Design and Manufacturing of Semi-Automatic Blending and Packing Machine

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Abstract: In Medical Industry, mixing is a unit operation that involves manipulation of a heterogeneous physical system with the intent to make it more homogeneous.A blender a kitchen and laboratory appliance used to mix, purée, or emulsify food and other substances. A stationary blender consists of a blender jar with a rotating metal blade at the bottom, powered by an electric motor in the base. A stationary blender consists of a blender jar with a rotating metal blade at the bottom, powered by an electric motor in the base. At an industrial scale, efficient mixing can be difficult to achieve. A great deal of engineering effort goes into designing and improving mixing processes. Mixing at industrial scale is done in batches (dynamic mixing), inline or with help of static mixers. Gearboxes are used to reduce speed and increase torque. Some applications require the use of multi-shaft mixers, in which combinations of mixer types are used to completely blend the product.Blending is very important part in our food industry.Mixing of powders is of great importance in food, chemical and pharmaceutical industries. However, direct online measurement of mixing is impractical due to difficulties in real-time particle sampling. Blenders are blade grinders designed specifically for use with wet ingredients. Blenders are popular tools for production of purées and pastes, using both the cutting and shearing effects of high speed blades.

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INTRODUCTION

In Medical Industry process equipment used in the healthcare industry follow rigid specifications for accuracy, consistency and cleanliness. These regulations ensure that end products are safe, pure, and effective. In particular, mixing equipment employed in the production of pharmaceuticals and medical devices deal with a higher level of complexity because their use is more specialized. Not one design fits all.Mixing fulfils many objectives beyond simple combination of raw ingredients. These include preparing fine emulsions, reducing particle size, carrying out chemical reactions, manipulating rheology, dissolving components, facilitating heat transfer, etc. So even within a single pharmaceutical product line, it is not uncommon to employ a number of different style mixers to process raw ingredients, handle intermediates and prepare the finished product. Moreover, most pharmaceuticals are highly process-dependent. Next to the chemistry of the formulation itself, the mixing operation has a decided influence on whether a drug will deliver the accurate dosage, have an acceptable appearance and texture, or be stable for the appropriate length of time. The importance of proper mixer selection and optimal operation can hardly be over-estimated.Particle mixing is an important process in many foods, chemical and pharmaceutical production lines. Well mixed ingredients are key to product reliability and reproducibility in these applications. In pharmaceutical applications, for example, mixing is commonly used to ensure that active ingredients are evenly distributed for controlled release and correct dosage, and to give tablets an even appearance.We develop the machine that automatically mixes the ingredients as we required with the help of electric valves. When electric valves open all ingredients mix simultaneously with different quantity. Blade grinder, also known as propeller grinder, is a machine that chops material while mixing it, by means of a high-speed spinning blade.

PROBLEM STATEMENT

There are many methods for mixing two or more substance, it will be done by manually also, but proper mixing, time required for mixing will be the problem against it, so therefore we are designing it mechanically to overcome this problem.

OBJECTIVE

- To design and develop a system which can mix the four items.
- To study the conventional systems and their developments.
- To develop a model with the help of CATIA V5 R20 software.
- To analyses the system and accordingly perform the calculations.
- To manufacture the system and perform the testing accordingly.

APPLICATIONS

- Countertop blenders are designed to mix, purée, and chop food. Their strength is such that the ability to crush ice is an expected feature.
- Blenders are used both in home and commercial kitchens for various purposes.
- Grind semi-solid ingredients, such as fresh fruits and vegetables, into smooth purées
- Blend ice cream, milk, and sweet sauces to make milkshakes
- Mix and crush ice in cocktails such as the Zombie, piña colada and frozen margarita
- Crush ice and other ingredients in non-alcoholic drinks such as Frappuccino's and smoothies
- Emulsify mixtures
- Reduce small solids such as spices and seeds to smaller solids or completely powder or nut butter
- Blend mixtures of powders, granules, and/or liquids thoroughly
- Help dissolve solids into liquids

Blenders also have a variety of applications in microbiology and food science. In addition to standard food-type blenders, there is a variety of other configurations of blender for laboratories. A food processor is similar to a blender. The primary difference is that food processors use interchangeable blades and disks (attachments) rather than a fixed blade. Also, their bowls are wider and shorter, a more proper shape for the solid or semi-solid foods usually worked in a food processor

COMPONENTS

Hopper: Hopper is a large, pyramidal container used in industrial processes to hold particulate matter that has been collected from outside. Hopper is usually large in size to allow for a greater connection. A hopper is a funnel shaped device used to move material from one receptacle to another. We put all wastage into container with the help of hopper. Hopper is directly connected to the container. A
container for a loose bulk material such as grain, rock, or rubbish, typically one that tapers downward and is able to discharge its contents at the bottom. In our design hopper is in rectangular shape for more intake. Hopper is directly connected to the container. In hopper we attach the cutting blade. In this machinewe distribute hopper in 4 different parts. Because we need to add 4 different types of ingredients in blending machine

Pipes: Pipes are place at the bottom of the hopper. When we put the ingredients in hopper, pipes arepass that ingredient to the blender properly.

Electric flow control valve: Control valves are normally fitted with actuators and positioners. Pneumatically-actuated globe valves and diaphragm valves are widely used for control purposes in many industries, although quarter-turn types such as (modified) ball and butterfly valves are also used. Control valves can also work with hydraulic actuators (also known as hydraulic pilots). These types of valves are also known asautomatic control valves. The hydraulic actuators respond to changes of pressure or flow and will open/close the valve. Automatic control valves do not require an external power source, meaning that the fluid pressure is enough to open and close them.

Motors: Mainly motors are used to run the conveyor belt and the cutter blade. An electric motor is an electrical machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and electric current in a wire winding to generate force in the form of rotation of a shaft. Electric motors can be powered by direct current (DC) sources, such as from batteries, motor vehicles or rectifiers, or by alternating current (AC) sources, such as a power grid, inverters or electrical generators. An electric generator is mechanically identical to an electric motor, but operates in the reverse direction, converting mechanical energy into electrical energy.Electric motors may be classified by considerations such as power source type, internal construction, application and type of motion output. In addition to AC versus DC types, motors may be brushed or brushless, may be of various phase (see single-phase, two-phase, or three-phase), and may be either air-cooled or liquid-cooled. General-purpose motors with standard dimensions and characteristics provide convenient mechanical power for industrial use. The largest electric motors are used for ship propulsion, pipeline compression and pumped-storage applications with ratings reaching 100 megawatts. Electric motors are found in industrial fans, blowers and pumps, machine tools, household appliances, power tools and disk drives. Small motors may be found in electric watches.In this Machine we use motor for only running a mixing blade. Motor is place in the bottom of the system. We adjust the speed as machine required.

WORKING OF THE SYSTEM

A blender consists of a housing, motor, blades, and food container. A fan-cooled electric motor is secured into the housing by way of vibration dampers, and a small output shaft penetrates the upper housing and meshes with the blade assembly. Usually, a small rubber washer provides a seal around the output shaft to prevent liquid from entering the motor. Most blenders today have multiple speeds. As a typical blender has no gearbox, the multiple speeds are often implemented using a universal motor with multiple stator windings and/or multi-tapped stator windings; in a blender with electromechanical controls, the button (or other electrical switching device or position) for each different speed connects a different stator winding/tap or combination thereof. Each different combination of energized windings produces a different torque from the motor, which yields a different equilibrium speed in balance against the drag (resistance to rotation) of the blade assembly in contact with the material inside the food container. A notable exception from the mid-1960s is the Oster Model 412 Classic VIII (with the single knob) providing the lowest speed (Stir) using the aforementioned winding tap method but furnishing higher speeds (the continuously variable higher speed range is marked Puree to Liquify) by means of a mechanical speed governor that balances the force provided by flyweights against a spring force varied by the control knob when it is switched into the higher speed range. With this arrangement, when not set to the Stir speed, motor speed is constant even with varying load up to the point where power demanded by the load is equal to the motor's power capability at a particular speed. The more modern version of this arrangement is electronic speed control found on some units.

- We put ingredient in a hopper.
- We put 4 different types of ingredients in hopper as shown in fig.
- We adjust the flow rate of ingredient with the help of electronic valve
- After putting ingredient in hopper this ingredient passes on in blender with the help of pipes as shown in fig.
- This all ingredient adds in blender with different quantity.

With the help ofmotor, we run the blender

BASIC DESIGN CALCULATION

Power required for blender

$P = 2\Pi N / 60$

We are using 12 V, 5 Amp motor

$P = 2\Pi N / 60$

$60 = 2*3.14*60 * T/ 60$

$T = 9.554$ N m

Now, torque required

$T_{req} = f*R$

$= m * a *R$

$= 5$ kg $* 9.81 * 223.335$

$T_{req} = 10.954$ Nm

Flow rate of stream is equal to the flow velocity and cross area

$Q = A*V$

Now, from 1st pipe flow rate will be

$Q_1 = \Pi / 4 * (10)^2 *1000 = 78500$ mm^3/sec

From, 2nd pipe

$Q_2 = \Pi / 4 * (12)^2 *1000 = 113040$ mm^3/ sec

From, 3rd pipe

$Q_3 = \Pi /4 * (8)^{2}* 1000 = 50240$ mm^3/sec

From ,4th pipe

$Q_4 =\Pi / 4 * (4)^2 *1000 = 12560$ mm^3/sec

Now, total flow rate will be

$Q = Q_1 + Q_2 +Q_3 + Q_4$

$= 78500 + 113040 + 50240 + 12560$

$Q = 254340$ mm3/sec

$Q = 0.255 *10^{-3}$ m^3/sec

Now, for 10 sec

$Q = 0.255 *10^{-3} * 10Q = 2.55 * 10^{-3}$ m^3/s

SAFTY PRECAUTIONS

The following points should be considered for the safe operation of machine

And to avoid accidents: -

All the parts of the machine should be checked to be in perfect alignment.

- All the nuts and bolts should be perfectly tightened.
- The operating switch should be located at convenient distance from the operator so as to control the machine easily.
- The inspection and maintenance of the machine should be done from time to time

CONCLUSIONS

In this semester we have successfully designed CAD Modeland done the material selection for a different part. For that purpose, we have used the CATIA V5 R20 software.

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