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ENGINEERING AND GINNING

Saw Gin Stands

Ed Hughs*, Greg Holt, and Ross Rutherford

ABSTRACT

The saw gin stand is the heart of the saw ginning system. From the initial filing of patents for the spiked-tooth gin and the saw gin in 1794 and 1796 by Whitney and then Holmes, respectively, the saw gin stand has predominated over early roller-type gins in the U.S. cotton ginning industry. These early saw gin stands were small, simple, and were manually fed hand-picked seed cotton and processed only a few hundred pounds of fiber per day. However, at this early stage, it was recognized that the gin stand had a huge impact on fiber quality and textile utility. These early saw gins tended to be single-stand installations that consisted of a gin stand and a bale press. The basic operating principle of separating fiber and seed by pulling the cotton fiber through narrow slots that blocked the passage of the cottonseed in these early saw gins has not changed. However, the size and complexity of the saw gin stand and the ginning system, of which the saw gin is the heart, has changed by orders of magnitude. The most recent Cotton Ginners Handbook documented all of the manufacturers and specifications of U.S. saw gins that were being used in the cotton industry at that time. Subsequently the saw gin has continued to evolve and some gin manufacturers are no longer in business whereas others have entered the field. This document provides the U.S. ginning industry the most recent information available on saw gin stands currently operating in the U.S.

The information presented in this chapter draws from earlier handbooks as appropriate (Columbus et al., 1994; Wright and Moore, 1977) and adds new information to address saw ginning practices and equipment currently being used by the U.S. cotton industry. The capacity of a well-designed saw ginning system depends on the design, operating condition, and adjustment of the saw gin stand. The necessary process of separating the fiber from the seed always causes some level of fiber and seed damage (Armijo et al., 2006; Hughs and Armijo, 2013; Hughs and Lalor, 1989; Hughs et al., 2011, 2014; Laird and Holt, 2003; Mangialardi et al., 1988). Fiber damage also impacts textile processing performance so the proper adjustment, operation, and maintenance of a saw gin stand are critical. Because the saw gin stand is central to the operation of the ginning system and the quality of the ginned fiber, it is critical that gin operators have the best information available as to the adjustments and operation of their saw gin stands. The latest U.S. saw gin manufacturers' products as well as older saw gin models still being used in the industry are documented herein to provide current information for the U.S. ginning industry.

All new saw gin stands are adjusted at the factory, but the settings can change during handling, shipping, and installation (Columbus et al., 1994; Wright and Moore, 1977). It is important, even in new gin stands, to check all settings and to make necessary adjustments in accordance with the manufacturer's instructions prior to operation. It is necessary for the efficient operation of each gin stand that all settings and adjustments are made prior to the beginning of each ginning season. Some of the more significant adjustments and settings for various makes and models of gins are shown in Figs. 1 through 11. Because well maintained and operated saw gin stands can remain in active operation for many years, there are a wide variety of makes, models, and designs of saw gin stands operating in the ginning industry represented by Figs. 1 though 11. Some of these differences include gin stands with or without huller fronts, with or without powered seed rolls, gin saws of different diameters, and differing numbers of gin saws and gin saw spacing. Also, a number of gin manufacturers, whose gin stands are

E. Hughs, USDA-ARS, Southwestern Cotton Ginning Research Laboratory, P. O. Box 578, Mesilla Park, NM 88047; G. Holt, USDA-ARS, Cotton Production & Processing Research Unit, 1604 E. FM 1294, Lubbock, TX 79403; and R. Rutherford, Lummus Corporation, 501 East Hunter Street, Lubbock, TX 79403
*Corresponding author: Ed.Hughs@ARS.USDA.GOV

still being used, have gone out of business or have been consolidated into other companies. For this reason, supply of repair parts or manuals for some older gin stands can be difficult to obtain, but might be available from alternate suppliers. Regardless of the availability of repair parts, a number of critical adjustments are common to all gin stands, and attention to these details is necessary for satisfactory operation of the gin stand and preservation of lint quality. Current gin machinery manufacturers furnish up-to-date manuals for their current and older saw gin models that give detailed instructions on installing, adjusting, operating, and maintaining their gin stands.

Before new equipment is installed or adjusted, the gin stand should first be placed in correct alignment with the other machinery, leveled, and firmly mounted in the gin plant according to manufacturer's specification. After the settings are checked and the necessary adjustments are made, the gin breast should be placed in the ginning position and the saw cylinder rotated by hand to make sure that all parts are clear, the saws are properly mounted and trained, and that no foreign objects are within the gin stand. Other than the manipulation of the normal operating controls, no adjustments or maintenance should be attempted while the gin stand is in operation. Serious injury and even deaths have occurred to gin personnel when attempting to adjust or clear ginning machinery when in operation. In addition, all guarding and safety devices should be in their proper place and fully functional whenever gin stands are being operated.

As in any new gin equipment, the motor phase should be checked before the drive belts are connected to ensure that the motor is rotating in the correct direction. Before the gin stand is run at full speed, the drive motor should be "jogged" to see if all cylinders of the gin stand are free to turn and that the cylinders are rotating in the proper direction. Then the motor should be turned on to check the saw speed. It is important that the saw speed is close to the manufacturer's recommendation, because as slight a variation as 20 to 25 rpm can make an appreciable difference by reducing processing capacity. Significant variations from recommended saw speeds also could reduce the gin stand's ability to adequately clean the seed. Other than the mounting of the gin stand, many of these same steps should be taken with installed and operating gin stands after major repair such as removal and replacement of the gin breast, saw cylinder, or drive motor.

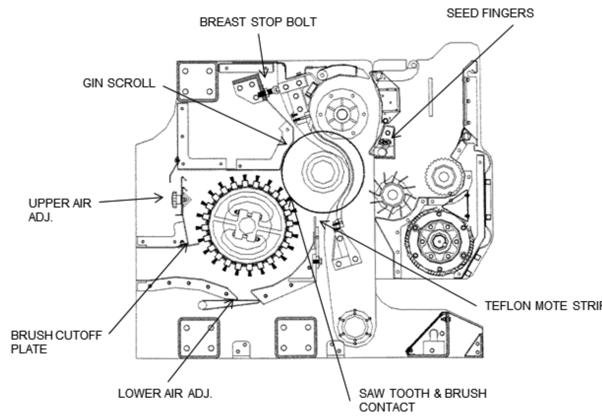

Figure 1. Important settings for BC Supply Dominator 170 and 206 gin stands. Saw to seed finger panel assembly should be adjusted by experienced gin personnel so that seed linters, lint turnout, and fiber grade are kept at optimal levels; saw cylinder to saw scroll, 3.18 mm (1/8 in.); doffing brush to saw cylinder, the brush bristles should extend to the bottom of the saw tooth; doffing brush to cutoff plate, 1.59 mm (1/16 in.) clearance; gin saw to teflon mote strip, 6.35 mm (¼ in.) clearance; recommended to start gin stand that bottom air adjustment be completely closed and upper air adjustment completely open (these adjustments might need to be changed after ginning has begun). Saw speed, 850 rpm; brush speed, 1,579 rpm; agitator cylinder speed, 419 rpm; saw roller, 497 rpm; and applicator roller, 497 rpm (Courtesy of BC Supply).

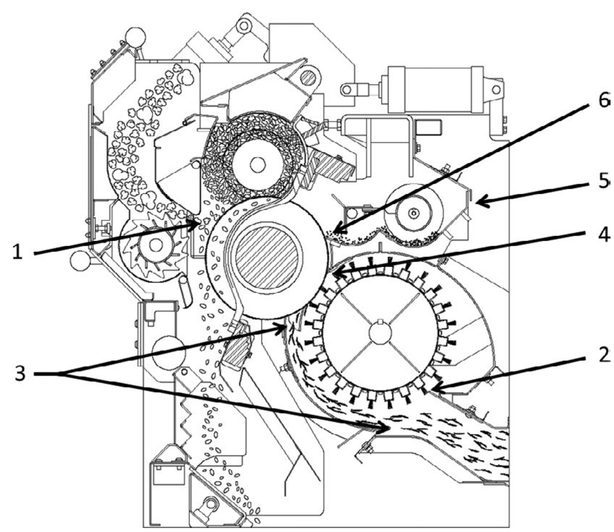

Figure 2. Important settings and adjustments for Avenger 174/193, and Magnum 244/270 saw gin stands. 1. Saw to seed retainer panel assembly, 6.35 to 9.52 mm (¼ to 3/8 in.); 2. Doffing brush tips to cut off plate, 3.18 mm (1/8 in.); 3. Brush cylinder upper air gap, 6.35 mm (1/4 in.); brush cylinder lower air gap, 6.35 mm (1/4 in.); 4. Gin saw to lower edge of mote chamber, 6.35 mm (1/4 in.); 5. Air gap at rear of mote chamber, 4.76 mm (3/16 in.); 6. Saw to top moting plate, 3.18 mm (1/8 in.) minimum. Saw speed, 850 rpm; brush speed, 1,320 rpm (courtesy of Cherokee Fabrication Co., Inc.)

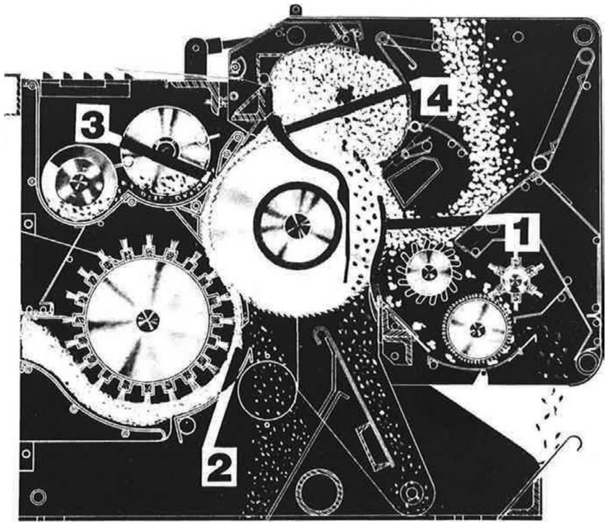

Figure 3. Important settings and adjustments for Continental Eagle 141 saw-brush gin. 1. Saw projection through huller rib, 9.52 mm (3/8 in.); 2. Gravity mote board to brush, 38.1 mm (1½ in.); 3. Overhead mote board to saw, 1.59 mm (1/16 in.); 4. Ginning point to point of rib, 50.8 mm (2.0 in.). Saw speed, 625 rpm; brush speed, 1,850 rpm (courtesy of Continental Eagle Corporation).

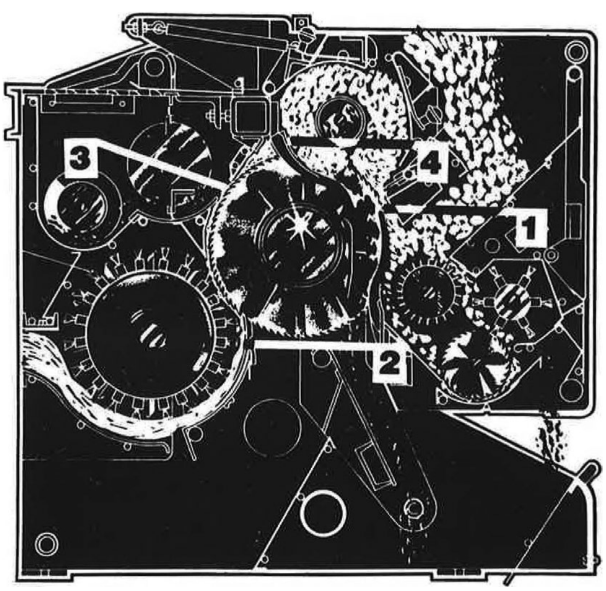

Figure 4. Important settings and adjustments for the Continental Eagle 141 Double Eagle and 161 Golden Eagle saw gins. 1. Saw projection through huller rib, 9.52 mm (3/8 in.); 2. Gravity mote board to brush, 38.1 mm (1½ in.); 3. Overhead mote board to saw, 1.59 mm (1/16 in.); 4. Ginning point to point of rib, 50.8 mm (2.0 in.). Saw speed, 615 rpm; brush speed, 1,552 rpm (courtesy of Continental Eagle Corporation).

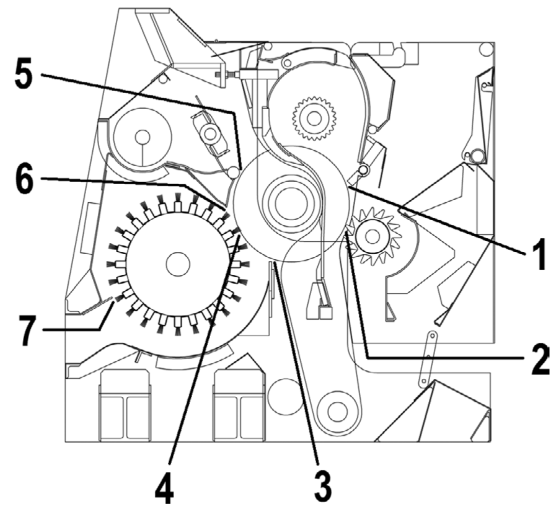

Figure 5. Important settings and adjustments for Consolidated saw gin (112, 164, 184, 198, and 222). 1. Saw penetration into roll box, 46.83 mm (1 27/32 in.); 2. Saw to picker roller, running clearance (picker roller should just clear the saw); 3. Saw to bottom "cut off," running clearance; 4. Brush to gin saw, depth of saw tooth; 5. Saw to mote bar, 3.18- 4.76 mm (1/8-3/16 in.); 6. Saw to mote wiper plate tip, 7.14 mm (9/32 in.); 7. Brush to "cut off," running clearance. Saw speed, 841 rpm; brush speed, 1,754 rpm; agitator (stimulator) roller speed, 438 rpm; picker roller speed, 365 rpm; mote wiper speed, 32 rpm; mote conveyor speed, 60 rpm (courtesy of Lummus Corporation).

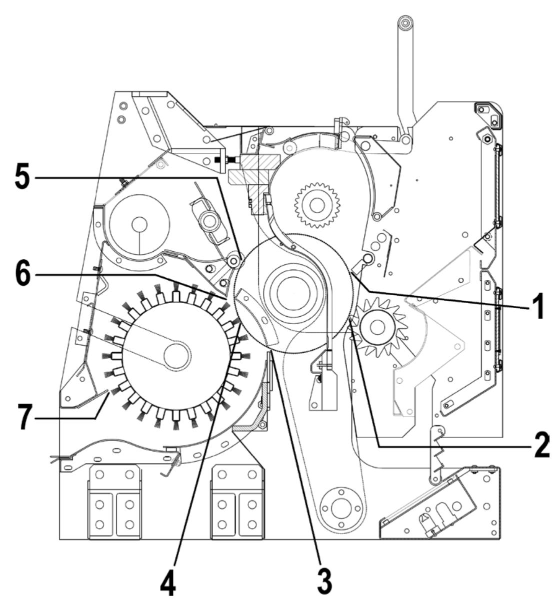

Figure 6. Important settings and adjustments for Consolidated saw gin (194 and 234). 1. Saw penetration into roll box, 46.83 mm (1 27/32 in.); 2. Saw to picker roller, running clearance (picker roller should just clear the saw); 3. Saw to bottom "cut off," running clearance; 4. Brush to gin saw, depth of saw tooth; 5. Saw to mote bar, 3.18-4.76 mm (1/8-3/16 in.); 6. Saw to mote wiper plate tip, 7.14 mm (9/32 in.); 7. Brush to "cut off," running clearance. Saw speed, 875 rpm; brush speed, 1,768 rpm; agitator (stimulator) roller speed, 438 rpm; picker roller speed, 365 rpm; mote wiper speed, 32 rpm; mote conveyor speed, 60 rpm (courtesy of Lummus Corporation).

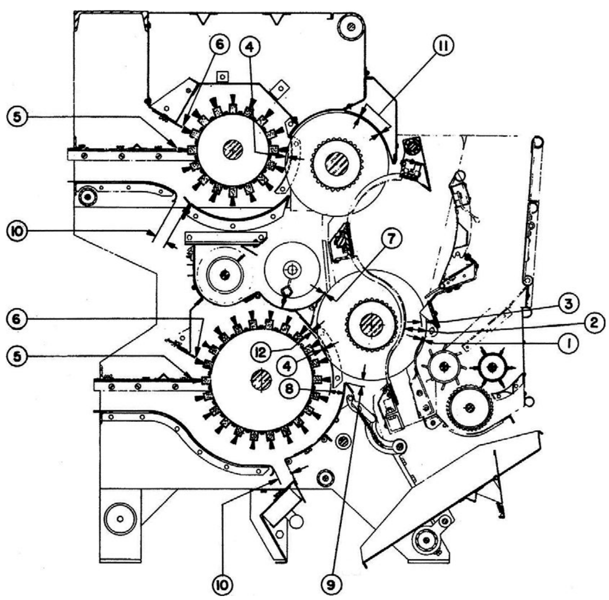

Figure 7. Important settings and adjustments for Hardwicke-Etter Regal 224 dual saw-brush gin. 1. Saw projection through split rib, 4.76 mm (3/16 in.); 2. Saw projection through gin rib, 60.32 mm (2 3/8 in.); 3. Huller knife projection into saw, 12.7-15.88 mm (1/2-5/8 in.); 4. Brush to saw, throat of tooth; 5. Lower cutoff plate to brush, 1.59 mm (1/16 in.) or closer; 6. Upper cutoff plate to brush, 3.18 mm (1/8 in.); 7. Mote board to saw, 1.59-2.38 mm (1/16-3/32 in.); 8. Mote board to brush, 26.99 mm (1 1/16 in.); 9. Lower mote board to saw, 19.05 mm (3/4 in.); 10. Airgap, nonadjustable; 11. Upper scroll to saw, 2.38 mm (3/32 in.); 12. Top brush scroll to brush, 6.35 mm (1/4 in.) minimum. Upper saw speed, 695 rpm; lower saw speed, 650 rpm.

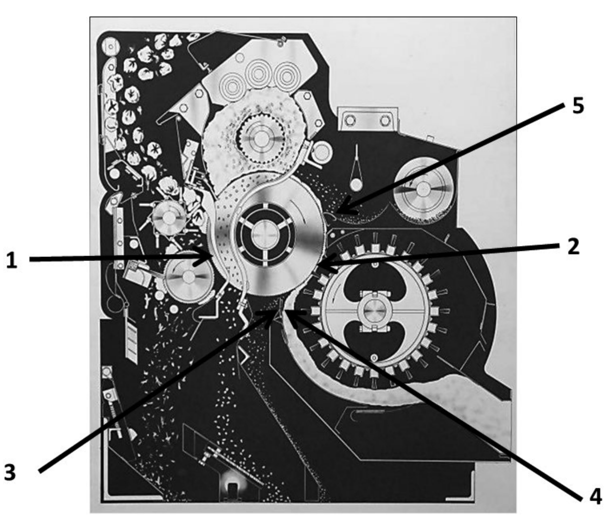

Figure 8. Important settings and adjustments for Lummus Imperial 88 and Imperial II 108, 128, and 158 huller front saw gins. 1. Saw projection through huller rib, 12.7-14.29 (1/2-9/16 in.); 2. Brush to saw, depth of saw teeth; 3. Mote board to saw, 6.35 mm (1/4 in.); 4. Mote board to brush, 44.45 mm (1 3/4 in.); 5. Overhead mote lip to saw, 3.18 mm (1/8 in.). Saw speed, 830 rpm; brush speed, 1,770 rpm (courtesy of Lummus Corporation).

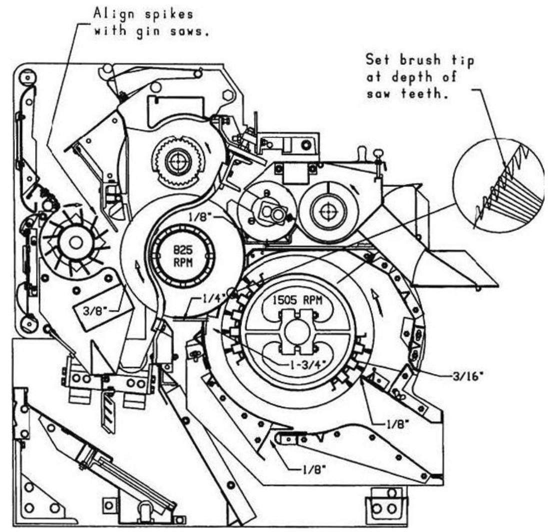

Figure 9. Important settings and adjustments for Lummus Imperial II Hullerless front 108 and 158 saw gins. Brush to saw, depth of saw teeth; upper mote board to saw, 3.18 mm (1/8 in.); lower mote board to brush, 44.45 mm (1 ¾ in.); lower mote lip to saw, 6.35 mm (¼ in.); seed cotton reclaimer to saw, 9.52 mm (3/8 in.); upper brush housing to saw, 6.35 mm (¼ in.); upper brush air gap 4.76 mm (3/16 in.); lower brush air gap, 3.18 mm (1/8 in.); cutoff plate to brush, 3.18 mm (1/8 in.). Saw speed, 825 rpm; brush speed, 1,505 rpm; seed roll agitator speed, 533 rpm; picker roll speed, 504 rpm (courtesy of Lummus Corporation).

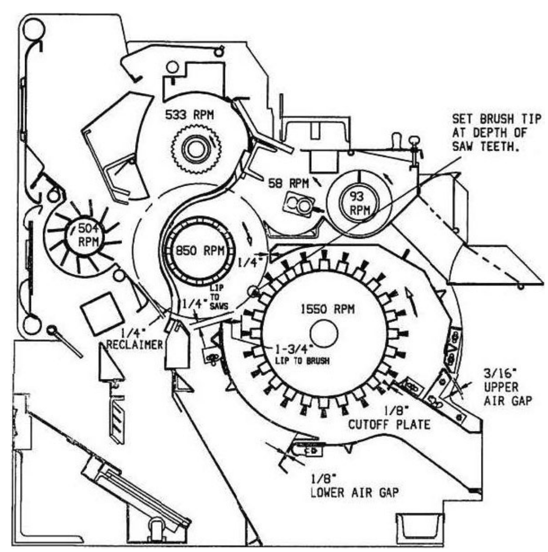

Figure 10. Important settings and adjustments for Lummus Imperial III Hullerless front 116 and 170 saw gins. Brush to saw, depth of saw teeth; upper mote board to saw, 3.18 mm (1/8 in.); lower mote board to brush, 44.45 mm (1 ¾ in.); lower mote lip to saw, 6.35 mm (¼ in.); seed cotton reclaimer to saw, 6.35 mm (¼ in.); upper brush housing to saw, 6.35 mm (¼ in.); upper brush air gap 4.76 mm (3/16 in.); lower brush air gap, 3.18 mm (1/8 in.); cutoff plate to brush, 3.18 mm (1/8 in.). Saw speed, 850 rpm; brush speed, 1,550 rpm; seed roll agitator speed, 533 rpm; picker roll speed, 504 rpm (courtesy of Lummus Corporation).

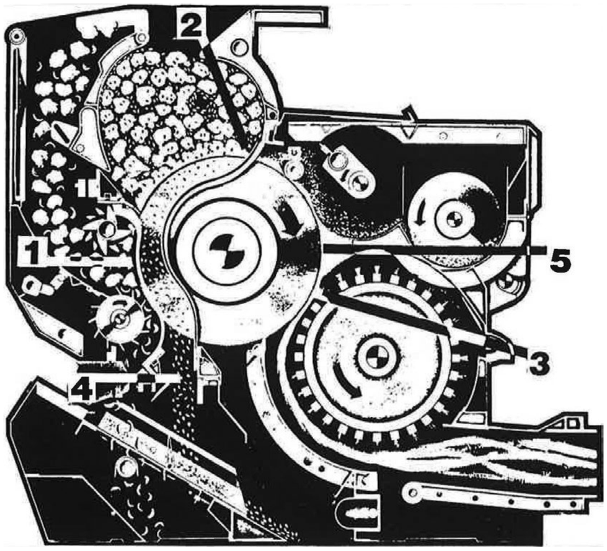

Figure 11. Important settings and adjustments for Murray 142-18 brush gin. 1. Saw projection through huller rib, 4.76 mm (3/16 in.); 2. Ginning point to point of rib, 50.8 mm (2.0 in.); 3. Brush to saw, depth of saw teeth; 4. Root of huller rib to ginning rib, 76.2 mm (3.0 in.); 5. Mote bar to saw, 2.38 mm (3/32 in.). Saw speed, 545 rpm (courtesy of Continental Eagle Corporation).

Gin manufacturers generally have made their gin stands safe to operate and in compliance with applicable safety and health regulations. However, gin stand operation can be hazardous unless proper training has been conducted and precautions taken. The gin stand should always be stopped and the power turned off and locked out before making adjustments to the settings or attempting maintenance work. All guarding and safety equipment should be replaced and in operating condition after any gin stand maintenance and before ginning operations are resumed. See the handbook section "Cotton Gin Regulatory Issues" (Wakelyn and Green, 2016), or consult with your state or regional ginning association or The National Cotton Ginners Association for more information or training materials.

GIN BREAST

After new gin stands are installed or old ones are repaired, the lateral adjustment of the breast should be checked. The saws should be positioned in the center of the rib slots. After visual inspection, the saw cylinder should be rotated slowly by hand to ensure none of the saws rub the ribs. On removal from a gin stand, the gin breast should be identified with that gin stand, and special care should be taken to be sure the breast is reinstalled on the same gin stand. When a broken rib is replaced, care should be taken to install the replacement so that the size of the saw opening is the same on each side. A matched set of ribs installed by well-equipped and experienced personnel will give better service and operation than unmatched sets installed without proper gauges and jigs. The breast should never be moved into ginning position when seed cotton is in the roll box unless the saws are running. To do so can damage the ribs and saws.

On some gins the position of the picker roller is adjustable (see Figs. 5 and 6). In some cases it can be adjusted by means of a ratchet lever while the gin is in operation. Generally speaking, the roller should be set as far away from the saw or huller ribs (depending on gin stand design) as possible without the gin dropping cotton. The closer the picker roller is set to the huller ribs on huller front gin stands, the less space there is for hulls to fall out and the more the saw will break up the hulls and pull small pieces into the roll box with the cotton. The latest model high-capacity gin stands are designed without huller ribs. Different adjustments must be made on these gins, and the individual manufacturer's instructions should be followed. Huller-front gin stands can be converted into higher capacity hullerless gins but the huller front and huller ribs should not be removed from an older model gin stand without consulting the manufacturer, as unsafe conditions will result when the conversion is done without providing proper guards.

The seed fingers, lambrequin, or seed panel should be set as wide open as possible but close enough that the seeds will be cleaned (cleaned seeds should be devoid of tufts of long fibers (tails) and only retain linters on their shell; see Fig. 12). When building up a new roll, the seed fingers should be closed and then slowly opened as wide as necessary to allow the cleaned seeds to fall out of the roll box. Holding seeds in the roll box longer than necessary will reduce the ginning rate and cause tight seed-roll operation, which reduces the value of the cotton by decreasing fiber staple length, can cause increased seed damage, additional seed coat fragments in ginned lint, additional energy consumption, and increased danger of damage to the gin saws.

Figure 12. Cottonseed with and without lint tails.

The relation of the saws to the ribs is critical. Figure 13 shows the general critical dimension locations for huller front gin stands. Hullerless gins also have critical dimensions for the A and C dimensions shown in Fig. 13 (B and D would not apply). Regardless of the gin design, the relation of the saws to the ribs is critical and in all cases the manufacturer's manual should be consulted for specifications to determine which of the dimensions shown in Fig. 13 should be checked to ensure proper saw-rib relations.

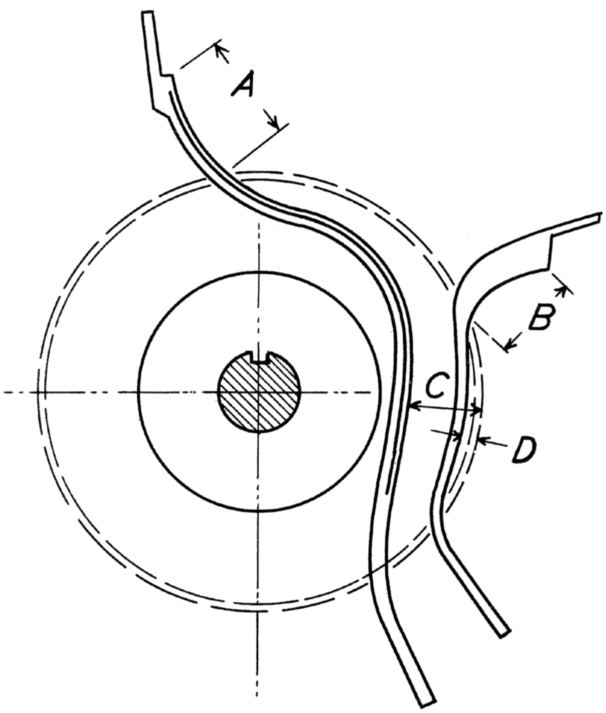

Figure 13. Critical saw-rib dimensions for the ginning rib and huller rib for huller front gin stands (A, B, C, and D).

GIN SAWS

Saws should be checked to ensure they are properly trained (that is, running true in the middle of the rib slots) and running at the recommended speed. If the distance from the point where the saws project through the ginning rib to the top of the rib is not correct, capacity will be reduced and fibers can be damaged. For huller-front gin stands, the distance the saws project through the huller ribs should also be checked. If the saws project too far, an excess of hulls and sticks will be pulled into the roll box. If the saws do not project far enough, ginning capacity will be reduced, seed cotton will fall out of the front, the huller ribs can become choked, and gin ribs and saws can be damaged.

The pitch and shape of the saw teeth are also important in maintaining capacity and cotton quality. Griffin and McCaskill (1969) found that neps were increased by dull or broken saws and by the use of saws whose diameter had been reduced by one-sixteenth of an inch after repeated sharpening. Although saw sharpening is no longer practiced or cost effective in the ginning industry, it does illustrate the principle that the gin saw that has been designed for a particular gin stand must be used to maintain ginning performance and fiber quality. To ensure good ginning, the teeth must pass through the ribs at the proper angle. The leading edge of the tooth should be parallel with the rib or the point of the tooth should enter the ginning rib slightly ahead of the throat (Fig. 14). If the saws are improperly filed or the saw-rib relationship is improperly adjusted so that the throat of the tooth enters the rib ahead of the point, the resulting cutting action will reduce capacity, break fibers, and can cause choking at the top of the ginning ribs (Wright and Moore, 1977). In many instances, the moting action of gin stands is affected by the saw teeth being tilted too far forward or backward. Holt and Laird (2010) found that modifications to gin stands that alter the saw tooth angle can significantly impact ginning rate and nep size. Any aftermarket modifications made to a gin stand to enhance performance should be done with caution and an evaluation of the saw tooth-rib angle interaction (Fig. 14).

Saws should be examined frequently, and bent teeth should be straightened or even broken off and filed smooth so that lint will not hang in them. Lint that cannot be doffed will tend to collect in the low part of the gin ribs. If this lint is allowed to accumulate, the friction of the saw will cause the lint to catch fire and perhaps damage the saws. A heat-damaged saw that wobbles cannot be retrained and should be replaced or removed immediately. Lint collected in the bottom rib slot (Fig. 13) also can be caught by the saw when the stand is disengaged, possibly breaking the ribs and damaging the saws.

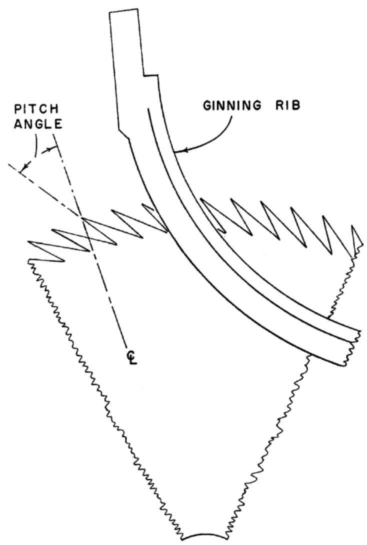

Figure 14. Pitch angle of gin tooth to ginning rib.

The number of bales that can be ginned before replacing the saws depends on the type of cotton handled and on the metallurgical properties of the saws. Stripper-harvested cotton, due to its higher trash content, generally causes more wear on gin saws than cleaner picker-harvested cotton, regardless of the type of steel used. Modern gin saws are made from stronger, more durable steel than older saws and thus have a much longer useful life. There is variation in gin saw life but modern high-capacity gin stands have been documented to gin from 6,500 bales per stand processing stripper-harvested cotton to more than 13,000 bales/stand processing picker-harvested cotton before changing (E. Hughs, unpublished research). The trashier the cotton being processed, the shorter the saw life and more frequent the necessary saw changes. Also, excessive spindle twists will cause teeth to break. Spindle twist is when seed cotton is twisted tightly into a wad by a spindle picker during harvest.

There is no hard and fast rule as to when gin saws should be changed during normal operation. Some ginners simply run their palm with gentle pressure over the saw teeth (with the gin stand lock out/tag out procedures followed) against the normal direction of saw rotation in several areas on a given saw mandrel. If the saw teeth are still sharp enough to snag or resist the passage of their palm then the saws still have serviceable life. This procedure would also be accompanied by a visual inspection of the saws to see if there are many bent or broken teeth. Others ginners monitor bale production rate and change saws if they believe there has been a significant drop in ginning rate relative to the condition of the seed cotton being ginned. Another somewhat subjective factor is to observe whether or not the ginned seed are being cleaned well enough or are the number of tags and level of linters on the ginned cottonseed getting to be excessive.

DOFFING SYSTEM

Brushes. For proper doffing, the brush tips should just reach the root of the saw tooth (Figs. 9 and 15). Belts driving the brush must be kept tight to maintain proper speed for doffing and to provide sufficient air velocity in the lint flue so that back lashing is prevented. Back lashing is a term to describe when the ginned lint on the gin saws coming through the ginning point is not completely doffed by the brush and the ginned lint is carried on back around by the saws into the seed roll. This can occur for reasons such as improperly set brushes, badly worn brushes, ginning excessively wet seed cotton, or by ginning sticky seed cotton.

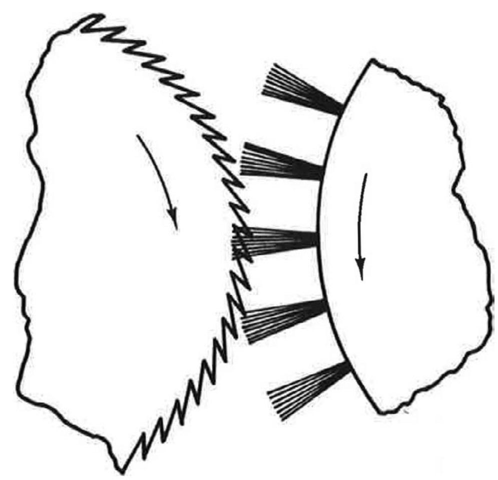

Figure 15. Relationship of gin saw to doffing brush.

The brushes should be examined periodically and replaced if the bristles are badly worn. They should be returned to the manufacturer for repair if facilities are not available for rebalancing them. Brushes that are out of balance will cause excessive vibration and bearing wear. Most doffing brushes used in the industry are the stick-type and must be replaced with like brushes when worn. There has been occasional use of solid-faced spiral wrapped brushes as doffing brushes. Solid-faced brushes tend to pump more air but at lower static pressure capacity at a given speed and are quieter than paddle-type brushes. Due to the way the wrapped construction is applied and fastened, solid-faced brushes tend to pull away from their core at higher rpms. This pulling away increases the overall brush diameter and can lead to excessive brush wear or damage because of increased contact with the gin saws.

When brushes in the stand are replaced, care should be taken to secure the shaft and bearings so that lateral motion or "end play" is eliminated and to adjust the setting of the brush to the saw, mote board, and cutoff plate according to the manufacturer's recommendations (see Figs. 1 through 11).

Airblast Nozzles. Refer to Columbus et al. (1994) if there is any information desired about airblast gins or nozzles. Airblast gin stands have not been manufactured for many years and are no longer used in the U.S. ginning industry to the best knowledge of the authors.

Moting System. Modern saw gin stands are equipped with some type of moting and most gin stands are equipped with both overhead and gravity (upper and lower respectively) moting systems. The seals on the overhead moting system, whether dropper wheel or roller type, should be kept in good condition. In some gins, pressure is maintained in the overhead moting chamber, and the system will not operate properly if the seals leak excessively. Insect sugars (honeydew) and green, wet lint sometimes cause motes to be sticky and build up on the moting bars, wiper flights, and roller seals. Such a buildup drastically reduces moting system effectiveness. Under extreme conditions the buildup will cause chokage in the gin ribs. When sticky motes are encountered, the moting bars and seals should be cleaned frequently with fine steel wool, and the surfaces should be coated with a light textile oil, silicone, or Teflon spray. The mote system should never be cleaned when the gin saw is turning. The gin saws should be stopped and lock out/tag out procedures followed before cleaning the moting system.

Proper adjustments are also important on gin stands having a mote board in the gravity moting system (Figs. 1 and 3). The mote board should be adjusted by opening it slowly until it starts dropping lint, then closing it slightly. The wider the mote board can be opened without losing lint, the more effectively the system will operate. On most gin stands the screws for adjusting the mote board are near the end saws. The gin must be stopped and lock out/tag out procedures followed before attempting to adjust the mote board.

GINNING EFFECTS ON QUALITY

The saw gin stands now on the market are the result of years of research and experience on millions of bales of cotton (Hughs and Holt, 2015). They will give good service as long as they are properly adjusted, kept in good condition, and operated at design capacity. Manufacturer's capacity recommendations for 1962 through 2016 model gin stands handling good, clean, dry seed cotton are given in Table 1. If gin stands are overloaded, the quality of the cotton may be reduced. Griffin (1977, 1979) showed that short fiber content increased as the ginning rate was increased above the manufacturer's recommendation. He also found that short fiber increased as saw speed increased. Mangialardi et al. (1988) found that increasing the ginning rate resulted in increases in Uster yarn imperfections. Seed damage can also result from increasing the ginning rate, especially when the seeds are dry. Watson and Helmer (1964) found that variations in ginning rate and seed moisture could cause seed damage ranging from 2-8 percent in gin stands. Thus, it is paramount to maintain the gin stand in good mechanical condition, to gin at recommended cotton fiber moisture levels of 6 to 7%, (Hughs et al., 1994; Valco and Ashley, 2016) and to not exceed the capacity of the gin stand or other components of the system.

Table 1. Manufacturer's specifications and capacities for various makes and models of gin stands

Manufacturer (model year)	Saw Cylinders (number)	Saw Diameter (inches)	Saws (number)	Capacity (bales/hr)	Horsepower	Model Name
BC Supply[y]						
1995	1	12	170	15	150	Dominator 170
2010	1	12	206	20	200	Dominator 206
Cherokee[y]						
2007	1	12	174	20+	200	Avenger 174
2009	1	12	193	20+	200	Avenger 193
2013	1	12	244	30+	300	Magnum 244
2015	1	12	270	30+	300	Magnum 270
Continental[y]						
1962	1	12	120	3 – 3.5	25	
1962	1	16	79	4	40	Comet
1962	1	16	119	6	50	Comet Supreme
1973	1	16	93	5	50	Eagle
1973	1	16	141	7.5	75	Eagle
1979	1	16	141	12	125	Double Eagle
1988	1	16	161	15	150	Golden Eagle
2010	1	16	201	20	200	Golden Eagle
Consolidated Corp.						
1986	1	12	164	10	75	Horn 164
1988	1	12	112	6 - 8	50	Horn 112
1989	1	12	164	12	100	Horn 164
1989	1	12	112	8.5	75	Horn 112
1994	1	12	198	15 – 18	150	CCGC 198
1998	1	12	198	18 – 20	200	CCGC 198
Hardwicke-Etter Co.						
1958	1	12	120	3	40	CXX
1958	1	12	100	2.5 – 3	30	Centurion
1962	2	11¾, 12[z]	178	4 – 4.5	50	Regal 178
1962	2	11¾, 12[z]	224	6 – 8	75	Regal 224
1974	2	11¾, 12[z]	200	4.5 – 5	75	Super Regal 200
1974	2	11¾, 12[z]	252	6.5 - 9	100	Super Regal 252
Lummus[y] Corporation						
1958	1	12	88	4 – 5	50	Super 88
1962	1	12	88	4 – 5	60	Imperial
1964	1	12	128	8	75	Imperial
1973	1	12	108	7	75	Imperial
1973	1	12	158	10	100	Imperial
1988	1	12	108	8.5	75	Imperial II
1988	1	12	158	12	125	Imperial II
1989	1	12	158	15	150	Imperial II
1994	1	12	170	15	150	Imperial III
1996	1	12	116	10	100	Imperial III
2007	1	12	198	18 – 20	200	Consolidated 198
2009	1	12	222	22 – 25	250	Consolidated 222
2013	1	12	184	18 – 20	200	Consolidated 184
2014	1	12	170	18 – 20	200	Imperial III
2016	1	12	194	20 – 22	200	Consolidated 194
2016	1	12	234	25 – 28	250	Consolidated 234
Murray						
1962	1	12	120	2	40	Brush Safety Gin
1962	1	18	80	4 – 5	50	Brush Safety Gin
1968	1	18	94	5 – 6	60	94 - 18
1968	1	18	120	6	60	120 - 18
1973	1	18	142	8	75	142 - 18
1980	1	18	94	6 – 8	75	Triple Crown
1982	1	18	142	8 - 10	100	Triple Crown

[z]Bottom saw 12 in.; top saw, 11¾ in.

[y]Gin machinery manufacturers currently in business

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