the source drill hole. Dashed lines illustrate the tubing of solar heat exchangers from solar collectors in the source drill hole and/or in the drain drill hole. In this way the temperature of the water in one and/or both drill holes can be increased and therefore the COP of the heat pump can also be increased. By way of water, solar heat can be accumulated in the geothermal surroundings within the drill hole; the subsoil is used for accumulation for later heat collection. Possible heating and/or cooling systems are illustrated within the home as floor heating and/or wall heating and/or ceiling heating and/or heating by way of wall bodies and/or via heat exchangers cooled by fans for the purpose of heating and/or cooling of interior air.

Figure 7a illustrates the structure of the heat pump evaporator created simply or in multiples inside the spiral of the wound tubing. The wound part of the tubing can be separated parallelly into several circuits by a manifold-distributor and manifold-collector. The tubing of the solar exchanger led either simply or spirally within and/or outside the evaporator is illustrated by a dashed line. According to this invention the evaporator and/or solar exchanger are in the drain and/or source drill hole. They can be placed also in another positions.

Figure 7b illustrates the construction of the evaporator with several inlet parallel circuits and ended with refrigerant manifold-collector. The vertical full line or dashed line illustrates the return tubing, which ascends spirally upwards to waft away with refrigerant vapors as well as with the compressor oil. The second dashed line illustrates the exchanger of a solar circuit. Vaporization tubing of a small diameter, as well as of many shapes, is placed between both refrigerant distributors; it can be straight, wavy, spirally wound and so on. According to figures 7a and 7b the evaporator can be positioned in the drain drill hole and/or in the source drill hole and/or on the water route between drill holes and/or in the inside or outside heat pump generator. Heat pump generator can be positioned outside and/or inside house.

Figure 8 illustrates the refrigerant circuit of the heat pump without the sides of condensation, which also has many options. The options of heating systems are listed. The following options preferentially involve the following:

- a heating system is directly condensing and the condensation media can be in floor heating, in wall heating, in ceiling heating and in heating bodies,
- a heating system with water condenser for connection of warm-water heating systems mostly with circulation pumps,
- a heating system with tubular gilled condenser and with fans for direct heating or cooling of the interior air,
- heating regime for the heating up of utility water from tubing refrigerant condenser, which can be located in the boiler, in the accumulation tank, on its surface and/or into its casing, the refrigerant/water condenser can be also plate construction,
- a heating regime in casing space of condenser, which is developed on the surface of a container,
- pool water heating
- reversible and/or direct cooling.

The simplified refrigerant circuit in figure 8 is illustrated without safety elements and illustrates at least one compressor as well as the described condensation side of the system and its options; it also contains a collecting vessel of condensed refrigerant, a filter and dehydrator, a stop valve and a throttling element that is composed of a valve and/or nozzle and/or capillary. An evaporator is also illustrated, is located in a drill hole and is surrounded by pumped water. A back exchange of heat from condensed refrigerant can be implemented for a further increase in the COP of the heat pump. A dashed line illustrates an exchange with tubing. Evaporator tubing of a small diameter collect heat from underground water. Tubing with condensed refrigerant is led upwards from the manifold-collector in a spiral around casing of the evaporator to the compressor suction. The main part of the evaporator is inside a cylinder in which there is flowing water. The cylinder is inserted into another exterior cylinder. A solar heat-carrying medium, whose inlet and outlet are illustrated by arrows, flow through the interspace according to this invention. The solar medium from solar collectors therefore increase the temperature of the water flowing inside the cylinder as well as increasing the temperature of the refrigerant vapours, which are aspirated by at least one compressor of the heat pump. In this way the COP is also increased.

Figure 9 illustrates the plan of the refrigerant circuit of the described heat pump without its evaporated and condensation sides for simplification; the lift to start suction of water in pumping chamber is created by pressure effects of a medium from the outlet of refrigerant compressor to the lifting and/or lowering device, which can be of various constructions. Figure illustrates lifting/lowering linear device with piston construction. Following the invocation of suction within the elastic pumping chamber in order to pump undergroundwater, the compressor continues in the heating and/or cooling regime or it is automatically switched off.

In another construction the suction effect can be created by encasing or enclosing the elastic body with the supply and offtake of pressurized medium including air. Elastic bodies suddenly change their volume, which leads to a change in pressure within the chamber and to the invocation of suction effect. Dashed lines are used to designate the elastic body whereas arrows are used to describe a change in volume and the supply and offtake of medium. The suction effect can also be created by any of the methods mentioned in the description section of this invention.

Figure 10 illustrates a pumping-suction elastic chamber for the vacuum pumping of water according to this invention. The chamber is illustrated in its compressed status prior to the start of suction. This condition is reached by an automatic lift by way of linear lifting and/or lowering device, which is designated by the dashes. The enlarged suction elastic chamber following the suction of water is also illustrated by dashes. An evaporator of the heat pump, which is inserted into the drain drill hole casing, is attached to the bottom part of the suction chamber. At least one outlet opening, valve, flap/or sliding door, is on the bottom part of the evaporating chamber. A weight can be hung on the evaporator chamber to increase the mass of the chamber. The bottom outlet opening can be remote controlled by the heat pump's automatic system. This means that the flow and collection of pumped water or liquid can be regulated to a certain degree by way of the transport tubing. The temperature of the flowing water is measured by a sensor in the evaporator chamber. The pumping chamber and evaporator are attached to the bottom of the skeleton and to the weight-bearing flange within the terrain surrounding the drill hole curbing. A change in chamber volume is illustrated by arrows. The aspirating water chamber can be further equipped with at least one closeable spigot, air-escape equipment, sludge equipment and so on.

Figures 11 to 15 are characteristic of very suitable ways of utilizing gravitational methods of pumping liquids by way of a suction chamber according to this invention.

Figure 11 illustrates a house with an interior heat pump HP with an interior or exterior elastic suction-pumping chamber for the over-pumping of water from drill holes and/or from wells into drain drill hole and/or well in accordance to the invention. The suction-pumping chamber can also be located inside the generator of the interior heat pump.

Figure 12 illustrates a house with a suction -pumping chamber located at a certain height. Water pumped from a source, for example a drill hole, flows out gravitationally from the pumping chamber into the collection tank from where it is distributed to the place of consumption. It is natural that pressure of the water for the house's distribution can be further increased via a circulation pump or air compressor with relatively low energetic demands.

Figure 13 illustrates a drill hole from which liquid is pumped by way of a suction-pumping chamber to a collection container on the surface, for example. Arrows illustrate a change in volume of the suction elastic chamber when starting the suction-pumping equipment up. A change in volume of the chamber to start the pumping-suction of liquid can be created by several of the methods mentioned in the description of this invention.

Figure 14 illustrates height over-pumping of liquid from collection site to collection site. It is natural that with each case and each method an aspirating-pumping chamber can be utilized to move liquid through an appropriate filter if filtered liquid is requested.

In the left part of figure 14, the dashed line illustrates the utilization of height over-pumped water and the resulting development of potential gradient for the production of electricity by way of liquid flowing through generator for production of electricity. The produced electricity is stored into the accumulator and by way of a regulator, control is gained and the elastic suction chamber of pumping equipment initiates lifting for the initiation of the suction effect and for the launching of pumping. The electricity can be utilized for other applications.

Figure 15 illustrates gravitational suction pumping in accordance to this invention, which secures the circulation of liquid within an open circulation circuit, in this case via solar collectors.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Example 1

Example1 of the invention is evident in figure 6. On the property there is a source drill hole 1 and drain drill hole 2. The drill holes are cased with casing 3. At drill hole 1 there is loose material 19 in a saturated layer and the casing is perforated 4 in this sector. Under the casing, there is a sludge space that is not illustrated in the figure. At drain drill hole 2, which is usually not so deep, casing 3 is perforated at sector 4. At this point there is seepage of cooled water via the loose material 19. Drill hole 1 is further equipped with a manipulation shaft 6 with a cover 7. The manipulation shaft can have frost-proof insulation 8.The shaft can be placed on plate 9 with a head lid 10 that prevents the transfer of weight from the shaft 6 to the casing 3. The same applies for drill hole 2 with the presence of plate 11 with head lid 12. A weight-bearing plate 14 has been embedded via sealing into the exterior casing of the heat pump 13, which is located on plate 11. In this case the plate 14 holds at lest one compressor 17, the electric and control distribution 18 and other important components. A compressor 17 is drawn as being partially submerged in the surrounding terrain 5. A shaped casing lid 15 is placed on the weight-bearing plate 14 again via sealing. A weight-bearing plate 14 and its components are removable for servicing and/or for easier access into the drill holes. The lid 15 and weight-bearing plate 14 are insulated within insulation 20 on the inside. Casing 3 at drill hole 1 as well as casing 3 at drill hole 2 are led from top to bottom to protect from seepage of surface water and the impurities of loose material 21. The compressor 17 is supplied by electricity induced by an inlet 51 via electric distribution 18. The source drill hole 1 is further equipped with at least one transport tubing 23, which is submerged below water level in the curbing of the drill hole. The tubing is bent above the outlet of the casing and at least one transport connecting tubing continues through sector 22 and 26 to the heat pump casing 13 where it is connected to the suction chamber 27. The suction chamber is firmly attached 28, which secures the transfer of the weight of the suction chamber to the bottom of the casing 13 onto the weight-bearing plate 11 and from it to the surrounding terrain. The weight of the suction chamber 27 therefore has no effect on the casing 3 of the drain drill hole. Transport tubing can also be equipped with T-piece(s). The elastic aspirating chamber has at least one closable opening with fitting(s) 30 (valve, flap/sliding door) located at the bottom part of the exchanger-evaporator 29. There is a temperature sensor within the fittings

30 and/or inside the chamber. Controllable fittings 30 and the temperature sensors are connected by cables 31 that lead to the electrical distribution 18 in the heat pump casing.

After embedding the system with water the suction chamber 27 is protracted due to impulse effect of lift 53. The methods described by this invention can be utilized to achieve automatic lift. According to figure 9, the pressure of compressor 17 of the heat pump is used for lift. This type of lift can be implemented upon starting the heat pump/or at any time during the operational mode of the heat pump if the instructions to execute one and/or repeated lifts are issued by the regulator. After the signal is issued, the compressor 17 is in operation; valve 64 in figure 9 is then closed, pressurized medium passes through the backflow valve 58 with a certain stiffness of a spring and further enters into a linear lift 53, which secures the change in volume of the elastic parts of the suction chamber 27 at a magnitude of 55. When equipment 53 achieves the desired effect, a certain pressure of the compressor medium is achieved and read by pressostat 63, which then creates a signal for opening valve 64; the pressurized medium exits by tubing to the selected connected parts of the refrigerant circuit. It is natural that the controllable closable valve 64 can be replaced by multi-way selector valve, 3-way for example. When the equipment is loosened, the weight of the water in the chamber 27 and the mass of the exchanger 29 and/or the weight cause it to return to its starting position. Under the influence of the mass of water and bottom parts 29 there is a suction effect created in the chamber 27 and water from transport tubing 23, 22, 26 is sucked into the chamber 27. Water entering the suction chamber is mostly at a temperature of 8 to 12 °C. There is at least one evaporator 16 of the heat pump located under the chamber 27 and/or inside the chamber in which the operative medium of the compressor is evaporated. The sucked water is cooled in the evaporator chamber 29 and flows out by way of the bottom controllable opening 30 into the drain space 33 of the waste disposal drill hole 2. The refrigerant vapors are sucked by the compressor 17 by way of the tubing 34. Displaced hot vapors exit the compressor through tubing 35. Vapors are further compressed through tubing 36 the shortest possible way to the heated house 39 where it is directly condensed within the selected heating system 40; the tubing is heat insulated with insulation 37. The medium in its condensed form flows through return tubing and then exits the house and flows back via insulated tubing into the exterior heat pump in this example. In the refrigerant circuit illustrated in figure 8 the condensed medium passes into the collecting vessel 42; from here it is led into the equipment for backward heat exchange 43 where the remaining heat is transferred to the cold vapors of the medium exiting the evaporator 16. The cooled condensed medium then flows via the dehydrator 41 and electromagnetic valve 44 into the throttling element 45 through which the refrigerant is released into the evaporator as flow through water from drill hole 1. According to the described operations of the heat pump, the cooled water is liquidated in the drain drill hole 2. Figure 6 illustrates the direction of the flow of underground water 46 within the subsoil. In order to improve the savings of the described heating system a solar exchanger 48 is further connected into part 29; this further increases the COP of the system.

Example 2

In accordance to figure 11 a house or premises with an interior heat pump HP with an interiorly and/or exteriorly located suction-pumping chamber for the over-pumping of water from drill holes and/or from wells into drain drill holes and/or wells in accordance to the invention while the suction chamber is located outside the drill holes. The suction-pumping chamber can also be located inside the generator of the inside heat pump.

Example 3

In accordance to figure 12 a house or premises with suction -pumping chamber located inside and at a certain height. Water is pumped from a source, for example a drill hole, and flows out gravitationally from the pumping chamber into the collection tank from where it is distributed to the place of consumption within the premises. It is natural for the water pressure from the house's distribution to be further increased via a circulation pump or air compressor with relatively low energetic demands.

Example 4

In accordance to figure 13 a drill hole and/or well from which liquid is pumped by way of suction -pumping chamber into a collecting container. The change in volume of the suction chamber when starting up the suction-pumping equipment is illustrated by the arrows. A change in chamber volume to start pumping-suction of the liquid can be created by any of the methods described by this invention.

Example 5

Figure 14 illustrates height over pumping of liquid from collection site to collection site. It is natural that with each case and each method an aspirating-pumping chamber can be utilized to move liquid through an appropriate filter if filtered liquid is requested.

In the left part of figure 14, the dashed line illustrates the utilization of height over-pumped water and the resulting development of potential gradient for the production of electricity by way of liquid flowing through an electricity generator. The produced electricity is accumulated into the accumulator and by way of a regulator, control is gained and the elastic suction chamber of pumping equipment initiates lifting for the initiation of the suction effect and for the pumping. The electricity can be utilized for other applications.

Example 6

Figure 15 illustrates the gravitational vacuum pumping according to this invention, which illustrates the circulation of liquid within an open circulation circuit, in this case via solar collectors where the liquid is heated.

INDUSTRIAL APPLICABILITY

Heating and/or cooling with the help of the system according to this invention can be utilized by premises and space found on properties having a rich supply of water thereby allowing for the use of gravitational suction pumping in accordance to the description provided. Heating systems with a heat pump also need a supply of electricity for compressor drive from the local distribution network and/or an alternative production of electricity.

The system is especially appropriate for the heating of homes, apartments and other premises. It is also possible to use this system to cool the above mentioned buildings.

The gravitational suction-pumping equipment according to this invention can also be used to pump liquid in various areas, to develop a liquid gradient and to move liquid by way of tubing.

The industrial applicability of the technical construction according to this invention is evident from this section of the invention and is also described in the sections concerning description and the examples of use.

LIST OF CORRELATED SYMBOLS

1- Source drill hole and/or well
2- Drain drill hole and/or well
3- Casing, curbing
4- Perforated casing
5- Terrain
6- Manipulation shaft
7- Cover
8- Heat insulation
9- Weight-bearing-flange of shaft
10- Head lid
11- Weight-bearing-flange of shaft
12- Head lid
13- Casing, skeleton
14- Removable weight-bearing plate
15- Shaped casing lid
16- Evaporator tubing
17- At least one compressor
18- Electric panel
19- Loose material
20- Heat and sound-proof insulation
21- Sealing loose material
22- Heat insulated transport tubing
23- At least one transport tubing within source
24- Suspension cable
25- Submersible fixing with tubing
26- Transport tubing
27- Elastic suction-pumping chamber
28- Fixed suction chamber and evaporator
29- Evaporator/exchanger chamber in drain drill hole
30- Outflow opening
31- Lead-in cable
32- Spigot and/or other fittings
33- Drainage part of drill hole
34- Suction tubing of compressor
35- Compressed tubing of compressor
36- Tubing
37- Insulation
38- Arrows to designate flowing of refrigerant
39- Heated space, house, building, object
40- Heating systems
41- Dehydrator, filter
42- Collecting vessel
43- Equipment for back heat exchange from compressed refrigerant
44- Controllable valve
45- Throttling element
46- Optimal flow of underground water
47- Extension of suction chamber
48- Solar heat exchanger
49- Solar collectors
50- Temperature sensor
51- Electricity supply
52- Straight casing lid
53- Lifting and/or lowering device
54- Drill hole flange
55- Starting lift and return
56- Refrigerant manifold-distributor
57- Refrigerant manifold-collector
58- Backflow valve
59- Simple or multiple spiral of solar exchanger
60- Spring
61- Solar exchanger tubing
62- Direction of flow of pumped water
63- Pressostat
64- Closable valve(s) or 3-way valve
65- Inflow and outflow of solar media
66- Elastic body to invoke a change in volume of pumping chamber
67- Condensation side and heating system
68- Fixture for weight and/or weight
69- Brace
70- Weight-bearing plate of suction chamber and evaporator
71- Casing space of exchanger solar-medium carrying

CLAIMS

1. A heating system with a heat pump uses as a primary source of heat energy of water is **c h a r a c t e r i - z e d i n t h a t,** it consists of at least one integral and/or connected tubing (23, 22, 26) leading from the source drill hole (1) and/or well into the disposal drill hole (2) and/or well, and the tubing is connected via a heat exchanger and/or an evaporator to at least one heat pump generator and at least one sucking and pumping chamber (27) of such construction offering a flexible change of its volume, where the movement and flow of water through tubing (23, 22, 26) from the collecting site is achieved by a suction effect and chamber vacuum, which are created as result of the gravitational effects of the water mass in the chamber, and/or the mass of the chamber, and/or its parts, and/or the mass of the exchanger (29) of the heat pump evaporator, and/or of the weight, and at least one outlet opening (30) is in the bottom part of the chamber (27) and/or exchanger (29), where this outlet opening can be realized as a controllable-type valve and/or sliding door, and/or flap through which the water flows out preferentially into the drain parts (33) of the drill hole (2) and/or well, and/or into other selected spaces, and the heat energy of the water, which flows out and/or flows through the exchanger of the heat pump evaporator is collected preferentially directly and/or by way of operative medium, which is sucked by at least one compressor (17), and from which the compressed medium further exits tubing (35) and the heat energy for heating and/or for cooling is further transferred by at least one heat-carrying medium into the heating system (40) within the premises (39), and the operative medium of the compressor circuit circulates through collecting vessel (42), dehydrator and filter (41), if need be through a controllable valve (44), and through at least one throttling element (45), and an equipment (43) allowing for the transfer of the remaining heat from condensed medium into the medium that is sucked by the compressor can be integrated into the suction tubing (34) in the operative circuit of at least one compressor (17), where this integration allows for an increase of the COP and heat pump efficiency.

2. A heating system with a heat pump according to claim 1 is **c h a r a c t e r i z e d i n t h a t,** at least one sucking and pumping chamber (27) of such construction offering a flexible change of its volume is positioned at the drain and disposal drill hole(s) (2) and/or well(s), and/or is located at the source drill hole(s) (1) and/or well(s), and/or is located between drill holes (1, 2) and/or wells, and/or is located inside and/or outside the premises, houses, buildings (39) in the generator and casing of the heat pump, and/or outside the generator, and to ensure a dynamic effect to create suction effect in the chamber (27) there are utilized mechanics of elastic bodies, and/or motor drive with electromotor or with other motor(s), and/or the effects of compressor-compressed media (66), and/or hydraulic effects, and/or the influence of magnetic forces, and/or heat effects, and/or pyrotechnic effects, and/or chemical effects, and/or wind effects, and/or human power, and/or animal power, and/or pressurized effect resulting from the outlet of at least one system refrigerant compressor (fig. 9).

3. A heating system with a heat pump according to claim 2 is **c h a r a c t e r i z e d i n t h a t,** the construction of at least one suction and pumping chamber (27) is produced as being partially or completely elastic, and a change of its volume and/or the shape is possible especially due to extension thanks to fixation and under the influence of gravitational effect, and chamber elasticity is secured by elastic materials and/or

by their combinations used in the construction of the chamber, which are based on natural rubber, and/or synthetic rubber, and/or elastic sandwich materials from multilayers of the same material, and/or from multilayers of different materials, and/or from materials made of fibercarbon, and/or fiberglass, and/or from elastic materials such as metals in springs, and/or from other elastic materials, and/or chamber elasticity, the suction effect and vacuum for water pumping are achieved by a gas and/or liquid spring.

4. A heating system with a heat pump according to claim 2 is **characterized in that**, at least one compressor (17) together with other components are located on a weight-bearing plate (14), which is straight and/or of a variety of shapes, and it is placed and/or attached to the casing (13) and is structurally designed as being removable from the casing for the purposes of control and for setting the generator and/or pumped water, and/or for the purposes of accessibility to the drill hole and/or well, and/or with at least one compressor with components it can be removed more easily as one part and taken for servicing.

5. A heating system with a heat pump according to claim 1 is **characterized in that**, at least one exchanger (29) of a heat pump evaporator is made of metal or plastic tubing (16), and/or its combination with a smooth and/ or shaped surface, which is wound into a simple and/or multiple spiral, and/or where individual sectors of the exchanger tubing connect onto the manifold-distributor (56, 57) and the manifold-collector (56, 57), between which there is tubing that is straight, and/or wavy, and/or spiral, and/or intersect, and/or are arranged either regularly and/or irregularly, and/or where there is at least one exchanger (29) of the heat pump evaporator, whose construction is tube within a tube, and/or a tank within a tank, and/or a plated structure, and a part of the heat pump collecting system that utilizes the heat energy of water can be of the construction that simultaneously collects heat energy from the soil, and/or from at least one body installed in the soil, and/or in a matter, and/or in a liquid.

6. A heating system with a heat pump is **characterized in that**, at least one heat exchanger (48) of a solar system (49) is located within a drain drill hole (2) and/or well, and/or in a source drill hole (1) and/or well, and/or in another appropriate water collection site, and the exchanger (48) is surrounded by water, and/or the water flows through and/or around it, and is constructed by tubing (61, 59), and/or the space between surfaces (71) of the exchangers, and/or is created in another appropriate structure and construction for the purpose of increasing the water temperature and/or the heat-carrying medium temperature for increasing the COP and efficiency of the heat pump, and/or for the storage of solar heat in water and/or in geothermal subsoil.

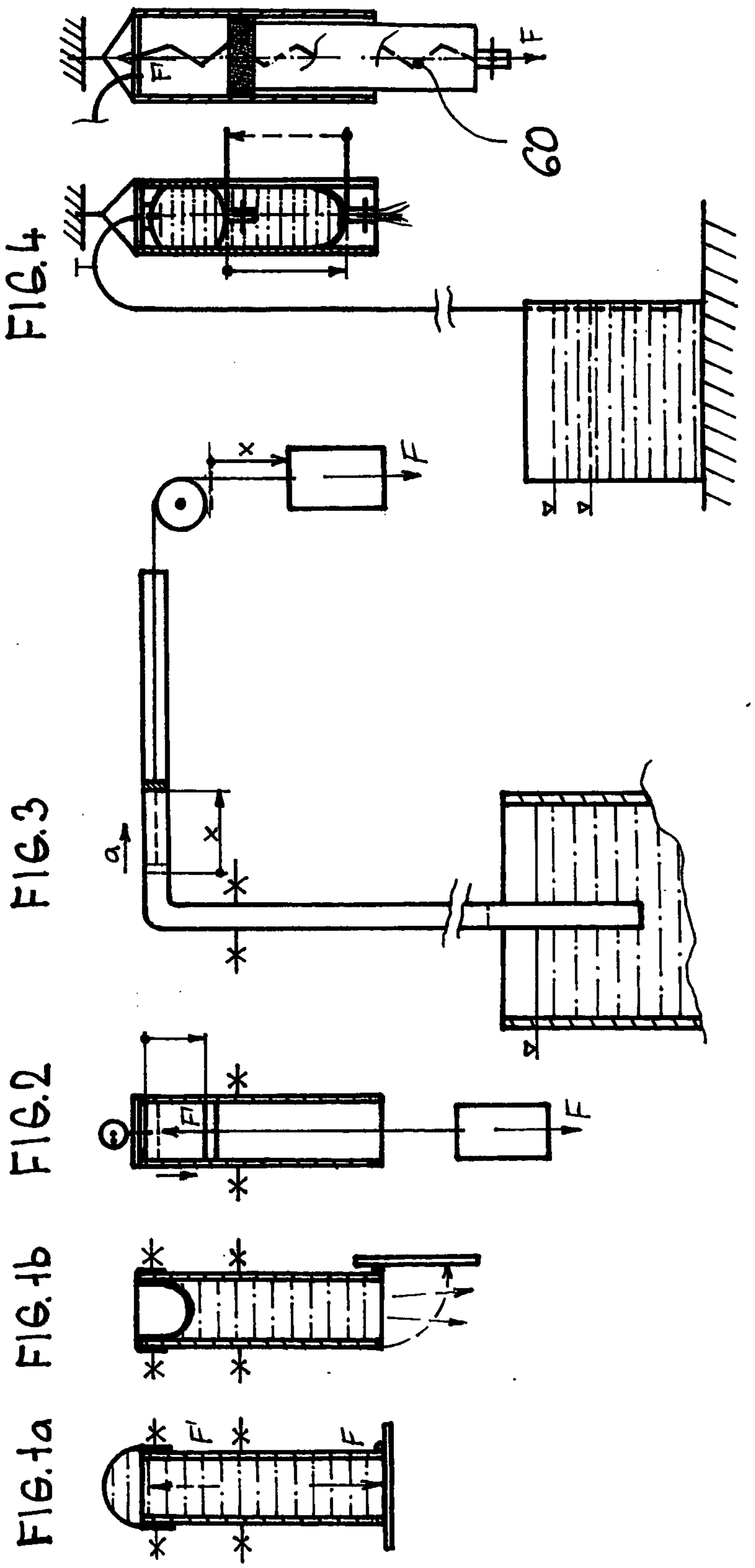
7. A heating system with a heat pump according to claim 5 is **characterized in that**, the heating system (40) inside the premises, houses, buildings (39) is in construction as directly condensing with direct condensation of the operative medium of the compressor (17), which is connected onto outlet tubing (35, 36) of at least one compressor (17) within the system, and/or is in construction as directly condensing with air fans for the circulation and heating up and/or cooling of air, and/or is in construction as a warm-water heating system with at least one condenser for the transfer of heat, and the heat systems in heated

and/or cooled premises or houses could be realised as floor, and/or wall, and/or ceiling, and/or bodies, and/or of another appropriate construction.

8. A heating system with a heat pump according to claim 5 **c h a r a c t e r i z e d i n t h a t,** the warm water for supplying the premises, houses, buildings (39), and/or for warming up swimming pool water is warmed up via direct condensation of the operative medium of the compressor (17) in the heat exchanger, which is located inside at least one boiler, and/or inside at least one accumulation tank, and/or is outside the boiler surface and/or accumulation tank, and/or is on the surface of a boiler and/or an accumulation tank, and/or the water is heated up indirectly by way of warm-water exchangers, and the warming up of swimming pool water can be realized by placing a direct and/or indirect exchanger into the swimming pool.

9. A liquid pumping method is **c h a r a c t e r i z e d i n t h a t,** a liquid is pumped from its collection site by a suction effect in at least one fixated suction and pumping chamber, which flexibly changes its volume and/or shape via gravitational effect and liquid weight in the chamber, and/or chamber weight, and/or added weight, which ensures suction effect, which brings on movement and flowing of liquid from its collection site, and there is at least one outlet opening and/or opening in the construction of a valve and/or flap, and/or sliding door in the suction chamber,
and the mechanics of elastic bodies, and/or motor drive with electromotor or with another motor(s), and/or the effects of a compressor-compressed medium, and/or hydraulic effects, and/or the influence of magnetic forces, and/or heat effects, and/or pyrotechnic effects, and/or chemical effects, and/or wind effects, and/or the effects of human power, and/or animal power are utilized to ensure the dynamic effect to create the suction effect in the chamber (27).

10. A liquid pumping method according to claim 9 **c h a r a c t e r i z e d i n t h a t,** gravitational suction pumping of water or other liquids by suction effects is utilized to ensure a liquid gradient (fig. 14), and the pumped water and/or other liquid(s) flows gravitationally into an electricity generator where the electricity is produced, which is electrically connected into an accumulator(s) and/or is used for starting lift, and/or for the creation of a dynamic effect for suction and pumping chamber(s) of the system and/or is utilized for driving other electric application(s).



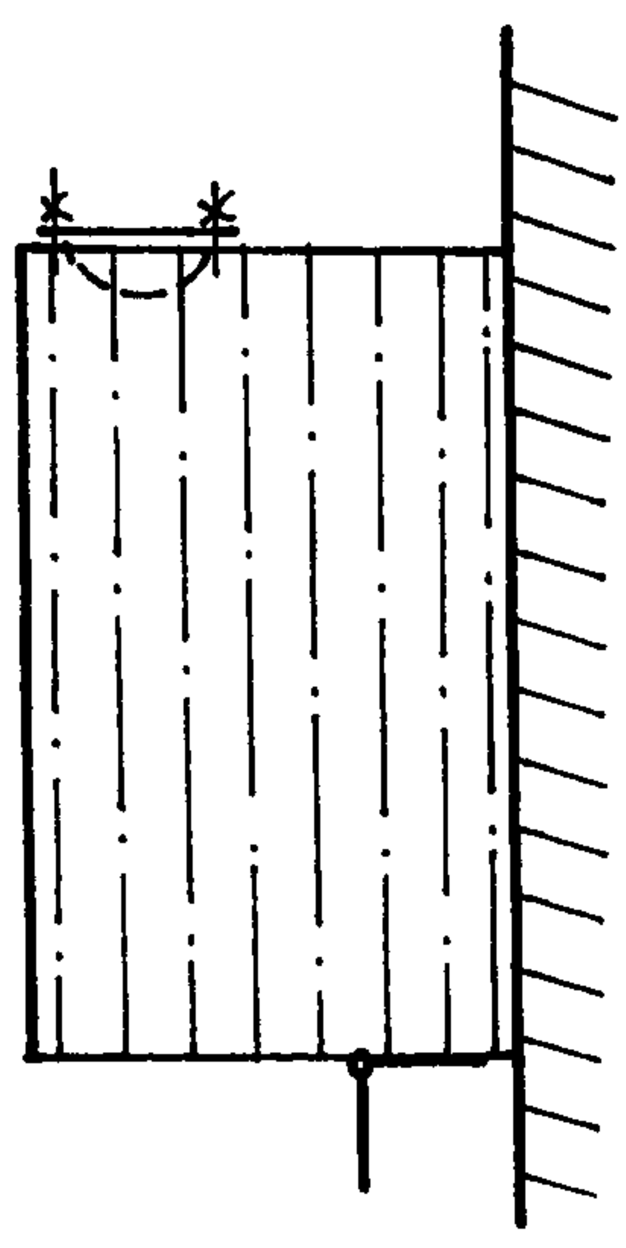


FIG.5

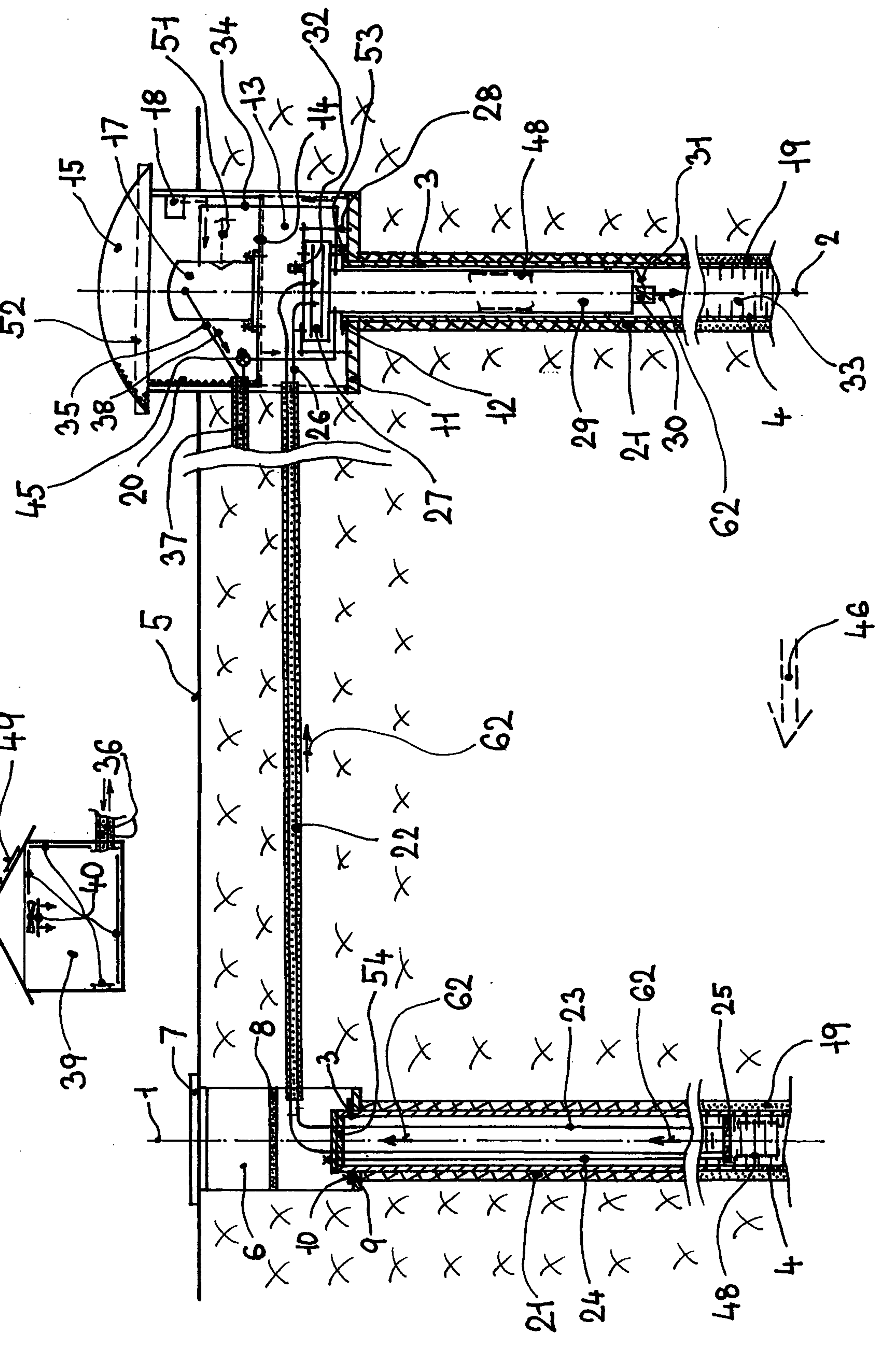

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FIG.6

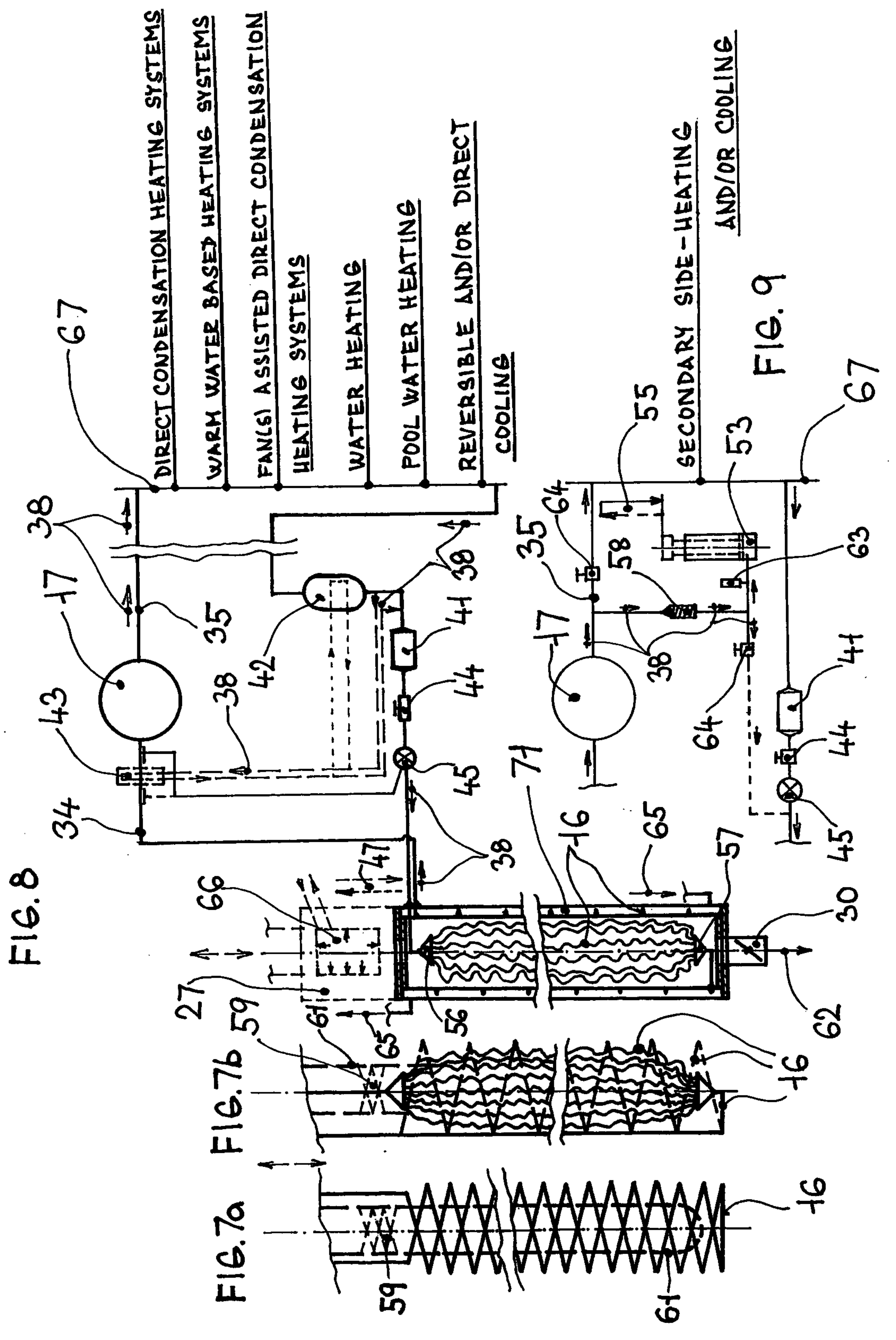
FIG. 8
DIRECT CONDENSATION HEATING SYSTEMS
WARM WATER BASED HEATING SYSTEMS
FAN(S) ASSISTED DIRECT CONDENSATION HEATING SYSTEMS
WATER HEATING
POOL WATER HEATING
REVERSIBLE AND/OR DIRECT COOLING
FIG. 9
SECONDARY SIDE-HEATING AND/OR COOLING
FIG. 7a
FIG. 7b
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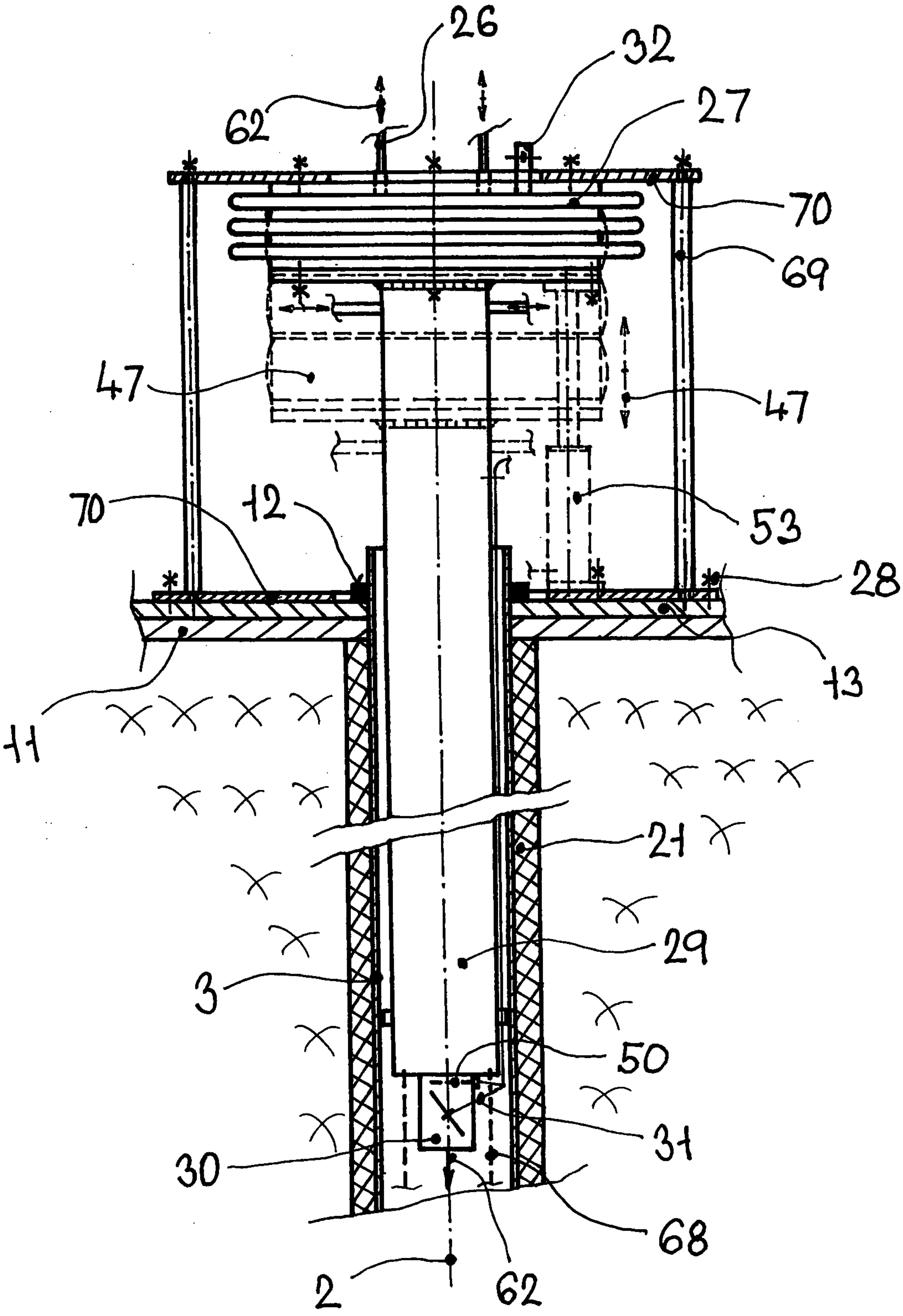
FIG. 10



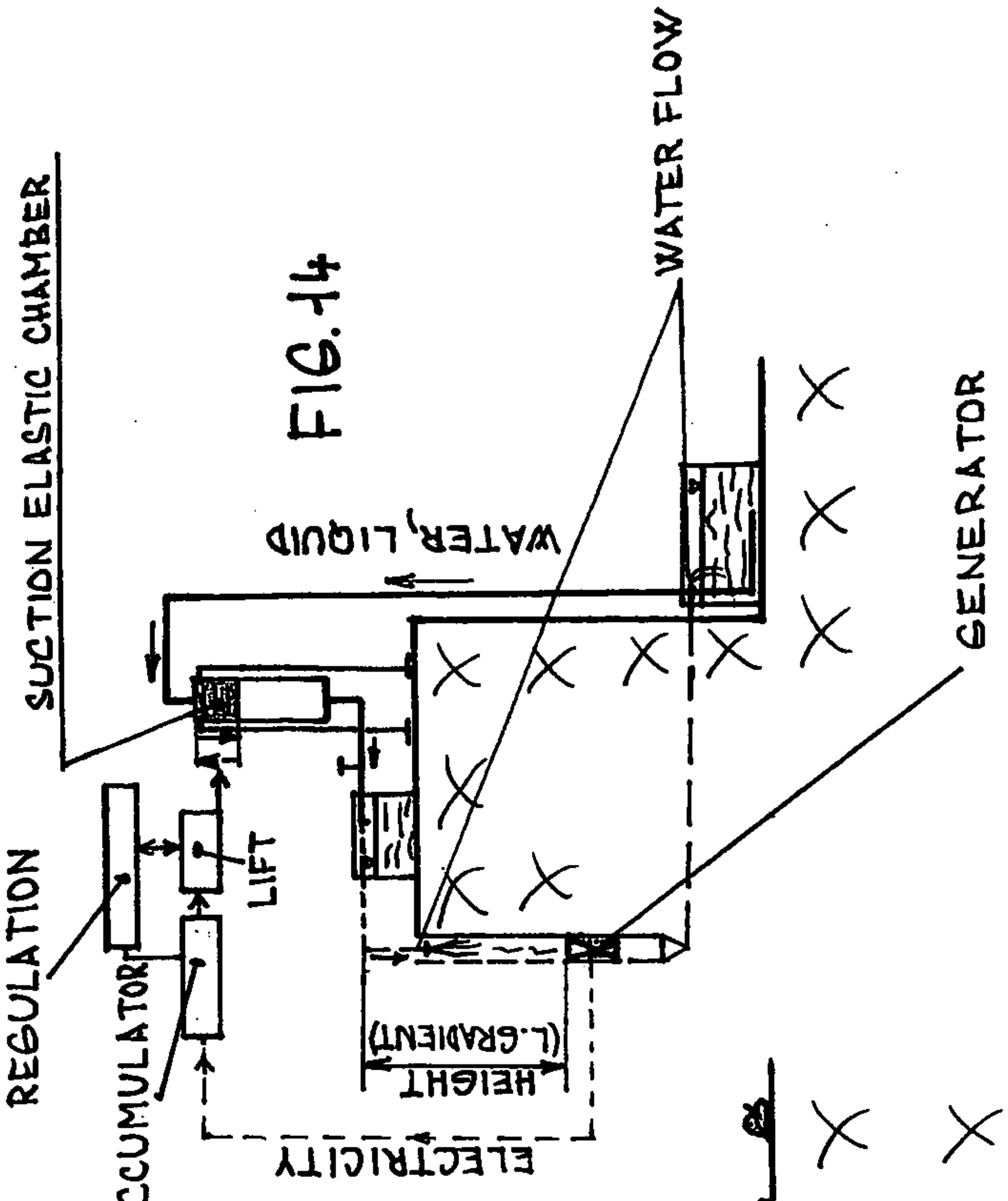


FIG. 14

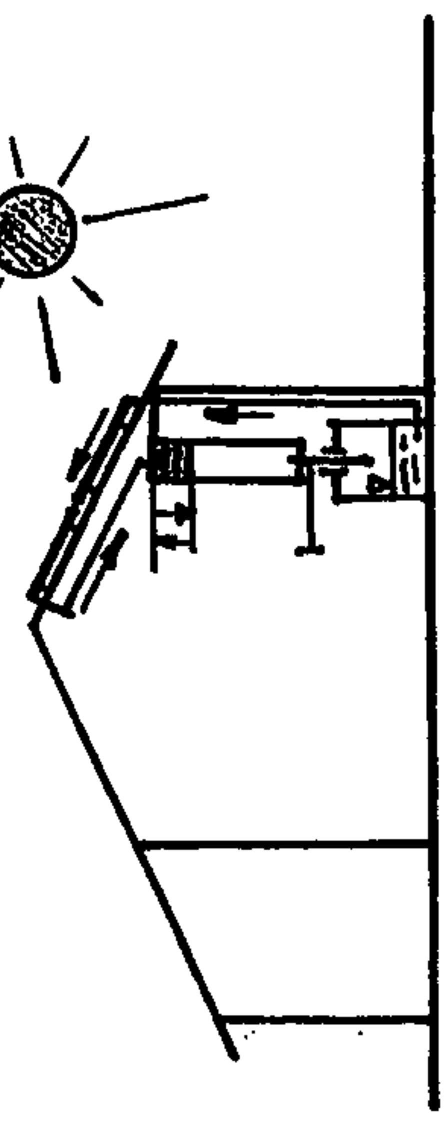


FIG. 15

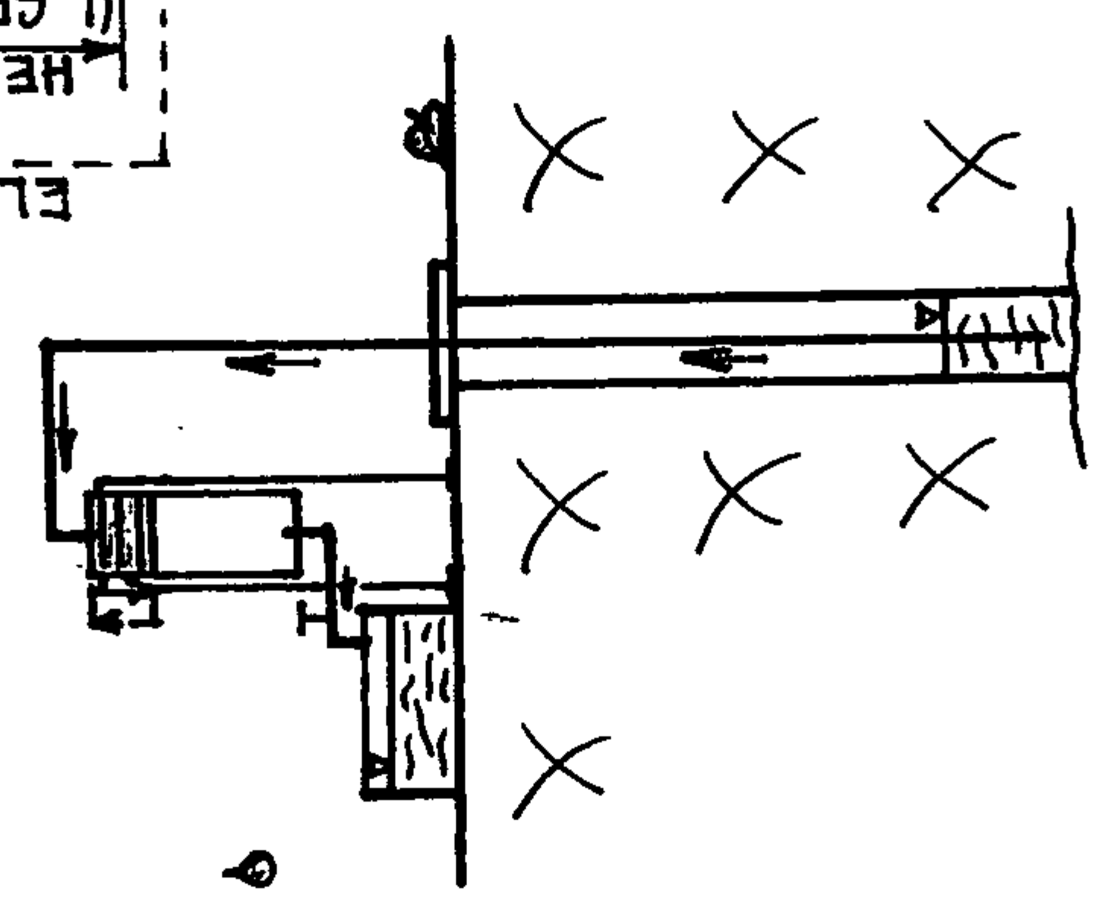


FIG. 13

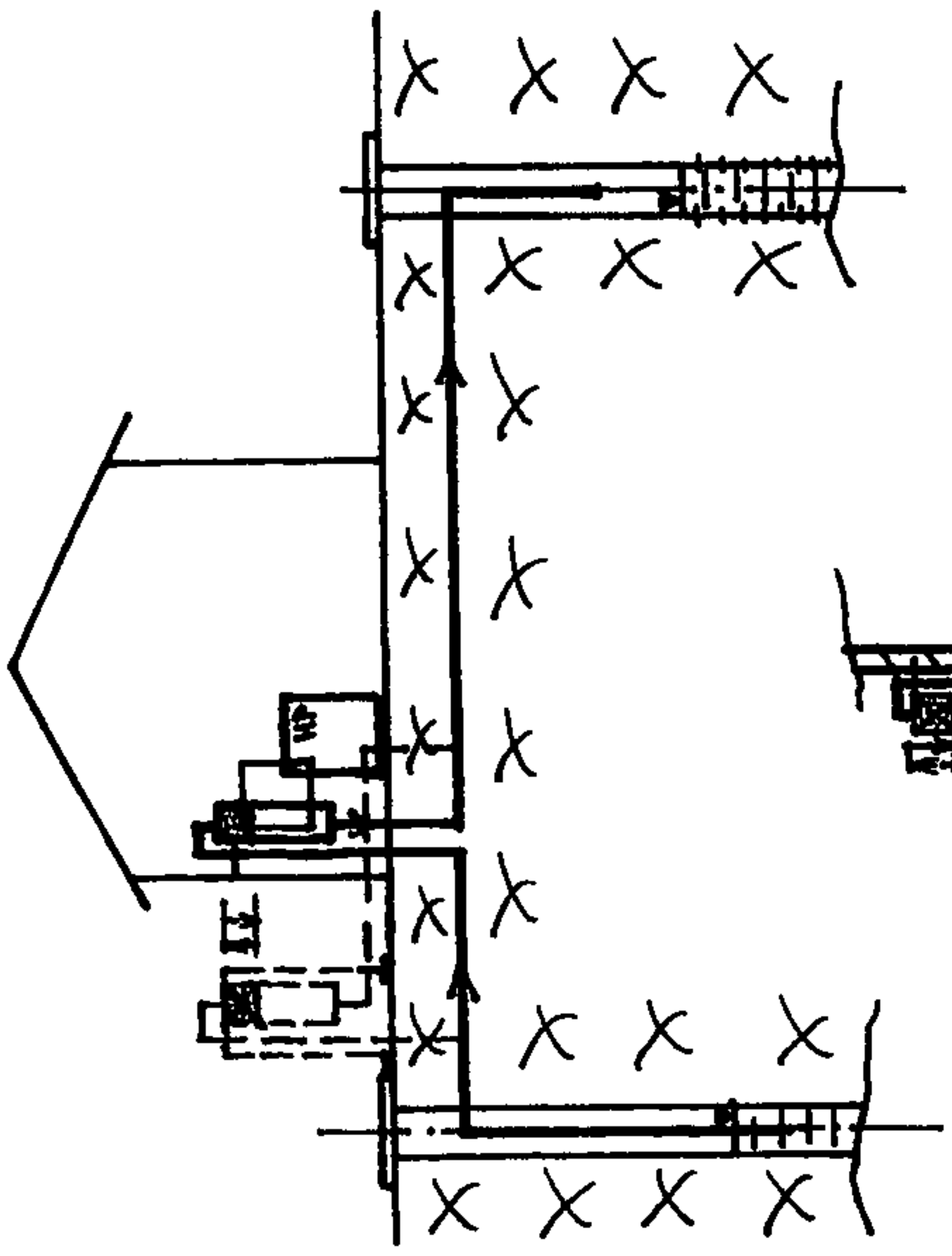


FIG. 11

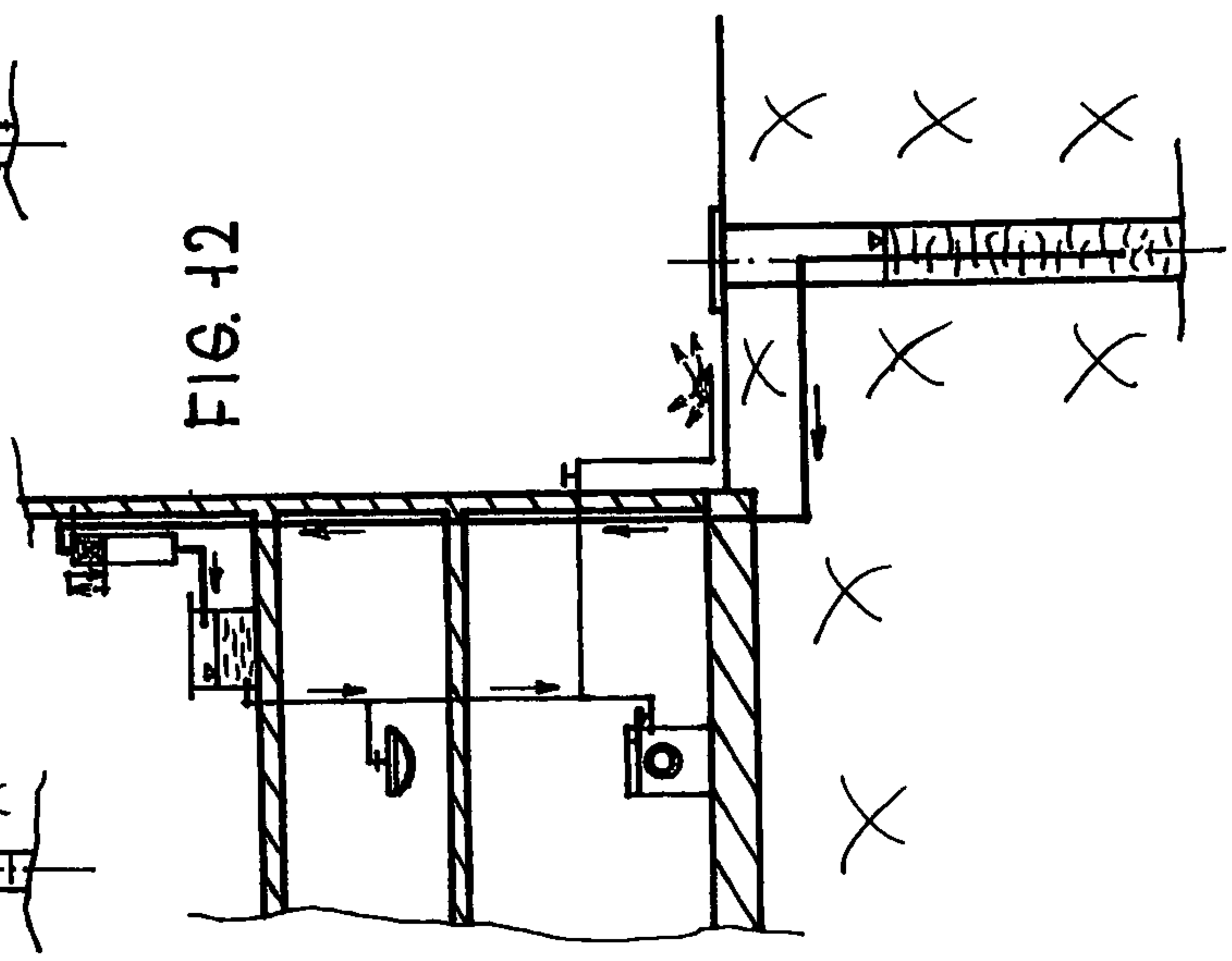
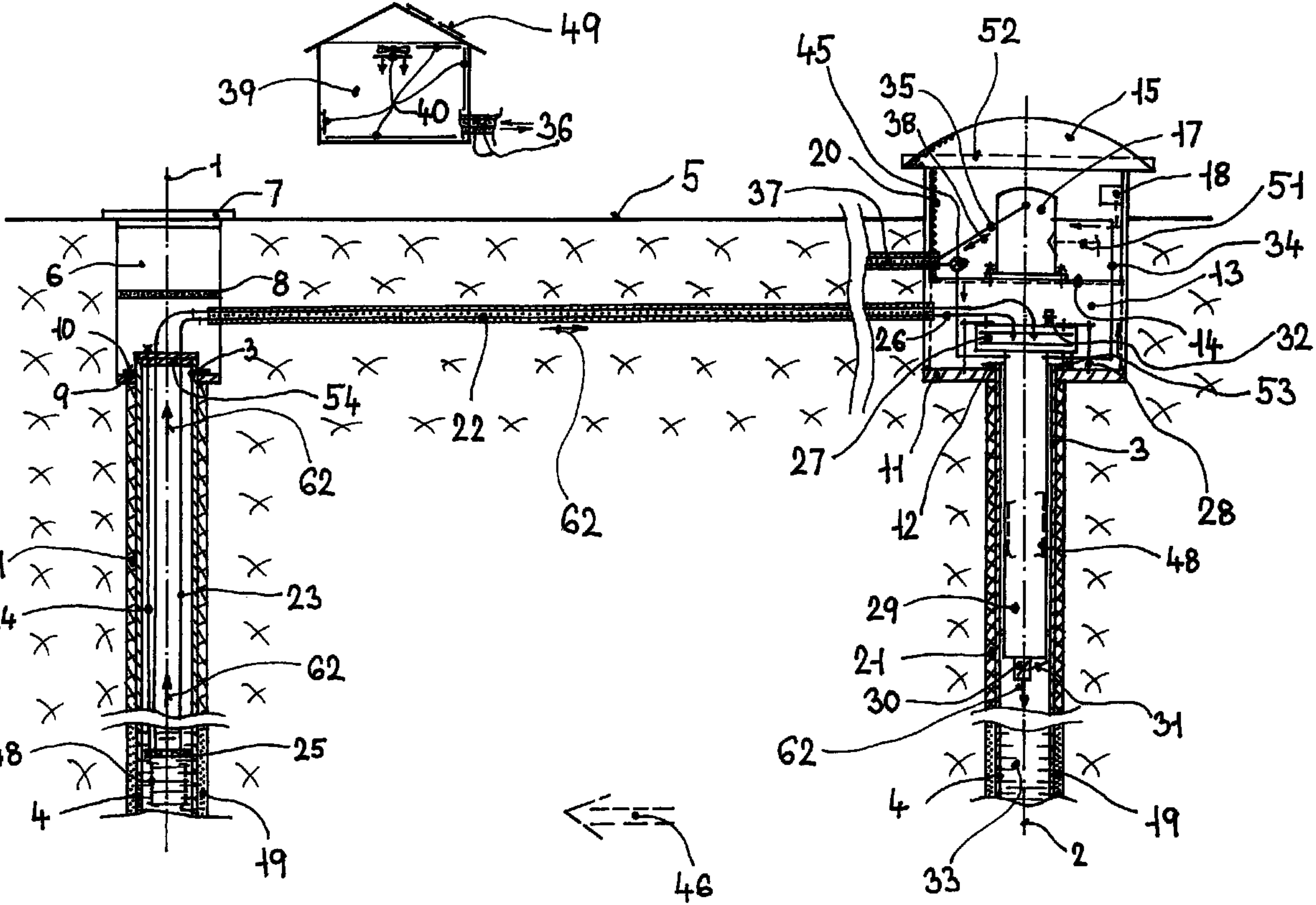


FIG. 12

FIG.6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