



INTELLECTUAL  
PROPERTY INDIA  
PATENTS | DESIGNS | TRADE MARKS  
GEOGRAPHICAL INDICATIONS



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The Patent Office, Government Of India

isVsAv çekok i7

Patent Certificate

(isVsAv fu;ekoyh dk fu;e 74)

(Rule 74 of The Patents Rules)

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459387

vkosnu la. / Application No.

201941015799

Qkby djus dh rkjhok / Date of Filing

22/04/2019

isVsAvH / Patentee

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CHANDRAN

çekfokr fd;k tkrk gS fd isVsAvH dks, mijksä vkosnu esa ,FkkçdfVr MULTI-AXIS SOLID CONNECTOR FOR  
HOLLOW STRUCTURAL MEMBERS uked vkfoedkj ds fy,] isVsAv vf/kfu;e] 1970 ds mica/kksa ds vuqlkj vkt  
rkjhok vçSy 2019 ds ckbZlosa fnu ls chl oekZ dh vof/k ds fy, isVsAv vuqñUk fd;k x;k gSA

It is hereby certified that a patent has been granted to the patentee for an invention entitled **MULTI-AXIS  
SOLID CONNECTOR FOR HOLLOW STRUCTURAL MEMBERS** as disclosed in the above mentioned  
application for the term of 20 years from the 22<sup>nd</sup> day of April 2019 in accordance with the provisions of the  
Patents Act, 1970.



*[Signature]*

vuqñku dh rkjhok :

16/10/2023

Date of Grant :

isVsAv fu;a7d

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**Note.** - The fees for renewal of this patent, if it is to be maintained, will fall / has fallen due on 22<sup>nd</sup> day of April 2021 and on the same day  
in every year thereafter.

**TITLE: MULTI-AXIS SOLID CONNECTOR FOR HOLLOW STRUCTURAL MEMBERS**

**Applicant name:**

- **DANIEL RUPHAIL SAGAYA VIJAYANTH.**
- **PARTHASARATHI JANAKIRAMAN.**
- **MARAIYA SOOSAI MANIKAM MERVIN CHANDRAN.**

**Application no:**

**ABSTRACT**

The present invention relates to a multi-axis solid connector for joining hollow structural members to form the desired frame structures. The multi-axis solid connector (1) includes tapered edges (3) with a slot (4) to enable smooth insertion and retention. Generally, hollow PVC connectors are used to join the pipes for fluid flow, those connectors cannot withstand load. But, many cases the hollow connectors are used for making frame structures with multiple unwanted joints due to unavailability of the solid connector with multiple extensions. The proposed invention can eliminate the above drawbacks. It can be used for bird cages, supermarket racks, mushroom beds, book shelf, table, chair and all DIY (do it yourself) based frame structures and other required structures.

### **FILED OF THE INVNETION**

The invention pertains generally to a connector. More specifically, the invention relates to a multi-axis solid connector for joining hollow structural members to form different frame structures.

### **BACKGROUND OF THE INVENTION**

Generally, hollow structural members are used to form the different frame structures like cage for pets, stands for hanging clothes and rack for trays. In many cases other than heavy industrial usage people are started using the hollow structural members which were used for water communications for making their own intended frame structures. But, the above process has some drawbacks, such as

1. The user may not have other options, they must use the joints which was used for fluid supply.
2. The presently available joints are having maximum 4 way joints. If the user requires more numbers, they need to extend multiple set of joints, it may spoil the entire appearance of the frame and lead to high cost.
3. Further, the multi way fluid joints are required precise manufacturing for fluid flow, this is also indirectly added in the product cost,
4. Most of the hollow joints/connectors are made of PVC materials. They may not withstand heavy weights.

The proposed invention will overcome the above drawbacks.

### **OBJECT OF THE INVENTION**

An object of the invention is to provide a solid connector assembly to form a different frame structures with minimum labor and tooling requirements.

Another object of the invention is to allow the user easily assemble and dismantle the frame with minimum time period.

Yet another object of the invention is to allow the unskilled person to make the desired frame structure.

Yet another object of the invention is to eliminate the need of costly hollow structural connectors.

Yet another object of the invention is to use the multi-axis solid connector for other than fluid utilities.

Yet another object of the invention is to enable easy insertion of hollow structural members by providing tapered shape in the edges of the multi-axis solid connectors.

Yet another object of the invention is to enable easy retention of hollow structural members by providing slot in the tapered edges which provides cushion effect while insertion and retention.

Further object of the invention is to allow the user to use the multi-axis connector for their all DIY (do it yourself) projects.

#### **SUMMARY OF THE INVENTION**

The present invention relates to a multi-axis solid connector for joining hollow structural members to form the desired frame structures. The formed frame structures may be used for bird cages, super market racks, mushroom beds, book shelf, table, chair and all DIY (do it yourself) based frame structures and other required structure.

The multi-axis solid connector (1) mainly includes plurality of solid non-hollow projections (2) extended towards multiple axis from an inner core to form the multi-axis solid connector which is solid across the entire section. Each extended end is having tapered edges (3) with slot (4) to enable smooth insertion and retention of the hollow structural members (5). To form the desired frame structures more than one same or different shaped multi-axis solid connectors (1) subsequently

connected with more than one hollow structural member (5) in same or different axis to form the structures thereby simplifying the assembly process.

#### BRIEF DESCRIPTION OF THE INVENTION

| S.NO | PART NAME                  | PART NO |
|------|----------------------------|---------|
| 1.   | Multi axis solid connector | 1       |
| 2.   | Solid projection           | 2       |
| 3.   | Tapered edge               | 3       |
| 4.   | Slot                       | 4       |
| 5.   | Hollow structural members  | 5       |
| 6.   | Frame                      | 6       |

Figure 1 illustrates one of the embodiments of the present invention which shows the multi-axis solid connector assembly.

Figure 2a, b, c & d illustrate different possible multi-axis solid connector assemblies.

Figure 3a, b & c illustrates one of the embodiment of the invention which shows the step by step connection procedure of the multi-axis solid connector with hollow structural members.

The above drawing illustrates the details given and will be provided with respect to certain specific embodiments. It is to be understood that the scope of the disclosure should not be limited to such embodiments but that the same are provided simply for enablement and best mode purposes. The breadth and spirit of the present disclosure is broader than the embodiments specifically disclosed and encompassed within the claims eventually appended hereto.

## DETAILED DESCRIPTION OF THE INVENTION

One of the embodiment of the invention discloses about a multi-axis solid connector for a hollow structural members consisting of plurality of solid non-hollow projections (2) extended towards multiple axis from an inner core to form the multi-axis solid connector which is solid across the entire section. More than one multi-axis solid connectors (1) subsequently connected with more than one hollow structural members (5) in same or different axis to form the multiple frame (6) structures thereby simplifying the assembly process and eliminating the requirement of skilled labor and equipments.

Another embodiment of the invention discloses about shape of each extended end. Each extended end is having a tapered edges (3) with slot (4) to enable smooth insertion and retention of the hollow structural members (5).

Yet another embodiment of the invention discloses about the hollow structural members (5) capable of being a pipe or elliptical or square or rectangular tubes or combination thereof. The multi-axis solid connector can be used for various hollow structural members.

Yet another embodiment of the invention discloses about the utility of the frame structures. Generally the desired frame (6) structure capable to accommodate article or subjects in inner or outer or circumferential side. Specifically, the desired frame structure may be a cage for Birds, stand for trays, basket for general use, temporary structure for mosquito net, portable table and chair and required other structures. There are 'n' number of modification can be made with the multi-axis solid connector.

Yet another embodiment of the invention discloses about the raw material used in the process of manufacturing the multi axis solid connectors.

In one aspect, this is made of resin for simplifying the manufacturing process, reducing the cost and eliminating the heating units for melting the raw materials. In the resin based manufacturing process, resin comes with hardener. When both parts are mixed, polymerization starts, the resin gets cured and the end product is a polymer. A simple non metal die arrangement is enough to manufacture the multi axis solid connectors using resins.

In another aspect, the multi-axis solid connector can be made of any polymer composition and metals. In this process can be used for manufacturing the industrial grade units.

Yet another embodiment of the invention, the multi axis solid connector may have any number of projections to insert the hollow structural members to form the desired shapes.

**Advantages:**

1. The multi axis solid connector eliminates the precise high cost fluid flow connectors for non fluid supply related applications thereby reducing the cost.
2. The multi axis solid connector can form the 'n' number of frame structures with respect to desired utility.
3. The multi-axis solid connector can allow the unskilled person to make their intended objects very simple way.
4. The multi-axis solid connector eliminates the requirements of advance tools.

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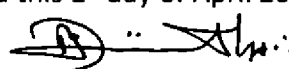
5. The tapered and slot configuration can ensure easy insertion during the assembly process and retention after assembly process.

**Applications:**

1. All house hold utilities.
2. Picnic tents.
3. Sales stalls.
4. Bird cages and
5. Racks in the super markets.
6. Required DIY (do it yourself) structures.

So that the manner in which the features, advantages and objects of the invention, as well as others which will become apparent, may be understood in more detail, more particular description of the invention briefly summarized above may be had by reference to the embodiment thereof which is illustrated in the appended drawings, which form a part of this specification. It is to be noted, however, that the drawings illustrate only a preferred embodiment of the invention and is therefore not to be considered limiting of the invention's scope as it may admit to other equally effective embodiments.

Dated this 1<sup>st</sup> day of April 2019

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Name: DANIEL RUPHAIL SAGAYA VIJAYANTH

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Total no of sheets: 3

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Application no:

Sheet no: 1

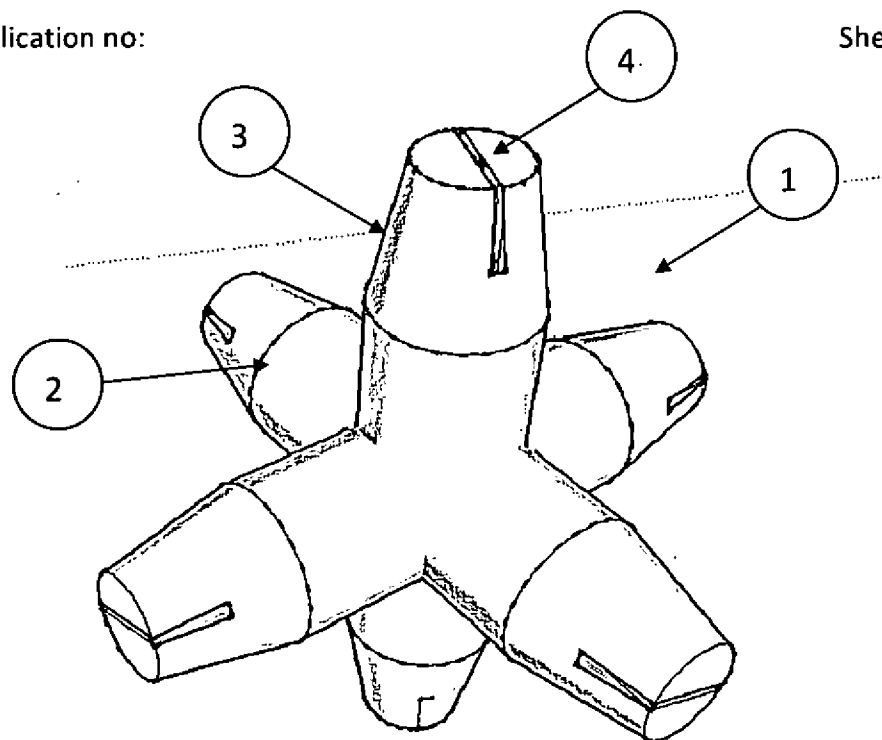


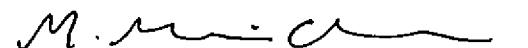
Fig 1

Signature: 

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Application no:

Sheet no: 2

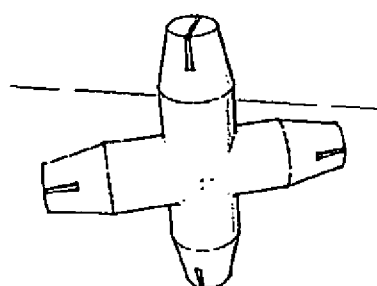


Fig 2a

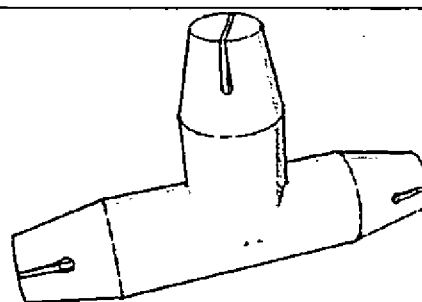


Fig 2b

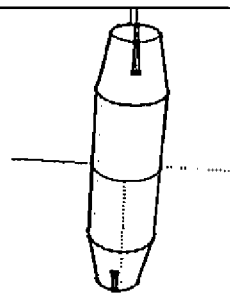


Fig 2c

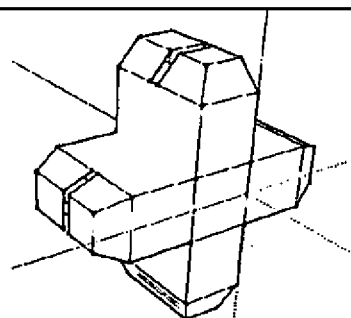
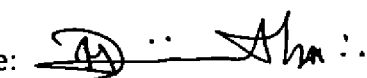


Fig 2d

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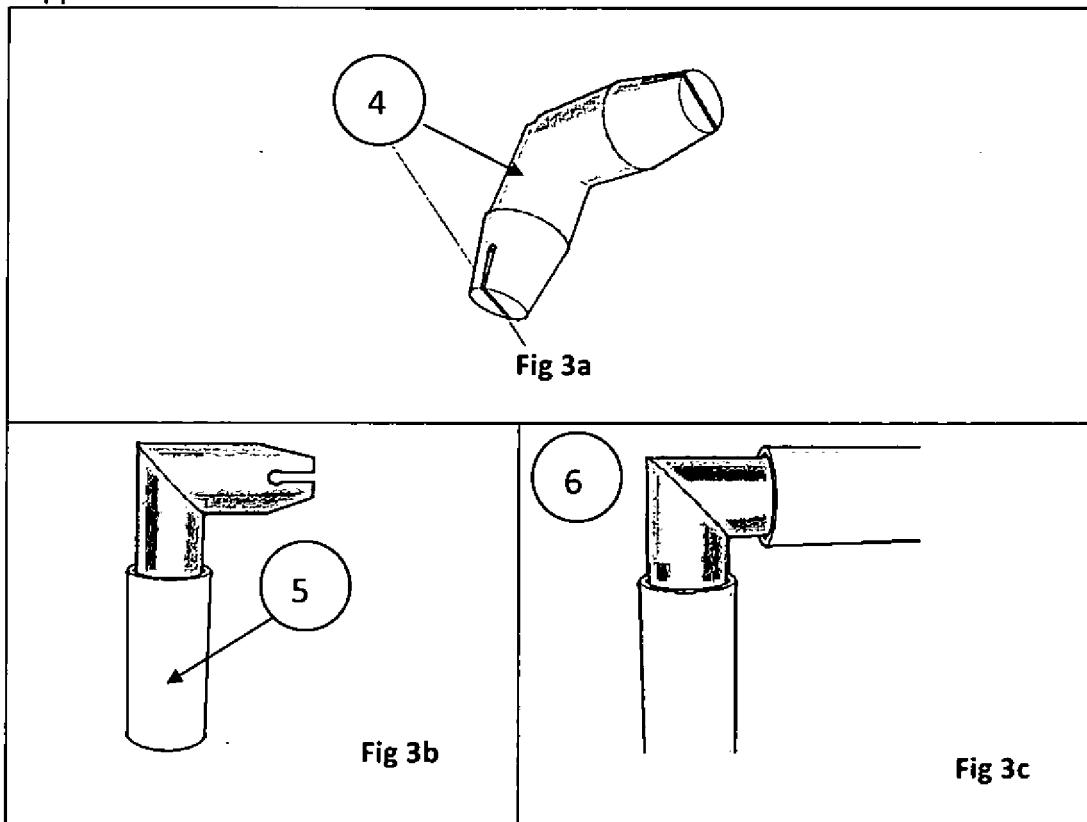
Applicant's name

Total no of sheets: 3

1. DANIEL RUPHAIL SAGAYA VIJAYANTH
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Application no:

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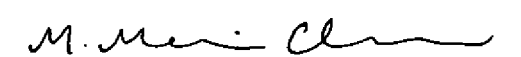


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Patent Certificate

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494373

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201941043781

Qkby djus dh rkjhok / Date of Filing

29/10/2019

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çekfokr fd;k tkkr gS fd isVsavH dks, mijksä vkosnu esa ;Fkkçdfvr DRAFT ANIMAL POWERED COMPRESSED AIR ENERGY STORAGE SYSTEM uked vkfoedkj ds fy,] isVsav vf/kfu;e] 1970 ds mica/kksa ds vuqlkj vkt rkjhok vDVwcj 2019 ds mUurhlosa fnu ls chl oekZ dh vof/k ds fy, isVsav vuqNk fd;k x;k gSA

It is hereby certified that a patent has been granted to the patentee for an invention entitled **DRAFT ANIMAL POWERED COMPRESSED AIR ENERGY STORAGE SYSTEM** as disclosed in the above mentioned application for the term of 20 years from the 29<sup>th</sup> day of October 2019 in accordance with the provisions of the Patents Act, 1970.



*[Signature]*

vuqNku dh rkjhok :

04/01/2024

Date of Grant :

isVsav fu;aZd

Controller of Patents

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**Note.** - The fees for renewal of this patent, if it is to be maintained, will fall / has fallen due on 29<sup>th</sup> day of October 2021 and on the same day in every year thereafter.

**TITLE:DRAFT ANIMAL POWERED COMPRESSED AIR ENERGY STORAGE SYSTEM**

**APPLICANT NAME:**

- DANIEL RUPHAIL SAGAYA VIJAYANTH,
- PARATHASARATHI JANAKIRAMAN ,
- MARAIYA SOOSAI MANIKAM MERVIN CHANDRAN

**APPLICATION NO:**

**ABSTRACT**

The present invention relates to a draft animal powered compressed air energy storage system and promotes the continued use of draught animals in agriculture which is a time tested renewable energy source for sustained agriculture in the face of lessening native breeds of cattle and decreasing reserves of the nonrenewable sources of energy. The present invention addresses the need of storage system (9) and provides unique solution via compressed air storage technology as well as provides option to utilization of generated energy either directly via shaft (2) or via storage units/compressed air energy storage unit (9). This will enable the farmer to consume the generated energy without any interruption for the purpose of agriculture as well import the generated power in the electric grid.

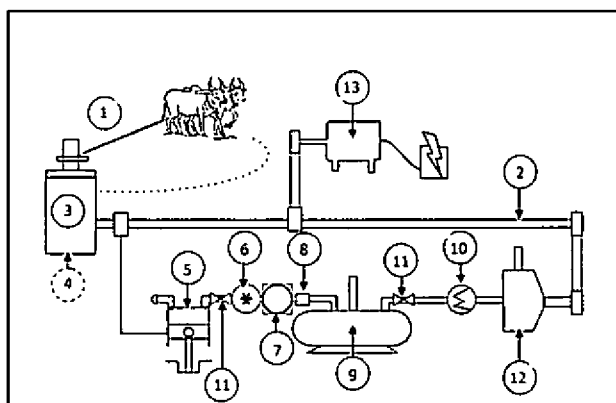


Figure 1

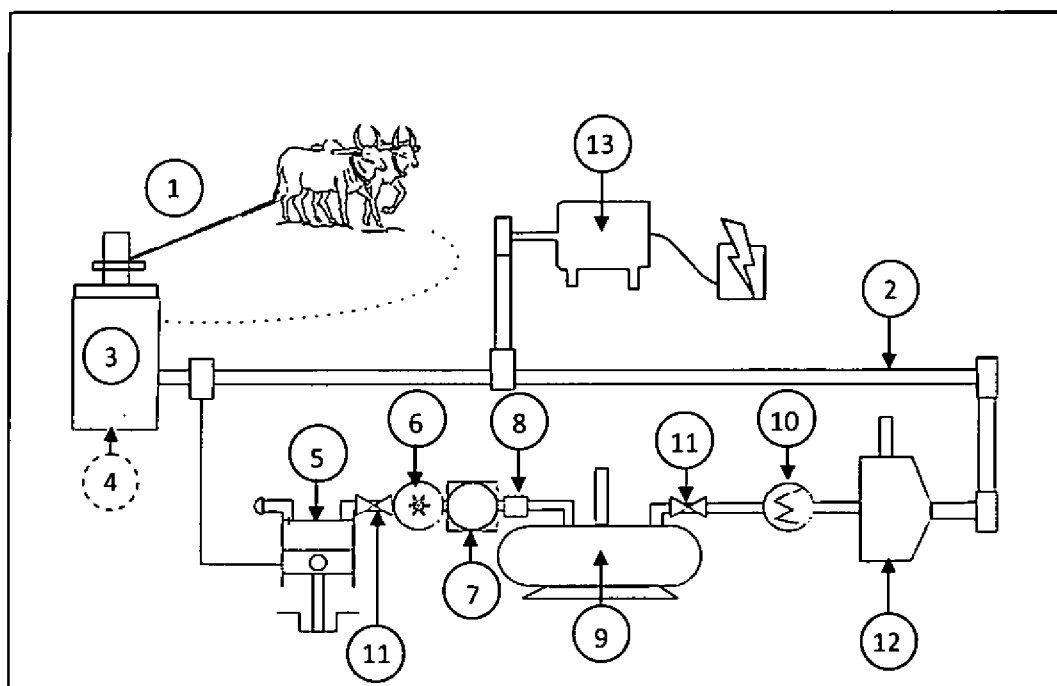
Applicant's name

Total no of sheets: 2

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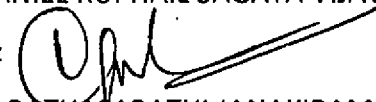
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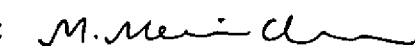


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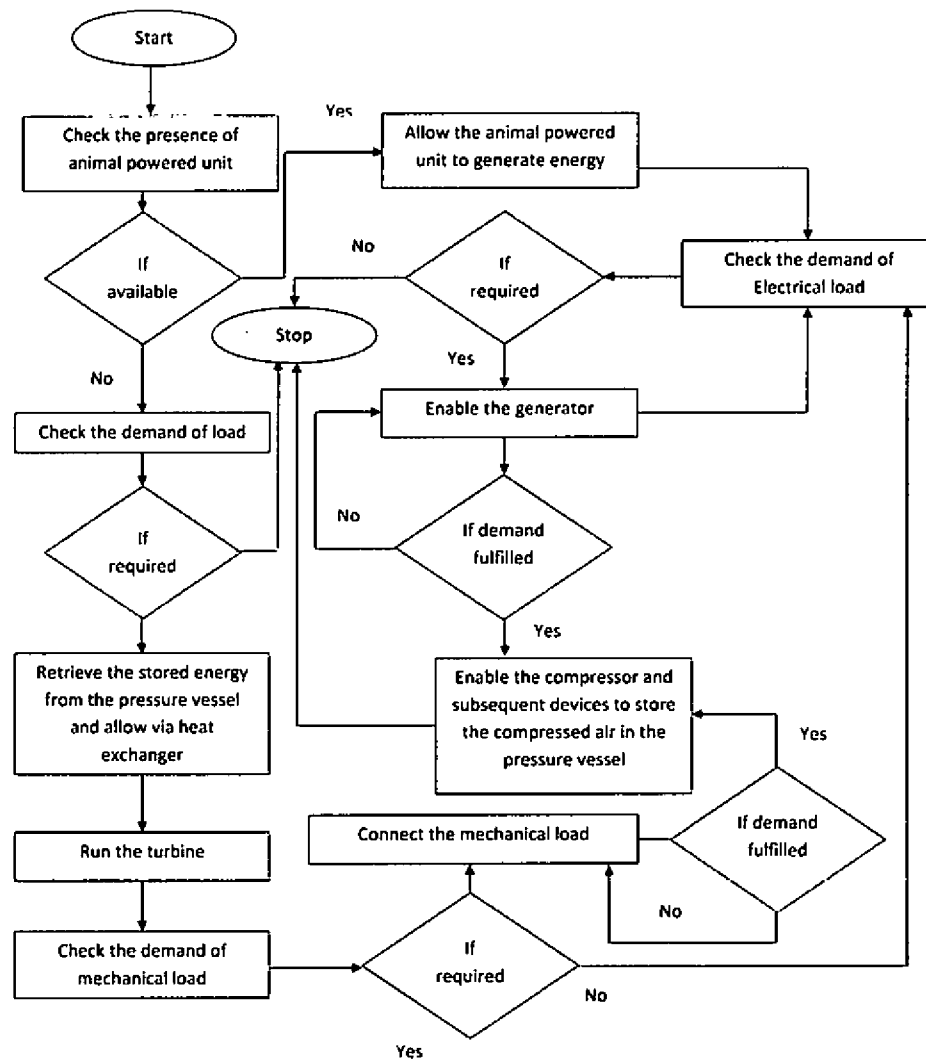


Figure 2

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## **TITLE: DRAFT ANIMAL POWERED COMPRESSED AIR ENERGY STORAGE SYSTEM**

### **FIELD OF THE INVENTION**

The present invention relates to a compressed air energy storage system more particularly animal powered compressed air energy storage system for generating energy via natural way and storing the energy for uninterrupted operation.

### **BACKGROUND OF THE INVENTION**

The resources are fundamentally different such as renewable and non-renewable. Although any resource that relies on the heat or motion of the earth, the moon or the sun to produce power for human consumption is a renewable resource. The ways one harnesses the resources are different, governing these resources usually deal with each resource on an individual basis - treating each resource as unique. Essential thing is, a common man should use the resources in affordable cost.

The proposed patent discloses about animal power, the use of animals has been very ancient, however, the technologies for harnessing of animal energy has remained at a primitive level for a very long time.

As a consequence, with the adventure of fossil fuels, the use of animals has greatly dwindled. Nevertheless, from all considerations, animal have proved to be a renewable, sustainable and a historic source of energy and with increasing thrust on renewable energy at a present times, it is essential to efficiently harness animal power particularly for all the rural and agriculture related activities.

India had the largest population of draught animals in the world. This localized resource is exhaustible and available resource with farmers, yet to be optimized properly.

Further, the proposed invention addresses the following major points:

1. Distributed power generation,
2. To save country cattle breeds,
3. Indirectly support the bio-diversity of the nature and
4. Energy storage via compressed air energy storage and retrieval system.

**Energy generation:** Conventional power stations, such as coal-fired, gas, and nuclear powered plants, as well as hydroelectric dams and large-scale solar power stations are centralized. Those stations are transmitting generated power via transmission lines.

The centralized power plants further affect the environment in the following ways:

- Air pollution: Coal-fired power plants account for major role for greenhouse gas emissions, including carbon dioxide. These plants also release smaller amounts of methane and nitrogen oxides. Air pollution from burning fuel often includes carbon dioxide, sulfur dioxide, nitrogen oxides, mercury, and particulate matter.
- Water pollution: Water used for steam production or cooling may be returned at warmer temperatures to water bodies like sea and may contain contaminants.

- **Waste:** Burning certain fuels results in solid waste such as ash, which must be stored and eventually disposed of properly. Some wastes contain hazardous substances. For example, nuclear power generation produces radioactive waste, while coal ash can contains heavy metals like mercury.
- **Land usage:** Large power plants require huge space for their construction and operations. The centralized generation requires transmission lines and multiple towers for power transmission;each transmission toweroccupies land.

By contrast, distributed energy resources (DER) systems are decentralized, modular, and more flexible technologies that are located close to the load they serve. These systems can comprise multiple generation and storage components; in this instance they are referred to as hybrid power systems.

Micro grids are modern, localized, small-scale gridscontrary to the centralized electricity grid. Micro grids can disconnect from the centralized grid and operate autonomously, strengthen grid flexibility, and help mitigate grid disturbances. They are typically low-voltage AC grids, often use diesel generators, and are installed by the community they serve. Microgrids increasingly employ a mixture of different distributed energy resources, such as solar hybrid power systems, which reduce the amount of emitted carbon significantly.

But solar and wind turbines are also suffered from following drawbacks:

- Solar panel:
  1. The solar panels are sunlight dependent; it cannot generate power during the night time, cloudy and rainy climates,
  2. It may not full fill the demand at required time. It is purely environmental dependent,
  3. It is practically not possible to produced energy in closed environment, it should focus the sunlight and
  4. Creates environmental impacts during the disposal of solar panels after expire.
  
- Wind turbines:
  1. Wind turbines also climate or season dependent, it cannot generate power based on requirement.
  2. Cannot generate power in closed environment, it should face the wind direction for power generation.
  3. Creates environmental impacts during the disposal of glass fiber blades and
  4. Common man cannot afford the wind turbine.
  5. Reduces the wind flow distances. That leads to the natural imbalance.

So, there is a need for a unique power generation system to overcome the above drawbacks and full fill the need of a common man for having their own power generation facility. It should overcome climatic and environmental dependency.

Another major need is "Energy storage".

Presently available energy Storage Technologies are,

- Flywheels,
- Superconducting Magnetic Energy Storage (SMES),
- Batteries,
- Pumped Storage Hydroelectricity (PSH),
- Compressed Air Energy Storage (CAES) and
- Electrolysis of water and Methanation.

The proposed patent uses the Animal powered compressed air energy storage (CAES) systems for storing the generated energy.

In general, maintaining demand-supply balance and regulating frequency are main issues in power system control. Conventional approaches focus on frequency-based load control scheme for demand-supply balancing and frequency regulation.

- The proposed patent can eliminate these drawbacks, further it can fulfill Demand Vs power generation. No need to wait for wind and sunlight.
- The system can save the biodiversity by saving country breeds,
- The system can eliminate costly battery requirement during the usage and
- Eliminate the environmental impacts by eliminating battery usage.

#### **OBJECT OF THE INVENTION**

An object of the invention is to provide an affordable and sustainable energy generation and storing system for supporting all kinds of agricultural related energy needs.

Another object of the invention is to provide a provision for directly consuming the generated energy and store the same when not required.

Yet another object of the invention is to use animal power as a source of energy and with Mechanical advantage.

Yet another object of the invention is to save the country breeds by using the same for energy generation.

Yet another object of the invention is to create awareness to the society about effective utilization of animal power for energy generation and save the native breed varieties.

Yet another object of the invention is to reduce sending the animal to slaughter house due to lack of awareness about animal power in the present situation.

Yet another object of the invention is to store the generated energy as a compressed air.

Yet another object of the invention is to provide a system to accommodate nature of animal power and generate constant energy by streamlining variable torque or speed.

Yet another object of the invention is to absorb surges of high power input and smooth the ripple in power output by using continuous energy providing means.

Further object of the invention is to eliminate transmission losses.

### SUMMARY OF THE INVENTION

The present invention promotes the continued use of draught animals in agriculture which is a time tested renewable energy source for sustained agriculture in the face of lessening native breeds of cattle and decreasing reserves of the nonrenewable sources of energy. The existing draught animal powered machine does not address the need of storage system. The present invention addresses the need of storage system and provides unique solution via compressed air storage technology as well as provides option to utilization of generated energy either directly or via storage units/compressed air energy storage unit. This will enable the farmer to consume the generated energy without any interruption for the purpose of agriculture as well import the generated power in the electric grid.

### BRIEF DESCRIPTION OF DRAWINGS

| S.NO | PART NAME                             | PART NO |
|------|---------------------------------------|---------|
| 1.   | Animal powered torque conversion unit | 1       |
| 2.   | Main drive shaft/common shaft         | 2       |
| 3.   | Continuous energy providing means     | 3       |
| 4.   | Speed regulator                       | 4       |
| 5.   | High Pressure Compressor              | 5       |
| 6.   | Moisture removal unit/separator unit  | 6       |
| 7.   | Air cooler /Intercooler               | 7       |
| 8.   | Drier unit                            | 8       |
| 9.   | High Pressure Cylinder                | 9       |
| 10   | Heat exchanger/preheating unit        | 10      |
| 11   | Control valve                         | 11      |
| 12   | Turbine                               | 12      |

|    |           |    |
|----|-----------|----|
| 13 | Generator | 13 |
|----|-----------|----|

Figure 1 illustrates the flow diagram of the proposed invention and  
Figure 2 illustrates the flow diagram of the proposed invention.

The above drawing illustrates the details given and will be provided with respect to certain specific embodiments. It is to be understood that the scope of the disclosure should not be limited to such embodiments but that the same are provided simply for enablement and best mode purposes. The breadth and spirit of the present disclosure is broader than the embodiments specifically disclosed and encompassed within the claims eventually appended hereto.

#### DETAILED DESCRIPTION OF THE INVENTION

One of the preferred embodiments of the invention discloses about adraft animal powered compressed air energy storage system consisting of an animal powered mechanical energy generation unit (1). A continuous energy providing means coupled (3) to the animal powered energy generation unit. A common shaft (2) extended from the continuous energy providing means (3) and coupled with an air compressor (5), generator (13) and turbine (12). The air compressor (5) compresses an intake air and diverts through an air cooler (7), moisture separator (6), and drier (7) before store into a high pressure cylinder (9). A heat exchanger (10) connected with an outlet port of the pressure vessel to pretreat the air before send to the turbine (12). Wherein when the system senses the demand/load condition then the system enables the generator(13) for power generation. Wherein when the system senses the no load condition then the system enables the compressor (5) and subsequent devices (6,7 & 8) to treat the air and store into the high pressure cylinder(9). Wherein when the system senses the absence of animal powered

generation unit (1) then the system consumes the stored compressed air by enabling the preheating unit (10) and turbine for driving the common shaft (2) and also enables generator (13) for power generation.

Another embodiment of the invention discloses about a plurality of control valves (11) provided in the air flow path for controlling the compressed air storing and retrieval process.

Yet another embodiment of the invention discloses about the generator (13) or compressor (5) or turbine (12) can be enabled or disabled alternatively either physically or electrically.

Yet another embodiment of the invention discloses about other optional application of the proposed system, in this embodiment the common shaft (2) can be connected with pump for pumping water for agriculture purpose.

Yet another embodiment of the invention discloses about optional feature of the system. The system can be placed in the closed atmosphere. Because, the solar and wind energy are fully environmental dependent, it cannot generate power in the closed environment. The environmental changes affect the performance of power generation. Even in this condition, the proposed system can generate power for home and agriculture utility.

Yet another embodiment of the invention discloses about a drive system of the proposed invention. Wherein the generator (13), compressor (5) and turbine (12) can be enabled with the common shaft (2) via geared or gearless or belt drive or combination thereof.

Yet another embodiment of the invention discloses about a continuous energy providing means (3) capable of being a flywheel, it can temporarily stores the mechanical energy and provides to uninterrupted energy to main shaft (2).

Yet another embodiment of the invention discloses about an optional speed regulator (4), it can be attached with the continuous energy providing means (3) for providing regulated speed to shaft.

Further embodiment of the invention discloses about optimize the draught animal power using the proposed invention and create the awareness about necessity of saving the country breed by using them effectively with available technology and also create opportunity for farmers to earn income from the resource.

**Advantages:**

1. The system can provide sustainable energy resource for agriculture.
2. The farmer can generate their own power without depending on grid power.
3. The system can be installed all kinds of terrain conditions.
4. The system need not depend on climatic factors.
5. The generated power can be utilized on demand.
6. The generated power can be stored without affecting the environment.
7. The mass usage of the system can save the country cattle breeds.

8. The system can eliminate transmission losses and derive the benefits of de-centralized energy generation.
9. The system never affects the environment; it's purely eco-friendly.

So that the manner in which the features, advantages and objects of the invention, as well as others which will become apparent, may be understood in more detail, more particular description of the invention briefly summarized above may be had by reference to the embodiment thereof which is illustrated in the appended drawings, which form a part of this specification. It is to be noted, however, that the drawings illustrate only a preferred embodiment of the invention and is therefore not to be considered limiting of the invention's scope as it may admit to other equally effective embodiments.

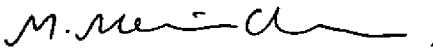
Dated this \_\_\_\_ day of October 2019

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Name: PARATHASARATHI JANAKIRAMAN

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Name: MARAIYA SOOSAI MANIKAM MERVIN CHANDRAN



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Patent Certificate

(isVsav fu;ekoyh dk fu;e 74)

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Qkby djus dh rkjhok / Date of Filing

29/10/2019

isVsavH / Patentee

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It is hereby certified that a patent has been granted to the patentee for an invention entitled **SELF EVAPORATIVE AIR COOLING SYSTEM USING POROUS WALLED CONTAINERS** as disclosed in the above mentioned application for the term of 20 years from the 29<sup>th</sup> day of October 2019 in accordance with the provisions of the Patents Act, 1970.



Controller of Patents

vuqNku dh rkjhok :

08/07/2024

Date of Grant :

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Controller of Patents

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**Note.** - The fees for renewal of this patent, if it is to be maintained, will fall / has fallen due on 29<sup>th</sup> day of October 2021 and on the same day in every year thereafter.

**TITLE:SELF EVAPORATIVE AIR COOLING SYSTEM USING POROUS WALLED CONTAINERS**

**APPLICANT NAME:**

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- MARAIYA SOOSAI MANIKAM MERVIN CHANDRAN

**Application no:**

**ABSTRACT**

The present invention relates to a self-evaporative air cooling system for maintaining the RH value within the comfortable level. The system is capable to control inner and outer surface temperature of the water circulation unit (15) by diverting the heated water via an array of self-evaporative porous walled containers (3) and evacuate the surface heat of the said containers through elevated chimneys/vent pipes (6) by means of exhaust blowers/fans (8). The system further includes a humidity sensor (13) in the indoor unit (2) control the humidity by controlling multiple flow control valves (17) or fan/blowers (8) or swing member (14) or combination thereof, thereby maintaining the decided temperature as well humidity within the comfortable or desired range.

Applicant's name

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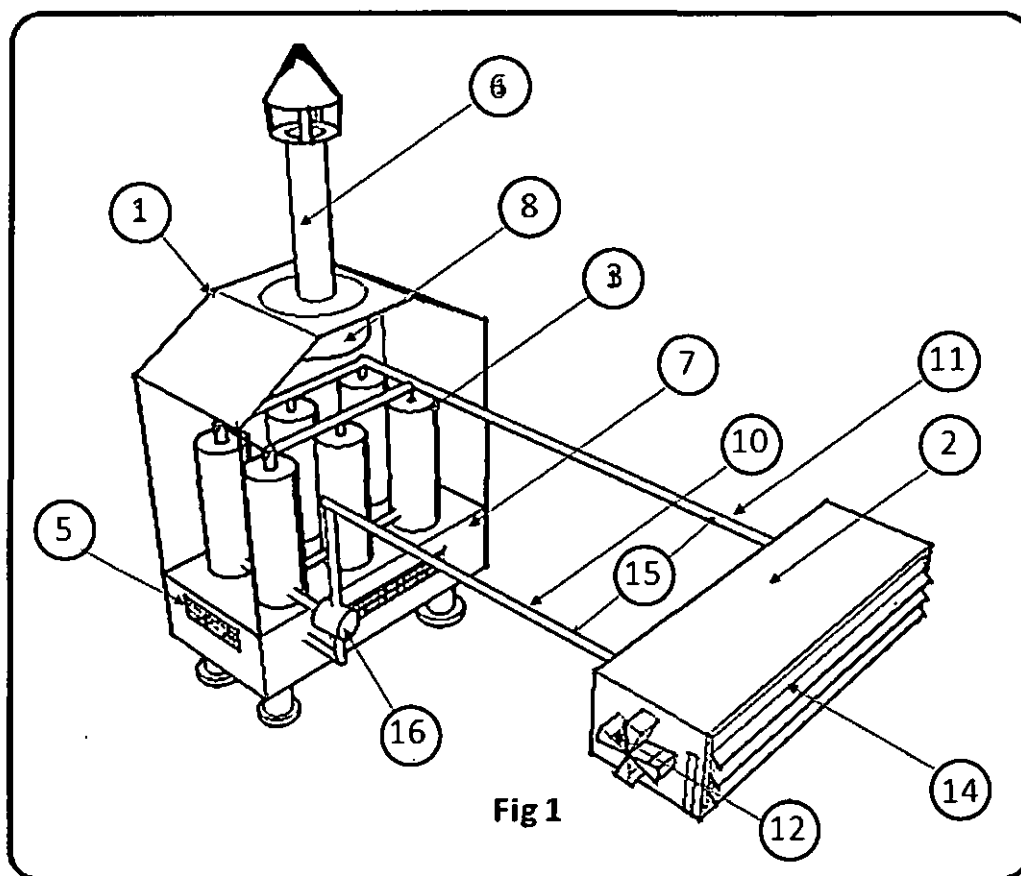
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3. MARAIYA SOOSAI MANIKAM MERVIN CHANDRAN

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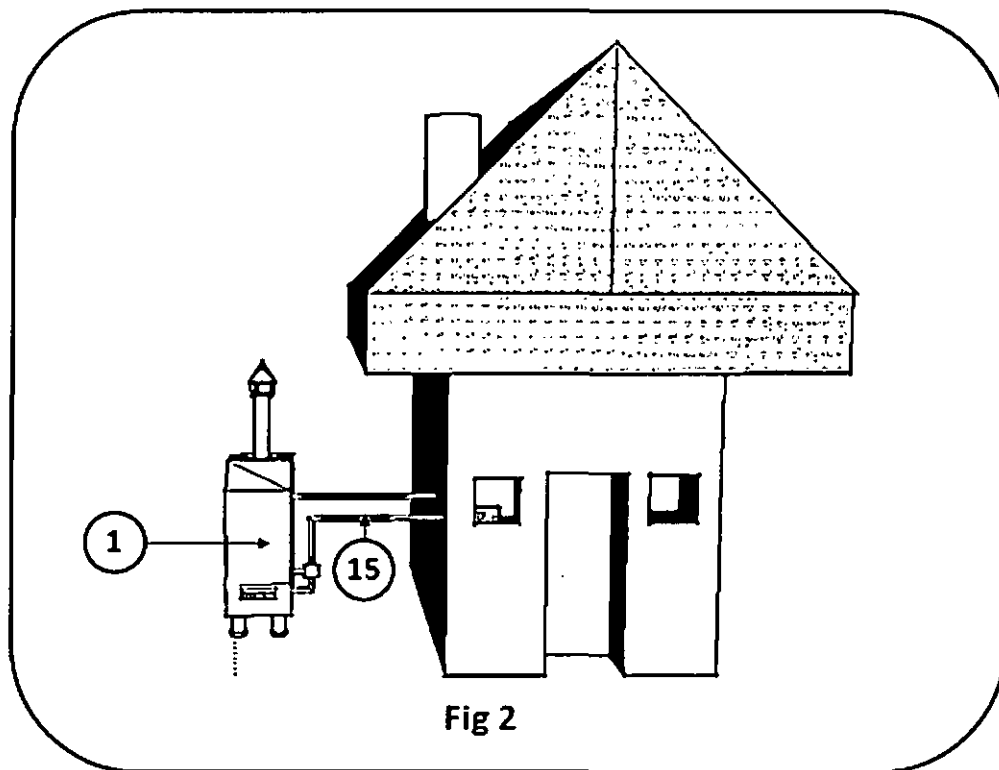
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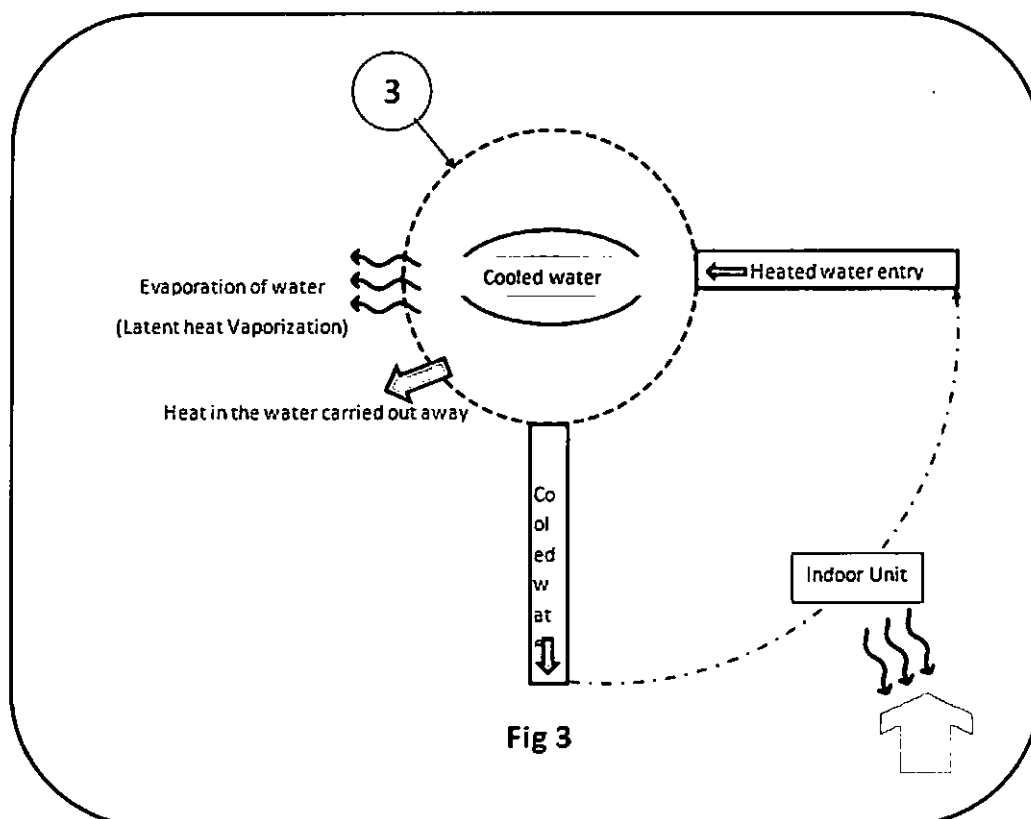
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## FIELD OF THE INVENTION

The present invention relates to an air cooling system more specifically the system relates to a self-evaporative air cooling system using porous walled containers.

## BACKGROUND OF THE INVNETION

Air coolers essentially contain water and work on the principle of cooling by the evaporation of water. Generally, these coolers are also called desert coolers or swamp coolers. The cooling effect is produced due to the transition in phase from liquid state to vapour state.

The major parts of the common coolers are;

- ◆ Fan and vents: Fan is needed to direct the cool air towards the room. These fans continuously flow cool air in the rooms.
- ◆ Water source: Evaporative cooler uses water so it is necessary to fill the cooler with water so that the cooling can take place.
- ◆ Cooling pads: The purpose of cooling pads is to absorb water and to pass air through the intended direction or living space for providing cool effect.
- ◆ Distributors: Water needs to be distributed properly to these cooling pads. This is done by cooling pumps and various pipes that interconnect the cooling pads. These cooling pads should always be in "soaked state" otherwise the water will evaporate away from these pads.

Advantages of air coolers compare with air conditioners:

- ◆ Air cooler's initial and running cost is very low,
- ◆ It consumes less Electricity,
- ◆ It does not require refrigerants and hence eco-friendly,
- ◆ Its maintenance cost is low,

- ◆ Special electrical connections are not required for installing an air cooler,
- ◆ It can work at normal voltage and frequency ranges,
- ◆ Power consumption is low,
- ◆ Can eliminate the danger of leakage of toxic refrigerants,
- ◆ It can eliminate the requirements of expensive insulation for the walls, ceiling etc.
- ◆ It can be placed in the open space like corridors, balcony, verandas, etc. So, tightness of doors and windows are not required while using these types of desert coolers.

#### Drawbacks of the existing air coolers;

- ◆ These air coolers do not have humidity control feasibilities,
- ◆ It cannot be used effectively in in high humidity regions,
- ◆ The entire unit is placed within the living area so the coolers need to clean in regular intervals to avoid smell and contamination,
- ◆ The parts of the coolers coming in contact with humid air may lead to corrosion,
- ◆ Once the water temperature is raised, it will not supply cooling air anymore and the cooling effect will be ceased totally. (Note: The water must be changed for further cooling).
- ◆ The air circulating with water moisture in the air Cooler circulates through filter and pads. The moisture is added continuously in the room space which is cause for high Humidity.

The prior arts 201841022934 and 858/CHE/2010 discloses about the use of one kind porous material in the refrigeration and cooling systems. But, they involve aluminum tube within the terracotta tubes, so the system cannot experience the full benefit of

porous materials. It is practically not viable to achieve cooling effect by making the tubes alone in the terracotta materials. The proposed system addresses the practical constraints and overcomes the same through its unique solutions.

The above said air cooling and air conditioning units available in the market in various capacities and usages but they can serve only minimum effect and also have high RH value in the air, which is very unsafe to health and comfort. It may not be suitable for people suffering from lungs related health issues like Arthritis, Bronchitis, Asthma, etc.

The reason is no inbuilt provision for 'humidity maintenance' in the 'Air Conditioning vapour compression system'. The establishment and the operation cost of a 'vapour compression air-conditioning system' are very high. It is not suitable for all common people and occasions.

So, there is a need for an economically viable system to effectively provide a cooling effect (5 to 7°C reduction) to the user/space even in a high ambient hot temperature ranges (between 30 to 40°C) and continuous air cooling cycle, and also there is a need for the system can be adaptable as well as expandable with the respect to space and number of users.

#### **OBJECT OF THE INVENTION**

An object of the invention is to control the water temperature within the limit by providing a self-evaporative poro-mechanic system.

Another object of the invention is to provide multiple control options for controlling the humidity.

Yet another object of the invention is to control the humidity within the comfortable range by effectively controlling the water spray rate, fan and pump speed.

Yet another object of the invention is to provide a split type water cooler for eliminating drawbacks of the existing single unit air coolers.

Yet another object of the invention is to advance the disposal of saturated air into the atmosphere by providing the elongated chimney in the outdoor unit.

Yet another object of the invention is to advance the heat exchange process of air cooler by effectively circulating the water via an array of self-evaporative poro containers and continuously evacuate the surface air.

Yet another object of the invention is to eliminate the requirement of replacement of water from the cooler.

Yet another object of the invention is to recirculate the seepage water from the poro- container and reduce the water wastage.

Yet another object of the invention is to provide a natural air conditioning to the user.

A further object of the invention is to eliminate the drawbacks of existing air coolers and make the cooler capable to maintain the intended room temperature.

#### SUMMARY OF INVENTION:

The present invention relates to a self-evaporative air cooling system for maintaining the RH value within the comfortable level. The system is capable to control inner and outer surface temperature of the water circulation unit by diverting the heated water via an array of self-evaporative porous walled containers and evacuate the surface heat of the said containers through elevated chimneys by means of exhaust blowers/fans. The system further includes a humidity sensor in the indoor unit control the humidity by controlling multiple flow control valves or fan/blowers or swing member or combination thereof, thereby maintaining the decided temperature as well humidity within the comfortable or desired range.

#### BRIEF DESCRIPTION OF THE DRAWINGS

| S.NO | PART NAME                                | PART NO |
|------|------------------------------------------|---------|
| 1.   | Outdoor unit                             | 1       |
| 2.   | Indoor Unit                              | 2       |
| 3.   | Porous walled container                  | 3       |
| 4.   | Cooled water within the porous container | 4       |
| 5.   | Fresh air entry port of the outdoor unit | 5       |
| 6.   | Elevated vent pipe                       | 6       |
| 7.   | Water collection chamber                 | 7       |
| 8.   | Fan/blowers/exhaust units                | 8       |
| 9.   | Cooled water delivery pump               | 9       |
| 10   | Cooled water delivery pipe line          | 10      |
| 11   | Heated water return pipe line            | 11      |
| 12   | Air blower of the indoor unit            | 12      |
| 13   | Humidity sensor                          | 13      |

|    |                   |    |
|----|-------------------|----|
| 14 | Swing member      | 14 |
| 15 | Water supply unit | 15 |
| 16 | Pump              | 16 |
| 17 | Valves            | 17 |

Figure 1 illustrates one of the embodiments of the invention, which shows the configuration of the proposed systems configurations.

Figure 2 illustrates the embodiment of the invention which shows the construction of the outdoor unit(1) and

Figure 3 illustrates the embodiment of the invention which shows the cooling process of porous walled containers (3).

The above drawing illustrates the details given and will be provided with respect to certain specific embodiments. It is to be understood that the scope of the disclosure should not be limited to such embodiments but that the same are provided simply for enablement and best mode purposes. The breadth and spirit of the present disclosure is broader than the embodiments specifically disclosed and encompassed within the claims eventually appended hereto.

#### DETAILED DESCRIPTION OF THE INVENTION

One of the preferred embodiments of the invention discloses about an array of porous walled containers (3) of an outdoor unit (1). These units are particularly designed for conversion of air cooler's water from the heating to cooling state with the help of evaporation. When a liquid changes to a gaseous (or vapour) state without boiling, it is known as evaporation.

In one of the embodiment, the porous containers (3) are made of mud and have many small openings (extremely small holes). Through these pores that the water, placed inside the earthen pot oozes out. Now, to evaporate, the water needs to absorb heat, which will change it to vapour.

The only way the water oozing out of the porous walled containers (3) can turn to vapour is by absorbing heat from the liquid within the porous walled container (3) and the container (3) itself. Due to this process of continuous absorption of heat from the water inside the containers (3), in a very short term, this water becomes cool. Further fastening the evaporation process, the chimney/elevated vent pipe (6) is extended towards the atmosphere and the exhaust fans (9) evacuate the air towards the atmosphere. Thereby keeping the water inside the containers (3) always in cooled state, that cooled water circulated to indoor unit (2) for performing the air cooling process.

But, in the existing air cooler's water holding vessel does not have any pores. So, the water placed inside vessels cannot seep out and evaporate. Therefore, the water remains hot. It leads to frequent change of water and the cooling also ceased in certain point. The above drawbacks can be avoided by using the porous walled containers.

Yet another embodiment of the invention discloses about a self-evaporative air cooling system. The system consisting of an outdoor unit (1) contains an array of water-filled porous walled containers (3), water collection chamber (6), an elevated vent pipe (6), a plurality of fresh air entry ports (5) and a plurality of fans (9). A water supply unit (16) connects an indoor unit (2), the array of porous walled containers

(2) and water collection chamber (7) via plurality of pumps (17) and valves (18). Wherein the water supply unit (16) is a combination of heated water supply pipeline (12) and cooled water delivery pipeline (11) configured to divert the water from the indoor unit (2) through the array of water-filled porous walled containers (3) to convert the heated/unsaturated water into cooled/saturated water and deliver the cooled water into the indoor unit (2) respectively. Wherein the plurality of fans arranged in the elevated vent (6) and fresh air entry ports(5) regions to evacuate the heated/unsaturated surface air of the porous walled container(3) and heated water pipe line (12) towards the atmosphere through the elevated vent pipe (6) and draw a fresh atmosphere air through plurality of fresh air entry ports (5). Wherein the system further senses the humidity level by means of a humidity sensor (14) provided in the indoor unit (2) and controls the humidity level by controlling the fan (9) or pump (17) or indoor unit's swing member (15) or valves (18) or combination thereof.

A further embodiment of the invention discloses about a water supply unit (16) capable of being a flexible house or rigid pipe or combination thereof.

**Advantages:**

1. Can manufacture the entire unit with locally available materials,
2. Can work in hot ambient temperatures,
3. Can provide the cooling effect without affecting the RH value,
4. Can maintain the RH value within the comfortable level,
5. Can run the system with low operational cost,
6. Even any unskilled person can make the entire system,
7. Eliminate the need of refrigerant gases and compressors,
8. The system uses the naturally occurring process for cooling the water,

9. This system can be used in schools, orphanage, old age homes due to lower construction cost,
10. The system eliminates wastage and frequent change of water,
11. The outdoor can keep outside the living zone and eliminate noise thereby providing a pleasant experience to the users,
12. The system is having a humidity control unit so this feature make the system suitable for all types of users,

So that the manner in which the features, advantages and objects of the invention, as well as others which will become apparent, may be understood in more detail, more particular description of the invention briefly summarized above may be had by reference to the embodiment thereof which is illustrated in the appended drawings, which form a part of this specification. It is to be noted, however, that the drawing illustrate only a preferred embodiment of the invention and is therefore not to be considered limiting of the invention's scope as it may admit to other equally effective embodiments.

Dated this \_\_\_\_ day of June 2019

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