

Sky Candle Special Purpose Machine Overview

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ABSTRACT: Normally a sky candle is made manually by hand (handmade) for medium and small scale industries. This paper gives an insight about automatic sky candle machines. In this machine, an automated system is used to make more sky candles in less time in an easy way which can be used in small scale industries at lower cost. The sky candle machines are made with the use of PU conveyor belt to move material forward and also used to apply glue on cardboard used in making of sky candle, pneumatic cylinders for pick and place material from conveyor belt and plc programming is used to make the system operate automatically. The main advantage of sky candle spm is to improve product quality, repetition of work and increasing production rate.

KEYWORDS: Pneumatic Cylinder, flat conveyor belt, Compressor, PLC programming, pneumatic connectors and reducers, automation, directional control valve, pneumatic fittings.

I. INTRODUCTION:

In Industries, sky candles are handmade which requires a lot of manpower and time. In this machine, we are using PLC programming to run the machine automatically to make sky candles. These machines should be easy to operate and maintain also. Hence, we are introducing a sky candle spm which will reduce manufacturing cost and minimize industrial labor problems which is the biggest headache for humans. The main objective for our project is to perform product holding operations effectively with less human efforts by using a machine with the programming power. This will also reduce the time required for metal cutting. By using these machines we can increase the production rate and automatically the industry will be in profit. Automation plays an important role in mass production. Automation can be achieved through programming. The main advantage of the system is that it is economically

cheap and easy to handle. The manufacturing operation is being automatic for the following reasons- To reduce human efforts, To increase production rate, To increase efficiency of industry, To reduce workload, To reduce production time

II. LITERATURE REVIEW:

Looking at the above image are three major parts of akash kandil: The Cardboard, Pakli (folded parts), and Zhurmuli (floating part). The pakli's stucked over the cardboard which is folded cylindrically, specifically 9 folded pakli's and zhurmuli are fixed below pakli which are floating in air (one side is fixed). so looking at the above design we get an idea that these are small and lightweight parts so operations should be done one by one. So we came up with a pick and place pneumatic cylinders system for picking and placing cardboard, pakali and zhurmuli and a conveyor system to carry and move them. Pneumatic Pick and Place System is widely used in automation industries to carry out small processes, which are controlled by PLC. The whole assembly of hardware is divided into two sections. It includes Conveyor operation and Pneumatic System. PROPOSED WORK- Initially machine picks cardboard from magazine with the help of pneumatic grippers and then both conveyor operation and pneumatic operation works simultaneously.



Types of pneumatic cylinders:

There are three main types of pneumatic cylinders, including:

1) **Single Acting Cylinders** - Single acting pneumatic cylinders only work on one end of the piston, compared to the double acting pneumatic

cylinder, which operates on both. The single-acting cylinder is most commonly used in internal engines, such as car engines, where it relies on an element, including springs or a foreign load to push the piston in the other direction, creating the motion. Single acting pneumatic cylinders are sometimes also found in pumps and hydraulic rams, helping with heavy duty jobs, such as lifting heavy materials.

2) Double Acting Cylinders - Double acting pneumatic cylinders operate on both ends of the piston, one element is used for the outstroke, while the other is used for instroke. While single acting pistons are most commonly used in internal engines, double acting pistons can be found in machinery such as steam engines, which is known as an external engine. This is because double acting pneumatic cylinders produce force from both ends of the piston.

3) Telescoping Cylinders - Telescoping cylinders also known as telescopic cylinders, these pneumatic cylinders are available in both double and single acting. They include a piston rod which, when activated, 'telescopes' as a segmented piston, providing an extended reach. Telescoping cylinders are often used in applications where minimal pressure is applied.

So as in the above study we can only use Double Acting Cylinders because we need load to move in both directions (i.e picking and placing) .

DOUBLE ACTING CYLINDERS- Double acting cylinders are a useful application when your machine requires more than one movement . Unlike single acting air cylinders, double acting cylinders can extend and retract without the need of aspirating. Instead of applying pressurized air into one port, double acting cylinders have two ports where air can enter in and out. Double acting pneumatic cylinders are mostly used in industrial and robotics industries. They perform tasks such as opening/closing doors and lifting and moving merchandise off conveyor belts. Other uses include medical applications, earth-moving equipment and space programs.



TYPES OF CONVEYOR:

1. Cleated Belt Conveyor - The vertical cleats are distributed along the width of the belt in the cleated belt conveyor. The function of cleats are to support the material and realize the large angle transportation. Cleated belt conveyor is widely used in coal, grain, building materials, chemical industry, hydropower and metallurgy industries. In the range of -19°C – $+40^{\circ}\text{C}$, it transports all kinds of easily scattered powder, granular, small block, paste and liquid materials with a stacking proportion of $0.5\text{-}2.5\text{ t/m}^3$.

2. Inclined Belt Conveyor - When materials need to be raised or lowered, it is often necessary to use inclined belt conveyors, but there is a certain limit to the tilt. Generally, the tilt up angle is not more than 18° .

3. Flat Belt Conveyor - Flat belt conveyor has the general structure and characteristics of the belt conveyor, which is suitable for the transportation of irregular shape and light weight objects, such as postal parcels, clothes, paper products, plastic products, etc. The flat belt conveyor is divided into built-in motor type, head drive type and middle drive type.

4. Trough Belt Conveyor - Trough belt conveyor has a large loading and conveying capacity, the conveyor belt of the trough belt conveyor adopts multi-layer rubber belt, with the belt width of 500mm, 650mm, 800mm, 1000mm, 1200mm and 1400mm. The carrying side conveyopr belt is supported by a troughed idler that composed of 3 rollers (the angle of the trough can reach 45°), and the return idlers are supported by flat rollers. Trough belt conveyors are widely used in electric power, iron and steel, mining, port, cement, grain, feed processing industry. Trough belt conveyors can transport bulk materials with large proportion such as coal, ore, soil, chemical raw materials, grain, etc., which are more suitable for a relatively

poor production environment.

5. Roller Bed Belt Conveyor - Roller bed belt conveyor is a kind of conveyor which uses several rollers which are set up on the fixed support according to a certain distance to transport goods. Roller bed belt conveyor is suitable for all kinds of boxes, bags, pallets and other pieces of cargo transportation, mostly used for station or airport luggage sorting. Roller bed belt conveyor can be used alone or in combination with other conveyors or working machines on the assembly line. It has the advantages of simple structure, reliable operation, flexible line layout, etc. According to whether the roller has driving device or not, the roller bed belt conveyor can be divided into two types: unpowered type and power type.

6. Portable Belt Conveyor - Universal wheels are installed at the bottom of the portable belt conveyor, which can move freely according to the stacking position of the materials, and are mostly used in the environment with small conveying inclination angle. Portable belt conveyor is mainly used in places where loading and unloading places change frequently, such as ports, wharves, stations, coal plant, warehouses, construction sites, sand and stone plant, farms, etc., for short-distance transportation and loading and unloading of bulk materials or single weight of less than 100 kg of finished goods.

7. Retractable Belt Conveyor - The frame of the retractable belt conveyor is equipped with a storage belt device, which can make the belt stretch freely in the length direction and adjust the conveyor length according to the change of the belt working position at any time. Retractable belt conveyor is the most efficient and commonly used machine in the continuous conveying of materials. It is the main equipment of coal conveying system in coal preparation plant and power plants.

8. Curved Belt Conveyor - Generally, the belt conveyor can only run in a straight line on a horizontal or vertical plane. To bypass obstacles or unfavorable sections, an intermediate transfer station needs to be set up, which has a high engineering cost. Curved belt conveyor realizes the natural curves of the conveyor by changing the arrangement angle of the idler group, reduces the transfer station numbers, and solves a series of problems brought by the transfer station. Curved belt conveyor has been widely used in mining, metallurgy, chemical industry, power station and ports, especially for long-distance transportation.

9. Steel Belt Conveyor - Steel belt conveyor uses stainless steel belt instead of belt. For the belt conveyor will release harmful substances when conveying materials with high temperature, while

the steel belt will not, steel belt conveyor is more suitable for material conveying in the food industry.

10. Special Belt Conveyor - Special belt conveyor is designed separately for the transportation of goods under special circumstances, which has a small range of applicability. Some of these are: magnetic belt conveyor, narrow belt conveyor, acid and alkali resistant belt conveyor, flame retardant belt conveyor, etc.

5 Types of Conveyor Belt Materials

1)PVC Conveyor Belt - PVC conveyor belt is a white or light colored, pollution-free conveyor belt made of high strength and quality cotton, nylon, polyester canvas as the belt core and combined with natural PVC. PVC conveyor belt features good elasticity, not easy to deform and wear-resistant. It is mainly used in food, tobacco, logistics, packaging and other industries. At the same time, it is suitable for underground transportation of coal mines, as well as material transportation of metallurgy and chemical industries.

2)PU Conveyor Belt - Polyurethane (PU) conveyor belt, with strong tear resistance, good elasticity, certain impact resistance, can be used normally under complex conditions, but also has good water resistance, can be used normally even in cold and humid conditions, without any impact on the conveyor belt. Polyester conveyor belt price is relatively high, but in the long run, polyester conveyor belt will be more economic.

3)PE Conveyor Belt - PE conveyor belt has high tensile strength, good flexibility, light, thin, tough, oil resistant, non-toxic, hygienic and easy to clean. PE conveyor belt conforms to the American FDA health standards, can be in direct contact with food, medicine, etc., and is a durable conveyor product.

4)Plastic Interlocking Belt - Plastic interlocking belts refer to the conveyor belt which is molded by plastic Thermoplastics into a single plate semi-finished product module, then repeatedly assembled into a chain type by the module, and installed on the conveyor to carry and transport materials. Plastic interlocking belt is a new type of conveyor belt, which has many advantages over the traditional conveyor belt: high strength, acid resistance, alkali resistance and salt water, wide temperature range, good anti viscosity, can be added with cleats, large lifting angle, easy cleaning, simple maintenance, and can be used for transportation in various environments.

5)Metal Conveyor Belt - According to different weaving methods, metal conveyor belt can be divided into different types, such as diamond mesh

belt, trapezoid metal mesh belt, ball mesh belt, u-chain mesh belt. The material of metal conveyor belt can also be used according to different requirements: stainless steel wire, carbon steel wire, polyester wire and galvanized wire, etc. Metal conveyor belt is characterized by high temperature resistance, wear resistance, corrosion resistance, high tensile strength and long service life. Stainless steel conveyor belt is the most widely used among the metal conveyor belts, which is widely used in stainless steel tableware annealing, glass products, machinery, powder metallurgy, etc.

As per above study flat belts are suitable for lightweight operations as sky candles contain light material and can be carried easily and also PU conveyor belt material is used.



PNEUMATIC FITTINGS

1. PNEUMATIC COUPLING AIR CONNECTORS: Pneumatic push-in fittings, also known as push fittings, are the standard on the pneumatic fittings market and are the most widely used. A pneumatic coupling is used to connect compressed air tools to a

compressed air line. A pneumatic coupler allows a tool to be easily connected or disconnected to a hose or pipe while it is under pressure. The system consists of two parts: the quick coupling (the female part) and the plug-in or nipple (the male part).



2. PNEUMATIC REDUCERS: A reducer is a kind of pipe fitting used in process piping that reduces the pipe size from a larger bore to a smaller bore (inner diameter). A reducer allows for a change in pipe size to meet pneumatic flow requirements of the system, or to adapt to existing piping of different sizes.



3. PNEUMATIC HOSE AND TUBE: Hoses and tubes are regularly used in pneumatic systems to distribute compressed air to the different components of the system. Polyurethane (PU) tubing is the most common type of tubing used for pneumatic applications. The PU material makes it durable, gives it good resistance to kinks and abrasions, and it is readily available. In this machine different diameter pneumatic tubes are used because somewhere we need more pressure and somewhere high.



4. **VACUUM GRIPPERS:** Vacuum grippers use the difference between atmospheric pressure and a vacuum to lift, hold and move objects. Operate by simply connecting 1 compressed air supply tube. Vacuum Grippers can handle a wide range of applications and are ideal for picking up uneven and even workpieces made of different materials, such as cardboard, glass, sheet metal (dry) and plastic. Because of the customizable bracket and unique air nodes. Vacuum Grippers provide manufacturers full control over their Gripper to make sure it's a perfect fit for their applications.



5. **DIRECTIONAL CONTROL VALVE :** It is the fundamental part of the pneumatic system. Allows the fluid to flow into different paths. It has Inlet from Compressor and Outlet to cylinders. The Electromechanical coil is lying inside it. The Operating Voltage is 12V-24V DC.

3-way, 2-position, normally closed direct-acting solenoid valve, spring return



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ADVANTAGES-

1. Easy maintenance and repair
2. Low investing cost
3. As we are using compressors to compress air, air is available everywhere it can be stored easily.
4. High speed operation performed
5. Continuous operation is possible without stopping
6. All movements are program operated
7. Technology can be easily learned
8. simple in construction

PHoses and tubes are regularly used in pneumatic systems to distribute compressed air to the different components of the system.

DISADVANTAGE-

1. Silencer must be use while compressing the air
2. Machine is heavy to carry , Crane required to lift machine

III. FUTURE SCOPE:

Since old age men always have time to gain more and more luxurious. Man is always trending to develop more and more modified techniques with the increasing ascetic look and economic consideration, hence there is always a lot of scope but being the mechanical engineers and having the ability to think and plan but due to font , we only have thought and put in the report the following future modification.

1. In future a cutting table for material cutting can also be installed side by side for cardboard, pakli and zhurmuli cutting of different sizes and shapes to get different designs of sky candles.
2. A normal compressor (i.e too noisy) is replaced by noiseless compressors to reduce noise pollution.
3. The place where there is scarcity of the electricity the electric motor operated compressor is replaced by an IC engine install compressor.
4. In this machine , compress air is used in pneumatic cylinders to move , pick and place the material. After the completion of the cycle the air moves out through the outward valve, this air is released to the atmosphere. In future the mechanism can be developed to use this air again for the working of the cylinder.

Thus in future there are many modifications, which we can make to survive the huge global work of computation.

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