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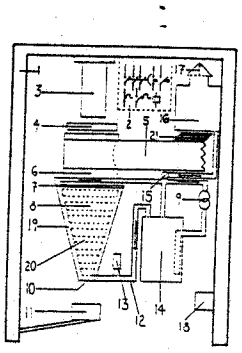
(54) **Titre :** Machine and process for recycling inorganic and organic trash and obtention of a moulding paste for different usages.

(57) **Abrégé :** This invention refers to a machine and a process for recycling inorganic and organic trash and obtention of a molding paste for different usages, this machine is formed basically by; one hydraulic piston, a pushing plate, a receptor camera, one reactor, one pump and a heater equipment. Likewise, said machine is involved in a process, which stages are essential in order to obtain the hot molding paste with the adequate characteristics; that when cooling, is transformed into products substituting wood and materials for construction; such as bricks, vaults, floors, paving blocks, tiles, floor edges, etc. This products will not be corrupted by humidity or moth, do not become rotten and can be cut, machined, etc. This machines does not require water in its industrial process, nor requires to wash the trash that is processed, does not pollute, has a low operation cost, since it is efficient and can be operated by just one person. This invention will benefit people and environment, since trash can be re-used and will avoid the use of and end with natural resources.



MACHINE AND PROCESS FOR RECYCLING INORGANIC AND ORGANIC TRASH AND OBTENTION OF A MOULDING PASTE FOR DIFFERENT USAGES.

TECHNICAL FIELD

This invention refers to a machine and a process for recycling inorganic and organic trash and transformation of it in a molding paste for different usages, such as wood substitutions and construction materials.

BACKGROUND OF THE INVENTION

Currently, the conventional methods for the treatment of wastes generated in metropolitan areas, municipalities, towns and ranches, as well as tourist areas, naval, military, agricultural, commercial, roads, etc., are based mainly, in the separation of the same, according to its origin, in other words, all the foregoing wastes are transformed in *organic and inorganic trash,* the first one, is commonly reincorporated to the nature that gave its origin, by means of the natural biodegradation process. In regards to inorganic trash, it is generally divided in metallic or non metallic, plastics of all kind, forms and characteristics, glass, fibers and synthetic litters, rubber, etc; in commercial amounts, ecologically and economically significant, same that the recycling industry reincorporates, as raw materials for industrial processes in order to be processed again.

The great worldwide problem regarding the re-usage of inorganic wastes, can be considerably reduced by means of adequate machinery and processes, therefore, analyzing the

foregoing problem, it was developed a machine, a process and a product, this last one as a result of processing trash and which is transformed in different useful items. This machine, is efficient and represents a safe of volume, space and energy, which is automated in all of its working stages, it can be operated by just one person, does not require water in its process, characteristic that conventional recycling machines lack, likewise, this machine does not need special or environmental hygiene conditions, this machine also reduces the size of its raw material (inorganic trash) 50 times or more its volume and its technological characteristics allow it to become useful and long lasting products, for people, ecology, industry, commerce, etc., since it advantageously substitutes wood because it is not harmed by humidity or moth, do not get rotten; and can manufacture materials for construction such as bricks, vaults, floors, paving blocks; as well as columns, racks, staves, boards, planks, walls, beams, mudsills, divisions, parts for wood, automobile, craft and naval industry, as well as furniture, taps, sewers, frames, doors, windows, mallets, trash cans, flower stands, benches and vaults, among others.

These products when substituting natural resources, contribute to reduce their exploitation, improve the environment, avoid cutting of trees, less alteration of the environment, and therefore, require less trash deposits.

At the moment it is known the Method and Apparatus to treat contaminated Plastic waste, comprising the densifying of plastic waste by making it to pass through a heating zone to produce contaminated molten plastic as described on patent Application Nr. WO92/08590.

The machine of the patent WO92/08590 utilizes as heating elements only electric resistors embedded in the walls of the so called Melting Chamber (the manufacturing of this melting chamber is by casting process with the electric resistors placed in the casting mold) also counts with electric resistor embedded in the central piece called "spider, this manufacturing characteristics make the machine more complicated to manufacture and there fore more expensive.

We utilize heated oil as heating element which flows around and trough the raw materials (inorganic and organic waste) by means of the two chambers that form the hallow walls and the connecting pipes; on patent WO92/08590 electric resistors are used as heating elements, this means that the two machines use completely different Heating Elements.

In the machine with patent WO92/08590, the molten plastic flows by the influence of the gravity, in ours, due to the type of raw material which the machine is capable to process, it requires a mechanical force to push the raw materials into the Reactor: the source of this mechanical force can be also, hydraulic, pneumatic, eolic, o by the use of a screw conveyor, those devises needed to apply this force, are not claimed as our invention.

Also our machine is conceived to process a mixture of inorganic and organic waste containing as minimum 80% plastics of any type, form or quality and 20% sponge, rubber, synthetic fivers, glass, metallic burs, fiver glass, paints, gluing materials and metallic pins; this 20% may contain up to 50% of polystyrene foam articles, and also this 20% may contain up to 50% (10% of the whole raw

material's mix) of organic waste. The machine of Patent WO92/08590 is conceived only for the purpose of densifying; ours is conceived for densifying and as well for producing useful materials for the construction industry.

Also a machine under request is known patent WO02/38276, which has a similar device (hydraulic piston with pushing plate in the end of the rod) in our invention, we don't pretend to claim the piston and the pushing plate as our invention.

DESCRIPTION

The characteristics of this new machine and its process are clearly shown in the following description and in the figure attached hereto. Each one of its parts has a reference number in order to be compared to the figure.

Figure 1. is a general view of the machine, with each one of its parts.

Figure 2 is a Three-dimensional view of the Reactor (8) must be observed that its walls are formed by Chambers (21) and (22).

Figure 3 is a plant view of the Reactor.

The machine for recycling inorganic trash is conformed by one metallic **structure or chassis** (1) that is used as general support for the equipment, including a **control switchboard** (2) where the electromechanical elements that govern the equipment are installed and as required, they accomplish their function automatically, semi-automatically or manually, depending on the stage of the process.

This switchboard (2) controls the filling of raw material, the ignition, the operation temperature and each one of the stages of the process; it controls the heat level for the ignition of the cool system in regular temperature, in this case the switchboard (2) is built with electromechanical devices in order to govern the operation of the machine and it can be governed by computer as well.

The machine has an **hydraulic piston** (3) which is the one that generates the force and the pressure; and for achieving it, the piston (3) in its movil part has a **pushing plate** (4) made up of steel, strong enough in order for the pressure of the piston (3) not to deform it, the piston (3) can be substituted by a force input, either mechanical, pneumatic, aeolian, hydraulic, transporter worm or spindle; the pushing plate (4) is a steel plate which shape will depend on the form of the **receptor camera** (6) of the raw material, in which case it is of circular form, it transmits the mechanical force that the piston applies (3), pressing and carrying the raw material towards the camera (6). Raw material is deposited previously under the pushing plate (4) by a **feeder worm** (5); it is formed by a metallic tube; the worm (5) helps to introduce to the camera (6) the raw material that is processed; said worm (5) is connected in its other edge to a feeder system of raw material, this latter one is not part of the machine. The reception camera of the raw material (6) is a tube or a container in which the raw material is deposited to be processed and inside it, the piston delivers its force (3) in order to push with the pushing plate (4) the raw material that is being processed and introduces it into the **reactor** (8), likewise, the camera (6) has a **flange** (7) in its edge, which is a ring of steel, attached to the receptor camera (6) and helps to join the camera (6) with the **reactor** (8).

The reactor (8), is the newest and most important part of the machine, that consists in an equipment of cone shape, made up of steel, however, it can be made up of brass or aluminum, which walls are formed by two chambers (21) and (22) which in term, these walls (19) are hallow, in other words, it has double wall, through the interior wall some conducts are connected (20) that can be rounded, triangular, squared, in other words, they can be polygonal, in this case, the conducts (20) are triangular. Through this conducts (20) and the hollow walls (19) it is circulating, like connecting cells, the heating element, hot oil, pushed by a **pump** (9). The reactor (8) is the equipment within which it is carried out a transfer of heat within a range of 250 to 350 centigrade degree between the walls (19) of the chambers (21) & (22) and the conducts (20) and the raw material. It is not determined an exact level of temperature, since the raw material is of all kinds, forms and characteristics, the points of softening vary too much. The reactor (8), transforms the raw material by means of the heat, into a puddle mass, softening, agglutinating y homogenizing all of the materials, which once they have passed through the reactor, and still hot, are vacated through an **exit overture** (10) that is located in the farthest edge of the reactor (8). The hot and puddle mass, when exiting, falls and fills the **molds** (11) which will give strength and mechanical resistance to the mass, in order to convert it in the previously selected products. The molds (11) are of different forms according to the piece or product that is required to be manufactured; the molds are not part of the machine, but are a necessary part in order to explain the functioning of the machine. However, oil can be substituted, which is the heating element, by other components such as steam or hot air. The reactor (8), is of cone shape in order to allow the entrance of the raw material in its natural form, in other words, voluminous and with

many hollows; however, the materials, when being softened and agglutinated_ because of the heat, will make the spaces disappear as raw material enters in it, in other words, it will be compacted; the cone shape is essential in order to form a molding paste, when compacted. In the reactor (8) it is achieved a uniform distribution of the heat, which transmits the heat to the raw material through all sides, however, such enters into the reactor (8) in a regular temperature, therefore, when being in contact with is corresponding connecting pipes (20) and the hollow walls (19) forming the chambers (21) and (22) that trough its interior flows the heating element, the raw material cools it; this is the reason why the pump (9) makes the heating element flow, forcing it to pass through the **heater equipment** (14), which increases again its temperature and such, once hot, continues its way, circulating, continuing its cycle in order to be introduced constantly through the chambers (21) and (22) of the walls (19) and the connecting pipes (20) of the reactor (8) the raw material circulates through them in a labyrinthine form, and hence it is able to soften and homogenize itself as well as to form a molding paste which exits through the overture (10) continuously. The pump (9) makes that the heating element circulates through the **tubes** (12), through the conducts (19) and walls (20), in other words, the tubes (12) are the means through which the heating means are circulating between the heater **equipment** (14) and the pump (9); in this form a **sensor with thermometer** (13) detects the temperature variations in the oil in order to maintain it at all times at the optimum operation temperature which is connected by tubes (12) with the heater equipment (14); the sensor (13) sends signals to the heater equipment (14) in order to maintain the temperature in the specific needs that are to be required. Since the heater equipment (14) is the one that heats and reheats the oil that is circulating, this

equipment can also work with: gas, carbon, diesel, fuel oil or logs. The machine also has a **Sensor or draining** (15) that is connected by the tubes (12) to the rest of the machine, this sensor or draining (15) is an electro mechanic device which detects if the level of cool oil at a regular temperature is in an optimum condition, in order to turn on the machine, since if the oil is under its level, the machine will not turn on. The machine has as well installed a **compensation tank** (16) which is connected to the rest of the equipment through the tubes (12); the function of the compensation_tank (16) is to absorb the enlargement carried out in the oil due to a natural reason when heating. Such shall has a volume of at least, two times the volume of operating cool oil, likewise, it is connected to a **tube with a hole of vent with cap** (17) in order to discharge into a container as a safety measure, if the enlargement of the oil is too high, disconnecting the system through this hole (17); the necessary air enters and exits in order to maintain the atmosphere's pressure to the heater element. The machine has also some **sensors** (18) that are two; the first one helps to detect the moment in which it is required to ignite or stop the feeder worm (5), when such is full or empty the receptor camera(6) as the case may be. The second sensor (18), which is the sensor for ignition and turning off the stroke, controls the various positions of operation of the plate (4), in order to control the moment of re-initiation of the new operation cycle, and when a cycle is concluded, it sends a signal for initiation of the following cycle.

It is important to mention; that this machine is so versatile, that can function from an inclination angle between 30 and up to 90 degrees. Logically when being at 90 degrees it will be more efficient, since it will take advantage of the gravity. The essential components

of the referred machine, are connected between them mechanically. The raw material, regardless of its characteristics, always process it with the same feasibility and efficiency and; its product always results with the same qualities. Dimensions of the machine: diametrically and longitudinally, will depend on the volume that is intended to be processed, for example, we have the following prototype; the dimensions of the model with a capacity for processing a volume of approximately 300 Kg. per hour are: ten tons in the piston (3); pushing plate (4) of 80 cm of diameter and 5 cm of thickness, receptor camera (6) of eighty centimeters of diameter by one meter of length; and the reactor (8) of cone shape, with entrance diameter of eighty cm by eighty centimeters of length, with exit overture (10) of 15 cm. All of this components are made up of steel. However, scale models can be manufactured, with a capacity of 5 tons per hour. The structure or chassis (1) is designed in order to support all of the components and that such work vertically, likewise, the machine can be installed and operated, either in the same place where the trash is generated or in the same public or private trash dump, or even be portable. Other qualities are: that 90% of the components of the machine, does not require of machined, since they are of structural and roller kind. It does not have wear out parts and, therefore, the useful life of the machine will be longer. Its manufacture, maintenance and operation cost are much more economic than the conventional recycling equipments; and the raw material, is like flaws for other recycling equipments, in this machine, such is its raw material for its processes and afterwards it will be its product, since regardless of the kind of raw material introduced in the machine, it works with the same efficiency and the resulting product is obtained with the same qualities and properties.

The machine has been described up to this point, however, this invention refers also to a process, since such is involved to the functioning of the machine in order to obtain the molding paste, product of this invention, which has the following stages:

First stage, recollection of *inorganic* trash, which is the raw material to be processed, it does not require previous cleaning but has to be: plastics, regardless its type, form, size, color, use or quality, physical state, new, used for domestic purposes or industrial ones, in amounts no less than 80%, the other 20% is composed by other materials, such as rubber, foam rubber, synthetic fabrics, burrs, glass, staples, paint, barren rocks, tags, glues or hasps. This mix of trash can contain up to 50% of dry ice in its different presentations.

The great amount of trash, can be polluted up to 10% with organic trash, which could be composed of paper, sawdust, tree leaves, grass, cotton in its different presentations, wood spalls, liquid residuals, food, earth, soot and dust. Due to the fact that the dimensions of the raw material to be processed are so different, for example: when transformed into disposable items, the chairs, tables or large carafe, pads or switchboards and auto parts, etc., when being voluminous, makes necessary, in order for the production to be efficient, to *fragment* all raw material and pass it through a **screen** (21).

The second stage is the introduction of the raw material once fragmented into the machine, through the feeder worm (5); the machine turns on through the control switchboard (2), it is verified by means of the sensor or draining (15), if the level of the heating

element is in an optimum point for operation, and the pushing plate in the top (4), the machine turns on, heats the heating element by means of the heater equipment (14), makes it circulate by means of a pump (9) through the tubes (12) that connect such with the reactor (8). The feeder worm (5) takes the raw material and introduce it under the pushing plate (4). The pushing plate (4) transmits the mechanical force that is applied to the piston (3) pushing and carrying the raw material to the interior of the camera (6), once inside it, continues to be pushed and compressed by the pushing plate (4) until it begins to be introduced into the reactor (8). The reactor (8) has the function to transform the raw material by means of heat, in a puddle mass, agglutinating and homogenizing all of the materials, which once processed and still hot and in a form of paste, are vacated through the exit overture (10) located in the edge of the same.

Third stage: The puddle mass when exiting, fills the molds (11). The paste in the molds (11) remains in excess in the top, therefore, it is necessary to press it when it is still hot. When this part of the material is pressed, the remaining hollows if any, are filled and with such it can be obtained a better finishing and a higher mechanic resistance in the products. The cooling process of the products will depend on the size and thickness of the pieces. For example, a 2 cm-thick piece by 10 cm-width and one meter-long, will take approximately 10 minutes to cool. A sleeper will take 40 minutes to cool. The product, once cooled has a mechanic resistance towards compression that varies form 70 to 100 Kg/cm^2. per square centimeter.

Among the **new** elements of this process are: that it does not require water in any of its stages, nor any other element but heat and strength, neither it requires that the raw material that is being processed has to be washed or cleaned, not even the place where the machine has to operate. It does not require special hygienic conditions. Likewise, **it does not pollute the environment,** since it does not produce residuals of any type or kind. The versatility of the raw material, the design, functioning, way of process, molding paste and the final products that can be manufactured by such, are the new element of this invention, since converts mixed and polluted trash, into new products, which can be commercialized.

As described above, the machine and the process together converts the wastes into a hot molding paste, the paste is formed by: 80% plastics, 20% of other inorganic wastes, such as rubber, staples, etc.; and up to 10% can be organic trash which can contain the rest of the wastes, that when cooling, is transformed in wood substitutes and construction materials, for example: bricks, vaults, floors, paving blocks, tiles, floor edges, columns, racks, staves, ground-sills, boards, planks and walls, as well as beams, mudsills, divisions, parts for furniture and automobile industry, sewers, frames, doors, windows, mallets, cans, benches, ornament items, etc.

All of these products generally will be formed by a single piece, however, if being doors or frames, they will be of two or more pieces, but most of the times, when exiting the molds, they will be ready to be assembled. Such will depend on the design and characteristics of the mold where the mass will be poured.

Likewise, the final products made up of this molding pastes based on inorganic waste, has the following qualities: are not rotten by humidity, moth, are not corrupted and can be cut, machined, shaped, brushed, filed, drilled, painted, sandpapered and polished; mended, assembled, screwed, glued, tapped and recycled.

On the other hand, this products can be painted, however the natural colors of these new products will have the predominant colors of the raw material. Another advantage of this products is that they do not need any other element, but heat and pressure, in order to be resistant and to have the desired form, it does not need time for forging, nor elements such as glues, solvents, substances or chemical products. It is so versatile that a lot of raw material which is introduced in order to be processed, will be ready to be used in one hour, therefore, it is quick, easy and economic.

CLAIMS

1. A machine to recycle inorganic and organic waste to obtain a moldable paste for diverse uses which comprises a Reactor characterized because this Reactor or Furnace is formed by hallow walls divided into two chambers through which the Heating Element (heated oil) flows from one to the other passing through the Connecting Pipes which are arranged in several layers therefore transmitting the heat to the raw materials (inorganic and organic waste) in a uniform manner, softening and agglutinating it and forcing the paste to follow various trajectories until it is expulsed through the exit of the reactor.

2. A machine to recycle inorganic and organic waste to obtain a moldable paste for diverse uses which comprises a Reactor or Furnace as described on Claim 1, which is characterized by the fact that both chambers forming a hollow wall are communicated by means of pipes or internal conducts arranged en diametrical form, this means, across the whole cavity of the reactor or furnace following the "communicating vessel principle"

3. A machine to recycle inorganic and organic waste to obtain a moldable paste for diverse uses which comprises a Reactor or Furnace as described on Claim 1, characterized by the fact that the two Chambers that form the hollow wall of the Reactor or furnace have a greater enough cross sectional area, therefore forcing to the Heating Element (heated oil) which flows in a closed circuit, to always circulate trough the totality of the internal connecting pipes and therefore not only trough the hallow walls of the Reactors chamber, allowing by this, that the raw materials (inorganic and organic waste) which has not been in contact with the heated Reactors walls, get in contact in the central part of the Reactor with the heated connecting pipes arranged in several layers and in diametric form, therefore ensuring a uniform transference of the heat from the heating

element (heated oil) to the totality of the raw materials (inorganic and organic waste) present inside the Reactor.

4. A machine to recycle inorganic and organic waste to obtain a moldable paste for diverse uses which comprises a Reactor or Furnace as described on Claim 1, characterized by disposition of the two chambers formed by the Reactor's hallow walls and the connecting pipes arranged in layers in diametric form which force the heating element (heated oil) to flow in uniform manner through the complete Reactor's body, ensuring a uniform heat transference from the heating element (heated oil) to the totality of the raw materials (inorganic and organic waste) present inside the Reactor.

5. A machine to recycle inorganic and organic waste to obtain a moldable paste for diverse uses which comprises a Reactor or Furnace as described on Claim 1, characterized by the fact that the disposition of the connecting pipes which cross the Reactor Chamber is such that forces the raw materials to describe a trajectory in labyrinth form similar to a mixing action.

6. A machine to recycle inorganic and organic waste to obtain a moldable paste for diverse uses which comprises a Reactor or Furnace as described on Claim 1, characterized by the fact that the Reactor transforms the raw materials (organic and inorganic waste by applying heat, into a dough like paste, softening, agglutinating and homogenizing all the raw materials (organic and inorganic waste), which is then evacuated through the opening in the extreme of the Reactor.

7. A machine to recycle inorganic and organic waste to obtain a moldable paste for diverse uses, as described in the precedent claims 1 to 6, which is characterized by the fact that the moldable dough like paste here by obtained and evacuated through the opening in the extreme of the

reactor, once cold becomes solid and possesses excellent mechanical properties.

8. Process to recycle inorganic and organic waste to obtain a moldable dough like paste to produce useful materials utilizing the machine described in Claim 1, characterized by the following stages:
First Stage: By means of the screw conveyor the inorganic and organic waste is introduced in the following proportions: 80% plastics of any type, form or quality and 20% sponge, rubber, synthetic fivers, glass, metallic burs, fiver glass, paints, gluing materials and metallic pins; this 20% may contain up to 50% of polystyrene foam articles, and also this 20% may contain up to 50% (10% of the whole raw material's mix) of organic waste:
Second stage: Mechanical, eolic, pneumatic or hydraulic force is applied to push the raw materials (inorganic and organic waste) into the Receiving chamber and finally to the inside of the Reactor:
Third stage: Heating of the raw material (inorganic and organic waste) by means of the Reactor's Heating Element (heated oil) which transfers its heat to the raw materials transforming this inorganic and organic waste into a soft and homogeneous moldable dough like paste, which once processed and still hot is evacuated through the opening in the most extreme part of the Reactor:
Fourth stage: The final products are obtained when the moldable dough like paste is ejected or evacuated through the opening in the extreme of the reactor and is allowed to fill open molds that once they are full, the paste on them is pressed to fill the entire cavity of the mold as well to eliminate the excess of plastic taking the advantage that the plastic continues hot, therefore achieving an excellent finished surface and a higher mechanical strength; the cooling of the pieces will vary accordingly with the size and thickness of the pieces being molded:

9. A moldable dough like paste for diverse uses, which is obtained according to the process described in Claim 8, characterized by being

formed by 80% plastics of any type, form or quality, and 20% of rubber, sponge, synthetic fivers, glass, metallic burs, fiver glass, paints, gluing materials and metallic pins; this 20% may contain up to 50% of polystyrene foam articles (which is up to 10% of the whole waste mix), and can also contain up to 50% of organic waste (which is a 10% of the whole waste mix).

10. The products obtained from the moldable paste for diverse uses , according to Claim 9, which are characterized by having a high mechanical resistance making them useful as construction materials.

11. A machine to recycle inorganic and organic waste to obtain a moldable dough like paste for diverse uses which comprises: a chassis or supporting structure, a control panel, a hydraulic piston, a pushing plate, a feeding screw conveyor, a receiving chamber, a flanged union, a pump, a discharge opening, some connecting pipes, a sensor with thermometer, heating equipment, a sensor with purge, a compensation tank to maintain the system at atmospheric pressure, a venting orifice with cap, some sensors, and a Reactor or furnace which is characterized by its advanced and novel disposition or arrangement of all its elements.

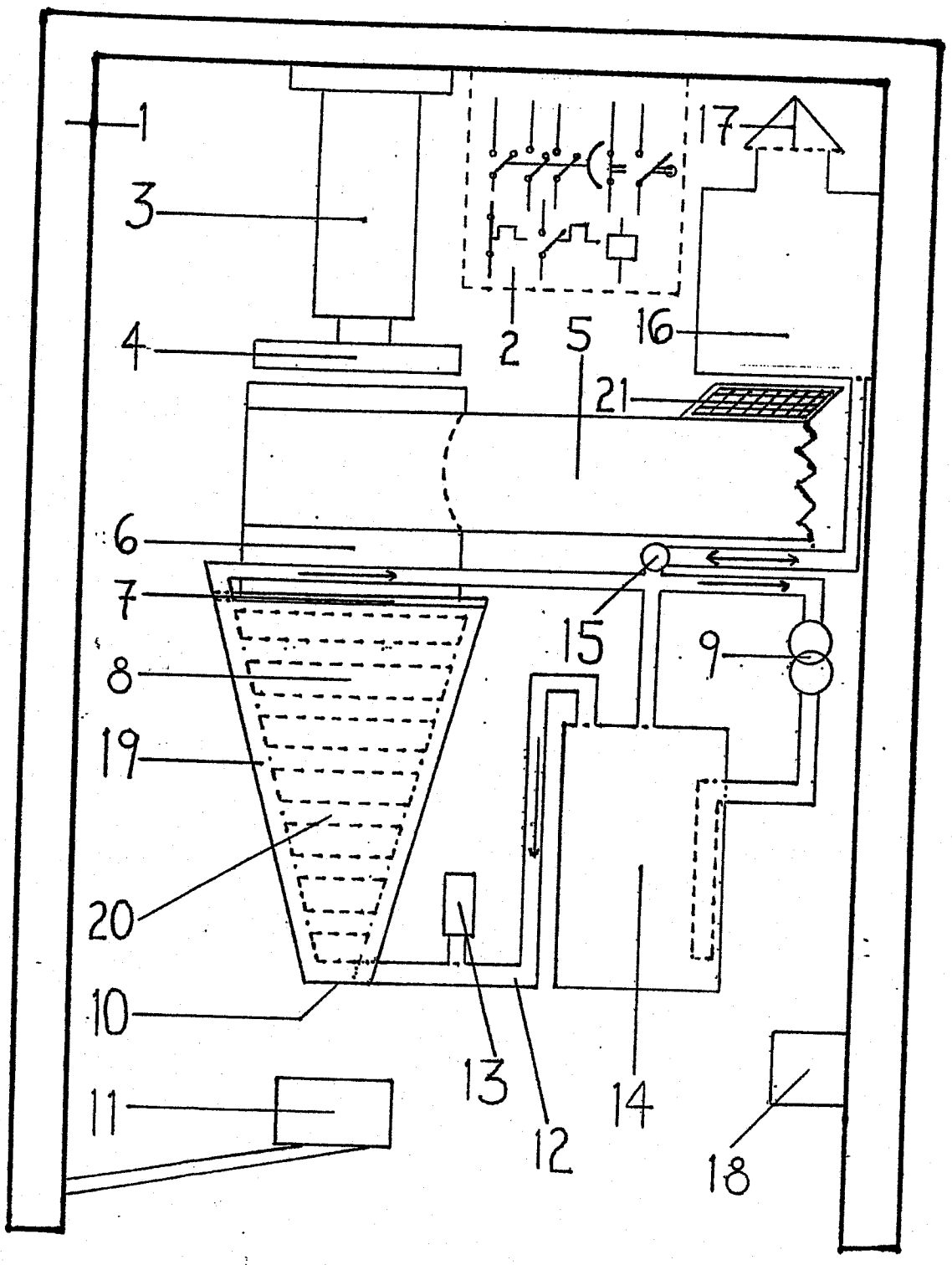


FIG. 1