RELOCATION AND INSTALLATION OF A COTTON GIN AND OTHER COTTON RESEARCH

A PROFESSIONAL PAPER

by

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AGRICULTURAL ENGINEERING
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ACKNOWLEDGEMENTS

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In addition, I want to thank Mr. Kenneth Watkins, who I worked with constantly during my internship, for his help and knowledge. I have learned a great deal from working with him.

Also I must thank Paul Hirschler, Allen Kopetsky and all the others who helped me out from time to time during my internship.

I want to thank my parents for their help and support during my internship and while I was writing this paper.

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INTRODUCTION

The Professional Internship is a requirement for the completion of the Master of Agriculture degree in Mechanized Agriculture. It is designed to allow the student to apply his education to a more practical area in business or industry.

My internship was with the Texas A&M University Agricultural Engineering Department. The time of the internship was from June 1, 1985 to October 31, 1985. I worked under the direction of Mr. Kenneth Watkins on a project for Mr. Lambert Wilkes. I worked with relocating the Agricultural Engineering cotton gin and in many other areas, such as working with the Department's cotton research plots at the University farm, and the seed cotton module builder tamper mounted moisture meter.

My observations, recommendations, and conclusions are listed later in this report.

BREAKDOWN OF INTERNSHIP

My internship was divided into three main areas and are as follows:

Relocating the Agricultural Engineering Cotton Gin

Field Production of Cotton

Seed Cotton, Module Builder Tamper Mounted Moisture Meter

Most of my time was spent with the cotton gin. Approximately two weeks were spent with the cotton research plots and another two weeks with the moisture meter.

RELOCATING THE COTTON GIN

COTTON GIN BACKGROUND

The cotton gin was in the old research building, which had burned several years ago, and was to be moved to the new Agricultural Engineering Research Laboratory. When I began my internship, most of the gin had been disassembled, but nothing had been moved.

The gin is a scaled down version of an actual cotton gin. The full size machines were brought into the research shop where they were disassembled, and cut down to a size more manageable for ginning small samples of cotton, and then were reassembled. All the machines were acquired and cut down in size over a period of about fifteen years. It is a 20 saw gin or about 14 inches wide. All material is conveyed by air. There are several main parts in the gin, each having a vital part in the proper ginning of cotton. These parts are as follows and will be explained in detail later:

Incline Machine

Stick Machine

Impact Machine

Extracter/ Feeder

Gin Stand

2 Lint Cleaners

Lint Condenser

Lint Press

Pickup Fan

Trash Fan

Doffing Fan

Condenser Fan

Lint Cleaner Purge Fan

Seed Fan

Seed Cyclone

Trash Cyclones

INCLINE MACHINE- The incline machine is the first machine which the machine harvested seed cotton enters. It is where some of the fine trash is removed. The incline cleaner uses a scrubbing action to remove trash. Spike toothed drums rub the cotton against grid bars and the trash falls between the bars.

LEAF AND STICK MACHINE- The leaf and stick machine is mainly for the removal of sticks, leaves and burs from the cotton. The stick machine uses a sling-off process for trash removal. The cotton

lint is grabbed by the teeth of rotating saw cylinders and the trash flies off from the saws. The machine will have more sticks to remove from stripped cotton than from picked cotton, as will the other trash removal machines.

IMPACT MACHINE- The impact machine is another trash removal machine. It uses a series of circular type saws and spike toothed drums to separate the small pieces of twigs, burs, leaves and other fine trash remaining, from the cotton. This cleaning process is called impact cleaning, and hence the name for the machine.

EXTRACTER/FEEDER- The extracter/feeder's main purpose is to feed the cotton into the gin stand in an even manner. It must feed the cotton at an even rate and uniformly across the width of the gin stand and have the capability of changing this feed rate to match gin stand capacity. The extracter/feeder also removes trash by means of a scrubbing and stripping process. The material leaving the extracter/feeder is now called seed cotton because most of the trash has been removed. It should be remembered that most cleaning machines normally remove only about 50% of the trash coming into them.

GIN STAND- The gin stand is the device where the seed cotton is separated into the two products, lint and seed. This is the process which most people think about when they think of cotton being ginned, and is almost unchanged from its inception in about

1794. It uses saws mounted on a shaft which turn between flat metal ribs. The toothed saws tear at the seed cotton until all the lint is removed from the seed and the seed falls away and are carried off. The lint is removed from the saws with air supplied by the doffing fan.

LINT CLEANER- The lint cleaner is the next machine the cotton enters after leaving the gin stand. The Agricultural Engineering Department's gin has two lint cleaners. The gin can be run with both, only one, or neither lint cleaner in operation. Naturally, the more cleaners the lint goes through, the cleaner it will be and the higher the price will be. Weight is also lost in the cleaning process so an economical analysis must be done to determine the amount of cleaning that will give the highest return. The lint cleaner works by feeding a thin layer of lint onto the surface of a turning saw and the heavier trash particles are slung off from the lint. As with any cleaner, the lint cleaner is only about 50% efficient at removing trash.

LINT CONDENSER- The condenser receives lint from the lint cleaners or from the gin stand if no lint cleaners are used. It separates the lint from the air which carries it, by using a rotating cylindrical screen. The air passes through the screen and the lint is left behind. The lint then passes through rollers which condense it from its very fluffy form and send it down a chute where it is caught in a container. In most commercial gins, the lint goes down the chute directly into the lint press.

LINT PRESS- The lint press is the last step cotton must go through to be transferred from bur cotton to baled lint. This is where commmercial cotton gins produce the 480 lb. bales which most people are familiar with. The press in the Agricultural Engineering gin will produce approximately 75 lb. bales. This is the only area where material is not handled by air. The lint must be taken from the condenser and manually placed in the press for baling. The lint press uses a hydraulic cylinder to press the lint into a bale.

MATERIAL HANDLING

There are six fans in the cotton gin which are responsible for all the material handling throughout the gin.

PICKUP FAN- The pickup fan takes the harvested cotton from the feed table and carries it to the first cleaning machine in the overhead, which is the incline machine.

TRASH FAN- The trash fan collects trash from the incline, stick, impact and extracter/feeder machines and carries it outside to a cyclone where it is separated from the air and then falls into a trash dumpster.

DOFFING FAN- The doffing fan supplies the air which doffs, or removes the cotton from the gin saws.

LINT CLEANER PURGE FAN- This fan pulls the ginned cotton into the lint cleaners and carries off trash removed by the lint cleaners.

CONDENSER FAN- The condenser fan pulls the cotton into the lint condenser and also carries off a very small amount of trash.

SEED FAN- The seed fan is responsible for carrying the seed away from the gin stand. Air is drawn through the seed cyclone which pulls the seeds into the seed cyclone where they fall out, and then it pulls the air and a small amount of trash outside to a larger cyclone.

CYCLONES- There are a total of five cyclones in the cotton gin. The seed cyclone discussed earlier is smaller than the other four and is mounted inside the lab. The other four are outside and serve to collect trash from the trash fan, condenser fan, lint cleaner purge fan and seed fan.

MOVING AND ARRANGEMENT

I have discovered that moving this cotton gin is a very challenging piece of work especially for only two people. Mr. Kenneth Watkins was responsible for moving the gin and I assisted him in almost every aspect of moving it. We began the task on about April 15, 1985 and ran the first cotton through it on October 29, 1985.

We began by erecting a platform almost 10 feet high and 30 feet long and 5 feet wide on which the fans and their drive motors could be mounted.

The next step was to move all the parts of the gin into the new building and place them where they belong. (Mr. Watkins had already calculated where they needed to go according to the amount and type of ductwork that was available.) Since the distance the gin was to be moved was relatively short, the parts could be moved with forklifts. The moving was fairly simple except for the overhead portion which consists of the incline, leaf and stick, and the impact machines. It was far too big to be moved with one forklift and too tall to fit into the door of the lab. The legs were cut off allowing it to be lowered to fit in the door and a forklift was used on each end for transporting. The move proceeded very slowly and carefully and the overhead arrived safely and without any unexpected problems. The gin stand and extracter/feeder were moved while still connected since they were

small enough to be handled together. All the other machines, such as the lint cleaners, lint press, condenser etc. were moved individually. Once everything was moved and in place in the new building we began connecting it all together.

The motors and fans had to be bolted down, the ductwork had to be installed, electricity had to be run to all 18 electric motors, the cyclones had to be set in their new stands and guards had to be made to cover the pulleys and sprockets which are exposed to possible contact by personnel working around the gin.

DUCTWORK

Installing the ductwork was a challenging job, especially since the lint cleaners and fans were placed on the opposite side of the gin stand than where they were before. Installing such a large amount of ductwork was much like solving a huge jig-saw puzzle. Much thought went into how each piece should go; however, the best method often seemed to be trial and error. One of the more challenging pieces was the trash duct, which is four small lines coming from four separate machines and all going into one large line. In order to save problems, the fans were put where they were supposed to go but were not bolted down until after the ductwork had been properly installed.

The color coding of the ducts made installation a great deal easier. Color coding is used in the gin so that the flow of material can be easily explained to people unfamiliar with the gin. See table 1 for the color code.

DUCT COLOR CODE

DUCT	DUCT COLOR
PICKUP	RED
LINT	BLUE
AIR OR AIR & FINE TRASH	GREEN
TRASH	ORANGE
SEED	YELLOW

TABLE 1

After the 4 cyclones had been set in place outside, ducts had to be connected to each of them. Additional ductwork had to be ordered for connecting to the cyclones because the placement of the holes in the wall did not allow the ducts to connect straight into the cyclones. The ducts had to come through the hole to the outside and turn upward for about two feet and then turn into the cyclones.

Setting the cyclones in their new stands was simply a matter of lifting them out of their old stands and into the new ones. This job did require a crane because of the height which they had to be lifted.

ELECTRICAL SYSTEM

The electrical system is another major component of the cotton gin. The entire electrical system was reworked when the gin was moved to its new location. New control buttons, wires, conduit, lay-in wireways and other parts were purchased for the gin. Much design and metal fabrication was also done on the new control panel. The control panel was designed to hold all the new start/stop control buttons for all electric motors except the lint press which has its own control station.

The new control buttons contain light modules which indicate when each motor is running. The new control buttons are more attractive and functional than the old ones. The new panel itself is a great improvement over the old one. It is much sturdier and can house more controls and it also blends in well with the rest of the gin. Appearance is important in this research laboratory because many visitors from industry and other universities come to observe the gin. The gin is also used for teaching from time to time, and is visited by a large number of students interested in cotton ginning and materials handling in general.

The electrical system design began with selection of the control buttons mentioned earlier. The next step was to determine the wiring required for each circuit in the system. Wires were run to each motor and control wires to each control button. Magnetic motor starters are used so that the power going to the motors does not come through the control buttons. Another safety and convenience item built into the system is a master shut off

switch. This switch must be pulled out for any of the motors to run and it can be used to conveniently shut down the entire gin after a ginning session is complete or in the event of an emergency. The complete wiring diagram is included in appendix A.

The next step was to design and build the electrical control panel. It was constructed of angle iron and square tubing and covered with 14 guage sheet metal. Two doors were hinged on the front to allow easy access for wiring. Holes were then punched to allow mounting of the control devices. The controls mounted on the panel are the start/stop buttons, master shut off switch, DC motor controller, ammeter for gin stand motor, electronic timer and a switch for the timer. There is also room to add more controls later.

The actual pulling of the wires and connecting them required a total of about a week. Three wires run to each motor and four control wires run from each starter to the control panel. A four inch wireway is used to connect the control panel with all the magnetic starters.

The electrical supply panel was built in when the building was constructed. It contains a 300 amp main breaker and 14 breakers for the 14 separate circuits in the gin. These were supplied with the building and the amperage rating of each had been designated earlier and ranges from 15 to 50 amps. The exact size of each breaker and all the other electrical information can be seen in table 2.

Electrical Power

NAME	CIRCUIT NUMBER	FLA	H.P.	VOLTS	WIRE SIZE AWG	BREAKER (AMPS)
SEED FAN	1	27.6	10.0	208	8	50
		1.6	1/3	208	12	*
DOFFING FAN	2	13.4	5.0	208	12	30
EXTRACTER/ FEEDER	3	9.0	3.0	208	12	15
		3.6	1/3	90 DC	12	*
IMPACT	4	14.2	5.0	208	12	20
STICK	5	3.2	1.0	208	12	15
INCLINE	6	14.2	5.0	208	12	20
TRASH	7	39.8	15.0	208	4	40
PICKUP	8	21.2	7.5	208	8	30
CONDENSER	9	14.2	5.0	208	12	20
		1.3	1/3	220 1Ph	12	*
LINT CLEANER PURGE FAN NUMBER 1	10	14.2	5.0	208	12	20
LINT CLEANER	11	14.2	5.0	208	12	30
		1.4	1/3	208	12	*
NUMBER 2 LINT CLEANER	12	14.2	5.0	208	12	30
		1.4	1/3	208	12	*
GIN STAND	13	14.2	5.0	208	12	20
LINT PRESS	14	27.6	10.0	208	8	30

Table 2

* NOTE: Circuits containing two motors are controlled by a single switch and have only one breaker for both.

GUARDS

As required by OSHA (Occupational Safety and Health Administration) moving parts are guarded to a height of seven feet. There are a few places not completely guarded, but it would be impossible to guard them and still have access to all controls.

The guards are constructed of an angle iron frame and expanded metal. The guards around the gin stand have a door on each side to allow servicing of the machine. The guards are bolted on instead of welded so that they can be easily and completely removed in the event major repairs are needed. All guards are painted safety orange to warn that they are covering something dangerous.

FIELD PRODUCTION OF COTTON

I have learned a great deal this past summer about the field production practices of growing cotton. I have lived in areas where cotton is grown before but have never had the opportunity to work with it a great deal until now. I was involved with the cotton plots this entire summer, from planting to harvest.

The cotton grown on the plots is used for a variety of purposes. A controlled traffic study is being done which determines the effect of eliminating or reducing vehicular traffic in certain areas of the plots, on soil compaction and plant production. A device called a penetrometer measures the force required to push a steel rod into the soil. The amount of soil compaction can be calculated from these measurements.

The cotton harvested from the plots is used for getting the cotton gin adjusted for other cotton samples and is used in the teaching of classes. Samples taken from selected 1/100 acre plots are ginned and tested for yield, grade, fiber length and other characteristics.

The cotton variety Stoneville 825 was planted on about May 20, 1985. The cotton came up quickly and a fairly good stand was obtained; however, there was some loss due to seedling disease. The young cotton plants are tender and require a lot of care. They need to be cultivated to control weeds and help aerate the soil but they are also susceptible to root damage from the cultivator. Straight rows are a necessity and the person driving

the tractor must still be very careful not to plow up or damage some of the cotton. This cotton was grown without irrigation so the only water the cotton received was from rainfall. The cotton did not have a large water deficit though, because there was adequate rainfall, especially early in the growing season.

The cotton was checked each week for insects and was sprayed according to infestations. Methyl Parathion, Pydrin and Galecron were the pesticides used individually or together to control the type of insect that might attack the succulent leaves, squares and immature bolls of the young cotton plants. The insects which gave the most problems were aphids, flea hoppers, thrips, boll worms, bud worms and boll weevils. Very few boll weevils were actually spotted but the pesticides which were sprayed for the other insects probably prevented them from becoming a problem. Table 3 lists the pesticides and rates at which they were applied as well as the other chemicals which were applied.

CHEMICAL USE TABLE

CHEMICAL	USE	RATE/ACRE
NITROGEN	PREPLANT FERTILIZER	40 lb
PHOSPHORUS	PREPLANT FERTILIZER	40 lb
POTASSIUM	PREPLANT FERTILIZER	20 lb
NITROGEN	SIDE DRESS FERTILIZER	50 lb
PYDRIN	WORM CONTROL	1/10 lb AI
METHYL-PARATHION	INSECT CONTROL	1 qt
GALECRON	OVICIDE	1/2 pt
CAPEROL	BROADLEAF WEEDS	4 pts
TREFLAN	GRASS CONTROL	2 qts
DROPP	DEFOILANT	1/3 lb
BANVIL	BROADLEAF WEEDS (MORNING GLORIES)	1 qt
ROUNDUP	JOHNSON GRASS	1 qt

TABLE 3

Finally the cotton was ready to be harvested. Four representative 1/100 acre plots were harvested from the controlled traffic cotton and four from the conventionally grown cotton. These were sacked individually and labeled for later tests. The remainder of the cotton was then harvested and put into a cotton trailer. After the harvest was complete the plots were sprayed with Banvil in hopes of reducing the morning glory problem next year. It is hoped that the chemicals will do a better job and require a lot less labor than hoeing.

MOISTURE METER

Work was done with a seed cotton module builder tamper mounted moisture meter. This device, which is mounted on the module builder determines the moisture content of the seed cotton as it is placed in the module builder. This is important to the farmer because it can tell him immediately what the moisture content of the moduled cotton is. Modules can be stored for a long time if they are dry enough. A moisture content of less than 12% is considered to be dry enough for safe storage. Any module over 12% moisture should be ginned as soon as possible.

The advantage that this type moisture meter could have over the present system is tremendous. The current method of determining moisture is to use a thermometer with a long probe to measure the temperature in the center of the module. Thermocouples are also being used in some areas. These methods work on the principle of relating the temperature to the moisture content. A temperature of about 120 degrees or higher would indicate that the module is too hot and needs to be ginned immediately.

The biggest problem with this method is that it may take 2 or 3 days for the temperature of the module to rise above the safe level and the module must be watched closely during this time. Most modules will increase in temperature during the first 2 to 3 days and then drop off again. An increase of 10 to 20 degrees can be expected during this time. A rapid overnight temperature gain

of 20 to 25 degrees indicates that the module is overheating because of excess moisture.

The tamper mounted moisture meter is made up of three components: A sensor plate located on the bottom of the tramper; a sending unit located on top of the tramper; and a computer which is located on the operator's platform.

The sensor plate takes a moisture reading each time the tramper is forced down on the cotton and sends it along to the sending unit. The sending unit receives data from the sensor plate, does some calculations on it and sends it to the computer. The computer takes data from the sending unit, does some more calculations on it, and then stores the data in its memory.

During the time we worked with the moisture meter, we never got any actual data out of it. The moisture meter was received from Applied Instrumentation; in California. We immediately mounted it on a seed cotton module builder for testing in the field. After we discovered that the moisture meter was not working properly, we began checking it out under the long distance telephone direction of Mr. Don Osias, who works for Applied Instrumentation. This was to no avail so the moisture meter was shipped back to applied instrumentation in California. They discovered that some of the chips in the computer were not compatable. The problem was fixed and the moisture meter was returned to us. However, we have not done any more testing on it due to the work with the cotton gin.

OBSERVATIONS

The research environment which I was involved with during my internship was very unique. It is quite different from the retail business or farming and ranching, which I have worked with before. In research, the economy of each project or transaction is not as important due to the nature of research. A project may appear to be uneconomical in the beginning, but if a new and better method can be found, its value to Agriculture can be almost unlimited.

This internship has been a valuable experience for me because I have been able to work around a number of quality people not always found in other areas. I have also been able to work with some excellent quality machinery, tools, and electronic devices which I have not worked with before.

RECOMMENDATIONS AND CONCLUSIONS

Recommendations are not easily made for a research organization such as this. If it were any other type of industry, I could recommend that it spend more time to do a better job on each project, such as the cotton research plots and the moisture meter.

With the limited amount money and labor available the greatest attention must be given to the most important project at that time, and the others put aside until later. The problem is that sometimes there just is not enough time to get back to those other projects at all.

As with any organization, there is always some room for improvement in the area of time management. I personally would prefer to try to finish one project before beginning another because I feel that I can do better work while working on one thing at a time.

Overall, I think the research going on here is very worthwhile and productive. I know there have been a lot of great ideas coming from this department which have helped agriculture.

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The Texas Agricultural Experiment Station,
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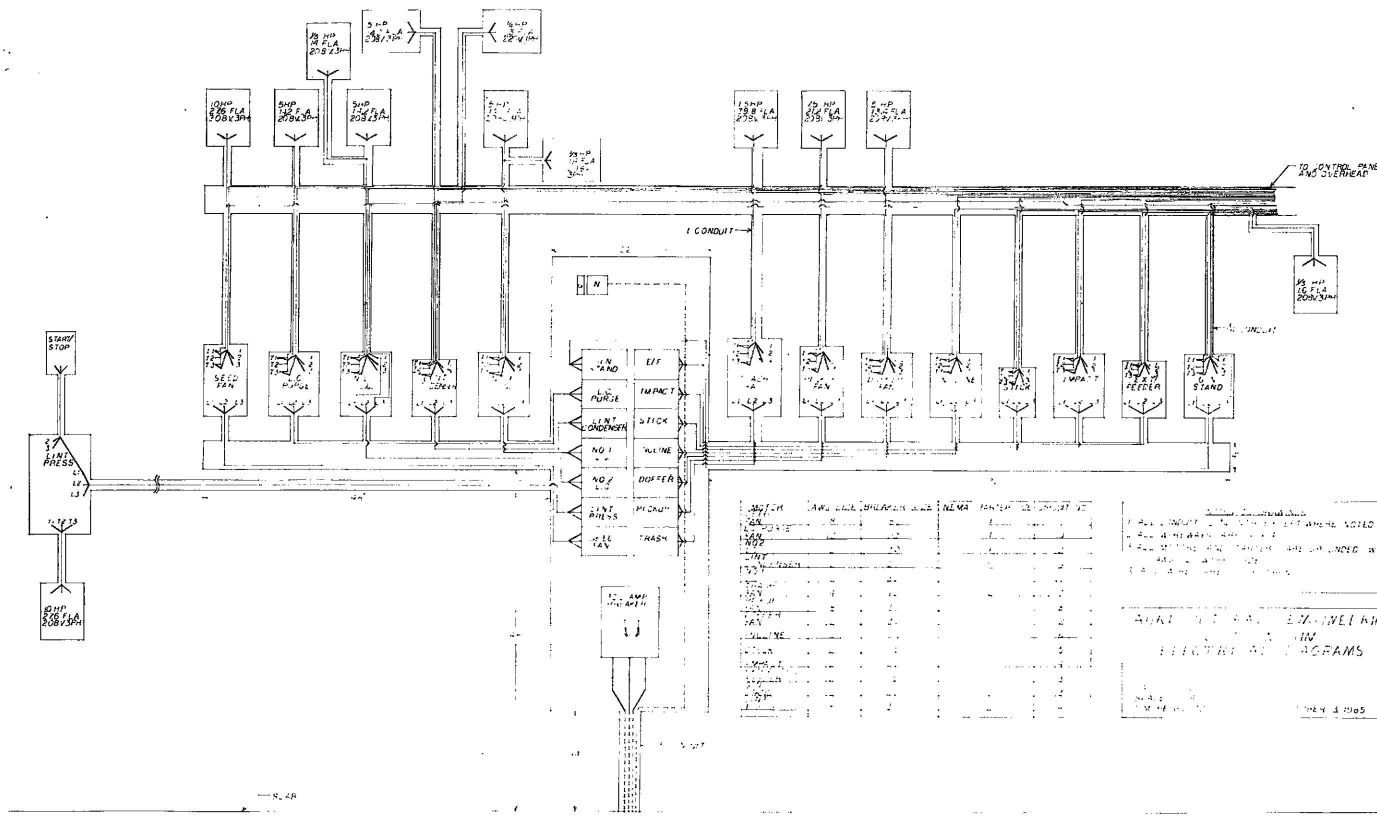
College Station, Texas

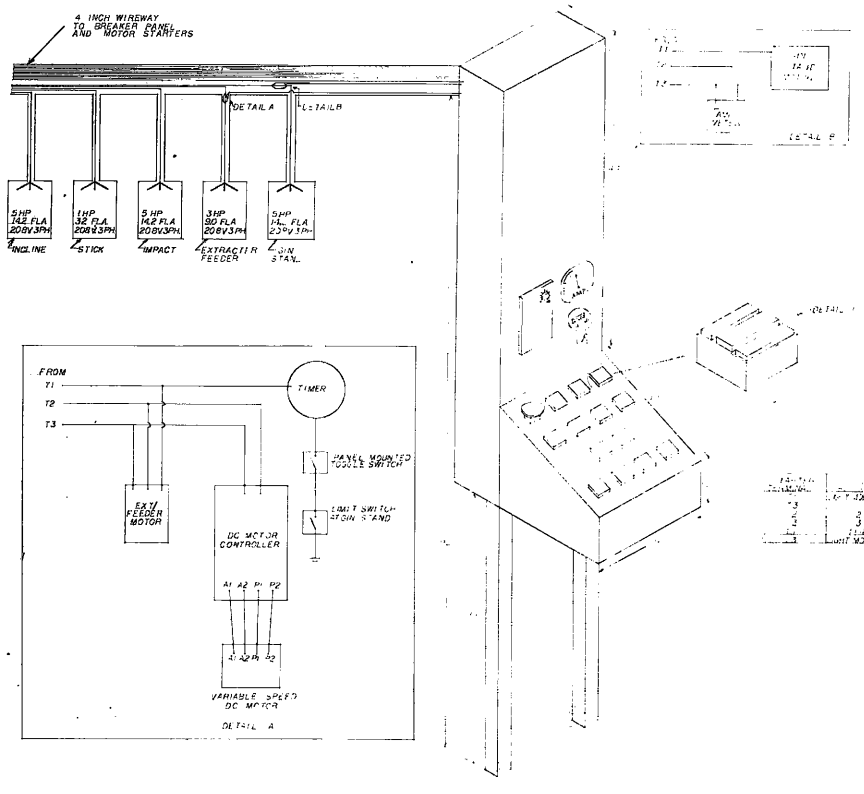


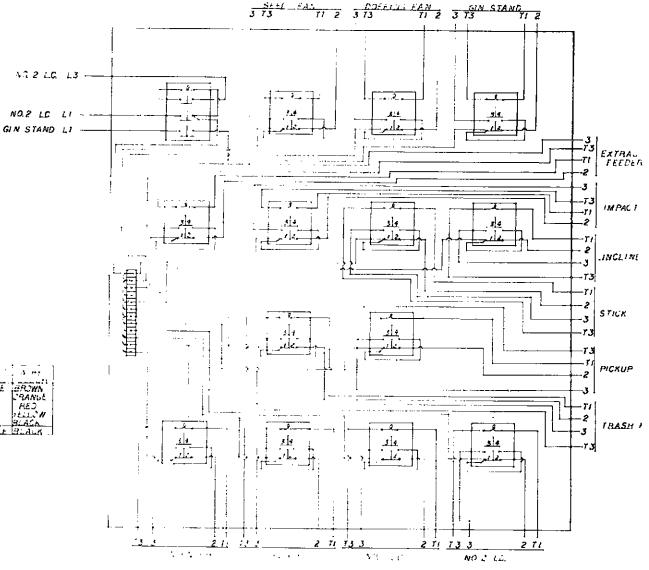
MOTOR	AWG SIZE	BREAKER SIZE	NEMA	STARTER SIZE	CIRCUIT NO
SEED FAN	8	[illegible]		1	[illegible]
L.C. PURGE FAN	[illegible]	[illegible]		1	[illegible]
NO 2	[illegible]	[illegible]		1	[illegible]
LINT CONDENSER	[illegible]	[illegible]		1	2
[illegible]	[illegible]	[illegible]			[illegible]
FAN	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]	[illegible]			2
FAN	[illegible]	[illegible]			2
INCLINE	[illegible]	[illegible]			[illegible]
[illegible]	[illegible]	[illegible]			3
[illegible]	[illegible]	[illegible]			3
[illegible]	[illegible]	[illegible]			3
[illegible]	[illegible]	[illegible]			2
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]

1. ALL CONDUIT ... EXCEPT WHERE NOTED
2. ALL BREAKERS ARE ...
3. ALL MOTORS AND STARTERS ARE GROUNDED WITH ...

AGRICULTURAL ENGINEERING
... GIN
ELECTRICAL DIAGRAMS

... 3, 1985





AGRICULTURAL ENGINEERING
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Cotton Gin showing:
Guards
Gin Stand
Control Panel

Electrical
Control Panel

Overhead cleaners:
Incline
Stick
Impact

Lint Cleaner

Fan Platform
with several
fans and motors

Trash Cyclones

Device to be used
with module
builder to test
the moisture meter