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ROLLER GINNING

American-
Egyptian
Cotton

in the Southwest

Agricultural Research Service

UNITED STATES DEPARTMENT OF AGRICULTURE

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ROLLER GINNING

American-Egyptian Cotton

in the Southwest

BY DAVID M. ALBERSON and VICTOR L. STEDRONSKY, agricultural engineers, Agricultural Engineering Research Division, Agricultural Research Service¹

Since 1950, cleaners, driers, extractors, and pneumatic conveyances have become increasingly important in ginning American-Egyptian cotton grown in the Southwest. Modern harvesting practices and the high price and shortage of labor have necessitated a change in ginning practices on extra long staple cotton. Each year the seed cotton has been arriving at the gin with more foreign matter and a higher moisture content.

Production of American-Egyptian cotton in the United States since 1950 has ranged from a high of 93,500 bales in 1952 to a low of 49,100 bales in 1956 (15).² In 1958, 81,900 bales were produced and in 1959, 69,100. The entire American-Egyptian cotton crop is grown in the Salt River Valley of Arizona, in New Mexico, and in District 6 of Texas.

This handbook contains available research data on the effects of cleaning, extracting, drying, and pneumatic handling on American-Egyptian cottons grown in the United States. Before 1950, this type of cotton had been ginned with less cleaning and handling by machinery than upland cotton, which requires more careful picking, roller ginning, and packaging.

The U.S. Department of Agriculture conducted limited research between 1926-41 on roller ginning. World War II halted the work and it was not resumed until 1950. Small-scale experiments were conducted by the Southwestern Cotton Ginning Research Laboratory at Mesilla Park, N. Mex., during the harvesting seasons of 1950, 1951, and 1952. Intensive investigations were started there in 1953 after facilities for roller ginning research were installed. Representative experiments and their results are reported in this handbook. Additional engineering data and some recent commercial developments are given in the appendix.

¹ Headquarters: Southwestern Cotton Ginning Research Laboratory, Mesilla Park, N. Mex.

² Italic numbers in parentheses refer to Literature Cited, p. 29.

PROBLEMS IN GINNING AMERICAN-EGYPTIAN COTTON

American-Egyptian cotton was first produced commercially in the Southwest in 1911 after discovery of a variety that became known as "Yuma." This variety was grown in the Imperial Valley of California and the Salt River Valley of Arizona until 1917. Production rose from 30 bales in 1911 to 15,966 bales in 1917 (7).

Yuma cotton had a staple length of approximately $1\frac{1}{16}$ inches (16), was very fine, and could not be ginned satisfactorily on a saw gin. Consequently, to retain the qualities required for spinning, Yuma had to be roller ginned and handled by methods similar to those used for sea-island cotton, which had formerly been grown in the Southeast for the high-quality cotton market (11). Bennett (3) has reviewed the history of American-Egyptian cotton in the Southwest and the development of machinery to gin this type of cotton.

With the coming of the boll weevil in the southern cotton States, production of sea-island cotton practically ceased. Many roller gins thus found their way to the Southwest for use in ginning the new long-staple varieties of cotton. Roller ginning at that time usually consisted of a simple cleaner feeder with a spiked draper belt that carried a small amount of very clean hand-picked seed cotton to the gin roller (10). If the cotton was trashy, it was usually passed through a 3-cylinder picker-roller cleaner and an inclined shaker before being fed to the roller gin.

The early roller gin mechanism, known as a McCarthy-type gin stand, consisted of a roller, a stationary knife, a moving knife connected to a crank by means of crank legs (connecting rods), a set of seed grids, a pusher board, and a doffer. A roller gin of this type is shown in figure 1.



BN 18405

FIGURE 1.—McCarthy-type roller gin stand with plain bearings, forged cranks and wooden crank legs, brush doffer, and a spiral-wound packing-covered roller with leather moting strips.

In 1918, Yuma cotton was replaced commercially by "Pima," which had been discovered as a single plant in a field of Yuma at the U.S. Cotton Field Station, Sacaton, Ariz., in 1910. From 1918 to 1939, Pima or Pima crosses were the only varieties of American-Egyptian cotton grown. More than 92,000 bales of Pima were produced in 1920.

Because of unstable production, gin owners were reluctant to make expenditures on roller gin improvements. However, from 1930 to 1940 some ginners made individual mechanical changes and improvements to the older McCarthy-type gin stands. Plain bearings were replaced with ball or roller bearings, gin frames were made more sturdy, and an effort was made to improve mechanical dependability and to achieve more continuous operation.

Production increased substantially in 1941 and 1942. As old equipment wore out and no other old gin stands were available for replacement, for the first time in several decades new roller gins were manufactured. American gin machinery manufacturers installed many new gin stands to handle and gin almost 74,000 bales in 1942 and almost 60,000 bales in 1943. But in 1944 the number of bales ginned dropped to 8,600. From 1944 to 1949 the industry was again almost dormant and many gins were idle. During those 6 years, an average of only 3,950 bales was produced annually.

In 1950 production again skyrocketed to 62,200 bales. Acreage in Arizona, New Mexico, and Texas increased greatly, and new ginning plants were constructed in the Salt River Valley of Arizona, in the Mesilla Valley of New Mexico, and in the El Paso Valley and near Pecos, Texas. Production reached an all-time high of 93,500 bales in 1952, only to drop to 64,500 in 1953. In 1954 and 1955 production again dropped to an estimated 40,000 bales annually but increased to 49,100 bales in 1956. In 1957, 79,700 bales were grown; in 1958, 81,900; in 1959, 69,100; and in 1960 only 60,000 (15).

It was believed for years that long, fine-fibered Pima cotton must be handled very gently and that ginning was a very delicate operation. Farmers took great care in harvesting clean, hand-picked cotton, and the ginners avoided unnecessary handling. In some cases one or two overhead unit extractor cleaners were added to the 4-cylinder cleaner, all of which received the seed cotton from the wagon suction telescope. After it passed through the separator or dropper and received limited cleaning, the cotton accumulated on the second floor and was then manually pushed to chutes and delivered by gravity to the gin stands beneath. Plants ranged in size from 12 to 36 stands. As the stands ginned the cotton, the lint fell to the floor and was manually pushed to a single-box press for baling.

The gins manufactured in 1942 were modern designs of sturdy steel or cast iron—a marked improvement over the old equipment. Ball and roller bearings or improved lubrication elements made continuous operation more dependable. Roller and crank speeds were increased to 125 and 900 r.p.m., respectively. However, as the old principles of operation were unchanged, the new gins had only slightly more hourly capacity than the old ones. The new gins were two sizes. One company manufactured a 40-inch roller whereas another increased the length to 54 inches. New roller ginning plants erected in 1942 followed the old pattern of building construction, generally two stories. The gins were on the ground floor, and a separator or pneumatic dropper and usually a 4-cylinder cleaner were installed on the second floor.

In 1952 several new ginning establishments were erected in Arizona, New Mexico, and Texas. One company increased roller length to 60 inches but retained other mechanical features similar to the 54-inch 1942 models. But in 1950 there was a marked change in the building construction of roller ginning plants.

THE MODERN ROLLER GINNING PLANT

Since 1950 the roller ginning plants constructed in the Southwest have included many of the latest design features, similar arrangements of machinery, and the modern equipment used in modern saw gins. The old two-story wooden or brick building has given way to single-floor or 1½-story prefabricated all-steel structures. Installation of the machinery at ground level is convenient for arrangement, change, and maintenance.

Overhead shafts for gin drives have been largely replaced by individual motors at each gin stand. Lint-conveyor belts carry the cotton to an air nozzle pickup and thence to a condenser and a double-box press. Latest types of seed-cotton cleaning and extracting machinery and drying equipment are being used, and each gin stand is fed by a unit feeder cleaner. Pneumatic seed-cotton conveyance and conventional screw-type augers have jointly replaced manual handling.

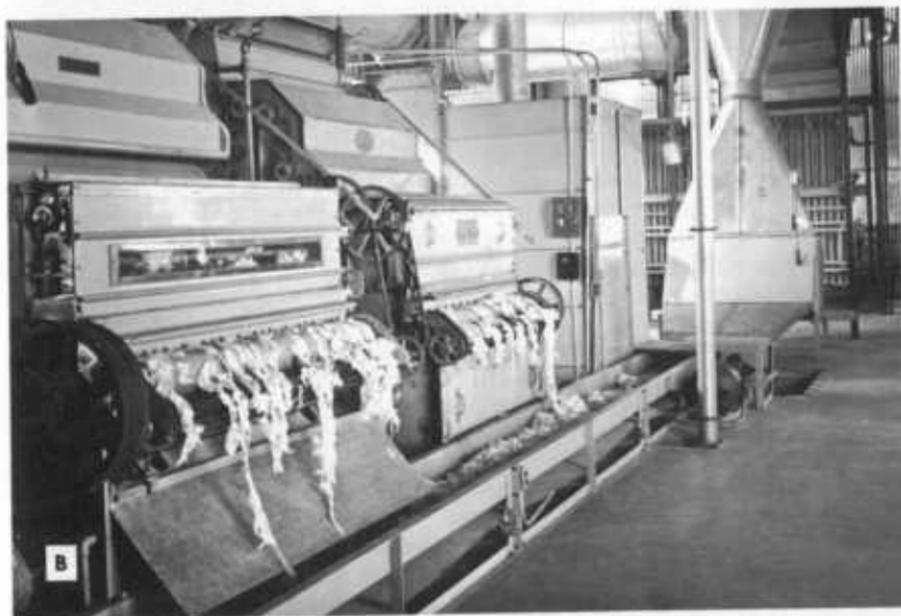
Many other practices followed in a modern upland-type saw-gin plant are followed in the ginning of American-Egyptian cotton varieties. Piping, air-flow, storage, and seed and trash handling requirements are similar to those that have been reported for saw gins (14).

Research on the ginning of American-Egyptian cotton until 1950 had been limited (5, 10, 11, 12). The USDA Cotton Ginning Research Laboratory at Stoneville, Miss., was faced with many research prob-



BN 18406

FIGURE 2.—Pneumatic lint-handling system installed in a commercial gin at Casa Grande, Ariz., in 1943.



BN 18399, BN 18402

FIGURE 3.—Roller gin research facilities at the Southwestern Cotton Ginning Research Laboratory, Mesilla Park, N. Mex. : A, exterior view ; B, interior view.

lems on upland cottons and could devote little effort to roller ginning, and then only when the need was greatest. Some ginning tests were performed by the Laboratory staff at Sacaton, Ariz., in 1932, 1936, and then again in 1940-43. As a result of these tests the USDA Cotton Ginning Research Laboratory developed a satisfactory pneumatic lint-handling system and one was installed in a commercial gin at Casa Grande, Ariz., in 1943 (fig. 2). The Laboratory also developed an improved doffer, a static eliminator, and other improvements that have been incorporated in modern roller gin stands and plants.

The Southwestern Cotton Ginning Research Laboratory at Mesilla Park, N. Mex., began roller ginning tests on a limited scale in 1950. In 1953, a roller ginning laboratory building was erected (fig. 3, A). It is fully equipped with drying, overhead cleaning, and extracting equipment plus a belt-pneumatic lint-handling system, double-box press, and most of the late-model roller gins. Thus, for the first time, facilities and working space were available to start a complete research program on roller ginning of American-Egyptian cotton (fig. 3, B). Also, for the first time, lint-cleaning devices were operated in conjunction with roller gins. This research was prompted by producers of long-staple cotton, who were being forced to harvest their crops mechanically because of high labor costs. In so doing, unsatisfactory grades were being produced in the existing gins.

OPERATION OF THE McCARTHY-TYPE ROLLER GIN STAND

Figure 1 shows a typical McCarthy-type roller gin with plain bearings, forged cranks, and wooden crank legs. This rather crude construction has not been conducive to continuous operation because constant adjustments and repairs are required. Such gins have operated with roller speeds of approximately 100 r.p.m. and crank speeds of 600 r.p.m. Ginning capacity has been relatively low in the United States—from 1 to 1½ pounds of lint per hour per inch of roller length.

The operation and gin settings of the 1950 model of the McCarthy-type roller gin stand are approximately the same as those of models built up to 1942. The greatest difference is that on the 1950 model these settings are easier to make and maintain. Bearings, eccentrics, and general gin construction have been improved. However, the settings and adjustments of roller gins vary greatly. Some settings and adjustments are based on experience accumulated over years of operating both the old model roller gins and the present gin stands. Others are purely theoretical and are based on engineering knowledge alone. The ultimate goal is the ginning of the greatest amount of cotton without undue wear on the gin, while retaining the highest possible fiber quality. Thus the proper setting or adjustment of a roller gin is based on a combination of experience, common sense, and application of basic or established engineering knowledge.

The following comments are not intended to be the set rule for roller gin adjustment, but rather a guide for "setting up" a roller gin stand. Final adjustments or settings will be determined by the operator after the gin is "broken in," and will depend on the characteristics of the cotton he is ginning and the optimum capacity he is able to obtain by the proper relation between the various settings. Figure 4 is a cross-sectional view of the important parts of the McCarthy-type roller gin. The settings of the roller gin are the relation of these parts to one another.

The stationary steel knife *B* (fig. 4) is about 4 inches wide and from 1/8 to 1/4 inch thick. Its thickness varies considerably because some ginners prefer a thin knife whereas others use the thicker 1/4-inch knife. As a general rule the 40-inch gin stands are equipped with a 1/8- or 3/16-inch knife and the 54- or 60-inch gin stands with a 3/16- or 1/4-inch knife.

The knife should be held tightly against roller *A* at a pressure ranging from 20 to 30 pounds per running inch, depending on the

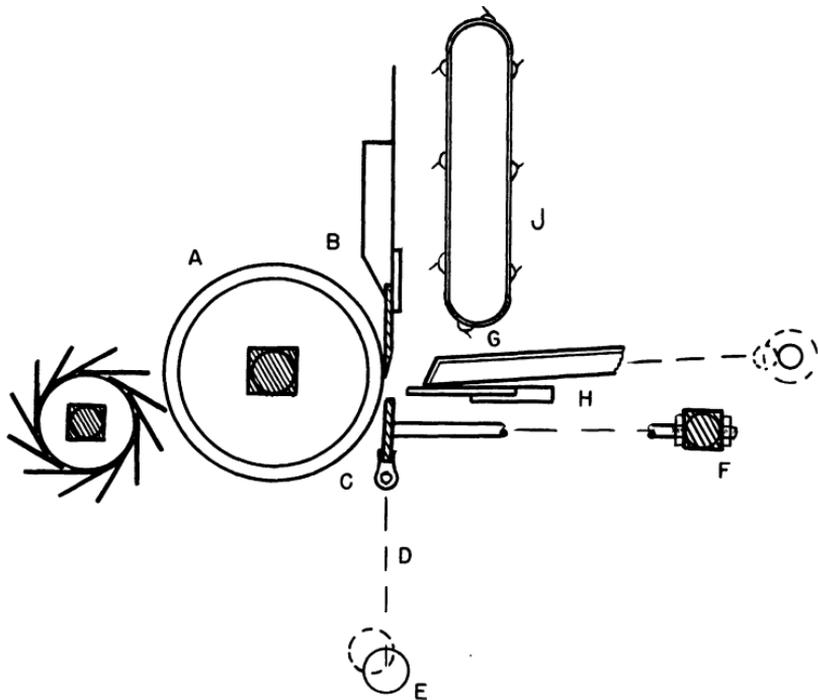


Diagram A

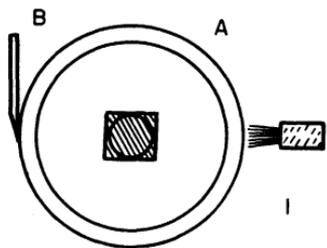


Diagram B

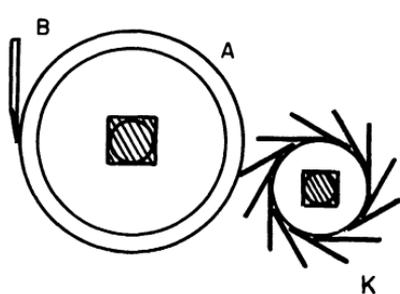


Diagram C

FIGURE 4.—Conventional features of McCarthy-type roller gin stands, models, 1917 to 1950. DIAGRAM A, typical cross section of upper portion of the unit showing A, ginning roller; B, stationary knife; C, moving knife; D, crank leg; E, cranks and crankshaft; F, pivot for moving knife; G, pusher board; and H, seed grid. DIAGRAM B, ginning roller, A, and stationary brush doffer, I. DIAGRAM C, ginning roller, A, and USDA-improved rotary doffer, J.

covering material. The working or bottom edge of the knife should be on or slightly below the center line of the roller. The stationary knife must be so clamped that its ginning edge is in the same plane as the axis of the roller; when set in this manner and when the ginning roller pressure is applied, the moving knife may be adjusted to the proper setting without digging into the roller. The stationary knife

setting is one of the first checks that should be made when setting up the roller gin.

The ginning roller *A* (fig. 4) consists of a cylindrical wooden core on a steel shaft. It is thickly covered by some material that has an affinity to cotton fiber, such as leather or special composition packing. Since about 1938, walrus hide and other leathers have been very expensive in the United States. A substitute for leather—an American waterpump packing made from laminations of canvas and rubber—is being used satisfactorily for roller covering.

The pressure of the ginning roller *A* against the stationary knife *B* is of primary importance in roller gin operation. The proper pressure will finally be determined by ginning performance, but basic rules enable the operator to achieve these results with a minimum number of changes after ginning begins.

The ginning roller should have enough pressure so that the surface of the roller will feel uniformly warm from one end to the other when the roller has been operating a few moments. After the roller has run a few hours, or is "broken in," a pressure mark is usually left on the roller by the stationary knife.

If the pressure is correct, a streak approximately $\frac{3}{8}$ to $\frac{7}{16}$ inch wide will show on the roller where the roller and stationary knife made contact. This streak should be uniform in width from one end of the roller to the other.

If the pressure is not correct, the roller will heat while running and the packing will burn or the impression will be too deep or irregular. The roller surface should never be allowed to become so hot as to burn your hand. Also, too much pressure between the roller and the stationary knife will result in excessive wear on the covering. Too little pressure will result in the roller not having sufficient grip or hold on the cotton while the moving knife strips the seed from the fiber. Evidence of this would be shown when the lint seemingly quivers momentarily at the ginning point before it is released and flows over the roller. Also, a cool roller shows that there is not enough pressure between the roller and the stationary knife.

The pressure must be readjusted as the roller covering wears down. Care must be taken while adjusting the pressure not to push the stationary knife into the moving knife. After any adjustment, turn the machine over by hand before starting it.

Adjustment of the moving knife *C* (fig. 4) consists of four major settings:

(1) The moving knife must align with the stationary knife so that the two edges are parallel and properly spaced. The ginning laboratory has found that face clearances between the moving and stationary knives should range between 0.025 and 0.032 inch for Pima cottons in the Southwest.

(2) Vertical adjustment of the moving knife—lengthening or shortening the crank leg—must be such as to expose ample ginning roller surface to the seed cotton.

(3) Horizontal adjustment of the moving knife—shortening or lengthening the pivot arm—must provide proper clearance with the fixed knife. This is necessary so that seeds cannot be lodged or crushed on the ginning or return strokes of the moving knife.

(4) The overlap—the distance that the moving edges pass the stationary edge—must suit the fiber length. This final adjustment

also is required for item (2). The correctness of these adjustments can be best proved by the appearance of the lint cotton. A steady and uniform flow of lint over the roller results if the adjustments are correct.

On the question of overlap, a good rule of thumb is that the overlap be approximately half the staple length of the cotton being ginned. Here again, however, the appearance of the ginned lint will indicate whether the overlap is excessive or insufficient. If the overlap is excessive, the lint tends to come off the roll in a rough, featherlike form with very little semblance to a uniform layer. If the overlap is insufficient, the cotton will not clear the ginning point properly, an indication that it is taking too many strokes of the moving knife to complete the ginning of each seed. Correct overlap will yield a smooth, even flow of lint over the ginning roller.

Adjustment of the seed grid is also important. The most satisfactory type of seed grid for ginning the varieties of cotton grown in the Southwest is a comblike assembly of $\frac{3}{4}$ by $\frac{1}{8}$ -inch fingers. These fingers are 3 inches long, tapered to approximately $\frac{1}{4}$ inch at the finger tip, and spaced $\frac{5}{8}$ inch on centers. This grid assembly allows the semifuzzy seed of the Pima S1 variety and the fuzzy seed of upland cotton to shed readily without loss of seed cotton. The grid should be adjusted so that the clearance from the moving knife is as great as can be obtained without dropping unginning seed cotton into the seed. The tip of the fingers should be adjusted to allow for the maximum exposure of the ginning roller when the moving knife is at the beginning of its stroke. However, they should not strike the moving blade adjustment bars.

The pusher board should be set so that in the forward position the nose of the board will be from $\frac{1}{4}$ to $\frac{1}{2}$ inch from the tips of the seed fingers.

The setting of the doffing roller, while simple, does require some attention. The center of the doffing roller should be from 2 to 3 inches below the center of the ginning roller shaft. The doffing flights should then be set to just clear the ginning roller when turning. This setting allows the lint to be removed from the ginning roller smoothly without wadding or dropping the cotton between the rollers. The speed of the doffing roller ranges from 30 to 50 r.p.m., depending on its diameter.

When a draper feeder (fig. 4, *J*) is used, the speed of the belt is adjustable and should be set so that each flight of needled slats delivers only slightly more seed cotton to the ginning point than can be ginned before the next slat delivers its seed cotton. The ginning laboratory has found that the draper feeder increases gin capacity.

CLEANING PIMA SEED COTTON

The Southwestern Cotton Ginning Research Laboratory at Mesilla Park, N. Mex., conducted extensive research studies from 1950 through 1956 on cleaning two American-Egyptian varieties of seed cotton—Pima 32 and Pima S1. The harvests were both hand picked and machine picked. A schedule of the cottons tested each season is given in table 1. Numerous combinations of machinery were tested, ranging from a simple to a very elaborate combination. Schematic dia-

TABLE 1.—*Pima* cotton tested, 1950–56

Year and variety	Type of picking	Picking season
1950: Pima 32.....	Hand.....	{ Early. Midseason.
1951: Pima 32.....	do.....	{ Midseason. Late.
1952: Pima 32.....	do.....	{ Midseason. Late.
1953: Pima 32.....	Machine.....	Late.
Pima S1.....	do.....	Do.
1954: Pima 32.....	{ Hand.....	Midseason.
	{ do.....	Late.
	{ Machine.....	Do.
Pima S1.....	{ Hand.....	Midseason.
	{ Machine.....	Late.
1955: Pima 32.....	Machine.....	{ Midseason. Late.
Pima S1.....	do.....	{ Midseason. Late.
1956: Pima S1.....	do.....	Midseason.

grams of the seed cotton cleaning machinery for roller and saw ginning at the laboratory are shown in figure 5. Figure 6 shows additional machinery for use only in roller ginning.

Every possible combination of machinery in these two diagrams has been tested in cleaning Pima seed cotton, but for simplicity three have been selected for discussion: (1) Simple (fig. 7), (2) moderate (fig. 8), and (3) elaborate (fig. 9).

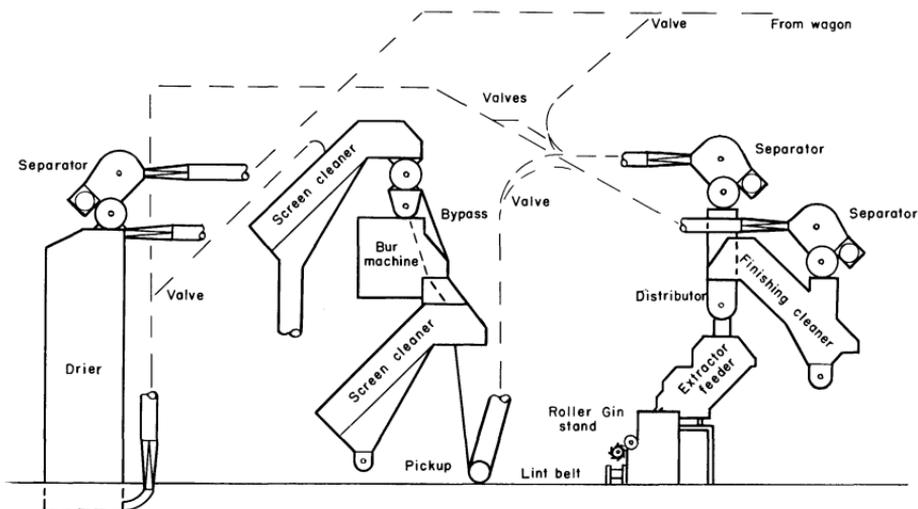


FIGURE 5.—Diagram of drying, cleaning, and extracting equipment, available by piping and valves, for roller ginning at the Southwestern Cotton Ginning Research Laboratory, Mesilla Park, N. Mex.

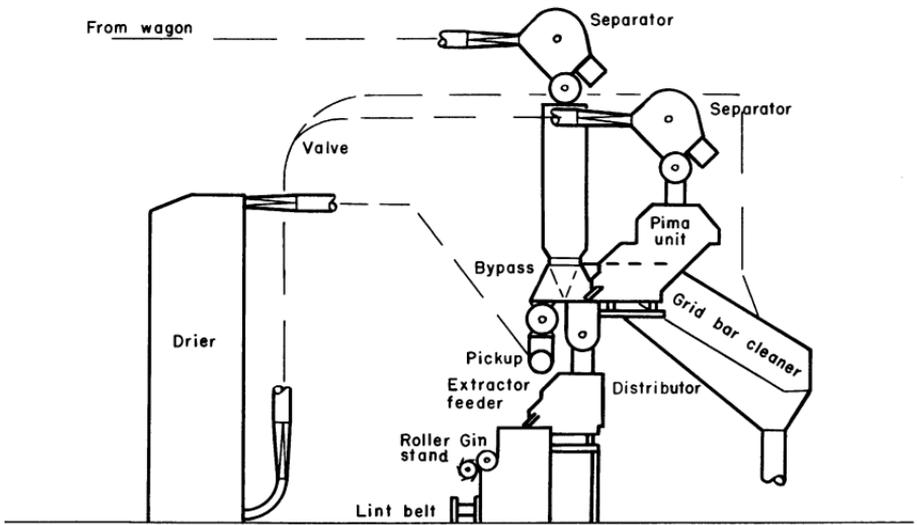


FIGURE 6.—Diagram of additional equipment in the roller ginning laboratory.

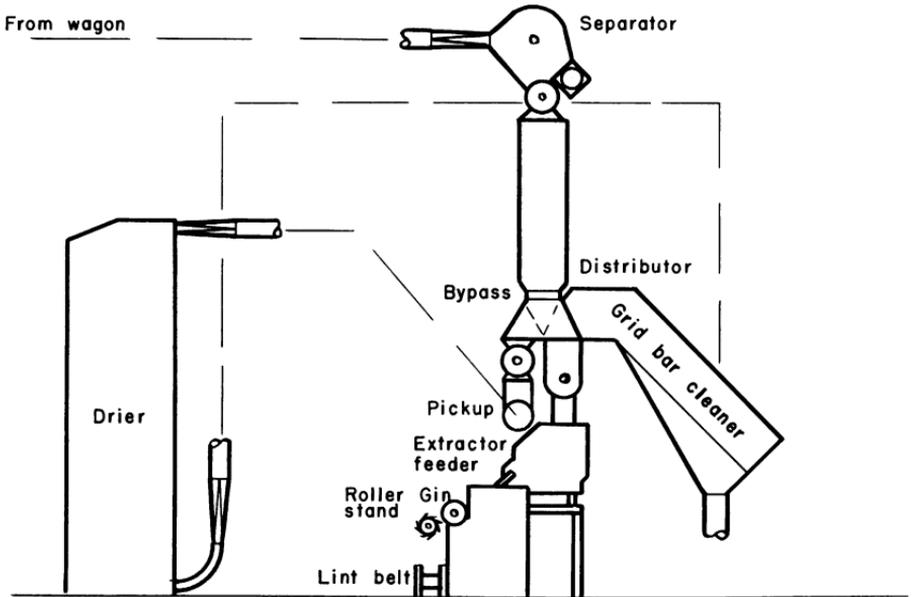


FIGURE 7.—Simple machinery combination for roller ginning research tests.

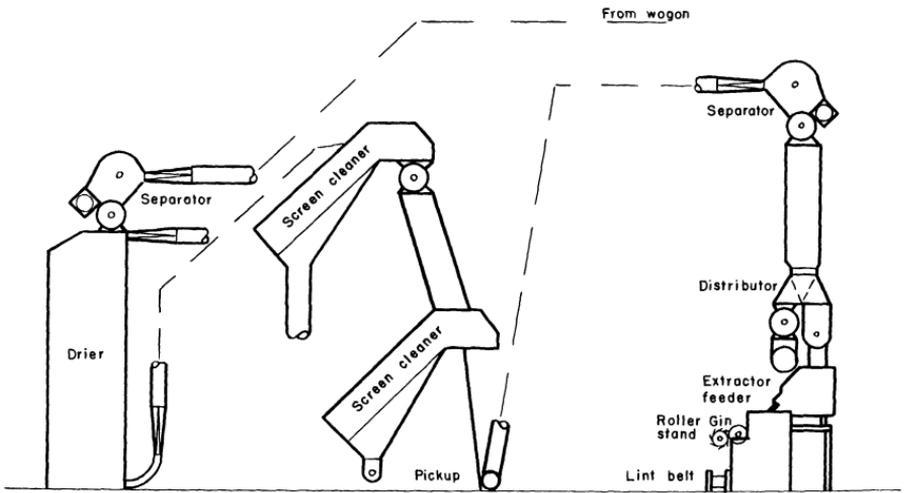


FIGURE 8.—Moderate machinery combination for roller ginning research tests.

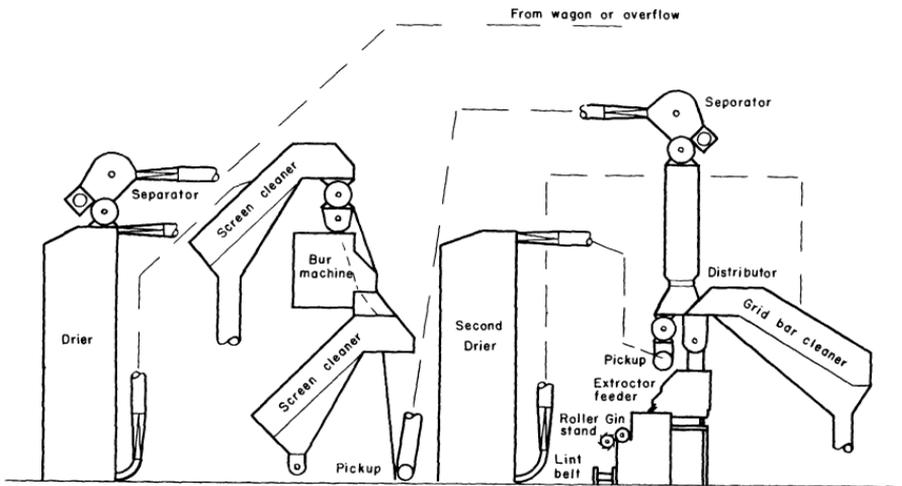


FIGURE 9.—Elaborate machinery combination for roller ginning research tests.

Testing Procedures

The seed cottons were obtained from growers in the upper Rio Grande Valley of New Mexico, District 6 of Texas, and the Salt River Valley of Arizona. When the cotton reached the laboratory, it was composited by hand turning and mixing to obtain homogeneity of both foreign-matter and moisture content. The seed cotton was then weighed into 150-pound lots and fed through the various machinery combinations being tested. Samples of seed cotton and lint were taken at different points for determining foreign matter and moisture content, and for fiber analysis and spinning results. A description of testing procedures has been published (13).

The positions from which samples were taken and type of sample for each lot are as follows:

- (1) Foreign matter—seed cotton: Wagon and feeder apron.

- (2) Moisture—seed cotton: Wagon and feeder apron.
 (3) Moisture—lint: Before and after lint cleaning.
 (4) Fiber classification—grade and staple: Before and after lint cleaning.
 (5) Fiber analyses—strength, upper half mean length, fineness, maturity, uniformity, fiber nep count, fiber array: Before and after lint cleaning.
 (6) Shirley analyzer or nonlint content: Percentage of foreign matter remaining in the ginned lint.
 (7) Spinning results: Lint samples, before and after lint cleaning, were card web nep count, picker and card waste, yarn strength, yarn appearance.

Hand-picked Undeveloped Cotton

The early picking of upland cotton occurs before the first picking of Pima, which begins at midseason. Hand-picked Pima 32 and Pima S1 were tested from pickings made at times that correspond to the upland midseason and late season pickings. Pima is usually picked only twice instead of three times. The average results for the 4 years during which these tests were made are shown in table 2.

TABLE 2.—*Cleaning effects of machinery combinations on undeveloped hand-picked Pima seed cotton, 1950-54*

Test item	Machinery combination					
	Simple		Moderate		Elaborate	
	<i>Mid-season</i>	<i>Late season</i>	<i>Mid-season</i>	<i>Late season</i>	<i>Mid-season</i>	<i>Late season</i>
Foreign matter:						
Wagon sample.....percent.....	1. 8	3. 5	1. 8	3. 3	1. 8	3. 3
Feeder sample.....do.....	. 03	. 07	. 03	. 05	. 02	. 03
Nonlint content.....do.....	2. 91	3. 65	2. 58	3. 45	2. 71	3. 21
Moisture content:						
Wagon sample.....do.....	6. 5	6. 2	6. 5	6. 2	6. 6	6. 2
Feeder sample.....do.....	6. 2	6. 2	6. 4	6. 1	6. 6	6. 1
Lint sample.....do.....	5. 2	4. 7	5. 1	4. 7	5. 1	4. 5
Lint turnout.....do.....	30. 79	30. 70	30. 59	30. 73	30. 65	30. 74
Grade designation, average grade index.....	1. 7	1. 3	1. 4	1. 2	1. 2	1. 2
Staple length:						
Inches.....	1½	1½ ₃₂	1½-	1½ ₃₂ +	1½-	1½-
32ds of an inch.....	48	47	47. 6	47. 3	47. 6	47. 8

The results show that there were only small improvements from the simple to the elaborate seed cotton cleaning combination on hand-picked cottons. The moderate combination (12 to 13 cylinders of cleaning and an extractor feeder) resulted in the same grade as the elaborate combination (18 cylinders of cleaning, a bulk extractor, and extractor feeders). There were no differences in the staples or percentage of lint turnouts.

Machine-picked Undeveloped Cotton

Machine-picked Pima 32 and Pima S1 from midseason and late-season pickings were tested during the 4 years 1953-56. The cotton varied greatly when it reached the laboratory. Moisture content and foreign matter of the seed cotton varied with picking season, ability of the picker operator, type of spindle the picker contained, and locality from which the test cotton was obtained. An average of the performance data for the test years is shown in table 3.

TABLE 3.—*Cleaning effects of machinery combinations on undeveloped machine-picked Pima seed cotton, 1953-56*

Test item	Machinery combination					
	Simple		Moderate		Elaborate	
	<i>Mid-season</i>	<i>Late season</i>	<i>Mid-season</i>	<i>Late season</i>	<i>Mid-season</i>	<i>Late season</i>
Foreign matter:						
Wagon sample.....percent..	5. 2	4. 9	5. 8	4. 9	5. 6	5. 1
Feeder sample.....do.....	1. 3	1. 4	1. 0	1. 0	. 9	. 7
Nonlint content.....do.....	6. 2	6. 2	5. 0	6. 0	4. 0	5. 0
Moisture content:						
Wagon sample.....do.....	8. 2	9. 1	8. 2	9. 3	8. 3	9. 0
Feeder sample.....do.....	7. 3	8. 4	7. 3	8. 4	7. 1	7. 8
Lint sample.....do.....	4. 9	5. 7	4. 8	5. 3	4. 6	4. 8
Lint turnout.....do.....	30. 20	29. 86	29. 90	29. 26	29. 60	29. 43
Grade designation, grade index.....	4. 2	3. 6	3. 9	3. 6	3. 4	3. 2
Staple length, 32ds of an inch.....	45	45	45	45	45	45

Note. Because of excessive moisture in the seed cotton in 1955 and 1956 cleaning arrangements included moderate drying temperatures ranging from 160° to 200° F.

Table 3 shows that the first-picked (midseason) cotton steadily increased in grade without fiber damage and with only a slight decrease in percentage of lint turnout as the cleaning machinery combination was increased from simple to elaborate. The grades of late season cotton increased slightly and then only when the elaborate combination was used. Percentage of lint turnout varied little from the simple to the elaborate machinery combination. Other fiber qualities were not materially affected by seed cotton cleaning equipment.

The conclusions drawn by the ginning laboratory from the research tests on the seed cotton cleaning of American-Egyptian cotton are as follows:

(1) Hand-picked cotton requires only a moderate cleaning machinery combination—from 12 to 13 cylinders of screen cleaning and an extractor feeder—to obtain near maximum grades (fig. 8).

(2) Machine-picked cotton may be cleaned with an elaborate cleaning machinery combination—up to 18 cylinders of cleaning, a bur extractor, and extractor feeders—with a resulting increase in grade and without affecting other fiber qualities. Moderate drying of early or before-frost machine-picked cotton is desirable.

Cross-sectional flow figures of the cleaning equipment used in the seed cotton cleaning tests made by the ginning laboratory on American-Egyptian cottons are shown in figures 10 through 14.

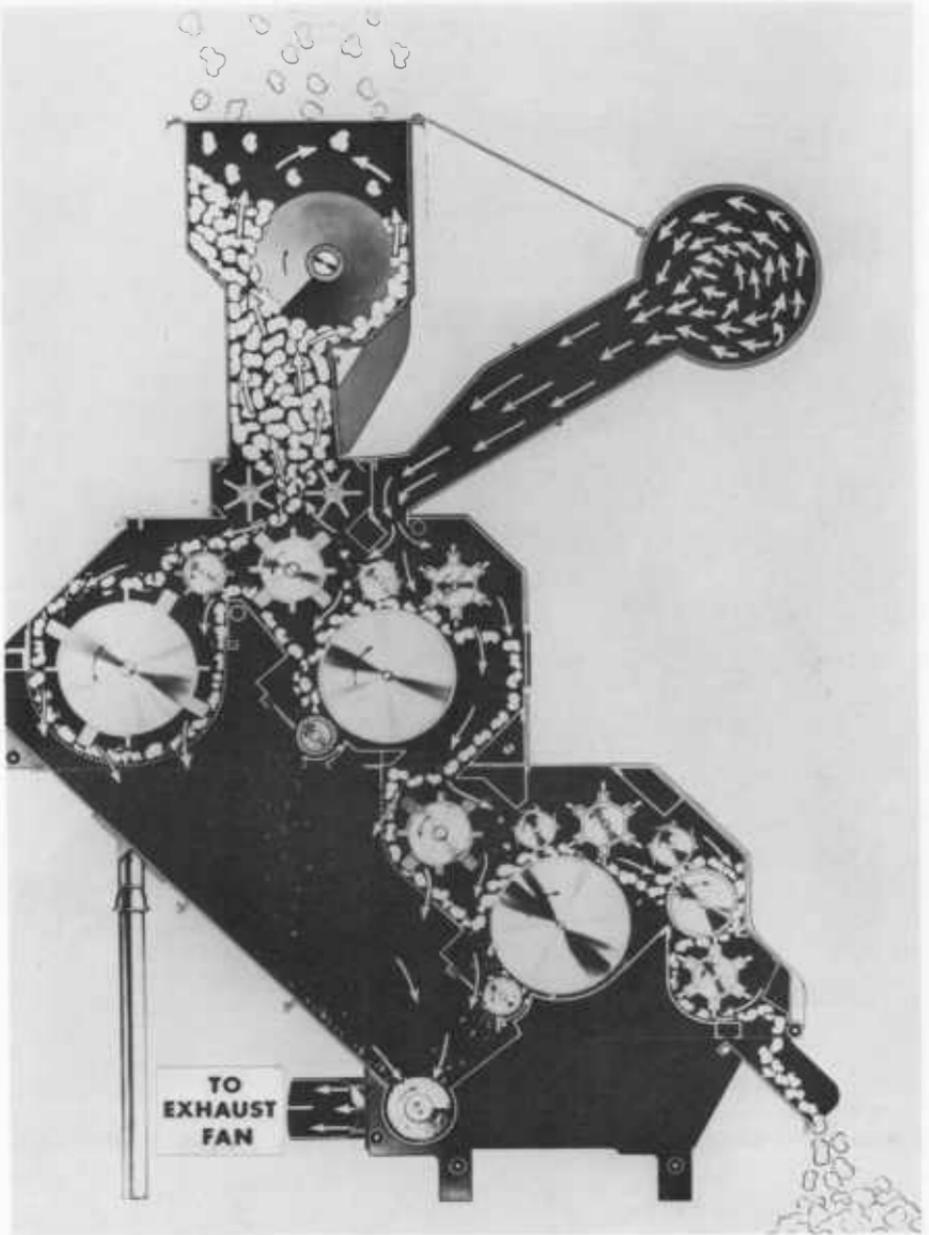


FIGURE 10.—Super unit extractor feeder (courtesy of the John E. Mitchell Co.).

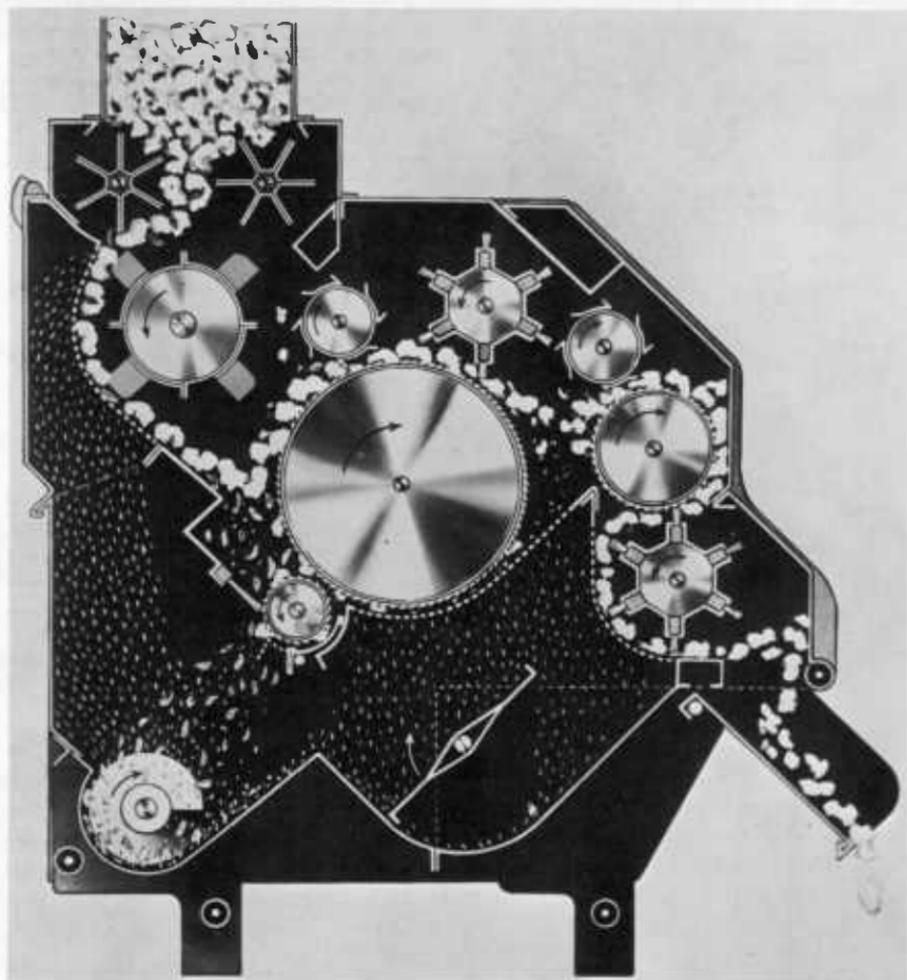


FIGURE 11.—Convertible extractor feeder (courtesy of the John E. Mitchell Co.).

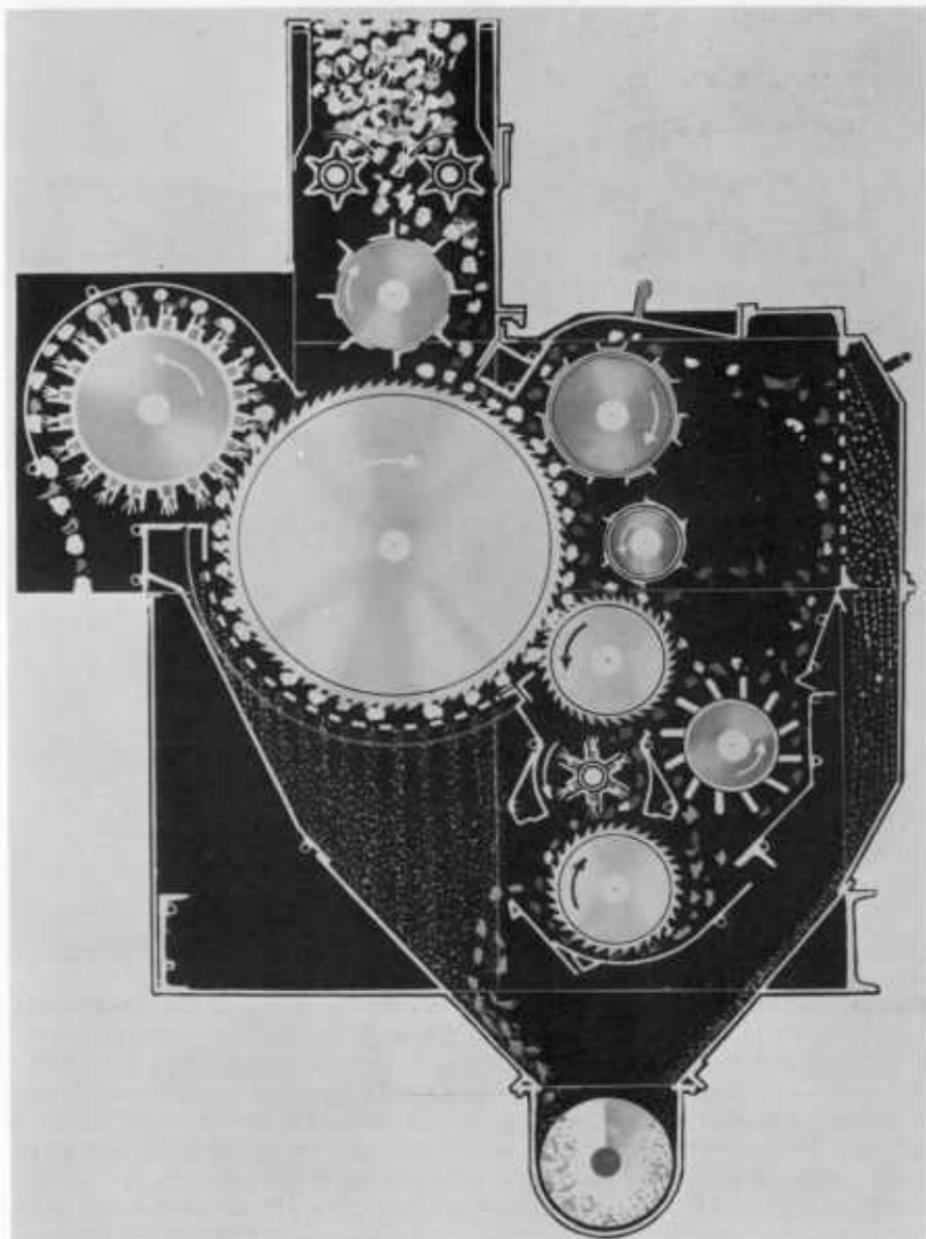


FIGURE 12.—Bulk unit bur extractor (courtesy of the Continental Gin Co.).

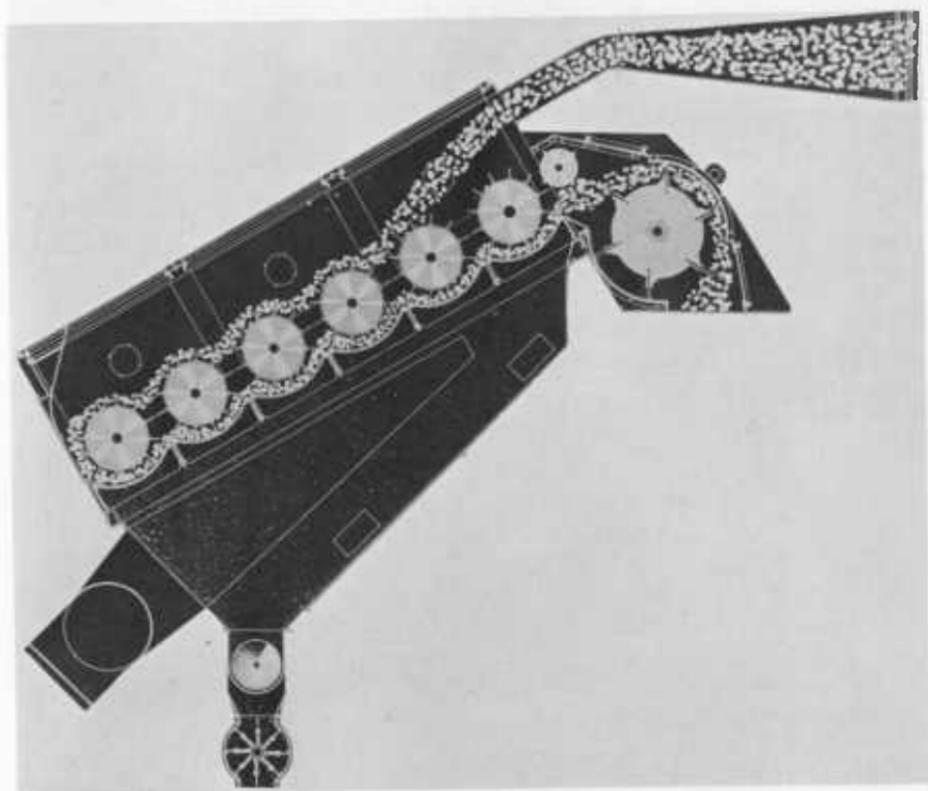


FIGURE 13.—Inclined screen seed cotton cleaner (courtesy of the Continental Gin Co.).

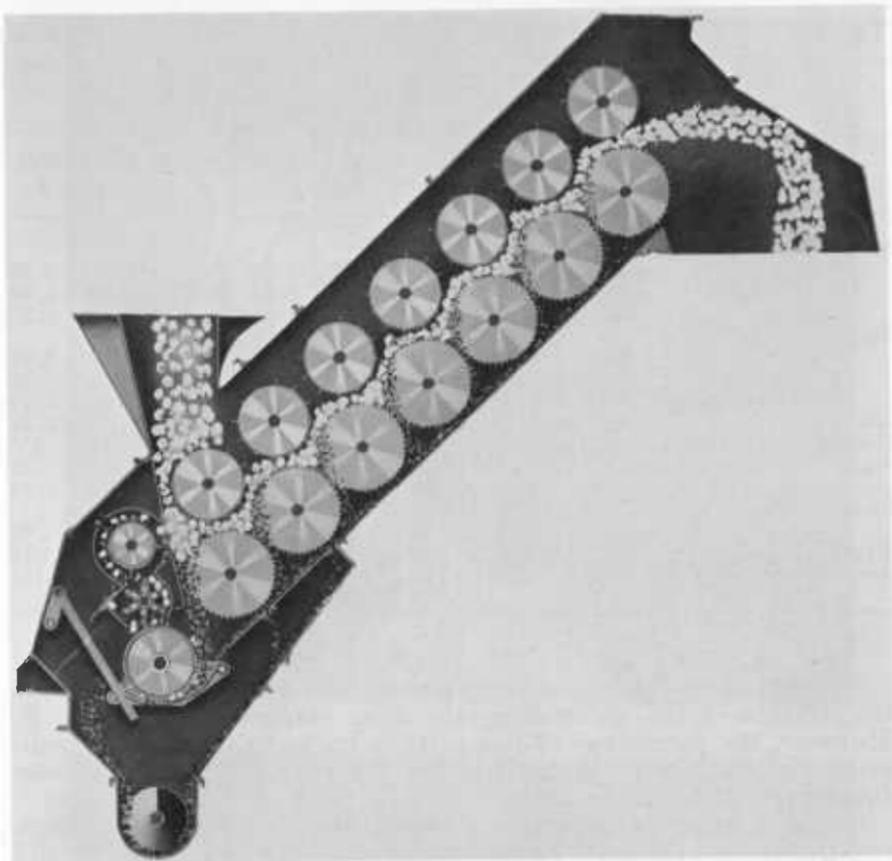


FIGURE 14.—Inclined impact seed cotton cleaner (courtesy of the Continental Gin Co.).

DRYING PIMA SEED COTTON

Until machine pickers for harvesting American-Egyptian cottons became prevalent, very little or no drying was needed in ginning these varieties. Very few roller gin establishments were equipped with driers until 1950. Roller gin plants constructed since 1950 have included seed cotton driers and they have been used beneficially at moderate temperatures without apparent fiber damage.

The Southwestern Cotton Ginning Research Laboratory conducted a series of drying studies on Pima seed cotton from 1954 through 1956. Machine-picked seed cotton was used for these studies. Drying temperatures ranged from no heat to 300° F. The average results are shown in table 4.

The average moisture content of the seed cotton as it arrived at the gin ranged from 8.34 to 9.52 percent. The average moisture content of the seed cotton at the feeder apron was reduced only from 7.92 to 7.02 percent when the maximum drying temperature of 300° F. was used. In contrast, the moisture content of the lint was reduced from an average of 5.33 to 3.21 percent by drying at the maximum temperature.

TABLE 4.—*Effects of temperature on drying Pima seed cotton, 1954-56*

Test item	Drying temperature ¹						
	No heat	150° F.	180° F.	200° F.	220° F.	240° F.	300° F.
Moisture content:							
Wagon-----percent--	8. 56	8. 46	8. 36	8. 58	8. 49	8. 34	9. 52
Feeder apron-----do----	7. 92	7. 68	7. 48	7. 45	7. 27	7. 06	7. 02
Lint-----do-----	5. 33	4. 89	4. 44	4. 16	4. 00	3. 46	3. 21
Foreign matter:							
Wagon-----do-----	4. 37	4. 19	4. 20	4. 83	4. 40	4. 72	4. 44
Feeder apron-----do----	. 81	. 82	. 82	. 81	. 88	. 70	. 60
Nonlint content-----do----	4. 24	4. 25	4. 37	3. 88	3. 94	3. 60	3. 70
Lint turnout-----do-----	32. 15	31. 41	31. 49	31. 30	31. 59	31. 12	31. 35
Classers' grade designation---	3. 6	3. 4	3. 3	3. 8	3. 5	3. 4	3. 5
Staple length: ½sd inch-----	46	46	45	44	46	45	45
Upper half mean-----inches--	1. 34	1. 34	1. 35	1. 33	1. 34	1. 32	1. 34
Picker and card waste							
percent--	12. 16	11. 79	11. 89	11. 38	11. 61	11. 22	10. 40
Average break factor-----	3, 165	3, 202	3, 199	3, 132	3, 191	3, 097	3, 073
Average yarn appearance-----	108	112	112	118	108	122	118

¹ At drier inlet.

Percentage of foreign matter removed did not increase until the temperature of the air entering the drier reached 200° to 240° F. However, the percentage of lint turnout began to decrease immediately with addition of drying heat but did not substantially decrease further at higher temperatures.

Grade and staple classifications varied little over the drying range, and the upper half mean length as measured by the Fibrograph did not indicate a shortening of the fiber. The spinning results from these drying studies show a definite decrease in picker and card waste, and general yarn appearance improved as drying temperatures were increased.

The conclusions from this series of drying studies are that when drying seed cotton is necessary, moderate drying temperatures may be employed without harmful effects and with an increase in cleaning efficiency. However, the decrease in the percentage of lint turnout and the possibility of fiber shortening necessitate the use of moderate temperatures—220°-240° F.—in the drier.

STATIC ELECTRICITY IN ROLLER GINNING

Static electricity is a problem to the roller ginner. Rubbing of the steel stationary knife by the covering of the ginning roller and the lint cotton during ginning generates a static charge on the lint sufficient to cause the ginned lint to adhere to the ginning roller, and creates a serious doffing problem. When the surface moisture content of the lint is not high enough to permit this static charge to dissipate rapidly, the lint adheres to the doffer flights and is carried back on the underside of the ginning roller to the stationary knife (figs. 4 and 15). A roller gin operating with and without static electricity is shown in figure 15. If lint is allowed to accumulate, it will be pushed



BN 18404, BN 18403
FIGURE 15.—(A), Roller gin showing effects of static electricity; and (B), the same gin after live steam has been applied at the ginning point.

into the path of the moving knife. This generally damages the knives and the ginning roller covering.

In a series of experiments, workers at the Southwestern Cotton Ginning Research Laboratory have attempted to eliminate undesirable static electricity at the roller gin. Spinning-mill types of misting spray nozzles were tried at numerous positions about the gin. The resulting accumulation of moisture on the machinery prevented their practical use. High potential ionization bars were investigated and reduced static electricity, but the air could not be ionized at a location that would allow the roller and doffer to shed the cotton satisfactorily without prohibitive costs.

An economical method of increasing the surface moisture of the lint is to raise the humidity of the air at or immediately before the ginning point by the use of live steam. Numerous methods of putting this steam into use, and numerous points of injection, can be found in commercial roller gins today. Figure 16 gives the details of a steam line used in the laboratory roller gin with very satisfactory results. The location of the line with regard to the roller may vary considerably. The laboratory has found that mounting the steam line below and to the back of the center line of the ginning roller with the outlet holes directed toward the ginning area produces satisfactory results with a small amount of steam and a minimum accumulation of dirt, lint, and trash in the gin stand or seed board.

Results of recent tests at the Southwestern Cotton Ginning Research Laboratory and in commercial gins show that static electricity during ginning can be controlled with an antistatic agent. The antistatic agent Tween-20³ (manufactured by the Atlas Powder Company, Wil-

³ Mention of trade products in this publication does not imply their endorsement by the Department of Agriculture over similar products not named.

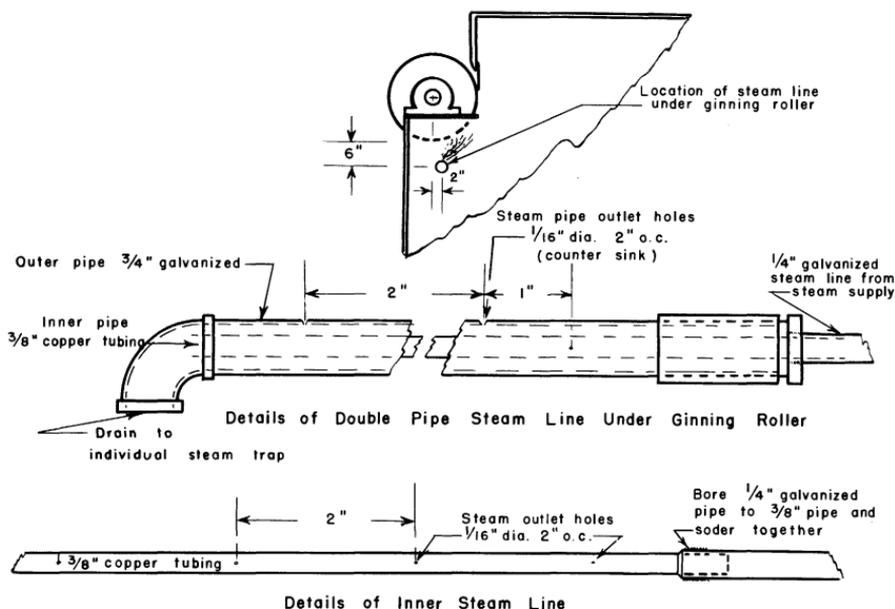


FIGURE 16.—Steam line for static electricity control.

mington, Del.) was tested for controlling static in a roller gin by two methods: (1) spray application to seed cotton; (2) direct application to the gin roller. The first was unsatisfactory; the second was satisfactory both in laboratory tests and at commercial gins. A mixture of 1 to 2 parts of water and 1 part of Tween-20 was applied to the gin rolls manually with a brush. Frequency of application was determined by the static conditions. Some ginners reported using two applications per day of approximately 1 gallon of Tween-20 per 100 bales of cotton (6).

PNEUMATIC CONVEYING AND CLEANING OF PIMA LINT

The modern roller gin is equipped to handle ginned lint mechanically. Research over the years has proved that conveying Pima cotton lint pneumatically does not harm its quality. Air handling alters the appearance of the lint as compared to manually pushing it to the press, but otherwise lint quality remains the same. Workers at the U.S. Cotton Ginning Research Laboratory at Stoneville, Miss., designed and installed a suction nozzle and lint flue system first in 1936 at Casa Grande, Ariz. (fig. 2). Roller gin plants built since 1950 have included in the ginning system a combination lint conveyor belt and air blast nozzle pickup delivering to a conventional condenser and double-box press (fig. 17).

Investigations were begun by the Southwestern Cotton Ginning Research Laboratory on the effect of pneumatic lint handling in 1954, when a pneumatic-type lint cleaner was installed between the air nozzle pickup and the condenser. These studies were continued three seasons, and the results of testing are shown in table 5.



BN 18401

FIGURE 17.—Lint handling system at the Southwestern Cotton Ginning Research Laboratory: Lint belt, air nozzle pickup, pneumatic lint cleaner, and a double-box press.

TABLE 5.—*Effects of pneumatic conveying and lint cleaning on hand-picked and machine-picked Pima cotton, 1954-56*

Test item	Pneumatic conveying				Lint cleaning			
	Hand-picked		Machine-picked		Hand-picked		Machine-picked	
	Before	After	Before	After	Before	After	Before	After
Ginning results:								
Lint moisture.....percent..	4.9	(¹)	5.9	(¹)	4.9	(¹)	5.0	(¹)
Nonlint content.....do.....	3.4	3.4	6.3	5.5	3.3	3.1	5.5	4.8
Lint cleaner trash per 480-lb. bale.....pounds..	(²)	(²)	(²)	(²)	(³)	1.0	(³)	3.2
Fiber analyses:								
Classer, grade designation.....	1.8	1.7	3.8	3.6	1.6	1.5	3.7	3.1
Classer, staple..... $\frac{1}{32}$ d-in.....	46	47	45	45	47	47	45	45
Fibrograph, upper half mean.....inches.....			1.30	1.30			1.32	1.31
Array, upper quartile.....do.....	1.47	1.48			1.48	1.49		
Fiber neps per 100 sq. in.....	7	8	10	11	8	10	11	12
Spinning results:								
Picker and card waste.....percent..	9.86	10.55	13.81	13.52	10.11	10.09	12.90	12.30
Neps per 100 sq. in. card web.....	11	11	10	11	12	12	10	13
Yarn appearance.....index.....	105	105	106	104	107	104	106	102

¹ Lint moisture not greatly affected by pneumatic conveying and lint cleaning.

² Lint cleaner not used. ³ Not applicable.

The two types of pneumatic lint cleaners used in the laboratory tests are shown in figures 18 and 19. Each of these units could be bypassed. Few or no harmful effects were detected from either the air handling or lint cleaning of hand-picked Pima cotton (table 5). There was, however, a slight decrease in the amount of trash remaining in the lint after pneumatic lint cleaning, as indicated by the non-lint content and the very small increase in grade classification. Fiber nep count increased only slightly and the resulting card web nep count averaged the same before and after pneumatic handling or pneumatic lint cleaning on hand-picked cotton.

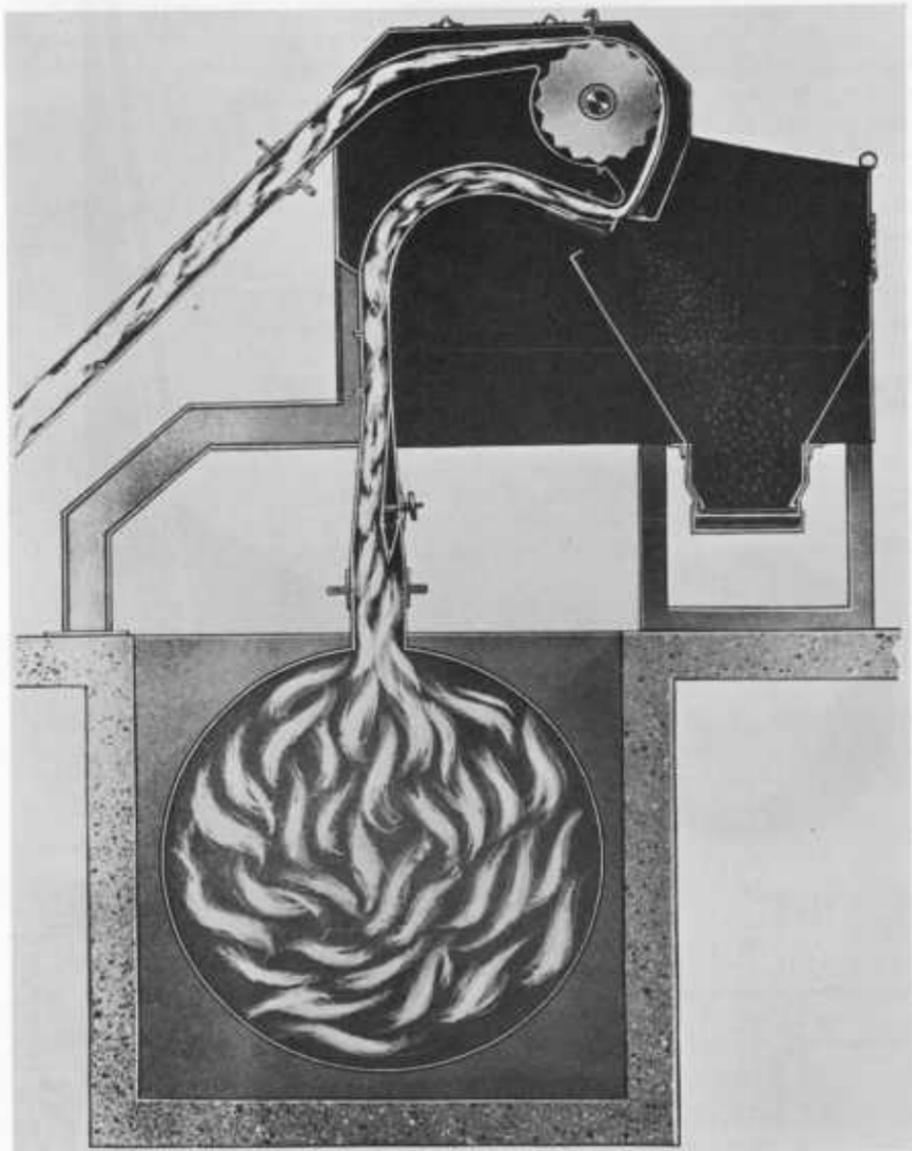


FIGURE 18.—Pneumatic lint cleaner (courtesy of the Murray Co. of Texas).

Some of the results for machine-picked cotton are more pronounced. Considerably more trash was removed from the lint, as shown in the nonlint content and the average grade increase. This was due to more trash being in the lint after ginning. As in the hand-picked cotton, no harmful effects to the fiber were detected from either air handling or pneumatic lint cleaning. The slight increase in the card

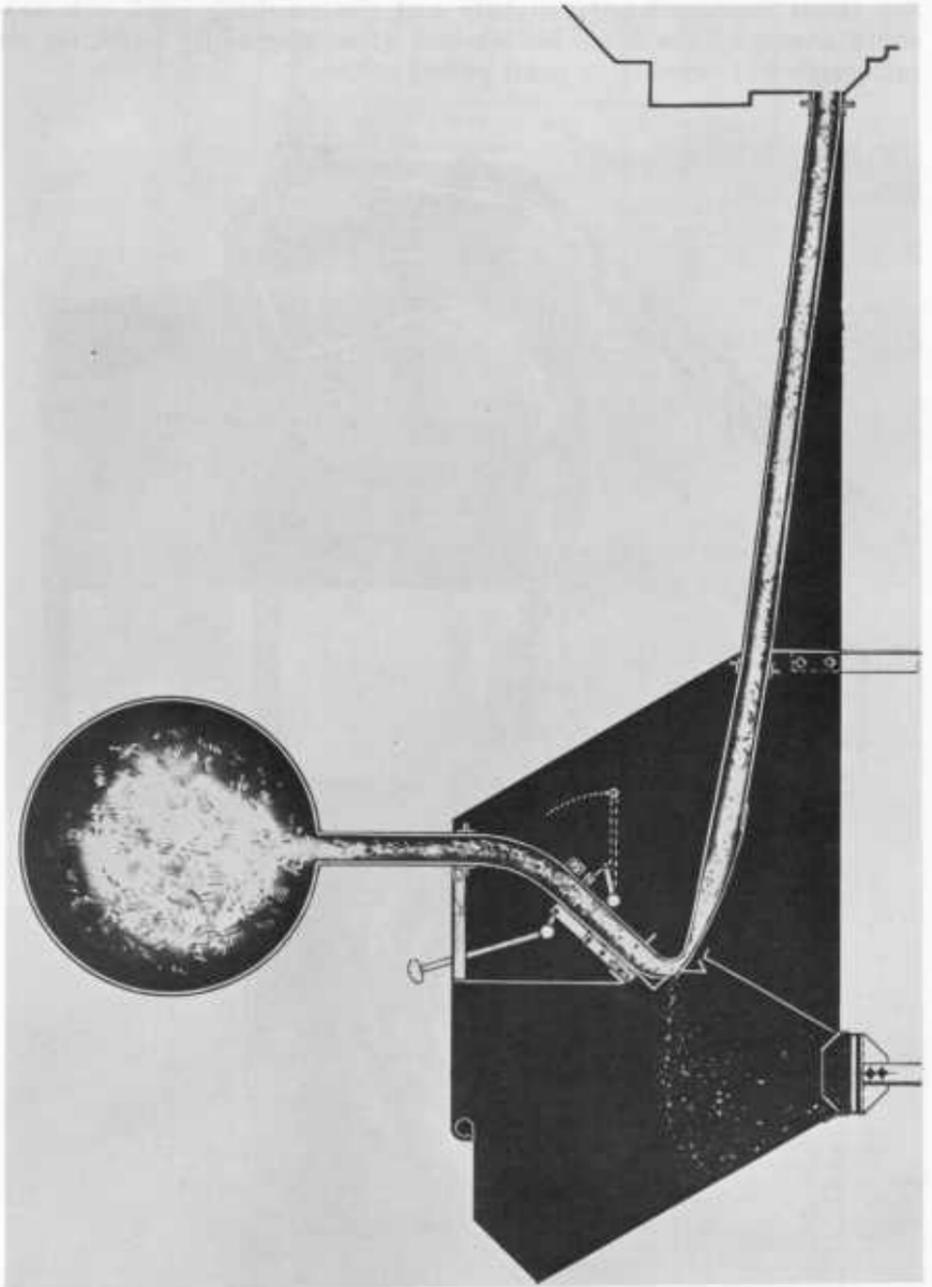


FIGURE 19.—Pneumatic lint cleaner (courtesy of the Lummus Gin Machinery Co.).

web nep count probably accounts for the small decrease in average yarn appearance.

The conclusion of the ginning laboratory after 3 years of study is that air handling and pneumatic lint cleaning of hand-picked and of machine-picked cotton can be done without detectable fiber damage.

SAW GINNING PIMA COTTON

Considerable interest has been voiced in the results of saw ginning American-Egyptian or Pima cotton. There is no evidence that this practice exists anywhere commercially, and only limited data are available from research on saw ginning Pima.

Small-scale studies of the saw ginning of American-Egyptian cotton have been undertaken at the Southwestern Cotton Ginning Research Laboratory several times in the past few years, primarily to establish a guide as to the results to be expected from this method of ginning Pima cotton. Prior to the development of the Pima S1 variety that has a semifuzzy seed, ginning Pima on a conventional saw gin was practically impossible because a seed roll could not be maintained. The Pima S1 variety can be ginned on a saw gin under certain mechanical conditions. In 1956, limited tests were made under different gin settings, such as saw spacing, air doffing pressures, methods of doffing, and a few different saw tooth designs.

The effect on fiber quality of saw ginning as compared to roller ginning is summarized in table 6. For these comparisons the classifications of the saw-ginned Pima were based on roller ginned cotton stands. Each saw-ginned sample was designated as very neppy. Consequently, the average grade in the table may be misleading. Both the classers' staple length and the Fibrograph upper half mean measurement show a shortening of staple by saw ginning. The fiber neps were increased threefold by saw ginning, and the resulting neps in the card web were reflected in a marked decrease in yarn appearance for the saw-ginned cotton.

Other saw-ginning tests of Pima cotton were made with a gin having 10 saws of 10-inch diameter. Methods of doffing, doffing pressures, saw-tooth designs, and saw and doffing-brush speeds were varied to

TABLE 6.—*Roller ginning compared to saw ginning of Pima cotton*

Test item	Saw ginned	Roller ginned
Moisture content:		
Wagon seed cotton.....percent..	7.1	7.1
Lint.....do.....	5.2	5.2
Lint turnout.....do.....	29.1	29.6
Grade, classers'.....	1.2	2.2
Staple $\frac{1}{2}$ d inch.....	43.2	46.5
Nonlint content.....percent.....	3.10	3.06
Fibrograph, upper half mean.....inches..	1.29	1.33
Fiber neps.....per 100 square inches..	32.0	11.0
Picker and card waste.....percent.....	12.24	11.54
Neps in card web.....per 100 square inches..	37.0	13.0
Yarn appearance.....index.....	99	108

¹ Neppy.

obtain basic information as to where the fiber damage was taking place in the gin stand. The results of these pilot ginning tests confirmed previous tests as to the high nep formation and fiber shortening. They also indicated that these harmful effects on the fiber were accumulative in the seed roll and were not the effect of any one operation within the stand such as speed or doffing method.

SUMMARY

Roller ginning in the Southwest was begun early in the 20th century in the Imperial Valley of California and the Salt River Valley of Arizona. In 1920 more than 92,000 bales of Pima cotton were produced in this country. Since 1920 production of American-Egyptian cotton has varied greatly, and concurrently changes and improvements in roller gin machinery design have been spasmodic. An increase in production during World War II supplied the incentive for manufacturing new models of roller gins in 1942, but it was not until 1950 that American-Egyptian cotton production sparked further improvements in roller gin design. From 1942 to 1950 the general conception of gin-plant designs and gin-machinery requirements changed from two-story buildings and comparatively simple seed cotton cleaning machinery plus very gentle handling of the cotton to the present-day single-story gin building equipped with modern upland-cotton-type cleaning machinery operating on a mass-production basis.

Roller ginning research was begun by the Department of Agriculture as far back as 1925. However, it was not until 1936 that extensive research on cleaning, drying, and lint handling was undertaken. Research on the adjustments and operations of today's roller gins has yielded basic engineering guides for operators in the field. Seed cotton cleaning and drying procedures ranging from simple to elaborate systems have shown that American-Egyptian varieties now grown can be cleaned and dried by modern machinery and approved techniques without harming the quality of the fiber. Research has also shown that pneumatic conveying of both the seed cotton and the lint do not harm fiber quality. Pneumatic lint cleaners are being used to improve the grades without significant damage.

Improved methods of applying steam at the gin stand are controlling static on the ginning roller. Copies of the design of a satisfactory two-pipe steam system are available at the ginning laboratories.

Additional studies at both the ginning laboratory and at commercial gins show that antistatic chemicals can be used to control static electricity. Brush applications of a solution of Tween-20 and water to the seed roll have proved satisfactory.

LITERATURE CITED

- (1) ARKANSAS-MISSOURI COTTON GINNERS ASSOC.
[n.d.] COTTON GINNER'S HANDBOOK. 159 pp., illus. Blytheville, Ark.
- (2) BENNETT, C. A.
1943. SIMPLIFIED PITOT TUBE CALCULATIONS OF AIR FLOW IN DUCTS AND PIPES. Rev. Bur. Plant Indus., Soils and Agr. Engin., U.S. Dept. Agr., 16 pp. [Processed.]
- (3) _____
[1959] ROLLER COTTON GINNING DEVELOPMENTS. Texas Cotton Ginner's Assoc. & The Cotton Gin and Oil Mill Press, joint sponsors, 90 pp., illus.
- (4) BUFFALO FORGE COMPANY.
1949. FAN ENGINEERING. Ed. 5, 808 pp., illus. Buffalo, N.Y.
- (5) JOHNSON, A. J., TOWNSEND, J. S., and WALTON, T. C.
1941. AMERICAN-EGYPTIAN COTTON QUALITY AND GINNING. Agr. Market. Sew., Bur. Plant Indus., and Bur. Agr. Chem. and Engin. U.S. Dept. Agr., 16 pp., illus. [Processed.]
- (6) LEONARD, C. G.
1960. CONTROLLING STATIC ELECTRICITY ON COTTON DURING GINNING WITH AN ANTISTATIC AGENT. U.S. Dept. Agr., Agr. Res. Serv., ARS 42-39, 16 pp., illus.
- (7) SHAW, E. A. & Co., INC.
[n.d.] AMERICAN-EGYPTIAN COTTONS. A BRIEF HISTORY OF THEIR DEVELOPMENT AND DESCRIPTION OF THEIR CHARACTERISTICS, 1900-1950. 18 pp. Boston.
- (8) STEDRONSKY, V. L.
1956. EXTRA LONG STAPLE COTTON AND ROLLER GINNING. The Cotton Ginner's Jour. Yearbook, v. 24, No. 1, pp. 37-39, illus.
- (9) TEXAS COTTON GINNERS' ASSOC.
[n.d.] WHAT WE KNOW ABOUT AIR POLLUTION CONTROL. Spec. Bul. 1, 31 pp., illus. Dallas.
- (10) TOWNSEND, J. S.
1925. GINNING PIMA COTTON IN ARIZONA. U.S. Dept. Agr. Dept. Bul. 1319, 10 pp., illus.
- (11) _____, MARTIN, W. J. and WALTON, T. C.
1940. SEA-ISLAND COTTON QUALITY AND GINNING. U.S. Dept. Agr., ACE-69, 15 pp., illus.
- (12) _____, WALTON, T. C., and MARTIN, W. J.
1940. ROLLER GIN CONSTRUCTION, MAINTENANCE, AND OPERATION. U.S. Dept. Agr., ACE-68, 14 pp., illus.
- (13) UNITED STATES DEPARTMENT OF AGRICULTURE
1955. COTTON TESTING SERVICE: TESTS AVAILABLE, EQUIPMENT AND TECHNIQUES, AND BASIS FOR INTERPRETING RESULTS. U.S. Agr. Market. Serv., AMS 16, 49 pp., illus.
- (14) _____
1956. MODERNIZING COTTON GINS. Agr. Handb. 99, 45 pp., illus.
- (15) _____
1963. AGRICULTURAL STATISTICS. 1962: 83.
- (16) WARE, J. O.
1936. PLANT BREEDING AND THE COTTON INDUSTRY. U.S. Dept. Agr. Yearbook 1936: 657-744.

APPENDIX

Supplemental engineering data applicable to roller ginning are provided in this appendix. In addition, the reader is referred to other literature (1, 9, 14).

Fans and Piping

For handling materials efficiently by air, it is important to consider (a) the rate of flow or velocity, and (b) the volume of air per pound of material.

Materials commonly handled at the cotton gin by air and the velocities normally required for efficient handling are as follows:

	Velocity for materials in pipes (Feet per minute)
Seed cotton-----	4, 000-4, 500
Seed cotton in tower driers-----	1, 200
Dried seed cotton (from machine to machine)-----	3, 000
Bollies in tower drier-----	1, 500-1, 600
Seed -----	5, 000-5, 500
Hulls and trash-----	3, 000-4, 000
Lint cotton-----	1, 000-1, 500

Volume of air normally required per pound of material to be handled is as follows:

	Volume of air per pound of material (Cubic feet per minute)
Low pressure fans (8 to 20 inches of water)-----	40-50
Seed pumps-----	5-6

In handling material by air, two things must be satisfied: (1) Rate of flow, and (2) volume of flow.

The gin operator can measure and calculate the air velocity and the air volume of a system by a simple method (1, 2). All that he needs to make these measurements is a Pitot tube (C) and a U-tube or manometer (D), shown in figure 20. The procedure is as follows:

First make a small hole in the pipe in which the air is to be measured, at least 4 diameters away from the fan or any elbow or other interference in the straight flow of air. Insert the Pitot tube into the hole and point the nose or open end upstream with the tube parallel with the pipe and in the center of the pipe. The difference shown between the two water columns in the manometer is the impact or total pressure (Pt). By removing the Pitot tube and placing one lead from the manometer against the hole or by pointing the Pitot tube downstream to the direction of air flow the difference in the manometer water columns is the resistance or static pressure (Ps) of the piping. The difference between the total pressure (Pt) and the static pressure (Ps) is the velocity pressure (Pv). From basic engineering formulae the equation

$$V \text{ (velocity in feet per minute)} = 997.5K \sqrt{Pv} \text{ (velocity pressure in inches of water)}$$

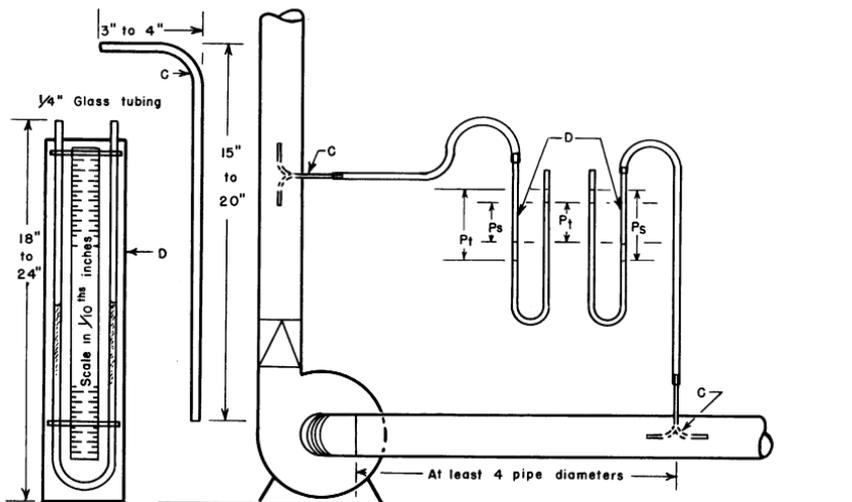


FIGURE 20.—Testing fan suction and discharge of piping.

has been derived where K is a constant varying with the atmospheric pressure, the temperature of the air, and the humidity of the air. Table 7 gives a value B ($997.5K$) for various altitudes, based on a barometric pressure at sea level of 29.92 inches of mercury and an average temperature of $70^{\circ} F$.

The volume of air being handled is obtained by the formula
 Volume (cubic feet per minute) = Velocity (feet per minute) multiplied by the cross-sectional area of the size of pipe being measured in square feet.

Table 8 gives the cross-sectional area of the common sizes of gin pipe in square feet. By following these means of measurement and the formula calculations, the air volume can be fairly accurately calculated.

Table 9 is included to enable the operator to get a fairly accurate account of air velocity and volume without calculations. This table is computed on the basis of a barometric pressure of 30 inches of mercury, $70^{\circ} F$ air temperature, and 0 percent relative humidity. However, at 70° it is accurate within 1.0 percent at any humidity. Also, at 70° , a barometric pressure change from 30 inches of mercury at sea level to 26 inches at 4,000 feet altitude would not change the air velocity appreciably. When measuring velocity or volume of air at high temperature and low relative humidity, a correction factor must be used (4).

Power requirements for modern roller gins are as great as for saw ginning plants. Since fans consume from 50 to 65 percent of the power required by the modern gin, it is important that the ginner operate his fans at their most economical and efficient speeds. Capacity or volume of air moved per unit of time (normally measured as cubic feet per minute) varies directly with the speed of the fan. Pressure varies as the square of the speed, and power varies as the cube of the speed. Thus, if the speed is doubled, the volume is doubled, but the

TABLE 7.—*Altitude correction for computing air velocities when using Pitot tubes*

[Air velocity in feet per minute equals constant multiplier B times the square root of the velocity head in inches of water measured at the center of a pipe with a Pitot tube. Constant multiplier A is for use when making traverse readings]

Altitude above sea level (feet)	Relative air density ¹	Real air density per cubic foot (d) ²	Cubic feet per pound of dry air (1/d)	(1/d) ^{1/2}	Constant multiplier A (1/d) ^{1/2} × 1096.2 ³	Constant multiplier B (1/d) ^{1/2} × 997.5 ³
		<i>Pounds</i>				
0-----	1. 000	0. 0750	13. 333	3. 6515	4, 003	3, 641
500-----	. 981	. 0736	13. 587	3. 6860	4, 041	3, 675
1,000-----	. 962	. 0722	13. 850	3. 7215	4, 080	3, 711
1,500-----	. 944	. 0708	14. 124	3. 7581	4, 120	3, 747
2,000-----	. 926	. 0694	14. 409	3. 7959	4, 161	3, 785
2,500-----	. 909	. 0682	14. 663	3. 8357	4, 205	3, 825
3,000-----	. 891	. 0668	14. 970	3. 8691	4, 241	3, 858
3,600-----	. 872	. 0654	15. 290	3. 9102	4, 286	3, 899
4,000-----	. 858	. 0644	15. 528	3. 9405	4, 320	3, 929
4,400-----	. 846	. 0634	15. 773	3. 9715	4, 353	3, 960

¹ From Buffalo Forge Co. (4).

² Based on a base density of 0.0750 lb. per cubic foot of dry air (0% relative humidity) at 70° F. and 29.92 in. of mercury barometric pressure.

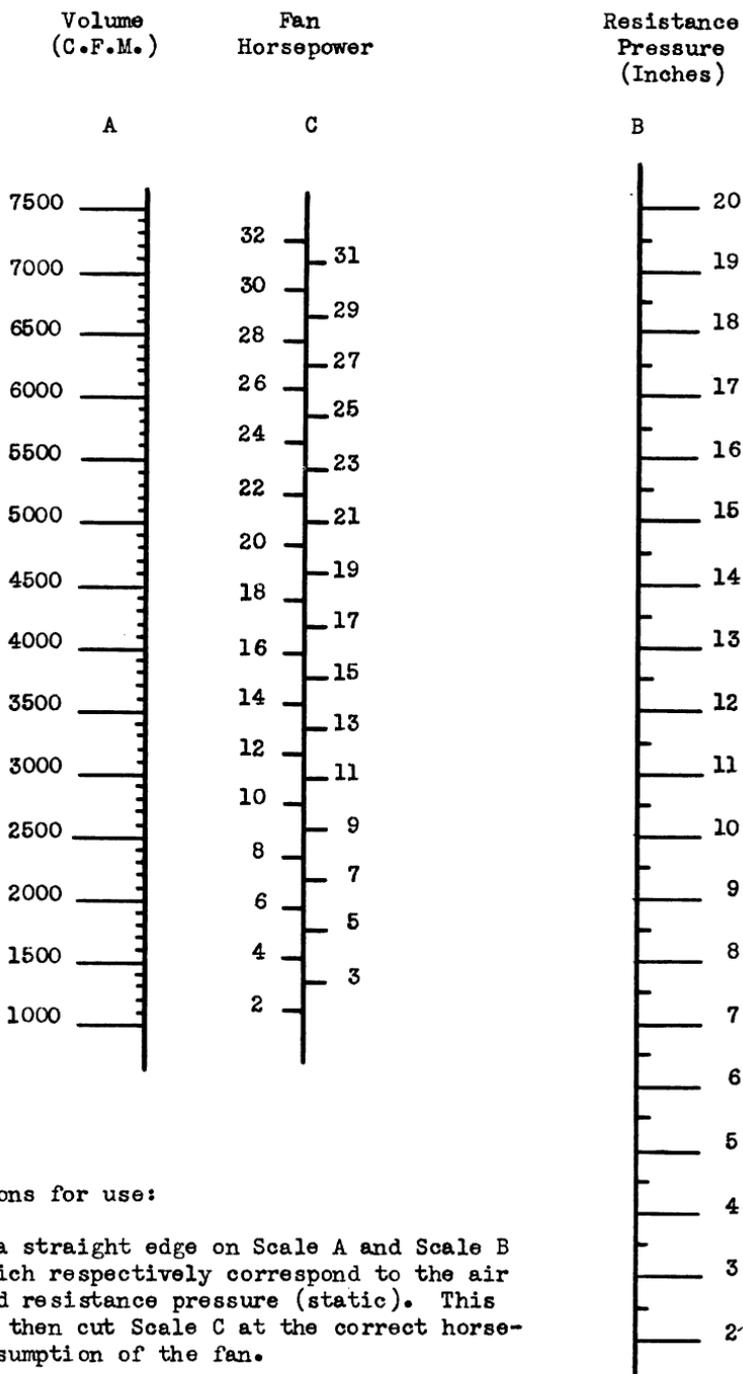
³ See Bennett (2).

TABLE 8.—*Cross-sectional area of cotton gin piping for use with
USDA cotton piping chart*

Diameter of pipe	Cross-sectional area of pipe	Diameter of pipe	Cross-sectional area of pipe
<i>Inches</i>	<i>Square feet</i>	<i>Inches</i>	<i>Square feet</i>
8.....	0. 3491	13.....	0. 9218
9.....	. 4418	13½.....	. 9940
10.....	. 5454	14.....	1. 069
11.....	. 6600	14½.....	1. 147
11½.....	. 7215	15.....	1. 227
12.....	. 7854	16.....	1. 396
12½.....	. 8522		

pressure becomes four times greater and the power eight times greater. Consequently, the lower the pressure the fan operates against and the lower the volume of air used to do the job, the greater the power savings.

Tables 10-15 in the nomograph (fig. 21) are included as guides for the ginner in determining the type, size, and speeds of fans necessary in performing the most efficient and economical material handling job. Also, for any set of measured conditions the ginner may determine whether his fans are overpowered, underpowered, running too fast or too slow, and what he can expect in performance when he changes any of these conditions. Tables 10, 11, and 12 are engineering facts pertaining to the most common types of gin fans, and tables 13, 14, and 15 are actual fan performance tables obtained by measuring the fans under operating conditions (1, 2).



Instructions for use:

Place a straight edge on Scale A and Scale B points which respectively correspond to the air volume and resistance pressure (static). This line will then cut Scale C at the correct horsepower consumption of the fan.

FIGURE 21.—Nomograph for determining approximate horsepower for fans from air readings.

TABLE 9.—*Velocities and volumes corresponding to P_v readings and pipe diameter*¹

P_v , inches of water	$\sqrt{P_v}$	Velocity, feet per minute	Cross-sectional area in square feet (first row) and pipe diameter in inches (second row) ²														
			0.4418	0.4922	0.5454	0.6013	0.6600	0.7215	0.7854	0.8522	0.9218	0.9940	1.069	1.147	1.227	1.396	1.576
			9	9½	10	10½	11	11½	12	12½	13	13½	14	14½	15	16	17
0.1	0.32	1,168	516	575	637	702	771	842	917	995	1,077	1,161	1,249	1,340	1,433	1,630	1,841
.2	.45	1,642	725	808	895	987	1,084	1,185	1,290	1,400	1,514	1,633	1,756	1,884	2,016	2,293	2,588
.3	.55	2,008	887	988	1,095	1,207	1,325	1,448	1,577	1,710	1,851	1,995	2,146	2,302	2,463	2,802	3,164
.4	.63	2,300	1,016	1,132	1,254	1,383	1,518	1,659	1,806	1,959	2,120	2,286	2,458	2,637	2,822	3,210	3,624
.5	.71	2,592	1,144	1,276	1,414	1,559	1,710	1,869	2,036	2,208	2,389	2,576	2,770	2,972	3,180	3,618	4,084
.6	.77	2,810	1,241	1,383	1,533	1,690	1,855	2,027	2,208	2,395	2,591	2,794	3,004	3,223	3,448	3,923	4,429
.7	.84	3,066	1,354	1,509	1,672	1,844	2,024	2,212	2,408	2,612	2,827	3,048	3,278	3,516	3,762	4,280	4,832
.8	.89	3,248	1,435	1,599	1,772	1,953	2,144	2,343	2,552	2,768	2,995	3,229	3,473	3,725	3,986	4,534	5,119
.9	.95	3,467	1,531	1,706	1,891	2,085	2,289	2,501	2,724	2,954	3,197	3,447	3,707	3,977	4,255	4,840	5,464
1.0	1.00	3,650	1,612	1,797	1,991	2,195	2,409	2,633	2,867	3,110	3,365	3,628	3,902	4,186	4,479	5,095	5,752
1.1	1.05	3,832	1,693	1,886	2,091	2,304	2,529	2,765	3,010	3,265	3,533	3,809	4,097	4,395	4,703	5,350	6,039
1.2	1.10	4,015	1,773	1,976	2,170	2,414	2,650	2,896	3,154	3,421	3,701	3,991	4,292	4,605	4,927	5,604	6,328
1.3	1.14	4,161	1,838	2,048	2,270	2,502	2,746	3,002	3,268	3,545	3,836	4,136	4,448	4,772	5,106	5,808	6,558
1.4	1.18	4,307	1,902	2,120	2,349	2,590	2,843	3,111	3,383	3,670	3,971	4,281	4,604	4,939	5,285	6,012	6,788
1.5	1.22	4,453	1,967	2,192	2,429	2,678	2,939	3,212	3,498	3,794	4,105	4,426	4,760	5,107	5,464	6,215	7,018
1.6	1.26	4,599	2,031	2,264	2,508	2,765	3,035	3,318	3,612	3,919	4,240	4,571	4,916	5,274	5,644	6,420	7,248
1.7	1.30	4,745	2,096	2,335	2,588	2,853	3,132	3,423	3,727	4,043	4,374	4,716	5,073	5,442	5,823	6,623	7,478
1.8	1.34	4,891	2,160	2,407	2,668	2,941	3,228	3,528	3,842	4,167	4,509	4,862	5,229	5,609	6,002	6,827	7,708
1.9	1.38	5,037	2,225	2,479	2,748	3,029	3,324	3,634	3,956	4,292	4,644	5,007	5,385	5,777	6,181	7,031	7,938
2.0	1.41	5,146	2,273	2,533	2,807	3,094	3,397	3,713	4,042	4,385	4,745	5,115	5,502	5,902	6,315	7,184	8,110
2.1	1.45	5,292	2,337	2,605	2,887	3,182	3,493	3,818	4,157	4,509	4,879	5,261	5,658	6,070	6,495	7,388	8,340
2.2	1.48	5,402	2,386	2,659	2,947	3,248	3,565	3,897	4,243	4,603	4,980	5,369	5,775	6,195	6,629	7,541	8,514
2.3	1.52	5,548	2,450	2,731	3,026	3,336	3,662	4,002	4,358	4,727	5,114	5,515	5,931	6,363	6,808	7,744	8,744
2.4	1.55	5,658	2,499	2,785	3,086	3,402	3,734	4,081	4,444	4,820	5,216	5,623	6,048	6,488	6,942	7,897	8,917
2.5	1.58	5,767	2,547	2,839	3,146	3,468	3,806	4,160	4,530	4,914	5,317	5,732	6,165	6,614	7,077	8,050	9,089
2.6	1.61	5,876	2,596	2,892	3,205	3,533	3,878	4,240	4,615	5,008	5,416	5,841	6,281	6,740	7,210	8,203	9,260
2.7	1.64	5,986	2,644	2,946	3,265	3,599	3,951	4,319	4,701	5,101	5,518	5,950	6,399	6,866	7,345	8,356	9,434
2.8	1.67	6,096	2,693	3,000	3,325	3,666	4,023	4,398	4,788	5,195	5,619	6,059	6,517	6,992	7,480	8,510	9,607
2.9	1.70	6,205	2,741	3,054	3,384	3,731	4,095	4,477	4,873	5,288	5,720	6,168	6,633	7,117	7,614	8,662	9,779
3.0	1.73	6,314	2,790	3,108	3,443	3,797	4,167	4,556	4,959	5,381	5,820	6,276	6,750	7,242	7,747	8,814	9,951

¹ Velocity— $3,650 \sqrt{P_v}$; volume—velocity times cross-sectional area of pipe.² Cross-sectional area of 6 inches=0.1964; 8 inches=0.3491; 8½ inches=0.3941; 18 inches=1.767; 19 inches=1.969; 20 inches=2.182.

TABLE 10.—*Wheel diameters for fans of various sizes*

Make of fan	No. 30 fan	No. 35 fan	No. 40 fan	No. 45 fan
	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>
ABC type C ¹	22	25	28	31
Clarage type C.....	20 ¹ / ₈	23 ³ / ₈	26 ⁷ / ₈	30 ¹ / ₈
Continental.....	20	23 ³ / ₈	27	30
Barley ²	18	20 ¹ / ₂	23	26
Boardman ³	32 x 4	32 x 6	32 x 8	32 x 10
Sturtevant C.....	20	25 ¹ / ₈	26 ¹ / ₄	30 ¹ / ₈

¹ Type C wheels have 18 blades with rims.

² Plain 6-blade wheel.

³ Width of wheel determines size.

TABLE 11.—*Rembert fans compared with standard fans*

Size of Rembert fan	Proportion of standard fan volume at same speed	Conversion factor ¹
35/30.....	3/8	2. 66
40/35.....	1/2	2. 00
45/40 or 40/45.....	5/8 to 3/4	1. 33

¹ Multiply standard fan speed by this factor to obtain desired Rembert fan speed.

TABLE 12.—*Most efficient operating speed for fans of various sizes* ¹

Type and size of fan	Operating speed
Burr: No. 25.....	<i>R.p.m.</i> Up to 2,000
Standard:	
No. 30.....	1,600–1,800
No. 35.....	1,600–1,800
Standard or special:	
No. 40.....	1,500–1,750
No. 45.....	1,500–1,750
No. 50.....	1,100–1,200
Standard: No. 60.....	1,000–1,100

¹ Courtesy, The Boardman Co.

TABLE 13.—*Volume of air delivered, most efficient operating speed, and brake horsepower required for most commonly used gin fans equipped with long shavings wheels and operating against given static pressures*

Item	Static pressure												
	2	3	4	5	6	7	8	9	10	11	12	13	15
No. 30:													
Volume, c.f.m.-----	1, 586	1, 982	2, 379	2, 577	2, 775	2, 974	3, 172	3, 370	3, 568	3, 767	3, 965	4, 163	4, 361
Speed, r.p.m.-----	1, 040	1, 285	1, 490	1, 650	1, 805	1, 950	2, 090	2, 210	2, 330	2, 450	2, 560	2, 665	2, 860
Brake horsepower----	0. 90	1. 69	2. 73	3. 66	4. 72	5. 86	7. 16	8. 57	10. 15	11. 80	13. 50	15. 40	18. 55
No. 35:													
Volume, c.f.m.-----	2, 170	2, 712	3, 255	3, 526	3, 797	4, 068	4, 340	4, 611	4, 882	5, 153	5, 425	5, 696	5, 967
Speed, r.p.m.-----	905	1, 110	1, 295	1, 430	1, 570	1, 695	1, 805	1, 920	2, 025	2, 125	2, 225	2, 320	2, 480
Brake horsepower----	1. 23	2. 31	3. 74	5. 00	6. 45	8. 04	9. 80	11. 71	13. 90	16. 20	18. 50	21. 00	25. 40
No. 40:													
Volume, c.f.m.-----	2, 794	3, 492	4, 191	4, 540	4, 889	5, 239	5, 588	5, 937	6, 286	6, 636	6, 985	7, 334	7, 683
Speed, r.p.m.-----	800	984	1, 140	1, 266	1, 390	1, 495	1, 600	1, 700	1, 790	1, 880	1, 970	2, 050	2, 190
Brake horsepower----	1. 58	2. 97	4. 80	6. 45	8. 30	10. 35	12. 60	15. 10	17. 85	20. 80	23. 80	27. 10	32. 70
No. 45:													
Volume, c.f.m.-----	3, 526	4, 407	5, 289	5, 730	6, 170	6, 610	7, 052	7, 493	7, 933	8, 373	8, 815	9, 256	9, 696
Speed, r.p.m.-----	694	850	990	1, 100	1, 205	1, 300	1, 385	1, 470	1, 550	1, 630	1, 710	1, 775	1, 900
Brake horsepower----	2. 00	3. 75	6. 06	8. 14	10. 50	13. 05	15. 95	19. 05	22. 60	26. 30	30. 10	34. 20	41. 30
No. 50:													
Volume, c.f.m.-----	4, 312	5, 390	6, 468	7, 007	7, 546	8, 085	8, 624	9, 163	9, 702	10, 241	10, 780	11, 319	11, 858
Speed, r.p.m.-----	631	776	905	1, 000	1, 095	1, 180	1, 265	1, 345	1, 415	1, 485	1, 555	1, 620	1, 735
Brake horsepower----	2. 43	4. 58	7. 40	9. 91	12. 80	15. 95	19. 45	23. 25	27. 60	32. 10	36. 70	41. 85	50. 40

TABLE 14.—*Volume of air delivered, most efficient operating speed, and brake horsepower required for most commonly used gin fans equipped with type C wheels and operating against given static pressures*

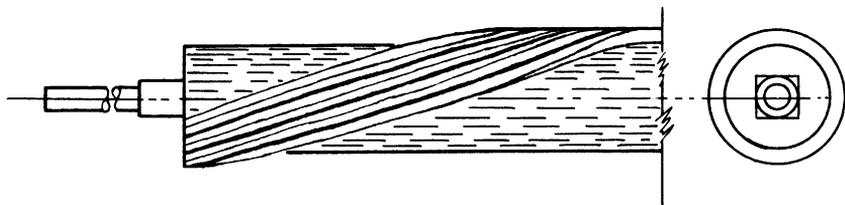
Item	Static pressure											
	4	5	6	7	8	9	10	11	12	13	14	15
No. 30:												
Volume, c.f.m.-----	2, 379	2, 775	2, 974	3, 172	3, 370	3, 568	3, 965	3, 965	4, 163	4, 361	4, 560	4, 758
Speed, r.p.m.-----	1, 302	1, 465	1, 606	1, 727	1, 845	1, 955	2, 085	2, 160	2, 265	2, 360	2, 450	2, 540
Brake horsepower-----	2. 76	4. 08	5. 22	6. 46	7. 80	9. 33	11. 68	12. 70	14. 52	16. 50	18. 70	20. 80
No. 35:												
Volume, c.f.m.-----	3, 255	3, 797	4, 068	4, 340	4, 611	4, 882	5, 425	5, 425	5, 696	5, 967	6, 238	6, 510
Speed, r.p.m.-----	1, 121	1, 261	2, 381	1, 487	1, 586	1, 678	1, 794	1, 859	1, 948	2, 029	2, 111	2, 180
Brake horsepower-----	3. 78	5. 58	7. 14	8. 83	10. 68	12. 75	15. 96	17. 35	19. 85	22. 59	25. 60	28. 45
No. 40:												
Volume, c.f.m.-----	4, 191	4, 889	5, 239	5, 588	5, 937	6, 286	6, 985	6, 985	7, 334	7, 683	8, 033	8, 382
Speed, r.p.m.-----	973	1, 096	1, 200	1, 291	1, 379	1, 459	1, 560	1, 612	1, 691	1, 762	1, 832	1, 898
Brake horsepower-----	4. 87	7. 18	9. 21	11. 37	13. 75	16. 40	20. 53	22. 35	25. 55	29. 06	32. 90	36. 60
No. 45:												
Volume, c.f.m.-----	5, 289	6, 170	6, 610	7, 052	7, 493	7, 933	8, 815	8, 815	9, 256	9, 696	10, 138	10, 578
Speed, r.p.m.-----	868	977	1, 071	1, 152	1, 230	1, 305	1, 392	1, 440	1, 510	1, 572	1, 635	1, 692
Brake horsepower-----	6. 14	9. 07	11. 62	14. 38	17. 38	20. 75	25. 93	28. 22	32. 25	36. 70	41. 60	46. 20
No. 50:												
Volume, c.f.m.-----	6, 468	7, 546	8, 086	8, 624	9, 163	9, 702	10, 780	10, 780	11, 319	11, 858	12, 397	12, 936
Speed, r.p.m.-----	786	886	970	1, 043	1, 114	1, 181	1, 260	1, 303	1, 370	1, 423	1, 482	1, 532
Brake horsepower-----	7. 50	11. 05	14. 15	17. 50	21. 15	25. 25	31. 60	34. 40	39. 40	44. 75	50. 72	56. 40

TABLE 15.—Approximate average horsepower required for a fan operating under specified conditions

Volume of air handled by fan (c.f.m.)	Resistance pressure against which fan is operating (inches)									
	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0
3,000	10.8	11.4	12.3	13.2	14.2	15.1	16.1	17.0	18.0	18.9
3,500	12.1	13.2	14.3	15.4	16.5	17.7	18.7	19.8	20.9	22.0
4,000	13.9	15.1	16.4	17.6	18.9	20.1	21.4	22.6	23.9	25.2
4,500	15.6	17.0	18.4	19.8	21.2	22.6	24.1	25.5	26.9	28.4
5,000	17.3	18.9	20.5	22.1	23.6	25.2	26.8	27.4	29.9	31.5
5,500	19.1	20.8	22.5	24.2	26.0	27.7	29.4	31.2	32.9	34.6
6,000	20.8	22.7	24.6	26.5	28.4	30.2	32.1	34.0	35.9	37.8
6,500	22.6	24.6	26.6	28.7	30.7	32.8	34.8	36.8	38.9	40.9
7,000	24.3	26.5	28.7	30.9	33.1	35.3	37.5	39.7	42.0	44.2

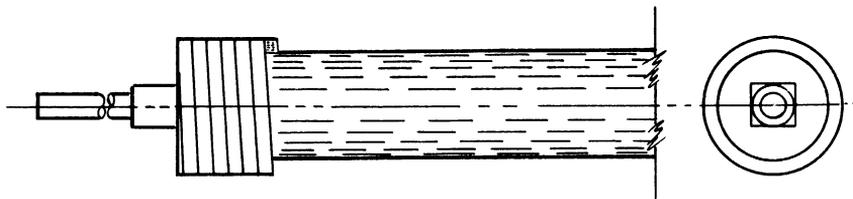
Gin Roller Coverings

Practically all gin rollers are covered with strips of packing made of cotton ducking and rubber. The roller core is either spool or spiral wound. Figure 22 shows these two roller coverings. The spiral-



SPIRAL COVERED ROLLER

With leather moting strip between every second packing strip



SPOOL WOUND ROLLER

Moting grooves are cut on a spiral out of the surface of the packing

FIGURE 22.—Gin roller coverings.

wound roller sheds the motes and fine trash from the ginning point without the aid of moting grooves. However, repairs to the packing cover of the spool-wound roller can be made without removing all the packing.

It is often necessary or desirable to cover the gin roller at the gin. Figures 23 and 24 are given as a guide to the construction of homemade rigs required to do a good job of covering. In making this device, short cross blocks are mounted on the left end of a work bench far enough apart to allow a gin roller to be mounted in between. Pillow block bearings are then attached to the cross blocks so that the roller shaft may be clamped into place. A large-diameter pulley for use as a crank is then placed on the left end of the shaft so that the roller can be turned as the covering work proceeds. A 2 x 4-inch timber is attached to one end of the cross blocks on edge in front of the roller and parallel to the roller shaft. A 11/2 x 11/2 x 1/8-inch angle iron is bolted to the top of the 2 x 4-inch timber. The ends of this angle iron are turned up and drilled to receive a guide rod. This guide rod is 5/16 inch in diameter, threaded on the ends, and bolted in the angle iron section. A pusher block for holding the packing strips during the covering operation is mounted on the guide rod as illustrated in figure 23. The forward edge of this channel iron pusher block is cut and bent down at a right angle and at approximately 24° with the center line of the roller. On the part of the channel iron that is bent down, four holes are drilled and tapped for 3/16 x 5/8-inch sharpened machine screws, inserted so that the points can make contact with the packing during the covering operation.

The roller is laid off for the first strip by driving a small nail part way into the core on each end of the roller in a line parallel with the

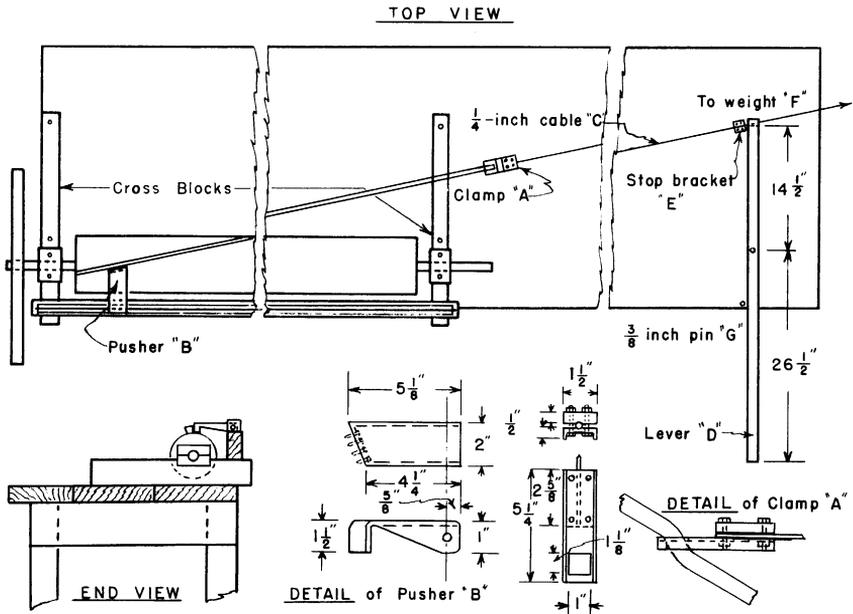


FIGURE 23.—Homemade mechanism for covering the roller gin roll with provisions for stretching the packing evenly.

roller shaft. A string is tied to one nail and passed around the roller core to the other nail making one complete spiral turn. This establishes a line position for the first packing strip. Glue is applied to the roller core along the positioning line. The packing covering is started by nailing one end of the strip at the left end of the roller over the glue. The packing is then spiraled around the roller and secured at the other end. Nails are put through the strip every 3 or 4 inches to hold it firmly in position as a guide for the succeeding spiral. After two strips have been attached this way, the succeeding strips are started at the left end and the pusher block is wedged between the angle guide and the packing strip. By pulling the roller forward the packing is forced tightly against the two strips that are on the roller. The pusher block is moved to the right as strips are progressively nailed.

Some mechanical device should be provided to maintain uniform tension on each strip as it is wound on the roller. Such a device for a 60-pound weight is shown in figure 23. Clamp A (fig. 23) is attached to cable C which passes over a small pulley and is fastened to weight F, which is free to move up or down. The arm of lever D is moved to the right and fixed with the pin G, which raises the weight and

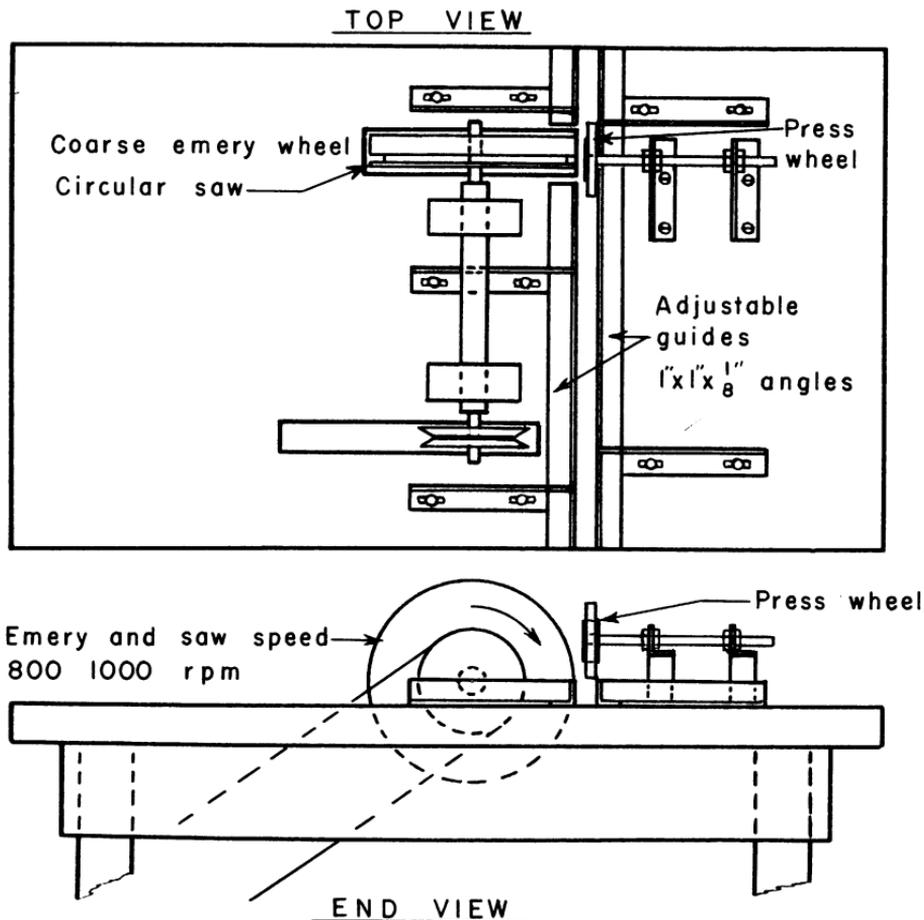


FIGURE 24.—Mechanism for beveling the sides of the packing strips.

allows clamp A to be slipped on the packing strip to about 6 inches from the right end of the roll. Pin G is then removed to allow the weight to exert its force on the strip. The roller is then turned one revolution and the packing nailed to the other or right end of the roller. The arm of the lever is then moved back to the right, releasing the pull of the weight and the packing is cut off. Then the strip which has just been laid on is nailed to the roller using pusher block B to press it firmly against the previous strip. Glue is applied generously with a 1-inch brush before the laying of each strip. Care should be taken, however, not to apply so much glue that it will squeeze up between the packing strip and cause trouble during ginning.

In order to place the packing on the roller so that the strips will lie close together, it is necessary to bevel the side of the strips. It is a tedious and difficult job with a jack plane. The mechanism shown in figure 24 has been employed successfully. It consists of a coarse emery wheel, adjustable guides, and a small press wheel to hold the strip down while the emery wheel is beveling the strip. A circular saw is placed to the side of the emery wheel to make the first rough cut, thus relieving the load on the emery wheel so that it makes only the finishing smooth cut. The saw should be slightly smaller in diameter than the emery wheel. A speed of 800 to 1,000 r.p.m. is recommended because the emery wheel has a tendency to clog up and burn the material at higher speeds.

Seed Cotton Reclaimers

The most prevalent variety of American-Egyptian cotton grown is Pima S1. It has a semifuzzy seed, which presents a problem in clearing the seed away from the ginning point fast enough without dropping some seed cotton into the seed disposal system. Ginning capacity can be increased by moving the seed fingertips back from the moving knife and by using a seed grid with the fingers spaced as much as three-eighths inch apart; however, with this adjustment considerable seed cotton is dropped into the seed. This seed cotton is then reclaimed by a unit at the end of a battery of gins and fed back into the suction line. Figure 25 is a schematic diagram of one such unit being successfully employed in an Arizona roller gin. The seed and seed cotton are being carried by a conveyor belt under the stands to a seed dropper at the end of each battery. During the travel down the belt, the seed tends to settle out leaving the seed cotton riding free on top of the seed. This seed cotton is picked up by a reclaimer saw and scrubbed over $\frac{3}{8}$ -inch grid bars spaced approximately $1\frac{1}{2}$ inches on centers with $\frac{1}{2}$ -inch clearance between the grid bars and the reclaimer saws. The seed dislodged by the first saw falls back onto the conveyor belt and that dislodged by the second saw drops through a sheet metal shoot directly into the seed dropper. The reclaimed seed cotton is sucked off the upper saw by a direct suction to the suction line separator immediately before the separator.

When a small-pipe pneumatic seed line is used, the seed and seed cotton from the auger system can be passed through a reclaimer unit between the auger outlet and the seed dropper. Since some of the seed cotton dropped by the seed fingers is hard lock or immature cotton, it is advisable to feed the reclaimed cotton back into the system

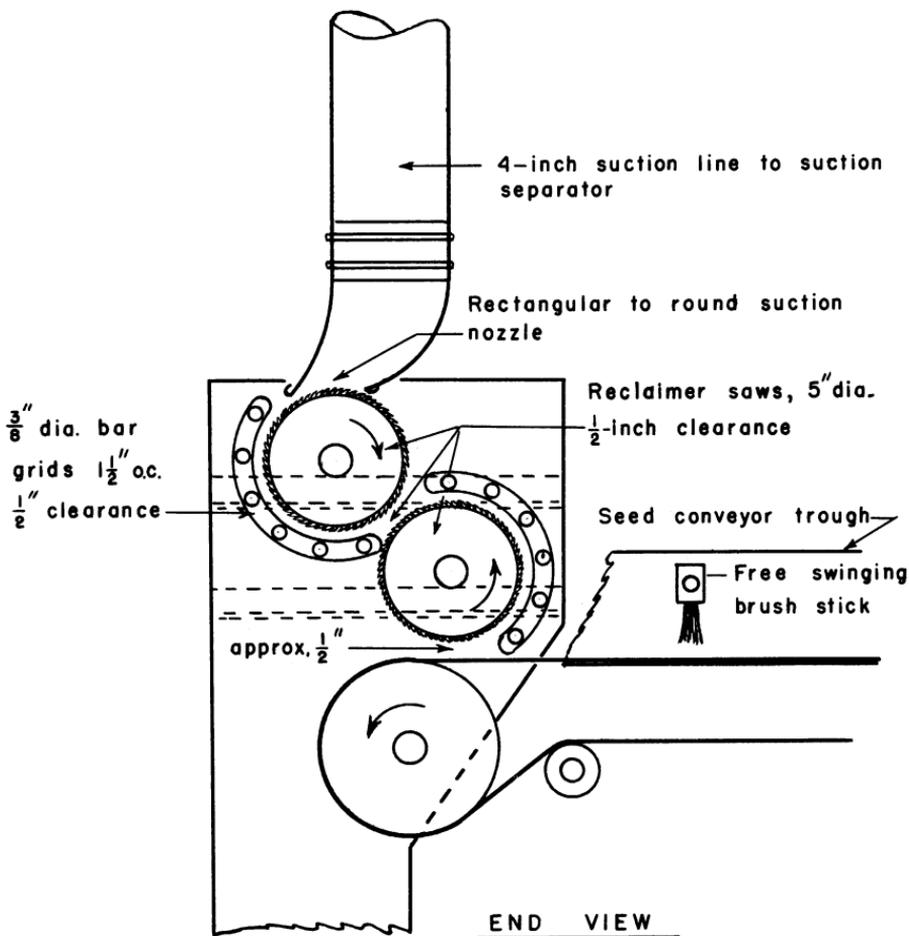


FIGURE 25.—Schematic diagram of a seed cotton reclaimer being employed to reclaim seed cotton from the seed belt in an Arizona roller gin.

during ginning rather than accumulate it to be fed back into the system from the overflow. Feeding this reclaimed cotton as overflow cotton could conceivably result in a two-sided bale.

Mill-type Lint Opener-cleaners

Mill-type opener and air jet cleaner combinations are now being employed in several roller gin plants. These units are reported to be very effective in improving the lint grade by removing motes, broken seed, entanglements caused by the machine pickers, and pin trash that had not been removed by the seed cotton cleaning machinery. A schematic diagram of the type of lint opener-cleaner being used is shown in figure 26. The lint cotton is picked up by a suction nozzle from the end of the lint conveyor belt and carried to a condenser from which it is fed into a Buckley beater-type opener-cleaner. This unit fluffs or breaks open the lint bat and carries it over closely spaced grid bars where some of the motes and pin trash are removed. From the opener the lint passes through a pneumatic-type lint cleaner.

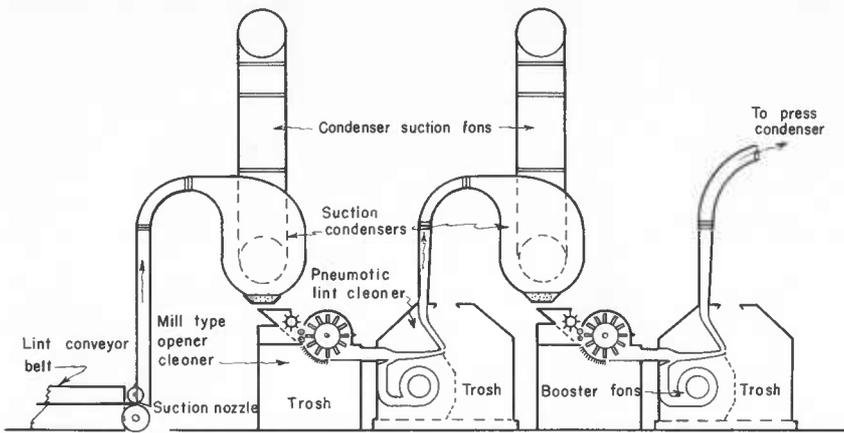


FIGURE 26.—Schematic diagram of the mill-type opener-cleaner used in some of today's roller gins.

From here it moves pneumatically into a second opener-cleaner combination and on to the press suction condenser.

The Southwestern Cotton Ginning Research Laboratory is carrying on cooperative research with commercial gins to further evaluate the use of this particular type of opener-cleaner arrangement. Figure 27 shows one of the units installed in a commercial gin.

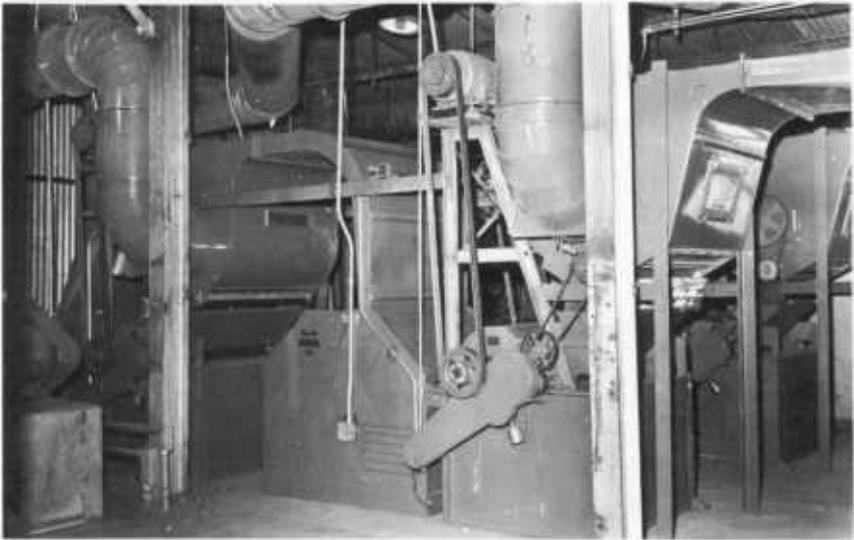


FIGURE 27.—Mill-type opener-cleaner installation in a roller gin.

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