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Study and Design of Conveyorised Oven System Used for Moisture Reduction in Batteries

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Abstract - With the up and coming innovations and accessibility of movement control of electric drives, the use of PID Controllers with power gadgets in electrical machines has been presented with the improvement of robotization frameworks. The utilization of PID in computerization forms expands unwavering quality, adaptability and decrease underway expense. The computerization of the structure of modern control forms has a background marked by solid developments.

Keywords — oven-blower-heater-conveyor belt-battery.

Introduction- In battery businesses, while producing many sort of battery, dampness content is a major issue in a lead corrosive battery. To evacuate the battery dampness content issue , legitimate sort of warming procedure is to be planned ,structure of warming procedure is a logical and measurable method for improving a framework, proficiency and procedure execution, conveyorised stove is the best answer for appropriate proliferation of warming procedure and expel dampness content. The capacity of drying broiler is to expel dampness from item relying on the procedure and creation necessity. Transport Ovens, in the least complex terms, are clump stoves that work with item traveling through it. Transport Ovens can use ordering or consistent movement, with even, vertical, slanted, or winding movement ways. Transport styles incorporate controlled roller, belted (different sorts/materials), chain tense (COE), overhead, or force and free. By examination, a bunch stove just takes into consideration item to be put in a static situation for warm handling. . Since transport broilers join movement, naturally they are a more costly arrangement than a clump stove, anyway there are various motivations to think about utilizing a transport broiler

1) High Production Volumes-If a client has enough item volume, sooner or later a clump stove may not, at this point be a reasonable answer for them. There may not be sufficient opportunity to stack, heat up, chill off (whenever required), and empty the measure of item that must be prepared in a given time.

2) Production Automation - A transport broiler can frequently effectively be consolidated into a creation line, killing or limiting human mediation with the gear. This can thusly, lead to an increasingly predictable item or item arrangement with less differences/absconds.

3) Process Flexibility-Oven transport drive frameworks can be fit with a variable recurrence drive (VFD) so as to change the speed of the transport. This can be helpful in changing the living arrangement time of item in a warmed zone/s. Also, an adjustment in the stove (temperature) set point, joined with that of a third parameter, for example air speed, can totally change a temperature profile. Transport broilers can be zoned dependent on a necessary temperature profile up to a zone for each profile fragment. Further, a client procedure may regularly direct that their item should be cooled. With a conveyorised framework, item can be moved to or through an assigned cooling zone.

LITERATURE SURVE

In pneumatic convective drying delta air temperature, starting dampness content, material throughput, relative moistness and speed of the drying operator have a significant impact on the drying energy and item quality. Numerous flash dryers utilized in nourishment, synthetic, agrarian and pellet enterprises are as yet lean towards the manual (fixed gain PID's)control technique for observing the drying conditions. In any case, this training yields a poor vitality efficiency, expanded creation expenses and at times may corrupt the item quality. In this manner, to accomplish a palatable drying execution and handling the items according to wanted quality, the channel air temperature of the pneumatic passing on dryers require to be controlled powerfully accordinsdg to the material through puts and starting dampness substance of wet materials [1].

The stove dry test, joined with the prong or stress test, is a helpful apparatus for the furnace administrator to have available to them. Frequently the furnace administrator is solicited to protect the precision from dampness meter estimations or a client just doesn't accept dampness meter readings. In different circumstances, the administrator might need to confirm meter readings for his own bit of brain. For circumstances in which dampness meters will give a similar data all the more rapidly and with little exertion, at that point they are the instruments of decision. Notwithstanding, it is essential to consistently recollect that the stove dry dampness content is the thing that the meters are attempting to appraise [2].

Modern stoves expend a lot of vitality and significantly affect item quality; in this way, improving broilers ought to be a significant goal for producers. This paper presents a novel and pragmatic way to deal with stove improvement that underlines both vitality decrease and upgraded process execution. Procedure improvement tends to the accompanying three parts of the broiler framework: framework controllability, process variety and vitality utilization. This movement hopes to create operability and amplify a broiler's capacity under its present procedure settings. Investigation of the framework, through a mix of exploratory and computational strategies, assesses how near its unique detail the present procedure performs. This would then be able to be created to build up an approach to surpass and improve the stove's unique ability [3].

Assembling organizations ceaselessly attempt to improve their procedures and tasks to improve consumer loyalty and decrease creation cost. One of the key execution estimations is the lead time and is connected with both client experience and cost. The presentation, however can be expanded if the effectiveness of the broiler is improved. An assortment of warmth treatment chambers, for example, heaters, furnaces and stoves are broadly utilized in various businesses. Among the various warmth move advances created, warm exchange from sight-seeing nozzles inside convection stoves are broadly utilized, including the glass temper, item covering, and preparing different nourishment items [4].

Mechanical stoves expend a sizable extent of vitality inside the assembling area. In spite of the fact that there has been significant examination into vitality decrease of mechanical procedures all through writing, there isn't yet a summed up device to diminish vitality inside modern stoves. The paper gives an application case of the technique to a relieving broiler inside a concealing tape fabricating office.. The segments of warming application incorporate gadgets that create or supply heat, gadgets that move heat from sources to item, heat containing gadgets and warmth recuperation gadgets. This paper will concentrate on heat containing gadgets, and specifically modern broilers. On the off chance that it is expected that the item should stay unaltered, at that point vitality decrease can be accomplished by either process improvement or through executing vitality proficient warming innovation [5].

METHODOLOGY

Project Design

An oven is required to heat up lead acid battery components. Conveyorised oven which consist of 44.625KW total power. The oven is 850mm high x 1150mm wide x 10000mm long and is lagged with 100mm of rockwool insulation. On top of the oven is an extraction duct, and air is exhausted from the oven through the duct at the rate of 4800m^3 per hour. Inside the oven are steel trays with contained in these trays are lead battery components weighing a total 3000kg. The trays and components are to be raised from 40°C to 250°C in 30 minutes. In above conveyorised oven consist total 5 working zone. Total power of 5 zone is 37.5kw and 7.5 kw power,10 A current per zone. We can operate zone as per the requirement of product.

Conveyor system design

Conveyor belt- Slat/pipe type and 80 x 40 mm in size, conveyor is consist of 1150mm width, 11566mm length and 850mm height.

Loading / unloading side roller conveyor- Belt Size (W x D x H) – 750mm x 1000mm x 850mm.

Capacity of conyeyor belt- 1000kg.

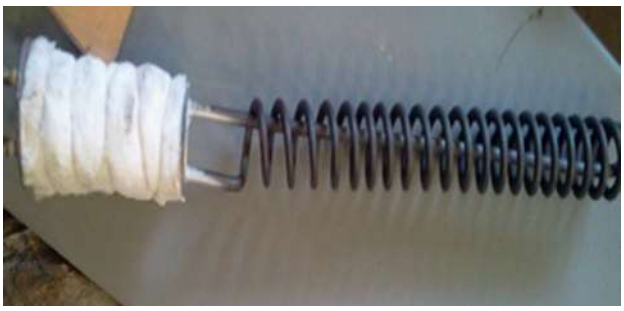
Construction and specifications

1) Heater: it is a spiral type heater with nichrome wire having ceramic coating. This heater can be used as heating component for oven to produce and supply heating energy by using input as electrical energy its capacity may range from 1KW – 12KW typically heater is producing small amount of heat energy so in most of the system have multiple heaters can

be installed in various application to cover required heating area .it works on joules heating law. Air heater is device are used for heating air in the enclosed area they include forced air product well as all types of radiant & space heater. Forced air products moderate & control air temperature by circulating air through a heat source with a fan or blower. Heater is fitted between middle & inner sheets (walls) from top side, connection & wiring is enclosed within the two sheets (walls) .The recirculation hot air also pass through this gap over the heating elements to the job from bottom of the inner wall.

According to heat load capacity of oven heater selected-

Heater type: electrical spiral heater Weight of spiral heater: 450-500 grm. Capacity of heater: 0.5 kW, Operating voltage: 230 V, Operating frequency: 50 HZ, Length of heater: 13" or 330.2 mm, Diameter of heater: 7" or 177.8 mm, Total 75 heaters are used for 5 zone, 15 heaters per zone.

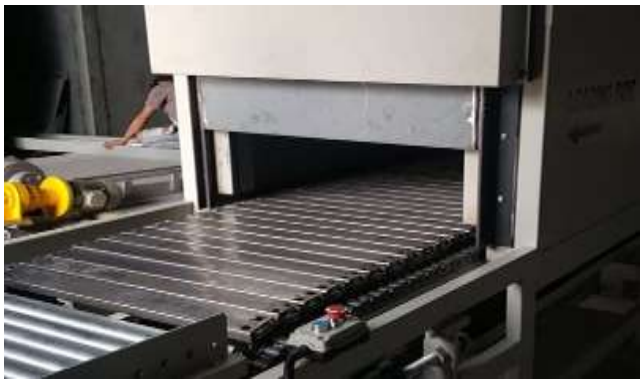


2) Blower: blower which is also referred sometimes as a fan in some literature to deliver the gas or air with appreciable pressure rise to overcome some kind of resistance in the flow, centrifugal blowers provides directional air flow by maximizing static pressure, making them optimal for spot cooling and air flow through a duct. The oven will have a blower on the roof mounted for inter circulation of hot air inside the oven will proper inter locking circuit. Selection of fan system depends on various conditions such as air flow rates, temperature of air, pressures etc.

According To Vertical Airflow and Considering Capacity of Heating-We Selected Blower Weight of blower: 4-5 kg, Operating voltage: 230 V, Power capacity: 1.5 HP, Rpm of blower: 1400, No. Of blower: 5, Power per zone =1.5*0.75 = 1.125 kw, Current per zone=1.1258*10^3/415*1.73 =1.56 A

3) Conveyor: conveyor is used for moving material through production line ,chain conveyor is used for continuous motion of product (Battery) in oven ,which is used for mass production product is loaded from one side and unloaded from another side. Conveyor utilizes power continuous belt arrangement as input for motion .it is popular, quick & efficient method for material handling. Conveyor material should withstand heavy loads without seizing due to deformation hence chain conveyor is best choice. The total cyclic process will be done by using chain conveyor by giving input from motor and gearbox for special purpose, required motion and time relation can be achieved by VFD (variable frequency Drive) for maintain the speed of conveyor. One motor is used in this oven.

Power capacity: 2 HP, Total power=2*0.75 =1.5 kw, Total current=1.5*10^3/415*1.73 =2.08 A



4) Controller Selected: Type of controller: P-I-D (Proportional-Integral-Derivative) , Sub type of controller: RTD SSR, Oprating current: 32 Ampere, Operating voltage: 230 V, Phase: single, No. of units: 5 in HEAT SINK

5) Variable Frequency Control: Operating power: 2 HP, Phase: 3ϕ drive with choke

Working

Drying oven consists of heater, blower, conveyor system, gearbox, motor etc. It uses 3 phase electrical energy to operate total system. Firstly convective heater system, conveyor system, blower system will be started, & waiting for optimum condition as to obtain specific temperature, airflow, motion of conveyor. the heating oven is kept open & empty till the temperature attain around 200°c, then battery lot fed through the loading side of oven on conveyor, then motion is transmitted through gear box to conveyor via chain & sprocket assembly for optimum & uniform heating. Blowers & fans operating in 5 sections to provide forced convection heat transfer .Velocity of the air to be transmitted inside is 4800 m^3/hr. Travel time for 1nos required 20 sec, PID controllers are used for maintaining the temperature between 200°c to 250°c. Heater of each of capacity 0.5 KW with uniform spacing as 7 on either side & 6 on other side are used. Rockwool as insulating material to reduce heat losses to the surrounding it gives best performance in low cost. Safety controller is used for limiting the temperature range up to 250°c. Duplex RTD temperature sensors is used for measuring temperature of oven. Rockwool as insulating material to reduce heat losses to the surrounding it gives best performance in low cost. Safety controller is used for limiting the temperature range up to 250°c. Duplex RTD temperature sensors is used for measuring temperature of oven. After removing the moisture batteries unloaded by other side. Cycle is completed and system will be reset.

CONCLUSION

The desired Set Temperature value is achieved. The continuous conveyor oven is running smoothly with effective speed control. With the help of PID, we can achieved accurate results i.e. maintain temperature, controls the speed of rotary system also Controls the blower's speed. Also with the Help of PID we control the loading and unloading movement. Using this method we remove the moisture content in batteries. According to above calculations and selections of different devices, the Design and Development of Battery Drying Oven is done successfully. By using this type of Battery Drying Oven the issue of moisture content of lead acid battery is resolved due to this efficiency and life of battery increased substantially the attempt made in fabricating of rotary curing oven with the available material is successful. The insulation provided is of material MS CRCA which gives proper robustness to the oven and provides proper insulation to achieve efficiency, flexibility to the Job Provided.

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