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Automatic Ream Handling For Automatic Storage and Retrieval System

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Abstract- **Tamil Nadu Newsprint and Papers Limited (TNPL) produces sheet bundle which is called ream can be stored in AS/RS (Automatic Storage and Retrieval System) of 7000 tons capacity. Reams which are stored in AS/RS can be retrieved and ready for loading point at any time. AS/RS system process is controlled by PLC (Programmable Logic Controller using the PLC process can be controlled manually and automatically as well. In TNPL finishing house area, the reams are packed manually by using brown sheet and being sent to the shrink wrapping machine. In which reams are packed by polythene cover. A single ream bundle contains 500 sheets and 4 or 5 reams are sent for eight fans for reams packing operation. From shrink wrapping machine the packed reams are collected and fed in to the AS/RS input conveyor manually. In our project the system eliminates manual handling and will be controlled by PLC with automation and manual control. By extending the output conveyor from shrink wrapping machine reams are pushed to the next perpendicular conveyor using hydraulic pusher and collected by input conveyor of AS/RS. The system also comprises storage conveyor to control the ream flow during maximum production. This system will produce the time consumption and manual efforts.**

I. INTRODUCTION

TNPL produces sheet bundle which is called Ream can be stored in AS/RS(Automatic Storage and Retrieval System) of 7000 tons capacity. Reams which are stored in AS/RS can be retrieved and ready for loading point at any time. AS/RS system process is controlled by PLC (Programmable Logic Controller), using the PLC process can be controlled manually and automatically as well. In TNPL finishing house area, the reams are packed manually by using brown sheet and being sent to the shrink wrapping machine. In which reams are packed by polythene cover. A single ream bundle contains 500 sheets and 4 or 5 reams are sent for eight fans for reams packing operation. From shrink wrapping machine the packed reams are collected and fed in to the AS/RS input conveyor manually.

In our project the system eliminates manual handling and will be controlled by PLC with automation and manual control. By extending the output conveyor from shrink wrapping machine reams are pushed to the next perpendicular conveyor using hydraulic pusher and collected by input conveyor of AS/RS. The system also comprises storage conveyor to control the ream flow during maximum production. This system will produce the time consumption and manual efforts.

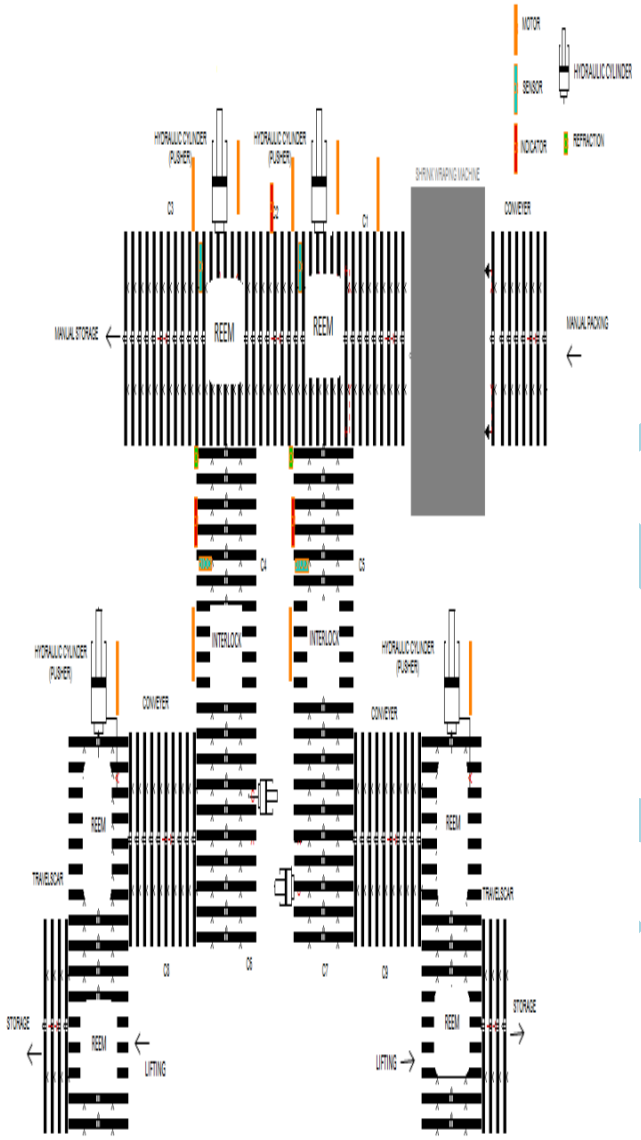
1. Conveyors
2. Shrink Wrapping Machine
3. Hydraulic Pusher
4. Solenoid Valves
5. Barcode Readers
6. Indicators

Using the above equipments along with the PLC, Proximity sensors the process is completely automated. The following will be the sequence of events required by the clients to happen.

II. SEQUENCE OF EVENTS

1. Initially assume that all devices are in automated view.
2. Reams are being loaded in conveyor.
3. The bundle which is called ream are output of the shrink wrapping machine are collected by the extended conveyor.
4. Prescribed load withstanding limit of ream is say approximately 60- 70kg.
5. When the start is “on” the ream which is from the shrink wrapping machine moved to the extended conveyor.
6. The reams moved are sensed by the “object sensor” and moved to the perpendicular conveyors by the use of hydraulic pusher.
7. Immediately after reaching the ream to the respected area it will sensed by the sensor and pushed by the another hydraulic pusher.
8. The reams pushed by the hydraulic pusher are loaded to the pallets which are capable of loading capacity of 3½ tonnes.
9. The reams loaded in the pallet are lifted by the “lifter” and which are to be taken to the “travels car”.
10. The pallet loaded in the travels car are travelled to the storage area and stored in the respected area with respect to the barcode.

11. If the storage area is completely full, immediately it will indicate and “alarm” is “on” the reams are moved to the manual storage.
12. The above process is handled by plc programming language through the automation.



III. ROLLER CONVEYOR

Roller conveyors are, as their title suggests, powered via a shaft beneath the rollers. These conveyors are suitable for light applications up to 20 kg such as cardboard boxes and tote boxes. A single shaft runs below the rollers running the length of the conveyor. On the shaft there are a series of spools; one spool for each roller. A rubber o-ring runs from a spool on the powered shaft to each roller. When the shaft is powered the rubber o-ring acts as a chain between the spool and the roller making the roller rotate. The rotating of the rollers pushes the product along the conveyor. The shaft is usually driven by an electrical motor, which is generally controlled by the an electronic PLC.A PLC (Programmable Logic Controller) electronically controls how specific sections of the conveyor system interact with the product being conveyed.

IV. HYDRAULIC DRIVE SYSTEM

A hydraulic drive system is a drive or transmission system that uses pressurized hydraulic fluid to drive hydraulic machinery. The term hydrostatic refers to the transfer of energy from flow and pressure, not from the kinetic energy of the flow. A hydraulic drive system consists of three parts: The generator driven by an electric motor, a combustion engine , valves, filters, piping etc.

Pascal's law

The principle of hydraulic drive system is Pascal’s law .the law state that as the pressure in the system is the same ,the force that the fluid gives to the surrounding is therefore equal to pressure*area. a small piston experiences a small force and a large piston experiences a large force

Hydraulic cylinders (also called linear hydraulic motors) are mechanical actuators that are used to give a linear force through a linear stroke. Hydraulic cylinders are able to give pushing and pulling forces of millions of metric tons with only a simple hydraulic system. Very simple hydraulic cylinders are used in presses; here, the cylinder consists of a volume in a piece of iron with a plunger pushed in it and sealed with a cover. By pumping hydraulic fluid in the volume, the plunger is pushed out with a force of plunger-area pressure.

V. BAR CODE READERS

A barcode reader (or barcode scanner) is an electronic device for reading printed barcodes. Like a flatbed scanner, it consists of a light source, a lens and alight sensor translating optical impulses into electrical ones. Additionally, nearly all barcode readers contain decoder circuitry analyzing the barcode's image data provided by the sensor and sending the barcode's content to the scanner's output port.

Pallet bar code

Bundle bar code

VI. PROXIMITY SENSORS

A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact. A proximity sensor often emits an electromagnetic field or a beam of electromagnetic radiation and looks for changes in the fielder return signal. The object being sensed is often referred to as the proximity sensor's target. Different proximity sensor targets demand different sensors. For example, a capacitive photoelectric sensor might be suitable for a plastic target; an inductive proximity sensor always requires a metal target.

The maximum distance that this sensor can detect is defined "nominal range". Some sensors have adjustments of the nominal range or means to report a graduated detection distance. Proximity sensors can have a high reliability and long functional life because of the absence of mechanical parts and lack of physical contact between sensor and the sensed object. Proximity sensors are also used in machine vibration monitoring to measure the variation in distance between a shaft and its support bearing. This is common in large steam turbines, compressors, and motors that use sleeve- type bearings. A proximity sensor adjusted to a very short range is often used as a touch switch.

ELEMENTS OF INDUCTIVE SENSORS

- Field sensor
- Oscillator
- Demodulator
- Flip-Flop
- Output

An inductive sensor is an electronic proximity sensor, which detects metallic objects without touching them. The sensor consists of an induction loop. Electric current generates a magnetic field, which collapses generating a current that falls asymptotically toward zero from its initial level when the input electricity ceases. The inductance of the loop changes according to the material inside it and since metals are much more effective inductors than other materials the presence of metal increases the current flowing through the loop. This change can be detected by sensing circuitry, which can signal to some other device whenever metal is detected.

VII. SHRINK WRAPING MACHINE

Shrink wrap, also shrink wrap or shrink film, is a material made up of polymer plastic film. When heat is applied, it shrinks tightly over whatever it is covering. Heat can be applied with a hand held heat gun (electric or gas)or the product and film can pass through a heat tunnel on a conveyor.

COMPOSITION

The most commonly used shrink wrap is polyolefin. It is available in a variety of thickness, clarities, strengths and shrink ratios. The two primary films can be either cross linked, or non cross linked. Other shrink films include PVC and several other compositions.

Co extrusions and laminations are available for specific mechanical and barrier properties for shrink wrapping food. For example, five layers might be configuration as EP/EVA/co polyester/EVA/EP, where EP is ethylene – propylene and EVA is ethylene –vinyl acetate copolymer.
A Shrink film can be made to shrink in one direction (unidirectional or mono-directional) or in both directions (bidirectional).

Films are stretched when they are warm to orient initial random pattern. Cooling the film sets the film's characteristics until it is reheated: this causes it to shrink back toward its initial dimensions.

Prior to orientation, the molecules of a sheet or tube are randomly intertwined like bowl of spaghetti. The molecules are coiled and twisted and have no particular alignment. However when a draw force is imposed, the amorphous regions of the chains are straightened and aligned to the direction of orientation. By applying proper cooling, the molecules will be frozen in this state until sufficient heat energy is applied to allow the chains to shrink back. One can visualize this phenomenon by stretching a rubber band and dipping it into liquid nitrogen so as to freeze in the temperatures. However, when enough heat energy is applied, the rubber band will shrink back to its original relaxed state Orientation on a commercial scale can be achieved using either of two processes: a tenterframe or a bubble process. Tenterframe technology is used to produce a variety of "heat-set" products, with biaxially oriented polypropylene (BOPP) being the most common (heat setting is a process whereby a film is reheated in a constrained state such that the shrink properties are destroyed).

The second commercial process is the bubble process, sometimes referred to as the tubular process. In this process, a primary tube is produced by either blowing or casting the tube onto an external or internal mandrel, respectively. It is common to use water to help cool the primary tube at this point. After the primary tube has been cooled, it is then reheated and inflated into a second bubble using air much like a balloon is blown. Upon inflation, the tube is oriented in both directions simultaneous.

VIII.INDICATOR

The five LEDs on the side of the scanner indicate the following:

LED	Colour	Description
READY	Green	This LED indicates the device is ready to operate. For Subzero models this LED blinks during the warm- up phase.
GOOD	Green	This LED confirms successful reading.
TRIGGER	Yellow	This LED indicates the status of the reading phase.
COM	Yellow	This LED indicates active communication on main serial port.
STATU S	Red	This LED indicates a NO READ result.

In On-Line mode the TRIGGER LED corresponds to the active reading phase signaled by the Presence Sensor. In Automatic and Continuous modes the TRIGGER LED is always on indicating that the reader is ready to read a code.

When connected to a Field bus network through the CBX500, the COM LED is always active, even in the absence of data transmission, because of polling activity on the Field bus network. During the reader startup (reset or restart phase), all the LEDs blink for one second. On the back of the reader near the cable, the "POWER ON" LED indicates the laser scanners correctly powered.

IX .CONCLUSION

The PLC being an effective tool in automation can automate any process logically along with the usage of I/O's. The main advantage in this regard is the retentively. Even if one PLC fails, the another PLC connected in the same network will retake the process without causing any interruption or malfunction. This kind of Cheaper and well efficient design if installed can create a perfect sequence of operation. The main Moto is to provide smooth and precise handling of paper storage. Since everything is automated the storage and

retrieval process with quick and more efficient then input to the system requires more consistent. Our project ensures the same. Similarly in case of production expansion the system needs some small changes in program generally in timer circuits. Thus a separate setup is not required such that the existing system itself will be well sufficient to meet maximum production.

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