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ELECTRIC POWER HAND TRUCK

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Abstract - *Electric power hand truck is the electric drive system truck which can be used at the Construction site for weight lifting and supply of material. Basically, it's fully electric and works on solar power which is renewable source of energy hence there is no need of any fuel. In electric power hand truck charge the battery by using solar panel. Electric power hand truck has zero emission. In India we see that people transport the materials at construction site manually it required more workers at the site for transport and lifting the material from one place to another place, which requires more labor cost. Also require machinery for heavy transportation of material. For reduce labor cost and easy transportation of the material we design Electric power hand truck. It can be built on the powerful electric drive system which works on solar hence helps to minimize the environmental pollution. It's capable for handling the maximum weight at the construction site. Its design is very simple and easy to operate.*

Key Words: **BLDC Motor, Solar Panel, Controller, Electric Drive.**

1.INTRODUCTION

The mini electric hand truck changes the way companies operate. Constructed using the robust electric drive technology utilised in all Overland Carts. Unique to this forklift truck is the built in versatility. The forklift truck has multiple attachments that can be added or removed quickly and easily via one pin. Each cart is driven by a rechargeable battery pack that has enough energy to last all day.

Fig no. 1 Electric Power Hand Truck

It consists of attachment including Hand Truck Attachment which comes standard with Transformer Hand Truck. Designed for general use. Mantis Attachment which Designed for oversized loads. The front two wheels move only forward and reverse direction but another two-wheel move in any direction which help to move this hand truck in any direction. Multi Mover Attachment which Designed for oversized loads. It is fully run on solar energy, when solar energy is absorbed by the solar panel it converts that solar energy into electrical energy. The battery is charged on solar and used to run the motor. We designed this electric hand truck for construction side for transportation of heavy load from one point to another point easily. There is no use of fuel so it is pollution free as well as less running cost. Because it uses solar energy which is available in nature free of cost.

2. METHODOLOGY

The electric power hand truck is an upgrade version of manually operated hand truck. In this mechanism we have to accelerate the motor speed and the hand truck will easily carry the load. The main motive to design this hand truck is reduced the workers problem, and perfect utilization of solar energy to drive the truck. There are different methods to drive this hand truck. In that we can use fossil fuels like petrol, diesel and motors to drive the truck. There are two motors that are mostly us for this type of application as per the requirements.

1. PMDC motor – permanent magnet motor has its own advantages and it is suitable for low torque application. It is use in some of the electric hand truck where we require less torque. For this electric truck the motor require is very powerful which carry the heavy load easily and the speed is also low for this motor. The maintenance is frequent in this type of motor, the life of permanent magnet motor is low and efficiency is up to 70-80%.

2. Hub motor- hub motor is also a very good option for electric power hand truck. It is small in size and the weigh is also less. For transportation of heavy load, we require high torque and this motor provide that torque easily. But the reason is our hand truck is having four wheels in that front two wheels is connected together by using shaft, and it is difficult to connect the hub motor with shaft.

3. BLDC Motor – the brushless DC motor is best and suitable for electric hand truck and we use for the truck. Because it is more powerful than the permanent magnet motor. The electric hand truck need high torque for its operation and this motor is perfect to run this electric hand truck. The controller is requiring in this type of motor to start and stop the motor also it is useful to control the speed of motor. The speed of the motor is very high compare to permanent magnet motor. The maintenance is less for this motor because of absences of brushes, because of that the losses also get reduce and the efficiency is increase up to 90%. If talking about the life span so it has typical life expectancy is 10,000 to20, 000 hours.

A brushed DC motor needs routine maintenance because brushes frequently need to be replaced due to mechanical wear. Sparking also happens as brushes transport current to the commutator. The armature's maximum speed and number of poles are constrained by brushes. A brushless DC motor does away with every one of these problems. A brushless DC motor needs an electronic control circuit to swap the stator magnets and maintain operation. As a result, a BLDC motor may be less durable.

More efficiency, dependability, a longer lifespan, no sparking, less noise, higher torque per weight, etc. are benefits of BLDC motors over brushed motors.

Another main component that is used in the hand truck is battery. There are two batteries which is generally use that is lithium-ion battery and another one is lead acid battery. The charge store capacity is higher in lithium-ion battery but it is very costly than lead acid battery. There is no difference in the performance of these two batteries. We have to make an electric hand truck in minimum budget so we go for the lead acid battery.

Construction –

A Brushless DC Motor is similar to a Brushed DC Motor but as the name suggests, a BLDC doesn't use brushes for commutation but rather they are electronically commutated. In conventional Brushed DC Motors, the brushes are used to transmit the power to the rotor as they turn in a fixed magnetic field. As mentioned earlier, a BLDC motor used electronic commutation and thus eliminates the mechanically torn brushes. The main design difference between a brushed and brushless motors is the replacement of mechanical commutator with an electric switch circuit. Keeping that in mind, a BLDC Motor is a type of synchronous motor in the sense that the magnetic field generated by the stator and the rotor revolve at the same frequency. Brushless Motors are available in three configurations: single phase, two phase and three phase. Out of these, the three phase BLDC is the most common one.

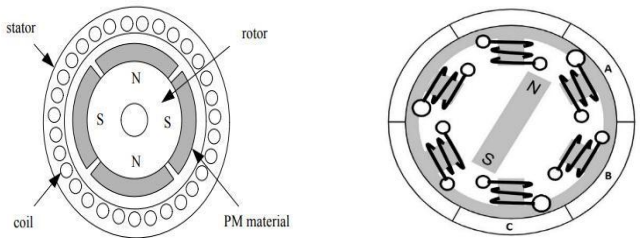

Fig. no. 2 construction of BLDC motor

The structure of the stator of a BLDC Motor is similar to that of an induction motor. It is made up of stacked steel laminations with axially cut slots for winding. The winding in BLDC is slightly different than that of the traditional induction motor. Generally, most BLDC motors consist of three stator windings that are connected in star or 'Y' fashion (without a neutral point). Additionally, based on the coil interconnections, the stator windings are further divided into Trapezoidal and Sinusoidal Motors. If we now pass current through coils B and C one after the other (in that order), the rotor magnet will rotate in clock wise direction. To increase efficiency, we can wind the opposite coils using a single coil so that we get double attraction. Further increasing the efficiency, we can energize two coils at the same time so that one coil will attract the magnet and the other coil will repel it. During this time, the third will be idle.

Working-

The Lorentz force law, which states that a current-carrying conductor experiences a force anytime it is put in a magnetic field, is the same concept that underlies the operation of a BLDC motor. The magnet will feel an equal and opposite force as a result of the reaction force. With a BLDC motor, the permanent magnet moves while the current-carrying wire remains motionless.

The stator coils become electromagnets and begin to produce a consistent field in the air gap when they are electrically switched by a supply source. Despite the fact that the source of supply is DC, switching causes an AC voltage waveform with a trapezoidal shape to be produced. Rotor rotation is maintained by the interaction between the permanent magnet stator and electromagnet stator. The controller chooses which coils to energise based on this sensor signal. When rotor poles approach hall-effect sensors, Low and High level signals are produced. The shaft's location is established by these signals.

Table-1: Comparison Chart

Particulars	Electric Hand Trucks	Outdoor Electric Forklift Truck	Jack EP Selling Electric Hand Pallet Truck
Manufacturer	Overland carts	Digging	Weiying
Lifting height	Min 60mm	Min 50mm	Min 80 mm/ Max 3000mm
Core Components	24V Lithium 20 amp hr rechargeable battery pack	Motor, Pump, Engine, PLC, Other	engine power source
Style	Electric	Electric	Electric
Load Capacity	750 lbs (295 kgs)	1500kg	1500 kg
Wheel type	Pneumatic	Nylon Wheel	Nylon wheel
Drive	24V 600W drive motor	AC Motor (1.5kw AC Motor)	DC motor
Application	Construction works, Building Material Shops, Manufacturing Plant	Energy & Mining, Food & Beverage Shops, Advertising Company, Other	garment shops, building material, machinery

3. DETAIL OF IMPLEMENTATION

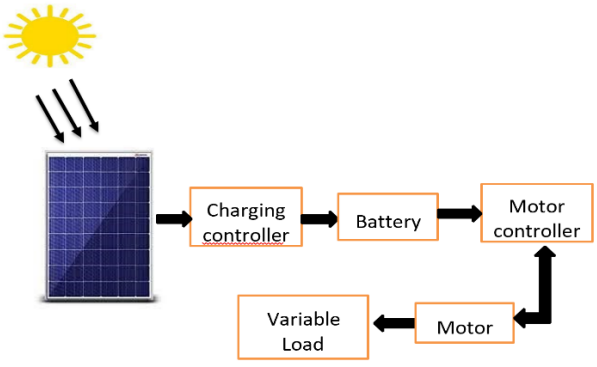

Fig. no. 3 block of electric power hand truck

This block diagram of electric power hand truck describes the block wise information of our project of electric power and truck. It is consisting of solar, charging controller, battery, motor controller and motor etc. It is run on DC supply which is stored in battery and charge by using solar panel. When solar rays absorb by solar panel it converts that solar energy into electrical energy and give the energy to charge controller. Charging controller help to charge the battery at the rated value of battery and protect from the damage. When we have to do the work, the supply is given to motor by turn on the switch with the help of motor controller. The controller helps us to turn on or off the motor it also helps to control the speed of motor easily.

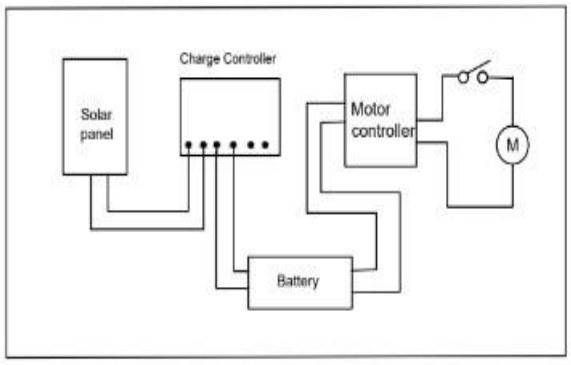

Fig. No. 4 Circuit Diagram

The above circuit diagram of electric power hand truck shows the connection charging point to utilization of energy to run this hand truck. It is consisting of solar panel, charge controller, battery, motor controller switch, motor. The solar energy is absorbed by the solar panel and it is connected to the charge controller which charges the battery at the safe value. There is another two terminal which used to connect direct dc appliances. The battery is connected to the motor controller and the controller is give supply to motor and motor start run. But there is one switch which is connected between the motor and controller to on and off the motor easily.

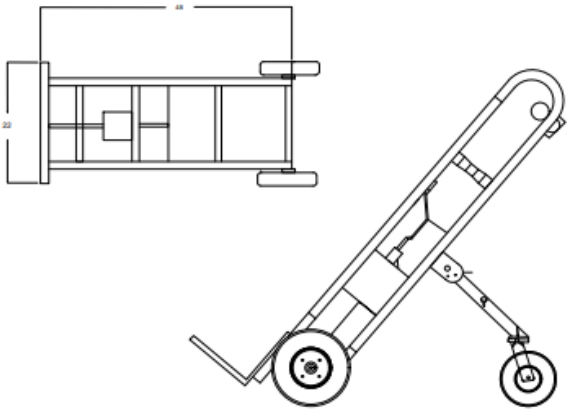

Fig no. 5 Electric Power Hand Truck

When battery is fully charged then the electric hand tuck is ready to run. Then we just have to turn on the switch which is connected between motor and motor controller then motor get the supply and it can star run. Motor is connected to electric hand truck through the chain when motor run then hand truck also run. After that we can vary the speed of motor as per the requirement, by using accelerator it helps to drive the motor as per the requirement. Then we have to add a variable load on the hand tuck and transfer the load from one place to another place. It also has one attachment which is box type structure use for the load transportation. When the battery gets dead then by using solar panel, we have to charge it after that we can drive the electric hand truck for another application. The battery is capable to run 5-6 hours after full charge.

4. CONCLUSIONS

In 2022 the pollution is increase day by day and greenhouse gases are also increases. Electric power hand truck minimizes the Environmental pollution due to fuel combustion. We try to build up a power hand truck which can carry the material at construction side. The power hand truck is eco-friendly hence there is no air pollution. This hand truck is compact in size so it can use in small areas easily. The total running cost for lifetime is low. Since this power hand truck is use electric motor so we can vary the speed as per our requirements this helps in mounting and upside-down area. Our project is works on solar energy, which is everywhere in the environment so people can afford it on reasonable price.

5. FUTURE SCOPE

The introduction of automated decision making into electric power hand truck technology will make operations safer. Next generation of environmentally friendly power hand truck has an electric powered core which combines with rechargeable battery capacity technology. By removing unnecessary processes, electric power hand truck around the world can reduce man hours, emission and cost significantly. In future we can increase the load carrying capacity of electric hand truck. We also add suspension system to drive it for off roads.

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