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N. L. Pugh Jr.

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ADVANTAGES AND PROBLEMS OF PARTIAL AUTOMATION

N. L. Pugh, Jr. 1/

If you will bear with me, I would like to point out one or two items important to justify the expenditure for automation in the seed industry.

You will find I am going to be referring mostly to the crop of soybeans and the processing of soybeans.

As I see it, there are two primary requisites for making automation pay. They are:

1. To be able to justify expenditure for installation of automatic equipment, we need to be sure we are going to have a volume of soybeans to substantiate the expenditure for automation.

2. To be able to have satisfactory results from automation, we need a uniform quality soybean supply as free of foreign materials as possible. The foreign materials that give the greatest problems on handling grain seem to be the light materials, such as stems, pods, cockleburs, and grass. The very small grass seeds and weed seeds along with soybean hulls will be a problem if you are drying grain, as the fines will be lost in great quantities to the outside air and 'foul up' your property.

Our average yield per acre on soybeans for the nation has stood at 25 bushels per acre for the past five years. It has been calculated that the average yield could be raised six (6) bushels an acre. It was estimated that the six bushel increase would give the grower double his present net profits from soybeans.

To realize Item No. 1, increase volume, and Item No. 2, uniform quality, the grower will need to use the latest available improvements in growing and harvesting.

Some of the points for acquiring these improvements have been established as the use of lime, deep plowing, shallow seedbed preparation, row spacing and plant spacing, with changes for different varieties planting; weed control through the use of herbicides, moisture control, inoculation, keeping in mind the best varieties of soybeans for each locality and the use of the best cutting methods to reduce harvest losses.
In the processing of soybeans we have storage of many different kinds. If flat storage is being used it will be necessary to convey the soybeans to a work bin to begin the automatic handling. If all vertical bins with gravity feed is the case, it will be possible to begin the automatic handling of the soybeans from the storage bins.

This will be the point of beginning in discussing automation.

From this point on, providing the supply is constantly available, the soybeans will be handled automatically.

We now need to determine the limiting factor in the cleaning and drying operation. If the dryer capacity exceeds the capacity of the cleaner being used, you will set the cleaner load to control the rate of flow by use of a variable feeder drive motor. Or it could be that you would need to limit the cleaner load to get the desired moisture reduction through the grain dryer. (Refer to drawing No. 1 at the end of this article)

Item "A" - Modulating Gate. We have installed a modulating gate to draw soybeans from the supply bin at the rate and when desired.

Item "B" - The soybeans will discharge into an elevator in this case.

Item "C" - Automatic Scale. The automatic scale will be desirable to give your capacity of flow per day or per shift as desired.

Item "D" - Conveyor from scales to cleaner surge bin.

Item "E" - Cleaner surge bin. The surge bin over the cleaner will need to be large enough to have a capacity large enough to minimize the feeding cycle from the supply bin and also to carry an overflow feed back from the dryer garner bin which I will describe later. There will be a bindicator located in this bin at a point that will shut off the feed from the supply bin, but will have additional space left to hold the volume of soybeans in the elevator leg and conveyors to the dryer in case the garner bin on the dryer becomes filled. There will be another bindicator located near the bottom of this bin that will open the Modulating Gate to supply beans when needed from the supply bin, but not low enough that the cleaner surge bin would run empty before the elevating and conveying time required for the soybeans to reach from the Modulating Gate to the surge bin.
TO EXTRACTION

• FROM

FLAKING ROLLS

ONE MAN OPERATION
24 HRS. PER DAY

CONV. "K"
REMOTE OPERATED GATES TO TANKS

BIN LEVEL CONTROLS

MAGNETIC PULLEY

CONV. "D"

AUTOMATIC SCALE

"E" SURGE BIN

SUPPLY BIN

SOYBEANS FROM STORAGE

"A" SUPPLY BIN

ONE MAN 12 HRS. PER DAY
5 DAYS PER WEEK

CLEANING DRYING

TO EXTRACTION

FROM

5 FLAKING ROLLS

5 CRACKING ROLLS

VIBRATING FEEDERS

MAGNETIC PULLEY

SURGE BIN

AUTO. SCALE

"A-I" MODULATING GATES

"L" TANKS

1 2 3 4 5

COND TANKS

"A" MODULATING GATES

MODULATING GATES CONTROLLED BY LOAD MONITOR

ELEVATOR "J" GRAIN DRYER

ELEVATOR "G"

ELEVATOR "B"

ELEVATOR "E"

CLEANER

CAPACITY = 26,400 BU

ONE MAN 12 HRS. PER DAY
5 DAYS PER WEEK

CLEANING DRYING
Item "F" - The cleaner. Can be set up as an independent link in the flow with only the cleaner feeder motor being interlocked to the down stream system.

Item "G" - Elevator from cleaner to the dryer. This elevator should have a dual spout on the discharge so that when the dryer garner bin becomes filled, the overflow will return back to the cleaner surge bin.

Item "H" - Grain Dryer. Should be large enough to give the most economical operation of the system. The automatic safety controls are usually furnished but there may be some additional controls desired. The grain dryer can be set to the rate of flow to give the desired moisture content of the beans leaving the dryer.

Item "I" - Collector conveyor or spout. To move the soybeans from the grain dryer discharge to an elevator.

Item "J" - Elevator from dryer to conditioning tanks.

Item "K" - Distributing conveyor over the conditioning tanks. This conveyor has remote control discharge gates for each tank.

Item "L" - Conditioning tanks. The purpose of these tanks are: No. 1 to give the grain time to fully equalize in moisture and temperature before processing. No. 2 to give capacity to allow the shorter cleaning and drying time for the most economical operation. No. 3 - A supply of soybeans ready at all times for the operator to draw beans from for processing.

The controls for the system of automatic supply of soybeans through the cleaning and drying operation and discharging into the conditioning tanks are located in a panel that is near the cleaner and the grain dryer. This operation is run by one man five days a week to supply conditioned soybeans to permit a twenty four hour day and seven days a week operation for the processing plant.
The next step of automation is controlled in the preparation department where one man operates the mechanized reclaiming of soybeans from the conditioning tanks to and through the entire preparation of the soybeans for solvent extraction. (Refer to drawing No. 1 at the end of this article.

Item "A-1" - Modulating Gates. There is a modulating gate discharge valve on each of the conditioning tanks that furnishes a controlled supply of soybeans to the conveyor belt.

Item "A-2" - Conveying system from the conditioning tanks to the preparation department. The discharge at this point should be equipped with a magnetic separator to remove tramp iron.

Item "A-3" - Surge bin over cracking rolls. To gravity feed to automatic scale, this surge bin should have a capacity large enough to supply the required load with as long a lag period as possible. There is a top level bindicator that will close the modulating gates on the conditioning tanks with enough space left in the surge bin to accommodate the load of grain in the conveying system. When the soybeans feed out of this surge bin and reach the lower bindicator, the modulating gate will open to a pre-set position and refill the surge bin.

Item "A-4" - Automatic scales. To be used as a processing load control, the volume passing this scale is used to set the processing hourly or daily crushing rate.

Item "A-5" - Modulating gates to feed cracking rolls. The cracking rolls are driven by individual motor drives. The amp load of the roll drive motor is fed into a load monitor. By setting the load required on the roll motor, the controller will maintain a constant load passing through each machine by actuating the modulating gate. The rate of processing the soybeans in tons per day is set at this point. Whatever load passes this point must be carried on through the complete preparation and on to the solvent extraction plant.
The application of automation will generally give a more uniform load through a series of operations and at the same time you will also greatly reduce your operating cost. The outstanding savings will be in labor costs.

The operators will soon find that very little effort is needed to set the points of control for a well designed system.

The problems generally seem to be in keeping the systems clean. This can be done in the location of the controls in the cleanest possible point for accessibility to the application. Also a schedule of maintenance check will pay off in smooth operations.