TECHNICAL NOTE NO. 1

HOW TO UNDERSTAND PRESSURE SENSITIVE LABELING EQUIPMENT

Pressure Sensitive Labelers have been around for over 25 years and have evolved from simply placing a small label on flat products at slow speeds to product orientation for specific label placement at 30 per min to 600 per minute coupon labeling.

Today Pressure Sensitive is considered in almost every application in pharmaceutical, cosmetic and in areas never considered previously such as ketchup and other high volume products. However, as complicated as Pressure Sensitive Labeler appear, they can be thought of in easy to digest segments.

Every Pressure Sensitive Labeler can be thought of having only three basic parts.

1. The Labeling Head: Its function is to accurately dispense a single label to the applicator at the required speed.
2. The Applicator: Its only function is to accurately place the label on the product at the required speed.
3. The Product Handling System: Its only function is to place the product consistently at the required sped in position for the applicator to do its job.

These three parts are present in every Pressure Sensitive Labeling System ever manufactured. By understanding how they go together to make a system, it will enable you to be more valuable to your customers.

There are other components that could be part of the Labeling System and will discuss them later in this technical not. One type bears mentioning Coders and Imprinters are used to print a batch and lot code for pharmaceutical applications or a code number for cosmetic and other applications. This coding or "Imprinting" is done before the label is dispensed.

The Specifics:

1. The Labeling Head: As we stated its function is to accurately dispense a label from the carrier paper (web or tape) to the applicator at the required speeds. Referring to figures 1 and 2 a Labeling Head is a motor driven tape (web) transport mechanism similar to tape recorder, that can move tape (web) at speeds up to 3000 inches per minute and is able to stop within ± 1/64" on command. The label, which is on the tape (web), is dispensed when it reaches the Peeling bar.

Fig. 1 - TAPE RECORDER

Fig. 2 - LABELING HEAD

Now that you understand that part of the transport lets discuss other important parts of the labeler.

How and what controls the starting and stopping of the labeling head is probably your next question: Well, the labeling head has a single completely solid state (Integrated circuits) Control Module.

1. By use of a light source and a phototransistor it reads the gap (matrix) between labels to tell the labeler to stop.

2. If there is a coder, the Module tells it when to operate.
3. By use of a Product Sensor it reads the presence of products to be labeled.
4. It controls the applicator.
5. It starts and stops the web drive.

Consider the control package as a black box with the following diagram showing the flow of events:

Flow Chart is Inserted Here

Your color TV set in your living room is about ten times more complex than the above control package. Your color TV has typically 9 controls so that you can optimize for various parameters. The control package has a total of 5 controls to adjust for the various functions of the labeler to optimize its function for a particular product and label. Referring to the Model 3000 Brochure you will see a front panel control which controls the label sensitivity adjustment. There are only four adjustments on the control module. There are adjustments for:

1. Applicator - Controls the speed of the applicator cycle, can be set for 20/minutes to 750/minutes.
2. Clutch Feed - This adjusts the delay on the clutched engagement preventing a label being dispenses before the applicator has returned to its label pick up position.
3. Label Stop - This control positions the label to the edge of the peeler bar.
4. Printer - This controls the firing sequence of the printer so that it fires when the label is stationary.

More about the circuit board and its special features later.

The Sequences of events for a roller applicator, referring to the control package diagram are:

1. The product passes the product sensor and a signal is sent to the control module.
2. The control module turns on the clutch, releasing the brake enabling the motor to advance the label.
3. At the same time the applicator is applying the label web to the product which is going by.
4. The label sensor is reading and looking for the gap between labels. When it finds the gap between labels a signal is sent to the control module.
5. This signal from the label sensor shuts off the drive signal to the clutch, engages the brake stopping the web.
6. The coder is energized white the label is standing still between dispensing functions.
7. The systems is now ready for the nest product and will repeat all the above steps.

B. The Applicators: As we stated before, the applicator's only function is to accurately place the label on the product at the required speed.

For single panel applications there may be as many as four applicators that can do the job, however, the product shape, product handling, sped and desired accuracy may allow only one efficient choice. We will discuss these aspects later on. But first lets discuss the individual types of applicators.

<u>Pad/Brush Wipe Applicator</u>

This is the simplest of all label applicators. It consists of a rubber pad or brush mounted just after the peeler bar and as the label is dispensed it literally wipes the label onto the product. It requires that the speed of label dispense be close to the speed of the product. This is accomplished by a manually adjustable, variable speed motor in the labeling head or a tachometer controlled variable speed motor. Speeds up to 300/min, accuracies up to ± 1/32" with tach generator and up to ± 1/16 with a Pad. Products can vary in height and have complex surfaces.

BRUSH/PAD (Picture)

2. Roll-On- This method is the oldest and most basic method of applying labels. It does exactly what is says- it rolls on the label as the label is being dispenses onto a moving product. It is capable of high speeds with goo accuracy. The roller, usually made of foam or rubber, is usually spring loaded and mounted just ahead of the peeler bar. It has been used at cycling speeds of up to 1200 per minute with accuracies at the speed of ± 1/8" to speeds of 300 cycles per minute with accuracies approaching ± 1/32". The limitations of the roll-on applicator are that the label must feed in the direction of product travel and the surface is usually flat or with a slight oval. The key to a successful roll-on application is that either the web speed must match the speed of the product or dispense the label onto a vacuum grid and let the product take the label away. Further explanation of this will be advanced when we talk about product handling in the next section.

ROLL-ON(Picture)

3. Air-Jet- This method is basically the same as a roll-on applicator that has been converted by removing the roller and replacing it with an air manifold, air valve, and timing circuit. An air manifold is a tube with a number of holes in a straight line along the length with on end closed and other end connected to the air supply. The manifold creates a "curtain" of air that is developed only when the label is feeding.

This curtain of air acts like a roller except that is more forgiving of variation in product height or width and shape. The air jet applicator is excellent for fragile products. Typical speeds 200-300/min. With accuracies up to ± 1/16.

AIR JET(Picture)

4. Air Cylinder Tamp Applicator- The air cylinder tamp applicator is the slowest of all methods commonly used but it is the most accurate. Am air cylinder is a closed cylinder with a tightly fitted piston inside connected to a shaft which extends through a seal that allows no air to escape. At each end of the cylinder there are air inlets to let air in and out. By switching air at high pressure into the inlet opposite from the piston's shaft we will push the piston and shaft combination down, extending the shaft some 2" plus by switching the use of internal and external guides we can, over short distances (2" or less) maintain a positional accuracy from extended to retracted position of ± 1/64 or better by placing a metal plate with a foam pad on the end of the shaft and include vacuum systems on the pad we can hold a label on the foam and them deliver it accurately to the vacuum of the applicator, the stays with the product. Speed of 50 to 60 per minute for stationary products are standard with most Labeling Companies. However our recently developed High Speed Tamp Applicator is capable of speeds of 200 per minute with high accuracy on both moving and stationary (indexing) products, more on this applicator later.

AIR CYLINDER TAMP(Picture)

5. Air Cylinder Roll-On Applicator- By combining the Roll-On applicator with an air cylinder, we had an applicator that can push a roller down onto a product. This enables easy set up, high accuracy (± 1/32), standard Roll-On Applicator. Speed matching is not required with this approach.

AIR CYLINDER ROLL-ON(Picture)

6. Vacuum Blow/Air Blast Applicator- This method blows the label down onto the product with a controlled blast of air. For good accuracy the distances between the product and the grid must be controlled closely. This applicator cannot wrap without additional components and has difficulty in accurately placing large labels. Under1/2" diameter there are also difficulties. At 300/min a 1" label accuracy will be about ± 1/16 consistently.

AIR BLAST/VACUUM BLOW(Picture)

C. The Product Handling: As mentioned previously, its only function is to place the product consistently in position for the applicator at the required speed. There are a number of time proven handling systems. We will discuss the range from semi-automatic to high speed automatic handling systems.

1. Semi Automatic Fixturing: A semi-automatic labeler is a labeler in which the operator inserts and them removes the product from molded using quick setting epoxies, or it is machined out of metal to the shape of the product. This fixture is them mounted below the label applicator, which us usually an air cylinder tamp. The fixture can also be just a right angle fixture of a V if the product is round. Obviously these simple product fixtures are low cost, but care still has to be maintained.

Note: If the product is made out of plastic of any kind, or molded glass make sure you ask for samples from each cavity mold. If you don't you can end up with a fixture where some parts won't even fit!

2. Conveyor: The conveyor is made of connected table top chain made of hard plastic (delrin) or other suitable material about 3" to 6" wide driven by a SCR

controlled variable speed motor. This becomes the next level of product handling. Of course, we are assuming the products can stand by themselves. With a simple conveyor like this, guide rails can control the product reasonably if the product is round, square, or rectangular. Oval shapes such as shampoo bottles cannot be correctly controlled without additional components. If this conveyor is being hooked up to the out put of another conveyor, speeding up the labeler's conveyor will control the spacing between products. Typical conveyor lengths are 72 inches long by 4 inches wide. Other sizes are available.

3. Timing Screw: The function of a timing screw is to separate butted products on a conveyor and space them out. They will be consistently in the same position and at the same rate of speed as the conveyor at the end of the screw. A timing screw is a constant diameter, variable pitch screw, made out of hard plastic. By constructing the screw face in steps or angular cuts or both, just about any product can be straightened, and spaced and positioned accurately. In high accuracy front and/or front and back applications, a two screws used for oval shapes. That is a timing screw on each side of the product with one slightly offset. Then the products is captured by a top hold down belt while still in the screws. The screws straighten and space the product and the top hold down belt holds it in place. This allows front and back labeling simultaneously.

4. Top Hold Down Belt: This assembly sits above the conveyor on an adjustable column for up and down travel. It is a driven rubber of foam that had a little give, so that products can be held without shifting on a conveyor.

5. Star Wheel: A star wheel is another product handling device and is usually used for spacing of products. It is a single or double stacked wheel with4, 6, or 8 pockets cut to the diameter or shape of the container. It rotates in relation with the conveyor. In this way we can space the products easily and a different product size wheel put into place with only the necessity of adjusting the guide rails.

6. Indexing Tables: This is a precision rotary mechanical device that can move through 4, 6, or 16 positions with an accuracy of ± .003 at each position. A metal plate with fixtures or a starwheel is attached that enables round oval, rectangular products to be positioned accurately for top, side or bottom labeling. A tamp or air cylinder applicator is used because the product is motionless and high product placement accuracy is achieved. Speeds of 40/min. are normal for hand placement into the fixtures or starwheel pockets with speeds of 100/min. being used with automatic feeders. Accuracies of ± 1/64" are achievable. The indexer pays for itself when designed into a semi-automatic labeler, because semi-automatics depend upon the operator placing the product in the fixture. The labeler then operates as fast as the operator wishes. This can be 40/min. in the morning to less than 20/min. in the afternoon. But with the indexer operating at 40 to 50/min. a constant rate is forced upon the operator. Most indexers pay for their additional cost in less than 3 months.

7. Indexing Conveyors: Here a conveyor is indeed with a special drive allowing straight line motion to be achieved. Pockets or other typed of fixturing are used to hold and control the product. Automatic feeders and collection stations can be fitted to this system. Speeds up to 120 products per minute can be handled by holding 2 products vertically. Accurate labeling can be accomplished on both sides. This type of conveyor can allow some rather unique products to be labeled.

Labeling Systems Inc., a premier manufacturer of heavy duty, "production rated" pressure sensitive labeling systems, is independently owned and managed by its founder. We have extensive Pressure Sensitive Labeler experience, collectively over 100 years in engineering, manufacturing, marketing, sales and field service.

The equipment is built with 24 hours a day, 7 days a week trouble free minimum down-time operation in mind. The Model 3000 Labeling Head is a universal heavy duty head that, by merely changing applicators and reprogramming

the Universal Programmable Circuit Module, can be used in most applications. The specific of the Model 3000 construction are as follows:

A. Mechanical Construction

1. One piece welded frame consisting of 1/2" aluminum plate with 1/4" aluminum plate sides. This construction is stronger than a cast frame. Most companies use plate with simple sheet metal or plastic for a housing. How can they call their equipment heavy duty when the internal components are not protected? Labelaire, Avery Dennison and others use this type of construction.

2. Bearings: Only double sealed precision call bearings are used throughout for precision, speed and longevity. All rotating shafts have bearings at two points for true rotation and trouble free operation. Many manufacturers use bushings rather than ball bearing. Bushings are cheaper and cannot perform as ball bearings can.

3. Control Interchangeability: Air control panel and electronics panel are symmetrical and can be interchanged and rotated 90 degrees. This allows for ease of set-up because of ease of readability. They can also be remoted on large systems.

4. Drive System: A 1/8 h.p. motor is used rather than the 1/15 h.p. motor used by many manufacturers. This h.p. gives that additional edge for long term reliability.

5. Maintenance: Important! This is probably such a unique feature that it could almost sell the head by itself. Because of our field experience our viewpoint on maintenance has enabled us to produce a piece of equipment where any part can be removed and replaced in 15 to 20 minutes. What this means is that if the unit does fail, its downtime will be quite short. Our competitors do not have this feature. Come units can take an hour or more to remove a brake/clutch and the same time to install a new one. This approach of ours gives a customer the lowest cost of maintenance because time is money.

6. System Features: Machine frames are built up from square tubing for maximum strength. This type of welded frame is stronger that the angle bracket frames that a competitor uses. Stainless steel construction is available for moisture, pharmaceutical or corrosive environments.

   A safety clutch is used on the main conveyor drive motor to prevent damage in case of products jamming. Oversized motors and heavy duty speed controllers are standard.