

COTTON GINNING MACHINERY

carried in wagons to the gin houses where it is either stored temporarily or ginned at once from the wagons.

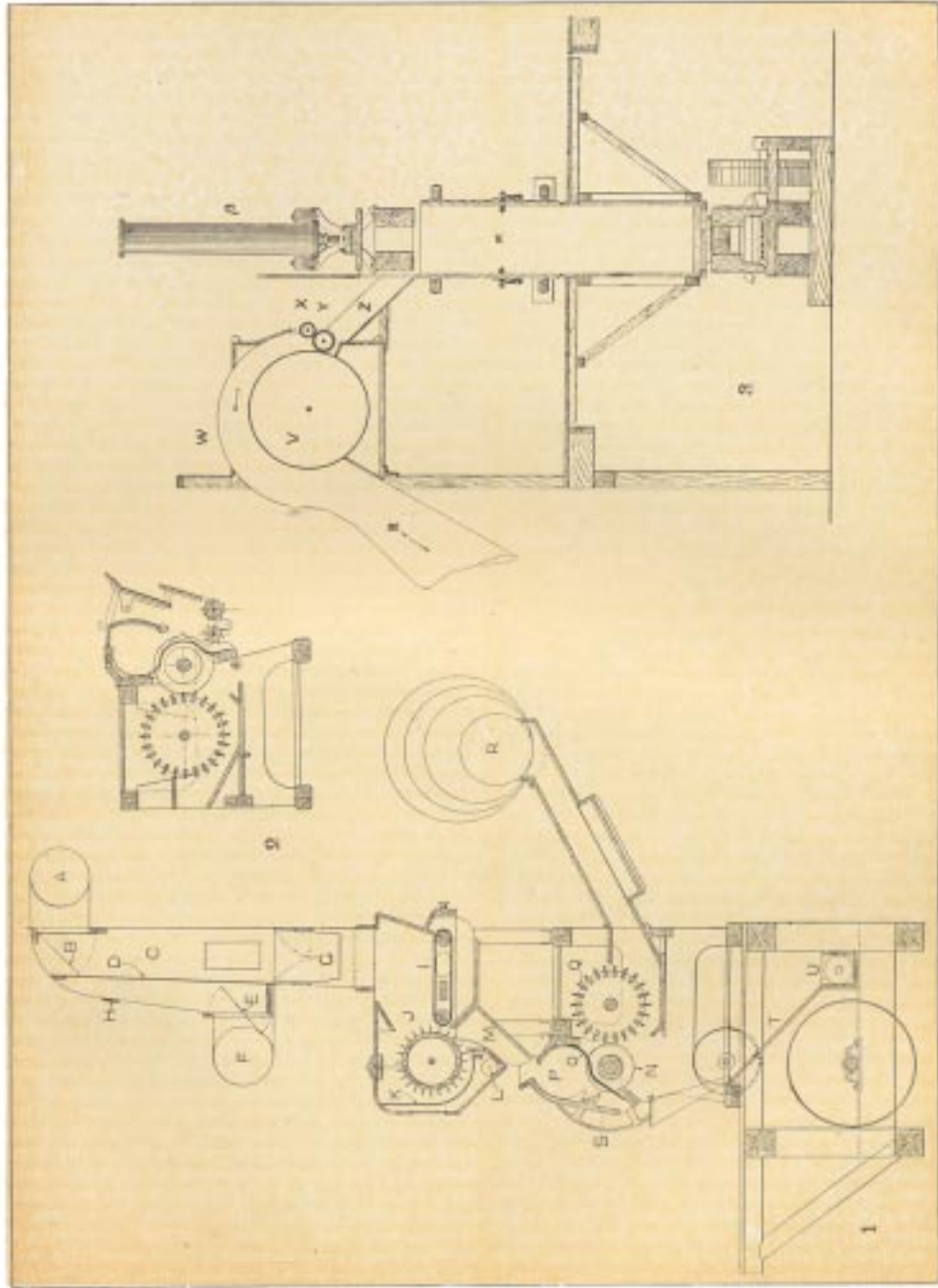
The earliest gin probably dates back to the days when the market price of animal skins became so great that man had to look around for a cheaper substitute for clothes. A primitive machine called the churka is an early gin. It is used to-day by the Hindus and Chinese. It consists of two plain rollers mounted on a frame and revolved in contact. Between these rollers the cotton is drawn and torn from the seed.

In most parts of the cotton belt of the United States the saw gin which Eli Whitney invented in 1794 is still the machine used to gin cotton. This cotton gin is one of the few mechanical inventions which seemed to spring spontaneously from the brain of the inventor a perfect machine. Evolution has done comparatively little to change its three essential elements, the saws, ribs, and brush. These have been retained in nearly all modifications intended to meet modern ideas, methods, means, and material of construction, and improve the quality and quantity of the staple of the cotton, but thus far no machine has been invented which can excel the saw gin in capacity. As the fibres of the cotton were found to be injured by the action of the saws, the McCarthy roller gin was introduced. It consists of a leather covered roller to which a knife is tightly held tangentially, and a moving blade that moves up and down in a plane just behind and parallel to the fixed knife. As the cotton is drawn between the rollers and the knife, the seeds are forced loose by the moving blade. The capacity of this gin is so limited that only the small part of the cotton crop which is of long fibre, like that raised on the sea islands of the Carolinas and Georgia and some parts of the river bottom lands, is ginned on it, and its limited capacity has prevented its general introduction throughout the South.

Until 25 years ago the average ginning plant consisted of one gin stand having a gang of 60, 70, or 80 saws, capable of turning out from 8 to 10 500-pound bales of cotton in a day. The isolated cotton plantations did not require a greater capacity than this size of plant, and each planter did his own ginning. But after the development of the Southwest with its large areas capable of raising cotton and the large number of small farms located close together, system gins were erected at railroad stations capable of ginning for the entire neighborhood. The scarcity of labor required that labor-saving apparatus be installed to get the cotton to the gins, and the product of ginning away. Thus this section of the country became the home of these labor-saving devices, and as the community grew, the competition of the gins with each other required a perfection of machinery never attempted in the older portions of the cotton belt. Then, as the development of the Southwest increased its competition with the Southeast, in self defense this latter section was compelled to adopt the methods which had grown up in the former. Small plantation gins were not rebuilt as they wore out or burned, but larger gins owned by a company of planters or merchants were built at the railway stations. Thus the entire cotton handling business underwent a revolution, until, for economy, speed, and

Cotton Ginning Machinery, machinery for preparing the raw or seed cotton for the cotton mills. Its primary object is separating the fibres of cotton from the seed. At present no successful mechanical means is in general use for harvesting or picking seed cotton from the stalks in the fields. The bolls begin to open in the latter part of July. When ripe they burst at the top and the locks of cotton streaming out are filled by the wind with sand and dust, and wet by the rains and dew. So to keep the cotton clean, picking must commence as early as possible and continue until the last of the crop is gathered. A day's work for an adult varies from 200 to 300 pounds, and of this weight about a third is lint and two thirds seed. Picking is done by contract at so much per hundred pounds, and the seed cotton is either stored in houses located in the fields, or

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1. Vertical cross section of elevator, feeder, plain gin flue, and platform.
 2. Cross section of Huller gin.
 3. Vertical cross section of condenser and press.

COTTON GINNING MACHINERY

efficiency, cotton handling machinery grew and developed until it is on a parity with the machinery for handling the grain crops of the Northwest.

The constant danger of fire which hangs over all cotton gins has caused the different buildings which go to make a complete establishment to be separated. The cotton is stored in an isolated house at least 60 feet from the gin house, and its contents drawn into the gin by the inlet current of an exhaust fan. In most cases, however, at large gins it is not stored in the house at all, but taken directly from the wagons as they arrive at the gins, and each wagon hauls its cotton away, selling the seed to the ginner, who usually buys for some oil-mill and ships direct to them. The gin building proper is only large enough for the machinery which does the ginning; no cotton is in the building except that which is undergoing the process of ginning. The seed house in which the seed is stored is also detached from the gin building and usually located on a spur of the railway. In some cases an additional building is used to store the bales until they are shipped. Further to avoid the risk of fire and to insure better running of the machinery, the gins are located on a low platform three feet high. The floor of the building is brick or cement, and the building is made of brick, stone, or sheet iron.

The line shaft is carried directly under the gins where all of its journals are in sight; it can be easily oiled and hot-boxes instantly detected. At the end of the row of gins a higher platform is built to surround the press. Bales are taken out on this platform and can be thrown into the wagons thence without further expenditure of labor. After the mechanical processes of carrying by the exhaust fan and dropping the cotton into each gin, blowing it from the gins to the presses and its packing there by a steam trumper, the operation of putting on the bagging and tying the hoops is the first manual labor necessary after the feeding from the wagon into the telescope.

The principal machines used in a modern cotton ginning establishment, in the order in which they are used, are the telescope, the elevator, the exhaust fan, the feeder, the gin, the seed conveyer, the flue, the condenser, and the press.

The machine which makes the separation of fibres from the seed is known as the gin; all the other machines in the gin house, except the engine and boiler, are intended to either get the seed cotton to the gins, or to take care of the seed and lint after they leave the gin.

The telescope is an extensible tube which hangs from the inlet cotton pipe; it is counter-balanced and so arranged that its tube can be pulled down and kept close to the pile of cotton as it decreases in size.

The pneumatic elevator, which is now the apparatus most generally used to distribute cotton to the gins, is arranged as follows: *A* is the cotton pipe leading from the telescope. *B* is a valve which swings away from *A* and allows the cotton to enter chute *C*. *D* is a screen which prevents the cotton getting into the air pipe, and *E* is a valve which separates the chute *C* from the air pipe *F*. *G* is a flexible valve which prevents the air from entering the chute from below. *H* is a valve for admitting outside air. A chute is mounted over each gin

feeder, all of the cotton pipes are connected to the common pipe *A* which extends to the telescope, and all of the air pipes are joined to the common pipe *F* which connects to an exhaust fan. The valves *E* are opened in rotation. In a system using four gins each valve is open a fourth of the time and closed three fourths. When air valve *F* in the first chute is open a vacuum is formed in the chute, the outside air carrying with it the cotton, rushes in from the telescope through valve *B*. The air is drawn through the screen into the fan, while the cotton strikes against the screen with enough force to take out a large part of dirt and dust, no cotton being ever allowed to get into the blades of the fan on account of the danger of fire which a spark might cause. As long as valve *E* remains open cotton continues to enter this chute and valve *G* remains closed, but when valve *E* in this chute is closed the corresponding valve in another is opened and the stream of cotton and air is deflected to the second chute, and the cotton in the first dropped from the screen and into the feeder below. Valve *H* is opened to allow fresh air to get in above the cotton and thus break the vacuum and blow the cotton off the screen.

The feeder which is located just below this elevator, and over the gin, has for its object the cleaning of the seed cotton, breaking up the lumps and then feeding the locks evenly and regularly into the gin. Its parts are as follows: A slowly moving apron *I* receives the cotton from the elevator and carries it to the picker wheel *J*. This wheel revolving with great rapidity picks up the locks of cotton and throws them against the screen *K*. The particles of dirt and trash go through this screen and are carried away by helical conveyer *L*. The cotton is rubbed over the screen and thrown on an inclined apron *M* which carries it into the roll boxes of the gins.

The gin used on upland cotton is practically the same in design as the one invented by Whitney. It consists of a gang of circular saws *N*, usually 70 in number, mounted about five eighths of an inch apart on a mandrel. A grating of cast-iron ribs *O* sits over these saws. The saws project through the spaces between the ribs and into the roll box *P*. The seed cotton from the feeder drops into this roll box and coming into contact with the teeth of the revolving saws, its fibres are stripped from the seed and carried between the ribs and out of the roll box, then the brushes *Q* clean the lint from the teeth of the saws, and at the same time generate enough air to blow the lint through the flue *R* to the condenser. Seeds freed from the lint are unable to go out through the space between the ribs, and so work out of the roll box to the adjusting board *S*, whose function is to hold them back until sufficiently cleaned or stripped of lint. Different varieties of cotton clean more or less easily, requiring different adjustments of this board. The seed rolls down an apron *T* into a helical conveyer *U* which runs under the line of gins and carries the seed into the blast of the same fan that draws the cotton to the elevator. The gin used on cotton grown in the river bottom or alluvial lands is modified from the plain gin for the following reasons: The cotton contains more woody bolls or hulls, either from the indifference of the picker or because the bolls do not open as

freely as the upland bolls do. It is necessary to extract these hulls to prevent their becoming mixed and cut up with the cotton fibres. This is accomplished as follows: The cotton is dropped from the feeder upon two small rollers. These feed it to the saws which drag it through a set of guards or fins which are located on the lower part of the rib and whose function is to strip off the hulls and prevent them getting into the roll box. The operation is then identical with the plain gins.

The flue which conducts the cotton from the gins is made of sheet metal and shaped like a long funnel with the larger end near the condenser. Cotton and air is blown from the gins into the main flue tangentially, thus insuring long, easy, spiral lines of travel, and as a layer of air is always between the walls of the flue and the flying cotton, friction is reduced to a minimum.

The condenser which is located at the end of this flue acts as a collector of the bunches of cotton that fly through the flue like snow, and makes them into a bat or sheet of cotton. It consists of a large revolving drum *V* covered with wire netting. The drum is surrounded by a rounded top *W* set eccentrically with it, with the wide part at the back where the flue enters. Each end of the drum opens into a dust flue leading to the outer air. The air and dust blown against this drum escapes out of the building while the cotton remaining on its circumference is carried around to the front where there are two doffing rollers *X* and *Y*. These wipe the cotton off of the drum, making it into a sheet or bat and also prevent the escape of the air into the house. This bat of cotton drops down the incline *Z* into the press.

The press used in all square bale system of gins, consists of two boxes mounted together on a turntable. Cotton from the condenser is allowed to drop into the first box and when enough cotton has been forced into it by the steam trampler the turntable is revolved and the other box comes in its place. The loaded box comes into position over a ram where it receives the final pressure. This ram is operated by a large direct acting steam cylinder, a hydraulic ram or a screw which is raised and lowered by a revolving nut. The bales turned out by this square press usually weigh 500 pounds gross. Of this weight about 30 pounds is the weight of the bagging which covers it, and of the steel ties which bind it. These bales average 28 x 56 x 42 inches in size and thus have a density per cubic foot of about 14 pounds. They are usually shipped from the gin house to some concentrating point where they are assorted and compressed and their size is reduced to 28 x 56 x 18 inches, giving them a density of 28 to 30 pounds per cubic foot. They are then ready to be shipped to the cotton mills.

The large compresses which do this pressing are usually located at large concentrating centres. They are enormous machines weighing in some cases as much as 200,000 pounds, and are operated either by direct acting steam cylinders coupled to the jaws of the press by multiplying levers, or the jaws of the press are brought together by a large link moved by hydraulic rams sitting directly over the press. These rams receive their charge of high pressure water from generators located in the engine room,

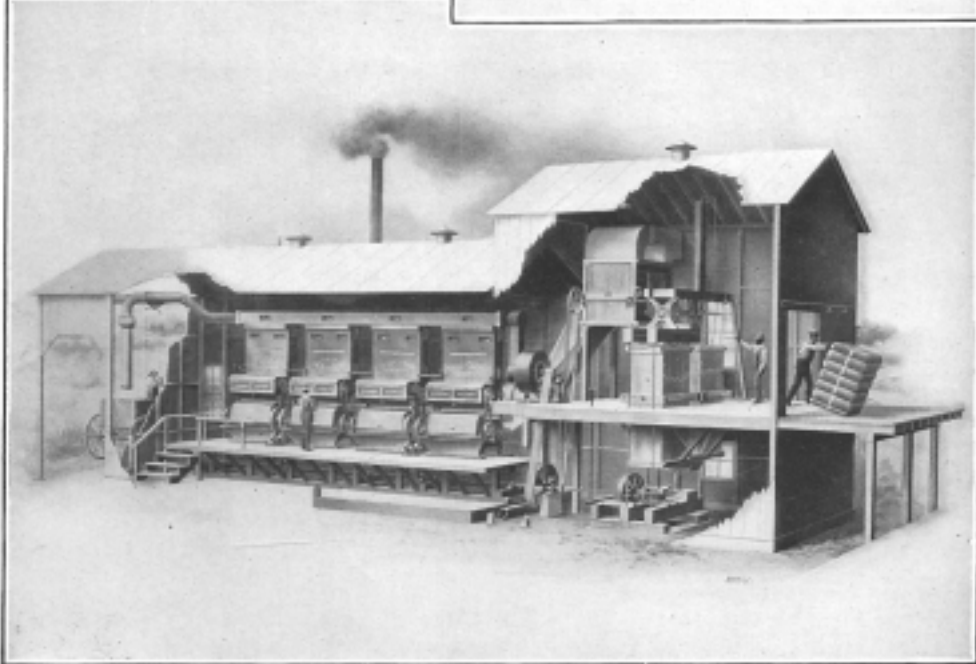
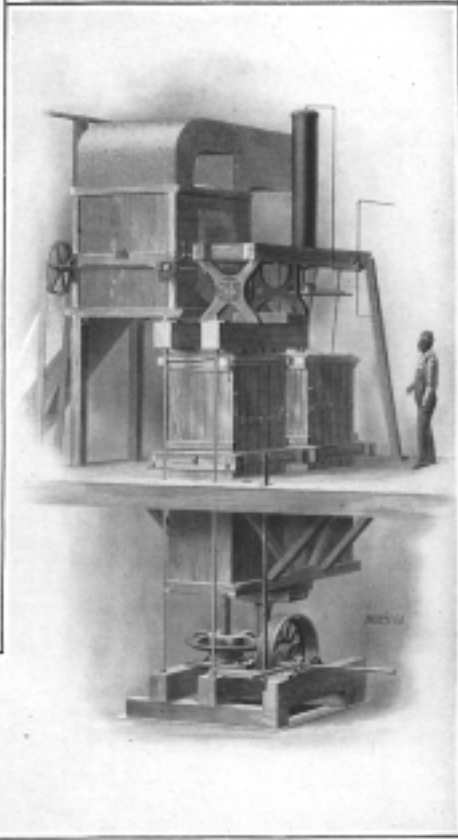
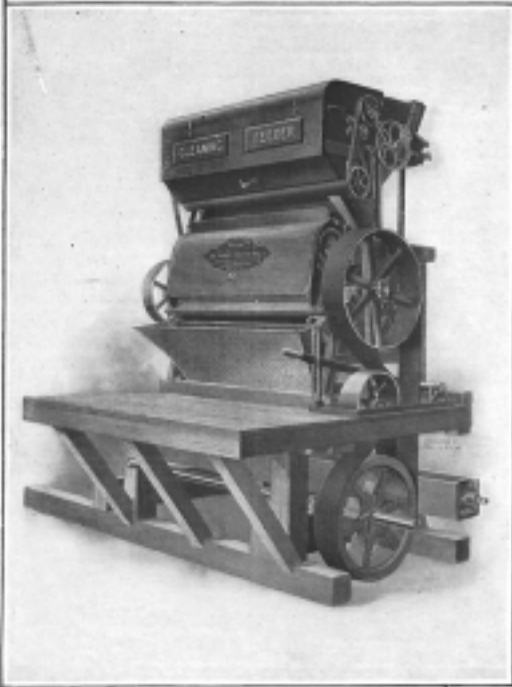
which are large direct-coupled steam pumps capable of filling the press ram at one stroke of the piston. The capacity of this press ranges from 800 to 1,200 bales in 10 hours. The bales while in the press are recovered and their bands are shortened to suit the reduced bulk. They are then loaded directly on the cars and shipped to their destination.

The round bale presses, which have been introduced within the last 10 years, are intended to take the place of the gin house presses, and to make a bale from the cotton as it comes from the gins, and at the same time pack it with sufficient density per cubic foot to allow it to be shipped direct to the mills without further compressing. They are a mechanical success and are sure to become universally adopted in time. There are two types of round bale presses, the older or round lap press, making a bale by wrapping layers of cotton batting around a spindle and then extracting the spindle, the bale growing in diameter as it is formed, and reaching a density of 35 pounds per cubic foot, measuring 35 inches long, about 22 inches in diameter and weighing about 250 pounds, and another type of press which makes the bales on end. The diameter, 20 inches, is constant, and the length varies as the weight, but averages about three feet. As high as 40 pounds per cubic foot density can be attained with this press. The bales weigh 250 pounds. The bales of the round lap press will unwind directly into the lapping machines of the cotton mills, thus doing away with one process through which all bales made on the square presses, or on the end-packed round bale presses have to go. In fact the round lap press is nothing more than a large, heavy lap machine used at the gin-house in place of the lighter one used at the mill.

The influence of improved machinery on handling cotton can best be illustrated by the following figures. In 1792 the exports of cotton from the United States was 138,342 pounds, scarcely more than 276 bales of 500 pounds each. Ten years after Whitney had invented the saw gin the exports amounted to 18,000,000 or 36,000 500-pound bales. Again in about 1876 the cotton crop was a little over 5,000,000 bales, then modern machinery began to be introduced, causing a saving in labor, and therefore the reduced cost of ginning acted as such a stimulus to cotton raising that at present the crop is about 11,000,000 bales. It is estimated that the introduction of the round lap bales which save the charges of compressing, and the expense of concentrating the bales, will make a net saving to the grower of almost \$3.00 per bale, or \$33,000,000 annually.

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