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Cotton Gin Fires and Losses in Tennessee

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Cover photo is through the courtesy of Fire Prevention and Engineering Bureau of Texas.

Summary and Conclusions

● The primary objectives of this study were to determine the causes and incidence of gin fires, losses per gin, per fire, and per bale, and to evaluate the relationship of various factors to gin fires and losses. The report is based on a study of fires and losses of 78 to 111 gins in Tennessee during the crop years of 1956 to 1958. It is part of a gin fire loss study of sample gins located throughout the cotton belt.

● During the 3-year period the total losses resulting from 584 fires amounted to $99,243. This included $55,050 for cotton, $25,445 for machinery, $9,397 for buildings, $4,145 for fire extinguisher, and $5,206 for labor or downtime. Annual losses for all gins averaged $334 per gin, $170 per fire, and 19.5 cents per bale ginned.

● Of the 400 fires for which the origin of the fire was known, matches or smoking, metals and foreign objects, and mechanical failure caused 77 percent of the fires and accounted for 92 percent of the losses. During the 3-year period, 83 percent of the fires resulted in no losses or losses under $100 per fire and 95 percent of the fires resulted in losses under $500 per fire.

● Foreign matter traps installed in gins were effective in reducing the number of fires caused by rocks, metal, green bolls, and foreign objects. Complete carbon dioxide systems in gins were effective in suppressing fires, once they started, and in reducing losses. Magnets and partial carbon dioxide systems were relatively ineffective in reducing fire losses. However, there was some evidence that often these devices were not installed and serviced to comform with accepted standards.

● The more important factors associated with gin fires and losses were auxiliary gin equipment and volume ginned. Gins with elaborate equipment—compared with those of simple equipment—ginned 2.4 times more cotton per gin, had nearly twice as many fires per 1,000 bales ginned, had 4 times as many fires per gin, sustained 27 times the dollar loss per gin, 7 times the loss per fire, and 9 times the loss per bale. Gins with elaborate equipment—compared with those of simple equipment, handled the same cotton 10 to 15 more times as it flowed through the complex drying, cleaning, and extracting equipment. Also, when fires occurred in

the large-volume and elaborately-equipped gins, the possibility of much greater losses increased because of high investment in gin machinery and buildings and large amounts of cotton on hand or in overnight storage.

● The number of fires per 1,000 bales ginned for hand-picked cotton was 43 percent greater than for machine-picked cotton; the fire loss per bale was 43 percent higher. Dollar losses, per fire and per bale, for fires occurring during rainy weather, were 58 percent lower than losses sustained during ginning on clear days. About 68 percent of all fires and 83 percent of all losses occurred in afternoon ginnings.

● During the 3-year period, 90 percent of the gins carried machinery and building insurance, and 6 out of 10 gins carried cotton products or baleyard insurance. For gins carrying machinery and building insurance, the annual premiums averaged $985 per gin; for gins carrying cotton products or baleyard insurance, the annual premiums for such insurance alone averaged $413 per gin or 21.7 cents per bale. The fire insurance loss ratio for the 3-year period averaged 9.6 percent for machinery and building insurance, and 34 percent for cotton products and baleyard insurance. For the sample gins studied in Tennessee, the average number of fires and losses per gin and insurance rates have declined during the seasons 1953-55 to 1956-58, this study shows.

● The results of this study stresses these rules or measures necessary to reduce gin fires, losses, and insurance rates:

1. Educate farmers, cotton pickers, and gin employees to keep the cotton free from matches and foreign material and to prohibit smoking in and around the gin.
2. Install foreign matter traps, magnets, and complete carbon dioxide systems in large-volume, elaborately-equipped gins.
3. Efficiently overhaul ginning machinery before the beginning of the ginning season, and frequently and carefully inspect machinery during the process of ginning, particularly during operation at peak capacity.
4. Install automatic feeders to prevent choke-ups and friction in the roll box and other machinery.
5. Insure proper electric bonding and grounding of moving parts in gins and periodic inspection for defective electrical equipment, including switch boxes.

6. Use recommended methods of cotton drying to prevent overheating in driers and fire hazards from burners and other equipment.
7. Use spark arrestors on tractors, trucks, and mechanical pickers.
8. Use safe methods to dispose of trash.
9. Isolate and mark fire-packed bales, and red-tag the bale preceeding and the bales following the fire-packed bale, or the one in which a fire occurs.
10. Keep the gin plant and premises free from clinging lint, dust, and trash.
11. Provide efficient, readily available fire-fighting apparatus at the gin.
12. Adequately lubricate machinery bearings to prevent hot boxes.
13. Use safe methods of fuel storage and supply.
14. Clean gin premises of grass and weeds.
15. Train gin employees on how to fight and prevent fires.
16. Prevent unauthorized people from entering gin buildings and premises.
17. Move cottonseed to oil mills, and baled cotton to bonded warehouses rapidly to reduce the volume of cotton stored overnight at the gin.
18. Employ a watchman for 48 hours following a gin fire.
19. Shift to non-combustible gin machinery, buildings and equipment. This is by far the most important factor in securing lower insurance rates.
20. Study the Cotton Gin Schedule of Credits and Deficiencies for adjusting gin insurance rates, published by the Tennessee Inspection Bureau.

● In establishing the rules and measures listed above each ginner must consider whether the increased costs of following such practices would pay through lower insurance premiums and reduced fire losses. The gin fire actuarial data presented in this bulletin should prove useful in making such decisions.

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Cotton Gin Fires And Losses In Tennessee

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INTRODUCTION

Problems Related to Cotton Gin Fires and Insurance

The property damage from fires in the cotton gin industry has been high and is reflected in the general cost of marketing cotton. The average cost of insurance per gin in Tennessee ranged from $907 in 1941 to $1,701 in 1958; the cost per bale ranged from 63 cents in 1942 to $1.24 in 1957.[1]

Since 1947 a number of fire prevention and fire fighting devices have been installed in Tennessee gins. Information was needed so that the effects of these devices on fire losses and fire control could be estimated accurately. Unpublished studies of the agricultural experiment station in recent years indicated that many ginners believed that as the number and kind of gin equipment increased from simple to elaborate, the number of fires and fire losses increased. This opinion needed to be checked.

Prior to this study, very little accurate information was available in Tennessee over a period of several years as to the causes of gin fires, dollar losses in relation to causes, and losses sustained by ginners as a result of fires which were not usually covered by insurance.

Purpose of the Study

The objectives of this study were: 1) to determine the place of detection and causes of gin fires; 2) to obtain cotton gin fire actuarial data on fires per gin, losses per gin, losses per fire, and losses per bale; 3) to evaluate the relationship of various factors such as fire prevention and fire fighting devices, type of equipment, volume of cotton ginned, and weather conditions, to gin fires and losses; and 4) to evaluate gin fire losses by type of loss and insurance coverage.

[1] Raskopf, B. D., Cotton Ginning Industry in Tennessee, Tennessee Agricultural Experiment Station Bulletin No. 303, September 1959.

Method of Procedure

The research reported in this bulletin is part of the Tennessee contribution to Regional Project SM-17, "An Economic Analysis of the Effects of Fires on Insurance and Other Costs of Gins." Cooperating agencies in the project include the Agricultural Experiment Stations of Arizona, Georgia, Louisiana, Mississippi, Missouri, Oklahoma, Tennessee, and Texas, and the Agricultural Marketing Service of the U.S.D.A. which conducted work in California, North Carolina, and Mississippi.

During 1955 a ginning machinery and equipment survey was made of each of the 335 gins in the state. On the basis of this survey, gins were classified into groups according to equipment and fire prevention and fire fighting devices. The three equipment groups, based on the number and kind of equipment, were Simple, Moderate, and Elaborate. Simple gins were those with no overhead cleaning or drying equipment or those with one drier or one overhead seed cotton cleaner, but not both. Moderate gins were those equipped with one overhead seed cotton cleaner and one drier or a combination of two overhead cleaners and one drier, or two driers and one overhead cleaner, in addition to a lint cleaner. Elaborate gins were those with two or more driers, burr machines, two or more overhead seed cotton cleaners, and lint cleaners.

The fire prevention and fire fighting gin classifications included: 1) gins equipped with foreign-matter traps designed to catch objects heavier than cotton and eliminate fires caused by sparks from green bolls, rocks, and other objects; 2) gins equipped with magnets only, designed to eliminate fires caused by sparks from tramp ferrous metal that gets into seed cotton; 3) gins equipped with both foreign-matter traps and magnets; 4) gins equipped with incomplete carbon dioxide systems to extinguish more promptly the fires that occur within the gin; 5) gins equipped with complete carbon dioxide systems, and having magnets or foreign-matter traps or both; and 6) gins having none of the above devices.

The number of gins cooperating in the study—by kinds of fire prevention and fire fighting devices, and type of equipment—for the three seasons is shown in Table 1. To increase the statistical validity of the actuarial data, the number of sample gins was increased from 78 in the 1956 crop year to 111 in the 1957 crop year. In the 1958 season three of the cooperating gins were idle.

Table 1. Number of Gins Cooperating in Cotton Gin Fire and Loss Study, by Type of Equipment and Fire Prevention and Fire Fighting Devices, Tennessee, Seasons 1956-57 to 1958-59.

Fire prevention or fire fighting category	1956-57				1957-58				1958-59			
	Equipment groups of gins (a)											
	S	M	E	All	S	M	E	All	S	M	E	All
	Number of gins in sample											
Traps only	3	5	4	12	5	10	5	20	4	10	5	19
Magnets only	3	5	4	12	2	7	6	15	(b)	8	6	14
Traps and magnets	(b)	7	3	10	(b)	9	6	15	(b)	10	7	17
Incomplete CO_2 systems	(b)	7	6	13	(b)	9	6	15	(b)	9	6	15
Complete CO_2 systems	(b)	4	5	9	(b)	7	8	15	(b)	7	8	15
None of these devices	7	10	5	22	7	19	5	31	2	21	5	28
All sample gins	13	38	27	78	14	61	36	111	6	65	37	108

(a) Equipment groups: S = simple, M = moderate, E = elaborate.
(b) No gins in this category in Tennessee.

The proportion of all gins in the state included in the sample during the seasons varied from 35 to 59 percent of the gins with foreign-matter traps only, 38 to 47 percent of the gins with magnets only, 63 to 94 percent of the gins with both traps and magnets, 68 to 79 percent of the gins with incomplete carbon dioxide systems, 90 to 100 percent of the gins with complete carbon dioxide systems, and 10 to 16 percent of the gins having none of the above devices.

The gins cooperating in the study were distributed widely throughout the cotton-producing area of the state so that data would represent the cotton growing, harvesting, and ginning conditions (fig. 1). As fires occurred during each season, the ginner made a report on each fire. At the end of the ginning season each cooperating ginner was interviewed to authenticate gin fires and losses and to obtain detailed fire insurance information. Each cooperating ginner furnished information on his gin fire losses and ginnings during the previous three crop years, 1953 to 1955. At the end of each of the ginning seasons, 1956-57 and 1957-58, preliminary reports were issued on cotton gin fires and losses in Tennessee.[2]

[2] Raskopf, B. D., **Cotton Gin Fires and Losses in Tennessee**, Tennessee Agricultural Experiment Station, Agricultural Economics Circulars, May 1957 and May 1958.

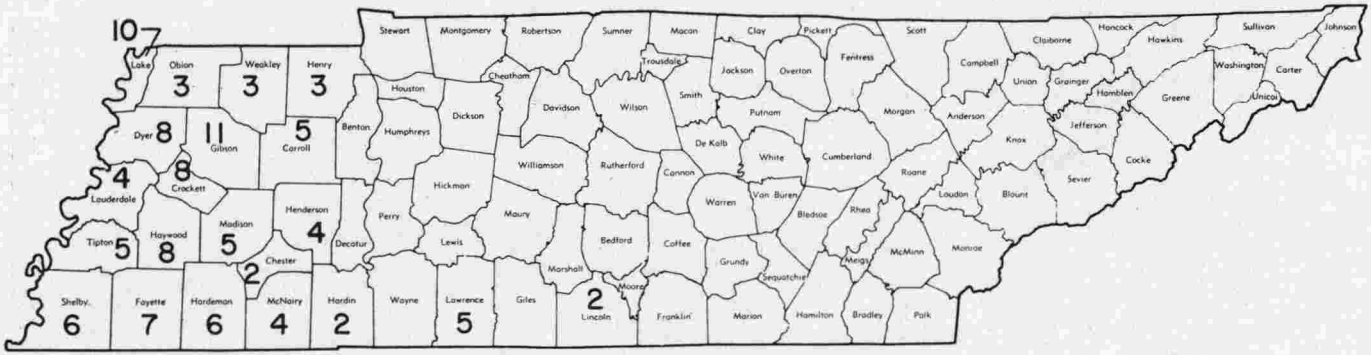


Figure 1. Location of gins cooperating in cotton gin fire and loss study, Tennessee, seasons 1956-57 to 1958-59

CAUSES OF FIRES

Causes of Fires and Places of Detection

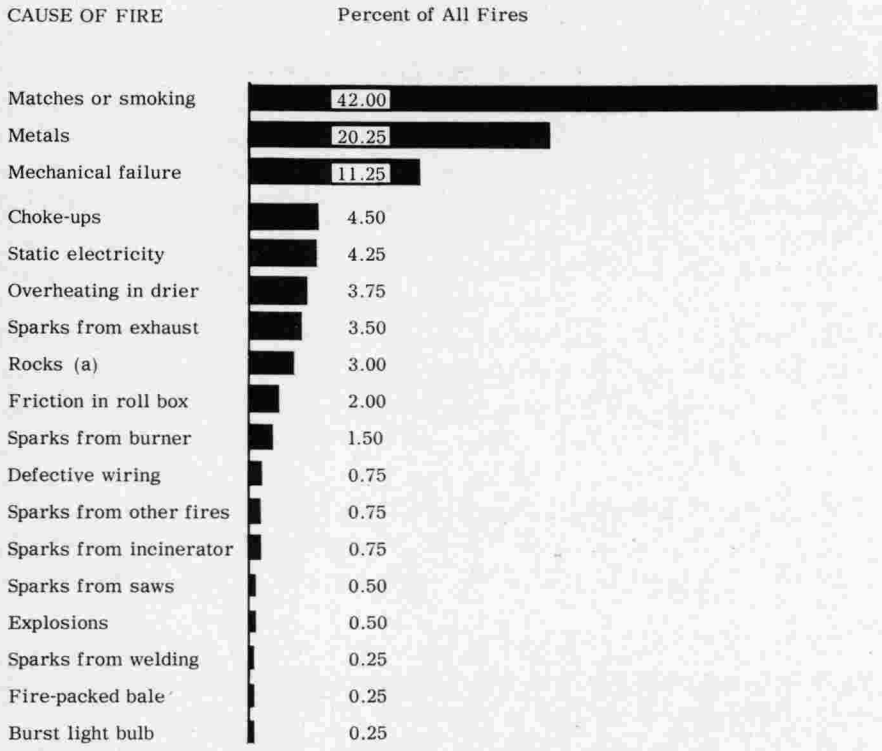
A primary objective of this study was to determine the cause of fires and their first place of discovery so that efforts might be directed toward preventing fires or reducing their losses. One important problem was that it was often impossible for ginners to determine the exact cause of the fire. Of the 584 fires occurring at the cooperating gins during the crop years 1956 to 1958, exact causes of 184 or 31.5 percent of all fires was unknown. Also, in some cases the fire was first noticed in more than one place or it was seen first at some other point than the real origin.

In the descending order of their frequency, 24.5 percent of the fires were first noticed in gin stands, 21.9 percent in overhead cleaners, 12.2 percent in conveyors, 7.4 percent in burr extractors, 5.7 percent in feeders, 5.5 percent in press boxes, 4.6 percent in seed cotton driers, 3.9 percent in separators, 3.4 percent on bale platforms or yards, and about 11 percent in 22 other places (Appendix I).

Of the 400 fires for which the origin of the fire was known, matches or smoking was the most important cause; it was responsible for 42 percent of the fires (fig. 2). Most of these fires were first noticed in gin stands, overhead cleaners, and conveyors (Appendix I). Metal in seed cotton accounted for 20.3 percent of the fires and these most often were first discovered in gin stands, overhead cleaners, burr extractors, and conveyor. The third most important cause of fires reported by ginners was mechanical failure of a machine or equipment. These fires accounted for 11.3 percent of fires of all known causes and most of them were first discovered in feeders, gin stands, and conveyors. Choke-up in ginning machinery and equipment caused 4.5 percent of the fires and most of these were first noticed in gin stands.

Several significant observations about the causes of fires resulted from this study:

1) The human element was an important factor. Matches or smoking, metals, rocks, and foreign objects caused nearly two-thirds of the 400 fires for which the origin of the fire was known. Most fires thus caused can be eliminated by educating farmers and cotton pickers to keep the cotton as free as possible from matches and other foreign material and to prohibit smoking and carrying matches in and around the gin. To reduce gin-processing



(a) Includes green bolls and foreign objects

Figure 2. Known causes of 400 fires occurring at sample gins in Tennessee, seasons 1956-57 to 1958-59

fire losses, many ginners have encouraged producers and cotton pickers to use book or safety matches. However, some ginners believe that the use of safety matches are as much of a fire hazard in gin processing fires as are the birdseye or sulfur-tipped matches. This problem merits further research.

2) Although matches or smoking were responsible for a large number of fires occurring each season, it appears that smoking was the most important cause. A study made in 1922 indicated that the incidence of fires from matches in cotton was very low. In three separate experiments with the placing of 575 marked birdseye matches in loads of seed cotton, only 4 fires were started. These fires occurred in the huller breast and were easily extinguished by lifting the breast and smouldering the flames.[3]

[3] Roethe, Harry E., Fires in Cotton Gins and How to Prevent Them, U.S.D.A. Circular No. 76, May 1929.

3) It appears that many of the fires, in addition to those caused by the human element, could have been prevented or the losses reduced. Of the fires of known origin, 23.3 percent were caused by sparks from metal, rocks, green bolls, or foreign objects. The majority of these fires occurred in gins not equipped with traps and magnets. Slightly over 11 percent of the fires of known origin were caused by mechanical failure. In about half of such fires the ginner indicated that the fire might have been prevented through more efficient overhauling of machinery before the beginning of the ginning season, or by more careful inspection of machinery and equipment during the process of ginning. Slightly over 4 percent of the fires were attributed to static electricity. Some of these fires may have been prevented through better electrical bonding and grounding at gins.[4] Although only 3.5 percent of the fires were caused by sparks from truck or tractor exhaust, these could have been prevented by using screened exhaust caps. Examination of other causes of fires (fig. 2) indicates that several may have been prevented through better methods of cotton drying, trash disposal, protection for gin machinery, and control of hazardous conditions conducive to gin fires.

Causes of Fires by Type of Fire

Fires occurring in and around cotton gins were grouped into four main types—in-transit, in-processing, baleyard, and other. The basis for classifying the fires was the form and location of the cotton when the fire occurred and the type of insurance, if any, carried on the cotton and gin.

In-transit fires were those occurring in the seed cotton from the time it was picked from the plant in the field to the suction pipe at the gin. In this study the total number of in-transit fires could not be determined and none of the ginners included in the sample carried insurance covering this type of fire. However, of the 565 in-processing fires (table 2), 23 could be traced back to in-transit origin. Of these fires, 14 were caused by sparks from truck or trailer exhaust, 7 by smoking on loaded wagons or trailers, and 2 by sparks from other fires.

In-processing fires were those occurring during the ginning process and included all fires from the entrance of seed cotton at

[4] Leonard, Clarance G., Effects of Electrical Bonding and Grounding on Static Generation and Elimination in Cotton Gins, U.S.D.A. Circular No. 949, October 1954.

Table 2. Causes of Gin Fires by Type of Fire, 584 Fires, Tennessee, Seasons, 1956-57 to 1958-59

	Processing	Baleyard	Other	Total
		Type of fire		
		Number of fires		
Unknown	168	16	—	184
Matches or smoking	168	—	—	168
Metals	81	—	—	81
Mechanical failure	45	—	—	45
Choke-ups	18	—	—	18
Static electricity	17	—	—	17
Overheating in drier	15	—	—	15
Sparks from vehicle exhaust	14	—	—	14
Rocks	12	—	—	12
Friction in roll box	8	—	—	8
Sparks from burner	6	—	—	6
Defective wiring	3	—	—	3
Sparks from other fires	2	1	—	3
Sparks from incinerator	2	—	1	3
Sparks from saws	2	—	—	2
Explosions	2	—	—	2
Sparks from welding	1	—	—	1
Fire-packed bale	1	—	—	1
Burst light bulb	—	—	1	1
Total	565	17	2	584

the suction pipe through the bale press. Of all fires, 565 or 97 percent occurred during processing and the causes of 30 percent of these were unknown. Most of the 397 in-processing fires for which the causes were known, were caused by matches or smoking, metal, mechanical failure, choke-ups in various equipment, static electricity, overheating in the drier, sparks from vehicle exhaust, and sparks from rocks, green bolls, and other objects.

As a general rule, in Tennessee, the cotton losses sustained during in-processing fires are not covered by formal fire insurance. The ginner normally estimates the value of seed cotton and lint that is damaged or destroyed and pays to the producer an amount equal to this value. Damage to ginning machinery and buildings is covered by general fire insurance and 9 out of 10 ginners carried this kind of insurance.

Baleyard fires were those which were first noticed in baled cotton lint after the bale had left the gin press and while it was stored at the gin baleyard. As an average during the 3 years, only

1 out of 6 of the sample gins carried baleyard insurance. Causes were known for only 1 of the 17 baleyard fires (table 2).

Two fires occurred which could not be classed as in-processing or baleyard. Both of these fires occurred in cotton houses. One of the fires resulted from a burst light bulb and the other was caused by sparks from an incinerator.

As an average during the 3 years, about half of the ginners included in the sample carried cotton and cotton products insurance. This kind of insurance covered the seed cotton from the time it arrived at the gin yard until it left the baleyard. It also covered cottonseed but did not include cotton damaged or burned during the process of ginning.

Causes of Fires by Dollar Volume

The total losses for the cooperating gins during the 3 seasons, 1956-57 to 1958-59, amounted to $99,243 or $170 per fire. This included cotton, machinery and building losses, cost of fire extinguisher, and labor or downtime. Of the total losses, in-processing fires accounted for 83.6 percent of the total, baleyard fires 8.5 percent, and other fires (cotton house) 7.9 percent (Appendix II).

Of the 584 fires occurring during the 3-year period, 168 of the 565 in-processing fires and 16 of the 17 baleyard fires were by unknown causes. However, the fires from unknown causes were first noticed in the same places as the fires of known causes (Appendix I). Also, the dollar loss per fire for those of unknown causes did not differ materially from those of known causes. For 397 in-processing fires of known cause, the losses per fire averaged $150, compared with $139 per fire for 168 fires of unknown causes. For 1 baleyard fire the losses were $600, compared with $487 per fire for 16 fires of unknown causes (Appendix II).

Fires due to 5 causes—matches or smoking, fire-packed bale, metal, mechanical failure, and sparks from burner—accounted for 90 percent of the total dollar loss of 397 in-processing fires for which the causes of fires were known. Matches or smoking caused the greatest dollar loss; the 168 fires averaged $144 per fire and accounted for 41 percent of the $59,674 losses from in-processing fires. The second most important loss which accounted for 25 percent of all losses from in-processing fires resulted from only one fire—a fire-packed bale.

GIN FIRES AND LOSSES

Fires Per Gin and Distribution of Fires

Records were available on the number of fires occurring at 78 to 111 of the same gins during the 6 crop years, 1953-58. From the first to the last 3 years of this period, the average number of fires for all sample gins decreased 55 percent, the average number of fires per gin for gins having fires decreased 50 percent, and a 13 percent decrease occurred in the proportion of gins having fires (table 3).

Table 3. Number of Gin Fires and Distribution of Fires, 78 to 111 Gins, Tennessee, Seasons 1953-54 to 1958-59

Number of fires		1953-54	1954-55	1955-56	1956-57	1957-58	1958-59
		Number of gins reporting fires					
None		14	11	15	16	29	26
1		9	13	9	25	31	22
2		13	15	16	11	25	29
3		10	9	15	11	16	15
4		11	12	14	6	5	7
5		9	6	8	1	1	2
6		11	15	10	4	1	3
7		9	7	7	1	1	2
8		3	5	1	1	1	—
9		—	—	2	1	—	—
10 and over		11	11	12	1	1	2
Sample gins	(No.)	100	104	109	78	111	108
Total fires	(No.)	448	481	473	172	195	217
Fires per gin	(No.)	4.5	4.6	4.3	2.2	1.8	2.0
Gins having fires	(No.)	86	93	94	62	82	82
	(%)	86.0	89.4	86.2	79.5	73.9	75.9
Fires per gin	(No.)	5.2	5.2	5.0	2.8	2.4	2.6

Of all cooperating ginners, 1 operated for 5 consecutive years without having a fire, 4 for 4 years, 8 for 3 years, and 19 for 2 years. During any one of the 6 years the chance of a gin completing the season without a fire ranged from 1 out of 7 in 1953 to 1 out of 4 in 1957 and 1958. While some gins had no fires or only a few fires during the 6-year period, as high as 12 gins had 10 or more fires per gin in 1955. The greatest number of fires occurring at one gin was 25 in each year 1953 to 1955, 15 in 1956, 20 in 1957, and 12 in 1958.

The decline in number of fires per gin from 1953 to 1958 may

be attributed to several factors: 1) A decrease in the volume of cotton ginned per active gin. The number of bales ginned per active gin decreased from 1,993 in 1953 to 1,383 in 1958. 2) The proportion of Tennessee gins equipped with one or more different kinds of built-in fire prevention and fire fighting devices increased from 30 percent in 1955 to 41 percent in 1958. 3) Since 1955 the results of the study on the causes of cotton gin fires and gin fire losses have been disseminated annually to ginners. And 4) during the past several years the Tennessee Inspection Bureau has made a concerted effort to have gin owners and operators improve their gin construction and operation in the prevention and control of fires.

Since 1955, the Inspection Bureau has helped publish reports on "Fire Prevention and Protection as Applied to Cotton Gins," "Standards for Magnetic Separators and Interpretation for Standards for Magnetic Separators," and a new "Cotton Gin Schedule" in which rates on the non-combustible type of gins were greatly reduced. Also, the Bureau has given credit for various types of fire prevention and fire fighting devices and practices.

Losses Per Gin

Losses resulting from fires in and around the gin may be classified for actuarial purposes on the basis of losses per gin for all gins in the sample, and losses per gin having fires. They may also be separated as to cotton, machinery, and building damages, and additional costs of fire extinguisher and labor or downtime lost during fires or the time necessary to repair fire damage.

The annual losses for the 3 seasons—1956-57 to 1958-59 for cotton, machinery, and buildings—averaged $303 per gin for all gins in the sample, and $398 per gin having fires. During the same period the cost of fire extinguisher annually averaged $14 per gin for all gins, and $18 per gin having fires. Labor or downtime resulting from fires annually averaged nearly $18 per gin for all gins, and $23 per gin having fires (table 4).

Several significant observations relating to losses per gin resulted from this study: 1) Losses per gin varied considerably from year to year, and by type of loss. Cotton, machinery, and building losses for all gins ranged from $676 per gin in the 1956-57 season to $98 per gin in the 1957-58 season. For the same seasons the losses per gin having fires ranged from $884 to $168. In the 1956-57 season the cotton losses per gin were much the highest, but in the other two seasons, most damage was to machinery.

Table 4. Gin Fire Losses Per Gin Reported by 78 to 111 Ginners, Tennessee, Seasons 1956-57 to 1958-59.

Type of loss		1956-57	1957-58	1958-59	3-yr. av. (a)
		Losses per gin of all gins in sample ($)			
Cotton		486.82	45.10	111.79	185.36
Machinery		87.50	52.81	118.12	85.67
Buildings		101.25	——	13.89	31.64
Total		675.57	97.91	243.80	302.67
Fire extinguisher		11.03	11.69	18.40	13.96
Labor (downtime)		15.86	14.36	21.99	17.53
Total all losses		702.46	123.96	284.19	334.16
		Losses per gin having fires ($)			
Cotton		612.45	61.04	147.23	243.59
Machinery		110.08	71.49	155.59	112.59
Buildings		127.38	——	18.29	41.58
Total		849.91	132.53	321.11	397.76
Fire extinguisher		13.87	15.83	24.23	18.34
Labor (downtime)		19.95	19.44	28.96	23.03
Total all losses		883.73	167.80	374.30	439.13
Sample gins	(No.)	78	111	108	99
Gins having fires	(No.)	62	82	82	75

(a) Weighted average.

2) While the cost of fire extinguisher and labor or downtime per gin varied from year to year, these costs were relatively unimportant compared with the cotton and machinery losses. 3) Total losses per gin for all gins and gins having fires appear to be decreasing. As an average, the combined annual losses of cotton, machinery, and buildings for all gins decreased from $443 per gin in the 1953-55 crop years to $303 per gin in the 1956-58 crop years. Similar losses for gins having fires during the same years decreased from $508 to $398.[5]

Distribution of Gins by Amount of Fire Loss

Fire insurance policies may be written with deductible clauses, therefore ginners are interested in the frequency with which fires occur in relation to dollar losses. As an average for the 3 years, 89 percent of the gins had losses under $500 per gin, and 66 percent had losses under $100 per gin (table 5). As an average during the 3 years the chances were 1 out of 59 that a gin would sustain a $5,000 loss; 1 out of 17 for a loss per gin above $1,000;

[5] Losses of the sample gins for the seasons, 1953-54 to 1955-56, were obtained but are not shown in Table 4. Data on cost of fire extinguisher and labor or downtime for cotton gin fires for the 1953-55 crop years were not available.

1 out of 9 for a loss per gin above $500; and 1 out of 3 for a loss per gin above $100. Fire losses per gin for all sample gins averaged $334. This included cotton, machinery, and building losses, as well as cost of fire extinguisher and labor or downtime as shown in Table 4.

Table 5. Distribution of Gins by Amount of Fire Loss, Reported by 78 to 111 Ginners, Tennessee, Seasons, 1956-57 to 1958-59.

Losses	1956-57		1957-58		1958-59		3 seasons		
	Gins	Loss	Gins	Loss	Gins	Loss	Gins	Loss	Loss per gin (a)
$	No.	$	No.	$	No.	$	No.	$	$
None	19	—	33	—	27	—	79	—	—
1-99	32	1,132	47	1,515	39	1,379	118	4,026	34
100-499	17	3,263	23	5,508	27	6,386	67	15,157	226
500-999	3	2,170	5	3,327	7	4,982	15	10,479	699
1,000-4,999	3	5,601	3	3,409	7	12,663	13	21,673	1,667
5,000 and over	4	42,626	0	—	1	5,282	5	47,908	9,582
Total	78	54,792	111	13,759	108	30,692	297	99,243	334

(a) Weighted average.

Losses Per Fire

Cotton, machinery, and building losses per fire ranged from $306 in the 1956-57 season to $56 in the 1957-58 season and averaged $154 annually for the 3 years (table 6). As an average, cotton losses per fire were twice as great as machinery losses, and nearly 6 times as great as building losses. However, wide variations

Table 6. Gin Fire Losses Per Fire Reported by 78 to 111 Ginners, Tennessee, Seasons 1956-57 to 1958-59.

Type of loss		1956-57	1957-58	1958-59	3-yr. av. (a)
		Losses per fire ($)			
Cotton		220.77	25.67	55.64	94.43
Machinery		39.68	30.06	58.79	43.57
Buildings		45.92	——	6.91	16.09
Total		306.37	55.73	121.34	154.09
Fire extinguisher		5.00	6.66	9.16	7.10
Labor (downtime)		7.19	8.17	10.94	8.91
Total, all losses		318.56	70.56	141.44	170.10
Sample gins	(No.)	78	111	108	99
Sample gin fires	(No.)	172	195	217	195

(a) Weighted averages.

existed from year to year by type of loss. In the first year the building losses per fire exceeded machinery losses, and in the last 2 years the machinery losses exceeded the cotton losses. The cost of fire extinguisher and labor or downtime per fire did not vary much by seasons and averaged less than $9 per year during the 3 years.

Fire losses per fire (cotton, machinery, buildings) increased from an average of $99 in the 1953-55 crop years to $154 in the 1956-58 crop years. Although the losses per fire increased from the first to the second period, total losses per gin actually decreased. This is explained by the fact that the number of fires per gin in the first period was 2.4 times the number of fires per gin in the last 3 years.

Distribution of Fires by Amount of Loss

As an average for the 3 years, about 83 percent of the fires resulted in losses under $100 per fire (table 7). The chances were 1 out of 117 that the fire loss would exceed $5,000; 1 out of 49 for a loss per fire above $1,000; 1 out of 21 for a loss per fire above $500; and 1 out of 6 for a loss per fire above $100.

During the 3 years, 5 of the 584 fires accounted for 48 percent of the total losses, and 28 fires resulted in 73 percent of the total losses. Fire losses per fire for all fires averaged $170. This included losses for cotton, machinery, and buildings, as well as cost of fire extinguisher and labor or downtime as shown in Table 6.

Table 7. Distribution of Fires by Amount of Loss, 584 Fires Reported by 78 to 111 Ginners, Tennessee, Seasons 1956-57 to 1958-59.

Losses	1956-57		1957-58		1958-59		3 Seasons		
	Fires	Loss	Fires	Loss	Fires	Loss	Fires	Loss	Loss per fire (a)
$	No.	$	No.	$	No.	$	No.	$	$
None	14	—	11	—	6	—	31	—	—
1-99	127	3,731	155	4,457	169	5,662	451	13,850	31
100-499	22	3,534	22	4,122	30	5,648	74	13,304	180
500-999	4	2,640	6	4,110	6	4,415	16	11,165	698
1,000-4,999	1	2,716	1	1,070	5	9,721	7	13,507	1,930
5,000 & over	4	42,171	0	—	1	5,246	5	47,417	9,483
Total	172	54,792	195	13,759	217	30,692	584	99,243	170

(a) Weighted average.

Losses Per Bale Ginned

Converted to a per-bale figure, the average total cost of cotton, machinery, and building fires for all gins in the sample ranged

from 35 cents per bale in the 1956-57 season to 6.3 cents per bale in the 1957-58 season and averaged nearly 18 cents per bale for the 3 years (table 8). For gins having fires, the cotton machinery and building costs per bale were higher. These ranged from 41.2 cents per bale in the 1956-57 season, to 7.2 cents per bale in the 1957-58 season, averaging 20.6 cents per bale for the 3 years.

For the 3-year period, the costs of fire extinguisher and labor or downtime (combined) resulting from fires averaged 1.8 cents per bale for all gins, and 2.2 cents per bale for gins having fires. The per-bale costs for fire extinguisher and downtime did not vary as much from year to year as did the losses for cotton, machinery, and buildings.

Table 8. Fire Losses Per Bale Ginned, Reported by 78 to 111 Ginners, Tennessee, Seasons, 1956-57 to 1958-59.

Type of loss	1956-57	1957-58	1958-59	3-year av. (a)
	Losses per bale of all gins in sample (¢)			
Cotton	25.2	2.9	6.5	10.8
Machinery	4.5	3.4	6.9	5.0
Buildings	5.3	—	0.8	1.9
Total	35.0	6.3	14.2	17.7
Fire extinguisher	0.6	0.7	1.1	0.8
Labor (downtime)	0.8	0.9	1.2	1.0
All losses	36.4	7.9	16.5	19.5
	Losses per bale of gins having fires (¢)			
Cotton	29.7	3.3	7.6	12.6
Machinery	5.3	3.9	8.1	5.8
Buildings	6.2	—	0.9	2.2
Total	41.2	7.2	16.6	20.6
Fire extinguisher	0.7	0.9	1.3	1.0
Labor (downtime)	1.0	1.1	1.5	1.2
All losses	42.9	9.2	19.4	22.8
Sample gins, No.	78	111	108	99
Bales ginned, No.	150,485	173,465	185,836	169,929
Gins having fires, No.	62	82	82	75
Bales ginned, No.	127,706	149,599	158,357	145,221

(a) Weighted average.

FACTORS RELATED TO GIN FIRES AND LOSSES

Fire Prevention and Fire Fighting Devices

Three years of gin fire loss data were available for evaluating the effectiveness of certain fire prevention and fire fighting devices on gin fires and losses. The specific fire prevention devices studied were: 1) foreign matter traps designed to aid in eliminating fires caused by rocks and extraneous material in seed cotton, and 2) magnets designed to eliminate fires caused by sparks from tramp ferrous metal. The fire fighting devices studied were complete and partial carbon dioxide systems designed to extinguish more promptly the fires that occur during the process of ginning. The summarized results of gin fire losses by the above types of fire prevention and fire fighting devices for 297 gins during the seasons 1956-57 to 1958-59 are shown in Appendix III.

Gins Equipped With Foreign-Matter Traps

Ginners in Tennessee first began installing foreign-matter traps in gins in 1945. About 16 percent of all active gins were equipped with traps in 1955, and the proportion increased to 23 percent in 1958. These devices are installed in the suction system of the gin. A section of the suction line usually is enlarged, suction reduced, and objects heavier than cotton fall into a trap before they enter the cleaning equipment in the gin. Traps are generally located in the suction line after the cotton leaves the wagon or trailer or just after the cotton leaves the drier. In addition to removing rocks, the traps are effective in removing green bolls, tramp metal, and other foreign objects heavier than cotton which contribute indirectly to gin fires.

During the 3 years of this study, a sample of over 200 different kinds of foreign objects was collected from gins equipped with traps. Included in this sample were such things as horse shoes, large pieces of iron, rocks, and shotgun shells which could have seriously damaged gin machinery and equipment. For example, one fire in 1958 and another in 1957 were caused from shotgun shells which exploded in the cleaners. Both of these fires occurred in gins not equipped with traps and the total fire losses amounted to $149.

Rocks, green bolls, and other foreign objects accounted for only 3 percent of the fires for which the origin was known. Traps were installed in 44 percent of the sample gins and probably were effective in eliminating many fires. Of the 12 fires caused by

rocks and other foreign objects, only 2 occurred in a gin equipped with traps and magnets (Appendix III).

The effectiveness of foreign-matter traps in reducing gin fire losses may be judged on the basis of losses caused by rocks, green bolls, and other foreign objects at 10 gins during 3 years. At 1 gin equipped with traps, 2 fires caused by rocks averaged losses of $39 per gin, $19 per fire, and 1.1 cents per bale ginned. At 9 gins not equipped with traps, 10 fires caused by rocks averaged $163 per gin, $147 per fire, and 8.8 cents per bale ginned. Based on these figures, a gin might well be given insurance credit for trap protection at the rate of 10 cents to 15 cents for each $100 of insurance. The Tennessee Inspection Bureau now grants a credit of 5 cents per $100 of insurance for gins equipped with traps installed in conformance with Standard.

An important consideration relating to the use of foreign-matter traps in gins is that this device, in addition to preventing fires, helps remove green bolls and thus reduces time lost due to choke-ups in gin equipment. The removal of green bolls and foreign-matter from seed cotton also aids in improving the grade of cotton. A survey made during the 1953-54 ginning season indicated that of a total of 1,162 gin fires, 27 percent was believed to have been caused by metal and rocks and 8 percent by chokages and friction in the roll box.[6] These results coincide closely with the present study. Of the 400 fires for which the origin of fire was known, 23.3 percent were caused by metal and rocks, and 6.5 percent by choke-ups and friction in the roll box (fig. 2).

Gins Equipped With Magnets

Ginners in Tennessee first began installing magnets in gins in 1947. About 16 percent of all active gins was equipped with magnets in 1955, and the proportion increased to 23 percent in 1958. Magnets are installed in the ginning system in the side of the drier or in the angle of the discharge of the drier so that seed cotton will impinge or be carried closely across the face of the magnet. When properly installed, magnets are effective in recovering tramp ferrous metal in the seed cotton that has not been removed by traps. To be most effective the magnets should be inspected several times daily and cleaned if necessary. Of the gins installed with magnets, 53 percent were inspected once or more

[6] Franks, Gerald N., and Griffin, Clyde A. Jr., Foreign-Matter Trap for Cotton Gins, U.S.D.A. Circular No. 973, November 1955.

daily, 20 percent twice weekly, 15 percent weekly, 5 percent twice monthly, 5 percent monthly, and 2 percent only twice a year.

Of the ginners whose gins were equipped with magnets, 92 percent thought that the number of fires had decreased since magnets had been installed. About half of the ginners who had magnets installed in their gins believed that the magnets had more than paid for their installation by preventing fire losses. The other half of the ginners stated that they had no basis for evaluating the effectiveness of magnets in preventing fires.

Metals in seed cotton accounted for 81 or 20.3 percent of the fires for which the origin was known. Magnets were installed in 41 percent of the sample gins and could have been responsible for preventing many fires. However, of the 81 fires caused by metal, 45 percent occurred in gins equipped with magnets. During 3 years at 17 gins equipped with magnets, there were 36 fires caused by sparks from metal that had by-passed the magnets. The losses from the 36 fires averaged $286 per gin, $135 per fire, and 12.5 cents per bale. During the same period 27 gins not having magnets had 45 fires caused by metal and losses for these fires averaged $132 per gin, $79 per fire, and 6.6 cents per bale.

The fact that this study showed the relative ineffectiveness of magnets in preventing gin fires due to metal, or in reducing the losses from such fires, requires some explanation. Magnets are considered satisfactory for recovering tramp ferrous metal only when they are installed according to manufacturer's recommendations, and for gin insurance credit purposes, meet the interpretations of standards for magnetic separators. The more important of these requirements relate to the proper location, size, accessibility, and maintenance of magnets. An important requirement is that magnets should be inspected and cleaned of collected metal several times a day.[7] The Tennessee Inspection Bureau grants a credit of 15 cents per $100 insurance for magnetic separators installed in gins in conformance with standards. During the 3-year period it was determined that magnets in 25 percent of the sample gins equipped with this device were not installed in conformance with standards. In addition, 47 percent of the gins equipped with magnets were not inspected daily and cleaned of collected metal.

Gins Equipped With Complete Carbon Dioxide Systems

The first gin in Tennessee equipped with a complete carbon

[7] Fire Prevention and Protection as Applied to Cotton Gins, and Standards for Magnetic Separators, Insurance and Inspection Bureaus of Cotton Growing States, 1955.

dioxide system was reported in 1948. The number increased to 10 in 1955 and to 15 in 1958. The cost of installation per system ranged from under $1,000 in the earlier years to $2,500 in recent years. All but one of the 10 gins equipped with complete carbon dioxide systems were included in the sample gins in the 1956-58 season, and all 15 were included in the sample during the 1957-58 and 1958-59 seasons (table 1).

The complete carbon dioxide method connects all vital parts of the ginning system to a central group of carbon dioxide tanks. In the case of in-processing fires, the carbon dioxide tanks are activated by pushing a button which shoots carbon dioxide gas into all vital parts of the enclosed ginning system and rapidly snuffs out the fire. Most gins having complete carbon dioxide systems were also equipped with traps and magnets for preventing fires caused by metal, rocks, green bolls, and other objects. Complete carbon dioxide systems are effective in reducing losses from in-processing fires but they offer no protection against bale-yard fires or fires originating in buildings or areas outside the gin.

Losses from 82 in-processing fires in gins equipped with complete carbon dioxide systems averaged $286 per gin per year, $98 per fire, and 14.4 cents per bale. This compared with 87 in-processing fires in the control group of gins that averaged $497 per gin per year, $274 per fire, and 28.7 cents per bale. The Tennessee Inspection Bureau grants a credit of 25 cents per $100 insurance to gins equipped with carbon dioxide systems for all-metal gin machinery in conformance with standard.

Important considerations relating to why complete carbon dioxide systems were used in gins were volume of ginning and type of equipment. Gins equipped with complete carbon dioxide systems, compared with gins in the control group not having such systems, ginned more cotton annually. Further, they were much more elaborately equipped with such machinery as seed cotton driers, overhead seed cotton cleaners, burr machines, and lint cleaners.

Gins Equipped With Incomplete Carbon Dioxide Systems

During the crop years 1956 to 1958, 19 gins in Tennessee were equipped with incomplete carbon dioxide systems. Of these, 13 were included in the sample in the 1956-57 season and 15 in each of the 1957-58 and 1958-59 seasons. Incomplete carbon dioxide systems were defined as those where, in the event of an in-processing fire, the carbon dioxide would enter some but not all vital parts

of the ginning system. Gins having incomplete carbon dioxide systems were not equipped with magnets or traps to prevent fires caused by metal, rocks, green bolls, or other foreign objects.

During the 3 years of this study partial or incomplete carbon dioxide systems were relatively ineffective in suppressing fires or reducing fire losses (Appendix III). Gins with the incomplete carbon dioxide systems had higher losses per gin, per fire, and per bale, from fires occurring during the process of ginning and attributed to causes other than metal, rocks, green bolls, and other objects.

Based on these data, probably Tennessee ginners are not justified in equipping their gins with incomplete carbon dioxide systems unless these gins conform to the Standard established by the Tennessee Inspection Bureau. A credit of 15 cents per $100 insurance is granted by the Bureau to gins having partial carbon dioxide systems providing the flues and condensers are protected.

Gin Equipment — Simple, Moderate, Elaborate

One of the opinions tested in this study was this, as the number and kind of gin equipment increased from simple to elaborate, the number of fires and fire losses would also increase. This opinion was based on several premises: 1) the gins with elaborate equipment, on the average, are larger ones and gin from 2 to 3 times as many bales as the plants with simple equipment, 2) gins with elaborate equipment, compared with those of simple equipment, handle the same cotton 10 to 15 times more as it flows through the complex drying, cleaning, and extracting equipment; and 3) the more elaborately equipped gins, under the pressure of heavy ginnings, should tend to have more mechanical failures, choke-ups, overheating in driers, and friction in roll boxes, and these represent fire hazards.

This study corroborated the above opinion. Gins with elaborate equipment, compared with those of simple equipment, ginned 2.4 times more cotton per gin, had 1.9 times as many fires per 1,000 bales ginned, had 4 times as many fires per gin, sustained 27 times the dollar losses per gin, 7 times the losses per fire, and 9 times the losses in cents per bale (table 9).

Gins classified as **Simple,** from the viewpoint of auxiliary equipment, had no overhead cleaning or drying equipment or had only 1 drier or 1 overhead cleaner but not both. Of the gins in this equipment group, 36 percent had traps and 15 percent had magnets. None of these gins had carbon dioxide systems. These gins had 23

Table 9. Fire Losses at Gins with Specified Equipment, 78 to 111 Gins, Tennessee, Seasons, 1956-57 to 1958-59.

Item	Auxiliary gin equipment (a)		
	Simple	Moderate	Elaborate
Gins, total for 3 years, No.	33	164	100
Annual volume per gin, Bales	950	1556	2233
Fires per 1,000 bales ginned, No.	0.7	1.1	1.3
Fires per gin, all gins, No.	0.7	1.7	2.8
Fires per gin having fires, No.	1.4	2.4	3.0
Losses per gin, all gins, $	26.63	164.16	714.42
Losses per gin having fires, $	51.70	232.09	768.18
Losses per fire, $	38.21	96.50	253.35
Losses per bale, all gins, ¢	2.8	10.6	32.0
Losses per bale, gins having fires, ¢	3.9	13.2	34.2

(a) **Simple** gins had no cleaning or drying equipment, or 1 drier or overhead cleaner, but not both. **Moderate** gins had 1 overhead cleaner and 1 drier or 2 overhead cleaners and 1 drier, or 2 driers and 1 overhead cleaner, and 1 lint cleaner. **Elaborate** gins had 2 or more driers, 2 or more overhead seed cotton cleaners, burr machines, and 1 or more lint cleaners. All fires and losses per gin, per fire, and per bale are annual weighted averages.

fires during the 3 years with total losses of $879. Of the total losses, about 87 percent were cotton, 9 percent labor or downtime, and 4 percent fire extinguisher. No building or machinery losses were sustained (Appendix IV).

Gins classified as **Moderate** had 1 overhead cleaner and 1 drier, or 2 overhead cleaners and 1 drier, or 2 driers and 1 overhead cleaner, and 1 lint cleaner. Of the gins in this equipment group, 42 percent had traps, 39 percent had magnets, and 26 percent had partial or complete carbon dioxide systems. These gins had 279 fires during the 3 years with total losses of $26,923. Of the total losses about 46 percent were cotton, 37 percent were machinery, 8 percent were labor or downtime, 7 percent were fire extinguisher, and 2 percent were buildings.

Gins classified as **Elaborate** had 2 or more driers, 2 or more overhead seed cotton cleaners, burr machines, and 1 or more lint cleaners. Of the gins in this equipment group, 51 percent had traps, 53 percent had magnets, and 39 percent had partial or complete carbon dioxide systems. These gins had 282 fires during the 3 years with total losses of $71,442. Of the total losses, about 59 percent were cotton, 22 percent machinery, 13 percent buildings, 3 percent labor or downtime, and 3 percent fire extinguisher. Annual fire losses for all gins in the Elaborate group averaged $714 per gin, $253 per fire, and 32 cents per bale (Appendix IV).

Hand Versus Machine Harvested Cotton

Of the 509,786 bales of cotton ginned by the sample gins during the 3 years of this study, only 3 percent or 15,258 bales were machine picked. Of the 584 fires occurring in all sample gins, only 10 or 1.7 percent occurred in machine picked cotton. All 10 of these fires occurred during the ginning process and 3 were caused by mechanical failure, 2 by metal, 1 by matches or smoking, 1 by choke-ups, and 1 by static electricity. The causes of 2 fires were unknown (table 10).

The number of fires per 1,000 bales ginned in hand harvested cotton was 1.2, compared with 0.7 in machine picked cotton, and the loss per 1,000 bales was $197 and $115 respectively. These differences were significant at the 95 percent level of probability.

Table 10. Fire Losses in Hand and Machine Picked Cotton, 78 to 111 Gins, Tennessee, Seasons, 1956-57 to 1958-59.

Item	Method of harvesting	
	Hand	Machine
Volume of cotton ginned, Bales	494,528	15,258
Fires, No.	574	10
Fires per 1,000 bales ginned, No.	1.16	0.66
Total losses, $	97,488.15	1,754.83
Cotton, $	54,563.06	487.43
Machinery, $	24,529.50	915.00
Buildings, $	9,247.30	150.00
Fire extinguisher, $	4,008.94	136.00
Labor (downtime), $	5,139.35	66.40
Loss per fire (a), $	169.84	175.48
Loss per bale (a), ¢	19.7	11.5
Loss per 1,000 bales, $	197.13	115.01
Fires caused by:		
Matches or smoking, No.	167	1
Metal, No.	79	2
Mechanical failure, No.	42	3
Choke-ups, No.	17	1
Static electricity, No.	16	1
All other causes and unknown, No.	253	2

(a) Losses per fire and per bale are annual weighted averages.

Volume of Cotton Handled and Seasonality of Ginning

To determine the relationship between gin fires and volume of ginnings during the season, the data on cotton ginned, fires and losses were grouped for specified ginning periods. These periods corresponded to the U. S. Bureau of the Census reports of ginnings

by specified periods. In Tennessee, seed cotton is not delivered in an even flow to gins because of variations in growing and harvesting and because of climatic conditions. Cotton picking in the state usually begins the last week of August or the first week of September and the peak of ginnings is usually reached during the first 2 weeks of October. As an average, over half of the cotton crop is ginned by October 17. In actual practice many gins are closed after about 4 months of operation, September to December, or operate only 1 or 2 days a week during the latter part of the ginning season which extends to March 20 of the next year.

During the 3 years of the study, 56 percent of the cotton was ginned by October 17, and 52 percent of the fires occurred during this period. Although the number of fires per 1,000 bales ginned during this period averaged 1.1 or the same as for the entire season, the gin fire losses were much greater. During the period September 1 to October 17, fire losses accounted for 75 percent of the total losses, and annual losses per gin, per fire, and per bale, were much greater (table 11).

Table 11. Gin Fires and Losses by Volume of Cotton Ginned During Specified Periods, Tennessee, Seasons, 1956-57 to 1958-59.

Ginning period	Bales ginned		Fires				Losses				
			Total		Per 1,000 bales ginned	Per 100 gins	Total		Annual (a)		
									Per gin	Per fire	Per bale
Date	%	No.	%	No.	%	No.	No.	$	%	$	$	¢
Sept. 1-15	7.7	37,221	7.3	63	10.8	1.7	21	32,184	32.4	108	511	86.5
16-30	7.7	92,262	18.1	74	12.7	0.8	25	21,703	21.9	73	293	23.5
Oct. 1-17	8.7	156,056	30.6	166	28.4	1.1	56	20,085	20.2	67	121	12.9
18-31	7.1	88,437	17.3	88	15.1	1.0	30	7,618	7.7	25	87	8.6
Nov. 1-13	6.6	55,464	10.9	74	12.7	1.3	25	3,206	3.2	11	43	5.8
14-30	8.7	33,764	6.6	63	10.8	1.9	21	11,184	11.3	38	178	33.1
Dec. 1-12	6.1	21,070	4.2	19	3.3	0.9	6	1,010	1.0	4	53	4.8
Dec. 13-Jan. 15	16.8	20,010	3.9	32	5.4	1.6	11	2,138	2.2	7	67	10.7
Remainder	30.6	5,502	1.1	5	0.8	0.9	2	115	0.1	1	23	2.1
Total	100.0	509,786	100.0	584	100.0	1.2	197	99,243	100.0	334	170	19.5

(a) Weighted averages.

These data indicate that during the early part and peak of the ginning season the ginners should be especially careful in following practices necessary in reducing fire hazards and losses. Under the pressure of heavy ginning the gin crews may be less attentive to

possible fire hazards. When ginning is at full capacity and continues for long hours, there are also greater fire hazards attributed to the human element from such causes as these: smoking, metals, and foreign objects, and to mechanical failures, choke-ups in equipment, static electricity, and other causes indicated in Figure 2.

Clear Versus Rainy Weather Ginning

About 11 percent of the cotton ginned by sample gins during the 3-year period was ginned during rainy weather, and about 11 percent of all fires occurred during rainy weather. However, these fires accounted for only 5 percent of the total losses. As an average, the annual fire losses per gin, per fire, and per bale, for fires occurring during rainy weather, were lower than losses sustained during ginning on clear days (table 12).

Table 12. Gin Fires and Losses in Clear and Rainy Weather Ginning, 78 to 111 Gins, Tennessee, Seasons, 1956-57 to 1958-59.

Item	1956-57		1957-58		1958-59		3 seasons (a)	
	Weather conditions during ginning							
	Clear	Rainy	Clear	Rainy	Clear	Rainy	Clear	Rainy
Gin fires, No.	167	5	142	53	208	9	517	67
Gin fires, %	97.1	2.9	72.8	27.2	95.8	4.2	88.5	11.5
Cotton ginned, %	92	8	84	16	90	10	89	11
Total losses, $	54,741	50	10,246	3,513	29,146	1,546	94,133	5,109
Total losses, %	99.9	0.1	74.5	25.5	95.0	5.0	94.9	5.1
Cotton, $	37,924	48	3,748	1,257	11,879	194	53,551	1,499
Machinery, $	6,825	—	4,187	1,675	11,653	1,105	22,665	2,780
Buildings, $	7,897	—	——	——	1,500	——	9,397	——
Fire extinguisher, $	860	—	1,039	259	1,830	157	3,729	416
Labor (downtime), $	1,235	2	1,272	322	2,284	90	4,791	414
Losses per gin, $	702	1	92	32	270	14	317	17
Losses per fire, $	328	10	72	66	140	172	182	76
Losses per bale, ¢	39.5	0.4	7.0	12.7	17.5	8.2	20.9	8.7

(a) Losses per gin, per fire, and per bale are annual weighted averages.

The extent of influence of weather conditions on cotton gin fires during ginning varied considerably by years. The weather during the ginning seasons of 1956 and 1958 was about normal in precipitation; about 1 out of 7 days was rainy and only 14 fires occurred during rainy days in both seasons. The 1957 ginning season was not normal. Rainfall was heavy, rainy days occurred about 1 out of 4 days, and much of the seed cotton brought to the gins was wet, trashy, and immature. Ginning of this cotton required above normal use of seed cotton driers and other ginning machinery. This resulted

in many conditions conducive to fires such as mechanical failures, choke-ups in machinery, overheating in driers, friction in roll boxes, and sparks from burners. In the 1957 season, 53 fires occurred during rainy days; 30 percent of these were caused by matches or smoking, 24 percent by mechanical failure, 11 percent each by choke-ups and friction in roll boxes, 8 percent by overheating in the drier, 5 percent by defective wiring, and 2 percent each by metal, sparks from vehicle exhaust, sparks from saws, and sparks from other fires.

Morning Versus Afternoon Ginning

As an average for 3 seasons, gin fires and losses were much higher for afternoon, compared with morning ginning. About 68 percent of the fires and 83 percent of the losses occurred during ginning in the afternoon. In the afternoon, compared with morning, the losses per gin were 5 times greater, losses per fire 2.3 times greater, and losses per bale 5 times greater (table 13).

Table. 13. Gin Fires and Losses in Morning and Afternoon Ginnings, 78 to 111 Gins, Tennessee, Seasons, 1956-57 to 1958-59.

Item	1956-57		1957-58		1958-59		3 seasons (a)	
	Morning versus afternoon ginning							
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
Gin fires, No.	46	126	61	134	77	140	184	400
Gin fires, %	27	73	31	69	35	65	32	68
Total losses in $:	8,389	46,403	2,735	11,024	5,307	25,385	16,431	82,812
Total losses in %:	15	85	20	80	17	83	17	83
Cotton, $	4,733	33,239	1,170	3,835	2,650	9,423	8,553	46,497
Machinery, $	3,125	3,700	785	5,077	693	12,064	4,603	20,841
Buildings, $	——	7,897	——	——	500	1,000	500	8,897
Fire extinguisher, $	205	656	437	861	782	1,205	1,424	2,722
Labor (downtime), $	326	911	343	1,251	682	1,693	1,351	3,855
Losses per gin, $	108	595	25	99	49	235	55	279
Losses per fire, $	182	368	45	82	69	181	89	207
Losses per bale, ¢	5.6	30.8	1.6	6.3	2.8	13.7	3.2	16.3

(a) Losses per gin, per fire, and per bale are annual weighted averages.

Records were kept as to the time of occurrence of the 584 fires. About 5 percent happened before 9 A.M., 26 percent between 9 A.M. and 12 noon, 16 percent between 12 noon and 3 P.M., 35 percent between 3 P.M. and 6 P.M., and 18 percent after 6 P.M. In the descending order of their importance, by number of fires per hour, 23 percent of the fires occurred between 3 and 4 P.M., 14 percent

between 10 and 11 A.M., 9 percent between 2 and 3 P.M., 7 percent between 9 and 10 A.M., and 7 percent between 4 and 5 P.M.

The higher incidence of fires and losses in the afternoon, compared with before-noon ginnings and during certain hours of the day, has several explanations. Under the pressure of heavy ginnings between 9 and 11 A.M. and 2 and 5 P.M., the gin crews have less time for machinery inspections and may be less attentive to fire hazards and to gin clean-up activities. When the gins are operating at peak capacity there are also greater fire hazards attributed to build up of heat in the gin machinery, mechanical failures, choke-ups in equipment, and to the human element from such factors as smoking.

Dollar Losses Related to Various Operations and Practices

The gins included in the study during the 3-year period were divided into 3 classes: 1) 40 gins having losses per gin under $100, 2) 37 gins with losses ranging from $100 to $499, and 3) 34 gins with losses ranging from $500 to $18,000. The general characteristics, operations, and practices of the gins in each of these groups were tabulated and the results shown in Appendix VII.

As an average, the gins having the highest total losses, compared with those having the lowest losses, ginned 36 percent more cotton per gin and a much higher proportion were elaborately equipped with driers, overhead seed cotton cleaners, burr machines, extractors, and lint cleaners.

There was little evidence indicating that the ginners sustaining the lowest losses, as an average, were following better practices in the prevention and control of gin fires. The primary reason for the low incidence of fires was related to low volume ginned and simple type of equipment. This is borne out by the data in Tables 9 and 11, and in Appendix IV of this report.

COTTON GIN FIRE INSURANCE

Gin Machinery and Building Insurance

During the 3-year period, 90 percent of the gins included in the study carried fire insurance on their gin plants. This kind of insurance offered protection against fire damage to the gin house, gin machinery and equipment, gin office, seed cotton houses, and other auxiliary gin buildings. This gin insurance did not cover cotton or cotton product losses, the cost of fire extinguisher, or business interruption cost of labor or downtime.

For the 3 years studied, the gins carrying gin machinery and building insurance had 529 fires with total losses amounting to $95,419, including $53,793 for cotton, $23,678 for machinery, $9,397 for buildings, $3,822 for fire extinguisher, and $4,729 for labor or downtime. Machinery and building fire insurance premiums for the 3 years amounted to $266,006 or $985 annually per gin, and 34 claims collected on damage to machinery and buildings was $25,475. The fire insurance loss ratio for these gins for machinery and buildings averaged 9.6 percent (Appendix V).

The combined machinery and building losses of $33,075 exceeded the claims by $7,600. In 71 fires, some damage to gin machinery and buildings was sustained but no claims made. Also, in 10 of the 34 claims the reported damages or losses exceeded the claims. About 30 percent of the cotton losses was covered by cotton products or baleyard insurance discussed later in the report. The combined losses of $8,551 for fire extinguisher and labor or downtime, accounting for 9 percent of the total losses, were borne by ginners.

For the gins included in this study the gin fire insurance loss ratios averaged 15.1 percent in the 1956-57 season, 5.7 percent in the 1957-58 season, and 9.6 percent in the 1958-59 season. These loss ratios were low compared with those for all gins in the nation. The fire insurance loss ratio on all cotton gins in the United States averaged 50.4 percent for the seasons 1953-54 to 1957-58.[8] The low gin fire insurance loss ratio for the Tennessee gins has several explanations: 1) during recent years the Tennessee Inspection Bureau has made special efforts to have gin operators improve their gin construction and operation in the prevention and control of fires; 2) since 1955 the results of this study on causes of gin fires and fire losses have been disseminated annually to ginners and gin workers; and 3) during the 3 years none of the gins in the study had serious fire damage to gin machinery and buildings.

During any one year a total loss at one gin, with average plant investment and 56 percent gin fire insurance coverage, could have increased the gin fire insurance loss ratio of all gins to 50 percent or more. For example, an additional loss claim of $24,000 occurring at any one gin in the 1956-57 season could have raised the gin fire insurance loss ratio of all gins to 50.8 percent.

Of the gins studied during the 3 years, 10 percent did not carry fire insurance on machinery and buildings. The gins not carrying

[8] Hubbard, Clarence T., Direct Writer Invasion of Fire Insurance Field Lightens Market for Cotton Ginners, Cotton Trade Journal, July 3, 1959.

plant fire insurance, compared with those that did, had about the same number of fires per gin but their dollar losses for the 3-year period were much lower per gin, per fire, and per bale (Appendix V). Only two valid explanations of these differences could be determined from examining the operation and practices of the gins. Ginners not carrying machinery and building insurance claimed that they more rigidly enforced the rule of "no smoking" during ginning, and their gins were much less elaborately equipped with drying, cleaning, and extracting devices.

Cotton Products and Baleyard Insurance

During the 3-year period studied, about 61 percent of the ginners carried cotton products or baleyard insurance. Cotton products insurance covered fire damage to seed cotton from the time it arrived at the gin until it left the baleyard. Cotton products insurance also covered cottonseed. Baleyard insurance covered baled lint cotton after it had left the gin press and while it was stored at the gin yard. Neither of these kinds of insurance covered seed cotton or lint damaged or burned during the process of ginning. Also, cotton products or baleyard insurance did not cover damage to gin machinery and buildings, fire extinguisher, or gin shutdown time. As indicated in Table 2, only 19 of the 584 fires occurring during the 3-year period were covered by cotton products or baleyard insurance.

For the 3 years studied the gins carrying cotton products or baleyard insurance had 388 fires with total losses amounting to $85,168, including $49,916 for cotton, $19,315 for machinery, $9,397 for buildings, $2,797 for fire extinguisher, and $3,743 for labor or downtime. Cotton products and baleyard insurance premiums for the 3 years amounted to $75,124 or $413 annually per gin, and 17 claims collected on fire damage to cotton were $25,562. For gins carrying cotton products and baleyard fire insurance, the loss ratio averaged 34 percent for the 3 years (Appendix VI).

The cotton losses of $49,916 exceeded the claims by $24,354. This was true primarily because so many of the cotton losses occurred during the process of ginning and ginners did not carry in-processing cotton insurance. Also, in the case of one serious baleyard fire no claim was collected because the fire occurred a few feet off the baleyard boundary. The combined fire losses of $28,712 in damage to buildings and machinery were partly covered by insurance as indicated in the previous section of this report. The combined losses

of $6,540 for fire extinguisher and labor or downtime, accounting for about 8 percent of the total losses, were borne by ginners.

For the gins carrying cotton products and baleyard fire insurance, the loss ratio was 104.8 percent in the 1956-57 season; that is, the claims actually exceeded the premiums paid. However, the low loss ratios of 4.1 and 2.7 percent during the following two seasons, held the 3-year average to 34 percent (Appendix VI).

Gin Insurance Rates

Among individual gins the fire insurance rates on gin plants (machinery and buildings) varied widely according to such factors as type of construction and arrangement of buildings, kind and amount of machinery, fire prevention and fire fighting devices and practices, methods of fuel storage and supply, methods of trash disposal, extent and methods of storage of cotton and cotton products, and extent of undesirable or hazardous conditions. During each of the three seasons of 1956-57 to 1958-59, the rates ranged from $1 to $5.60 per hundred dollars coverage among individual gins. As an average for all gins, the rates declined from $2.10 per hundred in the 1956-57 season to $2.02 in the 1958-59 season. The insurance coverage, as a percent of total value of gin plant, increased from 56 to 58 percent from the first to the last season. Among individual gins the extent of gin fire insurance coverage ranged from 20 to 100 percent during each of the 3 years.

The Tennessee Inspection Bureau is licensed by the State Department of Insurance to establish rates for fire and allied lines of insurance on gins. Insurance companies which may avail themselves of the services of the Inspection Bureau include Stock, Mutuals, and Reciprocals. For each gin carrying insurance by a member of, or subscribing company to the Bureau, an inspector visits the gin and makes a thorough inspection of the gin, auxiliary buildings, and gin operations and practices. The cotton gin schedule used by the Bureau for rating cotton gin risks is based on standards for fire prevention and protection which are recognized by rating bureaus in other cotton-producing states. Individual gin rate structures are reviewed and revised at least once in 5-to 8-year periods. If a ginner feels that his gin has been assigned an unsatisfactory rate, he can register a complaint with the agent writing his insurance or direct with the Tennessee Inspection Bureau. In such cases the ginner is informed by letter as to the make-up of his gin rate, or an inspector

is sent to the gin premises to point out to the ginner the reason for the charges and credits.

Any ginner, direct or through his agent, may request a review of his gin rate or a gin inspection at any time, but it may take from 1 to 2 months before the review or inspection can be made. Where a gin installation has been made which would produce a credit, the effective date of the corrected rate is usually dated as of the day the installation was completed and placed in operation.

The Tennessee Inspection Bureau, Nashville, Tennessee, is the official fire rating and inspection Bureau for all fire insurance companies operating in Tennessee. This Bureau has been licensed by the State Department of Insurance and Banking to make and publish fire insurance rates for all classes of business. However, in this study there were several gins which carried gin insurance with other organizations—Cornwall & Stevens, and Lloyds of New York. These organizations are not members of or subscribers to the Tennessee Inspection Bureau.

APPENDIX I

Place of Detection and Probable Causes of 584 Fires, 78 to 111 Gins, Tennessee, Seasons 1956-57 to 1958-59.

Fire discovered or first noticed at	Probable cause of fire												All Fires	
	Matches or Smoking	Metal	Mechanical failure	Choke-ups	Static electricity	Overheating in drier	Sparks from vehicle exhaust	Rocks & foreign objects	Friction in roll box	Sparks from burner	Other (a)	Unknown		
	Numbers of fires												No.	%
Gin stands	34	27	7	11	1	—	2	—	7	—	2	52	143	24.5
Overhead cleaners	58	20	1	2	—	3	2	5	—	2	1	34	128	21.9
Conveyor	36	6	5	—	—	2	—	1	—	1	—	20	71	12.2
Burr extractor	9	8	2	—	—	—	1	3	—	—	1	19	43	7.4
Feeders	5	—	20	1	—	—	1	1	—	—	—	5	33	5.7
Press box	3	3	2	—	13	1	2	—	1	—	1	6	32	5.5
Drier	4	3	1	1	—	8	—	—	—	2	—	8	27	4.6
Separator	4	1	1	1	—	—	1	—	—	—	—	15	23	3.9
Bale platform or yard	1	1	1	—	—	—	—	—	—	—	3	14	20	3.4
Overflow	1	5	1	—	—	—	—	1	—	—	1	4	13	2.2
Wagon or trailer	4	—	—	—	—	—	3	—	—	—	2	—	9	1.5
Lint cleaner	—	2	—	2	—	—	—	1	—	—	—	2	7	1.2
Cotton house	4	—	1	—	—	—	—	—	—	—	1	—	6	1.0
Seed cotton in transit	3	—	—	—	—	—	1	—	—	—	—	—	4	0.7
Condenser	—	1	—	—	2	—	1	—	—	—	—	—	4	0.7
Trash and mote house	—	1	—	—	—	—	—	—	—	—	—	2	3	0.5
Electric motor	—	—	2	—	—	—	—	—	—	—	—	—	2	0.3
Hull pile	1	1	—	—	—	—	—	—	—	—	—	—	2	0.3
Fire packed bale	—	—	—	—	1	—	—	—	—	—	—	1	2	0.3
Dropper	—	—	—	—	—	1	—	—	—	—	—	—	1	0.2
Starter switch	—	—	—	—	—	—	—	—	—	—	1	—	1	0.2
Switch box	—	—	—	—	—	—	—	—	—	—	1	—	1	0.2
Hull auger	1	—	—	—	—	—	—	—	—	—	—	—	1	0.2
Wall or building	—	—	—	—	—	—	—	—	—	—	1	—	1	0.2
Mote flue	—	1	—	—	—	—	—	—	—	—	—	—	1	0.2
Gin floor	—	—	—	—	—	—	—	—	—	—	1	—	1	0.2
Bale on truck	—	—	—	—	—	—	—	—	—	—	—	1	1	0.2
Vacuum box	—	—	1	—	—	—	—	—	—	—	—	—	1	0.2
Burner	—	—	—	—	—	—	—	—	—	1	—	—	1	0.2
Ribs	—	—	—	—	—	—	—	—	—	—	—	1	1	0.2
Stick & leaf machine	—	1	—	—	—	—	—	—	—	—	—	—	1	0.2
All fires, No.	168	81	45	18	17	15	14	12	8	6	16	184	584	(b)
All fires, %	28.8	13.9	7.7	3.1	2.9	2.6	2.4	2.0	1.4	1.0	2.7	31.5	100	

(a) Three of these fires were caused by defective wiring, 3 by sparks from other fires, 3 by sparks from incinerators, 2 by sparks from saws, 2 by explosions, 1 by sparks from welding, 1 by a fire-packed bale, 1 by a burst light bulb.

(b) In some cases the fire was first noticed in more than one place.

APPENDIX II

Causes of Gin Fires by Dollar Losses, 584 Fires, Tennessee, Seasons, 1956-57 to 1958-59.

Cause of fire	In-processing fires			
	Fires	Total losses		Losses per fire
	No.	$	%	$
Matches or smoking	168	24,232	40.6	144
Fire-packed bale	1	15,077	25.3	15,077
Metal	81	8,409	14.1	104
Mechanical failure	45	3,276	5.4	73
Sparks from burner	6	2,648	4.4	441
Choke-up in machinery	18	1,549	2.6	86
Rocks	12	1,508	2.5	126
Defective wiring	3	892	1.5	297
Overheating in drier	15	771	1.3	51
Sparks from vehicle exhaust	14	411	0.7	29
Sparks from incinerator	2	296	0.5	148
Sparks from other fires	2	193	0.3	96
Static electricity	17	152	0.3	9
Explosions	2	149	0.3	75
Friction in roll box	8	56	0.1	7
Sparks from saws	2	55	0.1	27
Sparks from welding	1	0	0	0
All known causes	397	59,674	100.0	150
Unknown causes	168	23,269	100.0	139
All in-processing fires	565	82,943	100.0	147
		Baleyard fires		
Sparks from other fires	1	600	100.0	600
Unknown causes	16	7,795	100.0	487
All baleyard fires	17	8,395	100.0	494
		Other fires		
Burst light bulb	1	875	11.1	875
Sparks from incinerator	1	7,030	88.9	7,030
	2	7,905	100.0	3,955
All fires	584	99,243	100.0	170

APPENDIX III

Gin Fire Losses by Type of Fire Prevention and Fire Fighting Devices and Specified Causes, 78 to 111 Ginners in Tennessee, Seasons, 1956-57 to 1958-59.

Gin equipment	Cause or origin of fire	Gins (d)	Fires	Total Losses	Annual losses (av.) Per gin	Per fire	Per bale
		Number		$	$	$	$
Traps only	Rocks (a)	—	—	—	—	—	—
	Metal	11	24	1,973.16	179.38	82.22	10.1
	Other proc. (b)	27	55	6,434.35	238.31	4.33	13.8
	Bale yard (c)	2	2	300.00	150.00	150.00	9.0
	Total or average	51	81	8,707.51	170.73	107.50	12.0
Magnets only	Rocks (a)	2	2	858.00	429.00	429.00	19.3
	Metal	5	7	195.05	39.01	27.86	2.1
	Other proc. (b)	30	69	13,034.04	434.47	188.90	21.1
	Bale yard (c)	3	3	600.00	200.00	200.00	9.0
	Total or average	41	81	14,687.09	358.22	181.32	18.6
Traps and magnets	Rocks (a)	1	2	38.53	38.53	19.27	1.1
	Metal	6	13	914.50	152.42	70.35	6.5
	Other proc. (b)	34	102	4,910.17	144.42	48.14	6.1
	Bale yard (c)	3	4	107.75	35.92	26.94	1.4
	Total or average	42	121	5,970.95	142.17	49.35	6.1
Complete CO_2 systems	Rocks (a)	—	—	—	—	—	—
	Metal	6	16	3,744.41	624.07	234.03	24.4
	Other proc. (b)	28	82	8,011.87	286.14	97.71	14.4
	Bale yard (c)	4	4	546.60	136.65	136.65	6.7
	Total or average	39	102	12,302.88	315.46	120.62	16.7
Incomplete CO_2 systems	Rocks (a)	3	3	445.37	148.46	148.46	7.8
	Metal	9	14	1,215.60	135.07	86.83	6.0
	Other proc. (b)	35	79	24,692.26	705.49	312.56	40.5
	Bale yard (c)	2	3	736.93	368.46	245.64	41.2
	Total or average	43	99	27,090.16	630.00	273.64	37.9

(Continued)

APPENDIX III

(Continued)

None of above devices	Rocks (a)	4	5	166.00	41.50	33.20	2.5
	Metal	7	7	366.25	52.32	52.32	2.5
	Other proc. (b)	48	87	23,848.14	496.84	274.12	28.7
	Bale yard (c)	1	1	6,104.00	6,104.00	6,104.00	377.25
	Total or average	81	100	30,484.39	376.35	304.84	26.6
All gins	Rocks (a)	10	12	1,507.90	150.79	125.66	7.4
	Metal	44	81	8,408.97	191.11	103.81	9.0
	Other proc. (b)	202	474	80,930.83	400.65	170.74	20.8
	Bale yard (c)	15	17	8,395.28	559.69	493.84	28.8
	Total or average	297	584	99,242.98	334.15	169.94	19.5

(a) Includes fires caused by rocks, green bolls, and foreign objects.

(b) Fires occurring during the process of ginning but attributed to causes other than metal, rocks and other objects.

(c) Included those fires that could not have been eliminated by fire prevention devices of traps and magnets or losses that could not have been reduced by carbon dioxide systems.

(d) Gin numbers do not balance with totals because some gins had no fires and some gins had more than one type of fire.

APPENDIX IV

Fire Losses at Gins with Specified Equipment, 78 to 111 Gins, Tennessee, Seasons 1956-57 to 1958-59.

Item	Auxiliary gin equipment			
	Simple	Moderate	Elaborate	All gins
Gins reporting, No.	33	164	100	297
Volume ginned, Bales	31,358	255,118	223,310	509,786
Annual volume per gin, Bales	950	1,556	2,233	1,716
Gins having fires, No.	17	116	93	226
Gins not having fires, No.	16	48	7	71
Total fires, No.	23	279	282	584
Fires per gin having fire, No.	1.4	2.4	3.0	2.6
Losses per sample gin, $	26.63	164.16	714.42	334.16
Cotton, $	23.04	76.10	418.09	185.36
Machinery, $	——	60.21	155.70	85.67
Buildings, $	——	2.44	89.97	31.64
Fire extinguisher, $	1.07	12.22	21.06	13.96
Labor (downtime), $	2.52	13.19	29.60	17.53
Losses per gin having fires, $	51.70	232.09	768.18	439.13
Cotton, $	44.73	107.60	449.56	243.59
Machinery, $	——	85.12	167.42	112.59
Buildings, $	——	3.45	96.74	41.58
Fire extinguisher, $	2.07	17.28	22.64	18.34
Labor (downtime), $	4.90	18.64	31.82	23.03
Losses per fire, $	38.21	96.50	253.35	170.10
Cotton, $	33.06	44.74	148.26	94.43
Machinery, $	——	35.39	55.21	43.57
Buildings, $	——	1.44	31.91	16.09
Fire extinguisher, $	1.53	7.18	7.47	7.10
Labor (downtime), $	3.62	7.75	10.50	8.91
Losses per bale, all sample gins, ¢	2.8	10.6	32.0	19.5
Cotton, ¢	2.4	4.9	18.7	10.8
Machinery, ¢	——	3.9	7.0	5.0
Buildings, ¢	——	0.2	4.0	1.9
Fire extinguisher, ¢	0.1	0.8	1.0	0.8
Labor (downtime), ¢	0.3	0.8	1.3	1.0

(Continued)

APPENDIX IV

(Continued)

Losses per bale, gins having fires, ¢	4.0	13.2	34.2	22.8
Cotton, ¢	3.4	6.1	20.0	12.6
Machinery, ¢	——	4.8	7.5	5.8
Buildings, ¢	——	0.2	4.3	2.2
Fire extinguisher, ¢	0.2	1.0	1.0	1.0
Labor (downtime), ¢	0.4	1.1	1.4	1.2
Gins equipped with: Traps only, No.	12	25	14	51
Magnets only, No.	5	20	16	41
Traps and magnets, No.	—	26	16	42
Incomplete CO_2 systems, No.	—	25	18	43
Complete CO_2 systems, No.	—	18	21	39
None of the above devices, No.	16	50	15	81

(Note) Fires and losses per gin per fire, and per bale, in the above table are on an annual basis.

APPENDIX V

Cotton Gin Machinery and Building Insurance Premiums and Claims and Fire Losses, 78 to 111 Gins, Tennessee, Seasons 1956-57 to 1958-59.

A. Gins carrying machinery and building fire insurance

Item	1956-57	1957-58	1958-59	3 seasons (b)
Gins, total, No.	71	100	99	270
Gins having fires, No.	59	76	76	211
Fires, No.	165	163	201	529
Bales per gin, No.	1,953	1,579	1,712	1,726
Total bales ginned, No.	138,638	157,940	169,444	466,022
Fire losses, total, $	54,254.53	13,135.97	28,028.21	95,418.71
Cotton, (a), $	37,696.99	4,613.98	11,481.57	53,792.54
Machinery, $	6,615.00	5,862.00	11,201.00	23,678.00
Buildings, $	7,897.30	0	1,500.00	9,397.30
Fire extinguisher (a), $	860.19	1,297.75	1,664.00	3,821.94
Labor (downtime) (a), $	1,185.05	1,362.24	2,181.64	4,728.93
Gin premiums: Total, $	67,125.33	100,932.15	97,948.03	266,005.51
Per gin, $	945.43	1,009.32	989.37	985.21
Claims: Total, No.	8	14	12	34
Amount, $	10,103.15	5,695.00	9,677.00	25,475.15
Per claim, $	1,262.29	406.79	806.42	749.27
Insurance loss ratio, %	15.1	5.7	9.9	9.6
Losses: Per gin, $	764.15	131.36	283.11	353.40
Per fire, $	328.82	80.59	139.44	180.38
Per bale, ¢	39.1	8.3	16.5	20.5

B. Gins not carrying machinery and building fire insurance

Gins, total, No.	7	11	9	27
Gins having fires, No.	3	6	6	15
Fires, No.	7	32	16	55
Bales per gin, No.	1,692	1,411	1,821	1,622
Total bales ginned, No.	11,847	15,525	16,392	43,791
Fire losses, total, $	536.85	623.31	2,664.11	3,824.27
Cotton, $	275.00	391.47	591.48	1,257.95
Machinery, $	210.00	0	1,556.50	1,766.50
Buildings, $	0	0	0	0
Fire extinguisher, $	0	0	323.00	323.00
Labor (downtime), $	51.85	231.84	193.13	476.82
Losses: Per gin, $	76.69	56.66	296.01	141.64
Per fire, $	76.69	19.48	166.51	69.53
Per bale, ¢	4.5	4.0	16.3	8.7

(a) Losses not covered by gin machinery and building fire insurance.
(b) Annual weighted averages unless totals are specified.

APPENDIX VI

Cotton Products and Baleyard Insurance Premiums and Claims, and Fire Losses, 78 to 111 Gins, Tennessee, Seasons 1956-57 to 1958-59.

A. Gins carrying cotton products or baleyard insurance

Item	1956-57	1957-58	1958-59	3 seasons (a)
Gins, total, No.	48	67	67	182
Gins having fires, No.	39	55	56	150
Fires, No.	112	129	147	388
Bales per gin, No.	2,115	1,758	1,895	1,903
Total bales ginned, No.	101,527	117,807	126,969	346,303
Fire losses, total, $	52,275.10	8,847.12	24,046.06	85,168.28
Cotton, $	36,053.16	3,740.98	10,122.12	49,916.26
Machinery, $	6,615.00	3,170.00	9,530.00	19,315.00
Buildings, $	7,897.30	0	1,500.00	9,397.30
Fire extinguishers, $	754.50	883.75	1,158.50	2,796.75
Labor (downtime), $	955.14	1,052.39	1,735.44	3,742.97
Cotton insurance premiums, total, $	22,651.85	27,713.03	24,758.87	75,123.75
Per gin, $	471.91	413.63	369.54	412.77
Per bale, ¢	22.3	23.5	19.5	21.7
Claims: Total, No.	8	5	4	17
Amount, $	23,746.60	1,140.00	675.00	25,561.60
Per claim, $	2,968.33	228.00	168.75	1,503.62
Insurance loss ratio, %	104.8	4.1	2.7	34.0
Losses: Per gin, $	1,098.98	132.05	358.90	467.96
Per fire, $	466.74	68.58	163.58	219.51
Per bale, ¢	51.5	7.5	18.9	24.6

B. Gins not carrying cotton products or baleyard insurance

Gins, total, No.	30	44	41	115
Gins having fires, No.	23	27	26	76
Fires, No.	60	66	70	196
Bales per gin, No.	1,632	1,265	1,436	1,422
Total bales ginned, No.	48,958	55,658	58,867	163,483
Fire losses, total, $	2,516.28	4,912.16	6,646.26	14,074.70
Cotton, $	1,918.83	1,264.47	1,950.93	5,134.23
Machinery, $	210.00	2,692.00	3,227.50	6,129.50
Buildings, $	0	0	0	0
Fire extinguisher, $	105.69	414.00	828.50	1,348.19
Labor (downtime), $	281.76	541.69	639.33	1,462.78
Losses: Per gin, $	83.88	111.64	162.10	122.39
Per fire, $	41.94	74.43	94.95	71.81
Per bale, ¢	5.1	8.8	11.3	8.6

(a) Annual weighted averages unless totals are specified.

APPENDIX VII

Distribution of Gin Fires and Losses in Relation to Gin Fire Prevention and Fire Fighting Equipment, Characteristics, and Practices, 78 to 111 Gins, Tennessee, Seasons, 1956-57 to 1958-59.

Item	Total dollar losses per gin (a)		
	None to 99	100 to 500	500 to 18,000
Gins, No.	40	37	34
Bales per gin, No.	3,533	4,874	5,533
Fires, No.	90	208	286
Fires per gin, No.	2.3	5.6	8.4
Losses: Total: $	1,173.24	8,282.22	89,787.52
(b) : " %	1.2	8.3	90.5
Per gin, $	29.33	223.84	2,640.81
Per fire, $	13.04	39.82	313.94
Per bale, ¢	0.8	4.6	47.7
Gins: Simple, %	20	5	0
Moderate, %	63	68	41
Elaborate, %	17	27	59
Gins: With traps, %	35	49	50
With magnets, %	25	38	41
With carbon dioxide systems, %	13	30	41
Gins with non-combustible building, %	45	49	68
Fire extinguishers per gin, No.	5.1	5.4	7.7
Age of gin, Yrs.	19.1	18.7	15.7
Gins distributing paper matches, %	23	27	21
Gins posting "no smoking signs," %	85	84	83
Years experience: Gin operator, No.	22.4	20.6	20.1
Gin crew, No.	7.9	7.6	7.4
Gin crews receiving special fire fighting instructions, %	55	70	59
Gins Red Tagging a bale:			
Preceding a fire, %	45	41	35
Following a fire, %	40	24	47
Gins isolating fire-packed bales, %	80	84	76
Gins employing a watchman:			
All of the season, %	13	30	32
Following a fire, %	48	41	50
Gins cleaning up daily or oftener, %	90	89	91

(a) Based on totals for the 3-year period.

(b) Losses per gin, per fire, and per bale based on annual weighted averages.

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