DESIGN AND PERFORMANCE DATA FOR CURRENT DRYING SYSTEMS (PANEL DISCUSSION)

Jonathan L. Hackett, Agricultural Engineer
General Manager
Industrial Metal Products Division of
Continental Eagle Corporation
Phoenix, AZ

It is certainly a pleasure to be with you this morning. Before I say anything else I want to make it clear that I have no intention of standing among the many years of experience which are represented on this panel and proclaim myself to be an expert in cotton drying systems. What I have to offer you is the same thing I have provided to Continental Eagle Corporation: several years of practical experience in the application of drying systems around the world. I have assisted with numerous Continental installations, observed a few of the other systems which have been or will be discussed today, and I have spoken with ginners around the world regarding the success of their systems.

Let me also state that each system being presented today has worked under specific conditions or in given situations. Unfortunately, the customer has the most difficult task in determining the system to best fit their requirements whether it be to increase the drying potential or capacity of an existing plant or construction of a new facility.

During a similar panel discussion in 1989, Mr. Bill Norman stated that "although we currently recommend the use of tower driers we are looking for a "Better Way". We now believe that we are providing a better way, however, this does not mean the end of our research in cotton drying systems, nor the end of our use of tower driers.

In our industry we battle with many of the standard principles of thermodynamics due to the delicate nature of both fiber and seed. Our task is to balance our system to maximize both effectiveness and efficiency. Continental Eagle Corporation has adopted the principle that drying with a higher volume of air at a lower temperature provides a maximum effectiveness at optimal efficiencies.

Please allow me to give credit where credit is due and also forgive me if an accurate account of recent history has eluded me. The principle of utilizing higher volumes of air and lower temperatures is nothing new to our industry within the past 10-15 years. As early as 1955-1960 Mr. A.L. Vandergriff was actively involved in the testing and research of these principles. The successful application of increased air volume and lower temperatures has been proven by Mr. Samuel Jackson the past ten years. If we as manufacturers were perfectly honest with ourselves, we would most probably admit that Mr. Jackson's earlier success was a catalyst for our surgence in drying systems research. Fortunately the entire industry has benefitted from this spirit of competition. Even though we now utilize these successful principles, we differ in opinion on the methods or their physical application.

To better explain our position, I will simply describe two separate systems which were installed this past season and operated with great success, and state a few observations.

The first system was designed for a production capacity of up to 30 bales per hour. (Figure 1- representative of one stage of drying). We supplied two stages of drying in a push-pull arrangement with each stage utilizing a 6' x 6' - 16" shelf space tower drier and a 5 million BTU heater. Each stage provides 16,000 CFM of air through the tower drier for a total system volume of 32,000 CFM. All sheet metal ducting is appropriately sized to maintain an approximate air velocity of 4,500 feet per minute. This is our recommended conveying velocity for seed cotton. Our drying system utilizes two temperature probes or control sensors. The first probe or "setpoint" probe is optimally located in the inlet transition of the tower, and the second probe or maximum limit/"alarm" probe is located approximately three feet before the mixpoint or blow box. From random testing over a four week period, thehighest noted moisture of incoming seed cotton was 18%. The trash content was high at approximately 16% with mostly green leaf and hulls. The relative humidity was about 80% with an ambient temperature of 55°F (13°C). This was my first opportunity to work with this particular drying set up, so I took the liberty to play with the settings testing some extremes. The initial control setting for the first stage "setpoint" probe was intentionally high at 194°F (90°C) and the alarm sensor was intentionally low at 275°F (135°C) The second stage setpoint was at 130°F (55°C) and the "alarm" probe at 257°F (125°C). These settings resulted in the first stage heater modulating to the alarm temperature and never reaching the setpoint at the tower. At the same time the second stage system never exceeded 130°F (55°C) at either probe. This was a clear indication that most of the drying was taking place in the first stage. In an effort to balance this system and reduce the maximum temperature in the first stage, we reduced the first stage setpoint to 167°F (75°C) and increased the second stage setpoint to 155°F (68°C). With these parameters we were able to maintain both setpoint temperatures without exceeding 275°F (135°C) at the "alarm" probe prior to the mixpoint. At this time seed cotton at the feeder apron was at approximately 6-1/2 - 7% moisture. These numbers are representative of one test lot of high moisture seed cotton. Moisture was monitored with three different moisture meters in an attempt to verify the results. The total drying system horsepower for this facility is 320 H.P.

Before we continue to the second drying system I want to

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 1:554-556 (1996)
National Cotton Council, Memphis TN

recognize a statement made in the 1980's by a prominent member of our industry regarding drying systems. It was stated that the manufacturers took the position of "Why sell less when we can sell more". I cannot confirm if this was an accurate statement for the period, but I can assure you that at this day and time it is totally inaccurate for Continental Eagle Corporation. I say this because the Continental system of choice is a towerless system which utilizes no other structure other than sheet metal ducting for the conveyance of air and material.

This method is represented in the second system (Figure 2 representative of one stage of drying). This system was designed for a production capacity of 45 bales per hour. It also is a push-pull arrangement in two stages with each stage being split. In this application each stage operates with a 10 million BTU heater and provides 32,000 CFM of air. This facility also utilized a third stage or preheater system at the unloading system. This ginning system was operating at periods in near identical conditions as to the one previously mentioned with high moisture contents of 18-20%, trash contents of 14-17%, relative humidity of 85% and ambient temperature of 45-50°F.(10°C). Samplings were random over a three to four week period and again, to avoid duplication of information, results were very similar to the first facility. This system actually provided reduced temperature requirements which are attributed to the implementation of a third heater at the seed cotton unloading system or Module Feeder disperser. This third heater was limited to 140°F and allowed the total temperature reduction through the remainder of the system.

In this installation, the air volumes are solely limited by the air handling capabilities of the 120" Inclined Cleaners. Each 120" Inclined Cleaner will allow approximately 16,500 CFM, and the total volume of air displaced by each pull fan includes approximately 10% in air losses through the system. (Total drying system horsepower for this facility is 650 H.P.) Modifications to this system are possible in order to obtain a total of 82,000 CFM or more in the system. Due to the fact that our customers were most interested in production at the height of the ginning season we are unable to fully monitor total power consumption, fuel consumption and numerical efficiencies of these systems. As previously stated, these were all personally noted observations. We do know that one of the greatest indications of success is the repeat sale of a system based on a customers recommendation. Such is the case with the towerless system. A neighbor to the system just described who has been in the industry for 30 years has most recently determined that this is his system of the future beginning in 1996.

A few of you may have attempted a towerless pipe drying system and were not convinced of the results. Please understand that this system is based on significantly higher volumes of air which should not be confused with higher velocities. A greater ratio of heated air per water molecule allows for a greater rate of vaporization. If you are operating a plant with smaller precleaning machinery and this is limiting your air handling potential, their are methods to increase your total air volume capabilities.

I have stated that this system does not mean the end of the use of the tower drier. This is due primarily to the comfort zones of our customers. We have become so accustomed to having a physical structure in the system that the full acceptance of no structures is probably several years away. We have also supplied other combinations of the two systems mentioned including one stage utilizing a high volume tower and the other stage towerless.

To summarize our position, we contend that effective, efficient and economical drying systems can be obtained without the use of a drying structure or numerous peripheral items. Yet, due to specific comfort zones within our industry we will continue the partial use of tower dries until further acceptance is realized. We will also continue our research of alternatives in order to continuallysupply the optimal system to our industry.

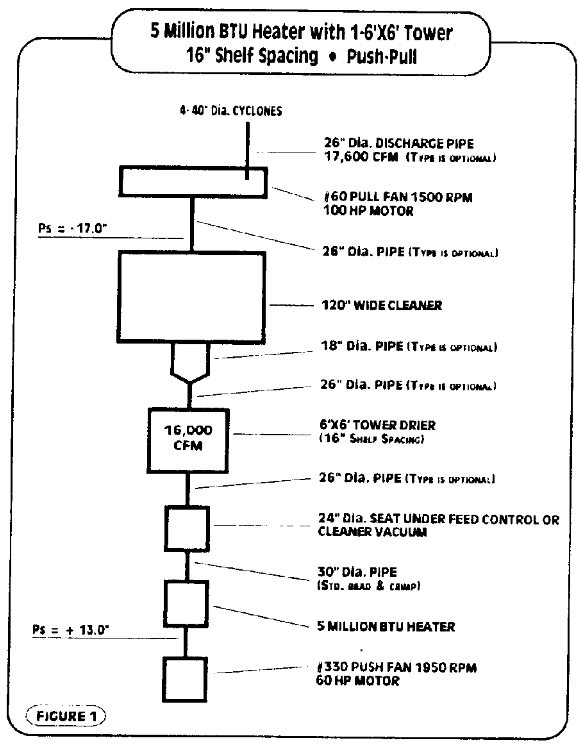

FIGURE 1

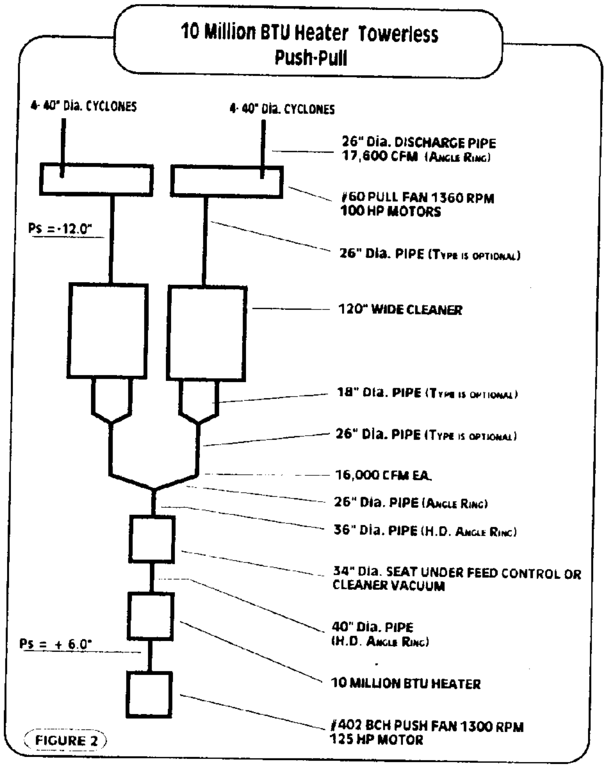
10 Million BTU Heater Towerless
Push-Pull
4-40" Dia. CYCLONES
4-40" Dia. CYCLONES
26" Dia. DISCHARGE PIPE
17,600 CFM (ANGLE RING)
#60 PULL FAN 1360 RPM
100 HP MOTORS
Ps = -12.0"
26" Dia. PIPE (TYPE IS OPTIONAL)
120" WIDE CLEANER
18" Dia. PIPE (TYPE IS OPTIONAL)
26" Dia. PIPE (TYPE IS OPTIONAL)
16,000 CFM EA.
26" Dia. PIPE (ANGLE RING)
36" Dia. PIPE (H.D. ANGLE RING)
34" Dia. SEAT UNDER FEED CONTROL OR
CLEANER VACUUM
40" Dia. PIPE
(H.D. ANGLE RING)
Ps = + 6.0"
10 MILLION BTU HEATER
#402 BCH PUSH FAN 1300 RPM
125 HP MOTOR

FIGURE 2