



Class FB241

Book 387

Copyright N^o _____

COPYRIGHT DEPOSIT



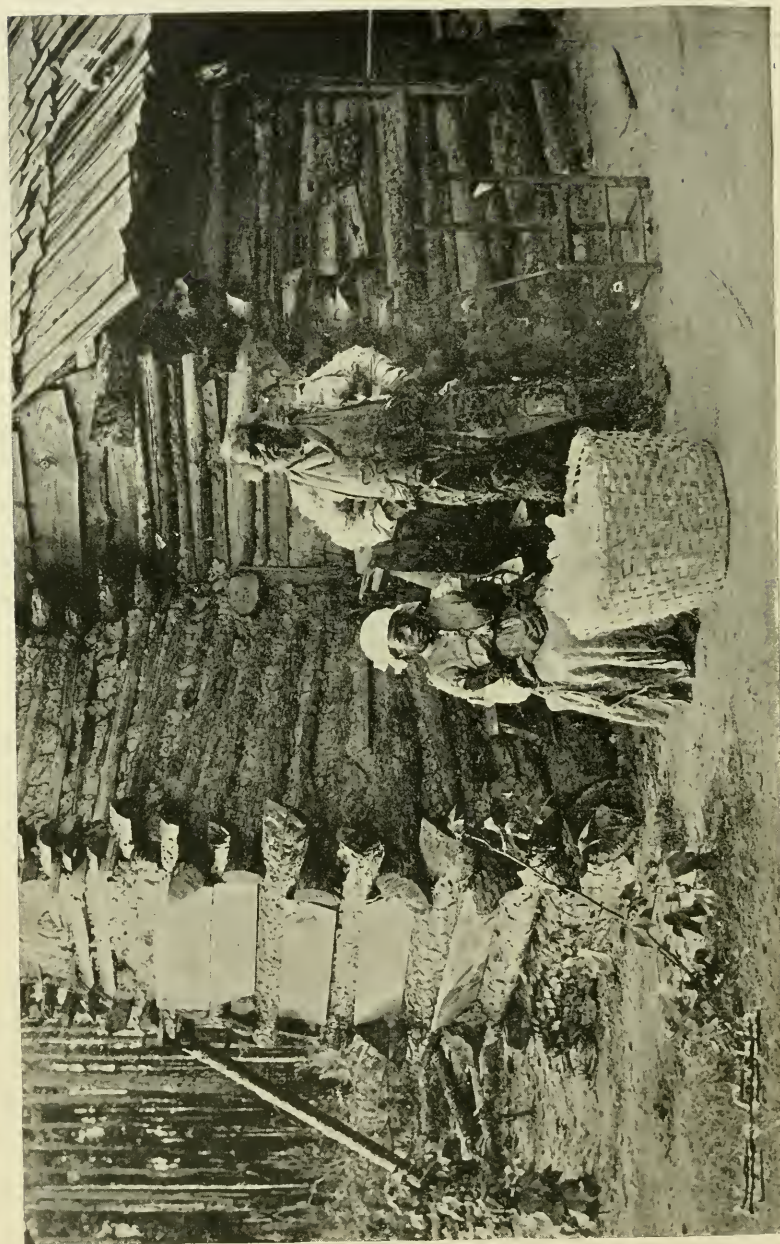
By the same author,
COTTON MANUFACTURING,
6th Thousand.

WEAVING CALCULATIONS,
4th Thousand.

See page 364.

221
102

COTTON.



Frontispiece. The End of the Day.

[To face title page.]

COTTON

ITS

Uses, Varieties, Fibre Structure, Cultivation,

AND

Preparation for the Market and as an Article of Commerce,

ALSO THE

Manufacture of Cotton Seed Oil,

Cotton Seed Meal and Fertilizers,

WITH

Especial Reference to Cotton Growing, Ginning, and Oil
Pressing in the United States.

BY
C. P. Brooks
C. P. BROOKS,

AUTHOR OF "COTTON MANUFACTURING" AND "WEAVING CALCULATIONS";
FORMER EXAMINER TO THE CITY AND GUILDS OF LONDON INSTITUTE
FOR THE ADVANCEMENT OF TECHNICAL EDUCATION; UNITED
STATES MEMBER OF THE BUREAU OF THE INTER-
NATIONAL CONGRESS ON TECHNICAL
EDUCATION.

NEW YORK:
SPON & CHAMBERLAIN, 12 CORTLANDT STREET.

LONDON:
E. & F. N. SPON, LIMITED, 125 STRAND.

LOWELL, MASS.:
CHRISTOPHER P. BROOKS.

1898.

All rights reserved.

9370

Entered according to Act of Congress, in the year 1898,

By CHRISTOPHER P. BROOKS,

in the office of the Librarian of Congress, at Washington, D.C.

Entered at Stationers' Hall, London, in the year 1898.

~~NOT RECEIVED~~

35064

All rights, including republication, reproduction and translation are reserved. The preparation of lantern slides of the illustrations is prohibited without permission and acknowledgment.

27 Oct 1898

1898

LOWELL, MASS. :
BUTTERFIELD PRINTING AND BINDING CO.
1898.

5526
388

CONTENTS.

CHAPTER I.

THE BOTANY OF COTTON.—LIFE HISTORY OF THE PLANT.—STRUCTURE AND COMPOSITION OF THE FIBRE.—THE COTTON AND COTTON FIELDS OF THE WORLD.	17
---	----

CHAPTER II.

THE AMERICAN COTTON BELT.—PEOPLE OF THE COTTON BELT.—LAND TENURE IN THE COTTON BELT.—AREA OF AVAILABLE COTTON LAND IN THE UNITED STATES.	106
--	-----

CHAPTER III.

COTTON CULTURE.—FERTILIZERS.—SELECTION OF SEED.—FOREIGN COTTON SEED.—COTTON PLANTING.—CHOPPING OUT.—CULTIVATING THE PLANT.—COTTON PICKING.—OPERATIONS OF COTTON CULTURE.—DAMAGE TO CROPS.—CULTIVATION OF SEA ISLAND COTTON.	129
---	-----

CHAPTER IV.

PREPARATION OF COTTON FOR THE MARKET.—GINNING AND BALING.—INVENTION OF THE SAW GIN.—OLD-TIME GINNING.—OLD-TIME BALING.—MODERN GINNING.—THE SAW GIN.—COTTON GINNERIES.—THE MODERN GINNERY.—THE ROLLER GIN.—PERCENTAGE OF LINT.—BALING.	202
---	-----

CHAPTER V.

THE FARMER TO THE COTTON MERCHANT.—LOCAL SALE OF COTTON.— SAMPLING AND GRADING.—COMPRESSING.—OCEAN SHIPMENT.—METH- ODS OF BALING COTTON.	240
--	-----

CHAPTER VI.

COTTON AS AN ARTICLE OF COMMERCE.—COTTON MARKETS OF THE UNITED STATES.—THE NEW YORK AND NEW ORLEANS CONTRACTS.— MILL PURCHASES.—LAND FREIGHT ON COTTON.—THE EUROPEAN COTTON MARKETS.—LIVERPOOL.—CONTINENTAL MARKETS.—OCEAN FREIGHT.—IMPORTS OF EGYPTIAN AND PERUVIAN COTTON INTO THE UNITED STATES.—COST OF RAISING COTTON.	274
--	-----

CHAPTER VII.

BYE PRODUCTS OF COTTON SEED.—COTTON SEED OIL MILLS.—THE MANU- FACTURE OF COTTON SEED OIL.—COTTON SEED MEAL.—OIL REFIN- ERIES.—USES OF COTTON SEED OIL.—COTTON SEED AND MEAL AS FERTILIZERS.—AN ENGLISH COTTON SEED OIL MILL.—DELINTING COTTON SEED.—PRICES OF COTTON SEED PRODUCTS.	309
---	-----

Detailed index to reading matter on pages 355 to 362.

P R E F A C E.

Considering that cotton is the greatest of all fibre crops and the most widely manufactured of all textiles, the attention which has been given in textile literature to the botany of the plant, to the structure of the fibre, and to the numerous processes through which it passes before its arrival at the mill, has been meagre in the extreme and especially small in proportion to the attention that has been given to descriptions of the after processes of manufacture. Among the many subjects of great importance to all engaged in, or associated with, cotton manufacture, which have hitherto not been made the subject of special study from a manufacturer's point of view, except in very few instances, are the growth and cultivation of the cotton plant, plowing, sowing, cultivating, and harvesting of the crop, the ginning, baling, and compressing of the fibre, and the shipping and handling of the bales in the markets of the the world; also the manufacture of the many bye products of the cotton seed, such as cotton seed oil, meal, linters, etc., and perhaps the most important of all, a description of the varieties of cotton from all parts of the world, and the characteristics of each cotton, its suitability for various purposes, the yarns and cloths that can be made from it, and the economy that can be attained by an accurate and skilled selection of cotton for each kind of yarn or goods.

Usually these have been passed over by a few sentences in textile text books, or altogether ignored, but in this volume they are now dealt with very fully.

Taking advantage of a residence in the United States cotton belt during the years 1895 and 1896, I made the investigation of some of the less known subjects connected with the

production of the great fibre crop a special study. The information that I then obtained, added to the results of fifteen years' experience in manufacturing the fibre, seemed to me worthy the attention of spinners and manufacturers of yarns and of cloth, of builders of textile machinery and students in textile schools, and I have added this book to those that I have previously written, hoping to give new facts of importance to those who would increase their knowledge of the fibre, and their skill in manipulating it in its manufacture into the thread or the fabric. My intention has been to produce at the same time a volume that would be of interest to the cotton factor, to the merchant, the broker, and all whose business it is to buy or sell the fibre in its raw or manufactured condition, and last, but not least, to produce a summary of the experience of many men and many minds as to the most satisfactory method of cotton culture that would be useful to the planter. To do this satisfactorily, it has been necessary to illustrate the book copiously; this has been done at considerable expense, but there is some compensation in knowing that it is one of the best illustrated textile books of recent years.

While the book is sufficiently technical to be of valuable assistance to the planter, the merchant and the manufacturer, and especially so to the students in the cotton departments in textile schools, yet I have attempted to make it sufficiently popular as to be of interest to the general reader.

I do not claim, in fact, it would be presumption on my part to do so, that my own experience and observations are to have exclusive credit for the information in this volume: on the contrary, I wish to take this opportunity of expressing my greatest appreciation of the assistance rendered by many friends on both sides of the Atlantic, and more especially in the southern states of the Union, for the interest they have taken, and assistance they have rendered, in the production of this volume, and also to the United States Department of Agriculture, and the Agricultural Departments and Experiment

•

Stations of several states, including South Carolina, Georgia, Mississippi, Alabama, Louisiana and Tennessee, and their courteous officials for the valuable information that they have from time to time provided me with, and for permission to make extracts from their bulletins.

I especially refer to the following : Hy. Hammond, Esq., of Augusta, Ga. ; Hy. G. Kittredge, Esq., of Boston, Mass. ; Fred Oliver, Esq., of Charlotte, N.C. ; Col. A. B. Shepperson, of New York City ; Signor Crespi, of Milan, Italy ; Dr. W. H. Evans ; D. A. Tompkins, Esq., of Charlotte, N. C. ; Peter Brown, Esq., Secy. Liverpool Cotton Association, of Liverpool, England ; C. J. H. Woodbury, Esq., of Boston, Mass. ; Dr. Payne, Atlanta, Ga., and to numerous farmers, planters, merchants and others in all parts of the Cotton Belt.

To the many private firms and individuals, officials of railway companies, amateur and professional photographers, and others who have helped me in the provision of illustrations for this volume, I would also express my thanks. In many cases, these are acknowledged in the references in the text, but in case there have been any unintentional omissions, I wish now to thank those to whom I refer. In this connection I would name the New England Cotton Manufacturers' Association, and its secretary and treasurer, C. J. H. Woodbury, Esq. ; Hon. Fred. G. Pettigrove, of Boston, Mass. ; J. C. Hale, of the Central of Georgia Railway Co. ; B. & F. Avery, of Louisville, Ky. ; Eagle Gin Co., of Bridgewater, Mass. ; Hy. G. Kittredge, Esq., of Boston, Mass. ; D. A. Tompkins, Esq., of Charlotte, N. C. ; the St. Louis Southwestern Railway Co. ; Dr. Bowman, of Northwich, Cheshire, Eng. ; Latham, Alexander & Co., of New York City ; Henry Lee, Esq., London, Eng. ; Jos. M. Wade, Esq., Boston, Mass. ; Hon. G. W. Hill, Washington, D. C. ; Mr. Coovert, Greenville, Miss. ; Stillwell-Bierce and Smith-Vaile Co., Dayton, O. ; Abraham Flatters, Esq., Manchester, Eng. ; The Cardwell Machine Company, Richmond, Va. ; The Carver Cotton Gin Company, East Bridgewater, Mass. ; The Draper

Company, Hopedale, Mass. ; Paul Bigelow, Esq., Morristown, N. J. ; L. Voorhies, Esq., New Orleans ; Carver Cotton Gin Company, Bridgewater, Mass., and others.

The writer wishes to state that the information in this volume has special reference to United States methods and to American cotton. While comparisons have been given with the conditions obtaining in other countries, yet where it is not especially specified, the writer refers to the United States systems and practices. Even in this, it has not been possible to give one standard system of cultivating, ginning, and baling, equally applicable to all the States, but an attempt has been made to render the information sufficiently comprehensive. The author would ask the reader to remember that systems and practices differ, not only in the different states, but in the different counties of each state, if not on the different farms in each county.

As has before been stated the bulk of the matter in the volume was written prior to 1897 ; it has since formed the subject matter of many lectures to the students in the Lowell Textile School.

The author invites correspondence with reference to any portion of the book and any suggestion or additional information that might be embodied in future editions.

CHRISTOPHER P. BROOKS.

LOWELL, MASS., *May*, 1898.

LIST OF ILLUSTRATIONS.

FIG.	PAGE.
Frontispiece; The End of the Day	to face title page.
1. Young Cotton Plant	25
2, 3, 4. Branches from Cotton Plant	27, 29
5. Cotton Plant showing leaves, flowers, closed and open bolls	31
6. Longitudinal and Transverse Section of Egyptian Cotton Pod	33
7. Cotton on the Seed	34
8. Microscopic View of Cotton Fibres	35
9. Ripe and Unripe Cotton Fibres	43
10. Flax and Ramie Fibres	44
11. Wool and Cotton Fibres	45
12. Wool and Hair	46
13. Cotton Fibres Under Chemical Action	47
14. Diagram to Scale—Cotton Crops of 1895-96	50
15. American Cotton Fibres	55
16, 17. Comparative Lengths of Cotton Fibres to Scale.	51, 52
18, 19. Sea Island Cotton, longitudinal views and sections	56
20. Orleans or Gulf Cotton, American, longitudinal views	57
21. Benders Cotton, American, longitudinal views	58
22. Uplands Cotton, American, longitudinal views	59
23. Texas Cotton, American, longitudinal views	60
24. Brazilian Cotton, sections	60
25. Pernambuco Cotton, Brazilian, longitudinal views	61
26. Maranhm Cotton, Brazilian, longitudinal views	62
27. Rough Peruvian Cotton, longitudinal views	63
28. Egyptian Cotton, sections	65
29. Brown Egyptian Cotton, longitudinal views	65
30. Brown Egyptian Cotton. sections	67
31. Broach Cotton, Indian, longitudinal views	67
32. Oomrawattee Cotton, Indian, longitudinal views	69
33. Dhollerah Cotton, Indian, longitudinal views	71
34. Scinde Cotton, Indian, longitudinal views	73

FIG.	PAGE.
35, 36. Indian and Other Asian Cottons, sections	74
37. Tinnively Cotton, longitudinal views	75
38. Comparative Sectional Views of Different Cottons	76
39. China Cotton, longitudinal views	77
40. China Cotton, sections	77
41. The Vegetable Lamb	96
42. Portrait of the "Barometz," or "Scythian Lamb"	97
43. Picking Cotton	99
44. A View on the Chattahoochee River at Columbus, Ga.	101
45. Convicts Working on County Road, near Atlanta, Ga.	103
46. Map of the United States	112
47. North Carolina Cotton Mill Help	111
48. Georgia Convicts	113
49. New and Old. A Northrop Loom in South Carolina	115
50. Cotton Mills to the Cotton.	117
51. Why Some People Cannot Make a Living in Arkansas	119
52. Hand Spinning and Weaving in the South	121
53. New Cotton Field	123
54. Old Cotton Field	125
55. A North Carolina Chain Gang	127
56. Cultivator with Stalk Cutting Attachment	131
57, 58. Wooden Plow Stocks	133
59. Steel Beam Plow	133
60. Plow Blades or Plow Shares	135
61. Steel Beam Plow with Middle Burster	137
62. A Cotton Field	139
63. Disc Cultivator	141
64. Cotton Field and Peach Orchard Together	143
65. Cultivator with Middle Burster	145
66. Dowlaw Cotton Planter	147
67. Cotton Planter and Fertilizer	149
68. Riding Cultivator	151
69. A, An Unpicked Cotton Field — Morning	153
B, The Same Field Picked — Evening	153
70. Cotton Field in Flower	155
71. Cotton Picking	157
72. Cotton Picking in the Late Fall	159
73. Cotton Picking	161
74. Pickers Waiting for Cotton to be Weighed	163
75. Weighing Cotton from the Pickers	165
76. Mosaic Disease, or Yellow Leaf Blight	169
77. Anthracnose	169
78, 79. Root Rot and Arceolate Mildew	171
80. Root Galls	173
81. Transformations of Cotton Boll Worm	175

COTTON.

CHAPTER I.

THE BOTANY OF COTTON. — LIFE HISTORY OF THE PLANT. — STRUCTURE AND COMPOSITION OF THE FIBRE. — THE COTTON AND COTTON FIELDS OF THE WORLD.

COTTON is the most widely manufactured of all fibres, and the cotton plant has been cultivated for countless ages. The vegetable fibre, known to commerce as cotton, sometimes called cotton wool, is the fruit of a plant belonging to the order of the Malvaceæ, to which belong the mallow, the hollyhock and the okra. The cotton plant belongs to the genus *Gossypium*, and the number of species from a botanical point of view is variously stated as from four to eighty-eight.

Species of Cotton. Prof. Parlatore, an Italian botanist of high authority, names seven varieties, as under :—

1. *Gossypium Barbadense*, embracing the long-stapled Barbadoes, Sea Island, Egyptian and Peruvian cottons.

2. *Gossypium herbaceum*, embracing the cottons of India, Siam, China, Italy, etc.

3. *Gossypium hirsutum*, the original cotton of Louisiana, and also of the variety known in commerce as uplands.

4. *Gossypium arboreum*, found in Ceylon, Arabia, South America, etc.

5. *Gossypium Peruvianum*, embracing the native varieties of Peruvian and Brazilian cottons.

6. *Gossypium Tahitense*, found in Tahiti, the Society Islands, etc., and,

7. *Gossypium Sandwichense*, including the cottons found in the Sandwich and adjacent islands.

Linneus originally gave only five species of the cotton plant, Dr. Bowman, the leading English authority on the cotton fibre, gives three, while Dr. Forbes Royle gives four. Dr. Royle's classification includes:—

Gossypium herbaceum.

Gossypium arboreum.

Gossypium Barbadense.

Gossypium hirsutum.

These are the four varieties principally known to commerce, and although there are possibly additional species they are not of very much importance.

Dr. Royle says:—

“The first mentioned of these species, *gossypium herbaceum* grows from four to six feet high, bearing a yellow flower. The seeds are covered with a short grey down, whilst the fibre it bears is classed short. It is found native or exotic in Egypt, Asia Minor, Arabia, India and China. The short stapled variety of Egyptian cotton is of this species. The Indian cottons are the product of a variety named by Lamarck the *G. Indicum*. This grows from eight to ten feet high, and, like the allied species generally, bears a yellow flower, the seeds being downy, and the fibre short-stapled and very white.

The *gossypium arboreum* when full grown attains a height of from fifteen to twenty feet, from which fact it derives its name. The flowers are red, the seeds covered with a greenish-colored fur, and enveloped in yellowish-white fibre. It is found in Egypt, Arabia, India and China.

The *gossypium hirsutum* is a shrubby plant, its maximum height being about six feet. The young pods are hairy, the seeds numerous, free, and covered with firmly adhering green down under the long white wool.

The *gossypium Barbadense* grows to the height of from six to fifteen feet. Its flowers are yellow, and its seeds black and smooth, being quite destitute of the hair that distinguishes several members of the species. As implied by its name, it is

a native of Barbadoes, or has been cultivated there for a long time. The cottons most highly esteemed in commerce belong to this species, having probably undergone only slight modifications as the result of climatic influences and variations in the method of cultivation. The Sea Island and Bourbon cottons, from which the fine yarns used in the manufacture of lace are made, the long-stapled Egyptian, and several other good varieties, are said to be from this stock, as they possess many points of identity or resemblance. If this is so, it has, however, undergone considerable alteration by its transfer to new localities and changes in the method of cultivation."

The above is, as before stated, the description of Dr. Forbes Royle, but the writer does not consider it reliable in all cases. For example, it is very clear that the *gossypium herbaceum* is largely cultivated in the United States although Dr. Royle does not mention the fact, while the *gossypium arboreum* so widely cultivated in Central and South America, is credited to the Orient.

Doctor Walter H. Evans says in Bulletin 33 of the United States Department of Agriculture:—

"Among the species recognized to be of more or less economic importance are *G. arboreum*, *G. neglectum*, *G. Brasiliense*, *G. herbaceum*, *G. Barbadense*, and perhaps a few others. In North America only the herbaceous cottons are cultivated to any extent. The shrubby and arboreous are grown occasionally as curiosities, but they seldom or never produce any lint in regions having as low a mean temperature as the cotton belt of the United States.

The determination of the species of cotton grown in the United States presents some peculiar difficulties. The authorities differ widely regarding the specific origin of the short-staple or upland cotton, while more nearly agreeing on that of the Sea Island cotton. The latter is generally considered as having originated from *G. Barbadense*, a technical description of which is given.

G. Barbadense Linn. was originally described as having leaves, three-lobed, entire. A more amplified compiled description is as follows: Shrubby, perennial, six to eight feet high, but in cultivation herbaceous and annual or biennial, three to four feet high, glabrous, dotted with more or less prominent black glands. Stem erect, terete, branching. Branches graceful, spreading, subpyramidal, somewhat angular, ascending, at length recurving. Leaves alternate, petiolate, as long as the petioles, rotund ovate, subcordate, three to five lobed, sometimes with some of the lower and upper leaves entire, cordate, ovate, acuminate; lobes ovate, ovate-lanceolate, acute or acuminate, channeled above, sinus subrotund, above green, lighter on veins, glabrous, beneath pale green and glabrous, three to five veined, the midvein and sometimes one or both pairs of lateral veins bearing a dark green gland near their bases. Stipules erect or spreading, curved, lanceolate-acuminate, entire, or somewhat lacinate. Peduncles equal to or shorter than the petiole, erect, elongating after flowering, rather thick, angled, sometimes bearing a large oval gland below the involuere. Involuere three-parted, erect, segments spreading at top, many-veined, broadly cordate-ovate, exceeding half the length of the corolla, nine to eleven divided at top, divisions lanceolate, acuminate. Calyx much shorter than the involuere, bracts cup shaped, slightly five-toothed or entire. Corolla longer than the bracts. Petals open, but not widely expanding after flowering, broadly obovate, obtuse, crenate or undulate margined, yellow or sulphur colored, with a purple spot on the claw, all becoming purplish in age. Stemens about half the length of the corolla, the tube naked below, anther bearing above. Style equaling or exceeding the stamens, three to five parted. Ovary ovate, acute, glandular, three, rarely four to five celled. Capsule a little longer than the persistent involuere, oval, acuminate, green, shining, three, rarely four to five valved. Valves oblong or ovate-oblong, acuminate, the points widely spreading. Seed

six to nine in each cell, obovate, narrowed at base, black. Fiber white, three to four or more times the length of the seeds, silky, easily separable from the seed. Cotyledons yellowish, granular punctate.

Species which have been considered synonyms of *G. Barbādense* and to which the above description will apply are *G. frutescens* Lasteyr., *G. fuscum* Roxb., *G. glabrum* Lam., *G. Jamaicense* Macfad., *G. Javanicum* Blume, *G. maritimum* Todaro, *G. nigrum* Hamilton, *G. oligospermum* Macfad., *G. perenne* Blanco, *G. Peruvianum* Cav., *G. punctatum* Schum. and Thonn., *G. racemosum* Poir., *G. religiosum* Parlatore, *G. ritifolium* Roxb., and perhaps others.

This species is indigenous to the Lesser Antilles and probably to San Salvador, the Bahamas, Barbados, Guadeloupe, and other islands between 12° and 26° north latitude. By cultivation it has been extended throughout the West Indies, the maritime coast of the Southern States, Central America, Porto Rico, Jamaica, etc., southern Spain, Algeria, the islands and coast of western tropical Africa, Egypt, Island of Bourbon, East Indies, Queensland, New South Wales, etc. It may be cultivated in any region adapted to the olive and near the sea, the principal requisite being a hot and humid atmosphere, but the results of acclimatization indicate that the humid atmosphere is not entirely necessary if irrigation be employed."

It will have been noted that two species, viz. : the *gossypium arborcum* and *Peruvianum* really belong to the class of trees as distinguished from the remainder of the species which are merely shrubs. The tree cottons are cultivated as perennials as distinguished from the *gossypium hirsutum*, *gossypium herbaceum* and other species, which are cultivated as annuals. Some measurements of the trunks of the tree cottons taken in Porto Rico, West Indies have been supplied to the writer by Mr. H. G. Kittredge and are :— Diameter of the stem at the ground, after one and one-fourth year's growth, one and one-

fourth inches ; after two and one-half year's growth, two inches ; after five year's growth, five inches.

The seeds of the tree cotton are in kidney-shaped clusters and thus the cotton is often called "kidney cotton."

United States Species. It is usually considered in the United States that the cotton plant which is chiefly cultivated belongs to the species *herbaceum*, and it is so believed by most of the leading agriculturists.

Some botanists consider that the *gossypium hirsutum* variety is the upland cotton of the United States and distinguish it from *herbaceum* by the green tinted down covering the seeds, but it is not by any means true that the whole of the mainland cotton of the United States is raised from the green seeded variety. It fact quite a large quantity of the seeds carry the grey down, which is supposed to denote the *gossypium herbaceum*. It is the experience of many farmers that if they plant green seeded cotton and use the seeds from the same plant year after year, that there is a gradual change from green seeded to grey seeded cotton, the conclusion being that the *gossypium hirsutum* was originally a sport from the *gossypium herbaceum*. It is probable, therefore, that the *gossypium herbaceum* and the *gossypium hirsutum* are not distinct varieties, but that the supposed distinctive features of the two varieties are more attributable to soil and cultivation than to being separate varieties. To this variety, *herbaceum* or *hirsutum*, whichever may be the correct name for it, the bulk of the cotton plants as cultivated in the United States belong. It has been noticed by the seed crushers that the green seed comes more from the northern than from the southern cotton growing states. There is, however, a strip of land along the coast of South Carolina and Florida, with adjacent islands, where *gossypium Barbadosense* is almost exclusively cultivated, and it is distinguishable by the long staple of the cotton and by the smooth black seeds to which the cotton is attached.

Assuming that the *G. hirsutum* and *G. herbaceum* varieties, as cultivated in the United States, are so similar that it is almost impossible to distinguish any difference, we will accept Dr. W. H. Evans' description of the *gossypium herbaceum* as being undoubtedly reliable.

“*G. herbaceum* Linn.—Shrubby, perennial, but in cultivation herbaceous, annual or biennial. Pubescence variable, part being long, simple or stellate, horizontal or spreading, sometimes short, stellate, abundant, or the plants may be hirsute, silky, or all pubescence may be more or less wanting, the plants being glabrous or nearly so. Glands more or less prominent. Stem terete, or somewhat angled above, branching. Branches spreading or erect. Leaves alternate, petioled, the petioles about equaling the blades, cordate or subcordate, three to five, rarely seven-lobed. Lobes from oval to ovate, acuminate, pale green above, lighter beneath, more or less hairy on the veins, three to five or seven-veined, the midvein and sometimes the nearest lateral veins glandular toward the base or glands wanting. Sinus obtuse. Lower leaves sometimes cordate, acuminate, entire, or slightly lobed. Stipules erect or spreading, ovate-lanceolate to linear lanceolate, acuminate, entire or occasionally somewhat dentate. Peduncles erect in flower, becoming pendulous in fruit. Involucre three, rarely four parted, shorter than the corolla, appressed spreading in fruit, broadly cordate, incisely serrate, the divisions lanceolate, acuminate, entire or sometimes sparingly dentate. Calyx less than half the length of the involucre, cup-shaped, dentate, with short teeth. Petals erect, spreading, obovate or cuneate, obtuse or emarginate, curled or crenulate, white or pale yellow, usually with a purple spot near the base, in age becoming reddish. Stamens half the length of the corolla. Pistil equal or longer than the stamens. Ovary rounded, obtuse or acute, glandular, three to five celled. Style about twice the length of the ovary, three to five parted above, the glandular portion often marked with two rows of

glands. Capsule erect, globose or ovate, obtuse or acuminate, mucronate, pale green, three to five celled. Valves ovate to oblong, with spreading tips. Seed five to eleven in each cell, free, obovate to subglabrous, narrowed at base, clothed with two forms of fiber, one short and dense, closely enveloping the seed, the other two to three times the length of the seed, white, silky, and separating with some difficulty. Cotyledons somewhat glandular punctate.

This species includes in its synonyms the following: *G. album* Hamilton, *G. Chinense* Fisch. and Otto, *G. croceum* Hamilton, *G. eglandulosum* Cav., *G. elatum* Salisb., *G. glandulosum* Steud., *G. hirsutum* Linn., *G. indicum* Lam., *G. latifolium* Murr., *G. leoninum* Medic., *G. Macedonicum* Murr., *G. micranthum* Cav., *G. molle* Mauri, *G. nankin* Meyen, *G. obtusifolium* Roxb., *G. paniculatum* Blanco, *G. punctatum* Guil. and Perr., *G. religiosum* Linn., *G. Siamese* Tenore, *G. sinense* Fisch., *G. strictum* Medic., *G. tricuspidatum* Lam., and *G. vitifolium* Roxb., together with numerous others the descriptions of which are too indefinite or the specimens too meager to determine them positively.

The origin of this series is much more confused than that of the Sea Island cotton. If we separated the upland cotton into two species, viz., *G. herbaceum* and *G. hirsutum*, probably the question would no doubt be simplified, as the former is generally considered of Asiatic origin, while the other is attributed to America. Todaro claims that the form called by him *G. hirsutum* originated in Mexico, from whence it has been spread by cultivators throughout the warmer portions of the world. To this form he ascribes the Georgia upland cotton. Parlatores considers it indigenous to some of the islands of the Gulf of Mexico as well as the mainland, and all green-seeded cotton, which is cultivated so widely, as originating from this form. On the other hand, he claims India, especially the shores of Coromandel, as the primitive home of *G. herbaceum*, from which place it has spread as



FIG. 1.
Young Cotton Plant.

extensively as its western congener, and is found in cultivation in nearly the same regions."

Life History of the Cotton Plant. The habit or life history is approximately similar in both the *G. herbaceum* and the *G. hirsutum*; germination occurs rapidly, and the first appearance of the plant above the ground is from four to fourteen days from sowing. The young plant shown at Fig. 1 was photographed a few hours after its appearance and the unfolding of the first two leaves.

Two periods in the life of this plant may be distinguished. The first extends from the time of planting, which in South Carolina is about the middle of April to the middle of summer. This is the time in which the plant makes its growth of stalk and foliage, and gathers nourishment, which will later be stored up in the seed. During this period tropical conditions are favorable, namely, the deposit of moisture on the soil from frequent rather than from long-continued rains, high temperature with small daily variation, plenty of sunshine, little wind, and a high relative humidity of the atmosphere to reduce evaporation to a minimum. During this period everything possible is done to prevent loss of water from the soil; grass and weeds are scrupulously excluded, and the surface of the soil is frequently stirred to conserve the moisture and increase the temperature.

In the second period the temperature rapidly falls and the rain fall diminishes; this is the fruiting season of the cotton crop, when every effort should be made to produce seed and lint rather than stalk and foliage. Every means is taken to dry up the soil, cultivation ceases, and the soil is allowed to become hard and compact to favor evaporation of the moisture. The exact date of the first sowing and the appearance of the first flower with the commencement of the gathering of the crop are given in another chapter, but it may be advisable to indicate something further of the life history of the cotton plant. Usually about forty days after the plant shows



Fig. 2. Branches from Cotton Plant.

A—White flower. B—Red flower. C—Square. D—Young boll or capsule.



Fig. 3. Branches from Cotton Plant.

A—Mature bolls or capsules. B—Open bolls.

above the ground there appears the first square or bud. From the formation of this bud, twenty-four to thirty days elapse before the appearance of the flower. The bud or square is shown on Fig. 2 at C, and again on Fig. 4 at C. The flower on the first day of the opening of the bud is yellowish white and has five petals. One peculiarity of the cotton plant is in the change of color of the flower. This, which on the first day is of a shade varying from a dull white to a canary, is found on the second day to be of a distinctly pink or reddish hue; the flower drops off on the third or succeeding day. The white flower is shown at A, Fig. 2, and again at A, Fig. 4, while the red flower on the point of dropping off is shown at B, Fig. 2. After the petals fall on the third day, there remains the small boll enveloped in the calyx; this develops until it becomes about the shape and size of a small hen's egg, and fifty to sixty days from the appearance of the flower it bursts. Bolls in the early stage are shown on Fig. 2 at D, and on Fig. 4 at E. Large ones almost ready to burst may be found on Fig. 3 at A.

An interesting view of a cotton plant bearing squares, flowers, closed and open bolls, is shown in Fig. 5.

There is a popular superstition among the colored population that twenty-seven days elapse from the bud or square to the flower, the flower remains three days on the plant, and that forty-seven days more elapse, at the expiration of which period the boll has burst and the cotton is ready for picking. While this may be accurate in many cases, the exact time varies with the season and with climatic conditions.

A self-explanatory diagram of an Egyptian cotton boll is shown at Fig. 6, taken from Dr. Bowman's valuable monograph on the Cotton Fibre.

When the boll bursts it exposes three to five cells, divided by membranous walls, and each of these cells contains seeds which are attached by filaments to the stem of the plant. The filaments ultimately disappear, leaving the seeds loose in



Fig. 4 Branch from Cotton Plant.

A — White flower. C — Square. D — Leaf. E — Young boll or capsule.

the cavity covered with cotton. Each seed is entirely enveloped by the cotton fibres attached to it, just as the human hair is attached to the head.

The seeds vary in number from thirty-two to thirty-six in each pod or boll. The view on Fig. 7 at A shows an empty pod or capsule, B is the seed cotton out of one cavity of the pod just as it appears after it has been removed by the fingers of the cotton picker, C shows the individual seeds with fibres of which the mass B is composed. In the next view, at D, is a reproduction of sections of these seeds with the fibres radiating in all directions, each attached at one end to the seed. The appearance of the boll before bursting is shown clearly on Fig. 3 at A, while at B bolls of almost similar size and growth are shown as having just burst. Botanists differ as to the exact cause of the bursting of the boll, but it is probably due to the increased space occupied by the fibre as it ripens and dries.

The cotton plant begins to flower in June and continues to do so until the early frost of winter.

The writer has seen newly opened flowers as late as October 11th in the most northern part of the cotton belt, but flowers are probably seen even later than this. Of course these late flowers do not produce fruit. As a rule no flower opening after the first week in September bears fruit.

Structure of the Fibre. It may be news to many interested in the cotton fibre to learn that the fibre itself, although apparently of such small diameter, is quite a complicated structure when examined under a microscope. The simplest description of a thoroughly developed cotton fibre is perhaps that of a collapsed tube with corded edges twisted many times throughout its length and having the appearance of an elongated cork-screw or carpenter's auger. According to one authority a perfectly constructed fibre is composed of four distinct parts: (1) An outside membrane which forms the hard outside skin of the fibre; (2) the red cellulose or olea-



Fig. 5. Cotton Plant showing leaves, flowers, closed and open bolls.

ginous deposit which forms about 85 per cent. of the fibre; (3) a central spiral fibre of a harder nature than the rest of the fibre, and (4) a matter secreted in the centre tube similar to that which occupies the core of a quill. Covering the outside membrane is what we might term a viscous varnish, but what is generally known as cotton wax. This wax amounts to about one-half per cent. of the whole. The views shown in Figs. 15 to 40 represent cotton fibres from various parts of the world, and the twisted formation which has been previously described is readily recognized. It is the fact of the existence of these convolutions which assists in the formation of a strong thread from a comparatively weak fibre such as cotton. In the formation of a thread the convolutions inter-lock with one another and help to resist any tension put on the yarn. These convolutions are less and less frequent as the fibre is less matured, and are almost altogether absent in the immature fibre, which has merely the appearance of a flattened ribbon when examined under a microscope. This immature fibre is transparent and has a glossy appearance, so that when it exists in any quantity in a bale of cotton it can be readily detected with the naked eye. It has the feature of not taking dye so readily as ripened cotton.

The reason of the existence of this immature fibre may be because some obstruction has been caused to the flow of sap in the plant, or some accident has occurred by which the twigs carrying the cotton bolls have been bruised or broken, or that the cotton has been gathered without having had time to fully ripen after the bursting of the boll. It is of great importance that the existence of the immature fibre should be detected in the samples from which the cotton is purchased. One of the best views of the cotton fibre under the microscope that I have seen is given at Fig. 8.

Dr. Bowman describes a typical cotton fibre as "a long tubular compound vegetable cell, from 1,200 to 1,500 times as long as it is broad. The outer or enswathing sheath of this

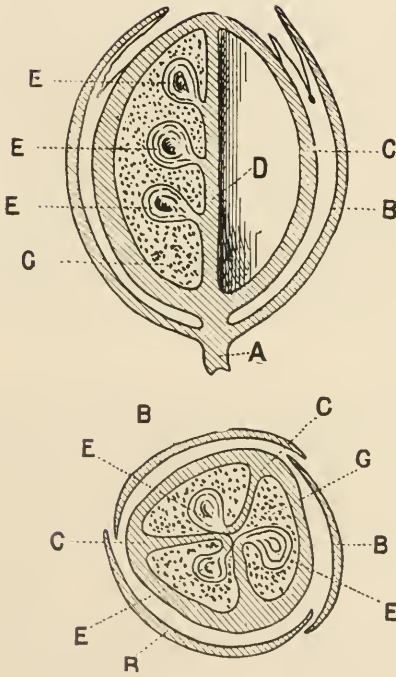
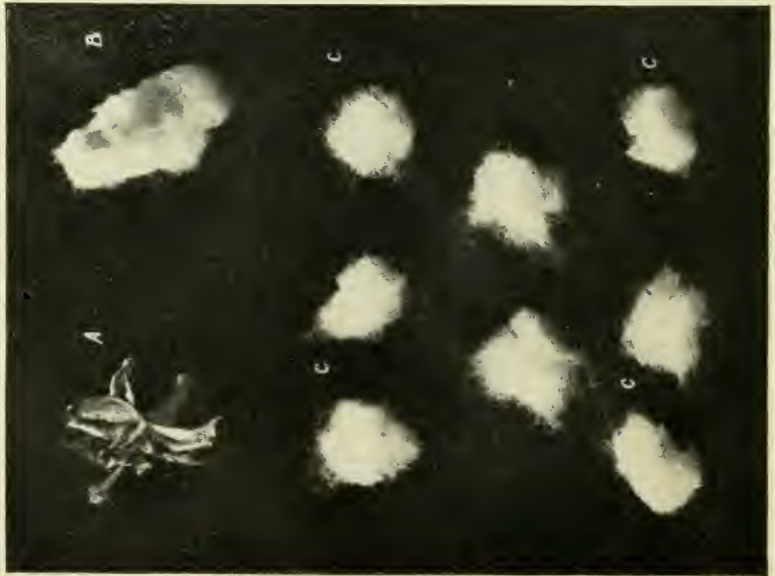


FIG. 6 Longitudinal and Transverse Section of Egyptian Cotton Pod.

A—Stem. B—Section of Calyx. C—Section of Carpel. D—Midrib with seeds attached.
E—Section of Seeds. G—Plexus of young Cotton Fibre.



FIG. 7. Cotton on the Seed



is a continuous liber cell of pure cellulose, similar to those which occur at the outside of the cambium-layer of dicotyledons, or the cells which form the outer part of the fibro-vascular bundles of monocotyledons, and which are also found in the branches of those containing no spiral structures; and the inner or thickening layers of the tube consist of secondary cellular deposits upon this outer epidermic layer, or else are formed by a gradual thickening of that layer itself arising



Fig. 8. Microscopic View of Cotton Fibres.

from the consolidation of the protoplasm or juices which supply nutriment, and which, by in some measure preventing the collapse of the thin outer sheath, strengthen and render it more elastic and expansible. The extreme outer layer appears to be formed of a continuous membrane, since no power which I have been able to apply to the microscope has enabled me

to detect even the most minute openings through its substance, and it is on this elementary pellicle that the cellular layers which appear to form the thickness of the tube walls are deposited in such a manner that they are, while united to it, still capable of being separated from it into distinct laminae.

I am aware that there are many botanists who make a distinction between the primary layer of liber cells and the thin pellicle which forms the sheath of such a vegetable hair as cotton, but, after all, the difference is one only of degree and not of kind, since it is extremely probable that the thickening of these hair walls arises from the successive deposits which occur within them during the process of growth, exactly in the same way as within the liber cell of wood fibre, only that these secondary deposits are not concentric like the layers within the liber cell of wood fibre, but consist in the development of a series of cells one over the other, whose walls are collapsed in upon each other, and which do not, except with the use of reagents, usually exhibit any signs of cellular structure; and in section from their extreme tenuity they can hardly be distinguished from a thickening of the outer pellicle or sheath itself. Hence, in the process of growth from the first formation of the hair within the boll to the mature fibre as it is fully ripe and ready for picking, we have every possible stage of this formation presented to us, from the immature fibre, where the thickening of the outer sheath has not yet begun, up to the perfectly ripe cotton.

In that stage of early growth, either within the unopened boll or just after its first opening, where the length of the tube is almost reached, a cross section of the hair presents us with a single line like the cross section of a steel band, presenting no structure or, at most, only a single line to indicate that it has any internal opening, the same as would be exhibited by an exceedingly thin tube squeezed flat under such pressure as to completely collapse the tube and form it into a ribbon. As

the development of the hair proceeds the thickness of the tube walls increases, and the ribbon-like structure gives place to a more and more distinct tubular form, when a central opening appears down the centre of the oval hair section.

In the perfectly ripe cotton the tubular form is distinctly seen in section, although from the want of strengthening layers in the spiral form, which always give increased rigidity, the shape is very seldom cylindrical; indeed, I have never seen it so except at the extreme end of the fibre, where there appears to be a tendency to form a more solid structure on account of the less diameter of the tube in proportion to the thickness of the walls."

Measurements of the Cotton Fibre. Many measurements have been made by various observers, among whom are Dr. Bowman, mentioned above, the well known English authority on cotton and wool fibres, H. Monie, Evan Leigh, O'Neill, M. Deschamps, and others, but the measurements do not agree in all cases.

The fact is that cotton fibres even from the same seed vary considerably in length and relatively in diameter, and only approximate measurements can be given. The diameter of a cotton fibre varies from $\frac{4}{10000}$ to $\frac{10}{10000}$ of an inch, and the length of the fibre from $\frac{1}{2}$ inch to $2\frac{1}{4}$ inches. Dr. Bowman is the authority for stating that there are 140,000,000 fibres in a pound.

Some very interesting measurements, admirable in their completeness, were made in connection with the tenth census of the United States by Prof. Ordway, and refer entirely to American cotton.

The general average for cottons of the United States is given by him as follows:

Length	{ inches	1.10
	{ millimeters	27.89
Width	{ $\frac{1}{10000}$ inch	0.91
	{ $\frac{1}{10000}$ millimeter	23.00
Strength	{ grains	125.60
	{ grams	8.14

This was obtained from detailed statistics by states as follows :—

AVERAGES FOR EACH STATE.

State.	No. of Samples.	Maximum length of fibre, Inches.	Minimum length of fibre.	Average length, Inches.	Width 1-1000 inch.	Breaking weight, Grains.	Weight of 5 seed, Grains.	Percentage of lint.
Alabama.....	60	1.427	0.789	1.027	0.896	137.8	12.38	32.96
Arkansas.....	13	1.143	0.965	1.036	0.917	134.7	13.36	32.85
Arizona.....	4	1.192	0.745	0.969	0.957	133.7	11.96	27.91
California.....	19	1.669	0.827	1.079	0.921	144.6	12.58	32.01
Florida.....	45	*1.910	0.854	1.384	0.793	124.1	12.64	29.14
Georgia.....	52	*1.572	0.806	1.066	0.913	136.9	12.80	33.18
Indian Territory.	2	1.140	1.023	1.081	0.905	119.3	13.42	31.87
Louisiana.....	24	1.267	0.862	1.069	0.882	127.5	13.01	33.08
Mississippi.....	18	1.282	0.810	1.047	0.957	134.3	12.11	34.01
Missouri.....	6	1.260	0.907	1.098	0.890	136.4	12.76	31.62
North Carolina.	94	1.357	0.695	1.058	0.929	132.7	12.55	33.21
South Carolina...	26	*1.996	0.766	1.234	0.957	120.3	11.80	31.62
Tennessee.....	7	1.131	0.821	0.992	0.898	133.3	12.33	33.10
Texas.....	72	1.380	0.819	1.075	0.897	132.8	13.07	32.34
Virginia.....	8	1.366	0.883	1.060	0.945	126.1	14.00	34.44
Total.....	450							

* Including Sea Island samples.

Chemical Composition of Cotton. Many chemical analyses of the fibres or lint have been made, but the most reliable analysis of American cotton was a determination of the proximate constituents found by the Tennessee Experimental Station to be as follows : —

Water	6.74 per cent.
Ash	1.65 " "
Protein	1.5 " "
Fibre	83.71 " "
Nitrogen-free extract	5.79 " "
Fat	0.61 " "
	100.00

showing that in its crude state, at least, it is far from being the pure cellulose it is often stated to be, a fact abundantly proved by other investigations.

Pure cotton fibre of which 83.71 per cent. is shown in the above analysis, is cellulose, a white substance, the chief constituent of all vegetable matter. It belongs to the class of carbohydrates, so called because it is a combination of carbon, hydrogen and oxygen, the two latter being present in the proper proportions to form water.

In order to arrive at this cellulose in analysing cotton fibres, it is necessary to remove all impurities by treating the fibre with various solvents, water, alcohol, ether and dilute acids. None of these will dissolve the cellulose, but they will remove all impurities which are likely to be found in cotton. The fibre itself can only be dissolved by concentrated sulphuric acid or by an ammoniacal solution of cupric hydrate.

Careful investigation of several analyses shows that probably not more than 86.5 or 87 per cent. is pure cellulose, even in the purest samples, and so large a proportion as thirteen per cent. of other substances being found in cotton, we cannot, therefore, consider cotton to be pure cellulose. In fact, there is a considerable quantity of mineral and other solid matter in cotton, which can best be detected by burning

the fibre at a low temperature and analysing the ash remaining. Perhaps the most reliable investigations on this point have been made by Messrs. Davis, Dreyfus and Holland. They took a portion from twelve different varieties of cotton, burned these to a white ash and mixed the ash from the twelve different samples together, afterwards analysing them. After deducting the sand the amounts were:—

Carbonate of potassium . . .	33.22	per cent., soluble in water.
Chloride of potassium . . .	10.21	“ “ “ “ “
Sulphate of potassium . . .	13.02	“ “ “ “ “
Carbonate of sodium or soda ash	3.35	“ “ “ “ “
Phosphate of magnesium . . .	8.73	per cent., insoluble in water.
Carbonate of magnesium . . .	7.81	“ “ “ “ “
Carbonate of calcium or lime . .	20.26	“ “ “ “ “
Peroxide of iron or ferric oxide	3.40	“ “ “ “ “
	100.00	

The above table gave the analysis of the ash, but did not state what proportion this bore to the bulk of the cotton, but the same analysts also conducted a series of experiments to determine the amount of sand and mineral matter contained in different classes of cotton. The samples were taken out of the bales upon their arrival in Liverpool. The following are the results:

Dhollerah	6.22	per cent.
Sawginned Dharwar	4.16	“ “
Bengal	3.98	“ “
Sawginned Broach	3.14	“ “
Oomrawuttee	2.52	“ “
Egyptian Brown	1.73	“ “
Peruvian, (soft)	1.68	“ “
Pernam	1.60	“ “
American	1.52	“ “
Sea Island	1.25	“ “
Egyptian White	1.19	“ “
Peruvian, (rough)	1.15	“ “

It will be seen from these figures that some varieties are very low in ash, such as Sea Island, rough Peruvian and

white Egyptian : while others of them, such as Dhollerah, Dharwar, Bengal and Broach contain considerable quantities. Some of the latter, especially the Dhollerah, contain large quantities and are very dirty. As a rule, it may be taken for granted that an excess of ash much above one per cent. arises from the presence of sand and carbonate of lime, which being only mechanical impurities will be removed by the processes through which the fibre is passed in manufacturing it into yarn.

Moisture in Cotton. There is a quantity of water always present in cotton, which cannot be driven out by a moderate heat, and, in fact, after it has been expelled by excessive heat, is replaced by a percentage of moisture from the atmosphere after the super heated cotton is allowed to stand in the open air. This water which exists in cotton naturally is given in the above analysis made in Tennessee, as 6.74 per cent ; it is given by Dr. Bowman as from five to seven per cent., and these figures are confirmed by a number of tests that have been made by the writer personally. This moisture is necessary to the satisfactory manipulation of the fibre in spinning, and if for any reason a portion of this natural moisture is driven out the spinning of the yarn is rendered more difficult until the moisture is replaced in the air. This natural moisture may be called the water of hydration, as distinguished from artificial moisture added in order to weight cotton, or absorbed by the cotton when lying on the open railroad platforms, or in the yards of the cotton ginnery or farms. Usually there is from one to two per cent. of moisture in cotton which can be driven out at a temperature of seventy to seventy-five degrees Fahrenheit in a dry room, and which is not reabsorbed by the cotton when it is placed in the open air under normal conditions. Quite a number of tests that have been made by the writer with American cotton tends to show that the excess of water above the water of hydration averages about one and one-fourth per cent.

Cotton Wax. Dr. Schunck in the proceedings of the Manchester, England, Literary and Philosophical Society, communicated considerable information on analyses of cotton and especially cotton wax.

This is a fatty substance found in very slight quantities coating the cotton fibre. The analysis of this wax, which is present from one-half to one per cent. in American, is given as carbon, 80.38, hydrogen, 14.51, and oxygen, 5.11 per cent. The wax fuses at 186.8 degrees Fahrenheit and solidifies at 179.6 degrees Fahrenheit.

Other Fibres. It is sometimes necessary to determine whether a fabric or a yarn is made of cotton or not, and while the experienced manufacturer is usually able to detect this by the appearance of the fabric, there are several tests which can be applied. In the first place a microscope is useful, as the appearance of the cotton fibre when highly magnified is different from that of silk, linen, or wool; the wool fibre being covered with overlapping scales, silk being smooth like a glass rod, and linen showing the vascular fibre bundles which make up the complete fibre.

The difference between cotton, wool, flax and other fibres is admirably shown in figures No. 9, 10, 11 and 12. These have been prepared by Mr. Henry G. Kittredge, the editor of "The Textile World," Boston, Mass., from investigations made by him on the nature of textile fibres. Figure 9 shows an immature cotton fibre a week before the opening of the boll, immediately before the opening of the boll, and also some considerable time before the opening. It also indicates the convolution of the cotton fibre as exemplified in American Uplands, Peruvian and Japanese cottons. The flax fibre from which linen yarn is made, and also the ramie or China grass fibres are shown on Fig. 10. The flax fibre is built up of fibre bundles only noticeable under the microscope and which are indicated in Fig. 10, which has been magnified four hundred times. The wool fibre is shown in Fig. 11 and it

will be noticed especially on the third fibre, the American merino wool, that it is covered with scales overlapping one another. If a section were prepared it would show saw-like edges. The existence of these serrations accounts to a large extent for the felting property of wool and for the fact of woolen goods shrinking after being wet. Fig. 12 shows a

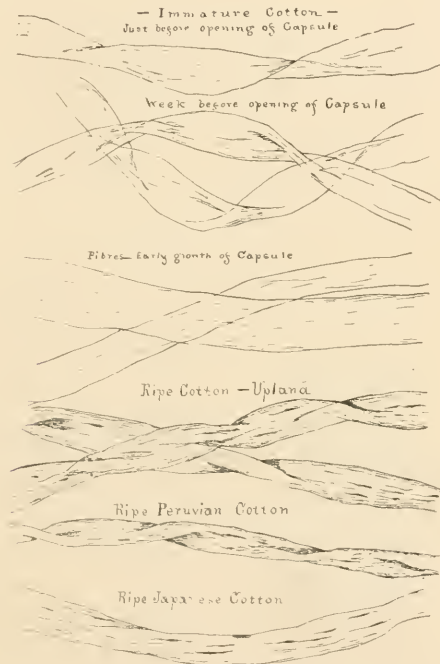


Fig. 9. Ripe and Unripe Cotton Fibres.

transverse section of wool fibres, while Fig. 11 shows transverse sections of cotton fibres.

In addition to the microscopical test another is made by burning a small portion of the yarn or fabric: in the case of cotton, this usually burns with a flash, leaving a very light ash. Animal fibres, on the contrary, such as silk and wool,

burn more slowly, emitting an offensive odor and leaving a curled bead, or lump of carbonized matter. Chemical tests may also be made by which the nature of the fibre may be determined without any doubt.

In applying chemical tests to determine the fibre of which a yarn or fabric is manufactured, the first test is to find out

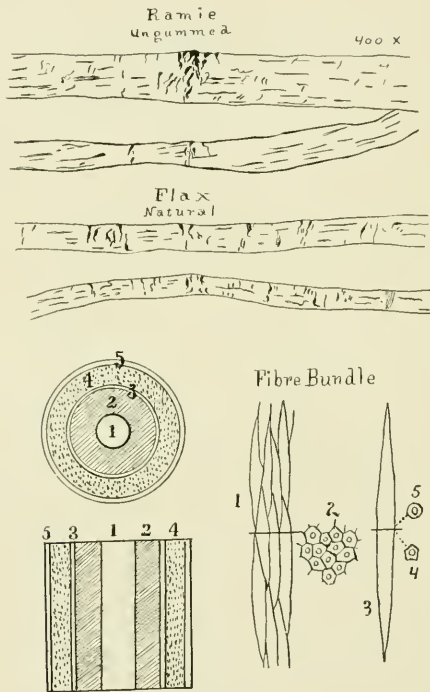


Fig. 10. Flax and Ramie Fibres.

whether it is an animal or vegetable fibre. The best test for this purpose is to boil the material in caustic potash lye, e. g. a solution containing about five per cent. of the caustic soda. After boiling about ten minutes, it will be found that all the animal matter is dissolved, and then the material must be washed in water to remove the caustic soda. Whether the

fibre mixed with the cotton is wool or silk, the test removes either of these animal substances.

Fig. 13, which is another view prepared by Mr. H. G. Kittredge, exhibits fibres at different stages of dissolution under Schweitzer's solution, previously named as an ammoniacal solution of oxide of copper. Mr. Kittredge says:—

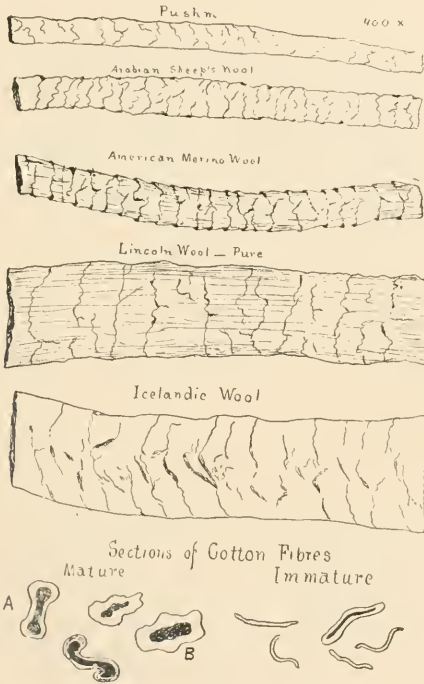


Fig. 11.

“This is the only known liquid in which cellulose dissolves without undergoing a chemical change, and its peculiar action on cotton is something of very recent discovery and publicity. Charles O'Neill, an English chemist of repute, was attracted to the action of this solution upon the cotton fibre, thirty-four years ago, but his inferences were disputed or held in doubt for

many years, or until 1883, when so excellent an authority on the use of the microscope as John Butterworth, of Shaw, England, confirmed the correctness of Mr. O'Neill's observations, which are diagrammatized at "O" and "OO" Fig. 13. The results of Mr. Butterworth's experiments inspired me to try them, and I was happily successful: but the phenomenon

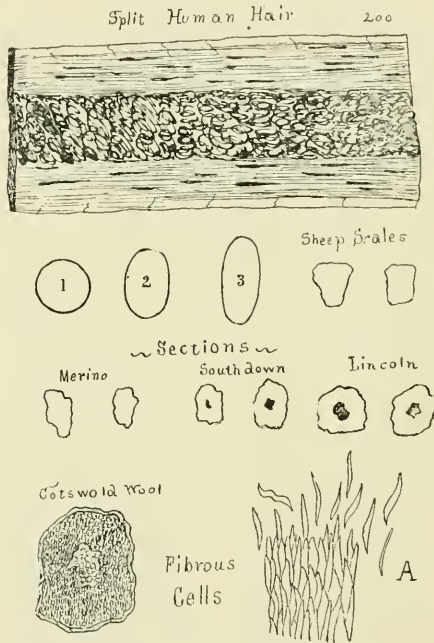


Fig. 12. Wool and Hair.

at C is something I have never been able to get, owing, possibly, to my not using strong enough magnifying power. The longitudinal striae, as seen in figure O, and evolved at A, can be seen while the fibre is undergoing its transformation, but not otherwise. The binding threads at B form a feature of intense interest to the observer as the fibre passes through its meta-

morphic career. If the solution is strong and the swelling of the fibre rapid, these thread-like bands sometimes burst and throw out tiny ends, as will be seen at B. The striated character of the fibre and the internal spiral core is seen in figure O O. Figures X to XXXXX are true representations of cotton fibres at moments of cessation to the influence of

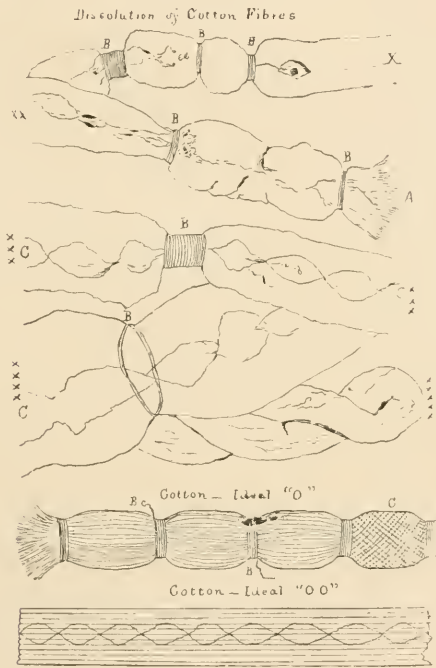


Fig. 13. Cotton Fibres Under Chemical Action.

Schweitzer's solution. These were obtained under a magnifying power of 400 diameters. The thread-like bands are to be seen at B, the expanded striæ at A, and the spiral core at C. Figure XXXXX shows a fibre that has assumed a knotted twist, one of the many shapes cotton fibres take in their convulsions when submitted to the action of the foregoing solution. The

bands *B* seem to be of tougher substance than the rest of the fibre, as they sometimes are alone left in the field of vision. The query, of course, naturally arises, what are the functions or meanings of these bands or rings, and core? The problem thus presented remains unsolved. Still it possesses this advantage, that any fibre having these characteristics is assuredly cotton and nothing else. My observation has been that an ammoniacal solution of oxide of copper acts quicker upon new than upon old cotton. This I attribute to the outside membrane of old cotton being less soluble, or more difficult of penetration, due to the hardening of the waxy covering."

Bleached flax has about the same chemical composition as bleached cotton, and it is difficult to find a chemical test that is of any service in indicating the difference between the fibres. Perhaps the best chemical test is to again use the caustic soda solution of considerable strength. In this case, the linen becomes deep yellow while the cotton is only slightly tinged. There are certain dyes which, when applied cold, give a very deep shade on silk, a light shade on wool, and an almost colorless effect on cotton. Magenta is one of these dyestuffs.

With a judicious combination of chemical and microscopic tests, the nature of the fibre entering into the manufacture of any fabric can be accurately determined.

Strength of the Cotton Fibre. The strength of individual cotton fibres varies from 75 to 300 grains, according to the kind of cotton, the distance between the points of suspension in making the test, and the portion of the fibre selected for the test. The fibre being weaker at the end furthest from the seed of course supports a smaller weight when the test is made with the points of suspension at each end of the fibre. This is proved by five different experiments on the same fibre of Sea Island cotton.

1st test	1.7 inch	broke with	18.1 grains	at .5 inch	from one end.
2d test	1.0 "	" " "	70.9 "	" "	.1 " " " "
3d test	.8 "	" " "	97.1 "	" "	.1 " " " "
4th test	.5 "	" " "	126.2 "	" "	.2 " " " "
5th test	.2 "	" " "	133.3 "	"	

The first test was made with 1.7 inch between the points of suspension when the fibre broke with a strain of eighteen grains. The fifth test had only .2 inch between the points of suspension and the fibre supported 133 grains. Taking an average of about .2 inch between the points of suspension and selecting that portion of the fibre furthest away from the tapering end, or in other words, nearer to the root, the average breaking weights have been found to be as under:—

Edisto Sea Island	83.9 grains
Another sample, Sea Island	90.0 "
Third sample, Sea Island	102.6 "
American Upland Cotton	104.5 "
Egyptian	108.0 "
American Mobile Cotton	118.8 "
American Orleans	139.7 "
Pernambuco, Brazilian	140.2 "
Dhollerah, Indian	141.9 "
Comptah, Indian	163.7 "

Cottons of the World. While the cotton crop of the United States is the most important in the world, and the most useful, in fact, being of such importance that the price of American cotton practically controls the price of other cottons, there are numerous cotton fields in various parts of the world where extensive crops are raised, and the product used for purposes for which American cotton cannot be utilized.

The most important cotton growing countries after the United States are India, Egypt, China, and Brazil.

A diagram (Fig. 14) shows the proportion of cotton raised in several countries to the world's crop in 1895-6, from information supplied by Col. Shepperson.

Sea Island cotton of the United States represents the highest as regards quality, is spun in the finest yarn, and used very largely for thread, laces, and fine cambrics. Next approaching in fineness of quality and length of staple is the Brown Egyptian cotton, so called because of its brownish tinge, which is a distinctive feature of this fibre. This is

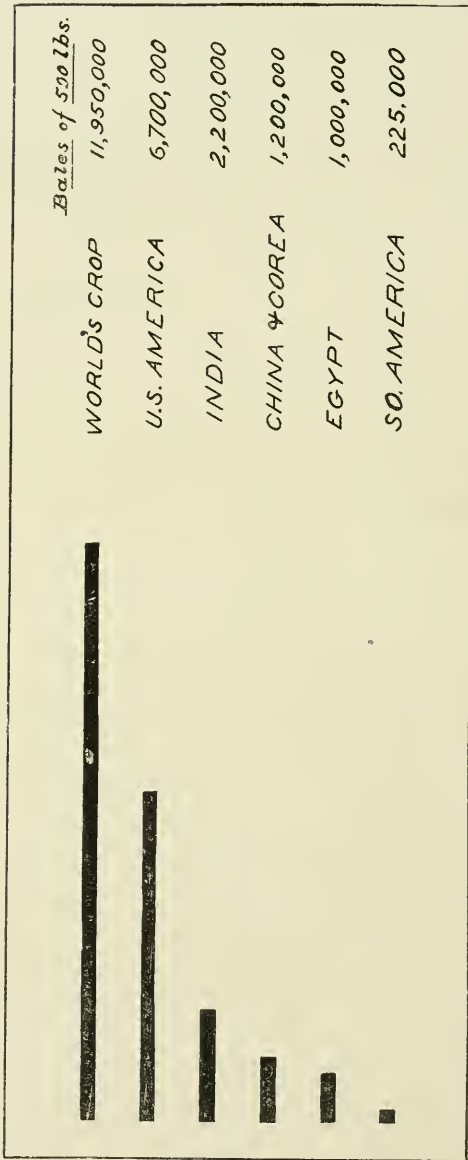


Fig. 14. Diagram to Scale — Cotton Crops of 1895-6.

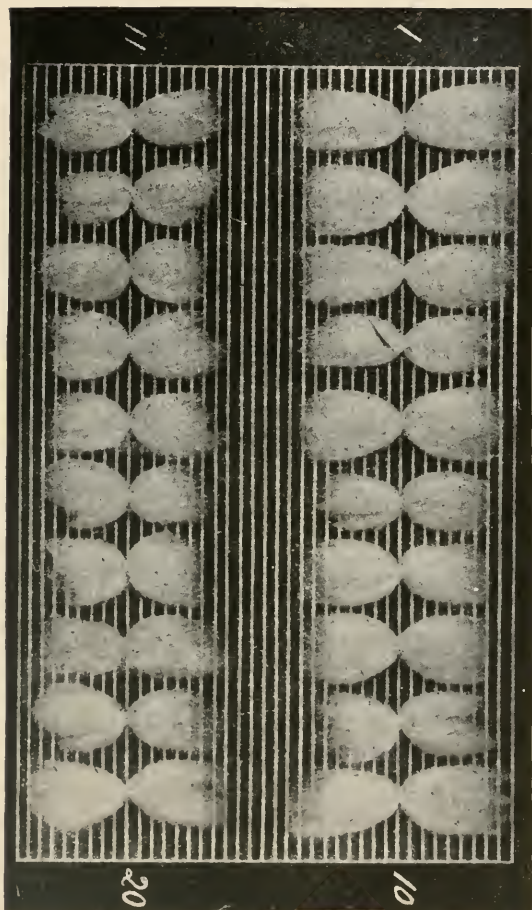


Fig. 16. Comparative Lengths of Cotton Fibres to Scale.

- | | | |
|--------------------------------------|---------------------------|-------------------------|
| 1. Sea Islands Extra Fine, American. | 7. White Egyptian. | 13. Ceara, Brazil. |
| 2. Sea Islands, Georgia, American. | 8. Ashmouut, Egyptian. | 14. Macoio, Brazil. |
| 3. Sea Islands, Florida, American. | 9. Smyrna, Asia Minor. | 15. Pernambuco, Brazil. |
| 4. Sea Islands, Tahiti. | 10. Smooth Peruvian. | 16. Maranhao, Brazil. |
| 5. Gallini, Egyptian. | 11. Rough Peruvian. | 17. Paratia, Brazil. |
| 6. Brown Egyptian. | 12. Ito Grande, Brazil. | 18. Red Peruvian. |
| | 19. Allan seed, American. | 20. Iwclers. |

very largely used for fine cotton yarns and goods of all varieties. Among other long staple cottons, which are not important commercially, are the Tahiti Sea Island, the Peruvian cotton, the White Egyptian, and the Egyptian Gallini cottons. The next grade of cotton of any importance is known as Brazilian. It has a staple somewhat longer than the average American cotton, but is somewhat rough in appearance and touch. The American cottons form the next class as regards quality, varying from the fine Mississippi cottons, Peelers, Benders, to the short clean Uplands cotton.

China produces one of the largest crops of cotton, after the United States, which is almost all consumed in that country. It is a beautiful white cotton, somewhat harsh to the touch, but unfortunately for its commercial importance is comparatively short staple, being about the length of the shortest American Upland cotton. The East India crop is also large, but is regarded as being both the dirtiest and the shortest staple cotton produced.

Owing to the long seasons of considerable heat required in order to bring cotton to maturity, this fibre can only be profitably cultivated in certain regions bordering on the north and south of the equator. This is usually described in text books as being the regions bounded by the line of latitude 45° north and 35° south of the equator, but no such arbitrary divisions can be made, as the isothermal lines have to be taken into account; for instance, a line drawn along 45° north latitude, includes such districts as New England, portions of Nova Scotia and Canada, where it is impossible to grow cotton, while if the lines were drawn about 38° north latitude, which is the northern limit of cotton grown in the United States, it would exclude portions of Turkestan, Southern Italy, Greece and other districts where it is possible to cultivate the cotton plant with success. Thus an isotherm must be followed along the lines of equal temperature in the northern hemisphere, and another isothermal line in the southern hemisphere.

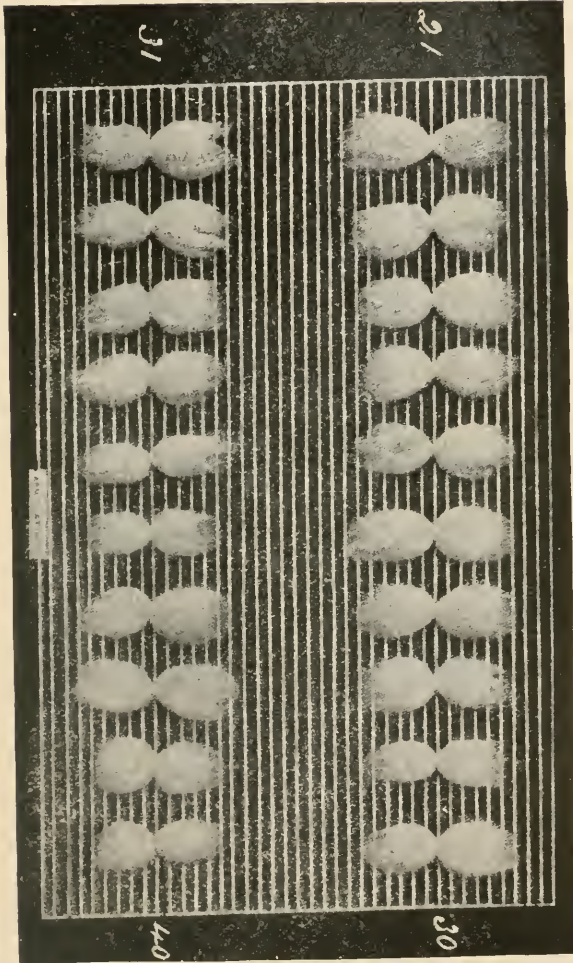


Fig. 17. Comparative Lengths of Cotton Fibres to Scale.

- | | | |
|--------------------------|--------------------------|------------------------|
| 21. Benders, American. | 27. Texas, American. | 33. Dharwar, Indian. |
| 22. Nashville, American. | 28. Hinglunghat, Indian. | 34. Comptah, Indian. |
| 23. Orleans, American. | 29. Oomrawitsee, Indian. | 35. Dhollerah, Indian. |
| 24. Memphis, American. | 30. Broach, Indian. | 36. Setnde, Indian. |
| 25. Ordinary, American. | 31. Rangoon, Indian. | 37. China. |
| 26. Uplands, American. | 32. Tinnivelly, Indian. | 38. Lagos, African. |
| | 39. Bengal Indian. | 40. Assam, India. |

This practically includes on the American continent, all the southern states of the Union, including portions of Virginia, North Carolina, Tennessee, all of Georgia, South Carolina, Alabama, Mississippi, Texas, Louisiana, Arkansas and parts of Indian Territory, Southern California and Florida, Mexico and Central American Republic; also in South America, Peru, the Argentine, Brazil, Venezuela, Guiana.

In Europe, the Islands of Malta, Sicily and southern portions of Spain, Italy, parts of Greece and Turkey.

In Asia, includes Arabia, Persia, Turkestan, India, China, Japan and some of the islands in the Malay Archipelago.

In Africa a very large region is suited for the cultivation of cotton, but at present it is cultivated only in Egypt, in some of the countries on the western coast and a little in South Africa.

In Australasia, Queensland is suited for the cultivation of cotton, as also are the Fiji Islands. A diagram on page 50 gives the quantities grown proportionately in each of the leading cotton producing countries of the world, and is instructive in showing the relative importance of these countries, according to the quantities they raise. Figs. 16 and 17 are two views showing the relative lengths of staple of cottons from various countries, and below will be found a table showing the relative importance of cottons raised in various countries according to quality:

A list of the more important varieties, with the best cottons first, is:—

- Sea Island.
- Peruvian.
- Brown Egyptian.
- Brazilian.
- American.
- Chinese and Indian.

This list could be largely extended, but further details are given on succeeding pages.

Sea Island Cotton. Sea Island cotton is the name used commercially to indicate the United States Sea Island cotton. This is grown on Edisto, St. Helena, Port Royal, James and John Islands off the coast of South Carolina, St. Simon and Cumberland Islands off the coast of Georgia, and others. It is recognized as being the best cotton that is grown in any part of the world. Very careful attention is given to its cultivation and ginning, quality being considered before quantity, and thus Sea Island cotton has a long, fine, strong and silky staple with comparatively regular convolutions, of a diameter from



FIG. 15. American Cotton Fibres, sections to scale $\frac{1}{1000}$ inch between parallel lines.

- | | |
|---------------------|----------------|
| 1. Gulf or Orleans. | 4. Peelers. |
| 2. Benders. | 5. Nashville. |
| 3. Memphis. | 6. Allan seed. |

.0004 to .0006 of an inch, ranging in length from one and three-eighths to two and one-fourth inches. It is largely used for thread and lace making purposes, and is regularly spun from 150s to 400s yarn, and occasionally even for commercial purposes as high as 600s. It is said that numbers 2150s were spun from Sea Island cotton at the great exhibition of London in 1851. The leading American market for Sea Island cotton is Charleston, South Carolina.

Where a very strong fibre is required for heavy yarns Sea Island is sometimes used, as for example, the linings of bicycle

tires, sail cloth, and so on. Figs. 18 and 19 show views of Sea Island cotton as seen under the microscope.

Sea Island cotton is ginned altogether by the roller gin. The crop is about 93,000 bales per annum. The variety Florida Sea Island, so called, is grown on the mainland of Florida from Sea Island seed. This is somewhat inferior to the Sea Island proper. It is a very useful cotton for yarns which require to be a little better than those made from Egyptian cotton. It has a white, glossy, strong fibre, a little coarser

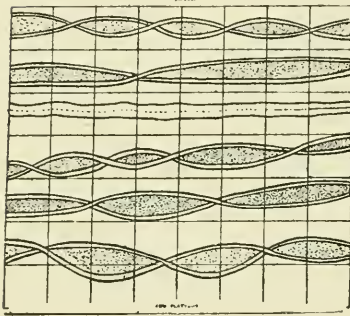


FIG. 18. Sea Island Cotton, extra fine. Longitudinal views to scale $\frac{1}{1000}$ inch between parallel lines.



FIG. 19. Sea Island Cotton. Sections to scale $\frac{1}{1000}$ inch between parallel lines.

- | | |
|----------------|-------------|
| 1. Extra fine. | 3. Florida. |
| 2. Tahiti. | 4. Georgia. |

than strict Sea Island, and is not quite so carefully cultivated. It is suited for yarns from 150s to 200s. Other Sea Island cottons are described under African and Australian cottons. See Table of Long Staple Cottons.

American Cotton. While the above Sea Islands cottons are American, this name is seldom applied to them, but is used to indicate the typical cotton of the world, which is grown in the Southern States of the American Union and used in all parts of the world where cotton spinning mills exist. The cotton described commercially as American is suited for

medium numbers of yarn, is usually clean, fairly regular in length of staple, satisfactorily graded, and consequently is one of the most reliable and useful cottons for a manufacturer's use. The quantity is greater than that produced in all other parts of the world together, and consequently the price of American cotton in Liverpool, which is the greatest market for it, regulates the price of cotton throughout the world.

American cotton may be divided into three important classes : New Orleans or Gulf cotton, Uplands or Boweds, and Texas cotton.

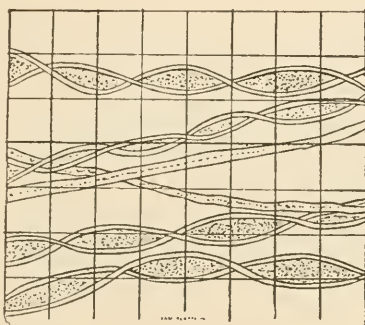


FIG. 20. Orleans or Gulf Cotton, American.
Longitudinal views to scale $\frac{1}{1000}$ inch
between parallel lines.

New Orleans or Gulf cotton usually consists of cotton raised in the basin of the Mississippi river, including the states of Louisiana, Mississippi, parts of Arkansas and Alabama. The name Gulf cotton is more usually applied in America from the fact that most of this cotton is shipped to ports on the Gulf of Mexico, especially New Orleans. In Europe the word New Orleans is usually applied, and is derived from the shipping port of that name. This style of cotton may be subdivided into others, known as Memphis, Benders, Allan-seed, Peelers and so on ; these being the names originally intended to represent certain styles of cotton, but which have been very much misapplied of late years.

New Orleans or Gulf cotton (Fig. 20) is from one to one and one-fourth inches in length of staple, from .0004 to .0007 of an inch in diameter, and is usually used for yarn from 28s to 44s warp and from 50s to 70s filling or weft. It is not usual to spin below these numbers, unless higher grade yarns are required. The Benders or Bottom Land cotton (Fig. 21) supposed to be grown at the bends of the Mississippi River, which are occasionally flooded and consequently well fertilized by the silt of the river, is one of the best grades of New Orleans cotton, and is used for the higher numbers named

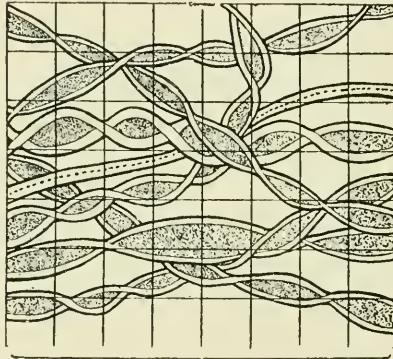


FIG. 21. Benders Cotton, American. Longitudinal views to scale $\frac{1}{1000}$ inch between parallel lines.

above. Peelers is a somewhat similar cotton, is used for similar yarns, is bluish-white rather than cream colored, and somewhat resembles short Florida Sea Island.

Uplands cotton (Fig. 22) is grown in the undulating country between the ocean and the mountains in the states of Georgia, North and South Carolina, Virginia and Alabama. It is usually used for filling yarns or weft yarns between numbers 30s and 40s, although it may be spun up to 45s or 50s if required. The length of the staple is from three-fourths of an inch to one inch and the fibre in diameter is from .0006 to .0007 of an inch. This cotton is usually very clean.

The cultivation of Texas cotton (Fig. 23) is largely on the increase, and for coarse warp yarns this is the most suitable style of cotton. In dry seasons it is apt to be somewhat harsh and brittle, and cannot be relied upon as well as New Orleans or Uplands cotton. The staple is usually from seven-eighths to one inch in length, sometimes exceeding this, in diameter from .0005 to .0007 of an inch. Numbers 26s and 32s warp yarns and 32s to 40s filling yarns are often made from Texas cotton, although it is eminently useful for warp.

Central and South American Cottons. The cotton crop of

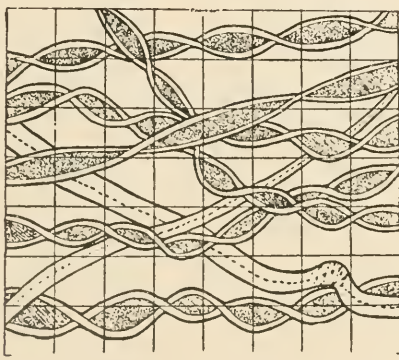


FIG. 22. Uplands Cotton, American. Longitudinal views to scale $\frac{1}{1000}$ inch between parallel lines.

Mexico is not of very great importance, being about 50,000 bales of 500 pounds each. The cotton is usually clean, of cream color, but is not very strong. The staple is usually harsh, and is the fruit of the cotton tree, which is a perennial. Undoubtedly a very much larger area can be used for the cultivation of cotton, especially in the zone along the Gulf of Mexico. The largest production of cotton is in the Laguna District in Central Mexico, about 400 miles from the United States frontier, in the province of Oajaca, in Compeche and Yucatan.

Formerly a large quantity of cotton was raised in the West Indian Islands, Hayti or San Domingo, Anguilla, Porto Rico, and also in the British possessions in the northern part of South America, British and French Guiana, the principal varieties of which being Surinam, Berbice, Cayenne, Demerara; also in the states of Columbia, Guatemala and Honduras and the countries now forming the Greater Republic of Central America.

Owing to the increase of cultivation of sugar, and for other reasons, the growth of cotton has diminished considerably, until now there is very little grown in these countries, except-

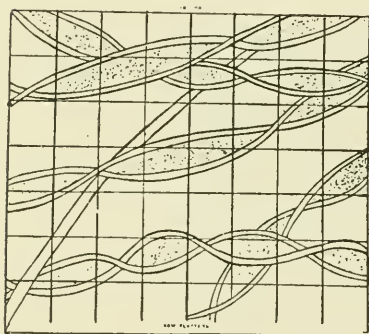


FIG. 23. Texas Cotton, American. Longitudinal views to scale $\frac{1}{1000}$ inch between parallel lines.



FIG. 24. Brazilian Cotton. Sections to scale $\frac{1}{1000}$ inch between parallel lines.

- | | |
|----------------|----------------|
| 1. Rio Grande. | 4. Maceio. |
| 2. Paraiba. | 5. Ceara. |
| 3. Maranham. | 6. Pernambuco. |

ing what is used in home manufactures; and it is somewhat rare to find any of these cottons in any of the open markets of the world. The staple is generally smooth and fine, the cotton runs from one and one-eighth to one and three-eighths inches in length, while the Island cottons are occasionally found as long as one and one-half inches. The brownest sample of cotton that the writer has seen was grown in Guatemala.

The coast of northern and north-eastern Brazil is one of the main sources of the world's cotton supply, and with greater enterprise and industry the crop could be immensely increased.

For several hundred miles along the coast, a belt of about fifty miles wide is devoted to the cultivation of sugar, and the upland region lying behind this is, for a considerable distance available for, and partially utilized in, the cultivation of cotton, thus forming a belt of country several hundred miles long and two hundred miles wide, on which long-staple cotton admirably suited for warp yarn can be grown.

The cotton is badly cultivated, badly ginned, large quantities of seed being found with the lint, and little effort seems to be made to improve it. The cotton grown in all this section

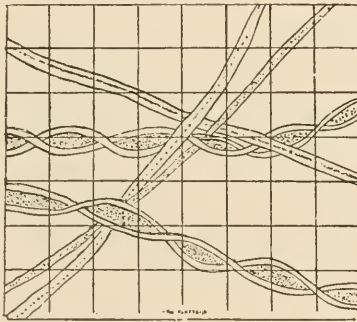


FIG. 25. Pernambuco Cotton, Brazilian.
Longitudinal views to scale $\frac{1}{1000}$ inch
between parallel lines.

is of a comparatively uniform character, and is usually classed according to the seaport from which it is shipped. These ports are, Ceara, Maceio, Maranham, Bahia, Paraiba, Aracaju, Aracati, and so on. The Maranham and Ceara are considered to be about the best of Brazilian cottons, but there is not a very great deal of difference in quality between any of them. Pernam or Pernambuco are grown in the province of the latter name. The variety known as Santos was formerly cultivated from American seed, but is not now of much commercial importance. Brazilian cotton has a length of staple from one to one and three-eighths inches, and diameter of .0006 to

.0008 of an inch. The crop of 1893-4 was estimated at 300,000 bales of 500 pounds, or about 900,000 of the Brazilian bales, which are only about one-third the weight of an American bale, being made so small on account of being carried to the coast from the cotton fields on horse or mule back. Microscopical sectional views of several kinds of Brazilian cotton are shown in Fig. 24, and longitudinal views in Figs. 25 and 26.

Very little cotton is exported from the Argentine, but with proper attention the cotton crop might be largely increased and made an important article of commerce. The writer has

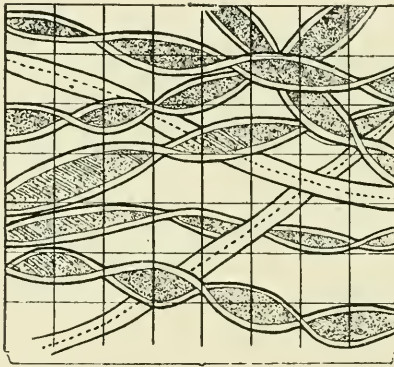


FIG. 26. Maranham Cotton, Brazilian.
Longitudinal views to scale $\frac{1}{1000}$ inch
between parallel lines.

examined a number of samples of excellent cotton grown in the interior provinces of the Argentine, of which the Rioja and Parana varieties are the best, being from one and one-fourth to one and one-half inches in length of staple, almost white in color. The Sanluis is fully as long, but has a reddish tinge, while the Catamarca, Salta and Sante Fe varieties are shorter, about three-fourths to one and one-fourth inches in length, of a decidedly reddish tint. All are black seed cottons.

The only other cotton of any importance grown on the American continent is the Peruvian cotton. There are three

varieties of this cotton. — Peruvian Sea Island, Peruvian Rough, and Peruvian Smooth. The Rough Peruvian (Fig. 27) is the most important commercially on account of its great suitability for mixing with wool, because of its long, harsh, wiry fibre. Rough Peruvian varies from one and one-fourth inches to one and one-half inches in length, and from .0006 to .0008 of an inch in diameter. It is usually used for warp yarns from 40s to 70s, one German authority giving 80s as possible numbers to be made from it. Some of the Rough Peruvian is very "high colored," and some of it, "Red," is

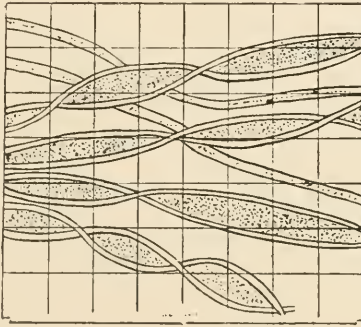


FIG. 27. Rough Peruvian Cotton. Longitudinal views to scale $\frac{1}{1000}$ inch between parallel lines.

raised on copper soil. The Smooth Peruvian, an exotic from American seed, is of much shorter maximum length of staple, and more generally resembles Orleans or Gulf cotton, and is used for somewhat similar numbers.

The Peruvian Sea Island, so called, is grown on the mainland from American Sea Island seed, and ranks almost equal to the Florida Sea Island. The length of staple is about one and one-half inches, in diameter from .0004 to .0007 of an inch, and is used for 100s to 150s yarn, usually for doubling purposes. It is not quite so clean as the so called Sea Island cotton from other countries.

Mr. Fr. Jac. Andres, of Boston, says, regarding Rough Peruvian cotton :—

“The native variety is a product of the ‘*Gossypium Peruvianum*,’ a perennial shrub growing from ten to fifteen feet high, and found in the tropical countries of South America, and most abundantly in the coast districts. It flowers and bears fruit for about seven years, though most abundantly and of the best quality after the rainy seasons in the second, third and fourth year’s growth. The cotton yielded by this plant is long, strong, rough, crinkly staple (called vegetable wool), and therefore excellently suited for admixture with wool for many purposes of manufacture. Its price has no relation whatever to the value of other descriptions of cotton, but is regulated by the price of ‘wool’ and the supply of Rough Peruvian cotton.”

Egyptian Cotton. Among African cottons, the Egyptian, of course, is the most important and the most valuable. Formerly it was cultivated only in the lower parts of the Nile valley, but during the last twenty years very great strides have been made in introducing the cultivation of cotton in upper and middle Egypt. Great attention has been given by the government to improve the methods of cultivation. Five to ten years ago there were probably more varieties of cotton cultivated in Egypt than in any other country, including Gallini from Sea Island seed, Brown Egyptian from indigenous seed, and White Egyptian from American seed, but experience has shown that the Brown Egyptian, known on the continent of Europe as Mako, or sometimes Jumel, is the most suitable and profitable for cultivation. This is a variety of cotton which lends itself admirably to the processes of combing, and is used very largely in Europe, especially in Russia. The imports also in the United States are increasing year by year. One objection to the Brown Egyptian, or Mako, is its color. This varies from a dark cream to a brown, according to the variety of the cotton, and is caused by the presence of

endochrome associated with the cellulose forming the fibrous sheath. One feature of this cotton is that its diameter is very regular.

The size of the crop and the quality of the fibre depend very largely on the annual over-flow of the Nile, although the irrigation works, which are now being constructed under the guidance of the British government, are helping to render the farmers somewhat more independant of the annual flood.

Extensive irrigation and drainage systems are in course of construction, which will doubtless greatly increase the area



FIG. 28. Egyptian Cottons. Sections to scale $\frac{1}{1000}$ inch between parallel lines.
 1. White Egyptian. 3. Gallini.
 2. Smyrna, Asia Minor, cotton. 4. Ashmouni.
 5. Smyrna, Asia Minor, cotton.

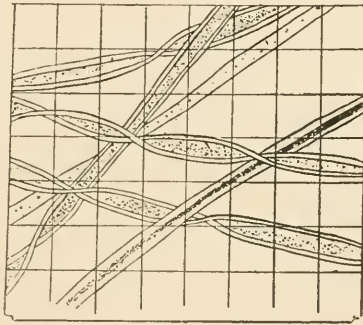


FIG. 29. Brown Egyptian Cotton. Longitudinal views to scale $\frac{1}{1000}$ inch between parallel lines.

of cotton culture. Moreover, other crops are being abandoned to some extent and cotton substituted for them.

The present production in Egypt is about 577,500,000 pounds of fibre, practically the whole of which is exported, and 22,275,000 bushels of seed, of which the greater part is exported.

Mako-Jumel, the name given to the variety of cotton first cultivated, experienced many changes and evolutions in Egypt, gradually changing its color to yellowish brown, and this new variety was known as Ashmouni, from the valley of

Ashmoun, where this change was first noted. The principal varieties of Egyptian cotton are the Ashmouni, Mitafifi, Bamia, Abbasi, and Gallini (Fig. 28). For many years the Ashmouni formed the bulk of the Egyptian crop, but it is now almost entirely superseded by the Mitafifi. In color it is a lightish brown, and its staple is one and three-sixteenths to one and three-eighths inches in length. Its cultivation is continued in some parts of Egypt, but the production of this variety is decreasing every year. Sections of it are shown at 4 in Fig. 28. In Upper Egypt, however, it is more extensively cultivated, the soil there being less favorable to Mitafifi.

The Mitafifi cotton was discovered by a Greek merchant in the village of that name. The seed has a bluish-green tuft at the extremity, which attracted the merchant's attention, and on planting it, he found that it possessed decided advantages over the old Ashmouni. It is more hardy and also yields a greater proportion of lint to the seed. At first from 315 pounds of seed cotton 112 pounds of lint were secured, and sometimes even more. It is now somewhat deteriorated and rarely yields so much, averaging about 106 pounds of lint to 315 of seed cotton. The Mitafifi is a richer and darker brown than the Ashmouni. The fibre is long, very strong, and fine to the touch, and is in greater demand, in fact it controls the market. It is shown in Fig. 29, reproduced from a microscopic view, and again in section at 1 in Figs. 28 and 30.

Next to Mitafifi, Bamia is an extensively cultivated variety in Lower Egypt. It was discovered by a Copt in 1873. The plant is of a large size and coarse growth. It is later and less hardy than the Mitafifi, and the fibre is poor as compared with that of the Mitafifi and Abbasi, light brown in color, and not very strong. In general it may be said this variety is inferior to Mitafifi in yield, hardiness and length and strength of fibre.

Abbasi is a variety of recent introduction and is not yet very extensively grown. It was derived from the Mitafifi

through the Zafiri. It resembles Mitatifi but is somewhat earlier. The lint is of a beautiful white color, fine, silky, very long, though not so strong as Mitatifi, and the first two pickings command the highest price in the market.

Attempts have been made for several years to introduce the white Abbasi cotton into the mills, but owing to its great variation in quality from one season to another these have not met with much success. Abbasi is cultivated in the Delta.

Lower Egypt extends for about 150 miles from the sea, and includes the Delta of the Nile. Middle Egypt is still



FIG. 30. Brown Egyptian Cotton. Sectional views to scale $\frac{1}{1000}$ inch between parallel lines.

- | | |
|----------------|----------------|
| 1. Raw Cotton. | 3. Mercerised. |
| 2. Bleached. | 4. Dyed. |

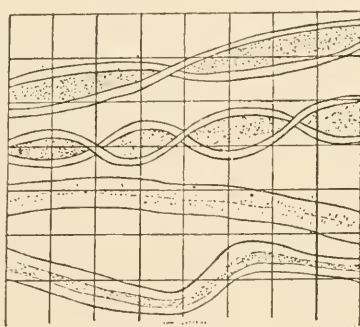


FIG. 31. Broach Cotton, Indian. Longitudinal views to scale $\frac{1}{1000}$ inches between parallel lines.

farther south of Cairo, and Upper Egypt is about 500 miles from the Mediterranean.

The Delta is the district in which most of the Egyptian cottons are cultivated, but considerable quantities are raised in the Fayoum district in Middle Egypt and also in Upper Egypt. In the Delta fogs are frequently the cause of a set back in the progress of the crops, and of damage to the plant and fibre.

Egyptian cotton is from one and one-eighth to one and three-eighths inches in length and is usually spun in 50s to 100s

warp yarn and 70s to 150 filling yarn, while a large quantity is used for doubling or ply yarns. Fig. 30 shows sections of brown Egyptian cotton in the raw state, and again bleached, mercerised and dyed.

Cotton is grown in other parts of Africa to a small extent, as for example, on the west coast, especially in Liberia, where some cotton of about one inch length of staple, of rather high color, dirty and irregular, somewhat resembling Brazilian cotton, is produced, but not much of it is exported; and a small quantity is also grown in Natal and South Africa.

The continent of Asia ranks next after America in quantity of cotton raised, India, China, Japan, Corea, Turkestan and Asia Minor all contributing to this.

Indian Cotton. India ranks, and perhaps always will rank, next to the United States as a cotton producing country. With an area of 1,367,000 square miles, lying south of the thirty-fifth degree of north ^{latitude} longitude and wholly within the cotton belt, India is twice the size of that part of the United States known as the Cotton States, and possesses a good cotton soil, although hampered by an uncertain and discouraging climate. Bounded on the east, north and west by mountains, with mountain chains traversing the central territory, and subject to two periodical wet seasons, portions of her territory are rendered unfit for cotton growing, either by excessive rain fall, which in some sections amounts to 500 inches per annum, or by the lack of moisture in others, where the annual rain fall is scarcely an inch. Although cotton has been cultivated there for fully 4,000 years the increase in production was but slight until stimulated by the diminished supply from the United States between 1861 and 1865. During the cotton famine of this period, the cultivation was pushed to its utmost extent, but when the United States regained its supremacy in cotton culture, the production of cotton in India was not pressed with so much vigor. At present the attention of the ryots has been turned to the production of the more profitable indigo and linseed, and it is probable

that the production of cotton will further decrease. The average yield in India varies in the different provinces from 40 to 100 pounds of clean cotton per acre, dependent on the seasons.

The part of British India, or Hindostan, where cotton is raised, embraces four principal cotton regions; the valley of the Ganges, the Deccan, western India and southern India.

The Ganges valley is again divisible into two parts, the lower Bengal district and that of the northwest provinces, including Doab and Bundelcund, lying on both sides of the Ganges and Jumna rivers.

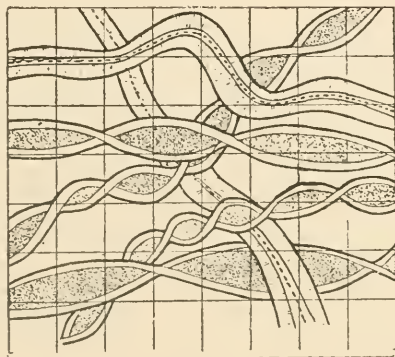


FIG. 32. Oomrawattee Cotton, Indian. Longitudinal views to scale $\frac{1}{1000}$ inch between parallel lines.

In lower Bengal the cultivation of cotton is not of great importance. In the plains of Bengal, which are so fertile in other produce, the production of cotton is very considerable, and very little is exported. The cotton raised here in former times, though short in staple, was the finest known in the world, and formed the material out of which the very delicate and extremely beautiful Dacca muslin was manufactured. This interesting and indefinite variety of *Gossypium herbaceum* is known as Dacca cotton, and what little is raised is used at home in the looms of a few weavers at Bazitpore, and seldom finds its way to Calcutta.

The border lands of the Ganges are too low and marshy, and the rain fall too great, for the successful cultivation of cotton, but the hills back from the river are suitable for this purpose, as they are better drained.

The Doab and Bundelcund districts produce almost the entire crop of the northwest provinces, and furnish about 70,000,000 pounds of cotton for export, which is good "Indian cotton." The climatic character of these districts is "first a flood and then a drought," with an inclination to an insufficiency of rain, in great contrast to that of lower Bengal.

The Deccan, Central India, is the great cotton section of India. It occupies the triangular area lying south of the Vindhya mountains, in latitude 23° north, and extends to the valley of the Kistna, at 16° north, with the eastern and western Ghauts on either side. It is an elevated tableland of undulating surface, having soil of great excellence and richness and of a consistency to retain moisture for a long time. Nearly all the cotton for export is raised within this region and finds its market at Bombay.

The Deccan may be divided into Nagpore, Hyderabad, Berar and Dharwar districts.

The soil in the valleys of Nagpore is a rich black loam which becomes very sticky and muddy during the rainy season, and hard and cracked during the dry season, in this respect very much resembling some of the Alabama soils. In the hilly portions there is red clay soil. The cotton grown within this district is very fine and soft, indicative of a moist and equable climate, especially that produced in the valleys of the Wurda and its tributaries. Some of it is known commercially as Hinghunghat cotton, from the chief town of that section, and is considered to possess the highest qualities of any Indian cotton.

Hyderabad is a plateau with a surface more or less hilly, and a general elevation of 2,000 feet above the sea level. The soil between the hills is remarkably fertile, and along the

Kistna, Godavery, and Wurda rivers and their tributaries is to be found some of the most productive soil of India.

Berar is an elevated valley through which flow several large streams that enter into the Godavery, and drain a country the soil of which is unsurpassed in richness, depth, and adaptability to the cultivation of cotton. From this section comes the cotton known as Oomrawattee, or "Oomras" (Fig. 32).

Dharwar is another good cotton district, being especially suited to the acclimatizing and culture of American cotton.

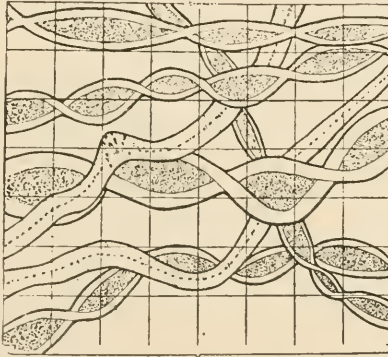


FIG. 33. Dhollerah Cotton, Indian. Longitudinal views to scale $\frac{1}{1000}$ inch between parallel lines.

The extent of territory is small, but, being nearer the sea and possessing a tolerable uniformity of atmospheric moisture, the combination of climate and soil is better adapted for the production of cotton than any other part of the Deccan, and consequently than any other region of India.

Western India is of no special interest in this connection, not being a heavy producer of cotton, except in the provinces of Scinde, Cutch, and Guzerat. The soil of these provinces varies in richness and productiveness from sand to deep black alluvium. The greatest drawback to the cultivation of cotton

in this region is the extreme heat and the drought succeeding a rainy season of small precipitation — three to ten inches in Scinde and Cutch, though parts of Guzerat have a yearly fall of 40 inches.

Southern India, or the southern part of the Madras Presidency, is best represented in cotton culture by the provinces of Coimbatore and Tinnivelly, which border on the western Ghauts, where the atmosphere is humid. The cotton raised in the latter province is the best grown in Southern India.

Although India has always produced large quantities of cotton, and made most beautiful and delicate webs from its fibre, exporting these fabrics to all parts of the world, it is only within the past 100 years that she has exported any considerable quantity of raw cotton.

The table of short staple cottons gives the dimensions of fibres and suitability of Indian cottons for various yarns.

Several views of Indian fibres, as they appear under the microscope, are shown in this chapter. Their study is interesting as showing the great variation that exists in fibres even of the same variety in diameter, thickness of the corded edges, and number of convolutions. The transverse sections of eleven varieties of Indian cottons, shown in Figs. 35 and 36, indicate this variation very clearly.

Indian cotton has the reputation of being the lowest class cultivated. This is largely owing to the great carelessness in cultivation. The fields are not properly prepared for cultivation, the cotton is not well ginned, and is often adulterated with Hindoo freehold estate to a large extent.

The Broach cotton (Fig. 31), which generally has a white and good staple, the Tinnivelly cotton (Fig. 37), which is creamy and shorter, and the Dhollerah (Fig. 33), which is dirty, but has a good staple, are usually considered to be the best of Indian cottons, while Bengal cotton is probably the dirtiest cotton on the face of the earth. The variety known as Hinghunghat is often mentioned in text books, but seldom

seen on the market, and is usually considered to be the highest grade of Indian cotton. If it is now cultivated to any extent it must be retained in Bombay for the use of the local mills.

Previous to about 1888, Indian cotton was a very important article of consumption in England, but its consumption has gradually fallen off during the cheapness of American cotton, and it is now only exported in large quantities to the continent of Europe. The reason of this is partially because the spinning of lower numbers is carried on to much greater ex-

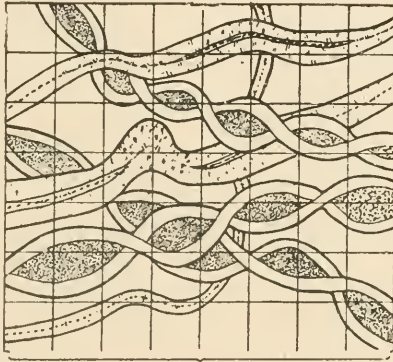


FIG. 34. Seinde Cotton, Indian. Longitudinal views to scale $\frac{1}{1000}$ inch between parallel lines.

tent in Germany and other European continental countries than in England.

The name often applied to Indian cotton is Surat, the name of a small port on the coast of Broach, in the Presidency of Bombay, and the name Surat is usually understood to refer only to Bombay Presidency cottons.

A table is given under the heading of short staple cottons containing details of the varieties of Indian cotton, district where grown, length and diameter of staple, and suitability for various purposes.

Other Cottons. The cotton production of China is found to be surprisingly large on investigation. Judging from the rarity with which this cotton is found in the cotton markets of the world, one does not expect to find a quantity equivalent to 1,300,000 bales of 500 pounds each raised annually and almost entirely consumed in the country, yet this is the estimate of the most reliable authorities. It is also estimated that 400,000 bales of 500 pounds each are raised in Corea. This cotton (Figs. 39, 40) is usually clean, has a short, rough

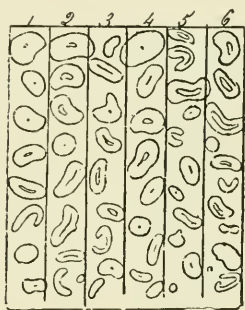


FIG. 35. Indian and other Asian Cottons. Sections to scale $\frac{1}{1000}$ inch between parallel lines.

1. Rangoon. 3. Broach. 5. Tinnivelly.
2. Assam. 4. Bengal. 6. Dharwar.



FIG. 36. Indian Cotton. Sections to scale $\frac{1}{1000}$ inch between parallel lines.

7. Compta. 9. Hinghungbat.
8. Oomrawattee. 10. Scinde.
11. Dhollerah.

staple, but is not used for numbers finer than 12s or 14s filling when manufactured on power machinery. It is about three-fourths of an inch long.

Another part of Asia where cotton is now largely cultivated and where increasing quantities are being raised every year is Asiatic Russia and Turkestan. The cotton is grown largely from American seed and is shipped overland to Russian mills. It is said that about one-third of the supply of cotton for the Russian mills is now obtained from the above countries, a greater portion of it being conveyed a large section of

its journey on the backs of camels. The cotton is about one inch in length, is of good color and grade, and somewhat rough.

The amount of cotton raised in Japan is comparatively unimportant, as that country imports more cotton than she grows. Japanese cotton is usually less than three-fourths of an inch in length of staple, and somewhat resembles Chinese cotton in its cleanliness.

In the Island of Java a small quantity of a very short, dirty cotton is raised, suited for numbers 4s and 6s yarns, of a

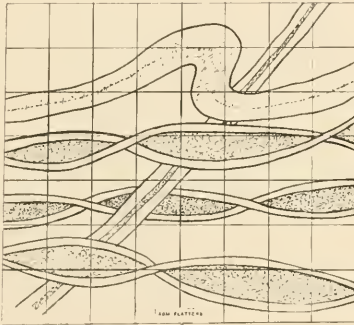


FIG. 37. Tinnively Cotton. Longitudinal view to scale $\frac{1}{1000}$ inch between parallel lines.

coarse, rough staple about three-eighths of an inch to five-eighths of an inch in length, and one of the shortest cottons grown.

The Phillipine Islands cotton is almost one inch long, smooth and of a good color.

In Australia there is a small quantity of cotton raised in the Clarence river district and in Queensland, which is said to be of good staple and clean, while in the Fiji Islands in Australasia, and also in the Tahiti Islands, a fairly good grade of Sea Island cotton is raised, of a similar or rather better grade

than Florida Sea Island cotton, and the same description applies to it to a large extent. A shorter stapled variety is grown in Hawaii.

The European cottons are comparatively unimportant; a small quantity is raised in Spain, some in Italy in the neighborhood of Naples, some in Greece, and a little in the islands of Malta and Sicily. This cotton is usually about three-fourths of an inch in length of staple.

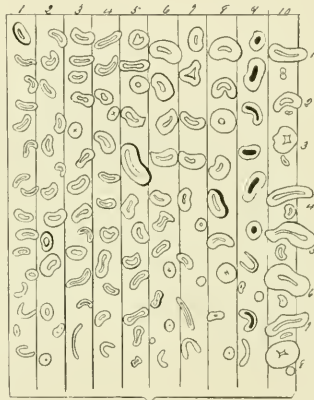


FIG. 38. Comparative sectional views of different cottons, to scale $\frac{1}{1000}$ inch between parallel lines.

- | | |
|--------------------------|--|
| 1. Tahiti, Sea Island. | 7. Lagos, African. |
| 2. Brown Egyptian. | 8. China. |
| 3. Gulf or Orleans (Am.) | 9. Red Peruvian. |
| 4. Rough Peruvian. | 10. Shows the extreme variations in the first eight samples. |
| 5. Maceio, Brazilian. | |
| 6. Scinde, Indian. | |

The Levantine cottons, grown in the neighborhood of Smyrna, Asia Minor, and on the island of Cyprus, with which may be included Turkish (Roumelian) and Persian cotton on account of their resemblance to the others, are very important European cottons. A description of them will be found in the tables given later in this chapter.

Smyrna cotton is the most important with regard to quantity grown, but the Persian cotton is of the most value, resembling Indian, but being superior to the best Indian cotton.

Some cottons are naturally of a high color, as, for example, red Northern and Coconada Indian cottons, red Guatemala cotton, red Peruvian cotton from Peru and Nankin, which has been variously stated to be cultivated in China and America, but really is only grown in the latter country.

A well known Liverpool broker says that he has imported Nankin cotton from America, and it was so called on account

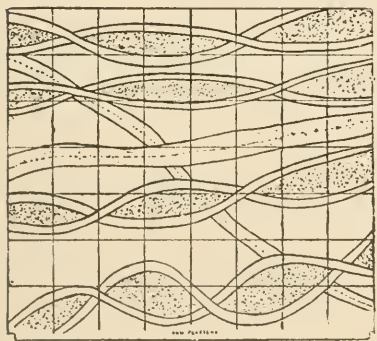


FIG. 39. China Cotton. Longitudinal views to scale $\frac{1}{1000}$ inch between parallel lines.

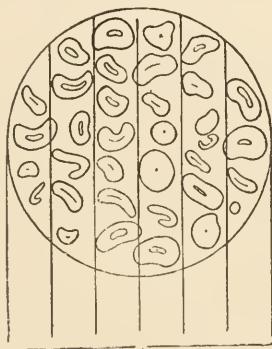


FIG. 40. China Cotton. Sections to scale $\frac{1}{1000}$ inch between parallel lines.

of its resembling the color of Nankin cloth formerly used for breeches. The writer has seen Nankin cotton which was said to have been grown in Alabama in 1860. The name being similar to that of a Chinese port has led to the assumption that it was a China cotton.

The letter appended proves that Nankin cotton was formerly grown in the United States:—

ATLANTA, GA., Feb. 5, 1898.

Dear Sir:— In May, 1895, when arranging for our great international exposition, I conceived the idea of securing a bale of Nankeen cotton raised in time of slavery, bring it here and have it carded, spun, and woven by old "Foh de Wah" women in the old-fashioned way on the exposition

grounds. I wrote to almost every port point in this country and Europe and finally found a bale at New Orleans that was raised by an old African, named Guinea George, alias George Washington, on Frog Level Plantation in Alabama, near the Louisiana line. He raised, picked and ginned it in 1860, and kept the bale at his home all through the years of "Hard Tack and Bullet." Sometime after the war he shipped the bale to New Orleans, and, as there has been no demand for Nankeen cotton since the war, it has remained there until I bought it and brought it here for the above named purpose, and have a portion of the bale here now. I herewith enclose you a sample of the cotton.

Yours truly,

HENRY H. SMITH.

The reproductions of microscopical views of cotton fibres in this chapter (Figs. 15 to 40) are used by the courtesy of Mr. Abraham Flatters of Longsight, Manchester, England, whose excellent work in micro-photography, especially of fibres, is now receiving deserved, if tardy, recognition.

Tables of Cotton Characteristics. Four tables are printed herewith which have been gradually compiled by the author during the last fifteen years, largely from personal observation and investigation. They give all the known cottons under their trade names and state where the cotton is grown, the length of staple, the diameter in 10,000ths of an inch, the characteristics and appearance of the cotton, the numbers of yarn into which it is usually spun, and whether these yarns are for warp (twist), filling (weft), or ply yarns (doubling), with other information.

With reference to the yarns named in the tables the author would state that they are intended to indicate the numbers usually spun for commercial purposes. For special yarns which have to be strong or of a high grade the cotton may be used for lower numbers; or for special or local reasons, may be possibly spun into higher numbers, or into warp, filling, or ply yarn where not so specified, but these are unusual cases, and are not considered in formulating the tables.

The cottons are divided into four kinds: Long stapled, medium to long stapled, medium stapled and short stapled.

TABLE OF COTTONS — LONG STAPLED.

Trade Name.	Where Grown.	Length of Staple, Inches.	Dia. in 10,000ths.	Character of Fibre.	Counts or Numbers of Yarn Usually Used for (Single Yarn)		Remarks.
					Twist or Warp.	Wet or Filling.	
Sea Island.	Edisto, John James, Port Royal and St Helena, S.C.; Cumberland and St. Simon, Ga.	$1\frac{3}{8}$ to $2\frac{1}{4}$	4 to 6	Silky, fine, strong and clean.		Doubled or Ply Yarn. 150s to 400s	Said to have been spun to 2150s in London in 1851.
Florida Sea Island.	On mainland of Florida, near coast, from Sea Island seed.	$1\frac{1}{4}$ to $1\frac{3}{4}$	5 to 6	Silky and clean.		150s to 200s	Good for lower grade Sea Island yarn.
Peruvian Sea Isl. and.	On Peruvian mainland, from Sea Island seed.	$1\frac{1}{2}$	4 to 7	Silky and strong, but not clean.		100s to 150s	
Fiji and Tahiti Sea Island.	Polynesian Islands, So. Pacific ocean.	$1\frac{1}{2}$ to 2	4 to 6	Silky, strong and clean.		100s to 200s	Very rarely used and little grown.
Bourbon.	French Island, off coast of Africa.	$1\frac{3}{4}$ to $1\frac{7}{8}$		Weak.		80s to 100s	Very rarely used and little grown.

TABLE OF COTTONS — MEDIUM TO LONG STAPLED.

Trade Name.	Where grown.	Length of Staple, inches.	Dia. in 10,000ths	Character of Fibre.	Counts or Numbers of Yarn Usually Used for (Single Yarn)			Remarks.
					Twist or Warp.	Welt or Filling.	Doubled or Ply Yarn.	
Brown Egyptian or Mako, Mitafii.	In Lower, Middle, and Upper Egypt. Lower and Middle Egypt.	$1\frac{1}{8}$ to $1\frac{3}{8}$ $1\frac{3}{8}$ to $1\frac{1}{2}$	5 to 7 5 to 7	Golden brown to brown. Rich dark brown; long, strong and fine.	50s to 100s	70s to 150s	70s to 150s	Principal variety.
Ashmouni.	Lower, Middle, and Upper Egypt.	$1\frac{3}{8}$ to $1\frac{1}{2}$	5 to 7	Light brown; fine.				
Bamia.	Lower Egypt.	$1\frac{1}{2}$ to $1\frac{1}{4}$	5 to 7	Brown; shorter and weak.				
Abbasi.	Lower Egypt.	$1\frac{1}{2}$ to $1\frac{1}{4}$	5 to 7	Almost white; fine and silky.				
White Egyptian.		$1\frac{1}{8}$	6 to 7	White.				
Gallini.	Egypt.	$1\frac{1}{4}$ to $1\frac{1}{2}$	5 to 6	White and silky			80s to 150s	Varies from season to season, not reliable. From American seed. Resembling Gulf or New Orleans cotton. Very rarely seen.
Paraiba. Maranham.					40s to 60s 60s to 60s			From Sea Island seed. Resembling Florida Sea Island. Very rarely grown.
Ceara. Aracaju.					32s to 50s 32s to 50s			The first two are about the best of Brazilian cottons.
Rio Grande.	Brazil.	1 to $1\frac{3}{8}$	6 to 8	All Brazilian is harsh, wiry, clean, creamy colored, true cotton.				All Brazilian cotton is good for warp yarns, especially yarns for sizing. Gives strength when mixed with American.
Fernambuco. Bahia. Maccio. San Paulo. Santos.	Brazil.				32s to 50s 32s to 50s 32s to 50s 32s to 50s			
Rough Peruvian.	Peru.	$1\frac{1}{4}$ to $1\frac{1}{2}$	6 to 8	Rougher than Brazilian.	40s to 70s			American seed. Some very weak and high color.

Surinam, Berbice.	British and French (Guiana).	$1\frac{1}{8}$ to $1\frac{3}{8}$	Smooth and fine.	Said to spin 160s	Very little grown or used.
Cayenne, Demerara.	Central America.	1 to $1\frac{1}{8}$	White and clean.		Resembles the cotton from Guiana.
Guatemala.	Central America.				
Honduras.	Central America.				
Colombia.					
San Domingo or Hayti.	West India Islands.	1 to $1\frac{1}{2}$	Smooth, glossy and clean; variable.	Said to spin 120s	Very little grown or used.
Porto Rico.					
Anguilla.	Argentine.	$\frac{7}{8}$ to $1\frac{1}{4}$	Reddish.		
Catamarca.	Argentine.	$1\frac{1}{8}$ to $1\frac{3}{8}$	Reddish.		
Santa Fe.	Argentine.	1 to $1\frac{1}{2}$	White.		
Salta.	Hawaii Islands.	1 to $1\frac{1}{2}$			
San Luis.					
Rioja.					
Parana.					
Hawaii.					

TABLE OF COTTONS — SHORT STAPLED.

Trade Name.	Where Grown.	Length of Staple, Inches.	Dia. in 10,000ths.	Character of Fibre.	Counts or Numbers of Yarn Usually used for			Remarks.
					Twist or Warp.	Welt or Filling.	Doubling of Ply Yarn.	
INDIAN COTTONS.								
Comptah.	Central Provinces.	$\frac{3}{8}$ to $\frac{7}{8}$	7 to 9		11s and below	18s and below		Dirty. Very seldom used. Lossy.
Hingmuhat.	Central Provinces.	$\frac{1}{2}$ to $\frac{1}{4}$	7 to 9		18s and below	24s and below		
Omrawattee.	Bears in Central India.	$\frac{7}{8}$ to 1	7 to 9	Good color, cleaner than Dholerah.	11s and below	20s and below		
Dharwar.	Bombay Pres. Extreme South.	$\frac{3}{4}$ to 1	7 to 9	Neppy.	6s to 12s	6s to 12s		
Seinde.	Western India, Province of Scinde.	$\frac{5}{8}$ to $\frac{7}{8}$	7 to 9		14s and below	22s and below		
Broach.	Bombay Pres. Western coast.	$\frac{3}{4}$ to $\frac{7}{8}$	7 to 9	Soft fibre and high color.	11s and below	24s and below		
Khandesh.	Bombay Pres.	$\frac{5}{8}$ to $\frac{7}{8}$	7 to 9		11s and below	24s and below		
Bilatee.	Bombay Pres.	$\frac{5}{8}$ to $\frac{7}{8}$	7 to 9	White, and has considerable dirt.	11s and below	24s and below		
Dholerah.	Bombay Pres.	$\frac{7}{8}$ to $1\frac{1}{16}$	7 to 9		11s and below	24s and below		
Surat.	Port, Bombay Pres. Dist. of Broach.	$\frac{3}{4}$ to 1	7 to 9	Creamy.	11s and below	24s and below		
Tinnivelly.	Presidency of Madras.	$\frac{3}{4}$ to 1	7 to 9		Very low numbers.	1s to 10s		
Western Bengal.	Western Madras.	$\frac{5}{8}$ to $\frac{7}{8}$	7 to 9	tinged, dirty, weak fibre.	4s to 8s	6s to 12s	Dirtiest cotton grown.	
Dacca.	Bengal Pres.	$\frac{1}{2}$ to $\frac{3}{4}$	7 to 9	Short, harsh, rough staple, not very clean, often tinged.	6s to 8s	4s to 10s	Resembles wool.	
Cocoonada.	India.	$\frac{1}{2}$ to $\frac{5}{8}$	7 to 9	Red color, weak, irregular and dirty.	1s to 6s	6s to 16s		
Red Northern.	North Eastern India.	$\frac{1}{2}$ to $\frac{3}{4}$	7 to 9	Dull appearance, harsh, stiff fibre, and fairly clean.				
Assam.							A high colored variety of Indian cotton. Resembles wool.	

OTHER ASIAN COTTONS.

China and Corea.					
Camilla.	China.	$\frac{1}{2}$ to $\frac{3}{4}$		6s to 11s	A variety of China.
Turkestan. Indigobons.	Central Asia. (Russian Provinces)	1		6s to 11s	From American seed.
Turkestan. Exotic.	Central Asia. (Russian Provinces)	1			
Japan.	Japan.	$\frac{5}{8}$ to $\frac{3}{4}$			
Philippine.	Philippine Islands.	$\frac{5}{8}$ to 1			
Java.	Isle of Java.	$\frac{3}{8}$ to $\frac{5}{8}$		1s to 6s	Resembles Indian but is superior to the best Indian.
Persian.	Persia.	$\frac{3}{4}$ to $1\frac{1}{8}$			
Smyrna.	Asia Minor.	$\frac{5}{8}$ to 1			
SUNDRY COTTONS.					
Nankin.	United States.	$\frac{3}{4}$	4 to 7		Not now grown.
African.	Liberia and West Coast.	About 1			Somewhat resembles Brazilian.
Greek.	Greece.	$\frac{1}{2}$ to $\frac{3}{4}$			
Caucasian.	Caucasia.	$\frac{7}{8}$ to 1			Shortest cotton grown.
Queenland.	Australia.	$\frac{7}{8}$ to 1			(Gray seed.)
Clarence River.	Australia.	$\frac{7}{8}$ to 1			
Mexican including Yucatan, Laguna, Campeche, and Oajaca.	Mexico.	$\frac{3}{4}$ to 1			
Cyprus.	Isle of Cyprus.	$\frac{3}{4}$ to 1			
Malta.	Isle of Malta.	$\frac{5}{8}$			Very little grown.
Turkish.	Roumelia.	$\frac{5}{8}$			Very little grown.
Italian.	Neighborhood of Naples.	$\frac{5}{8}$			
Sicilian.	Isle of Sicily.	$\frac{3}{4}$			Very little grown.

TABLE OF COTTONS — MEDIUM LENGTH OF STAPLE.

Trade Name.	Where Grown.	Length of Staple, Inches.	Dia. in 10,000ths.	Character of Fibre.	Counts or Numbers of Yarn Usually Used for		Remarks.
					Twist or Warp.	Wet or Filling.	
AMERICAN COTTONS.							
Gulf Cotton or New Orleans.	Mississippi, Louisiana and neighboring states.	1 to 1 $\frac{1}{4}$	4 to 7		28s to 44s	50s to 70s	A variety of Gulf or New Orleans cotton.
Benders or Bottom Land.	Mississippi River bottom, Louisiana and Mississippi.				28s to 44s	50s to 70s	A variety of Orleans or Gulf cotton usually inferior in quality.
Mobile.	Varieties originated in Mississippi and grown usually in Mississippi, Louisiana, Arkansas, Alabama.			Bluish-white usually.	28s to 44s	50s to 70s	Somewhat resembles short Florida Sea Island.
Peelers.				Long staple.	28s to 44s	50s to 70s	Ranking among best of New Orleans cotton, usually bad to card.
Allan Seed.					30s to 40s	30s to 40s	A clean, easily manipulated useful cotton, suitable for wett or filling.
Uplands.	Georgia, North Carolina, South Carolina, Virginia, Texas, Georgia, Mississippi or Louisiana. Alabama.	$\frac{3}{4}$ to 1	6 to 7		26s to 32s	32s to 40s	Suited for warp.
Texas.		$\frac{7}{8}$ to 1	5 to 7	Generally clean.	See	Above.	A variety of Uplands.
Georgia.				Generally very clean.	"	"	Varieties of Orleans or Gulf cotton.
Mississippi or Louisiana.				Generally good staple but heavy.	"	"	Variety of Orleans or Gulf cotton.
Scma.				Generally very clean.	"	"	Variety of Orleans or Gulf cotton.
Arkansas.	Arkansas.			Generally good staple but heavy.	"	"	Variety of Orleans or Gulf cotton.
Boweds.	Alabama.			Generally very clean.	"	"	Another name for Uplands.
Memphis.	North Carolina and Virginia.			Generally very clean.	"	"	A variety of Gulf cotton or Orleans.
Norfolk.	Georgia.			Generally very clean.	"	"	Variety of Boweds or Uplands.
Savannah.				Generally clean.	"	"	Variety of Boweds or Uplands.

Selection and Classification of Cotton. The selection of cotton from samples, or the judging of cotton, is a matter of considerable importance and in order to become thoroughly proficient requires a long period of practice to produce the trained eye and hand necessary to distinguish the gradations and differences in quality, which add to, or detract from, the market value of the fibre. This is not of so much importance in the southern markets, where the bales are usually on hand to be referred to in case of dispute, but in the northern states, and in any country where cotton is largely purchased from samples, it is of the utmost importance. This also applies to the large European cotton markets, such as Liverpool, Havre, Bremen and Genoa. Although large stocks of cotton are kept in these ports, cotton is seldom, or never, purchased from the examination of the bale, but from parcels containing small pieces of cotton from each bale, technically known as "papers of samples." It is customary in well managed mills, on both sides of the ocean, to take samples of each new lot of cotton that arrives at the mill, sometimes a sample from every bale, and at other mills only from a certain number of bales out of each hundred. The samples are then compared with the buying samples to see if the cotton is equal to the quality purchased.

In judging cotton from a sample or in selecting cotton with a view to purchasing it from samples, the first thing to do is to investigate the authenticity of the sample. If it is a factor's sample or a merchant's sample it is not usually considered to be as reliable as a broker's sample; in fact, it is customary to consider that a seller's sample, especially if it be an American sample, is at least a quarter grade better than the cotton may be expected to turn out.

The points then to be determined are: First, the grade of the sample; second, the staple; third, the color; fourth, the amount of sand; fifth, the amount of dampness; sixth, whether the cotton is even running or not. These points are arranged

in the order of their usual importance. This is not necessarily accurate in selecting cotton for some purposes; for instance, in cotton to be used for filling yarns, the color is more important than in cotton for warp yarns. As the warp yarn has to be sized, it somewhat spoils a good colored sample, or hides the defect of a dull colored cotton. In either case, the length of staple may be the most important point to consider, where it is desired to produce a strong yarn without regard to its appearance.

American cotton is usually graded according to a standard agreed upon in all the leading cotton markets of the world, the highest grade being fair, followed by six other grades, the lowest being ordinary.

The seven full grades of American cotton are :

- Fair.
- Middling fair.
- Good middling.
- Middling.
- Low middling.
- Good ordinary.
- Ordinary.

This gradation is not sufficiently fine for the cotton merchant, and consequently each grade is sub-divided into two half grades, one of which has the prefix "strict," and each half grade sub-divided again into quarter grades, with the prefixes "fully" and "barely," thus, taking the grade middling, we speak of strict middling, fully middling, middling, barely middling. The middling is the full grade, the strict middling is the half grade, the fully and barely middling are the quarter grades; in other words, strict is a half grade higher than middling, fully middling is a quarter grade higher than middling, barely middling is a quarter grade lower than middling. The same is done with each of the other grades: thus we may speak of strict low middling, fully low middling, low middling, and barely low middling, low middling being the full grade.

A list can be made up giving twenty-six of these grades, half grades, and quarter grades, for American cotton exclusively, including what is known as low ordinary, the only one lower than ordinary.

These grades represent standard samples that are kept at the New York Cotton Exchange, duplicates of which are at the various markets throughout the United States. The same system of grading is maintained in Liverpool and other continental cotton markets in name only. As a matter of fact, while the same names are used in Liverpool, the Liverpool grading for strict low middling to middling fair inclusive, is half a grade lower or more lenient than in New York; thus, a middling in New York would be graded a strict middling in Liverpool, while for grades below strict low middling it is quarter to half a grade higher or more strict than in New York.

In case of Brazilian, Egyptian, and other grades of cotton, other systems of classification are adopted.

The grades of American cotton usually quoted on the Liverpool Cotton Association reports are: Middling fair, fully good middling, good middling, middling, low middling, good ordinary, ordinary.

Of Sea Island cotton:

Extra fine.

Fine.

Medium Fine.

Good medium.

Medium.

Common.

Ordinary.

Of Egyptian cottons:

Extra fine.

Fine.

Good.

Fully good fair.

Good fair.

Fair.

Middling fair.

Middling.

Of Brazilian cottons :

Fine.

Good.

Good fair.

Fair.

Middling fair.

Middling.

Of East Indian cottons :

Superfine.

Fine.

Fully good.

Good.

Fully good fair.

Good fair.

The best grades are those at the top of the list in each case.

A specimen weekly report of the Liverpool Cotton Association is bound in with this book.

Grade really means the appearance of the cotton as regards cleanliness, and the above system of grading depends on the appearance of the cotton as to its freedom from leaf and other impurities; some graders consider what is known as bloom or brightness of the cotton, which add to, or discoloration, known as "off color," or "tinges," which detracts from, the grade. This method of valuing the bloom and color is more an American custom than a European one.

After determining the grade, the next thing to do in judging cotton is to find the staple. The word staple usually means average length of the bulk of the fibres forming the bale assessed, and it is found by taking a small portion of cotton in the way hereafter described, preparing a tuft of fibres from

which the very short fibre has been removed, and then measuring the average length of the fibres remaining. There is something more which is usually implied by the word "staple," and that is strength of the fibre. This is determined by holding the tuft between the finger and thumb of the two hands and breaking it. The word "staple" may, therefore, be taken to mean the average length of the fibres forming the bale, and it is also understood to include the strength of the fibre; thus we have the expressions, "length of staple" and "strength of staple."

After the staple has been determined, it is necessary to discover the amount of sand and dirt in the cotton. This is often done by raising the cotton from the paper that holds it and noticing the amount of sand remaining on the paper, this sand having fallen out by the repeated handling of the cotton. It is, perhaps, better to hold the handful of cotton as high as one's head and shake it so that the sand, if there is any, can be seen to fall from it.

Another test is that for dampness. This can only be detected in the sample paper, if the samples are newly drawn, in which case it can be felt by the hand. If the samples have been lying around the office for some time the dampness evaporates and cannot be detected unless it has previously been so great as to cause a slight formation of mildew on the cotton, in which case it is indicated by the smell.

The bloom of cotton is the rich bright creamy appearance which it has, especially in the early part of the year. This bloom is only found on certain growths of cotton and adds somewhat to its value, especially where it is to be used for making weft or filling yarn, or where the goods into which it is to be made are to be sold in their unbleached or undyed state, technically known in Europe as "in the grey," and in some parts of America as "in brown." "Tinges," "high colored," or "off colored," ought to be looked for. These are caused, where the cotton has become tinged while on the plant, through rain

stains, or by having fallen on the ground, having become mixed with some of the red clay of the cotton field. These bales ought to be avoided, and in case of purchasing from a sample containing some of these tinged bales, an agreement for a reduction in price on the bales ought to be arranged, or a condition made that these bales will be thrown out before shipment of the quantity purchased.

The last point, and one which is important, is to see that all bales are somewhat alike.

Usually a sample paper is made up of a handful of cotton from each one of the lot of bales; by testing first one sample and then another it is discovered whether the lot of cotton is even running; occasionally, however, if not graded properly by the cotton factor, a lot of cotton is found to be mixed. Some bales may be higher grade than others, some may be longer stapled than others, and even in the same bale an abnormal variation in length and strength of staple may be found. Cotton of this kind ought to be avoided altogether as it is almost impossible to make satisfactory yarn out of cotton mixed in this manner.

Gin damaged cotton ought also to be avoided. This is referred to in another chapter.

As has before been stated, constant practice is necessary to become a good judge of cotton. Even experienced cotton graders and cotton buyers improve year by year in their judgment of the fibre, until some of them, by a quick glance or the slightest touch, can determine at once whether the cotton is suitable for their purposes or not. It is not an unusual thing for a cotton buyer in a market like Liverpool to become so expert as to be able to examine samples in a single morning representing tens of thousands of bales.

Usually the grade is first mentally determined, then a small handful of cotton is grasped by both hands, having the thumbs uppermost, and pulled apart. One half is thrown away, and the ends of the fibres which project from the other

pieces are grasped between the thumb and first finger of the right hand, and the left hand is employed in removing short fibres or fud from the tuft. The tuft of cotton, now much lessened in size, is grasped by holding the other ends of the fibre in the left hand, while the right hand removes further short fibres or fud. By these few quick movements an experienced cotton tester has arrived at a small tuft of fibres laid parallel, which can be first measured, usually with the eye only, and afterwards grasped firmly between the first finger and thumb of each hand, the thumbs being uppermost, and broken by a short strong pull. By always taking the same amount of cotton in the hand at once, and reducing it to the same size of a tuft, the cotton man fixes a standard of length and strength for himself by which he can assess the value of almost any kind of cotton. After the grade and staple have been determined in the manner just named, a test is made for sand and for uneven running; the appearance as to bloom, color and evidences of gin damage are noticed, completing the test of the cotton, by which time a cotton expert should have made a mental estimate of its value.

A good deal more can be said on this subject, but we will close this description, merely stating that local circumstances often affect the judgment on a lot of cotton: for instance, a good north light is the best to judge cotton in, as the light is more regular than any other. Cotton should not be purchased from a sample wrapped in paper with a blue lining, as this causes the cotton to appear better than it really is.

The same system of judging cotton applies to all growths, although some cottons require to be observed more carefully for impurities than American cottons. In other cases, such as Brazilian, Peruvian, China, or Assam cottons, it is necessary to observe the roughness of the fibre, as those are often used to mix with wool, and the rougher and more wiry, the more valuable is the cotton.

History of Cotton Cultivation. The cultivation of cotton had undoubtedly its home originally in the East Indies; certain references are made to cotton in some of the Hindoo religious works, written over four thousand years ago, which indicate clearly that cotton was known, spun and woven in those days.

The historian who endeavors to trace the history and development of such a gigantic industry as the cotton trade, becomes, as it were, the explorer of a mighty river. As he traces its course, he may come across a broad expanse which gives the impression that it is the main stream, and that if it be followed far enough the source will easily be found; but a few miles higher up this stream may divide into almost equal parts, and higher still other tributaries may flow in, almost indistinguishable by their size from the main stream, until nearer the source, the main river is lost in many subsidiary supplies. Thus it is, inversely, with the earliest stages of the history of the cotton cultivation. The information is very scant, and what we can trace is not always reliably based, as it is on the insufficiently proved tales of early travellers, on references in profane literature, clouded by the use of technical words and trade names which often materially differ from those of our own age. Perhaps the best method of tracing the history of the cotton industry is to find where cotton was first cultivated for the sake of its fibre, for we may depend upon it, that the country where it was first grown would also be the first to manufacture it. Each nation was isolated from the other, and scarcely able to communicate with, much less to transport the raw material from, one country to be manufactured in another, returning the manufactured goods.

Taking this line of argument we may dispose of any supposition of the cotton manufacture (and consequently the cultivation of the plant for its fibre) having had an American or even European origin. Cotton fibres and cotton fabrics were known in Europe long before the date of Columbus'

voyage of discovery, and it is not recorded that the cotton plant was found in North America by any of the early explorers.

Cotton was certainly grown centuries ago in Spain and Italy, but there are records that its cultivation was only introduced into the former country from the East by Abdurrahmah the Great so recently as the tenth century. In Africa, the only country which can have a shadow of a claim to the parentage of the cotton industry is Egypt, and here, we find that although Pliny, the historian, relates that the cotton plant was known there in the time of Christ, yet his evidence is unsupported, and classical scholars consider that he was referring to another plant. It is quite certain that it did not become an important object of cultivation in Egypt till the introduction of cotton growing by Mahomet Ali Pasha, in 1821, resulting in the first exports to England in 1823. We also find that during the first and second centuries of the Christian era, large quantities of Indian cottons were imported into Egypt, and a further proof of the fact that the manufactures of ancient Egypt were linen, and not cotton, is found in the result of the long scientific discussions which took place many years ago, as to the material of which mummy wrappings were composed. It was finally decided that they were linen and not cotton, after the peculiar form of the cotton fibre had been discovered by the aid of the microscope. In China, we find that although cotton is now grown there to an enormous extent, it was only introduced into that country about 600 years ago, and at first it was only cultivated for the sake of its beautiful flowers. In the year 502 A.D. it is recorded of one of the Chinese Emperors that he had a robe of cotton. This must have been a remarkable possession for the record to have been handed down as a wonder to the present time. The cultivation and manufacture of cotton was so little known in China in 1295, when the country was visited by Marco Polo, a celebrated traveller of Venice, that he does not even mention it,

although he minutely describes the inhabitants and their habits, stating in one place that they were clothed solely in silk.

We may also omit the continent of Australia, for, as it was only discovered in 1699, it evidently cannot have originated cotton growing and manufacture. Having exhausted the list of countries where cotton is or has been a recognized product, with one exception, that of India, we may come to the conclusion that there is the country of origin, where cotton was grown, spun, and woven at least two thousand years ago.

There can be no doubt of India being the early country of cotton, China that of silk, and Egypt that of flax.

The early seat of the cotton trade in India is borne out by all or almost all the evidence that we can adduce. It is a matter of regret that the period covered by reliable history of India and the Hindoos is limited, and as compared with that of other nations we arrive much sooner at a period of fable and legend. It is chiefly by the religious books of the Hindoos that we can trace out their customs and habits. In one of these books, the Rig Veda, supposed to have been written fifteen centuries before the time of Christ, or three thousand four hundred years ago, we find a reference to threads in the loom, and there is in this book also a reference to sizing. Also 800 years before, or 2700 years ago, in another of their sacred books, cotton is very frequently mentioned under its name of Kurpas, or Kupas, which name is still in general use in India. The fabrication of cotton goods must have attained a high perfection in India several centuries before the Christian era, for it is stated by the ancient Greek historian Herodatus, who was born 484 years before Christ, regarding the Hindoos, that :

“They possess likewise a kind of plant which, instead of fruit, produces wool of a finer and better quality than that of a sheep, and of this the Indians make their clothes.”

This historian, a most reliable one according to modern opinion, does not mention cotton as being used by any of the then known nations — Greeks, Romans, Egyptians, Assyrians, Jews. We may conclude that its manufacture was at that time confined to Eastern countries, perhaps India only.

A further and greater proof of the early origin of a well-developed cotton industry in India is the history of the voyage of Nearchus, one of the admirals of Alexander the Great, recorded by two different historians, Strabo and Arrian; this mighty conqueror, shortly before his death, despatched one of his admirals on a voyage of discovery on the river Indus, and on that ocean now known as the Indian Ocean, about 327 B. C.

The history of this voyage is carefully related, and a part of it reads thus :

“The Indians wore linen garments, the substance whereof they were made growing upon trees, and this is indeed flax, or something much whiter and finer than flax. They wear shirts of the same, which reach down to the middle of their legs, and veils which cover their heads and a great part of their shoulders.”

It was no doubt owing to the voyages organized by Alexander the Great that the fabrics of India first became known as articles of clothing in Europe, Asia-Minor, and Egypt. In the year 131 A. D., Arrian, the historian, relates that Indian cottons, muslins, plain and figured, and raw cotton for stuffing couches and beds, were landed in Egypt from India. Cotton is not mentioned in the Bible, except in one single instance, and in that case it is only named in the Hebrew, and is not referred to in either of the English translations by the name of cotton. We have often references in the Bible to wool and linen, to spinning, weaving and dyeing, to looms and to shuttles, but the only reference to cotton is in the Book of Esther, where the palace of Shushan is described as possessing white, green and blue hangings. The word hangings in Hebrew is

Karpas, or in Greek, Karpasos, and the similarity between this word and the word named above, as the name used for cotton from time immemorial in India, viz. Kurpas, is at once seen.

Thus the passage in Esther should describe the decorations as "white and violet colored cottons." This is a subject of a marginal note in the revised version. Here is another



Fig. 41. The Vegetable Lamb.
After Sir John Mandeville.

proof of the fact of Indian cloth being exported at so early a date, namely, 521 B. C.

Persia being nearer India would have cotton fabrics earlier than Egypt, and the Indian name being applied to the cloth, stamps the country of origin.

In Europe, about the fifteenth and sixteenth centuries, cotton was so little known that there were several superstitions believed regarding it. One was that its seed was useful as a cure "for asthma, coughs, dysentery, and wounds," and was

a good remedy in case of poisoning, while the oil of the cotton seed was recommended to take away spots or freckles, in fact, it was a cure-all, and reminds us of a patent medicine circular of modern times.

Another curious superstition regarding it was as to its mode of growth: this was nothing more or less than that the cotton wool was really the wool of lambs that grew and lived

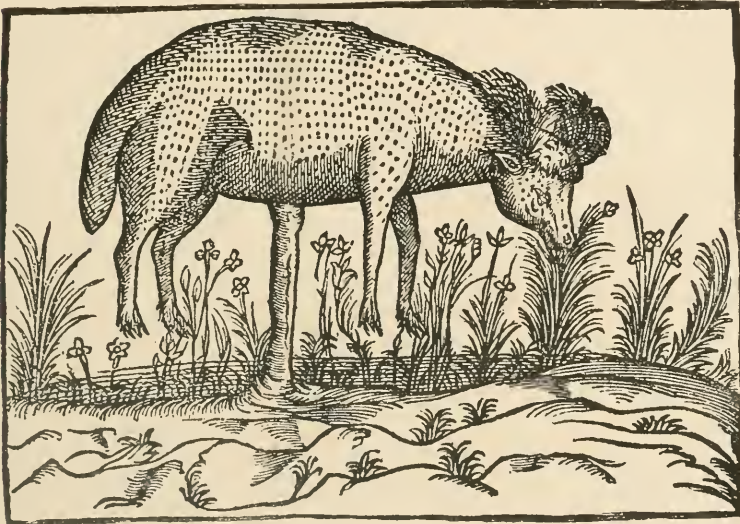


Fig. 42. Portrait of the "Barometz," or "Scythian Lamb."

attached to branches of trees. Of course the only knowledge of fibrous substance possessed by our forefathers in those days was that of ordinary wool or of flax, and no doubt their first impression of any other fibre would be something that resembled the wool of the sheep or the hair of the goat. This belief was fostered or more probably established by one Sir John Mandeville, described as a man of learning and substance, of the town of St. Albans, in Herefordshire, who in the year 1322 left his native city, became a globe trotter, and did

not return for thirty-four years. In his report of his journey he states that he travelled through all the then known kingdoms of the world, and among other things discovered this vegetable lamb. His account in his own words is : " Now shall I say you of countryes and isles that be beyond the countrye that I have spoken of. Passing beyond Cathay and India and Bachary is a kingdom that men call Caldeya, that is a fair countrye and there groweth a manner of fruit as though it were gourds, and when they be ripe men cut them in two and men find within a little beaste in flesh and in bone and in blood as though it were a little lamb with wool outside it. Men eat both the fruit and the beaste and that is a great marvel. Of that fruit I have eaten, although it were wonderful, but I know that God is marvelous in all his works." Sir John's drawing is reproduced at Fig. 41. Another account is by Baron Von Herberstein, an ambassador to the Court of Maximilian. His account is that the seed when put in the earth grew a plant resembling a lamb, and attaining to the height of $2\frac{1}{2}$ feet. It had a head, eyes, ears and all other parts of a body as a newly born lamb. It had an exceedingly soft wool, which was used in the manufacture of head coverings. It was rooted by a stem in the middle of the body and devoured the surrounding herbage and grass, and lived as long as that lasted : when there was no more within its reach, it died. A representation of this animal is shown at Fig. 42.

Fables of the kind that I have related appear in many of the traveller's tales of the Middle Ages, and there is no doubt that this ridiculous tale achieved much popularity.

History of Cotton Cultivation in the United States. With reference to the introduction of cotton growing in the United States, it was not until the year 1621 that it was cultivated for the sake of the fibre in this country. In the southern half of the continent, Magellan, while circumnavigating the globe in 1519, found the Brazilians using cotton in making their materials for their beds : cotton fabrics were sent from

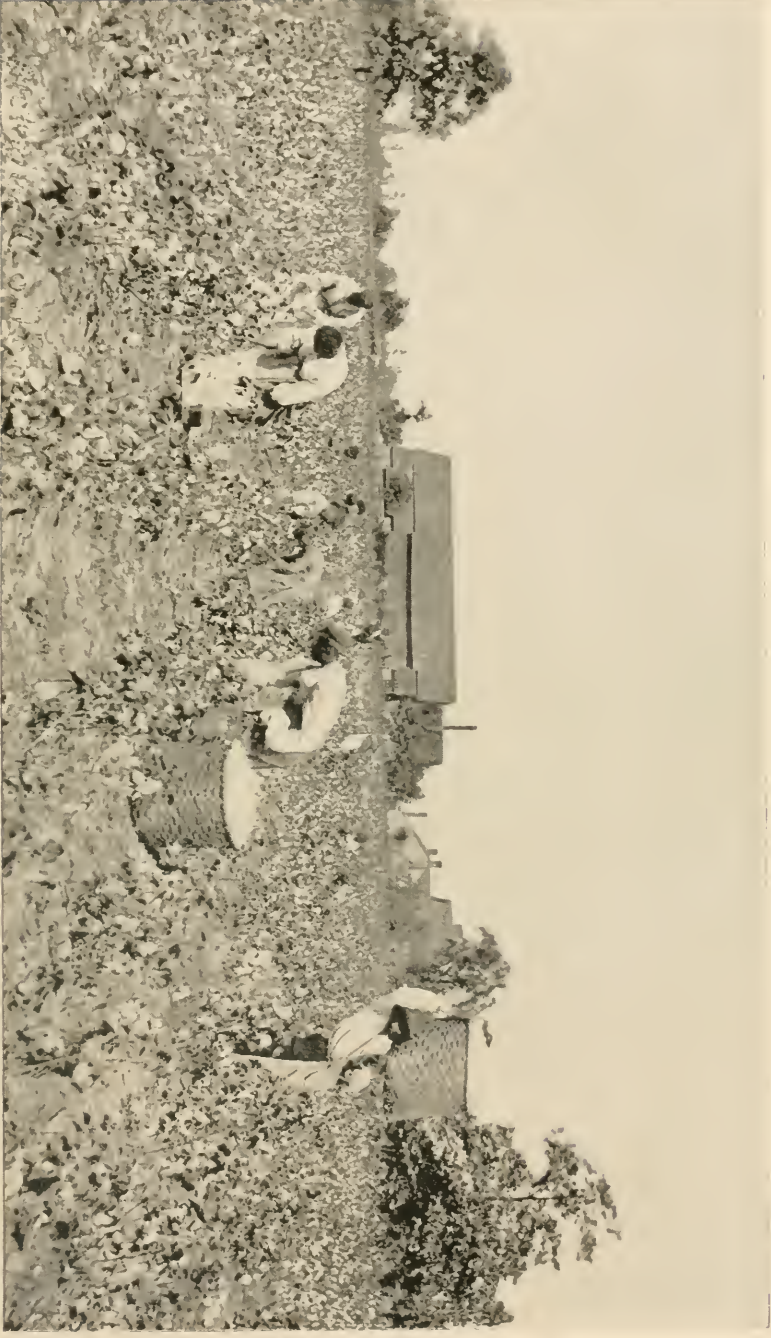


Fig. 43. Picking Cotton.

Mexico to Spain in the same year as presents to Emperor Charles V.

The year 1621 is regarded as the birth year of cotton culture in the United States. It had previously been found growing in a wild state, however, in various portions of the South, more particularly in the country bordering upon the Mississippi (Meschachebe) and its many tributaries.

A volume entitled "Purchas's Pilgrims" thus records the fact: "Cotton seeds were first planted as an experiment in 1621, and their plentiful coming up was, at that early day, a subject of interest in America and England."

A tract called "A Declaration of the State of Virginia," published in London in 1620, mentions cotton wool as one of the commodities of the "collony." A list of articles "to be had in the Virginia collony," in 1621, mentions "cotton wool Sd. per pound" as among the number. The cotton thus introduced was probably from the seed from the West Indies or the Levant, and its cultivation was for a long time limited to such qualities only as were needed for domestic use, as the cost of hand cleaning or separation of the seed by hand exceeded the commercial value of all cotton so cleaned.

Some colonists from Barbadoes who settled on the Cape Fear River, in 1664, brought with them cotton seed, which they cultivated for domestic purposes.

In the description of the Province of Carolina, by Samuel Wilson, addressed to the Earl of Craven, in 1682, it is stated the "cotton of the Smyrna and Cypress sort grows well and good, plenty of the seed is sent hither."

In "Rivers' Historical Sketches of South Carolina" are found the following passages in the instructions given by the proprietors to Mr. West, the first governor of South Carolina :

" 'Mr. West, God sending you to Barbadoes, you are then to furnish yourself with cotton seed, indigo seed, ginger roots. Your cotton and indigo is to be planted where it may be sheltered from ye north-west winde, for they are both apt to blast.' "



Fig. 44. A View on the Chattahoochee River at Columbus, Ga.

‘West was also instructed to receive the products of the country in payment of rents at the following valuations: Ginger, sealed, at 2d. per pound; scraped ginger at 3d. per pound; indigo at 3s. per pound; silke at 10s. per pound; cotton at 3½d. per pound.’”

About that time great efforts were being made to establish indigo culture in the Carolinas. Indigo was also introduced into Louisiana by the French in 1718, and within ten years became an object of export.

About 1740, when rice became reduced in price, the seed of the East India indigo plant, which had been for many years extensively cultivated in the West Indies, was sent, with cotton, ginger, lucerne, etc., from Antigua by Mr. Lucas, the governor of the island. Previous to the war of the Revolution, indigo held the position among the products of South Carolina afterwards occupied by cotton. It was hardly less important in Georgia.

Miss Lucas, the daughter of the Governor of Antigua, and the mother of General Charles Cotesworth Pinckney, was, at the age of eighteen, in charge of a plantation in South Carolina. In her journal, 1739 and 1741, she speaks of the pains she had taken to bring cotton and indigo to perfection. The first export of cotton was from Savannah. An exportation of seven bags, valued at £3 11s. 5d. per bag was made from Charleston, between November, 1747, and November, 1748.

American Cotton Cultivation in 1832. It may be interesting here to reprint a review of the state of cotton cultivation in the United States, written in 1832 by James Montgomery, who came from Glasgow, Scotland, to take charge of some cotton mills. At that time the American cotton crop was about 1,000,000 bales of 500 pounds, instead of nearly 10,000,000 bales as at present.

“Previous to the year 1790, North America did not supply England with a single pound weight of cotton; it was



Fig. 45. Convicts Working on County Road, near Atlanta, Ga.

only after the termination of the American War that cotton began to be cultivated in Carolina and Georgia, and it has succeeded so well that it forms one of the staple productions of the United States. But that which was first sent into the English market was very imperfectly cleaned, and, in consequence, was for some time used only for spinning low numbers. It was soon perceived, however, that the cotton grown upon the coast, termed Sea Island cotton, had a longer and finer staple than that which was produced farther up the country, and known by the name of Upland cotton. But some years elapsed before it was ascertained to be of a quality in every respect superior to that which was brought from the Isle of Bourbon, the only cotton then used for the finest qualities of yarns, but which is now almost superseded by the former.

American cotton is generally distinguished by the names of Sea Island, Upland, New Orleans, Alabama, Tennessee, &c.

Sea Island cotton is the finest that is imported into this country, or, indeed, that is known, and takes its name from being grown upon small sandy islands contiguous to the shores of Georgia and Carolina, and on the low grounds bordering on the sea. The principal islands are situated between Charleston and Savannah. It is a fine silky cotton, having a yellowish tinge, both long and strong in the staple, and used only for spinning the finest qualities of yarn, or for a superior quality of power loom warps. But its qualities differ so much, that the finest specimens are often more than double the price of the inferior sorts. Its close vicinity to the sea exposes it to the inclemencies of the weather, by which it is often injured, consequently that which is thus damaged sells at a much lower price than the better kinds.

Upland cotton is a different species from Sea Island, and is grown in Virginia, North and South Carolina, and Georgia; and for a considerable time the cultivation was confined to these states.

As the planting extended to the south, the quality varied in some respects, and the cotton received the name of its place of growth ; hence, New Orleans cotton, Alabama, Mobile.

That which is known in the market by the name of New Orleans, is a very superior cotton, clean, soft, and of a glossy and silky appearance, rather short in staple, and incorporates freely with other cottons of a longer staple. It is grown upon the banks of the Mississippi, and sent in great quantities into the English market, where it ranks in price and quality about equal to the common qualities of Brazil cottons. Alabama and Upland rank next to New Orleans, and are soft, short, and weak in staple.

The cultivation of cotton wool is carried to a very great extent in the United States at present. The quantity exported from this country is estimated at about 350,000,000 lbs. yearly, and apparently still increasing. The quantity consumed by the American manufacturers is now about 90,000,000 lbs. The total quantity grown in the United States is estimated to be nearly 500,000,000 lbs. yearly, the value of which must be about £9,000,000. This article alone furnishes one-half of the whole exports of the United States."

As has been before stated the above was written in 1832.

CHAPTER II.

THE AMERICAN COTTON BELT. — PEOPLE OF THE COTTON BELT. — LAND TENURE IN THE COTTON BELT. — AREA OF AVAILABLE COTTON LAND IN THE UNITED STATES.

The American Cotton Belt. In the southeast corner of the continent of North America lies that section of the country known as the South — “The Sunny South” — as it is affectionately called by its inhabitants, and by the Northerners who make it a winter resort.

The South, so-called, is all situated within the boundaries of the United States, but does not include the whole of the geographical southern states, excluding New Mexico, Arizona, and Southern California, which, although as near the equator as South Carolina and Georgia, are not included in the territory called the “South.”

It is in this country that the fibre known to commerce as American and Sea Island cotton is grown, and it is from this section that the world has principally drawn its supply of raw cotton for two generations.

The cotton growing states bordering on the Atlantic are : Virginia, North and South Carolina, Georgia and Florida ; on the Gulf of Mexico, Louisiana, Mississippi and Alabama, with the inland states of Arkansas and Tennessee, the latter being connected with the ocean by means of the great Mississippi River, — “The Father of Waters,” — flowing into the Gulf of Mexico. Kentucky, though part of the South, is omitted in the above list, as the production of cotton is so small as to very slightly affect the total, and the same remarks as to production apply to California, Indian Territory and Arizona.

The tract of country specified as above, and shown on the map, Fig. 46, may be called the cotton producing section of the South, and is approximately 1300 miles from the most easterly to the most westerly point, and 500 miles from the north to the south, being in the form of an irregular rhomboid. The northern portion of the Cotton States is divided by a range of mountains, the southern termination of which is called the Alleghanies, the Blue Ridge and the Cumberland mountains, and comprises the highest peaks in the United States east of the Rockies. These mountains jut into the cotton belt as above defined, and lie almost midway between the eastern and western boundaries of it. From the mountains in all directions slopes an undulating country of gradually lessening elevation, descending on the east to the Atlantic Ocean, on the west to the Mississippi, and on the south to the Gulf of Mexico, all of which waters are at a distance of about 350 miles from the mountains. It is these elevated undulating plains that on the eastern side especially have acquired the name of Uplands, and given that name to a much used class of cotton. East and west of the Mississippi lies a flat tract of country, including the states of Louisiana, Arkansas and Mississippi, intersected by numerous bayous and watered by many streams flowing into the Mississippi River.

The mountain region contains many beautiful vistas, such as were described as "long drawn beautiful valleys and glorious highlands" by Lord Cornwallis, after marching through this country on the last occasion of a British army being found south of the Great Lakes; but away from the mountainous region, it is country that cannot be classed as picturesque, as the groves of pines or fir trees covering knolls of red soil intersected by gullies become extremely monotonous to the traveller, especially in the winter season. Even when the monotony is relieved by a river it is a liquified repetition of the land view — a muddy red stream fringed by the same unfailling pines and flowing between banks of red clay. In the spring

and summer, the luxurious vegetation in most sections gives a charm to many of the views, decorating them with beautiful green and an ocean of flowers, which remain until scorched by the intense heat of the summer sun, when the vegetation fades, the ground is dried up and parched, and, by fall, only the forests of pine and firs relieve the monotony of the red soil until another spring returns.

With the exception of a few hot summer spells, when clothing is from a utilitarian view unnecessary, when at night even a sheet or coverlet is an encumbrance, and when sleep will not be tempted until morning on account of heat, or because of the mosquitoes, the climate is exquisite.

The winter season is not cold as a rule; when snow falls it is only to a depth of an inch or two, and it readily clears away, while the morning sun easily breaks up any frost that shows itself during the night.

The air at mid-day at Christmas time is as balmy as a New England May-day. Spring is early and summer long, and it is this fact that admits of cotton raising.

Cotton is a plant that requires an early start and long season to bring its fruit to maturity. In the South, it is not unusual to have hot weather begin in April and May, lasting almost without intermission until September. June and July are usually extremely hot, and those who are able take refuge in the mountains of Georgia, North and South Carolina.

Cotton flourishes best when the nights are warm as well as the day, but this advantageous feature, from a cotton raising point of view, is of distinct disadvantage to the human race. Some of the effects of the weather on the cotton crops are treated of later.

The fall, winter and early spring are delightfully pleasant, with balmy warm days and evenings, and a touch of chilliness in the morning air.

The cotton plant is grown throughout all this region. In some districts it is the staple article of cultivation, while in

others it is cultivated as a surplus crop, or in specially favored plats. We find it in the stiff calcareous and otherwise profusely fertile buckshot soil of the great valleys and uplands, as well as on the brown loam bluff and timbered table lands, in the stiff red clay lands of the uplands, and even to some extent on the sandy soils of the coast region.

The country is sparsely populated. The population of North and South Carolina, Virginia, Georgia, Florida, Mississippi, Louisiana, Alabama, Texas, Arkansas and Tennessee was only 14,050,295 in 1890, or 24 people to the square mile. Compare this with 278 to the square mile in Massachusetts, or 540 to the square mile in England.

In North Carolina the whole population is only that of Philadelphia, of Berlin (Germany), or of Manchester and Liverpool (England), while the area of the state is 48,580 square miles, or larger than England, and considerably larger than New England, excluding Maine, yet it has only three cities of 20,000 inhabitants.

The states bordering on the Gulf of Mexico and the Mississippi river possess fine cities, but the description that applies to one southern state is largely applicable to another, and the figures regarding North Carolina, given above, indicate what possibilities of expansion and progress yet exist in the whole of this practically undeveloped territory.

People of the Cotton Belt. The population is largely composed of native born Americans, there being perhaps a smaller proportion of foreigners in the South than in any other section of the United States. Many of the whites are descendants from the original settlers who won the country from their Indian predecessors in the days when deer and buffalo swarmed over the cotton fields of today. These people have inherited or evolved qualities that are characteristic of southern as compared with northern people in all countries, whether in the old world or the new.

Men more genial, women more beautiful, and both more

sentimental, generous and hospitable, as a rule, than people of more northern latitudes, who are more rugged in speech, sterner in manner and more industrious and enterprising.

At the present time there is a continual influx of northern and foreign settlers, but they are not sufficiently numerous to visibly affect the characteristics of the southern people, although in many instances peculiarities of the original race, from which residents of certain districts are descended, can be traced, as for instance, where the country or a section of the state was originally settled by Swiss, by Scotch Presbyterians, by Ulster Irish, or French Huguenots.

The better class of white people are largely descendants of merchants or planters, who before the war, cultivated large areas of land under cotton, sugar and tobacco, by slave labor. These people, impoverished by the war, are only now beginning to recover from its effects, but many of them are building up businesses as merchants (which in the South includes every variety of store-keeper), as flouring millers, cotton dealers, owners of saw mills, and even cotton, woolen and hosiery mills.

There is a very large sprinkling of a very poor class of whites, particularly around the Blue Ridge mountain region, who are spoken of in Georgia as "crackers," whose existence as available cheap labor affords a possibility for a great increase in the manufacturing industries which would not otherwise be possible. These people when on the mountain farms are dreadfully poor, are in almost all cases so ignorant that they cannot even read or write, and carry, especially the women, a gaunt, anxious, haggard appearance, which indicates an unceasing struggle for a bare existence. Their habits are primitive, and such old world industries as hand spinning and weaving are still known among them. At the mills they are much more prosperous and their condition rapidly improves. A group of North Carolina cotton mill help is shown at Fig. 47.



Fig. 47. North Carolina Cotton Mill Help.

Hitherto, these people have cultivated small farms on the share system on the upland slopes of the mountains, and are now glad of the opportunity that is being afforded them of finding work in the cotton mills that are springing up all over the South, and which it would not be possible to run without drawing on a class of labor such as this.

There are three states — Mississippi, Louisiana, and South Carolina — where the colored people out-number the white. While a large proportion of the population in every southern state consists of the colored descendants of the slaves, only a small percentage of the colored people consists of the real “slave negro.” The hard working, civil, virtuous, well trained “uncle” and “auntie” of “befo’ the wah” times is fast disappearing, and is almost as scarce as a “Crimean Veteran,” and their place is being taken by an undesirable class of lighter colored, lazier, and more thriftless colored people.

Formerly the African had to work from compulsion, but now hunger is often the only incentive to labor. The character of the present day negro is seen in the ill-cultivated farms, the crowds of loafers at the street corners and store doors, or the heavy percentage of “colored” on the chain gang, as shown in several views throughout this book.

Even the negro belonging to this class considers himself or herself superior to the “cracker” or “white trash” type of white men previously named, as abundant instances show.

The future relation of the colored to the white race is one of the sternest problems that the southern legislators will have to deal with.

The bulk of the cotton that is raised is produced by these two classes of people, the negroes or the poor whites, working for the better class planters, or working for themselves on the share system previously named.

Another resident in the South, who ought not to be forgotten, for on the farm he is always to be found with the negro, is the mule. The colored farmer always prefers a mule





FIG. 10. M. 11. THE UNITED STATES. (PART.)

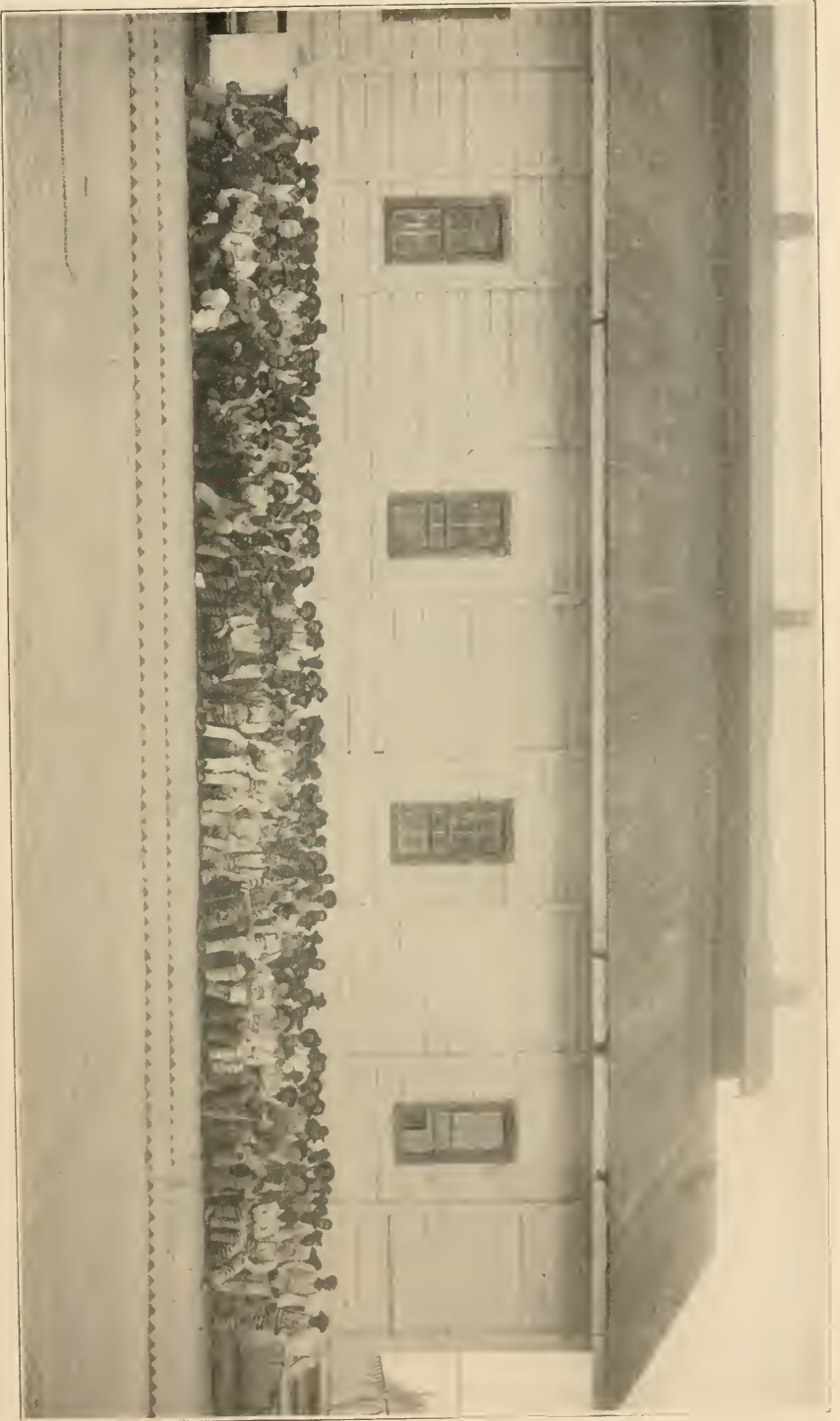


Fig. 48. Georgia Convicts.

to a horse, and it is a standing joke in the South how well these two work together. The wagons in the upland countries are almost always drawn by mules, or "mountain canaries," a name which anyone who has ever heard them sing will thoroughly understand. As the southern mule is singing bass, tenor, alto and treble in one long-drawn note, its owner is apt to caution you to "keep away from de business end of dat ar mule."

An odd combination of the new and the old is shown in Fig. 49, where are seen an ox and two mules drawing the latest production of the weaving mechanics art — a magazine or Northrop loom — over the rough country roads of South Carolina, for which view I am indebted to the Draper Company, Hopedale, Mass.

Land Tenure in the Cotton Belt. The cotton crop is now raised principally by small farmers. Before the war the plantations were large, and the position of a cotton planter with broad acres and numbers of slaves was an important one. At the time of the war all the planter's wealth was in slaves and land, and when freedom came, he, in many cases, lost both. The loss of capital represented by the slaves, which, on an average, were worth a thousand dollars each, was enormous, and the immediate effect of this was a great depreciation in the value of land, for there was not labor enough in the country to cultivate it. The negro, always fond of idleness, has never worked since the war as he did before it, and, apart from the planter's own family, the whole population was small, consisting chiefly of small farmers who had their own lots to cultivate, and the white men who had been employed on large plantations as millers or mechanics.

Land previously worth \$20 to \$30 per acre fell to \$4 or \$5, and some of it lay fallow for many years. \$5 = £1.

Out of these circumstances has been evolved the renting of small farms, sections of former plantations, to both white and colored farmers, on what is known as the share system.

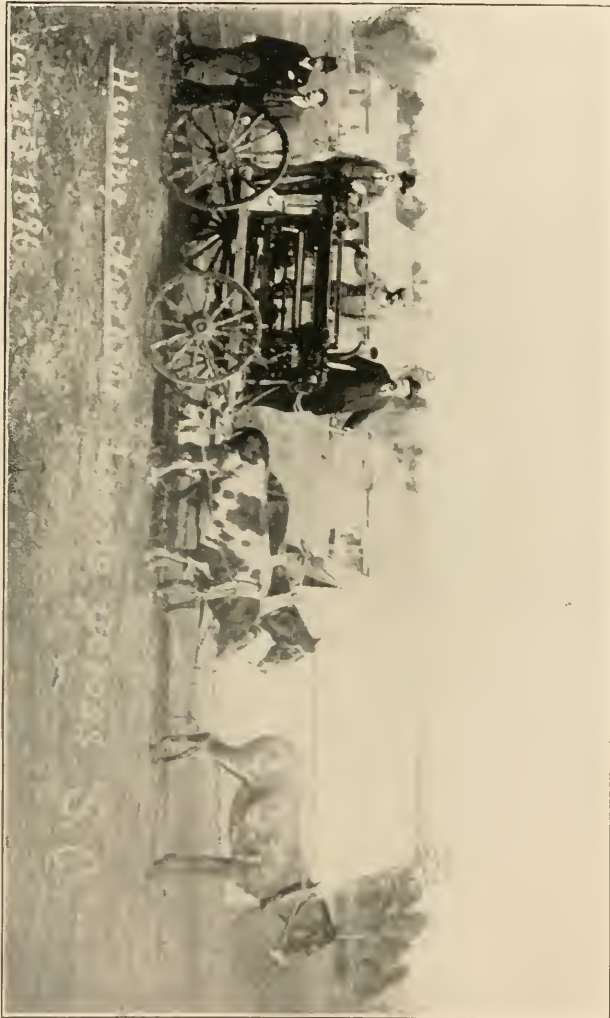


Fig. 49. New and Old. A Northrop Loom Being Hauled in South Carolina.

Those of the former planters or their descendants who had retained possession of the plantation, almost always derive their rent from this system, retaining a section of land to cultivate themselves, or running stores, ginning and flour mills, cotton presses, and the like, and it is this class of people that is now largely aiding in the new movement of "Cotton Mills to the Cotton."

The share system is undoubtedly a great burden to the country, a tax on the cultivator and a serious addition to the price of cotton. Yet it has been a necessary evil, for on no other system could such enormous crops have been raised during the last thirty years in a country impoverished by war and by the loss of almost all its capital.

The system varies in different sections of the country, but it is usually on the basis of the land owner taking his rent in a portion of the crop. The proportion varies in various districts, according to whether the crop is mostly corn or cotton, whether the land owner provides fertilizers, mules, ploughs, or not, and according to the location of the land. The average in a number of the states is that about one-fourth or one-third of the crop is equivalent to the rent of the land, that another one-third of the crop is equivalent to the supply of fertilizers, hardware, mules, implements, feed for the stock, and blacksmith's work, leaving from one-third to five-twelfths as being a fair equivalent for the labor of raising the crop. From these particulars the following instances can be given:

In one case the negro or poor white pays one-fourth of the crop for the use of the land and defrays all expenses himself; in another case the land owner allows the use of the land, and pays the bills for fertilizers, blacksmiths, keep of mules, and so on, and takes one-half the crop; in another case the land owner provides everything but the labor and takes two-thirds of the crop.

The maximum crop that is generally raised is usually



FIG. 50. Cotton Mills to the Cotton A Spinning Mill Being B. of C. 1890. F. 1890.

considered to be 500 pounds of lint, or one bale to the acre. From this the crop diminishes to a very small amount, the average over the whole cotton belt being less than 250 pounds, or half a bale to the acre.

As an instance of the products per acre which it is reasonable to expect under the best cultivation in this section, the premium list of a county fair held in eastern North Carolina contains the following limitations :

“ For largest yield of lint cotton upon one acre, not less than 500 pounds.”

“ For largest yield of corn, not less than fifty bushels.”

“ For largest yield of rye, not less than thirty bushels.”

“ For largest yield of sweet potatoes, not less than 250 bushels.”

A bushel of corn (maize) weighs fifty-six pounds ; of rye, fifty-six pounds ; of sweet potatoes, sixty pounds ; and of cotton seed, thirty pounds.

The rents for cotton farms when paid in cash seem somewhat excessive, for example :— land valued at \$5 to \$6 an acre is rented frequently for \$2.50 ; that valued at \$4 is rented for \$2 ; and in another case, that valued at \$10 is rented for \$4. Of course it must be borne in mind that the whole of the farm is not figured in estimating the rental, as some of it is not fit for cultivation, and also that the landlord is not always able to collect his rent, but even considering these points, the cash rental appears excessive in proportion to the valuation.

The name “ planter ” is largely dying out and in its place the word “ farmer ” is used. A planter was at one time a kind of feudal lord, with broad acres, a fine mansion and slaves. Now the farmers often live in a cabin on a patch of a few acres. Most of the cotton that is now grown is raised on small farms, which can be cultivated by the farmer and his family and by the use of one or two mules. This is the cause of considerable variation in the quality of the cotton,

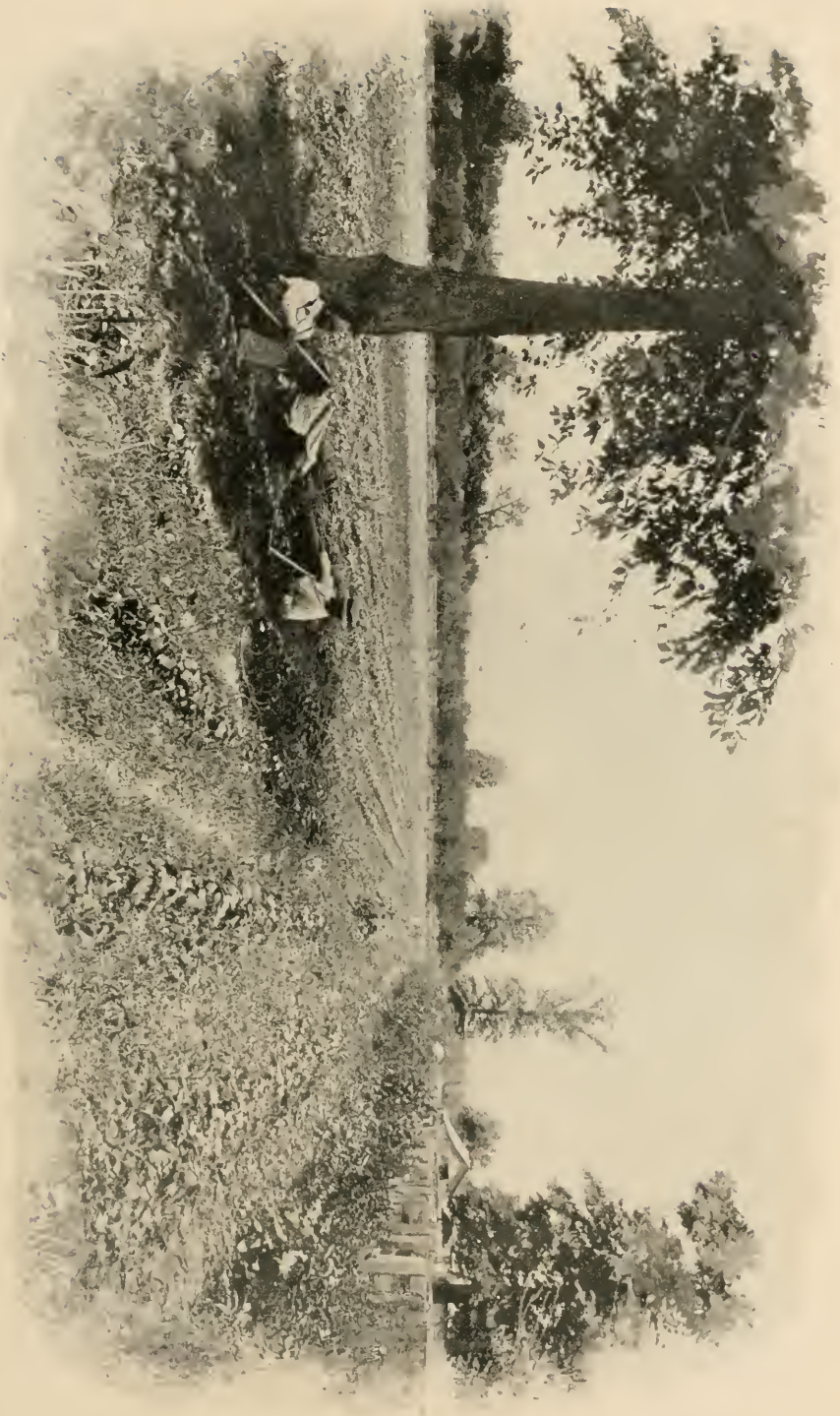


Fig. 51. Why Some People Cannot Make a Living in Arkansas.

even from the same district, owing to the difference in care and attention paid to the cultivation by different farmers. In many cases, very little attention is given to improving the farm, the negro especially, not being very fond of "intense" farming, does as his forefathers have done and neglects the use of improved machinery, deep ploughing, or fertilizing, and other features of improved farming.

The farmer who pays a cash rental for a farm, or who pays rent equal to one-fourth or one-third of his crop, and who has sufficient spare capital to finance himself until the ingathering of the crops, is in a fairly good position. Of course, in order to raise a big crop, the farm requires a great deal of attention and employment of labor in the periods from April to July, and again from September to November; but it has been stated, and is undoubtedly true, that a cotton farmer by only working two days per week on an average throughout the year, can raise a crop sufficient to support his family. There is no doubt that settlers with capital can find a good opening in cotton growing, and if they do not succeed it will be from the reason indicated at Fig. 51.

On the other hand, a penurious farmer who starts out by guaranteeing some portion of his crop for rent, and then in January or February gives a mortgage on the balance of his crop, which is not yet sown, and who gives a further chattel mortgage in April or May on his household belongings, for the purpose of obtaining provisions, tools, fertilizer, new mules or wagons, is in a very sorry plight. He is fortunate, if on the sale of his crop, any balance remains after paying his debts, and the merchant is also fortunate if he gets paid.

This system leads to a very unnecessary expense in the cultivation of cotton and a consequently enhanced price per pound. The high prices charged by the merchant for supplies, excessive interest on loans, and the fact of being in debt, prevent the farmer from adopting improved systems or devoting to his business that energy and enterprise which a man in a

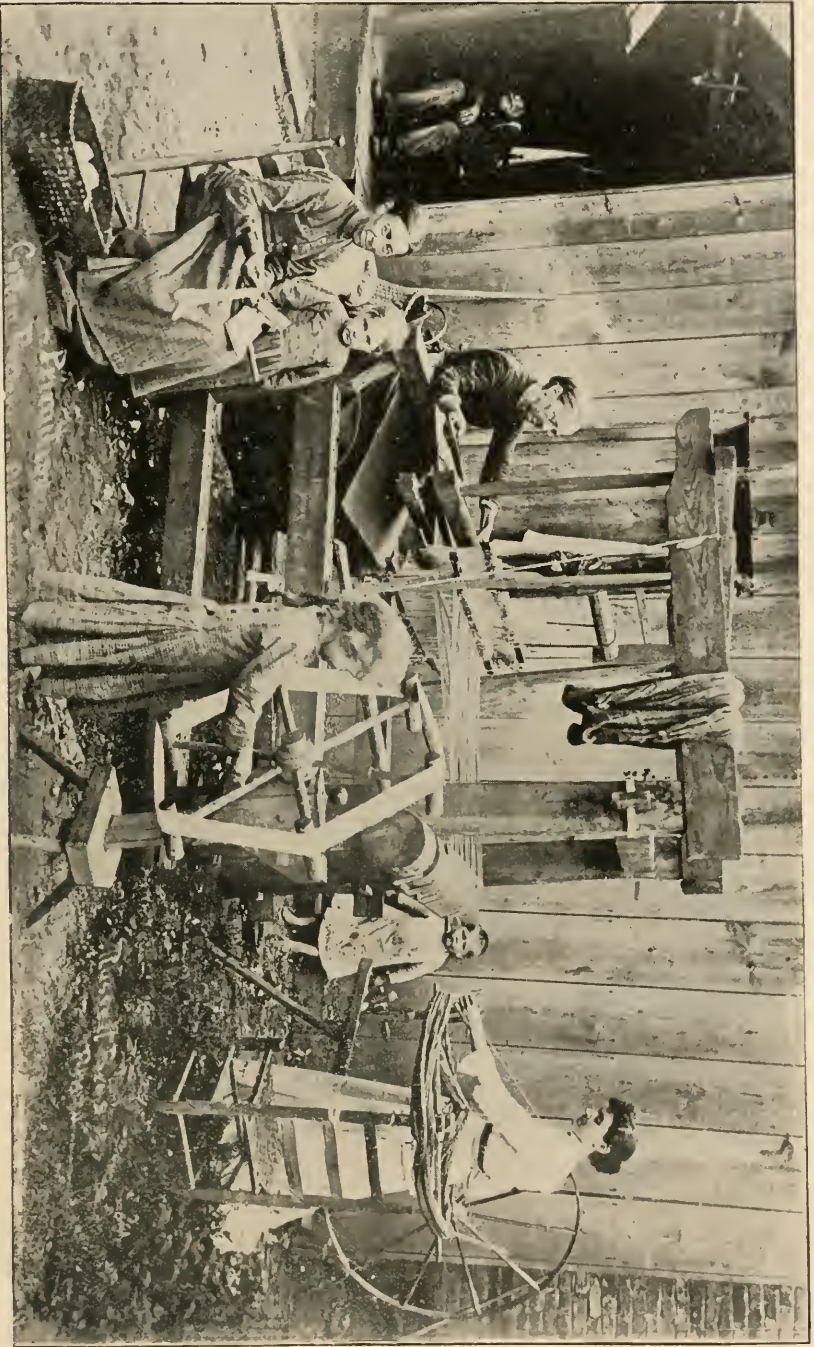


Fig. 52. Hand Spinning and Weaving in the South.

more independent position would exert, to bring down the cost of cotton raising to the lowest possible point.

Purchasing supplies on credit prevails to a considerable extent, especially among the small farmers. The exact rate at which the advances are made cannot be given, as it is not charged as interest, but is included in an increased price asked for supplies purchased on credit. It varies from 20 to 100 per cent. above the market value of the goods, according to the amount of competition among the store-keepers, who here are by far the most prosperous class of the community, in proportion to the skill and capital employed. The better class of farmers do not approve of this credit system. It furnishes facilities to small farmers, and encourages them to undertake operations they cannot make remunerative to themselves; it reduces the number of laborers, and precludes high culture.

The rental value of land is thus increased, and that which could not be sold for \$10 may be rented for \$5. The thriftless culture resulting from the small farms, unduly multiplied by this unhealthy stimulus of credit, causes many acres to be thrown yearly out of cultivation. Thus the increasing demand to rent land, in consequence of the increasing facilities for credit, to small farmers, and the constantly diminishing area of arable land resulting from the very imperfect system of culture which their lack of means forces them to adopt, create high rents, injurious to the small farmer, and impoverish the landlord by deteriorating the quality of his land, as well as by abstracting the labor he could employ in remunerative culture.

In the above system, it will be seen that cotton has been considered as currency, a bale of cotton all over the southern states being as good as money. The receipt of a seaport warehouse for so many bales of cotton is equal in buying power to a greenback in any part of the state. Warehousing cotton does not necessarily imply that it is to be sold immediately. It lies in safety until the owner needs the money, or the price

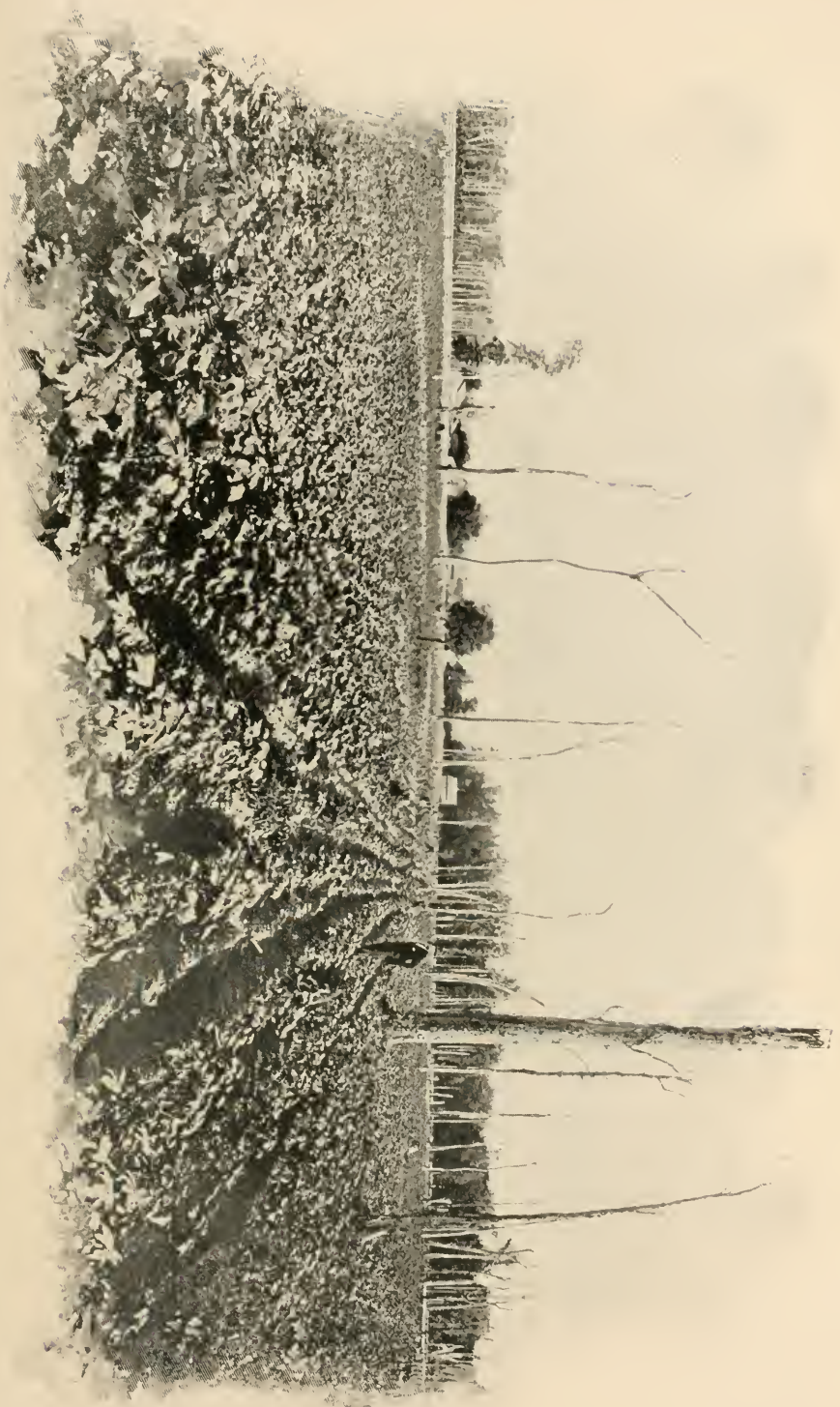


Fig. 53. New Cotton Field on Line of Cotton Belt Route.

is high enough, and then a telegram to the agent to sell all or any part of it completes the business.

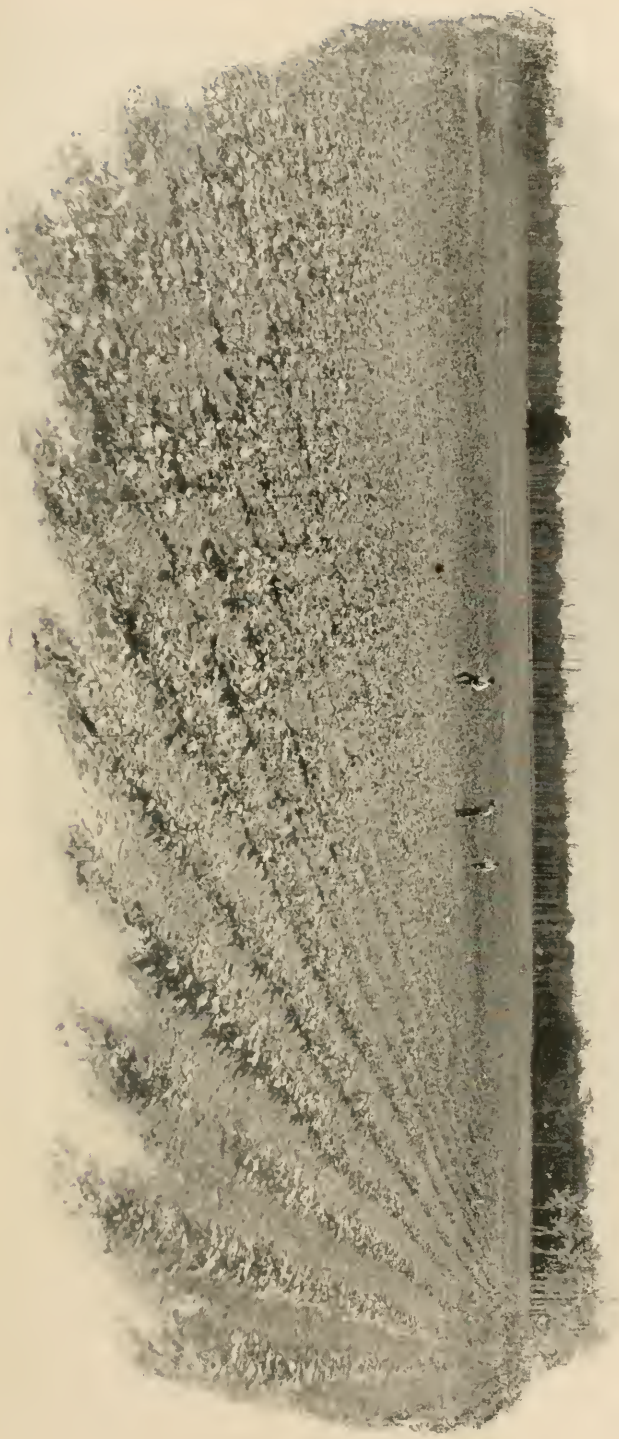
The extent to which cotton is the equivalent of cash in the cotton country is hardly equalled by any product in the North, and the time has been when the man with cotton bales laughed at the man who had nothing but cash, that is, when a bushel of confederate money would hardly buy a ham. In those days cotton was a good means of exchange, and the system has thus grown up by which a bale of cotton can be ginned for 25 lbs. of cotton; a farm can be rented by the payment of one bale out of each two, three, or four raised, and the current price of cotton has come to be the standard of value.

The winter is usually a dull season in the cotton districts. The time in some cases is employed in household industries. There are still to be found in some parts of the South the old spinning wheels and hand looms on which yarn and cloth are prepared from home grown wool, of which a view is given at Fig. 52, for which I am indebted to Mr. Jos. M. Wade of Boston. The occupation for the men is ginning or hunting, anglice, shooting quails and other game.

During the last forty years there has been great improvement in cotton culture; formerly the virgin soil was cultivated and after it was exhausted a move was made to new ground, which was exhausted in turn, but the tendency now is to stay on one farm, and by means of deep ploughing, heavy fertilizing, and by giving great care to the cultivation of the cotton the increase of crop per acre reduces the cost per pound.

When new land has to be cleared it involves considerable expense, especially if away from the railroad. In this case the lumber that is cut is not worth the hauling to the railroad, and is burned on the site or stored for fuel. In a country where a large tree can be bought for ten cents there is obviously very little value attached to the material forming the virgin forest.

Fig. 54. Old Cotton Field on Line of Cotton Belt Route.



The clearing of new land is performed by the farmer and his family until he reaches the point when the logs are too heavy for him to move, and there is then occasion for an old-fashioned log rolling. It is only on an occasion like this, a camp meeting, or a visit to the market town, that farmers get together in any large numbers. The log rolling especially, although now decreasing in popularity with the advent of the steam log pullers and other machinery, is still an occasion for much whiskey drinking and hilarity. By the aid of a large number of men the logs are rolled into huge piles and burned.

In some sections of the country it is not the custom to fell all the trees, the large ones, the monarchs of the forest, are left standing, and the bark is stripped from them for some height from the ground, so as to kill them, and they are brought down at last by a wind storm. A newly cleared field with the gaunt trees still standing is shown at Fig. 53, and an old field at Fig. 54.

The cost of clearing land is usually about \$5 an acre when away from the railroad; if the land is sufficiently near the railroad to enable the wood to be hauled there and sold, the cost of clearing is somewhat reduced, and the wood brings from sixty-five cents to two dollars a cord, according to the locality. For fuel it is usually estimated that two cords of wood equal one ton of coal.

Available Area of Cotton Land in the United States. There is still a great area suited for cotton in this country which is not cultivated. In 1889 1.06 of the total area of the United States was devoted to the cultivation of cotton. Only a small percentage of the land adapted for cotton is yet under that product, as is shown by the following statistics of the eleventh census (1890).

Taking nine suitable states, which are of sufficient importance from a cotton raising point of view to have one per cent. of suitable cotton land, the average per cent. of suitable



Fig. 55. A North Carolina Chain Gang.

land under cultivation is only 6.162 per cent. of the whole, the details of which, according to states, are :

South Carolina	10.29 per cent.
Mississippi	9.72 " "
Georgia	8.86 " "
Alabama	8.37 " "
Arkansas	5.01 " "
Louisiana	4.37 " "
North Carolina	3.69 " "
Tennessee	2.80 " "
Texas	2.34 " "

As shown above, there is still a very large percentage of the area available for cotton raising which may be some time put under cotton cultivation, immensely increasing the already enormous crop of this staple produced in the United States.

The tendency of cotton growing is moving gradually westward. It was first started on the seacoast of South Carolina, but now it extends very much further westward. Half of the increase of acreage between the tenth census and eleventh census of the United States was west of the Mississippi River, and, notably in Texas, the western counties are now raising large quantities of cotton.

The production of cotton by states, according to the latest information which is available, is as under :

The estimate is by Col. Shepperson :

1896-7.	
North Carolina	485,000 bales.
South Carolina	760,000 "
Georgia	1,270,000 "
Florida	60,000 "
Alabama	1,000,000 "
Mississippi	1,220,000 "
Louisiana	570,000 "
Texas and Indian Territory	2,267,000 "
Arkansas	730,000 "
Tennessee	300,000 "
Virginia, Missouri, Kentucky, etc.	44,000 "
Total	8,706,000 bales.

CHAPTER III.

COTTON CULTURE. — FERTILIZERS. — SELECTION OF SEED. — FOREIGN COTTON SEED. — COTTON PLANTING. — CHOPPING OUT. — CULTIVATING THE PLANT. — COTTON PICKING. — OPERATIONS OF COTTON CULTURE. — DAMAGE TO CROPS. — CULTIVATION OF SEA ISLAND COTTON.

Cotton Culture. The usual encyclopaedia or text book description of cotton cultivation gives a very clear and precise statement of the routine of cotton culture, including the dates of all operations, but in practice the cultivation of cotton cannot be, by any means, so well defined as the movement of the hands round a clock face. From the extreme north-eastern to the extreme south-western corner of the cotton growing section of the United States is a distance of 1300 miles, and there must necessarily be, in so large a territory, many systems of farming born of dissimilar training and traditions of the farmer. There is a vast difference in the soils, in all gradations from the calcareous "buckshot" soils of the Mississippi Valley to the sandy belt of North and South Carolina. The latitude, ranging from 29° in Texas to 37° in Virginia, giving quite a different length of season, is another disturbing factor, while in the characteristics of the farmers themselves lies the cause of the greatest difference in method. An energetic, skilled man may, and often does, raise a bale or more to the acre by the side of another farmer whose indolence and ignorance keep him from making half a bale.

Among the chief points which receive the attention of the intelligent farmers are fall or early winter plowing, deep plowing, careful selection of seed, retention of seed or seed products on the farm as manure, or the replacement of it by

suitable fertilizers, and continuous cultivation during the growth of the plant. On the richer classes of soil in southern latitudes the fall plowing is almost impossible, as the cotton plant produces until winter, and the use of commercial fertilizers is also often unnecessary, but the other points named receive the careful attention of every good farmer.

In preparing land for a crop of cotton, the first treatment of the land is known as "breaking up." If the land is new, this is almost always done in the fall, but if the land has previously been under cotton, many farmers leave the breaking up until spring, and then only use a one-horse or one-mule plow, going down three or four inches. Some of them only disturb the old beds and use them again. The best plan is to break up the land as soon as possible after the old crop of cotton is gathered. In case of the old crop having been affected by an early frost, the breaking up may take place in the winter.

The stalks of the old cotton have to be dealt with. On small farms they are often clubbed down, on others a heavy limb of a tree is drawn over the field and the plants broken down so that they can easily be turned under with the plow. Another plan is to have a drag chain attached to the mule and plow by which the old plants are drawn under the operation of the plow, broken up, and turned under. If this is done early in the season, their decay is insured before the next crop is sown. The up-to-date farmer uses a mechanical stalk cutter, as shown at Fig. 56.

The plow may be of many kinds, heavy or light, the latter being largely in use for one-horse work. Views of plows are shown at Figs. 57, 58, and 59, the one at Fig. 57 being the cheapest one most largely used, while the others are better grade. The most useful material for their construction is wood; a wooden plow stock, style as in Fig. 57, may be purchased at all prices, from a dollar and a quarter (five shillings) upwards. The more expensive ones have steel beams, (Figs.

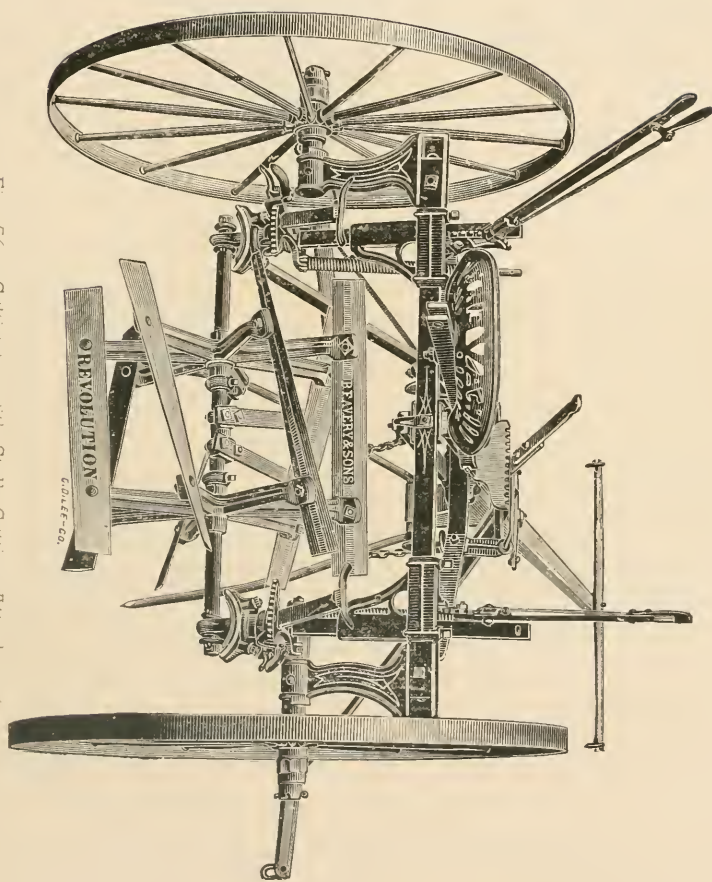


Fig. 56. Cultivator with Stalk Cutting Attachment.

59 and 61), and they cost from five dollars (one pound) upwards. The farmer usually has quite an assortment of plow shares or blades which he attaches to the stocks for different purposes, some of which are shown on Fig. 60. These blades are often worn out by a few days continuous plowing, and the quantity and assortment disposed of at the local hardware store in plowing time is surprising. For the illustrations, Figs. 56 to 61 and also Figs. 65 to 69 inclusive, the author is indebted to Messrs B. and F. Avery, Louisville, Ky.

To break up thoroughly a two-horse or two-mule team is used, and a plow to give as deep a cut as two mules can pull. This depends on the land, but may be from eight inches to eleven inches deep. The plow in this case turns the soil over on one side, burying all vegetation. One object in breaking up as early as possible is to get the vegetation of the previous season turned under while it is yet green and the sap is in it, so as to give it a better chance of decaying, thus saving fertilizer; another is to open up the soil to the action of the frosts of January and February, which pulverize the earth and destroy the insects secreted in the soil. While the fall plowing is generally admitted to be beneficial it is not commonly practiced throughout the cotton belt except in Georgia and Arkansas, and occasionally in other states. Some farmers in rolling country object to fall or winter breaking up on account of the tendency to wash-outs during the winter rains.

The work of preparing the soil begins in earnest in the spring, usually about March, a time being chosen when the soil is not wet after rain. It may happen that the farmer gets two weeks plowing continuously or that his work is continually being interrupted by rain.

If the breaking up has not been performed in the previous fall or winter, the old stalks are clubbed down, and, if small, turned in with the soil, or, if large, burned. The latter is a wasteful plan, but there is not now time for the large stalks to decay before the seed time, and their presence in the

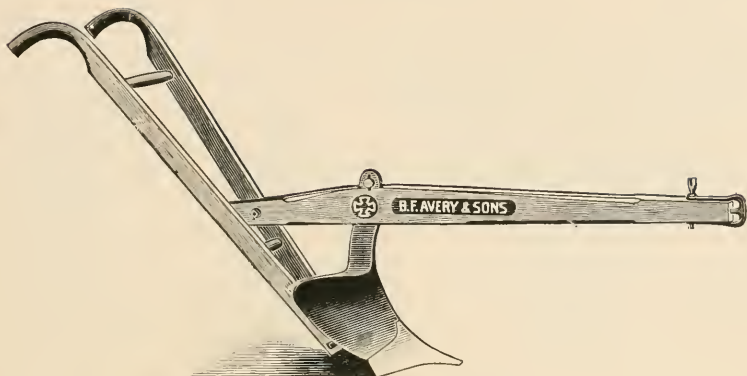


Fig. 57. Wooden Plow Stock.

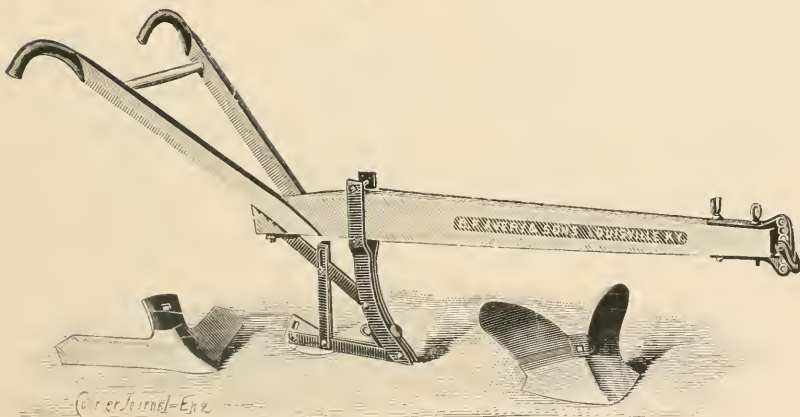


Fig. 58. Wooden Plow Stock.

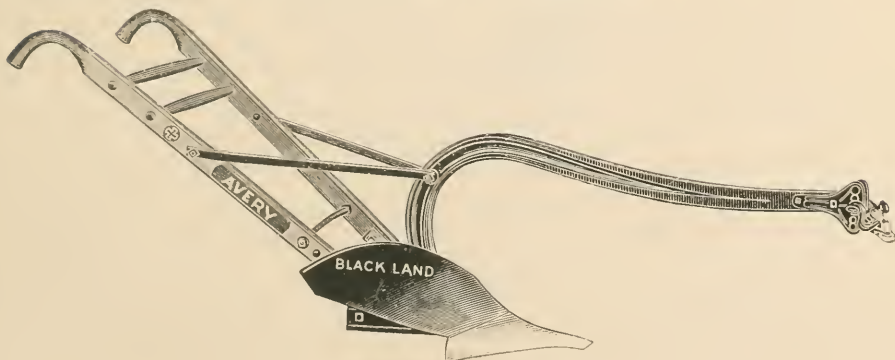


Fig. 59. Steel Beam Plow.

ground during cultivation disturbs the young plant. The ground is then broken up with a two-horse plow having a deep cut, as previously described.

The best opportunity now presents itself for inserting broad cast the natural manures — cotton seed, which has been composted with vegetable matter, acid phosphate and kainit, or may be the manure consists merely of barn-yard manure, marsh muck, if available, coarse refuse fertilizers, or sweepings from cotton seed oil and fertilizer mills.

If fertilized rough cast, then the harrow usually used is a wooden frame toothed harrow, or one of the many machines for pulverizing the soil, by means of rolls on a shaft or shafts, as shown in Fig. 63.

The next process is bedding-up. Especially on new land, the making of the first furrow, or laying-off furrow, is a matter of some considerable importance. It may be that a special laying-off furrow is made with a shovel plough, to locate the beds, but more often the first cut towards bedding-up lays off the bed. Especially on uneven ground, laying-off or terracing is of much importance, as by a proper arrangement of the furrows to give good surface drainage, washouts during heavy rains and undesirable accumulations of water are prevented. Where possible the water should drain to a branch (small stream).

The recognized and accepted mode of cultivating cotton through all the South is in elevated ridges or beds, varying in the distances apart according to the habit of the plant as to height and foliage. On rich bottom lands, where the plant attains a height of from six to ten feet, as for example in the bottom lands of the Mississippi River, the furrows are usually six feet apart, diminishing on poor land or more northern latitudes, as in North Carolina or Virginia, to two and one-half feet. An average over the cotton belt would be about four feet.

The next work is to form these beds. This is done by a one-horse turning plow, with a large cut, and the bed is

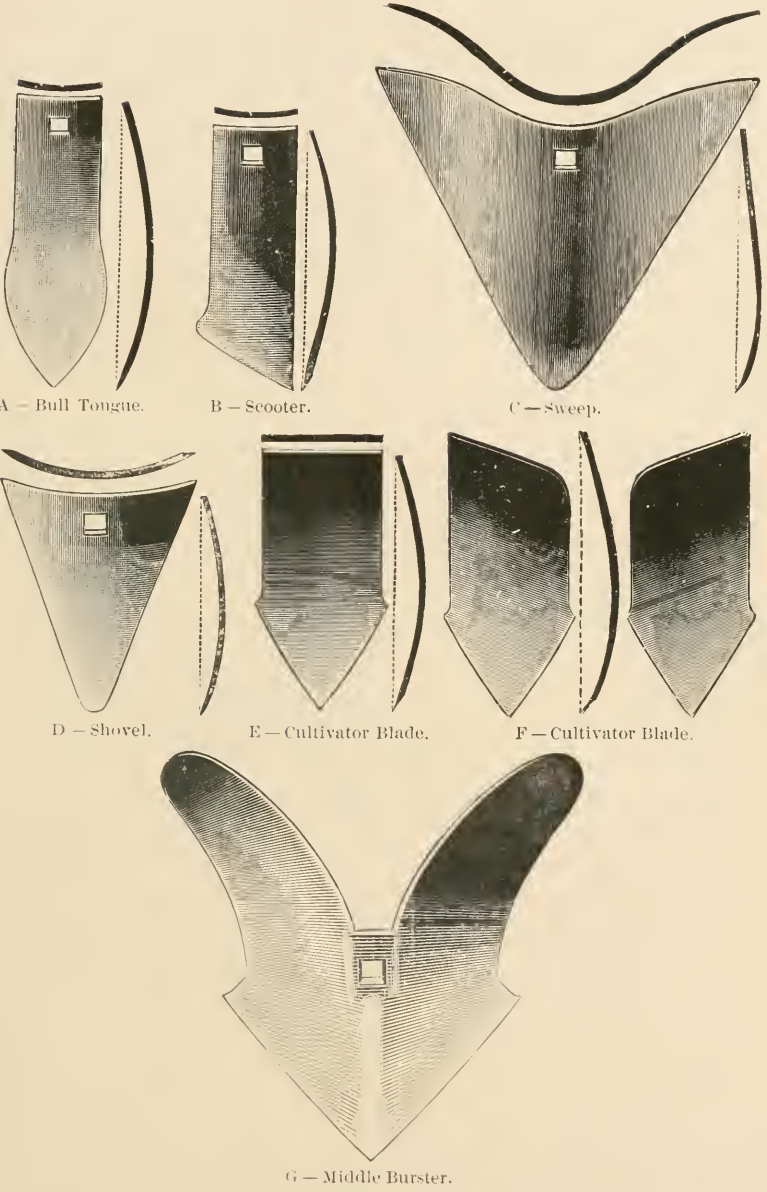


Fig. 60. Plow Blades and Plow Shares.

formed by plowing along the field, throwing the soil one way, and down the opposite side of the bed, throwing the soil to meet the previous furrow; or it may be that two plows are used, one taking each side of the bed and throwing up the soil to meet that thrown up by the plow preceding. This is repeated sometimes twice. By this means the compost of manure thrown broadcast is turned into the bed.

The operation of "splitting middles out" is now performed, which consists of running a furrow along the center of the bed, throwing the soil to each side to receive the fertilizer, if any, and later the seed. On small farms this is usually done with a special tool attached to the plow, as shown at Fig. 61, but on large up-to-date farms a sulky, with middleburster attachment, is often used, as shown at Fig. 65. The operation of "bedding-up" is now completed.

The succeeding operation is manuring the beds by means of commercial fertilizers, which are in the form of a powder. The most approved plan is to fertilize by means of a machine, consisting of a hopper carrying the fertilizer suspended on a frame, like that of a wheelbarrow, and usually arranged with a movable bottom to the hopper, alternately opened and closed by the revolutions of the wheel. This is done by the bottom of the hopper being suspended by two rods which rest on a series of projections on the wheel. As the wheel revolves, these rods drop from one projection to another, and as the bottom of the hopper opens, fertilizer drops on the shoot and is distributed regularly. Two shoes behind the machine cover up the fertilizer. This is advisable rather than to lay the cotton seed in actual contact with the fertilizer, some kinds of which are so strong as to damage the tender plant in the early days of its germination.

The more primitive method of fertilizing is by means of a fertilizer tube. This is a tin tube some five or six feet long, with a funnel at the upper end. The field hand using this carries the fertilizer in a bag suspended from his or her waist

or shoulder, and feeds the tube by hand through the funnel, the lower end of the tube resting in the place where it is desired to deposit the fertilizer.

Fertilizers. There are many varieties of these fertilizers. Barn-yard manure is used alone to some extent, but it is also the practice to use cotton seed in many districts, composted with acid phosphate and stable manure, sometimes with the addition of other litter and lime. The seed is killed by the heating of the compost, and is applied broadcast over the land

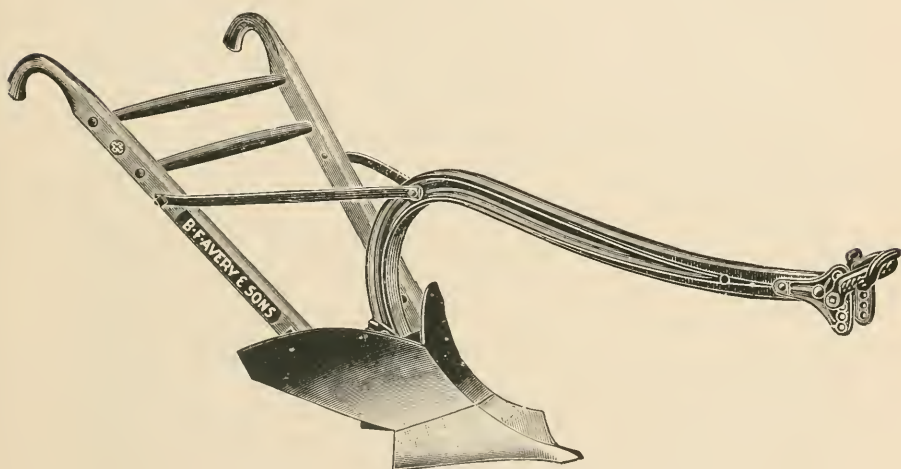


Fig. 61. Steel Beam Plow with Middle Burster.

before breaking up, as before described, or in the drill at the rate of a quarter of a ton to a ton per acre. Still these coarse manures only form a small proportion of the fertilizers used annually. What are known as commercial or artificial fertilizers are most largely in use. These are substances which contain available phosphoric acid, nitrogen or potash, in the best form for assimilation by the growing plant.

In consequence of the demand for a cheap fertilizer, there is frequently only from twelve to twenty per cent. of plant food available in these manures. There are many varieties of

them ; they may be imported manures, such as German kainit, which is an impure potash, or as Peruvian guano ; they may be domestic fertilizers, removed from some other parts of America, such as phosphate rock from the deposits in Florida and South Carolina ; or the fertilizers may be of local production, as for example, cotton seed meal. More usually, a commercial fertilizer is a combination of these substances, mixed at the local fertilizer works, usually run in connection with a cotton seed oil mill. There are many other substances which are of great value as plant foods, and which are only suited to certain districts. Among these are dried blood, bone meal, horn and hoof waste, from the stock yards of Kansas City and Chicago.

It is very necessary that careful selection of fertilizers should be made ; insufficient attention is at present given to this important matter. The selection of fertilizers depends upon many circumstances, such as the nature of the soil, or location of the land, the latitude of the state in which the cotton is grown, and the state of cultivation of the farm. In the more northern latitudes, fertilizer is required that will force the crop and bring it to early maturity in consequence of the shortness of the season, while in the southern latitudes a fertilizer should be selected which will cause strong growth of the plant rather than unusually early marketing of the staple, for there is usually in the more southern states sufficient time to pick all the cotton that a plant will make.

The decision as to a suitable fertilizer to use should be determined by analysis. It is not the object of this book to recommend fertilizers, but any cotton planter desirous of finding the best manure to use on his land has generally at his call expert analysts in connection with his state department of agriculture. By submitting samples of his soil, and a statement of his agricultural conditions, he can obtain local expert advice which will be of great value to him. It is undoubtedly advisable to buy fertilizers on the result of analysis. Frequently an apparently high priced fertilizer may be cheaper than a low priced



Fig. 62. A Cotton Field.

one. A fertilizer that has the largest percentage of plant food is ultimately of less cost to the farmer, in consequence of his saving the cost of freight, handling and bagging, a large percentage of useless material. Most of the southern states have state laws for the protection of the farmer in regard to the purity of fertilizers, and many states levy taxes on the handling of fertilizers, in order to maintain the control of the analyses and to prevent fraud.

The quantity of fertilizer used on each acre of land is also a matter for local decision. The best results of fertilizing are not obtained in the first year or even in the second year; the fertilizer used the first year has an influence on the second and third years, and the system of continued fertilizing improves the yield more in the third and fourth years in proportion to the amount of fertilizer used than in the first and second. As has been before stated, some lands do not require any fertilizing, other lands require from half a ton to a ton per acre. The quality of the fertilizer and the state of the land determine the quantity to be used.

Cotton Culture. In cases where it is desired to dispense with as much work as possible and where cotton is planted on the same ground year after year, even the preliminary breaking up is dispensed with and the first or laying off furrow is run down the alley of the former year's cotton. Manure composts are laid in the first furrow and the new bed made by turning the soil on top of this. Still another plan is to bar off the old bed and run the new furrow through its center; this brings the plants on the same spot each year.

It is a debatable point whether the practice of planting on ridges is as advisable as it is to plough the land deeply and then sow the seed on the level ground. The ridge system has grown up with the system of light tillage, whereby the surface of the land receives only perhaps a two or three inch scratching, but a bed is formed ten inches deep or more by the soil being thrown up on each side. A good seed bed is thus

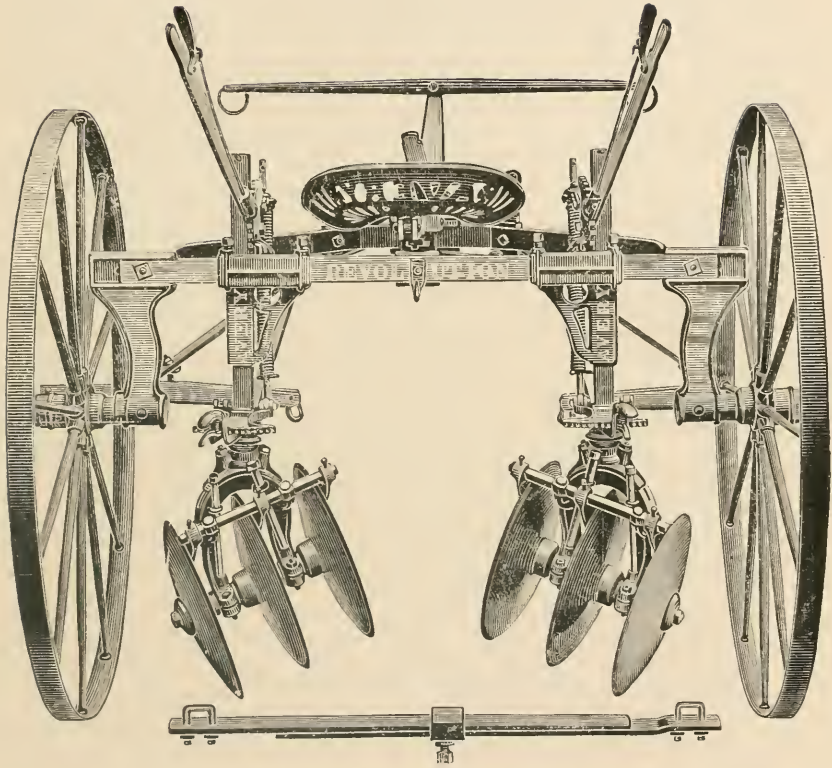


Fig. 63. Disc Cultivator.

easily formed, but it does not retain the moisture during the growing season as does a deeply ploughed field.

Cotton Planting. After the ground has been manured it is left until planting time. This varies according to the latitude of the district in question, but it may be accepted as occurring in April in the vast majority of districts. In some of the favored districts of Mississippi, Louisiana and Texas, where the season is abnormally long, seed is planted in the latter part of March. In the heart of the cotton belt April 1st is accepted as a suitable date; in North and South Carolina and Tennessee it is considered unwise to plant before April 15th; while in the extreme northern edge of the belt, as in Virginia, planting is deferred to the last days of April or early in May.

It has long been an accepted rule among the planters that when the dogwood blooms seed time has come, while another is that seed time will come ninety days from when the katydid is first heard.

Selection of Seed. The selection of seed is a matter of importance. The too common method of saving seed for planting is to take a sufficient number of bushels just as they come from the gin, or, perhaps, to buy them from an oil mill. No attention has thus been given to the selection of individual plants from which these seeds came, and those from the poorest, least prolific, and latest maturing are all taken together with those from the best; seeds from less prolific plants will have greater vitality and so produce stronger plants than those from the more prolific plants, and when this process is repeated for a few generations it is sure to result in a marked decrease in yield and a deterioration in quality.

A process of selection has been practiced for many years by wide-awake planters and the result is an immense number of "agricultural" varieties, of course, not botanical ones. Cotton is a plant which sports easily, which responds quickly to any differences in environment, soil, climate, treatment



Fig. 64. Cotton Field and Peach Orchard Together.

and fertilizers, and which can be greatly modified in form and habit in a very few successive crops. The flowers are large and open, so cross fertilization is not only common, but usual.

By selecting seed from plants showing good yield, early fruiting, length and fineness of staple, by planting these seeds separately and again selecting the best, several very fine strains of seeds have been obtained and are usually known by the names of the planters who originated them.

By far the larger number of names of varieties now in cultivation are simply synonyms of other names. Changes of names are commonly made by using the name of the person from whom seed is purchased, giving a new name to an old variety for advertising purposes, substituting a local name for one in general use, or transferring names from one locality to another. Often several varieties receive the same name.

The leading varieties are Allen Seed, Bates, Boyd Prolific, Cherry Cluster, Cook, Dickson, Drake Cluster, Okra, Peterkin, Taylor, Smith, Peeler, Texas Storm Proof, and Herlong.

Two tables are here given from Bulletin 33 of the United States Department of Agriculture.

I. Classification of varieties according to time of maturity.

Early.	Medium.	Late.
Bailey. Brooks Improved. Cherry Cluster. Dickson. Drake Cluster. Early Carolina. Grayson Early Prolific. Hunnicutt. Jenkins. Kieth. King. Matthews. Oats. Okra. Ozier. Peerless. Pittman. Welborn Pet. Williamson. Zellner.	Barnett. Bates Big Boll. Ben Smith. Boyd Prolific. Brannon. East. Eureka. Griffith. Hawkins. Herlong. Jones Long Staple. Magruder Marvel. Mattis. Moon. Peterkin. Peterkin Cluster. Petit Gulf. Pollock. Six Oaks.	Allen. Barnes. Bates Favorite. Brag. Long Staple. Catawba. Champion Cluster. Cobweb. Colthorp Pride. Cook. Ellsworth. Ethridge. Jones Improved. Mammoth Prolific. Marston. Minter. Peeler. Southern Hope. Texas Storm Proof. Truitt Premium. Willis.

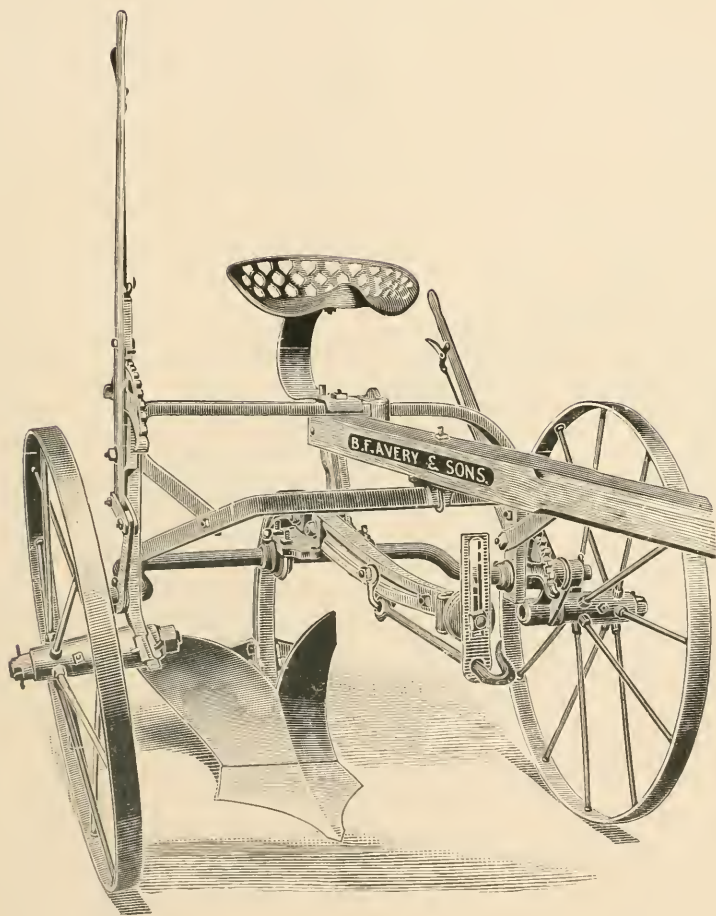


Fig. 65. Cultivator with Middle Burster.

II. Relative rank as regards yield of different varieties :

Variety.	Number of tests.	Maximum.	Minimum.	Average.	Variety.	Number of tests.	Maximum.	Minimum.	Average.
Haggerman	3	149	101	131	Hawkins.....	34	148	57	101
Texas Wool.....	9	143	105	123	Ozier	17	119	45	100
Taylor.....	7	177	96	119	Southern Hope....	34	139	68	99
Brannan	9	140	102	117	Ellsworth	8	125	54	99
Peterkin.....	53	171	70	116	Oats	7	120	65	99
Fishburn.....	4	149	95	116	Cochran	6	130	76	98
Thomas.....	5	157	101	115	Eureka	9	140	78	98
Keith.....	5	134	100	111	Chambers.....	3	101	89	97
Drake Cluster....	6	152	88	112	Ethridge.....	3	117	68	97
Excelsior.....	10	154	81	109	Hays China.....	5	114	84	97
King.....	44	173	76	108	Jowers.....	11	128	76	97
Boyd Prolific....	10	156	68	107	Willis.....	3	112	72	97
Truitt Premium....	45	161	40	106	Cherry Long Staple	14	132	74	96
Barnett.....	6	126	83	106	Jones Long Staple..	26	136	57	96
Duncan.....	8	129	86	105	Peeler.....	8	108	81	96
Hummieutt.....	8	134	74	105	Petit Gulf.....	15	132	46	96
Jones Improved...	23	135	82	105	Okra.....	28	124	67	95
Peerless.....	36	143	76	105	Allen.....	34	144	52	94
Texas Storm Proof.	27	176	69	104	Bolivar County....	3	116	83	94
Early Carolina...	7	126	83	104	Rameses.....	6	105	83	94
Bailey.....	4	132	79	104	Zellner.....	9	105	44	94
Rogers.....	3	122	94	104	Cobweb.....	5	103	87	93
Dickson.....	21	141	74	103	East.....	3	113	75	92
Deering.....	19	150	80	103	Cherry Cluster....	13	123	55	90
Peterkin Cluster...	5	124	80	103	Matthews.....	6	111	62	88
Shine Early.....	18	132	61	103	Colthorp Pride....	3	99	71	87
Welborn Pet.....	37	185	73	103	Cook.....	12	123	56	85
Ben Smith.....	11	139	73	102	Six Oaks.....	1	126	57	82
Dean.....	3	105	99	102	Wonderful.....	4	113	44	80
Crawford Peerless.	20	155	58	101					

[The average for all varieties taken as 100.]

Of course the origin of many varieties has been lost in obscurity, but from what information has been gathered it appears that the most frequent methods by which genuine new varieties have been originated have been by (1) the selection of individual plants for original stock; (2) the saving of seed from the earliest maturing bolls, and planting them (usually) on soil which has been highly fertilized; (3) cross fertilization; and (4) the very simple process of changing the names.

Foreign Cotton Seed. Seed from other countries has been tried. Varieties received from Japan produced very dwarf plants, with small bolls, very small seeds, and a staple not more than one-half to five-eighths of an inch long, which has

been harsh and woolly. Turkestan cottons have been uniformly light in yield, short and weak in staple, and usually somewhat colored. The Egyptian varieties are closely related to the Sea Island, and produce an immense growth of stalk. Mitafifi and Bamia are the two varieties which have been most widely tested, but neither has proved to be profitable. Both produce a very long and fine staple, but mature too late for the American climate. Possibly in Texas greater success might be met with. Seeds of both these varieties were dis-

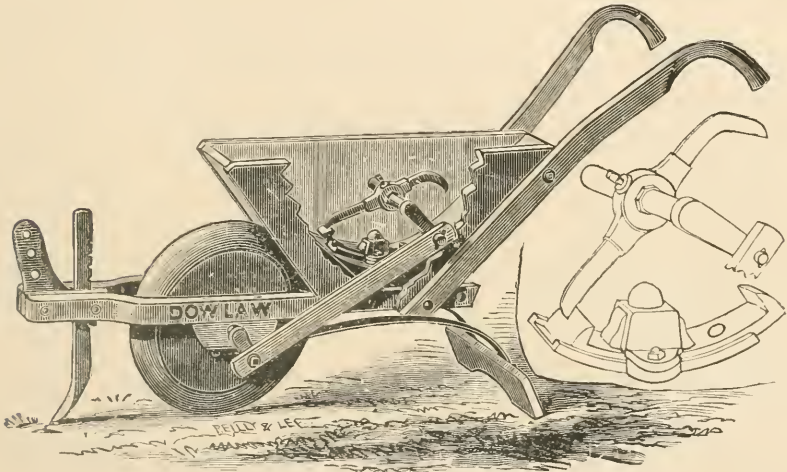


Fig. 66. Dowlaw Cotton Planter.

tributed quite freely by the United States Department of Agriculture in 1892, and since then a number of hybrids between them and some of the American upland varieties have been reported, which promise to have considerable value, especially in the southern part of the cotton region. The Indian varieties which have been received have been of two distinct types. One is much like the Japanese varieties in leaf, boll and lint, but produces a large and spreading plant which bears a very light crop. The other type is evidently descended

from the American seed which was sent to India in 1844, and which has become quite common in that country. It is interesting to note that this American cotton, which has been grown in India for fifty years, has come back to this country practically unchanged, and cannot now be distinguished from the Petit Gulf, which was so common in America from 1830 to 1850.

While the seed from other countries has not, as a rule, been successfully used here, the same applies to American seed sent abroad.

Some years ago a shipment of American seed was sent to Russia, for use in Russian Turkestan, and it was found that although the seed germinated, the plants attained a good height, and even formed bolls, yet these bolls would not open. To test the seed a barrel of it was shipped back from Turkestan to the United States. This seed never came up, probably in consequence of being killed by heating in transit.

Cotton Planting. For cotton planting, a machine called a planter is used by the more advanced farmer, and a popular one, the Dowlaw planter, is shown in Fig. 66. This economises seed, plants the seed more evenly, produces a better stand, and facilitates cultivation. Planters can be arranged so that the machine opens the drill, drops the seed, and covers it up afterwards; but the most approved system is to run it over the center of the bed with a bull tongue blade, Fig. 60 A, on the plough, so as to open the bed exactly over the fertilizer.

The planter is then drawn over the row by a mule or horse, and deposits the seed continuously, covering it up lightly by means of two shoes behind the planter, or a board, as in Fig. 66.

The planter may be described as a wheelbarrow, with a hole in the bottom. The wheel is of wood and is formed almost to an edge: immediately in front of it is a tool for opening the drill, which may, or may not, be used, as has

previously been mentioned. Attached to the wheel is a crank connected by a wooden rod to a lever attached to the seed box. The reciprocating movement given to this lever opens and closes alternately the seed orifice in the box, the slide keeping a constant delivery of seed by moving backwards and forwards, while a board behind the seed box, suspended on springs, levels the top of the ridge, covering up the seed. Another method of planting is to use the tube previously men-

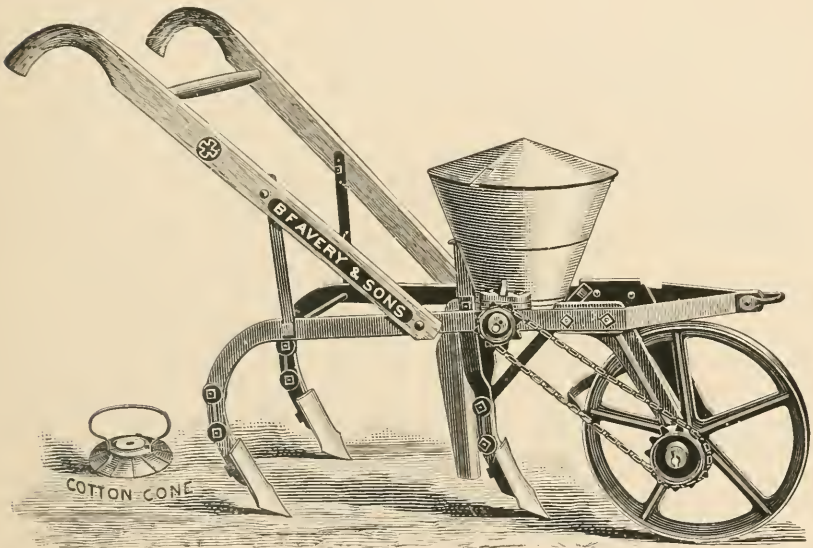


Fig. 67. Cotton Planter and Fertilizer.

tioned as in use for fertilizing. In this case, the bed has to be opened by a light plow, and after the seed has been dropped through the tube, a harrow, a wooden block, or a board, is drawn over the field to cover up the seed. This is only in use on small farms which are rented, and where the farmer, generally a negro, cannot afford, or has not the desire to pay \$5 for a planter. It is astonishing how the negro clings to old-time methods, and how slow he is to see any advantage in

“white folks’” improvements. Often he will not admit that cultivation has anything to do with it; but his explanation of the greater success of his neighbor is that Massa Johnsing has great luck, because he is the possessor of a left hind foot of a graveyard jack rabbit, which he “totes” round. He is correct in so far as the white Southerner often does carry such a fetish with him.

Another method is to use a machine shown in Fig. 67.

As will be seen from the sketch, there is a revolving seed or fertilizer holder, driven by a sprocket wheel and chain from the hub of the driving wheel. It has a tool in front to open the drill, and two shoes to close up the drill after the seed has been dropped. Seed and fertilizer can be deposited together by this machine, but the disadvantage of this method is principally in the seed being planted in contact with the fertilizer, and the advantage is that it combines two journeys over the bed in one.

It is a good machine for rich land, where little fertilizer is needed, and the quantity deposited is insufficient to injure the germinating seed. On light, sandy soil the planter covers the seed sufficiently, but on heavy clay soil, or other lumpy formation, it is occasionally the custom to run a turning plow up and down each row to complete the bed, or more usually a harrow is drawn over the field.

In moist, warm weather, the cotton germinates rapidly, and on a large farm that first planted may appear above the ground before the last seed has been sown. Three days after planting is about the earliest recorded appearance of the seedling, and in dry or cold weather, it may extend to as many weeks. The average time may be taken as seven days. The plants appear in a broken line, the spaces being caused by the non-germination of seed or the irregularity of planting; and still there are far too many plants in the row, so many as to obstruct each other's growth and grow too thickly for cultivation, or the light and heat of the sun to develop the

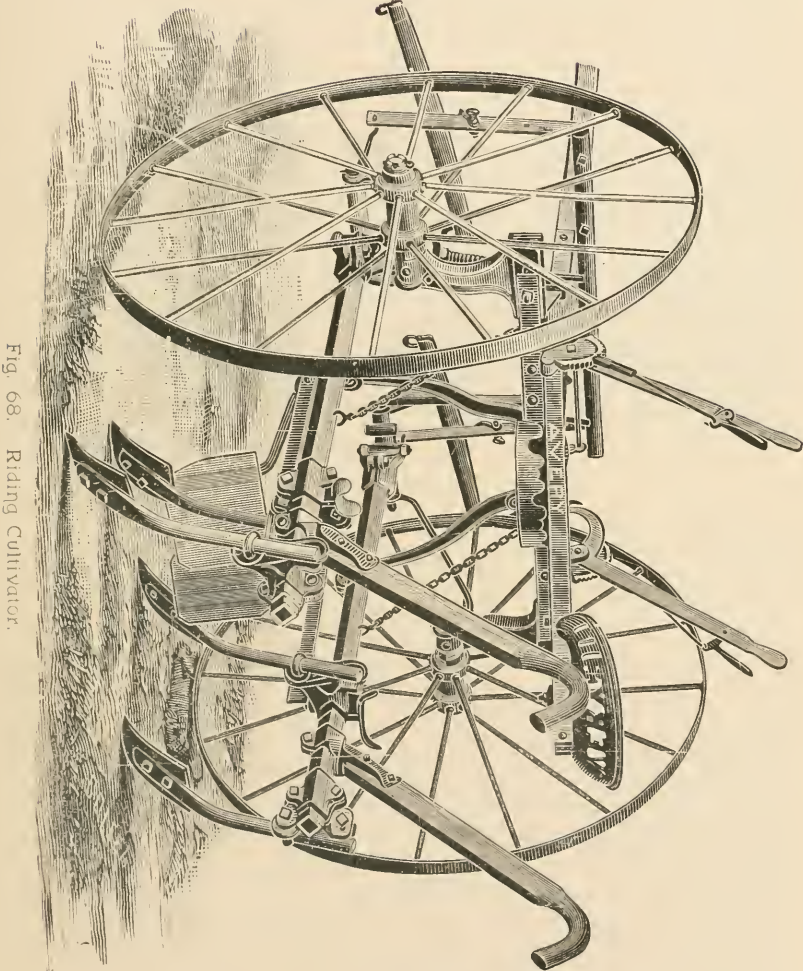


Fig. 68. Riding Cultivator.

flowers and the fruit. The whole field has, therefore, to be thinned out.

Chopping Out. The thinning out is accomplished by killing the surplus plants by a cut from a hoe, and thus a more expressive term often used is "chopping-out." This is one of the two great expenses of cotton culture, the other being cotton picking. Chopping out requires the services of every one on the farm, man, woman, and child, and often some hired help, if it is to be had. All through the month of May the railroad traveller sees the field hands at work, letting their heavy hoes drop apparently carelessly, but really with great precision, cutting away a dozen plants for each three left standing, but always leaving the right ones.

As they mechanically raise and drop their hoes, they sing songs and tell stories of the latest appearance of the "banshee behind Crowler's hill"; or the terrible apparition in "Mr. Johnsing's barn yard," or the "hoodoo that has been put on Mr. Thompson's farm." These ghost stories, however, must be taken on faith for no white man ever hears them. The moment a white man appears on the field, the talking stops and every boy and girl is a model of industry.

The distance left between each plant in the row is a matter which depends on the soil and the usual growth of the plant. In the inclined lands of Texas, Mississippi and Louisiana, as much as two feet, or even three feet, are exceptionally left between the plants, but the plant in these districts grows to a height of six or eight feet, or even more. In all other sections of the same states, and generally over the cotton belt, eight to twelve inches are left between plants on poor land, and twelve to fifteen inches on richer land.

In the North, for example North Carolina, Tennessee, and Virginia, it is exceptional to leave more than twelve inches. After all it is the number of plants that makes cotton, and the tendency in all the states is towards closer planting on the ridges, leaving full spaces between ridges, the belief being that



Fig. 69 A. An Unpicked Cotton Field — Morning.



Fig. 69 B. The Same Field Picked — Evening.

it is sufficient if the plants get plenty of sun one way. Some very interesting experiments have been conducted by the agricultural departments of various states, but although close planting is undoubtedly shown to decrease the yield of each plant, the aggregate production is greater on account of the much larger number of plants in the field. An extract from the bulletin of the Georgia agricultural department shows this very clearly.

(1.) On land capable of making between one and one and five-tenths bales of cotton per acre, the plants should not be closer than four by two feet nor wider than four by three feet.

(2.) The greater distance given, the more important it is to secure an early stand, thin out early and give rapid cultivation.

(3.) Close planting gives a larger yield in the early fall or at the first and second pickings. (The four by one series in the experiment was 161 pounds ahead of the four by two series at the close of the fourth picking, Oct. 15). This is because each plant, when planted closely, will make nearly, if not quite, as many blooms in the first few weeks of blooming as each plant in widely planted rows. Between the date of the first and second pickings, a period of twelve days, one pound of cotton was yielded by every fifteen plants in the four by one series, while in the four by two series, twelve plants were required to make one pound. When it is considered that there are only 5005 plants to the acre in the four by two series, against 9250 plants in the four by one series, the explanation of the greater yield of the four by one series in the second picking is plain. At the fifth picking, Nov. 4th, forty-three plants in the four by one series yielded one pound, while in the four by two, only thirteen plants yielded one pound.

Machines have been invented and tried for the purpose of performing the chopping out, but without satisfactory results.



Fig. 70. Cotton Field in Flower.

It requires a certain amount of judgment to select the most suitable plants to leave, in order to get a good stand, and the thinning out is all done by manual labor.

The plant is allowed to make three or four leaves before thinning out, attaining a height of five or six inches.

Cultivating the Plant. An anxious and busy time now ensues for the up-to-date farmer. He is afraid lest the first few nights of May should be cold. Cotton loves moist heat. Warm days and warm nights in May add a million bales to the crop, but warm days and cold nights, even though the thermometer does not fall to freezing point, may so weaken the young plants that it is not wise to allow them to remain, and there is nothing left but to plow them up and replant. He is also scared lest he may have too much rain, causing the growth of grass on his field and weed on the plants (the word "weed" being used through the South to indicate superfluous growth of stalk and leaf, and tendency to run to wood), or else that he may have too dry weather for his cotton to make proper progress, encouraging rust and cotton worms. His time is all occupied in "cultivating" the land, which term, although applied generally to the whole series of operations of raising cotton, is used more specifically for the operations between thinning out and cotton picking, the object of which is to keep the field free from vegetation, crab grass, cow-vetch, rag-weed, cocklebur, morning glory and such vines, so called.

This season is a succession of plowing and hoeing. "A long row to hoe" has long been a proverbial expression. Usually to clear the grass on the side of the beds the farmers bar off the soil from each side of the ridge by a turn plow, or twisting shovel plow. The soil and weed are allowed to remain in the bottom of the alley until the grass is killed, then by means of a sweep the soil is thrown up to the foot of the plant again. This barring off is occasionally performed before thinning out, and after the surplus plants have been chopped out the soil is thrown up again to the root of the plant. The



Fig. 71. Cotton Picking.

operation can only be performed up to the time when a stand has been formed, as otherwise the spreading roots of the plants are damaged. There follow, at different intervals, according to the weather and progress of the grass, several hoeings and plowings, usually in all about three hoeings and four plowings. The hoeing is performed by negroes principally, although a white farmer presses his family into service and they pass through the rows, chopping down grass and objectionable vegetation, occasionally cutting down a cotton plant where weakly or where the shrubs are planted too thickly.

Too much emphasis cannot be placed on the fact that heat helps the cotton plant wonderfully. Warm days and nights with occasional showers increase the crop prospects exceedingly.

The soil is kept disturbed in all possible ways, plows with plow shares, sweeps (Fig. 60C), scooters (Fig. 60B), bull-tongues (Fig. 60A), and other tools, mechanical cultivators, shown at Figs. 68 and 69, and other contrivances are all used, but the favorite tool is the sweep attached to the plow. There are many varieties of these sweeps, a different form being used in almost every state. They are attached to the stock of the plow by bolts and are winged tools, that is, the soil is thrown to both sides by the operation of the two slopes on the tool. Various forms of these are shown at Fig. 60, D being a Memphis shovel, E and F blades for cultivators, and G is the middle burster previously named. Depth of cultivation gradually diminishes as the ground fills up with roots, and in the last operation the surface is merely skimmed, the plow being kept almost out of the ground. Deep plowing is injurious a month after the thinning out has taken place.

The object in all this cultivation is not only to keep down the grass, but to retain the moisture in the soil. During June and July moisture in the soil or humidity in the air benefits the plant most materially, and by keeping the soil loose and open the desired end is attained. Later, when it is desired to



Fig. 72. Cotton Picking in the Late Fall.

make the plant fruit and the bolls burst, the crop is laid by and the ground allowed to harden and dry.

It is the aim of all the farmers to complete cultivation by the end of June, and then, to use their expression, "the crop is laid by." This period of rest usually begins from the first to the fifteenth of July, according to the season, and includes the remainder of July and as much of the month of August as elapses before the commencement of picking. It is the aim of the farmer to lay by his crop between the first and fourth of July where possible.

This is the happy time of the negro farmer; his pockets are empty, but he knows it is only a matter of a few weeks before he will have his crop on the market, and he forgets his poverty and the year of toil just ended, and indulges in the luxury of a camp meeting. This combination of Christianity and heathenism, devotion and profanity, is usually held at this time of the year.

During all this period of cultivation the plant has been making progress in its growth, as described in its life history in a previous chapter, and the farmer now only awaits the reward of his labors. The first flowers of the season have appeared, and Fig. 70 represents a cotton field in flower. This is not so attractive a scene as might be imagined, the flowers are not large and are not even noticeable in the large mass of dark green foliage, which stretches in an almost unbroken sheet.

Cotton Picking. Picking in an average season commences in August, beginning from the first of August in some parts of Texas to the last of August in the northern states of the cotton belt.

Occasionally in an abnormally early season, such as in 1895-1896, some cotton is picked in July. In the season named, the first bales of new crop cotton appeared on the market in July from several states, but this is of course very unusual.

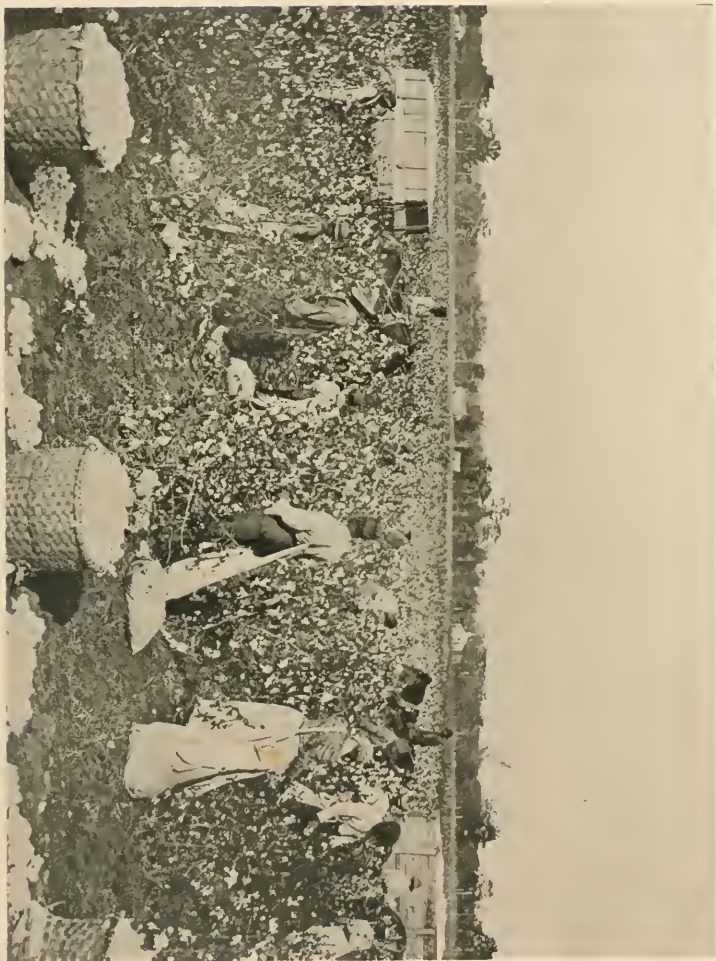


Fig. 73. Cotton Picking.

The picking season absorbs all the surplus labor of the cotton states. The number of hands required for cultivating is entirely insufficient to suffice for picking, and this operation is consequently the most expensive part of cotton growing, not only because of the additional help required, but also by reason of having to pay comparatively high wages to the specially hired negroes. The fields have changed from green to a snowy white. All colored men, women and children are picking cotton.

“Picking time” is a season that is dreaded by Georgia house-wives. A treasure of a cook can make more money picking at forty cents a hundred pounds than she can make in the kitchen, and she throws up her place forthwith and becomes a field hand. When the season is over, she is glad to go back to her pans, and generally her mistress is glad to take her back.

“We hear of strikes all over the country among all conditions of labor, but our cotton pickers never strike or give any trouble,” said a young planter the other day as he surveyed his whitened fields. “If the cotton in either of the fields out in front here — there are about sixty bales of it open — should have to stand, say, a week, it would be ruined. The negroes know this as well as I do, and they know also that they are the only ones to pick it: but never in a single instance is anything said about raising the price of picking or refusing to pick. The negroes are the most tractable, easily managed laborers in existence, if you understand them. When they get unruly and ugly it is because they have been persistently rubbed the wrong way and treated unfairly. It is that kind of dealing, in my opinion, that is at the bottom of most of the troubles that result in lynching. I am the only white man on this big tract of land, 5000 acres or more. I have thirty-five negro tenants and their families on the place, besides the hands who work the land that I plant myself. I have never had any trouble with them yet, beyond a little



Fig. 74. Pickers Waiting for the Cotton to be Weighed.

stealing now and then, and my father never had any before me.”

After the cotton has been picked and ginned, it goes to the press and comes out in bales. Then about Christmas time, perhaps a little before or a little after, the tide of bales begins to flow towards town and the railroad station.

The field in an ordinary season is picked over three times. In the Gulf states the times of the three pickings are: —

First, August and September.

Second, October.

Third, November and December.

In Georgia, North and South Carolina, Tennessee, Arkansas, the three occasions of picking fall in September, October, and November respectively. There is, of course, no fixed rule for this, the weather greatly affecting the time of picking, as also does the forward or backward state of the crop. When the black frost, or killing frost, comes late, there is usually considerable gleaning in December and January. The picking season is perhaps the most picturesque time during the cotton growing.

Cotton picking *appears* to be very easy work. The fruit hangs from the bolls apparently ready to drop into the hand if touched, and to watch the cotton pickers' quick movements and swift clearing of the bolls, there seems to be no difficulty at all. But in fact the cotton clings somewhat tenaciously to its pod, and the projecting points of the outer boll or capsule prevent the easy removal of the fibre, consequently rapid picking of cotton is the result of practice and experience. It is very tiresome work in the northern latitudes, where the plant is only eighteen inches or two feet in height, making one's back ache, and here the pickaninnies are found very useful, so much so that northern cotton is often called “bumble-bee” cotton. This is clearly shown in Fig. 71. Fig. 72 shows a field where the leaves have dropped from the cotton plant, leaving only the bare stalks and the bolls open and unopen.



Fig. 75. Weighing Cotton from the Pickers.

As the leaves of the plant assume their autumn tints, the fields dotted with white as far as the eye can reach, the flowers of the top growth, the motley costumes of the negroes of all grades of color, from the almost white "yellow girl" to the coal black powerful nigger, who looks as if he had just been transplanted from the Congo, and who picks his 300 lbs. per day, all combine to form one of the really interesting scenes of the world's every-day life. (Fig. 73). Still more interesting is it to see them gather round the weigher as the sun sinks low in the west, when each weary picker rests on his or her basket, waiting for it to be weighed and booked, as shown at Figs. 74 and 75.

In the morning, the cotton picker starts as soon as the dew has disappeared from the open boll, and begins at the end of a row of cotton, deftly grasping the boll with one hand, and with one adroit movement stripping the boll of its seed and cotton, transferring it to a bag slung round the waist, and emptying this at the end of the row into a basket or larger bag. An interesting comparison is shown at Fig. 69. The upper portion of the figure is reproduced from a photograph of a cotton field, taken by the writer in the morning of a November day, before the third picking. The lower picture is a photograph of the same field in the afternoon after it is picked.

Machines have been introduced by many inventors for picking cotton, but none have hitherto been successful. The principal difficulty lies in the fact of the cotton ripening at different periods, consequently the machines hitherto introduced do great damage to unopen bolls and unripe cotton, while gathering the fully developed fibre. Machines also gather a large quantity of trash, so that the cotton is of a lower grade than hand-picked, as the field hand can avoid gathering the leaf and trash, thus improving the grade. Machine picked cotton has to be sorted by hand before it can be ginned.

As the cotton is weighed it is loaded into wagons and hauled off to the farm yard (Fig. 104) to be housed until the neighborhood gin is at liberty, when it is again loaded into wagons and taken there.

The small tenant farmer usually stores the seed cotton in his own house until he has enough for a bale, while on the very large plantations, a gin house is run by the planter and the cotton is ginned as it is gathered.

Cotton gins badly if damp, and consequently picking is not usually practiced in the very early morning till the dew is dried off, nor is the cotton picked soon after a rain. Moisture is added after ginning if desired.

Operations of Cotton Culture. A list of the necessary operations in their proper sequence with the month in which each is usually performed, both for poor farming and for good farming, is given below. It is assumed that the land has been previously cultivated.

POOR FARMING.

Forming bed by turning out old rows, March.

Sowing seed, and possibly fertilizer, April.

Chopping out, May.

Cultivating more or less, June.

Picking, September, October, November.

GOOD FARMING.

Breaking up, burying vegetation, broadcast manuring and harrowing, December and January.

Bedding up, February.

Fertilizing in drills, March.

Sowing seed in drills, April.

Barring outside of row, chopping out to a stand and throwing up to root, May.

Cultivating by plow and hoe, scooter, scraper, sweep or cultivator, latter end of May or in June.

Laying by, part of July and part of August.

Picking, August, September, October, November, and if the season be an open one, December and even January.

A shorter summary of the different stages of cotton cultivation is :—

Breaking up and plowing, January, February and March.

Cotton planting, April.

Chopping out, May.

Cultivating with plow and hoe, June.

Laying by, July and August.

Picking, September, October, November and December.

The principle of rotation of crops, so strongly advocated in British agriculture, and, in fact, in all agriculture, is admittedly beneficial to land used for cotton growing. The American cotton farmers admit it, but judging from agricultural reports do not practice it to any extent. Cotton is the crop they like, the crop they are accustomed to, and it is usually cotton that is planted. Again, if the rotation of crops provided for cotton to be planted two years out of four, there would be far too much wheat, corn, and other cereals, grown for the requirements of the inhabitants, and in grain growing for the market the South cannot compete with the Northwest. It is, therefore, somewhat difficult to carry out the principle of rotation of crops to its acknowledged conclusion, and as an alternative it is more general in the recently settled parts to cultivate a tract of land for a number of years, exhaust it and commence again on virgin soil, leaving the other land fallow for the same length of time, when it is found to have recovered its fertility. This is very general in Texas, where new land is cleared and used without fertilizer for a few years. If all the seed and stalks are returned to the soil and only the lint taken away, it will yield good results for ten years without fertilizers, then when the land begins to tire, a new tract is cleared and fenced in, and the process repeated. It is not very general to mix any other crop with cotton,



Fig. 76. Mosaic Disease, or Yellow Leaf Blight.
Macrosporium form.



Fig. 77. Anthracnose.

although the writer has seen grape vines planted in rows about twenty-five feet apart, and the intervening space under cotton; also peach trees and cotton grown together, as shown in Fig. 64. In some districts corn is planted with cotton, to attract the cotton worm from the cotton, this corn being named "trap corn."

The practice of systematic drainage of the sub-soil is not at all general in southern agricultural circles. In certain districts, properly carried out, this would add to the yield of the crop and materially decrease the amount of weed, the land requiring less cultivation.

Damage to Crops. However carefully cotton may be cultivated, there are three important natural causes of damage to the crop which occasionally neutralize the efforts of the most careful farmer: these are, first, diseases of the plant; second, attacks of insects; third, unsuitable weather. The diseases of the plants are thus summarized by Prof. G. F. Atkinson of Cornell University:—

“ Investigations, continued for several years, have brought to light several quite well characterized maladies of the cotton plant in the United States. Some of these are physiological in their nature, being due to disturbances of nutrition and assimilation.

Other diseases of this plant are due to the action of fungus organisms, which live as parasites in various parts of the plant, consuming the nutriment and causing destructive changes, which bring about the death of the part attacked, if not of the entire plant. The term “rust,” frequently defined as “red rust” or “black rust,” has become so general in its application as to be utterly valueless other than in conveying the notion of disease. If we accept the term “cotton rust” as simply synonymous with cotton disease, it will tend to eliminate much of the confusion which must necessarily result should the term be accepted for any single disease, and the great indefiniteness which has clustered around this term as a



Fig. 78. Root Rot.



Fig. 79. Arceolate Mildew.

name for a single disease will be cleared away. By the application of appropriate names to carefully discriminated conditions of the plant, much progress will be made in the understanding and treatment of these troubles.

These diseases may be classed in three general divisions, according to their etiology.

Diseases due to physiological causes. — Mosaic disease, or yellow leaf blight (Fig. 76); red leaf blight, shedding of bolls, and angular leaf spot.

Fungus diseases. — Frenching; sore shin; damping off, or seedling rot; anthracnose (Fig. 77); root rot (Fig. 78); cotton-leaf blight; areolate mildew (Fig. 79); cotton-boll rot; and ripe decay of bolls.

Nematode diseases. — Root galls (Fig. 80)."

Prof. Atkinson continues his remarks by giving a very exhaustive description of the diseases of cotton, which can be referred to in Bulletin No. 33 of the United States Department of Agriculture, from which Figs. 76 to 98, with their explanatory notes, have been reproduced.

The question of insects which infest the cotton plant has been summarized by Col. A. B. Shepperson in his book on "Cotton Facts" as under:—

The boll-worm of cotton (Fig. 81), generally called the boll-worm (*Heliothis Armiger*), is a true moth, like the cotton caterpillar, having the four regular stages of growth, viz.: First, the egg; second, the larva, or worm; third, the chrysalis; fourth, the moth.

The eggs (Fig. 81 at 1) are usually deposited singly and have been found on all parts of the plant. They generally hatch in three to five days, but a longer time is taken in the spring and fall.

The worm (Fig. 81 at 2, 3, 4, 5) is hatched and developed very similarly to the cotton caterpillar, but when full grown is somewhat larger. It feeds chiefly on the young forms, buds, flowers and bolls, into which it bores, causing their utter destruc-

tion. When young, the worms feed upon the forms, buds and small bolls, but as they grow they attack larger bolls. They go from bud to bud, and from boll to boll, and thus each worm destroys a number of them. A close observer reports having found eighteen young bolls, besides many unopened



Fig. 80. Root Galls.

buds, to have been bored into by a single half-grown boll worm.

The chrysalis (Fig. 81 at 6) is always found a few inches beneath the surface of the ground. This state lasts seven to ten days in midsummer, and fifteen to twenty days in cooler weather.

DESCRIPTION OF FIG. 81.
TRANSFORMATIONS OF COTTON BOLL WORM.
(*Heliothis armiger* Hübn.)

- Fig. 1. Egg on under side of leaf.
- Fig. 2. Larva one-third grown boring into square.
- Fig. 3. Entrance hole of young larva in square, with excremental pellets at edge of hole.
- Fig. 4. Nearly full grown larva just issued from boll.
- Fig. 5. Full grown larva on leaf stem.
- Fig. 6. Chrysalis or pupa shown in center of underground earthen cell; cell shown in longitudinal section.
- Fig. 7. Adult moth, light variety.
- Fig. 8. Adult moth with dark forewings.
- Fig. 9. Adult moth in resting position, wings slightly elevated, hind border of hind wings slightly showing.



Fig: 81: Transformations of Cotton Boll Worm:

The moth is in appearance and habits much like that of the cotton caterpillar, but does not usually appear in cotton fields until July or August. (Fig. 81 at 7, 8, 9.)

The boll worm invariably hibernates in the chrysalis state and under the ground.

Many generations are produced until cold weather. The first to the third broods generally feed in corn fields, so that the first brood of boll worms found on cotton plants is really the fourth brood.

The natural enemies of the boll worm are birds, spiders, beetles, wasps, ants, domestic fowls, etc., but ants are probably their most active and destructive enemies.

The worms also eat each other and a good many are destroyed in this way.

The damage from boll worms is greatest in the states of Texas, Arkansas, Mississippi and Louisiana, in the order named, while the injury done in other sections of the cotton belt is unimportant.

Fields, and indeed large sections, are sometimes injured to the extent of twenty to twenty-five per cent. The maximum annual loss to the entire crop of Texas may be estimated at from five to ten per cent. There can be little doubt that more injury is now inflicted by the boll worm than by caterpillars, as these latter are easily held in check by the intelligent use of insecticides, while from their habits the boll worms are not so easily destroyed.

Preventive measures are the use of poisons, by sprinkling them in powdered form over the plants. Paris green is probably the poison most largely used.

Fall plowing gives good results, as it upturns and exposes the chrysalides, and those which are not devoured by fowls, etc., are killed by the cold.

The cotton caterpillar or the cotton worm (*Aletia Argillacea*), is a true moth, having the four regular stages of growth, viz.: First, the egg; second, the larva, or worm; third, the chrysalis; fourth, the moth.

The eggs are deposited by the moth singly, on the under side of the lower or larger leaves of the cotton plant (Fig. 82). They are first deposited usually in May or in early June, and rarely more than three or four to a leaf ; though later in the season the upper surface of the leaf receives a share of eggs, and larger numbers are found on the leaves. The eggs are usually hatched in three or four days, but the time varies

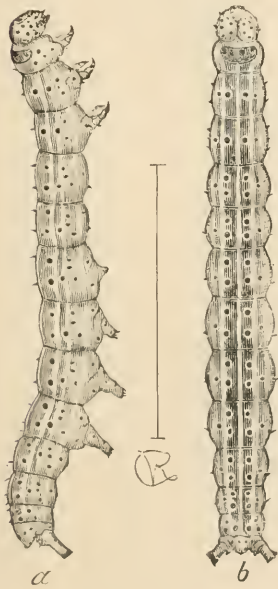


FIG. 83. Cotton caterpillar : a, from side ; b, from above — twice natural size.

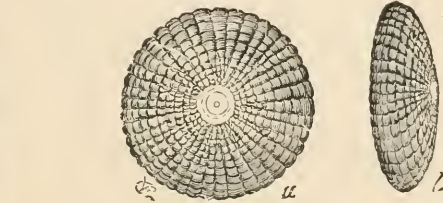


FIG. 82. Egg of cotton worm moth ; a, top view ; b, side view — greatly enlarged.



FIG. 84. Cotton worm moth : a, with wings expanded in flight ; b, wings closed, at rest — natural size.

with the temperature and a longer period is required in the spring and fall than in summer. Moisture favors hatching. Frost, as well as extreme heat, destroys the vitality of the eggs.

The worm (Fig. 83) molts five times, and the term of larval existence varies from one to three weeks. Until after the second molt it remains on the under side of the leaf.

After the third molt it moves toward the top of the plant, feeding on the tender foliage. While preferring the leaves, it will eat the bolls and all parts of the plant, even barking the stems. The worm does not thrive on anything but the cotton

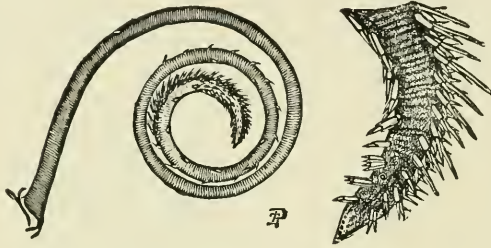


FIG. 85. Proboscis of cotton worm moth — enlarged; tip at right still more enlarged.

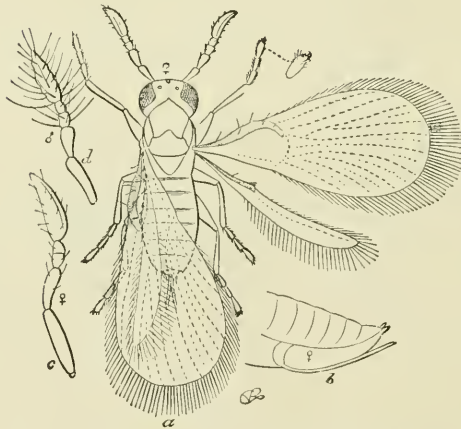


FIG. 86. Cotton worm egg parasite (*Trichogramma pretiosum*): a, adult female, greatly enlarged; b, ovipositor; c, female antenna; d, male antenna, still more enlarged.

plant. It moves by its thread or web and also springs from plant to plant, the maximum spring being about two feet.

Having obtained full growth, the worm “webs up,” forming a cocoon usually within the roll of a leaf, sparsely lined

with silken meshes. The chrysalis state lasts from about a week in midsummer to three weeks in cooler weather. The average time is about fifteen days. The worm does not burrow in the ground, and chrysalides are never found below its surface.



FIG. 87. *Chalcis flavipes*, an important parasite of the cotton caterpillar.



FIG. 88. Skin of cotton caterpillar attached to the underside of the cotton leaf by silk spun about the pupæ of *Euplectrus comstockii*, — natural size.

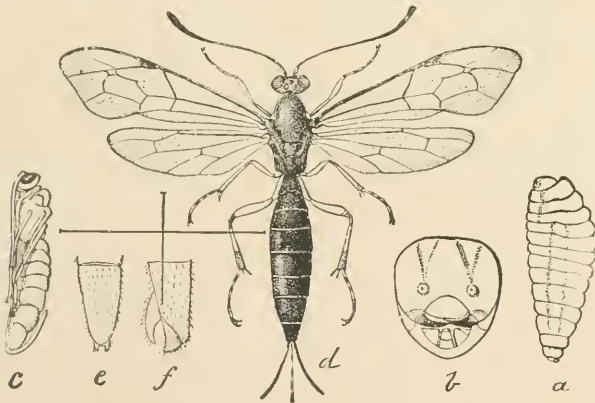


FIG. 89. *Pimpla conspicator*, one of the principal parasites of the cotton caterpillar: a, larva, enlarged; b, head of same, still more enlarged; c, pupa; d, adult female, enlarged; e, f, end of abdomen of adult male, still more enlarged.

The moth (Fig. 84) is nocturnal, and, as a rule, flies only at night. During the day it flies for short distances when disturbed. The female begins to lay from two to four days after issuing from the chrysalis, and lays an average of

four hundred eggs during the season. Its natural food is the juice exuding from the glands upon the mid-rib of the leaf, and at the base of the blooms and bolls of the cotton plant; but it also feeds upon fruits of all kinds as they ripen.

Until the worms are numerous enough to badly riddle the leaves, the moths continue to lay their eggs in the neighborhood of their birth, then they begin to migrate and appear in numbers everywhere, and at points far distant from the cotton fields. The time for migrating varies, but it is rarely until after the third generation of worms, or about July 1 in southern Texas and later in higher latitudes. Migrations are more common in the fall months, and the moths fly on cloudy days as well as at night.

There has been much diversity of opinion upon this subject, but the investigations of the United States Entomological Commission seem to establish fully the fact that the *Alitia* never hibernates as egg, larva or chrysalis, but survives the winter only in the moth state and in the southern part of the cotton belt, perishing in other sections with the approach of cold weather. The hibernating sections seem to be more in the southwestern than in the Atlantic states. Caterpillars are usually more numerous after severe and steady winters than after mild and changeable ones. Under the former conditions the moths remain torpid until early spring, but with mild winter weather they are aroused to activity only to perish from lack of nourishment at that season. The moth hibernates under the shelter of rank wire grass, under the barks of trees, in decayed logs and in the timbers of buildings.

The first generation appears about May 1st, in the extreme South. In Southern Texas as many as seven generations are produced during the season. The first and second generations are confined to restricted areas, often not exceeding a few acres. The third generation becomes more widespread, and the moths produced from it so numerous that they begin to migrate. This generation appears in Southern Texas the

Fig. 90. Cotton Field. Red River Bottoms, on Line of Cotton Belt Route.



latter part of June, and in South Alabama and Georgia somewhat later. This is usually called the "first brood" in those sections, but is simply the first which has attracted notice. The subsequent generations become, under favoring conditions, more and more numerous, widespread and destructive. In the northern portion of the Cotton Belt the number of broods is less and varies according to the date of the first appearance of the moths from further south, and other circumstances. There is increasing activity in development until July, and thereafter decreasing. In midsummer, from the laying of the egg to the development of the moth takes but three weeks, while earlier and later in the season it may take twice as long. The average time from the egg of one generation to that of another is about a month. The worm is seldom noticed and never in great numbers until the plant begins to bloom.

Low, alluvial lands, where the plants are large and luxuriant, are the earliest places visited by caterpillars. This rule is of general application. Moist atmosphere is favorable and dry weather unfavorable to their development. Warm rains cause them to multiply rapidly, while dry, hot weather is not only destructive to worms and chrysalides, but prevents the eggs from hatching. A hot, dry spell generally puts an end to the caterpillars.

In years of severe injury the crop upon some plantations may suffer from 25 per cent. to almost total destruction, while upon other plantations the loss will be trifling. The greatest average of loss is in the more southern portion of the belt, where, from climatic causes, the worms appear earlier and develop a greater number of broods.

In the northern portion of the Cotton Belt the caterpillars sometimes appear so late that they do more good than harm, by removing the super-abundant foliage, thus admitting the sun to the bolls and hastening their maturity.



Fig. 91. Cotton Planted With Corn.

The natural enemies of caterpillars are domestic fowls, birds, spiders, beetles, wasps, ants, etc. Blackbirds, rice birds and ants are probably the most active and destructive enemies. Several parasites (Figs. 86, 87, and 88.) also infest the cotton worm.

Preventative measures most generally adopted are the free use of poisons, by sprinkling them in powdered form or spraying them over the plants. Paris green is probably the poison most used, and has usually proved effective when applied properly and in time.

Aside from the cotton worm and the boll worm, the cotton plant can not be said to suffer seriously from the attacks of insects. Cut worms — *Peltia annexa* — (Fig. 92) sometimes damage the young plants in the beginning of the season; plant lice occasionally cause the withering of the terminal leaves (also usually early in the season); there are several bugs which sting the young bolls, although never to any serious extent; grasshoppers sometimes "rag" the leaves in Texas, and there are several leaf-feeding caterpillars which, like the cotton worm mentioned above, appear later in the season, and in reality do little but remove the superabundant foliage and expose the bolls to the sun, causing earlier ripening, and consequently a beneficial rather than an injurious effect. The plague of what are called "sharp-shooters" by the planters is caused by a leaf hopper — *Homalodisca coagulata* — (Fig. 93), which punctures the boll. We occasionally learn of a case of local and temporary damage by one or another of several species of insects, such as the garden web-worm, which injured young cotton growing in proximity to garden crops in Texas, Arkansas, and Indian Territory a few years ago; but these cases are rare, and do not deserve extended consideration. The American locust — *Schistocerca Americana* — (Fig. 94) sometimes causes alarm among farmers. The cotton stalk borer (Fig. 95) only attacks dead or decayed stalks.

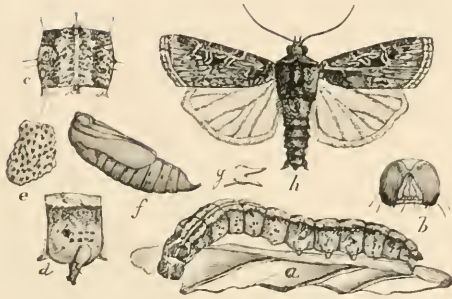


FIG. 92. *Feltia annexa*: a, larva; f, pupa; h, moth—natural size. (After Riley.)

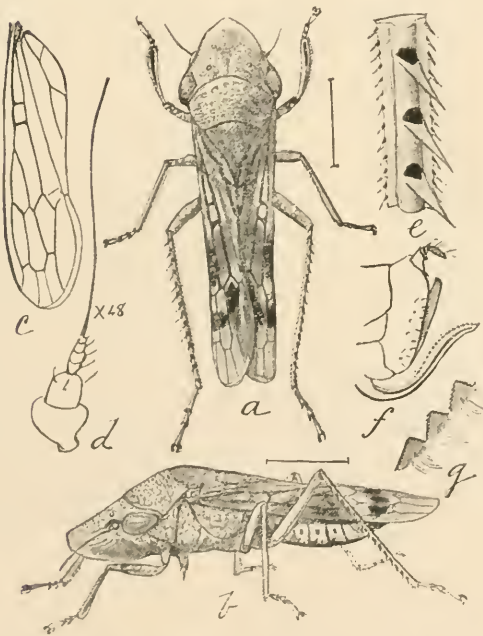


FIG. 93. *Homalolisa coagulata*: a, adult female seen from above; b, same, side view; c, venation of forewing, enlarged; d, antenna; e, section of hind tibia; f, female genitalia, still more enlarged; g, serrations of ovipositor, still more enlarged. (From Insect Life.)

A serious exception to this general statement may in the future be found in *Anthonomus grandis* (Figs. 96, 97 and 98), a Mexican weevil which damages cotton bolls. This insect,

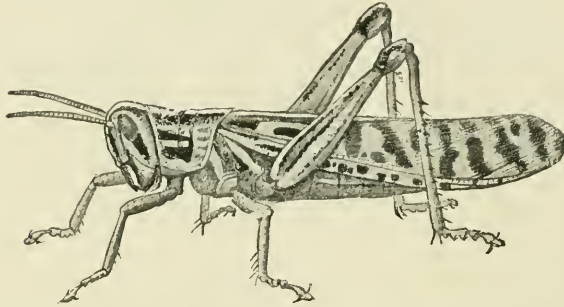


FIG. 94. *Schistocerca americana*: adult female—natural size.
(From Insect Life.)

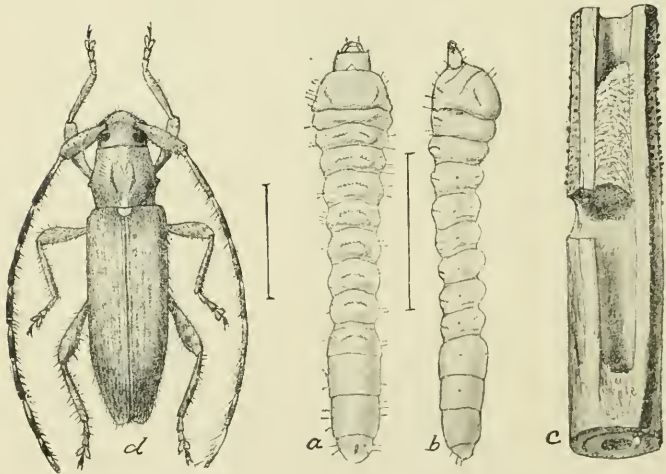


FIG. 95. Cotton stalk borer (*Ataxia crypta*): a, larva from above; b, larva from side; c, tunneled cotton stalk showing exit hole; d, adult beetle—all enlarged except c (original).

down to the close of the season of 1894, was known only through a few specimens collected upon cotton bolls in Mexico some ten years since by Dr. Edward Palmer. During 1894,

however, it was learned that the species had made its appearance in the state of Texas. It works in a peculiarly injurious manner, utterly destroying many bolls. The life history of

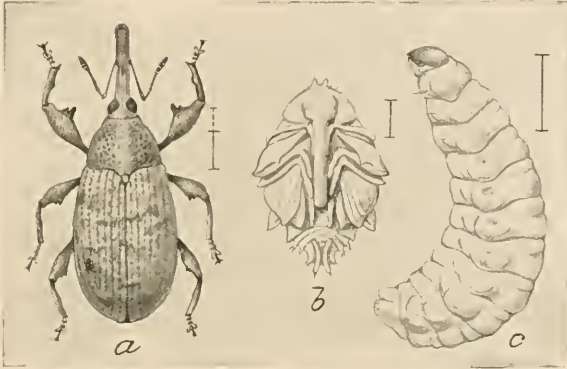


FIG. 96. The cotton boll weevil (*Anthonomus grandis*): a, adult beetle; b, pupa; c, larva — enlarged. (From Insect Life).



FIG. 97. The cotton boll weevil: a, newly hatched larva in young square; b, nearly full-grown larva *in situ*; c, pupa in young boll picked from ground.

the species was carefully investigated during 1895, and Dr. L. O. Howard has published two circulars of information, which have been widely distributed among cotton planters.

After this brief summary it will be evident that the subject of insects injurious to cotton in the United States can be classed under four main headings—(1) the cotton worm, (2) the boll worm, (3) the Mexican cotton boll weevil, and (4) other cotton insects. (Bulletin 33, United States Department of Agriculture.)

Cultivation of Sea Island Cotton. While the foregoing part of this chapter may be considered an *accurate* description of the cultivation of what is ordinarily known as American cotton, something should be said on the special methods adopted in the cultivation of Sea Island cottons. I am

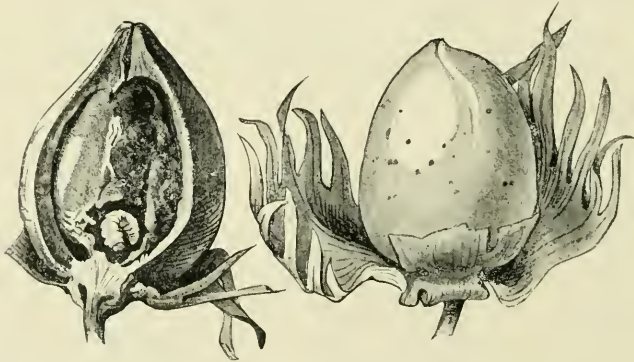


FIG. 98. Mature boll cut open at left, showing full-grown larva; the one at the right not cut, and showing feeding punctures and oviposition marks.

indebted to an article in the South Carolina Hand-book, and to Mr. H. Hammond, for much of the following information,

The Sea Island cotton plant has a larger and more vigorous growth than the Upland plant. It withstands the vicissitudes of the heat and cold better, and it is less subject to disease; so called blight and rust do not affect it as readily as they do the Upland cotton, nor does it shed its forms and bolls to anything like the same extent. These remarks as to rust apply also to those varieties of Uplands in which the length of the staple has been improved by selection of the seed, and rows of this

are often seen healthy and vigorous, while the short staple Uplands around are withered with the rust. The early growth of the Sea Island is so vigorous, that it maintains itself in fields infested with Bermuda and nut grass, as the Uplands could not. The leaves are larger, smoother, and of a brighter green than Uplands, and the flowers are larger, handsomer, and of a more golden yellow. But the bolls are smaller, and instead of being five-lobed are usually only three-lobed—these lobes being so sharp pointed as to prick the fingers, to the serious inconvenience of pickers not accustomed to gather Sea Island cotton. Of course the small size of the bolls requiring so many to make a pound, adds much to the expense of harvesting the crop.

On the Sea Islands of Carolina, field labor is performed almost exclusively by negroes. Nearly all of them are engaged in farming on their own account: a large number own farms; a still larger number rent land for cultivation, and even the laborers are paid most generally by granting them the use of so many acres of land for certain stipulated services. The total number of farms on the islands is stated to be fifty-four hundred and fifty-three, but the number probably exceeds six thousand, the enumerators having had the lands and crops cultivated by renters returned by the landowner, and consolidating them as being in some way under one management, when they were, in reality, entirely independent—an error ever likely to occur, and sometimes quite difficult to avoid, and which has no doubt caused the number of farms to be underestimated and their size overestimated in many sections of the South. The largest number of acres of Sea Island cotton planted under one management nowhere exceeds one hundred acres. The white planters do not probably average more than thirty acres, and this necessitates that they should be landlords of considerable estate. For as the laborers are frequently given five to seven acres for two days' work in the week, and as this two days' work per week does not suffice for the

cultivation of more than four acres, to cultivate thirty acres of cotton under this system requires seventy-five acres of land ; add to this the amount usually planted in corn and other crops, and we will have one hundred and twenty acres. As under the best system the land lies fallow every other year, the planter of thirty acres of cotton will require two hundred and forty acres of open land ; and as scarcely one-fifth of the land is under cultivation, such a planter will probably own some twelve hundred acres. Thus there is no proportion between the size of the farm actually cultivated and the land holding — the first being quite small and the last large. This state of things is owing to absence of capital and the low price of land and labor. Lands which were worth fifty dollars to sixty dollars an acre more than half a century ago, and which had increased in value down to 1860, being until recently either wholly unsaleable or selling at ten dollars per acre or less.

On James Island, which at this time is perhaps under a more progressive system of culture than the other sea islands, laborers are paid cash for their work, at the rate of fifty cents per diem and ten dollars per month, with board — the latter being a ration of three pounds of bacon and one peck of grist a week, with shelter and fuel. The soil and the condition of the laborers are reported as improving, and cash wages are considered preferable to the share, or the land, system of payment. Arable land rents here at two dollars an acre per annum. The price of land is from fifteen dollars to thirty dollars an acre. A few laborers own their own houses, but very few own any farming land.

On John Island, cash wages are from eight dollars to ten dollars a month, with board. Most of the laborers, however, are engaged for two days' work a week by allowing them a house, fuel, and six or seven acres of land free of rent. The report is that the system is not satisfactory. The lands worked by the landlords are improving ; that worked by the laborers

on their own account is deteriorating rapidly. The labor is not so easily controlled as when cash wages are paid. The lands vary greatly in price — prices ranging from two dollars and fifty cents to twenty dollars per acre, with some lands valued recently still higher. Rent is higher than on James Island, in consequence of a system that increases the demand by multiplying small farmers, and it is about three dollars per acre per annum.

On Edisto Island, the two days' system prevails. The average yield of cotton on Edisto Island is a bale to 2.6 acres; for the six largest planters it is a bale to 1.7 acres. Considering the quality of the staple produced, it may be safely said that the larger farms yielded between two and three times as much as the small ones. Lands here are worth from ten dollars to twenty-five dollars per acre — formerly they were worth from fifty dollars to seventy dollars per acre. Small tracts rent for about four dollars per acre per annum, larger tracts for less. This state of things tends to reduce the saleable value of lands, while it increases their rental value.

A mule can do the plowing required in the cultivation of thirty acres in Sea Island cotton, and can, in addition, cultivate a sufficiency of land to supply corn for its own feed, perhaps something over. The first step in the preparation of the land is to hoe off the weeds ("hurricane"), cut up the cotton stalks, and pile and burn this litter. This costs forty cents per acre. Bushes are grubbed up at a cost of seven cents per acre. The land is not broken up broadcast with the plow, but early in February two furrows of a single-horse turning plow are run in the old alleys, making a trench seven or eight inches deep. In this furrow a subsoil plow may or may not be run, according to the character of the subsoil. Wherever under-drainage is practised, as on James Island, the furrow is generally used. Before plows came into use this trench was never made, and even now it is omitted by some of the most successful planters. Into this trench, or into the middle of the

alley, where there is no trench, the manure is placed. This consists usually of about twenty cart loads of marsh mud and one thousand to one thousand four hundred pounds of cotton seed. Stable and lot manure, together with composts of marsh mud and rushes, are also applied in the furrow at the rate of forty cart loads per acre on such a portion of the land as the limited number of stock enables the farmer to treat in this method. On the lines of manure thus laid down, a certain quantity of commercial fertilizer is drilled. This practice, wholly unknown formerly, is very common now, even the smallest negro farmers often going heavily in debt to obtain these fertilizers from the store-keepers. They are handy, obviate the labor and care of stock, and the forethought and toil of collecting and manipulating composts. On James Island and John Island a mixture consisting of two hundred and fifty pounds of acid phosphate, two hundred pounds kainit (German potash salt) and two hundred pounds calcined marl is applied per acre. On Edisto Island are used two hundred pounds fish scrap (half dry in barrels), two hundred pounds kainit and two hundred pounds acid phosphate per acre. On St. Helena Island little fertilizer is used. Cotton seed is worth fifteen dollars to twenty dollars per ton, and the commercial fertilizers from fifteen dollars to thirty dollars, which would make fifteen dollars an acre the cost of the manure among the best farmers.

The land is now ready for listing, which is done by hauling on to the manure with a hoe the soil from the tops and sides of the old beds. A more recent practice is to lap in with two furrows of a turning plow on the manure. This costs only seventeen and one-half cents per acre, while the listing with the hoe costs eighty cents, although the latter has the great advantage of bringing all the vegetable mould and humus directly to the spot where the roots of the plant are to grow. Over the mass of dirt, weeds, manure, etc., thus collected in the old alley, a double roller, five feet from center to center,



Fig. 99. Selling Cotton on the Street.

and weighing about eight hundred pounds, is passed to press together and compact the whole, completing two rows at a time. All this should be completed by the first to the middle of March, and the bed is then built up by lapping in two more furrows on a side, with a single or double horse turning plow.

The land is now ready for planting, which may begin any time after the twentieth of March; but the first to the tenth of April is the time preferred. Cotton planters are not used. Three hands do this work; the one ahead chops a hole with a hoe on the top of the bed at intervals of twelve to eighteen inches; another hand drops eight or ten seeds into each hole, and the third follows and covers carefully with the hoe. Three or four pecks of seed are used to the acre. The seed makes its appearance above ground in eight to twelve days after being planted, and the stand is perfected from the second week in April to the first week in May. Hoeing begins about the first of May. The second hoeing takes place the last of May. The plows then break out the middles (the spaces between the new beds where the old beds stood). The hoe hands follow and pull up the loose dirt left by the plow to the foot of the cotton. This is called hauling; by it the new bed is completed, the cotton is kept from "flagging" (falling down), and the grass is kept under. It costs eighty cents per acre. At the second hoeing some stalks are thinned from the bunch in which the seed breaks the ground, and at each succeeding hoeing and hauling other stalks are removed, until in July only one stalk of each bunch is left. There are four hoeings and four haulings by the last week in July, one or more furrows with a sweep plow being run through the middles previous to each hauling. By the last of July the culture is completed, except to run a furrow with the sweep between the rows in August, to destroy grass and keep the cotton growing.

The first blossoms appear about the middle of June, when the cotton is fifteen inches high, and the bolls open towards

the end of August, when the plants have attained a growth of four to five feet. Cotton picking commences from the last week in August to the second week in September. For the first picking, while the cotton is thin, one and a half cents per pound seed cotton is paid. Subsequently the price is one cent per pound, never less, until the last of November, when it rises again to one and a half to two cents. By the fifteenth of December the crop is gathered.

When the cotton has been picked, weighed and housed, it is next spread out in the sun, on what is called "an arbor." This is a platform usually made of inch boards, raised a few feet above the ground, and some twenty-five feet or more square. Here the sun and air dry the cotton, preventing it from heating, which it is liable to do when stored in bulk, and it is also thought to cause the lint to absorb some of the oil in the seed, which adds to the silky lustre of the fibre. After being thus dried, it may be either stored or passed at once to the "whipper," a machine that knocks out the dust and sand, and leaves the cotton whiter and more open. Formerly, when the price was higher than it is at present, it was all assorted. A hand was given one hundred and fifty pounds of seed cotton as a day's task, which he thoroughly overhauled, picked out all specks, stained cotton, fragments of leaf, etc. At present, however, this is usually done by two hands, who examine the cotton as it passes into the gin, and two others behind the gin, who pick out cracked seed and motes, as the lint issues from the gin. The roller gin in some form has always been used for detaching the lint from black seed cotton. The first roller gin used in this country was one constructed in 1788, by Mr. Bissell, of Georgia. It consisted of two short wooden rollers moving in opposite directions, each turned by a boy or girl, and giving, as the result of a day's work, five pounds of lint cotton. To this succeeded the foot or treadle gins, imported from the West Indies, where they had been in use, having reached there with this variety of cotton seed.

Other improvements took place in the roller gin, from time to time, and about 1840, F. McCarthy, of Alabama, devised a machine which bears his name, and has been in use ever since on the Sea Islands. Shortly after this, small steam engines were used with the McCarthy gin, and now oxen and horses have been discarded and all the gins on the Sea Islands are run by steam power. Two horse power is required for each gin, which turns out on an average, a bale weighing three hundred and fifty pounds as a day's work. There is a recent English improvement of the McCarthy gin, known on the Sea Islands as the double McCarthy. This gin gives two bales in a day's work; but it requires greater skill to attend it.

The usual charge at these gins is three and a half to four cents per pound of lint, and they are said to pay well. The cotton is packed in Dundee bagging, in round bales. No press is used, as it is thought it would injure the fibre. The work is done by hand, the cotton being beaten into the bag with a pestle. At the large gin house on St. Helena, however, even this work is accomplished by machinery. The bag is conveniently suspended from an iron hoop, and a disc of two-inch plank, exactly fitting the bag, and moved by steam, pushes the cotton in, securing greater dispatch and accuracy in the packing.

What has been written refers distinctly to the Sea Islands. A considerable quantity of long staple cotton in addition is grown on the mainlands and is known as Floridas, Santees, and as Mains. The general economy of the culture is the same as on the Sea Islands. The seed is obtained annually or biennially from the islands, as it is thought to deteriorate very rapidly on the mainland. In the absence of determinate experiments for a series of years, it is not easy to say what the cause of this deterioration is, or even if it is due to causes of a permanent character. That the seed does deteriorate is a fact beyond question.

The cost of production may be considered from two points of view. First, the actual cost to certain producers, of whom inquiry has been made. Second, what may be termed the rational cost, that is, the labor, material and capital, necessarily expended in production, directly or indirectly, by the producer himself, or by some one else. The first is real, but by no means expresses everything involved. For instance, on unsaleable land, a landholder, with little or no expenditure of capital, may produce a certain amount of cotton with labor given in return for debts that could not be otherwise collected. Such cotton would cost almost nothing to the producer. Between this and the opposite extreme, where the land had been bought above its real value, and a large expenditure made in the culture, there is every variation of individual experience—from one of immense profits to one ending directly in bankruptcy. The rational cost, on the other hand, is purely theoretical: in estimating the cost of each item of expenditure, it must be generalized and reduced to an average that does not, perhaps, conform exactly to the experience of any individual. It summarizes these items, and leaves them recorded for consideration. Both methods are given. Messrs. Hinson & Rivers, on James Island, say eighty dollars a bale of four hundred pounds, or twenty cents per pound. Dr. A. B. Rose, of Charleston, puts the cost at seventy dollars an acre, which should yield a bale of 350 pounds, which gives, likewise, twenty cents per pound. One of the most, if not the most, successful among Sea Island planters, Mr. J. J. Mikell, of Edisto, says the cost is fifteen cents per pound there.

Before considering the rational cost, a word should be said as to the amount of production. The highest yield on record to one acre is 566 pounds of lint, on a single acre on Mr. Schaffier's place, on Wadmalaw Island. A planter on John Island made an average of 290 pounds of lint per acre, on a tract of twenty acres, while small farmers in the same locality produced only fifty pounds to seventy-five pounds lint per

acre. On Edisto Island, there is a tract of 100 acres, producing 210 pounds of lint per acre, and conservative farmers there consider that 200 pounds of lint on the larger farms, year in and year out, to be an average yield of fine staple. In Mills' statistics of South Carolina, published in 1825, it is stated that a farmer on Edisto Island produced on an extensive scale, an average of 270 pounds of clean cotton to the acre. He also states that there were lots of lands that had produced 435 pounds of lint to the acre. From which it would appear that the soil, climate, and old methods of culture had a capacity not very far inferior to that with which the invention of fertilizers, and of improved implements and methods at the present time, endow this locality.

SEA ISLAND COTTON — CROPS, EXPORTS AND UNITED STATES CONSUMPTION. (SHEPPERSON.)

Season.	Florida crop.	Georgia crop.	South Carolina crop.	Texas Crop, etc.	Total crop.	Exports to Great Britain.	Exports to the continent.	Takings of U.S. Spinners.
1874-75...	8,139	1,074	7,308	166	16,687	13,139	1,907	2,192
1875-76...	7,598	2,121	4,722	74	14,515	11,591	1,345	1,915
1876-77...	10,832	2,558	4,933	29	18,352	11,865	1,369	4,068
1877-78...	11,675	3,556	6,249	30	21,510	12,594	3,701	6,451
1878-79...	10,214	2,052	7,133	202	19,601	10,456	2,242	6,688
1879-80...	11,300	3,420	10,142	...	24,862	13,729	3,294	9,389
1880-81...	16,950	3,179	14,868	24	35,021	20,259	4,136	11,270
1881-82...	20,992	6,049	10,796	25	37,862	22,303	2,453	14,762
1882-83...	16,898	3,126	16,591	94	36,709	21,565	1,892	13,573
1883-84...	16,762	1,399	7,329	...	25,490	12,166	1,413	11,674
1884-85...	23,526	4,327	12,588	11	40,452	18,422	3,143	17,358
1885-86...	23,501	5,780	8,497	...	37,778	14,748	1,680	19,973
1886-87...	29,991	6,411	8,735	...	45,137	25,216	1,435	20,515
1887-88...	22,614	8,304	8,561	...	39,479	18,698	1,915	19,560
1888-89...	22,471	12,000	9,618	...	44,089	21,515	1,811	20,132
1889-90...	23,918	13,629	9,256	...	46,803	25,991	2,251	19,124
1890-91...	22,214	29,613	16,306	...	68,133	34,300	4,823	26,602
1891-92...	17,059	30,576	11,499	...	59,134	24,778	2,653	32,279
1892-93...	9,882	28,324	7,212	...	45,418	20,650	1,890	22,927
1893-94...	19,107	39,367	2,578	...	61,052	33,385	4,636	23,516
1894-95...	15,031	53,703	5,894	...	74,628	35,033	5,711	34,765
1895-96...	20,771	61,312	9,971	991	93,045	43,174	7,269	40,092
1896-97...	26,219	65,040	10,701	2,597	104,557	47,272	11,180	41,676

COST OF EACH ITEM OF LABOR AND MATERIAL EXPENDED IN THE CULTURE OF AN ACRE OF SEA ISLAND COTTON.

Items.	One.	Two.	Three.	Four.	Five.
	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.
Rent or interest on money invested in lands.....	5 00	5 00	5 00	3 00	3 00
Wear and tear of implements....	1 00	1 00	1 00	....	....
Cleaning and burning weeds and stalks.....	40	40	40	....	30
Other cleaning up.....	07	07	07	25	25
Digging and carting salt mud....	1 00	....	....	....	....
Spreading salt mud.....	80	....	....	....	....
Cotton seed for manure, 20 bush., at 30 cts.....	6 00	....	....	....	....
Lapping mud and seed in with two furrows, or rolling ditto....	12½	12½	....	15	....
Fish scrap, 200 lbs., and spreading, 15 cts.....	2 65	....	....	....	....
Kainit, 200 lbs.....	1 50	....	....	....	....
Acid Phosphate, 200 lbs.....	2 00	....	....	....	....
Spreading last two, 15 cts. each..	30	....	....	....	....
Commercial manures.....	....	6 50	6 50	10 00	2 50
Home-made manures.....	....	7 25	7 25	2 00	50
Applying manures.....	....	1 45	1 45	55	10
Bedding up with plow.....	25	40	40	50	50
Splitting middles.....	....	25	25	50	50
Breaking out ridge of old bed....	12½	12½	12½	....	....
Planting.....	45	50	50	50	50
Replanting.....	20	25	25	25	25
Seed.....	30	30	30	1 50	40
Eight to ten hoeings and haulings	5 60	5 60	5 60	6 00	6 00
Plowings with sweep plow.....	25	25	25	2 50	2 50
Thinning and regulating stand....	12½	12½	12½	50	50
Cleaning ditches.....	10	10	10	....	....
Picking cotton.....	8 00	8 00	8 00	11 20	4 00
Sunning and drying cotton.....	15	15	....	....	....
Ginning, cleaning and packing..	3 00	8 00	7 00	8 80	3 50
Bagging and twine, per bale.....	55	55	55	55	27
Hauling to gin.....	....	40	40	50	25
Hauling to steamboat and freight to city.....	50	50	50	50	25
Storage, insurance, weighing, drayage and selling.....	2 50	2 50	2 50	2 50	1 25
Foreman's wages and rations....	2 75	1 50	....	....	....
Total.....	45 69½	51 29½	48 52	52 25	27 32

The previous table presents the rational cost, giving an itemized account of all expenditures, as reported by intelligent Sea Island planters. The first three columns are from Edisto, the yield being placed at 200 pounds of lint cotton to the acre. Number four is from James Island, the yield taken at 280 pounds of lint per acre. Number five represents the average expenditures of the better class of small farmers on John Island.

It would be a still more difficult problem to arrive at a satisfactory estimate of the profit per acre to the farmer. This would vary, in the first place, according to the grade of cotton produced, the prices fluctuating with the fineness of the staple, from thirty cents all the way up to one dollar and ten cents per pound. The value of the cotton, too, would depend greatly on the handling of the crop, whether it was picked in time, properly stored, sunned, dried, ginned, and moted, — in all of which operations the skill, care and forethought of the farmer would count for a great deal. But if we place the price of cotton at forty cents per pound, we may offer the following estimates as coming somewhere near the correct deductions to be made from the data furnished by the foregoing figures :

COST OF SEA ISLAND COTTON PER POUND AND PROFIT PER ACRE.

	One.	Two.	Three.	Four.	Five.
Cost per pound.	22 8-10c.	25½c.	24½c.	18 3-5c.	27 3-10c.
Do. plus value of seed produced and less in- terest on investment, }	17 9-10c.	20 7-10c.	19 3-10c.	15 1-10c.	21¾c.
Profit per cultivated acre.	\$45 20	\$38 20	\$41 40	\$69 72	\$78 25

These figures can, of course, only be approximately correct, but the wide difference that prevails between large farms

and high culture, and the small farms and insufficient culture, is a hopeful indication that the efforts for improvement have met with success, a success that would be much enhanced if we estimate the improved value of soil itself, where high culture has been practised.



CHAPTER IV.

PREPARATION OF COTTON FOR THE MARKET. — GINNING AND BALING. — INVENTION OF THE SAW GIN. — OLD-TIME GINNING. — OLD-TIME BALING. — MODERN GINNING. — THE SAW GIN. — COTTON GINNERIES. — THE MODERN GINNERY. — THE ROLLER GIN. — PERCENTAGE OF LINT. — BALING.

Ginning and Baling. Before the farmer disposes of his cotton, or rather before he is willing to dispose of it, it has to be put in marketable shape in the form of a bale, and prior to baling has to be ginned. The seed cotton as it is picked contains two-thirds of its weight in seeds. Each boll contains thirty or forty seeds, and the cotton is attached to these by one end of each fibre, just as the human hair is attached to the head. To remove the fibre from the seed, the gin used in America, except for Sea Island cotton, is generally of the variety known as the saw gin, and after the lint has been removed, it is baled in baling presses.

Invention of the Saw Gin. To thoroughly understand the process in use at the present day, one must study the history of ginning.

On the 14th day of March, 1794, a patent was issued to Eli Whitney, a native of Massachusetts, then living in Georgia, by George Washington, President of the United States, for a cotton gin. On the 12th day of May, 1796, another patent for an improvement in cotton gins was issued to Hogden Holmes, of Fairfield County, South Carolina. The State of South Carolina recognized Eli Whitney as the inventor of the gin, and by an act of the legislature fifty thousand dollars were paid to him for the free use of his invention in South Carolina. North Carolina imposed a royalty of $62\frac{1}{2}$ cents per saw on each gin used in the state, which amount was faith-

fully collected and paid. Tennessee also paid something to Whitney.

In the State of Georgia, where Whitney worked, he received no compensation as the inventor of the gin, it being alleged that Joseph Watkins, a planter of large means and influence, had devised the same machine for separating the seed and lint of upland cotton, and that Whitney had visited Mr. Watkins and seen his machine in successful operation before he had produced one of his own.

It is probable that the main idea on which the design of the cotton gin is founded was original with Joseph Watkins, but it is also probable that the same idea was equally original with Eli Whitney. Both of these men drove spikes made from wire into wooden cylinders, and while this plan was the best known at the time, it remained for Hogden Holmes to cut a saw from a sheet of metal, and dispense altogether with the wooden cylinder and spikes.

While Watkins, Whitney, and Holmes, all undoubtedly did original and valuable work in designing and experimenting on mechanical means of separating lint from the seed of cotton in the perfected cotton gin, the best ideas of them all are incorporated in the present day gin, and this perfected machine was more due to the energy of Eli Whitney than anybody else. Therefore, the South Carolina Legislature decided that if any one man could be considered the inventor Mr. Whitney was the man, and he was accordingly recognized and paid as above stated for its free use in that state.

Old-time Ginning and Baling. We find many evidences of the fact that in the early days of the republic the people of the South were as full of enterprise and resources as the people of any part of the Union. The design of a plantation gin house, while a crude piece of work, in the light of our knowledge of machinery at the present time, yet considering the facilities, — materials and conditions then existing, — it is doubtful if any engineer of the present day could suggest how it could have been improved.

Some of these conditions may be enumerated as follows: Cotton was picked (harvested) in the fall and early winter. On rainy days no picking could be done because firstly, cotton picked and stored when wet was sure to rot, and secondly, it exposed the negroes to the danger of sickness, and leaving the humane view of the matter out of the question, they were too valuable property to be thus exposed. During the fall and winter months, the difficulty of the planter was not scarcity of labor, but rather scarcity of suitable work for the negroes, work where they would not be too much exposed to inclement wintry weather. Therefore, in considering the question of ginning, economy of labor did not enter.

For power the most suitable was mule or horse. On a plantation it was necessary to keep, for producing the crop, more mules and horses than were necessary to gin the cotton produced. As in winter, and especially in bad weather, the negroes had little to do, so also was there little for the stock to do. There were few machine shops or foundries in the country, but every well-regulated plantation boasted a carpenter and blacksmith amongst the slaves. Fourteen hands were commonly required to gin cotton on a plantation, including baling. Of course this number could be reduced without affecting the amount of work done, as previously explained.

The illustration at Fig. 100 shows the most common type of old plantation gin house and screw, the one which was standard throughout the South for nearly a century, and which is yet by no means entirely abandoned, though the modern engineer has lately made war on it and it is rapidly giving way before the progress of steam and iron in the "New South."

The illustration named shows the screw for packing the ginned or lint cotton into bales, but this feature did not come so quickly after the invention of the gin as the gin house. The earlier gin houses had a hole about three or four feet in diameter cut through the floor in a suitable place. A large bag of about the same diameter as the hole and about seven

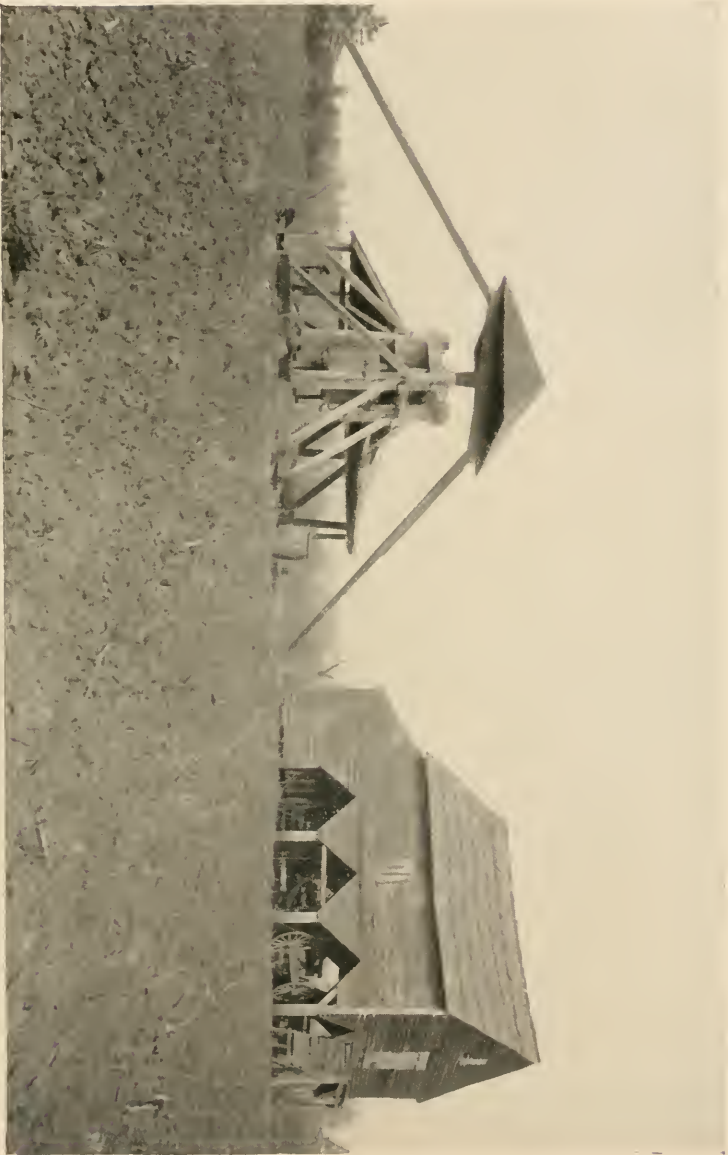


Fig. 100. Screw Press and Gin House.

feet long, was suspended in this hole in such a manner that it could be conveniently packed full of lint cotton. When filled it was cut loose from the supports and allowed to fall. The top was sewed up and it was then ready for the market. At a later period the screw was introduced for packing lint cotton into bales that were at the same time much more compact and of much better shape than the bags.

The size, shape and weight of these bales were also determined by surrounding conditions and circumstances. Much of the cotton raised on the plantations had to be hauled to distant markets. Bales of such size that four of them would fit into an ordinary wagon body were most suited to long trips on rough roads. When it was desired to haul more than this, four could be placed cross-wise, then four on top of these, and others still above, making ultimately a load of ten bales, weighing four or five hundred pounds each, which was considered a maximum load to be drawn by six mules over the ordinary roads of the South in winter weather. These bales were bound together, and to the wagon by a pole placed lengthwise on top, the ends being drawn down, front and back, by ropes reaching to the axles of the wagon. Topmost of all was an arched frame made of bent wood, covered with canvas, under which corn and fodder for the mules, and some bacon, bread, a few eggs and a frying pan, were stored for the requirements of the trip. Much cotton was hauled in loads as described from a distance of fifty, and even one hundred and fifty miles. From the large plantations from two to three such loads would be sent together.

A gin house was designed, in which by means of mule power applied to wooden levers, a vertical wooden shaft was turned, on which was a wooden cog wheel, the teeth of which engaged with "wallowers" or "wobblers" on a horizontal shaft. The latter carried a pulley, from which the gin was operated by a belt.



Fig. 101. The Power of the Screw Press.

The screw, shown in Fig. 101, which, with Fig. 102, is inserted by courtesy of the New England Cotton Manufacturers' Association, was simply a large wooden screw, working in a wooden nut, supported by a frame, in which the box for receiving cotton was also built. The screw was operated also by mule power applied to long levers fastened to it at the top.

All seed cotton was handled by hand, the lint was carried to the screw in baskets, and, all in all, more hands were required to keep one gin going, to gin three or four bales a day, than are now required to operate six gins and gin sixty bales in the same time. But the planter cared nothing for more improved methods; in the winter, proper work for slaves was scarce, and on cold or rainy days, when asked by a hand what to do, it was easy to answer "go help about the gin house,"

For the purpose of ginning and packing cotton with the above appliances and facilities, there were required four mules to operate the gin, two at each lever under the gin house, with a driver to each pair. In the story above there was required a ginner to stand at the gin and feed the cotton into it properly; a ginner's helper to supply the cotton from the pile to the gin; a helper to push the lint cotton as it accumulated in a small room behind the gin down into the lint room, and a hand to remove the seed from the foot of the gin.

For baling the cotton, one mule was required to pull the lever of the screw. The labor required was two to four hands to "tote cotton" (carry cotton from the lint room to the screw); two hands in the box to pack the cotton down to make the box hold a bale; two to tie the bales with hemp or other rope, and one or two extra hands for sewing up ends of bales, driving the mule at the lever, and so on.

From the time of the invention of the gin to the end of the late civil war there was no demand for other methods than those above described. Steam would have brought



Fig. 102. Plantation Gin and Press.

responsibility, with no commensurate advantages from the planter's point of view. The boiler might explode, and if it did, the smallest part of the loss would be that of the engine and the boiler. Twenty thousand dollars' worth of negroes might be killed, and perhaps many scalded and otherwise injured, which would make large doctor's bills.

Old-Time Baling. The bale of cotton as made in the ordinary plantation "screw" (press) was about five and a half feet long by thirty inches wide and twenty-four inches thick. It was covered almost entirely by jute or gunny bagging, and bound round in five or six places with hemp ropes securely tied.

Fig. 103 shows admirably all the plantation work necessary for the preparation of cotton for the market. On the left is the gin house, with an ox wagon loaded with cotton on the seed just brought to be ginned; in the centre of the group is seen the screw press, with a mule turning it by means of a chain attached to one of the long sweeps, while a mule wagon is laden with bales loosely pressed and covered with bagging ready for the trip to market; the typical grove of shade trees and the planter himself on horseback complete the group.

The overseer would select the negro boys fourteen to sixteen years old to drive the mules, and would direct them to be at the gin house "the first thing in the morning" with four mules to pull the gin gearing, and themselves to drive. He would call up the ginner, who was the negro most expert at handling the gin and was one of the plantation institutions along with the blacksmith, carpenter, or wagoner, and give him necessary instructions. The rule of work on a plantation, winter and summer alike, was from daylight to dark, and ginning was no exception to the rule. It was a rule particularly suited to Sambo, for, in the winter, the days were short. Sometimes the ginner would ask for special hands as helpers, but generally the hands were assigned by the overseer. Often the women would help to carry the cotton from the lint room

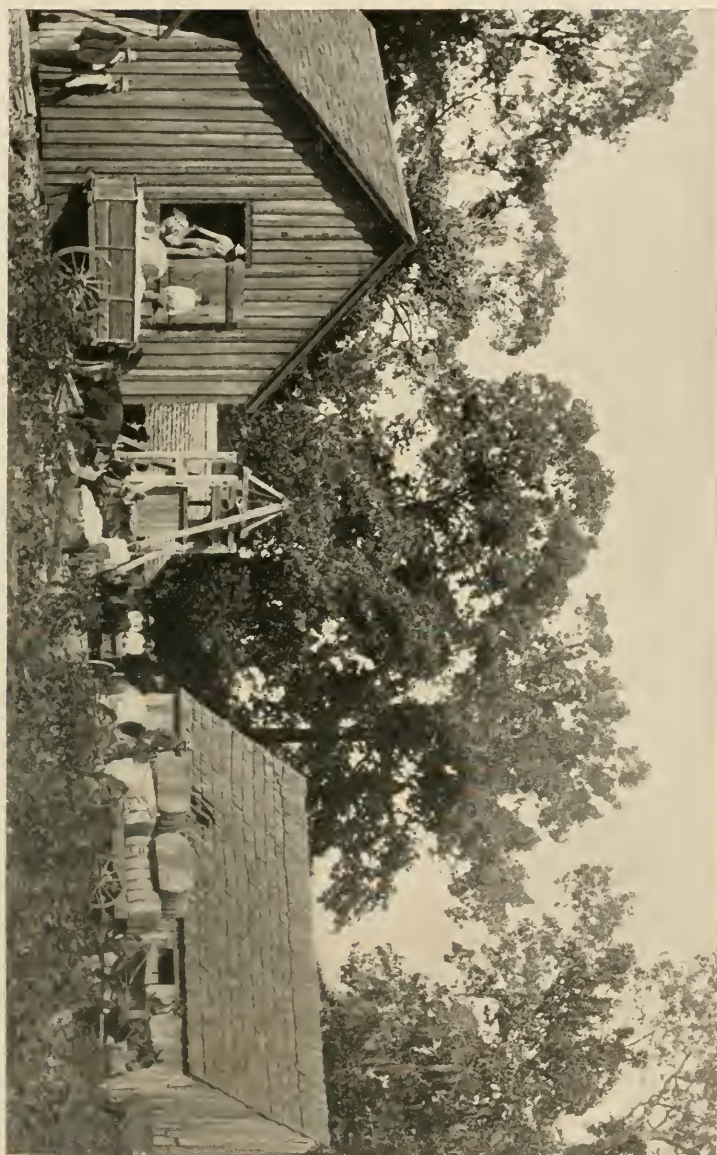


Fig. 103. An Old-Style Ginney.

to the screw, and there were generally one or two women to sew the bagging together at the ends of the bale.

When the morning came, the mules were hitched to the levers, and in a few moments the interior of the lint room would more nearly resemble fast falling snow than any imitation of it that has ever been attempted on the stage. This cotton would be pushed from time to time from a small room behind the gin, and on the same floor, to the lint room proper. One helper would keep the ginner supplied with cotton on the gin, another would keep the seed out of his way, and still a third would keep the lint cotton pushed down into the lint room.

While the bale was being ginned preparations were going on at the press to pack it. At the bottom end of the box were doors hinged at the bottom by extending the rounded ends of the bottom batten of the door into holes mortised into the main frame of the screw. (The word screw is used in the sense of its plantation meaning and means the entire screw press.) There were end doors at the bottom of the box also, but these were not hinged. Preparatory to packing a bale, the side doors were left down and the end doors were taken out. The block was raised to its highest position by the mule (driven by a boy) pulling the screw around by one of its long levers. A piece of bagging would be cut to three yards long and forty inches wide, and this would be spread on the bed of the box, the ends and sides extending over. Then the doors would be raised and fastened by cross-bars of wood and wedges also of wood. The movable block being now at its highest point, out of the top of the box, it would be turned around at right angles to the length of the box. This would give room to put the cotton in at each end from the baskets on a platform. The cotton would be brought from the lint room to this platform in these baskets. After putting in some cotton, two men would get in the box on top of it and tramp it down in order to make the cotton hold better. As they tramped,

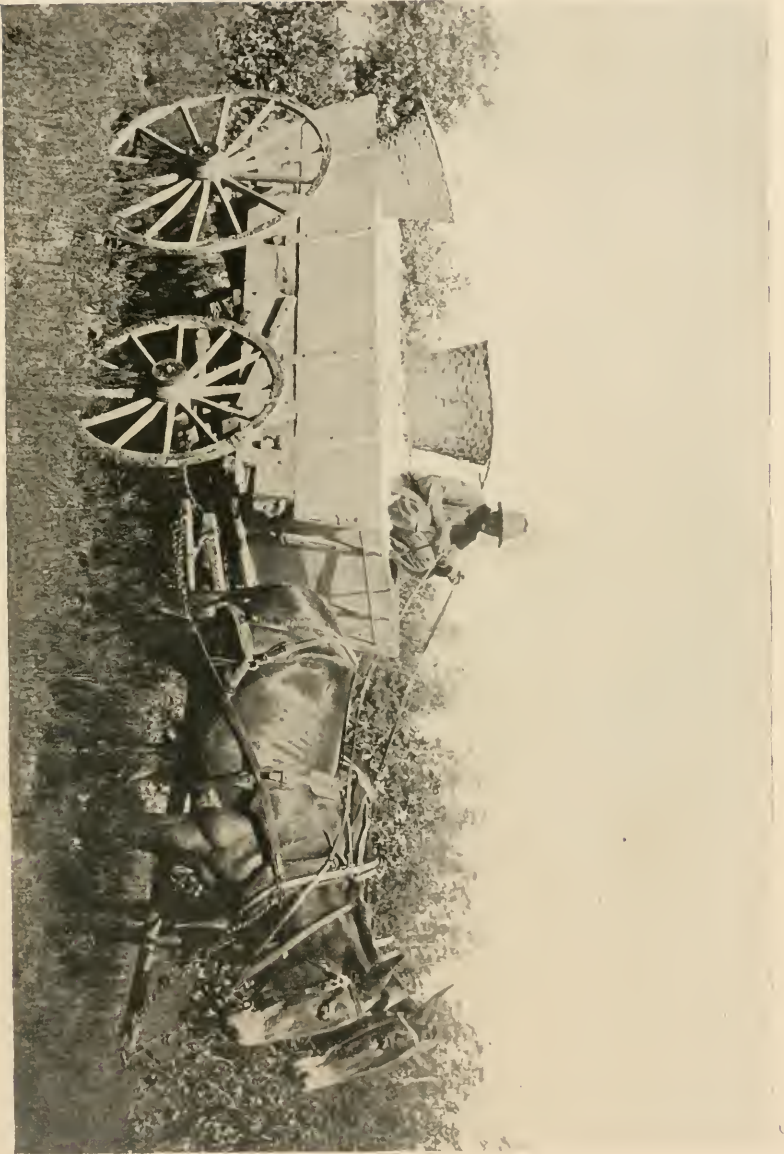


Fig. 104. Hauling Cotton to the Gin.

the insides of the box would often be wetted with a "mop" (a wad of cotton tied to the end of a stick), for which purpose a bucket of water would be kept near by. When the box was full another piece of bagging was spread on the top, the block was turned, the mule unhitched from the end of the lever and being given a start the screw would run down itself until the increasing pressure would gradually stop it. Then one mule would be hitched to a lever, and by his pulling, further pressure would be applied. If the bale was a heavy one, another mule might have to be hitched to the lever to make the final round to run the screw down to make the bale standard size. When the last turn was made the wedges would be knocked out, the side doors let down, the end doors removed entirely and the bagging pulled over at the sides and at the ends, covering the latter completely. The ends were sewed with twine. Ropes were bound around the bale and tied by a peculiar knot that admitted of the rope being drawn very tightly by a lever before the knots were made.

The bale being completed, the mule would be again hitched to the lever and the screw run up, thus relieving the pressure, when the bale was rolled out, new bagging was put down, the doors were raised and fastened, and the packing of the next bale was commenced. Five bales per day was very ordinary work, and eight bales made a good day's work.

Modern Ginning. The ginning and baling of cotton is now performed mostly by steam power, and the unfortunate American principle of sacrificing everything to cheapness of production obtains in ginning cotton. Quality, except in the Sea Island cotton, is seldom considered, and cotton is rushed through the gins as fast as is possible, damaging the staple and reducing the value. One reason for this is the unwillingness to obtain sufficient machinery, as the gin and the capital represented by its cost, lie idle eight months out of the year. Thus, if two gins can be made to do the work of three, the ginner prefers the arrangement, as the outlay on the third gin is avoided.

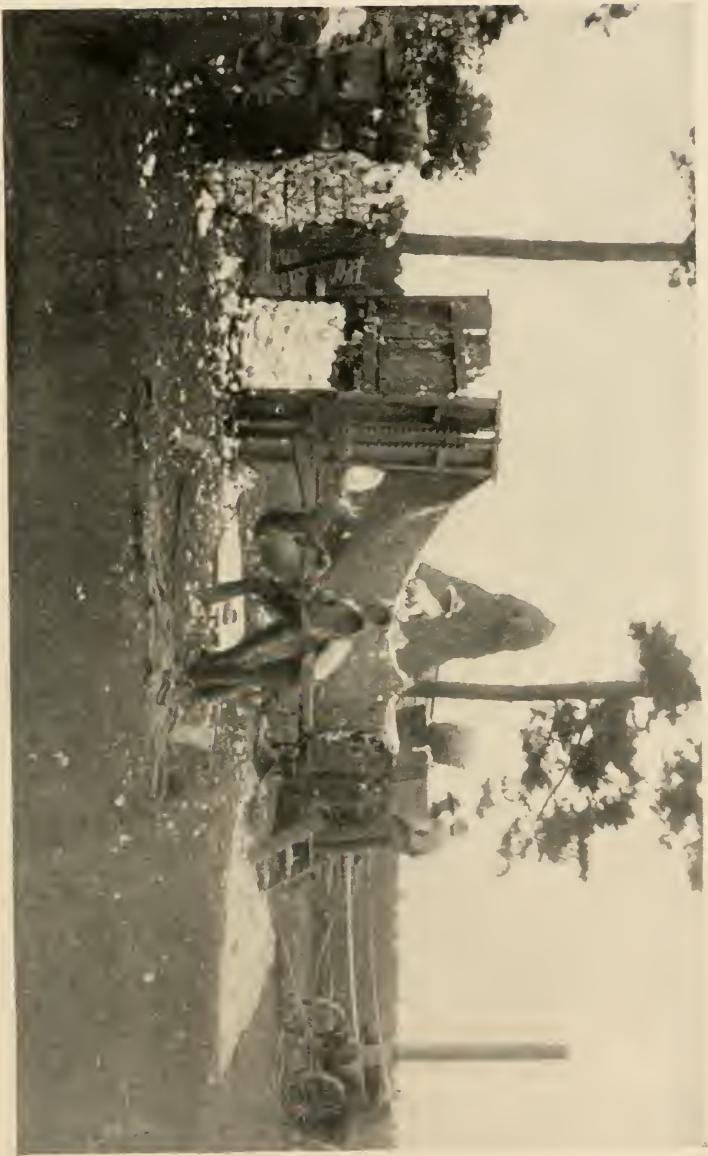


Fig 105. A Travelling Cotton Gin.

There can be no doubt that the cotton produced before the war, and for some fifteen years after it, was less gin damaged than at present, but may be had more seed in it.

Before the subdivision of the large plantations into the numerous small farms of the present day, nearly every cotton planter had a gin house of his own. Now, however, there is not more than one gin house to each thirty-two farms growing cotton. From this it has resulted that cotton ginning has become a business, in a large measure separate and distinct from cotton growing. In the reorganization of southern industries on the new basis, it was first thought that movable ginneries would meet the necessities of the case, and for a year or two traction engines with ginning equipments went through the country for this purpose, shown in operation in Fig. 105. It was found, however, that they would not fill the requirements necessary. The small cotton farmers did not have the facilities for storing their cotton until the whole or even the larger portion of their crop was gathered; the exigencies also of their financial condition made it necessary for them to put their cotton in the market without delay after it was gathered. For these reasons, the portable gins were obliged to change their location for nearly every bale they ginned, which was so expensive that, after a fair trial, they were abandoned as unsuitable. Immediately, in addition to the gin houses established of old upon the plantations, new ones were erected by country merchants and others, as toll gins, expressly for the purpose of supplying the wants of the new growth of small cotton producers.

The competition for custom among these new establishments greatly reduced the charges for ginning: formerly the seed was given for the ginning, now bagging and ties are supplied in addition, by the gin house, where the seed is taken for payment. The money charges for ginning were at first one dollar per hundred pounds of lint ginned, or five dollars a bale; now it has been reduced to three dollars and even as

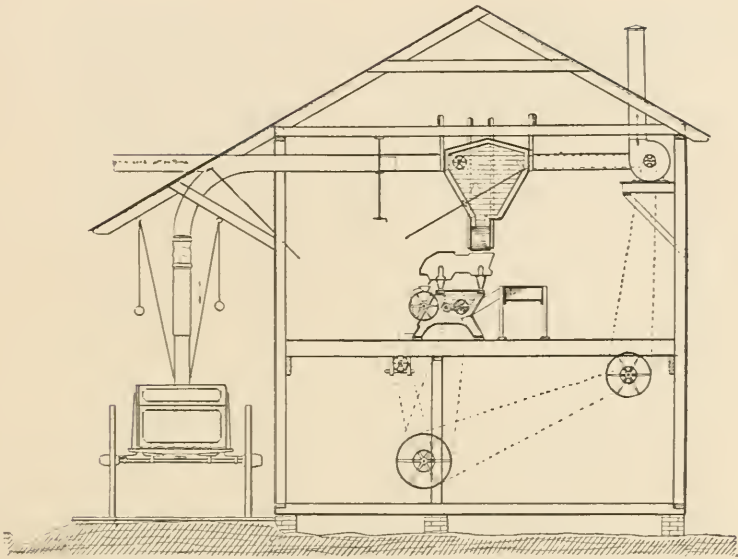


Fig. 106. A Country Custom Gin House and Water Power.

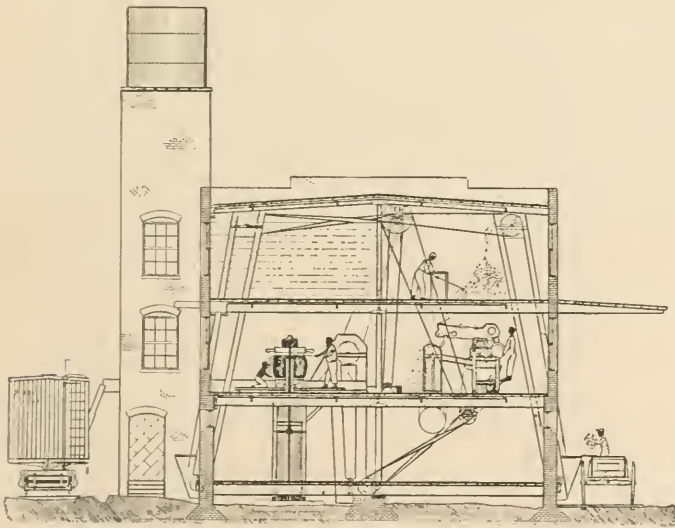
low as two dollars a bale where the gin provides the bagging and ties, or one dollar per bale where the farmer provides them, the farmer taking all the lint and seed.

Unfortunately with the reduction of the charges for ginning, there has been, as before stated, a great falling off in the quality of the work done. There is usually a cheap steam engine of five or eight horse power, the gins average forty to forty-five saws each, and the object is to prepare the cotton as rapidly as possible for their customers, to take the lint from the seed as closely as practicable, and not to reduce the weight of the product by separating too much of the dust and motes from the lint. The consequence is that the quality of the staple is much poorer, not only on account of the motes and dust not removed, and of the short fibres which the close ginning of the seed mixes with the longer ones, but also by the knotting, and even breaking, of the fibres, owing to the high speed at which these small gins are run, in order to turn off each customer's work with the least possible delay. As a rule, a forty saw gin is made to give ten or twelve bales, or about 5000 pounds of lint per day, whereas to separate the fibres without injury from the seed, four bales or 2000 pounds lint per day, is the most that was done when horse or mule power was used, before the introduction of steam engines.

The deterioration of American cotton, which has recently been much complained of, both in America and in England, is partly due to the causes above mentioned. Other causes co-operate to promote this evil. The small and decreasing size of the farms leads more and more to the intermixture of cotton of different qualities. First, because where less than one bale is produced on the farm, it must necessarily be mixed with cotton grown elsewhere, and most likely of different quality. Again the necessities of the small farmers compel them to dispose of much of their cotton to country store-keepers, which is, perhaps, the most frequent cause of mixture. In these regards, the situation approaches that which has occasioned the



SECTIONAL END OF A MODERN GINNYERY.



SECTIONAL END ELEVATION OF MODERN GINNYERY.

Fig. 107. A Modern Ginnyery.

inferiority of Indian cotton. This evil is corrected to some extent by efficient "grading" by cotton factors.

The laborers, being paid by the hundred weight, find it to their advantage not to separate the dirt and trash from the cotton: indeed, it is not uncommon for them to add water and sand to increase the weight, a practice very apt to escape detection where the baskets and sheets are weighed in the twilight, at the close of the day's work. The sheets on which the cotton is emptied during the day by the pickers were formerly kept open and exposed to the sun's rays, so that the dew on cotton gathered early in the morning might be thoroughly dried out; now the sheets are kept carefully covered, so that the laborer may escape loss from evaporation.

In addition to the small country ginneries, a modern gin-
nery is now generally found in all large southern market towns, and in some of the larger cities in each state an oil mill and fertilizer works are run in connection with the gin-
nery. By permission of Mr. D. A. Tompkins, of Charlotte, N. C., two views of a cotton gin-
nery are given at Fig. 107. A modern gin-
nery consists of a complete plant for elevating the seed from the wagon to a room or receptacle above the gins, a series or battery of gins with condensers for removing the fibre (lint) from the seed, and a lint conveyor to deliver the ginned cotton to one of the numerous baling presses now in use.

The view at Fig. 108 shows a plant of this description. The elevating tube is seen above the wagon of seed cotton and is connected at the opposite end to a fan of suitable capacity. The current of air generated by the fan shown draws the cotton up the telescopic tube from the wagon or cotton house into what are known as receptacle boxes. These hold a supply of seed cotton, which is taken from them by short horizontal feeders to each of the gins. By these feeders a constant supply of cotton to each gin is assured. To secure economy in ginning it is advisable not to allow the gin to stop work too long in changing from one farmer's wagon of cotton to

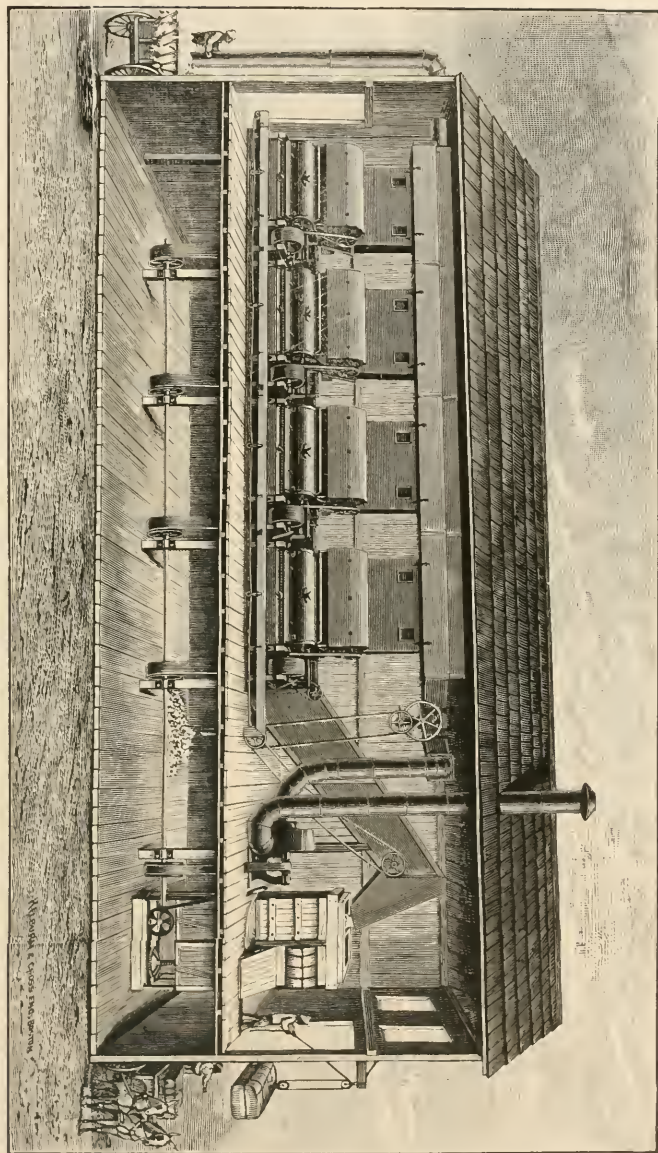


Fig. 108. A Battery of Cotton Gins.

another, and the above named arrangement enables the receptacle to begin filling with cotton from a new wagon after the old cotton has passed into the feeders, thus economizing time, and yet keeping the cottons separate, which is of considerable importance at a custom gin.

The Saw Gin. The feeder above the gin is somewhat on the principle of the automatic feeder for cotton openers in a spinning mill, and depends for its action on a spiked lattice and spiked cylinder, which takes the seed cotton over into the roll box at a regular rate, and yet does not carry over heavy foreign substances which might injure the saws. A feeder shown on the Pratt gin at Fig. 110, is the usual style of feeder where the gins are not arranged in a battery.

The construction of a saw gin may be briefly expressed as a series of circular saws with fine teeth, revolving with an arc of their circumference projecting through a grid into a receptacle for seed cotton; they tear the lint from the seed and carry it through the grid. It is removed from the saws by a brush and carried to a condenser.

Fig. 111 is a section through a gin showing one saw marked D. The seed cotton receptacle, or seed box, is marked A. C is the saw cylinder on which the saws are fixed, another view of which is shown in Fig. 112 at C, while the individual saws are shown in Fig. 112 at A and B. E in Fig. 111 shows the grate through which the saws project, known as the breast or grate fall, also shown in Fig. 112 at D. M is a moveable iron plate to regulate the cleaning of the seed and is adjustable by the screw N. The chamber, A, is full of seed and not seed cotton. Figs. 108, 109, 111, 112, and 118 are inserted by courtesy of the Eagle Cotton Gin Company of Bridgewater, Mass.

Seed cotton having been fed into the chamber, A, passes round on the outside of the mass of seed. The teeth of the saws projecting through the grid about half to three-quarters of an inch tear the fibres from the seeds nearest to them. The

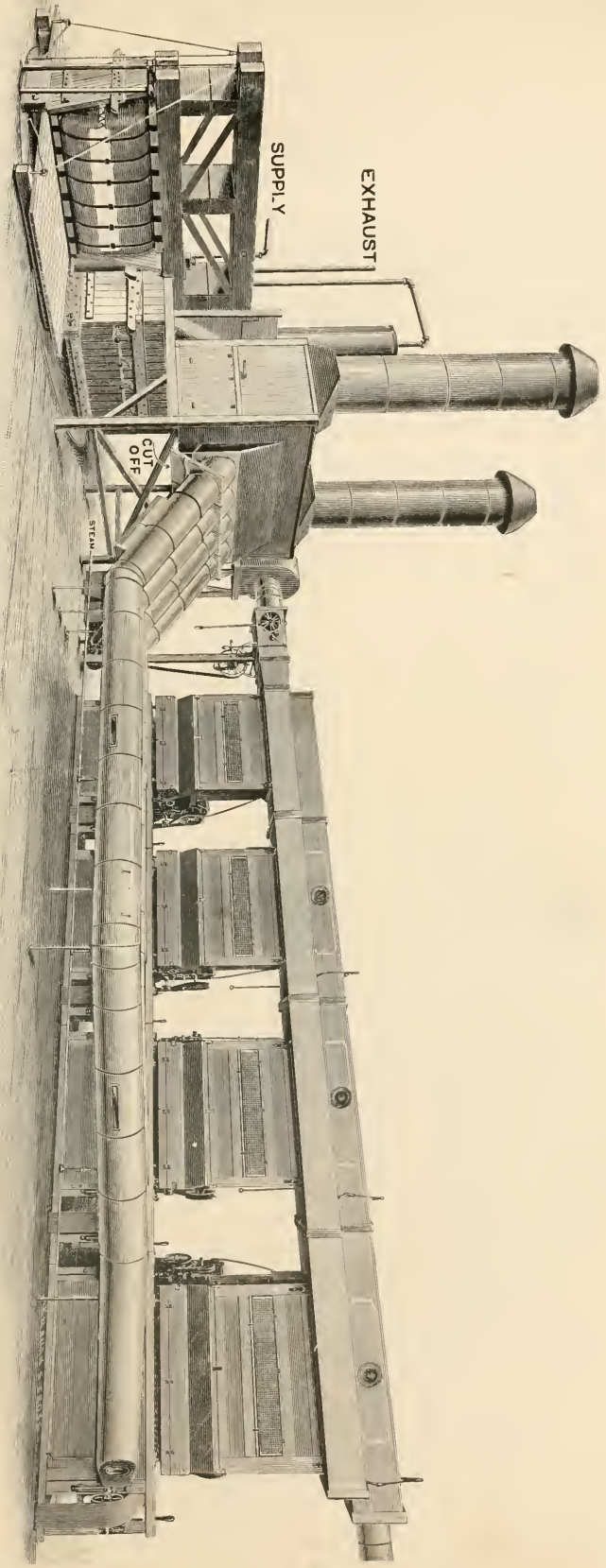


Fig. 109. Rear View of a Battery of Cotton Gins.

quick speed of the saws (about 350 revolutions per minute) sets up a rolling motion of the mass of seed, which is the reason for one of the names of the chamber, "roll box." New seed cotton is continually being brought under the action of the saws, the fibres are carried forward by the revolution of the saws and are removed by a rotary brush. Some gins are made with what is called a "revolving head," in which case the ends of the roll box are iron plates which revolve on studs at the same speed as the rolling mass of seed. The object is to reduce friction of the seed on the ends of the roll box and keep the mass of seed rotating at a uniform speed all across the box.

The circular brush, shown in Fig. 111 at J, and at E in Fig. 112, is an important part of the machine; it should be filled with heavy bristles and the frame work and ribs should be strongly constructed and well bound together. The brush revolves at four or five times as many revolutions per minute as the saws, in the direction indicated by the arrow below it in Fig. 111, and the cotton is blown either into a lint room on the old system, or, where a condenser is used, the fibres are drawn forward by the air current to the surface of wire covered drums or screens; by passing between these screens they are delivered in the form of a sheet, being deposited on the floor in case of gins that are not connected to a conveyer.

Where several gins are connected in a battery, as shown in Fig. 109, the lint is drawn forward through tubes from each of the gins in the battery to one condenser. Each tube can be separately "cut off," and thus one or more gins can be used at once, and the current of air regulated for each of them.

This condenser delivers above a baling press, which may be constructed with two boxes, so that cotton can be delivered into one, while the other is being packed.

The saws should project about three-fourths of an inch through the grate or they will cause the breast to shake or

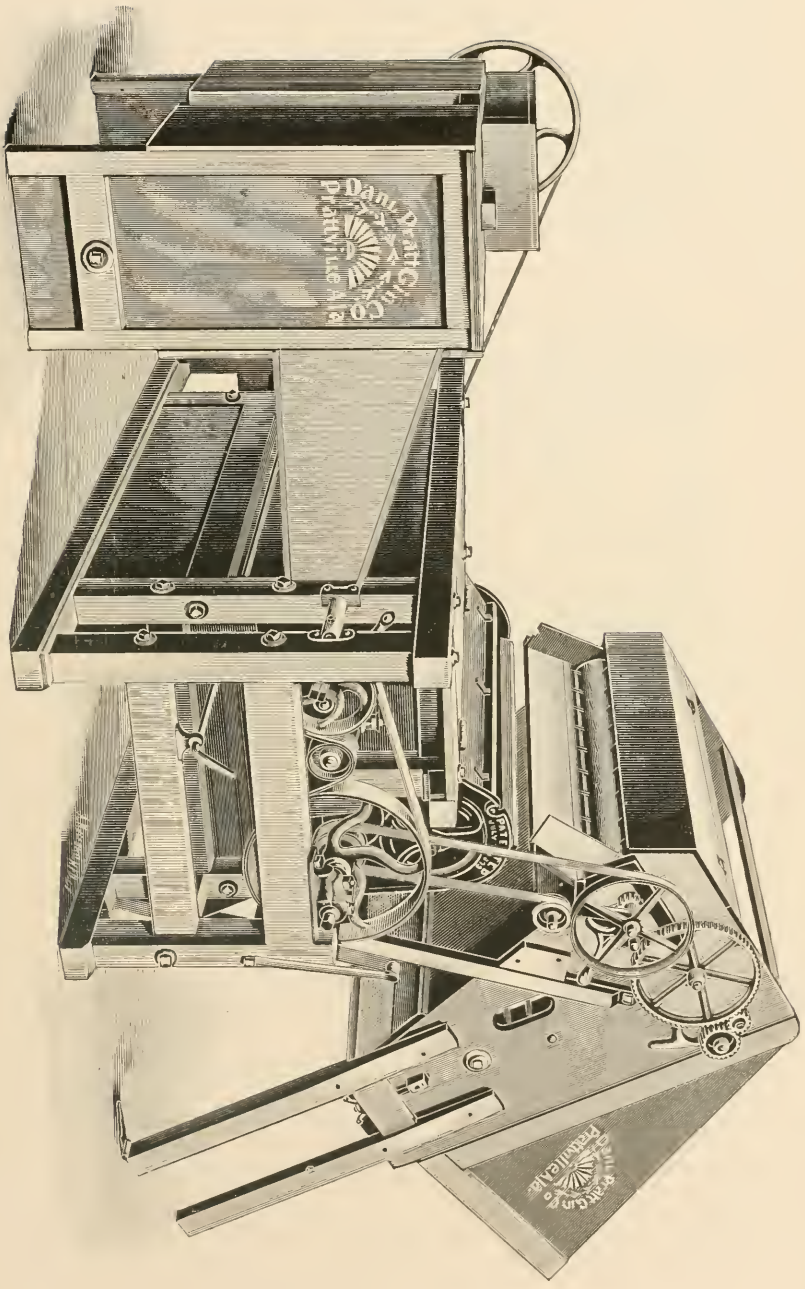


Fig. 110. Saw Gin With Feeder.

dance. The mote board should be perfectly smooth, otherwise motes tend to gather and gradually choke up.

Gins are most frequently used of sixty to eighty saws each, ten-inch or twelve-inch diameter, and the highest speed that a twelve-inch saw cylinder ought to be driven for good work is 300 per minute, although they are frequently detrimentally run up to 400 revolutions per minute and above.

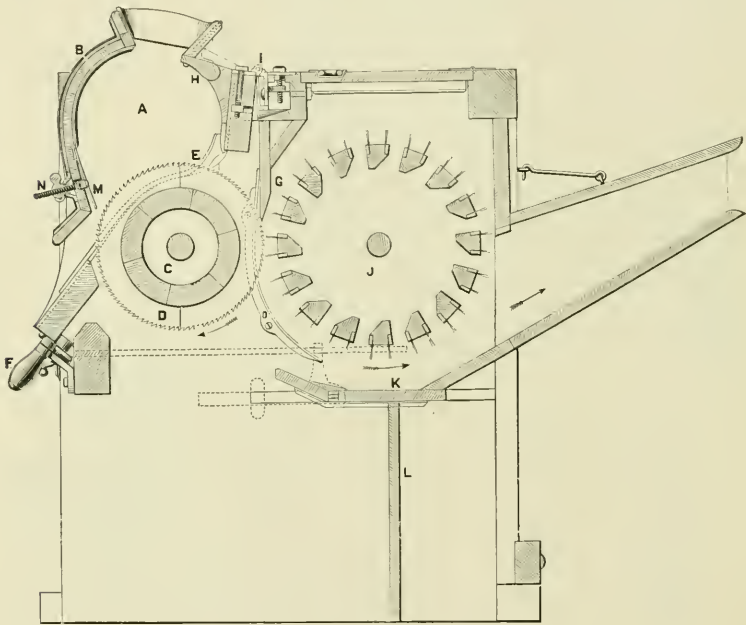


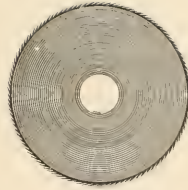
Fig. 111. Saw Gin in Section.

Gin Damage. Defective ginning is caused by having the saws too near to the bars of the grate so as to rub, by running the saws too fast, or by having teeth too sharp; when newly sharpened the teeth have a square edge which ought to be somewhat rounded off by running some old cotton loaded with sand through the gin.

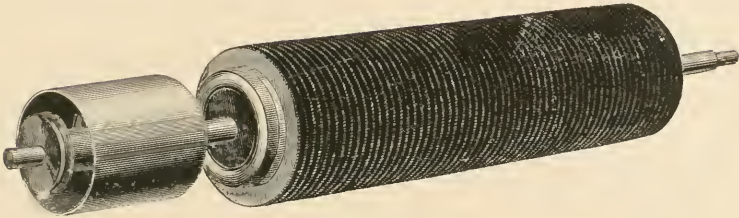
An experienced judge of cotton can detect the results of bad ginning by an examination of the cotton in the bale.



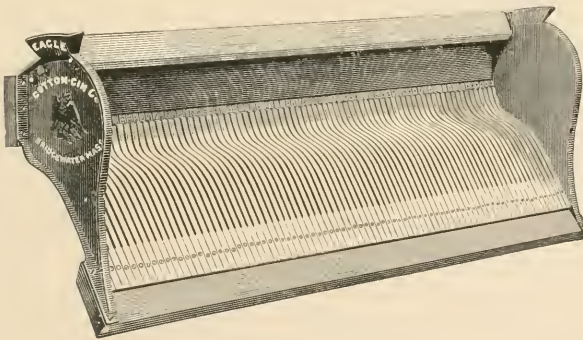
A. Saw in Sections.



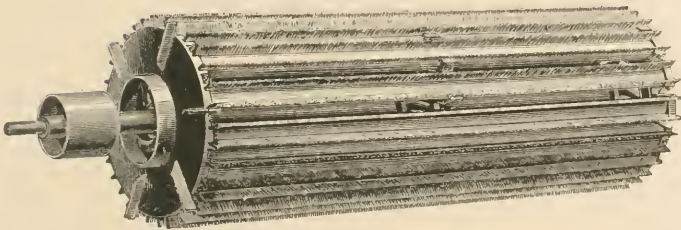
B. Solid Saw.



C. Saw Shaft and Saws.



D. Grate, Grid, or Breast.



E. Brush.

Fig. 112. Parts of Saw Gin.

There are three principal effects caused by bad ginning: one is nep, another is cut staple, and the third is stringy or tailed cotton. Cotton should never be ginned while it is wet or even damp, as it will not leave the seed as satisfactorily then as it will when ginned in a dry state, and after it has been removed it has a tendency to string, or form lumps and bunches. This is the least important damage that is done in a gin, the cut staple being much more detrimental in succeeding operations.

The cut staple is caused by running the gin too fast. In this case, the fibres are ruptured by the sudden pull given to them by the saw teeth, and an indication of a gin having been run too fast is sometimes seen in a bale when the cotton is found to contain a large number of little clusters or V shaped bunches of fibres, showing that the brush has not been able to cleanse the saw teeth sufficiently slowly to brush these kinks out. Of course, the faster the saw is run the faster the brush has to be operated in order to remove the fibre at all. Neps are caused by saws not being properly set and rubbing against the grid; the fibre in this way is rolled into minute balls, which are very difficult to remove in the after process of carding. When it does not actually roll it into neps, the gin bruises the fibre sufficiently to cause the whole of the cotton that passes between the wrongly set saws and the bars to be of a rough fluffy nature. If the samples drawn from the bale show gin damage the whole shipment ought to be condemned, for although it may, and probably is not, grown by one farmer, it is far more probably ginned at one ginnersy, and the fault will often run through the lot.

Cotton Ginnersies. The capacity of a saw gin driven by steam or water power is about eight pounds per saw per hour, or a 500 pound bale can be ginned in one hour on a sixty saw gin. As has been previously pointed out, the staple of the cotton is better if ginned more slowly than this. Often gins are speeded up so as to gin a bale in thirty-five to forty-five minutes, but the results are bad. The old mule power gin of

forty to forty-five saws rarely does above 1500 pounds per day or only one-half of the capacity of the steam driven gin, but other conditions being equal, does better work. The makers of cotton gins assume that each saw will gin ten bales a season.

Under the gin, as it is usually constructed, is an adjustable sliding mote-board, by which it is claimed that motes can be separated from the lint, by regulating the volume of air passing to the gin brush, which sweeps the lint into the lint room.

At the bottom of the roll box or grate fall there is also another adjustment, so that the seeds can, if desired, be so thoroughly cleaned as to be almost de-linted before leaving the gin, or allowed to drop out with the short lint still attached, which is the much better plan where good results are desired.

Unfortunately, the farmer objects to the fractional loss even of the motes or short lint on the seed and cotton, the removal of which would be advisable, as the value of the cotton would then be increased.

The Modern Ginnery. It is amusing to watch some farmers who bring their cotton to a modern ginnery with its numerous tubes and trunks. Their leading idea apparently is that one or another of these mysterious orifices may be a means of robbing them, and that if they do not watch all of the feed and delivery ends at one and the same time, some of their cotton will mysteriously disappear. The same suspicious feeling prevents a farmer selling his cotton in the seed. From the point of view of the spinner, it would be to the advantage of many of the new cotton mills starting up in the South, to have their own ginnery where cotton could be ginned slowly and carefully, saving the staple: but it has been found almost impossible to persuade the farmer to sell his cotton on the seed. This on his part is a wise precaution if he intends to return the seed to the soil. Another reason for not disposing of seed cotton is that several states have laws prohibiting the sale of cotton on the seed between dusk and sunrise as a precaution against plantation theft over night.



Fig. 114. Steam Ginmery.

A representation of one of these steam ginneries is shown at Fig. 114, where the wagons laden with seed cotton add a picturesqueness to the scene. A little to the right of the gin-ery are seen several bales of cotton dumped in the field, where they may have lain for weeks. This is one of the causes of the mildewed and decayed cakes of cotton occasionally found at the spinning mill.

It is not to be assumed that all ginneries are so complete as the modern plant just described. There are many on the very primitive principle described in the early part of this chapter, with the wooden pin-gears operated by mules or horses; there are others on remote water-powers, or driven by antiquated engines with gins dating back two decades or more, and each edition of a southern paper, in the ginning season, generally contains a report of a boiler bursting, an engine gone to pieces, or a gin-ery burned down.

Some of the ginneries which were built in slavery days are still used, because of the labor and expense of hauling seed cotton to the custom gin, which takes up as much time as is absorbed by the primitive apparatus already installed, but the tendency of the times is towards large custom ginneries with power presses.

Fig. 115 on the opposite page shows individual American cotton fibres:

1. Texas.
- 2 and 3. Rome, Georgia.
4. Sea Island.
5. Yazoo Delta, Mississippi.

The Roller Gin. There are other important machines for the purpose of ginning cotton besides the saw gin. Perhaps the best known of these are the knife roller gins for single or double rollers.

The single roller single action gin is a long staple cotton gin for Sea Island and Egyptian cotton, production seventy to ninety pounds of ginned cotton per hour.

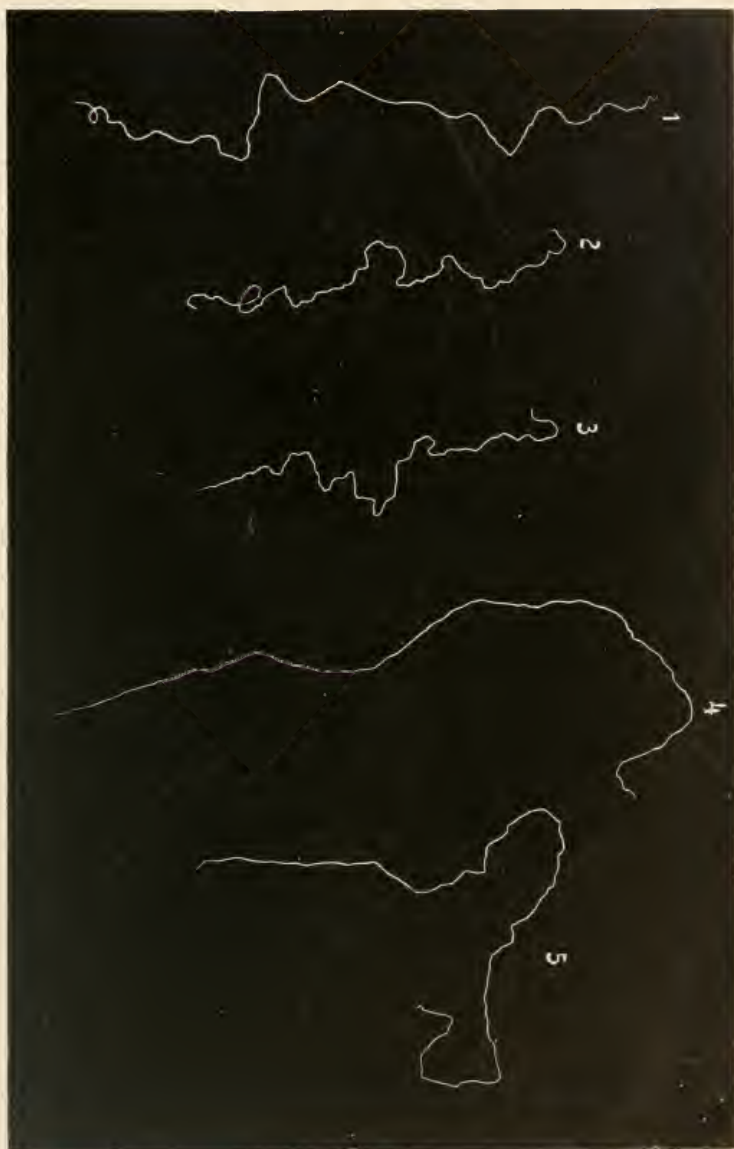


Fig. 115. Individual Cotton Fibres.

The single roller double action gin is a short staple gin for American Upland, Indian, Chinese, and all short staple cottons having a wooly or green seed, production twenty-five to forty-five pounds short staple per hour, and forty to seventy pounds long staple per hour. This is the favorite gin for India.

The double roller gin is for both long and short staple cottons, production 95 to 125 pounds short staple per hour; 140 to 180 pounds long staple per hour. The double roller gin is the best gin where ten, twenty or thirty of them can be operated in one mill, or where mill owners gin their own cotton, as they do in India and Brazil. The above figures have been supplied by Platt Brothers & Co., of Oldham, England. Figs. 113 and 115 are used by courtesy of the New England Cotton Manufacturers' Association,

There is no doubt that the roller gin separates fibre from the seed with very much less damage than in the case of the saw gin. Referring to Fig. 115, which was prepared by Mr. Edward Atkinson, the well-known statistician of Boston, it will be seen at once how the tugging of a saw at such delicate fibres as are shown in the figure, can bruise and break the filament. Experiments have proved that cotton from the same field is stronger when ginned on a roller gin than when ginned on a saw gin, and while the expense of roller ginning is slightly greater than that of the saw gin, there is no doubt that roller-ginned cotton is more valuable and would bring a higher price in the market, if a supply of roller-ginned American cotton were available; the writer feels convinced that the time is not far distant when some form of the roller gin will be widely adopted in the American cotton belt. It is now very largely used in India, a country which formerly utilized the most primitive methods of separating cotton from the seed. There the method of ginning formerly used, and which still obtains to some extent, is the old roller gin.

Fig. 116 shows one form of construction of this gin, which requires two persons to work it, one turning the upper



Fig. 116. Hindoo Ginning.

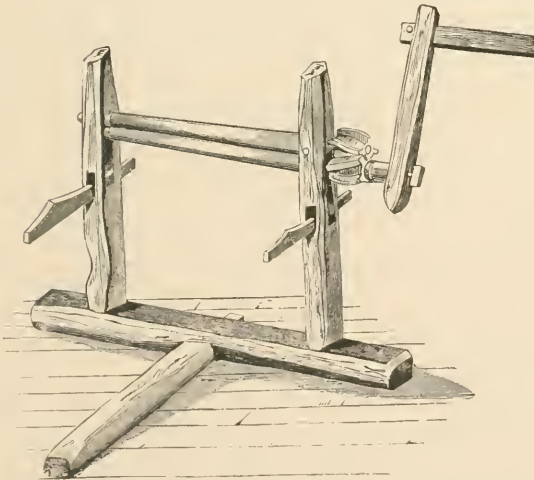


Fig. 117. Hindoo Gin.

roll with a staff, and the other turning the under roll by a crank, feeding cotton at the same time.

The gin shown in Fig. 117 is a slightly improved form of the same gin, as it can be operated and fed by one person.

Percentage of Lint. A rough and ready mode of calculating the proportion of lint to the total weight of seed cotton is that the lint forms one-third of the whole, and the farmer always hopes that his cotton will "third" itself. As a matter of fact, the average will hardly be one-third. Cotton grown on rich land does not usually third itself, nor does cotton ginned immediately after picking, or picked after the boll has recently opened, as the excess of natural moisture in the seed has not had time to dry out, but for all practical purposes an estimate that two-thirds by weight of the seed cotton is seed and one-third is lint is sufficiently accurate. The proportion of lint to seed is increasing year by year as the cotton farmer becomes more careful in the selection of his seed.

Baling. At the country ginneries, the cotton is baled as well as the facilities admit of, but has to be compressed again at a shipping point. The pressed bale is formed in some few districts still by the old mule press shown at Fig. 102, but very rarely. In this case, the number of bales made in a day does not exceed ten, and this with two or three men and a mule, the production being usually between five and eight bales per day.

Power presses are rapidly being introduced and there is an immense variety of these—screw presses, direct steam cylinder presses, down packing presses, up packing presses, double box presses, self tramping presses, and so on.

A figure of a double box revolving press with a direct acting steam trampler, is shown at Fig. 118.

This press is so arranged that the baling boxes can be revolved on a platform, so as to bring them alternately under the operation of the press. After the bagging has been spread the cotton is thrown into the box which is not under

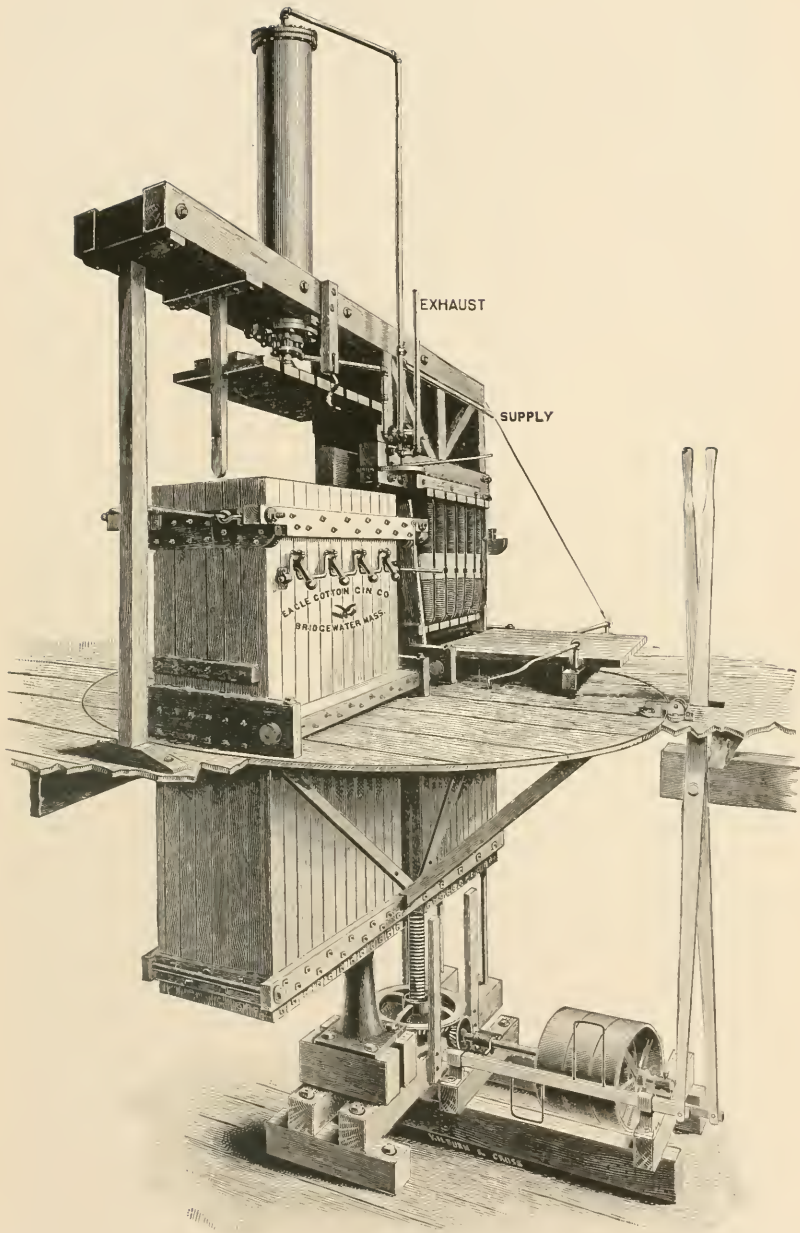


Fig. 118. Cotton Baling Press.

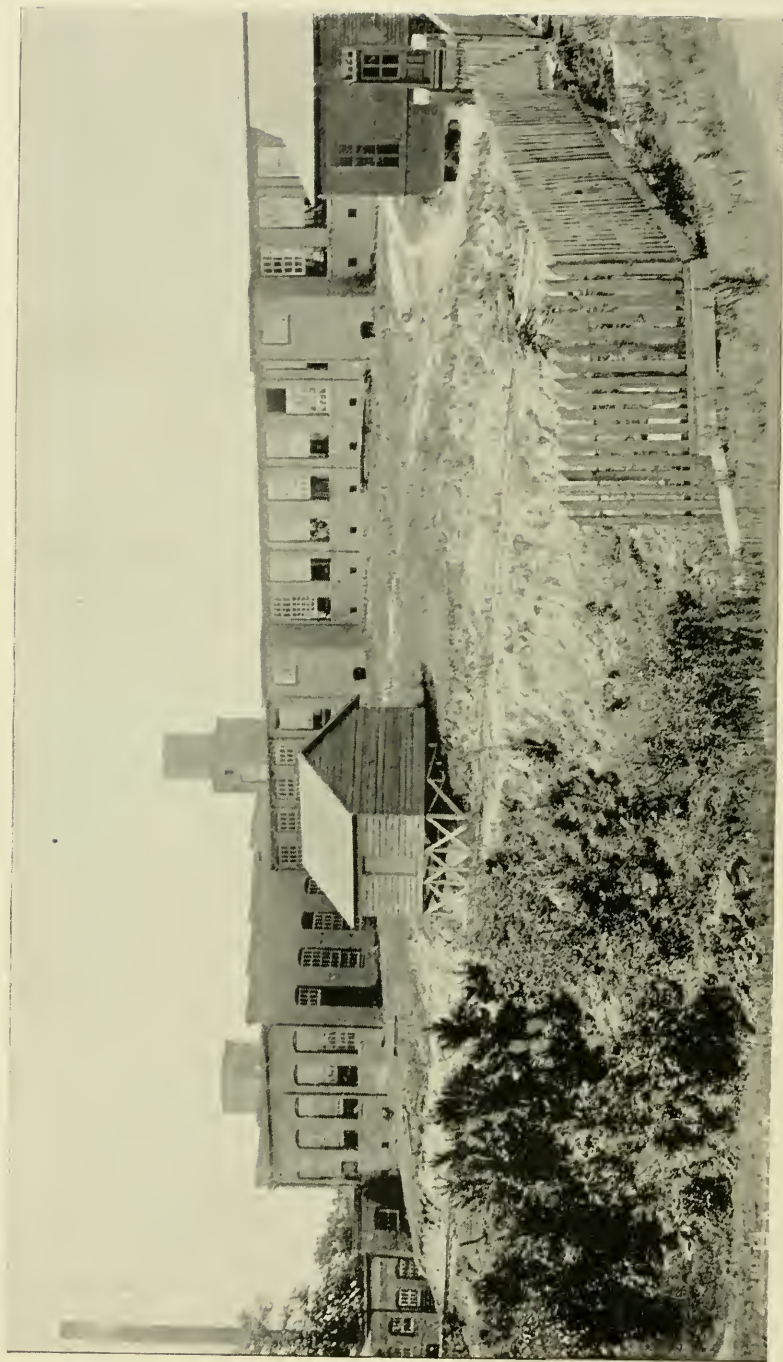


Fig. 119. The Average Size of a Southern Cotton Mill.
The Chewalla Mill. Eufaula, Alabama.

the operation of the press, until it is filled with loose flakes of fibre. Steam is then turned on the piston above the "tramper." This is a platen working in slides, which is pressed down on the loose cotton to reduce the space it occupies. It is raised as well as lowered by steam. After several fillings and trappings the box is full, and the platform is revolved to bring the box over the press. The platform is carried and revolves on a hollow column, four inches in diameter.

The platform of the press proper is moved upwards by the rotation of a threaded gear or wheel on a five inch steel screw.

After sufficient pressure has been put on the bale, the ties are passed round and buckled, the pressure released, and the bale removed by throwing open the sides or doors of the box.

Additional information on baling is given in the next chapter.

Fig. 119 is a view of a southern cotton mill, the Chewalla cotton mill at Eufaula, Alabama. This is a small mill, but is the average size of the southern mills. The above named figure, together with several others in the book, viz.:— Figs. 43, 44, 64, 91, 149, 161, and 163, are used by courtesy of the Central of Georgia Railway Company, and are views on the line of that railroad.

CHAPTER V.

THE FARMER TO THE COTTON MERCHANT. — LOCAL SALE OF COTTON. —
SAMPLING AND GRADING. — COMPRESSING. — OCEAN SHIPMENT. —
METHODS OF BALING COTTON.

The Farmer to the Cotton Merchant. The American cotton crop has reached the immense total of 10,000,000 bales in one year, and the reader will correctly conclude that there exists quite an army of merchants and brokers whose principal business is in dealing with cotton between the grower and the spinner, or to use an American expression “handling” the crop. As yet, less than one million bales are consumed in the cotton mills of the New South, and consequently the ultimate destination of most of the cotton crop is New England, Canada, or Europe, and the larger cotton houses at the inland and seaport cities have direct foreign connections. On the other hand, they have buyers at many of the villages or railroad stations in their district, and thus they form a direct link between the farmer and the Boston, Liverpool, Havre, or Bremen cotton merchant.

Local Sale of Cotton. In the days of slave grown cotton and of large plantations, it was the custom for the up country planters to consign their cotton to a seaport — New Orleans, Wilmington, Norfolk, Charlestown, or Savannah, or to some large river city like Memphis or St. Louis, and leave it in the hands of a commission merchant for sale. The planter having paid haulage to the river or railroad, transit charges to the market and insurance while in transit, found that the deductions from the merchant’s remittance included charges for weighing, packing, storing, and repairing bagging, together with two and one-half per cent. commission, and consequently

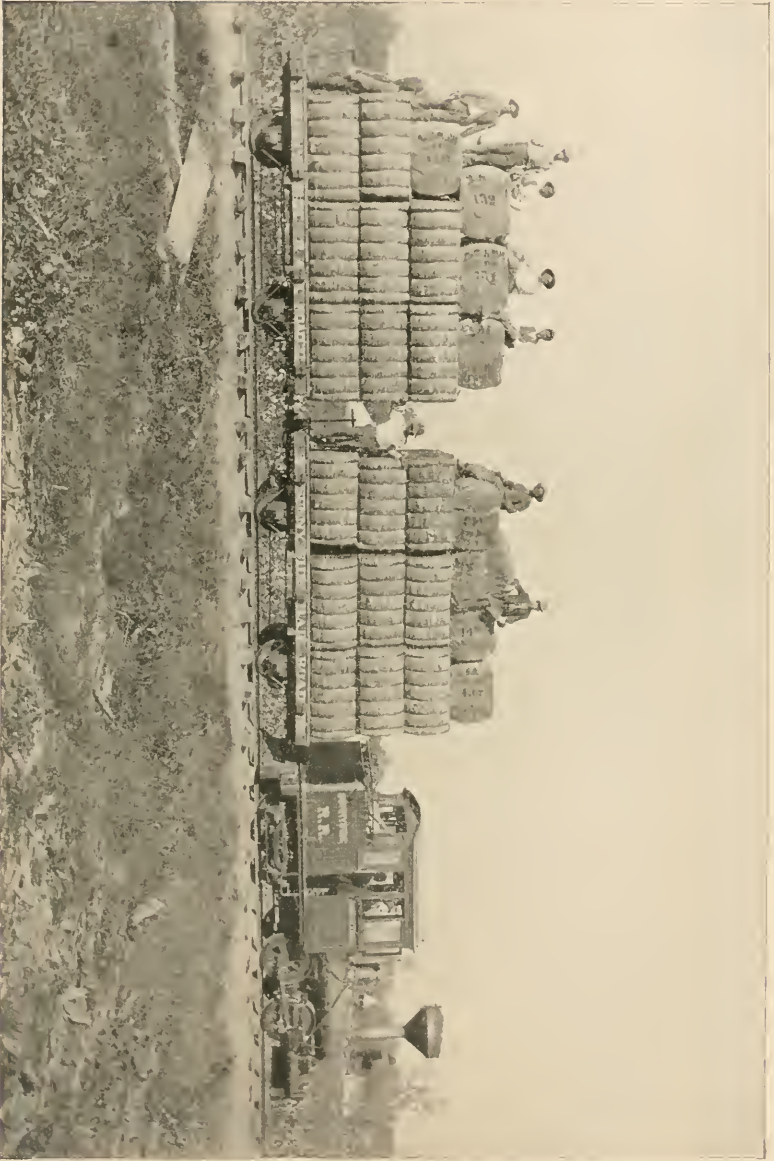


Fig. 120. Cotton Cars on a Country Railroad.

this part of the business was a heavy tax on him. The system was followed for some time after the war, and meant an average expense of probably five dollars per bale to get the cotton from the plantation to the ship. Partially in consequence of this expense and principally because of the growing of cotton by so many small farmers who are not free agents or who cannot trust the commission man, the consignment of cotton for sale has almost died a natural death, and it is now almost all sold to local storekeepers and by them to cotton exporting firms in a neighboring city, or it is hauled by the farmer into the city and sold directly to the exporter.

The average small farmer is usually in debt to his local storekeeper, and also has to turn over to the ground landlord so many bales of cotton as rent, one-half, one-third, or one-fourth of the crop, according to the terms of tenancy, the land owner having this claim prior to all other creditors.

The local storekeeper is dignified by the name of merchant, and, although the town in which the store is situated may only be populated by five white people, seven niggers and a yellow dog, he is also mayor, postmaster, tax collector, and may be owns the cotton gin in addition to dispensing hardware, dry goods, boots, shoes, groceries, buggies, and fertilizers.

The farmer has to satisfy this merchant's mortgage for a year's supply before he can sell his cotton, and it generally happens that it all goes to the storekeeper, at his own valuation, to pay off the farmer's debts. This incubus being removed, the farmer's credit is again good, and he returns home with bags of flour, and suits of clothes, mule harness, a jug of corn whiskey, a new banjo, or gingham for a woman's gown, according to his tastes, but all of which is the beginning of another debt to be paid for by cotton for which the land is not yet plowed. If he has been successful in smuggling off his farm, unknown to his merchant, one bale of cotton during the night, he may be in the unusual position of having money to spend. He also usually sells the seed that ought to be returned to the ground for manure.

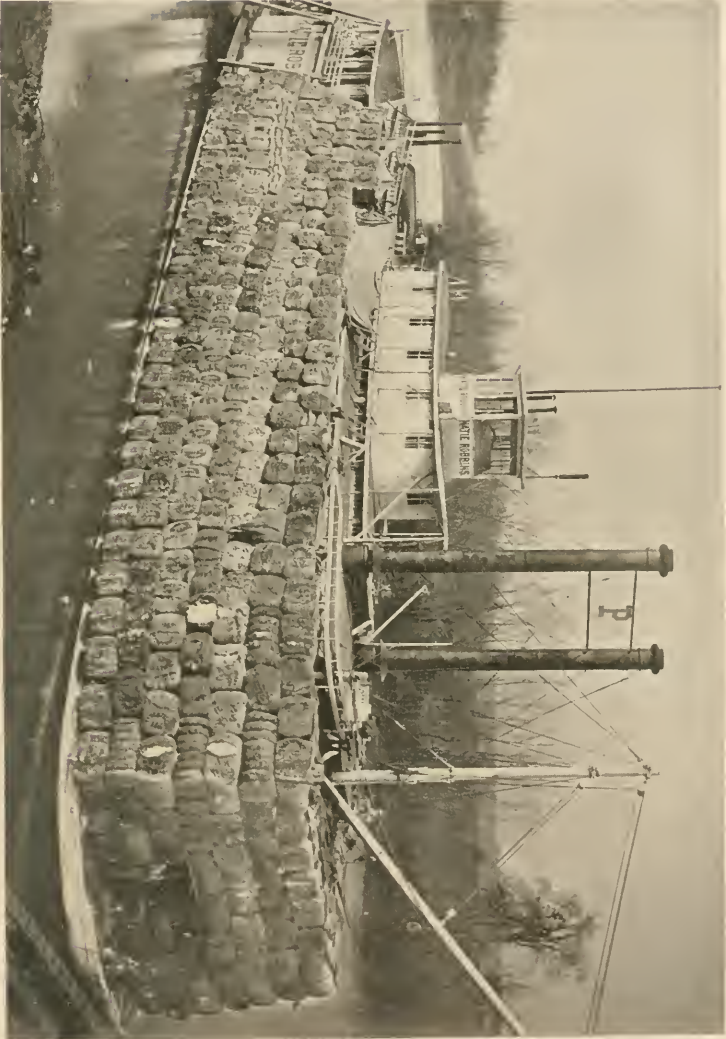


Fig. 121. A River Steamboat Loaded with Cotton.

The farmer who is sufficiently independent to be able to sell his own cotton, hauls it to the same merchant, and sells it at the best price he can get, as a rule getting cash for it, less a deduction for weighing. The storekeeper, who in addition to his other duties, is often a buying agent for a cotton exporter in a neighboring interior city which is a cotton market or compressing point, or if not the buying agent himself, is in touch with one, forwards this cotton in earload lots, each ear carrying cotton grown on half a dozen farms and of as many qualities.

In the above case it has been assumed that the cotton has to be shipped by rail, but it often happens that water transit is the cheaper, and possibly the only mode of shipment. In this case the cotton is loaded on the river steamers, so familiar to residents near the Mississippi river, Red river, and other rivers, as shown at Fig. 121. Another view (Fig. 120) shows cars laden with cotton on a branch railroad. On arrival at the city, it is trucked out and arranged on large platforms for examination and grading, as shown in Fig. 122, from a photograph taken at the Charlotte, N. C., cotton platform. At these platforms it comes in contact with cotton hauled in by road from within a radius of fifteen or twenty miles, and which is sold on the streets of the city by the farmer directly to the cotton exporting firms.

Several other views are shown, one in Fig. 123 representing the streets of a Texas city on a hot day — the open umbrellas of the whites testifying to this. The farmers' wagons laden with cotton are seen all round the square.

The farmer deals directly with the only firm that intervenes between him and the foreign cotton merchant, and thus middlemen's profits are avoided. The cotton exporting firm is of course in touch with prices all over the cotton world through the local cotton exchange, and usually has some advantage over the farmer in this way, but the latter has to sell, or else haul his cotton fifty miles in another direction. The trade



Fig. 122. A Cotton Platform, Charlotte, North Carolina.

being made, the cotton is passed by two city officials — a cotton weigher and a cotton inspector. The duties of the former are to give an official weight, and the latter to examine both sides and the middle of the bale, looking for false packed cotton, wet bales, bad baling, excessive weight of tares, and other defects, for any or all of which the farmer is penalized by a deduction from the actual weight. The decision of the weigher and inspector is usually accepted as final on both sides, and a fee in the larger markets where much cotton is sold, of ten cents (five pence) per bale is paid by the farmer for the examination, which increases in small places to twenty or twenty-five cents.

These weight deductions are not at all infrequent in the cotton belt, but the English or northern spinner usually finds his cotton invoiced to him at full weight. On the other hand, the custom is to pay the farmer on the gross weight, including bagging and ties (tares and hoops), which weigh twenty to thirty pounds per bale, and for which the English spinner gets an allowance.

Sampling and Grading. In the cities the exporters affix a tag to each bale by which to identify it, and take a sample from every bale, which is numbered the same as the tag. This method of sampling cotton is shown at Fig. 125. The samples are put in a basket and taken to a room with a good light, judged by an experienced "grader," and if necessary compared with standard samples. Thus the cotton is assorted into grades such as low middling, middling, good middling, etc., as explained in Chapter I. It is then made up into 100 bale lots, if possible, and "compressed," being branded at the same time with the mark under which it is to be sold in Europe. A sample room of a Mississippi cotton factor is shown in Fig. 136.

Compressing. By the term "compressing" is meant the second pressing of the bale of cotton. The old wooden screws on the farms or even the more modern power baling presses

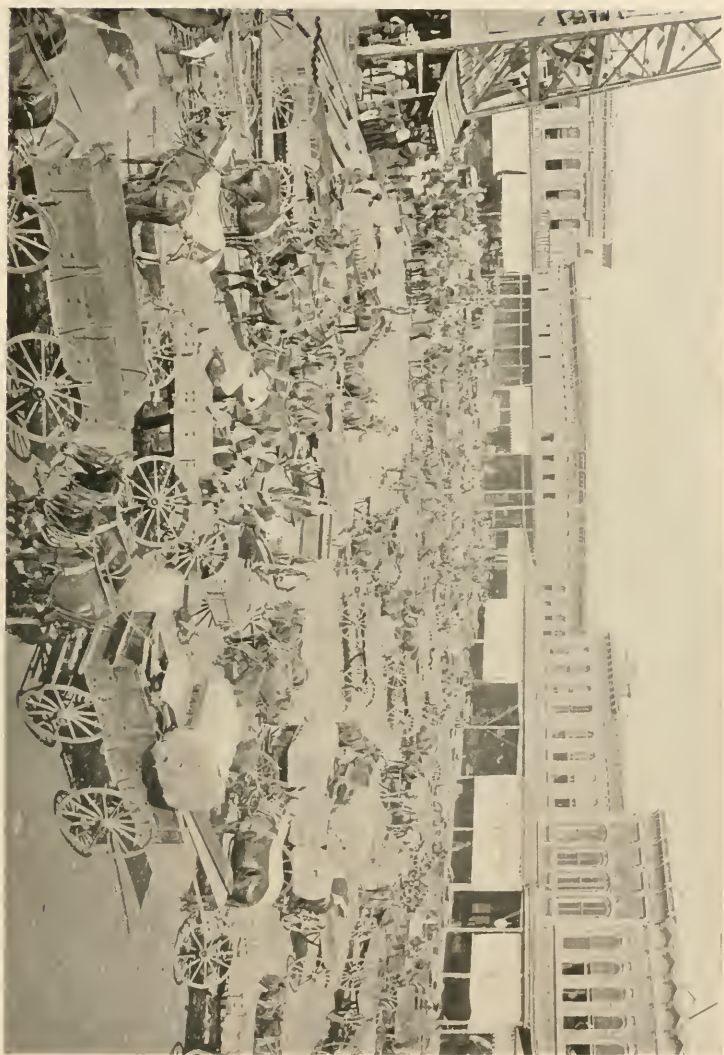


Fig. 123. Selling Cotton in a Texas City.

are only sufficiently powerful to make a loose bale about twenty-eight inches thick. The power necessary to compress a bale into the small compass of the package as it arrives in Liverpool or Boston is very great, and the plant very expensive, but of great capacity. Consequently, at every inland city and seaport in each state, there are compresses. Some of these belong to private cotton export firms who do a large business, but more frequently to the railroad companies. The railroads give through freight rates to Europe or Boston, and establish the compresses so as to economize space; firstly, in their own freight cars by handling closer packed cotton, and secondly to get a greater weight of cotton in a ton measurement (ocean ton), and thus be able to give better ocean freight rates to their customers. It is found that an extra and often useless patch of bagging is also placed on each bale during compressing.

These compresses are massive affairs, with batteries of two or three large boilers, the press proper, steam and hydraulic cylinders, etc. There are also the large store-houses of the plant, and the various appliances for handling and loading the cotton, both before and after it is pressed.

An ordinary compress requires, to pay expenses, at least a business of 40,000 bales per annum; so they are located only at central and convenient distributing points, to receive the output of the various plantations and storehouses.

The compresses are very strong and heavy, a good illustration of which is found in the following record of the weights of some of the parts of the press:

Lower platen, about	22,000 pounds
Upper platen, about	16,000 "
Crosshead, about	25,000 "
Two wrought iron links, each	24,000 "
High pressure steam cylinder	25,000 "
Low pressure steam cylinder	22,000 "

Various pressures are put on a bale of cotton, according to the capacity of the press, varying from 1000 to 3000 tons.



Fig. 124. Weighing Cotton at the Platform.

The bale in some instances is reduced from three feet thick to six inches thick, though after leaving the press this will expand to twelve inches thick. The steam pressure varies from about 100 pounds to 125 pounds, and the hydraulic pressure from 3000 to 4000 pounds per square inch. The steam cylinders vary in size from sixty inches in diameter to seventy-five inches in diameter, nine feet to ten feet stroke, hydraulic cylinders, from sixteen and one-half inches to thirty inches diameter, and five feet four inches stroke.

The compress strikes the visitor to the South perhaps more than any other process in the raising of cotton, or in its preparation for the market. It is interesting to see a bale which has been already partially pressed at a country hand press, about twenty-eight inches thick, placed between the huge jaws of this contrivance and condensed in bulk until it is only eight inches thick, and the agility and daring of the fourteen niggers who insert the bale, the covers and the ties, between the jaws of the huge press, are very noticeable. It is very clear that much agility is developed when it is recorded that at the Charlotte, North Carolina, compress, there is a record of 936 bales having been compressed in five hours, each bale tied with seven bands and heads well sewed. The average dimensions of a bale from the farm are: length, five feet; height, four feet; width, twenty-eight inches, making about forty-eight cubic feet, or eleven pounds to the cubic foot. The powerful compresses now constructed will reduce the above bale measurement in the press to seven inches thick, making seven cubic feet, with a density of about seventy-five pounds to the cubic foot. After the bale is released from the press, it expands, but remains at a density of between forty and fifty pounds, after the pressure has been removed. The cost of compressing is nominal compared with the great saving in freight.

The compress shown in Fig. 127, and made by Mr. Lucien Voorhies, of New Orleans, is known as the Morse press, and consists of a huge steam cylinder which is ninety inches in diameter and worked at a pressure of 120 pounds to the



Fig. 125. Sampling Cotton for Grading.

square inch. It carries at the lower end of the piston rod a wedge shaped toothed rack, into which are geared cycloidal sectors, one at each side of the rack. Each of these sectors is very massive, and each has two links or lifting rods connected to it in such a manner as to raise the platen or platform. As before stated, these parts weigh from 16,000 to 25,000 pounds each. Between the cylinder and the lower platform is a beam, forming part of the frame work of the press, and it carries an upper platen supported from a wedge. The lower and upper platen form the jaws of the press and are grooved in such a manner as to admit of the ties or bands being slipped around the bale at a period when the highest pressure is being exerted. Usually the ties are removed from the plantation bale, the bale is trucked to the press, additional bagging put on the lower platform, the bale dropped on this, and additional bagging thrown on the upper part of the bale. Steam is then admitted to the cylinders, and in cases where the wedge is used, also admitted to a small additional engine for the purpose of moving the wedge, the bale being raised with the lower platform towards a fixed beam.

The builder of the press estimates that the maximum pressure is 6,000,000 pounds on each bale, after allowing for dead weight and friction. While the bale is in this position new bands are passed around it and made tight, the pressure is then removed, and the bale taken out to be marked and trimmed. The distance between the jaws of the press, when the highest pressure is being exerted, is between six and nine inches, according to the size of the bale, but the bale immediately expands, on being released, to one and a half or twice this size. The greatest depth between the jaws of the press is sixty-four inches, and the number of men required to operate the press is about fourteen.

Ocean Shipment. The bales are marked with three or four letters or some device to indicate the lot of cotton to which they belong. These lots are the result of various "gradings" to obtain bales in each shipment all of one class.



Fig. 126. A Cotton Grader's Sample Room.

It is then usually weighed, piled away in covered freight cars holding on an average fifty-five bales to a car, and forwarded to a seaport, not necessarily the nearest, but the one to which the best land freight rates are to be had. This depends on the current position of the railroads, whether they are cutting rates with one another for special classes of trade, or whether there is a combine keeping up the rates to any particular port.

It is more than probable that the cotton will be forwarded to the seaport in loose bales and "compressed" there. In that case, the bales are taken right from the "compress" to the ship side, the ship lying close by, either slung over into the hold three bales at once, or drawn up a gangway, and packed away very carefully, being screwed down into their places by jack screws to reduce the possibility of the cargo shifting. The loading of cotton for ocean shipment into a tramp steamer is shown at Fig. 128, representing a scene at the port of Savannah, Georgia.

There is a continual waste of cotton in transit such as sweepings and pickings from bales. There is a considerable quantity of sample cotton discarded after each cotton deal, while the frequent fires in cotton districts create a large quantity of loose cotton. Dealing in loose cotton is an important trade, and, as it has to be sorted and baled, a number of people are engaged at seaport towns in this work. At Fig. 129 a picture of negroes thus employed is shown.

Methods of Baling Cotton. The baling of American cotton calls for special criticism. Contrast an American bale with an Egyptian or Indian one in any European cotton market, and there is a picture which needs no comment. The American bale shows the bare cotton in a dozen places. The cover is usually hanging in rags owing to the breakage of ties (bands), and the wretched quality of the bagging (tare) used, while the bales from Egypt and India are perfect, firm, square cornered packages, entirely enclosing the cotton.

The covering for cotton bales used in the South is known as gunny bag. This is made up in fifty yard lengths and in

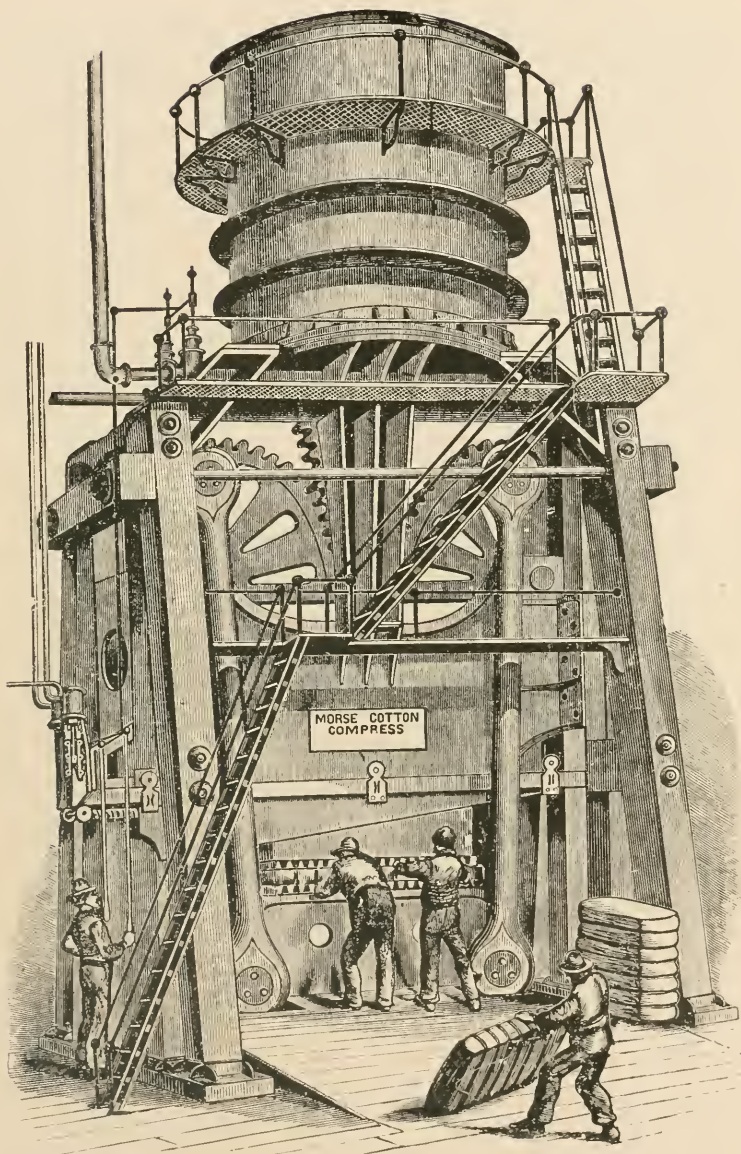


Fig. 127. A Cotton Bale Compress.

forty-two inch widths. The weight is usually two and one-half pounds to the yard. The bagging and ties are estimated to cost seventy-five cents per bale.

The rope formerly used for tying cotton bales is not now used, its place having been taken by iron bands or "ties." Each tie passes round the bale once and is secured by passing the end through an arrow, anchor, or buckle fastener. These ties are made in England as well as in the United States, and in ordinary years the price is fifty-five to sixty cents per bundle. Each bundle contains thirty ties, supposed to be enough for five bales. In 1896, in consequence of the American makers getting control of the English output, the price was advanced to \$1.25 per bundle, but has since been reduced.

It had been hoped by the southern planters that wire ties would offer an avenue of escape from the exactions of the flat iron tie trust. The wire ties are made of large, stiff, iron wire, a size smaller than the ordinary lead pencil, twelve feet long, and about thirty to the bundle. They weigh about the same as the ordinary flat tie, and when bought by the carload can be retailed at one dollar per bundle. The cotton compresses found that the wire ties would not work. At first the wire was too thin, and cut the bagging. Later the difficulty seemed to be that the wire was too thick, and not pliable enough for the compress, consequently a number of the compresses declined to receive bales bound with the wire ties.

The weight of the bale increases with each season, as will be seen from the following table of *net* weights :

1855-56	. . . . .	420	pounds.
1865-66	. . . . .	441	"
1875-76	. . . . .	444	"
1885-86	. . . . .	463	"
1891-92	. . . . .	473	"
1892-93	. . . . .	473	"
1893-94	. . . . .	474	"
1894-95	. . . . .	484	"
1895-96	. . . . .	476	"
1896-97	. . . . .	477	"



Fig. 128. An Ocean Steamship Loading Cotton at Savannah, Georgia.

The reason for the weight being kept up is that cotton merchants discourage light bales, and indeed in several states, Texas, Arkansas, and North Carolina, it is the custom to make a deduction of a dollar for each bale from the price paid to the farmer if the bale weighs less than 400 pounds, and two dollars or even three dollars in Texas if it weighs under 300 pounds. The reason of this is that many of the charges on cotton are made at a fixed rate per bale, and thus the total charges per pound on a shipment of heavy bales are somewhat less than on the same number of light bales.

An interesting table is given below from Shepperson's Cotton Facts, showing average weight of cotton bales from each state for the past six years :

AVERAGE WEIGHTS OF AMERICAN COTTON BALES.

	Season of 1891-92.	Season of 1892-93.	Season of 1893-94.	Season of 1894-95.	Season of 1895-96.	Season of 1896-97.
	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
North Carolina.....	485	482	480	490	488	489
South Carolina.....	487	485	481	491	484	484
Georgia.....	487	487	484	492	485	488
Florida.....	487	485	482	490	480	483
Alabama.....	498	502	501	508	500	506
Mississippi.....	496	500	500	508	500	506
Louisiana.....	498	500	502	511	508	507
Texas.....	521	530	522	532	525	528
Arkansas.....	508	515	508	518	512	515
Tennessee.....	502	501	500	510	502	502
Average for U.S.....	499	500	498	509	502	502

The figures are *gross* weights.

The standard size of the American bale (Fig. 131), as before named, is fifty-four inches long by twenty-seven inches wide, is usually sixteen inches thick, and weighs about 500 pounds on the average. The thickness varies according to the expansion after compressing. The weight and make-up of this bale is very different from cotton of other countries. The Brazilian and Indian bales are smaller and lighter, the Egyptian bale, though not larger, is heavier. American cotton has the reputation of being perhaps the worst packed of any cotton

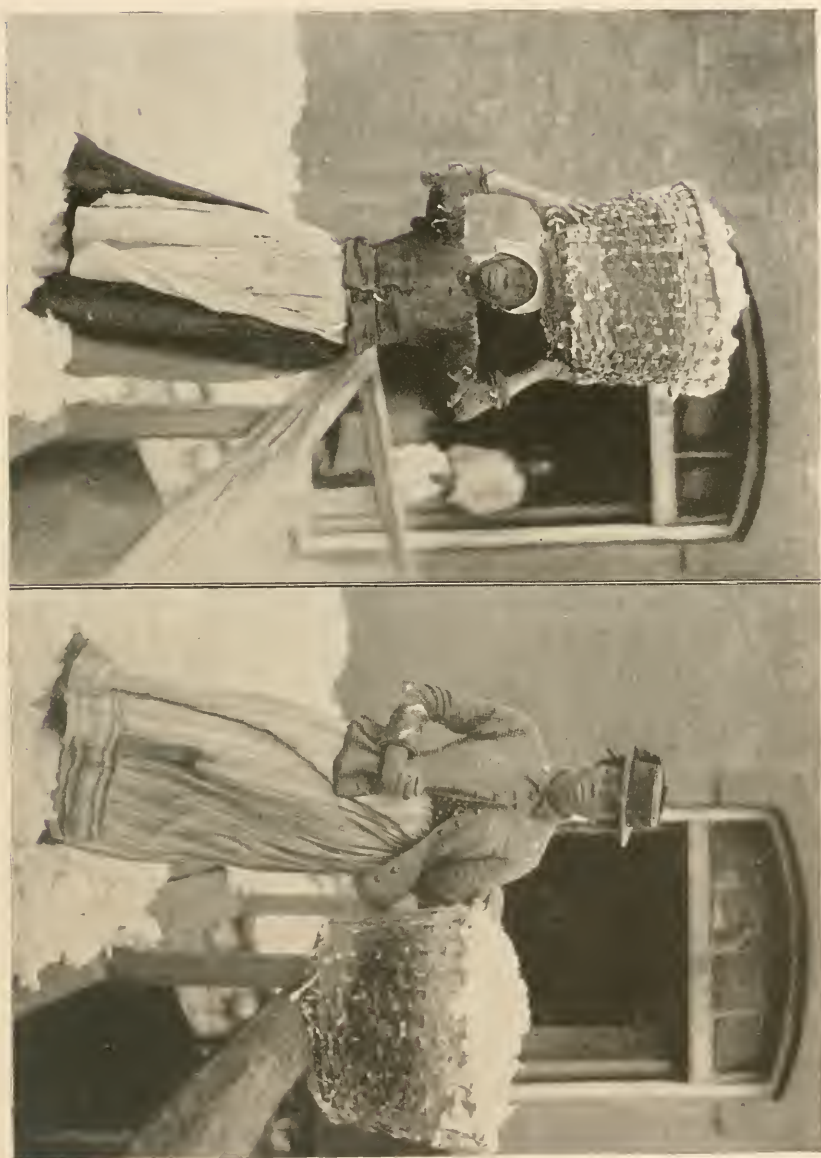


Fig. 129. Types of Southern Colored Women.

that is raised. The covers are usually of very poor quality, the ties not sufficiently strong or well bound, and although the bale on leaving the compress may be of satisfactory appearance, it does not get very far on its journey before a tie has burst, the bagging gets torn, and on arrival at the northern or European mill, it is usually a very sorry object. Not only so, but the bagging, although of poor quality, is usually so heavy as to materially affect the percentage of cotton that the spinner gets from the gross weight of the invoice, and forms the subject of numerous complaints. Some remarks are given below on the system of making round bales, which is attracting some attention; certainly if this round bale system, or some other new baling system is not immediately adopted, considerable attention ought to be given to improvements in the present method of baling American cotton. At present, the loss to the spinner through heavy tares, damaged cotton, and cotton lost in transit, is considerable. If greater attention were paid to making bales of uniform size, more closely compressed, in thinner but stronger covers, and more ties to the bale, considerable benefit would result to the farmer, as the spinner would be able to pay a higher price for the cotton. The Egyptian bale, for instance, shown in Fig. 132, usually weighs about 700 pounds, is not so long as the American bale, but a little thicker, but yet it has in its length about eleven ties, as compared with the six or seven of the American bale. It is usually a compact, square cornered, well covered package, and there is very little complaint from spinners regarding it.

The Indian bale (Fig. 133) is still more closely compressed, is considerably smaller than the American both in length and width, and has a tie usually running spirally round the bale, making eleven or twelve turns. This cotton is so closely compressed that it has to be "willowed" before going into any ordinary cotton spinning machinery. The weight of the bale of Indian cotton is usually about 400 pounds.



Fig. 130. Hauling a Heavy Load of Cotton to Market.

Brazilian cotton is made up into one of the lightest of bales (Fig. 134), averaging about 200 pounds; the reason for this is that it has to be carried on horse or mule back to the seacoast. It differs from other bales in having vegetable ties or bands; a trailing vine or liano is used for this purpose. The covering is usually of coarse burlap bagging, considerably thinner than American bagging, and in some seasons considerable quantities of cotton bagging are used to enclose the bale. Figs. 131 to 134, inclusive, are used by courtesy of the United States Department of Agriculture.

In a recent year the average gross weights of cotton bales were as under:

	1896-97.
American	502
Brazilian	230
Egyptian	735
Indian	400 (estimated)
Peruvian	182

The tare of an American cotton bale usually amounts to about twenty pounds, of which fourteen pounds is made up of bagging, and six pounds of iron hoops or ties. Ten hoops usually weigh thirteen pounds. The total amount of tare on an Indian bale is from twelve to seventeen pounds. On a Brazilian bale the bagging does not weigh more than four pounds, and ten hoops or vegetable ties weigh nine pounds.

The word "tie" is usually used in America to indicate the iron band round the bale, which in England is called a "hoop," and the word "bagging" is usually used in the United States to indicate the covering of the bale, which is often called the "tare" in England; thus, "bagging and ties" is the American phrase, synonymous with "tares and hoops" in the English rendering.

In America, the spinner usually buys on the gross weight of the cotton; in England, the spinner always claims and obtains an allowance for this. In case of buying cotton on C. I. F. and six per cent., he obtains an allowance of six per



Fig. 131. American Cotton Bale.



Fig. 132. Egyptian Cotton Bale.

cent. for tares and hoops; if the tares and hoops weigh more than this, up to seven per cent., he loses; and if less, he gains, in the weight of raw cotton.

This method of buying cotton is not in practice to so great an extent as is the method of buying cotton "on the spot." In this case, the spinner obtains an allowance of four pounds per hundred weight (112 pounds) for tare, the ties are counted, and he is allowed at the rate of thirteen pounds for each ten hoops. In addition to those two allowances, the European spinner is also allowed two pounds per bale for what is technically known as "double draft."

"This liability of fire to live in the bales is the most serious objection to the present system of baling American cotton," says Mr. W. Muir of Liverpool. "When fire takes hold of the old-style bales they will sometimes, weeks afterward, although they have been submerged in water for several days, again show signs of fire and cause an outbreak. This is not mere theory, but has come within my personal observation over and over again. This liability of American bales to carry fire is entirely owing to the system followed in America in compressing the bales. The compresses in the United States are as large, powerful, and as well fitted as any in the world, and are capable of pressing cotton to almost any density. This is shown by the fact that in the compressing, the bales are pressed to at least double the pressure at which the cotton is received in Liverpool. After compressing the cotton is allowed to rise or expand in the press to the height of the ties. This operation causes the bale to suck in a great quantity of air, and it is found that an American bale compressed in this manner is one system of oxygen cells. The fire, when once it starts in one of these bales, follows the course of these air cells, and this is the reason why the fire is so difficult to put out. The best pressed bale known to underwriters is the Egyptian. An outbreak of fire among bales of Egyptian cotton is unknown. The Egyptian bale is compressed to a



Fig. 133. Indian Cotton Bale.

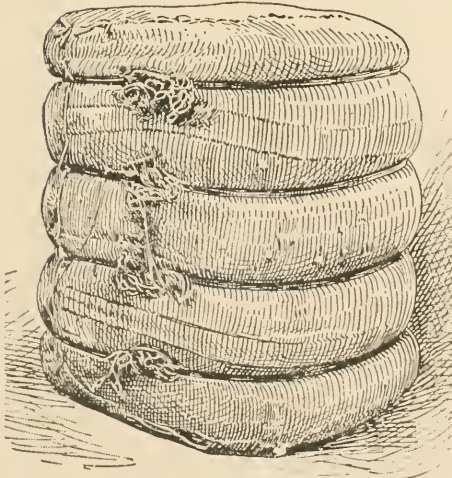


Fig. 134. Brazilian Cotton Bale.

density of forty-five pounds to the cubic foot, and is held to that density by a sufficient number of steel bands (or ties), and there are four or five more bands around an Egyptian bale than around an American bale. We find that the density of the old-style compressed American bale as received here is only from eighteen to twenty-two pounds to the cubic foot. The difference in density arises not so much from the difference in the method of compressing as in the fact that the compressed condition is maintained in the Egyptian bale by the superior method of banding the cotton, while in the American bale the compressed density is relaxed in the banding. What I have said as to Egyptian bales applies very largely to cotton received from India." The writer considers that eighteen to twenty-two pounds to the cubic foot for American bales named above is too low an estimate.

One of the largest Liverpool cotton dealers, and one who is interested in the trade throughout the United States cotton belt, has made the following statement:—

"Everybody in the cotton business over here realizes the need of an improvement in baling. I am thoroughly familiar with the handling and shipping of cotton in the United States. I am sure that the baling could be materially improved in America by having the present box presses at the ginhouses in the South made all of uniform size, which, I am told, could be done at the small cost of about \$2.50 a press. If the bales were of a uniform size, they could be stowed in vessels and discharged therefrom without mutilation, whereas now, the bales being of irregular lengths, are often torn to economize space in the holds of the ships, and to stow more closely.

Very considerable attention has been given during recent years by both capitalists and inventors to improvements in the system of baling American cotton. There is undoubtedly a very great field for improvement in this direction. The objects which some of the new baling systems claim to obtain are:—



Fig. 135. A Cylindrical Baling Press

Firstly, a greater compression of the material giving more pounds to the cubic foot, consequently saving ocean freight and enabling better rates to be given for land freight.

Secondly, a lessened risk of fire, on account of the absence of oxygen in the bale, owing to the special method of compressing it.

Thirdly, better ginning and removal of the foreign substances usually found in cotton, and which generally remain to be removed by the picker or scutcher in the cotton mill.

Fourthly, the formation of the cotton into a rolled sheet, which can be unwound at the primary cotton mill process. The first two advantages are the leading ones, and undoubtedly have been attained by several of the new processes of baling cotton. It is very much more doubtful whether either of the third or fourth named advantages have yet been arrived at, or even whether any strong attempt has been made in some of the new methods, to remove more of the dirt than is usually customary in ginning and baling cotton.

The reports of the mill men who have used these new bales, admit that the cotton is more compact, that there is less risk of fire, and that the new bales are easier to handle, but more complaints have been received that in the interiors of the bales are found occasionally very hard cores, caused by the super-winding of the outer layers. While some companies are giving attention to improving the square bale, the most attention has been given to what is known as the round or cylindrical bale, and the above remarks apply to this style of bale. The cylindrical system of baling cotton has been considered of so much importance by capitalists that a few men with ample resources have formed a strong company to operate it. At present, however, a very small fraction of the American crop is baled on the new system, and further improvements will have to be made before it will be adopted to any large extent in the South or receive the unqualified approval of the cotton manufacturer. There is no doubt that



Fig 136. Square and Round Bales.

if the cotton were not only ginned, but also passed through the process known in England as opening and scutching, or in America as opening and picking, in the neighborhood of the cotton field, that a very considerable saving would be effected in the economy of cotton manufacturing. At present there is a very considerable loss to manufacturers in careless baling and in the fact of having to pay freight on unnecessary bagging and ties and on the foreign substances that are found in the cotton bales to the extent of five or six per cent.,



Fig. 137. An American Freight Car Loaded With Round Bales.

as this freight might be obviously saved if cotton were put up in the form of a cleaned lap. Considerable modifications of the improved form of picker room lap would have to be made in order to insure satisfactory transportation, but the effort is certainly worth making. Figs. 135, 136, 137 and 138, which are used by the courtesy of the United States Cotton²/₄ Manufacturers' Association, are views taken in connection with making round bales. They are self explanatory, and it will be seen that the cotton after being ginned is laid in a sheet, which



Fig. 138. Unrolling a Round Bale at the Mill.

is formed into a roll under heavy pressure. These round or cylindrical bales are very compact, and a very much greater weight of cotton can be packed in an ordinary freight car, or steamship hold, than with the old style or so called square bale.

General. Formerly, the English spinner relied very much on the name of the seaport from which the cotton was shipped to give him some idea of the quality of the staple, giving the preference to New Orleans cotton, but this is no longer reliable. Not only is good cotton being raised in other than Mississippi river states by improved cultivation, but cotton shipped from New Orleans does not necessarily now mean that it has been grown near to, and shipped down, the Mississippi river, as formerly. The port of shipment ought not to warp the buyer's judgment either way.

If forwarded by a reliable railroad of good financial standing, the seller of the cotton in the states gets a through bill of lading to Liverpool, Bremen, or other ports, and this, if the railroad company is of good financial standing, and with the bill of exchange attached, is negotiable and excellent security. The bill of exchange is payable sixty days after presentation, as a rule. The banker in the interior city will lend a large percentage of the value of the cotton on this security. The document is forwarded to New York, the financial centre of America, and dealt with in the usual course, being sent to the country of destination for acceptance, as explained in the next chapter.

From the moment of leaving the farm to arriving at the cotton mill in New England, or old England, Japan or wherever its destination may be, the cotton bale is branded with a series of marks—marks of the farmer, the ginney, the factor, the shipper, and numerous others—each having a meaning, though often unintelligible to the uninitiated, yet sufficient to trace false packing, bad ginning or fraud back to its source. Not only so, but each bale on its shipment from

the point of origin has a perforated label or tag attached with various particulars as to marks and weight. The stubs of these tags are detached at the compressing or shipping point, and as all labels bear a progressive number, track can be kept of bales in transit, just as easily as a bank can trace its drafts.



CHAPTER VI.

COTTON AS AN ARTICLE OF COMMERCE.—COTTON MARKETS OF THE UNITED STATES.—THE NEW YORK AND NEW ORLEANS CONTRACTS.—MILL PURCHASES.—LAND FREIGHT ON COTTON.—THE EUROPEAN COTTON MARKETS.—LIVERPOOL.—CONTINENTAL MARKETS.—OCEAN FREIGHT.—IMPORTS OF EGYPTIAN AND PERUVIAN COTTON INTO THE UNITED STATES.—COST OF RAISING COTTON.

Cotton Markets of the United States. The largest crop in any of the states is raised in Texas, and this makes Houston one of the most important interior markets of the United States. In the season of 1896-97 over 500,000 bales of spot cotton were sold in this market, only excelled by the Gulf port, New Orleans, where 1,054,000 bales were sold in the same season. Memphis, on the Mississippi River, is a market of importance and is a great centre for long staple cotton; in the season referred to above, 481,000 bales were handled there, and 294,000 at Augusta, Ga.: 270,000 bales of spot cotton were sold in New York, and 205,000 bales in Savannah, Ga.

The figures for the season of 1895-96 are somewhat different, New Orleans led with 864,000 bales of spot cotton sold; Houston, Texas, was second with 425,000; Memphis third with 363,000; Augusta, Ga., fourth with 182,000, while New York was fifth with 168,000.

Among other important cotton markets are Savannah, Georgia; Charleston, South Carolina; Mobile, Alabama; St. Louis, Missouri; Shreveport, Louisiana; Vicksburg, Mississippi; Columbus, Mississippi; Macon, Georgia; Columbus, Georgia; Rome, Georgia; Selma, Alabama; Montgomery, Alabama; Eufaula, Alabama; and Nashville, Tennessee.

The above figures refer only to the sale of cotton in each of the markets, and the figures indicating the number of bales exported from cities that are also seaports of course differ considerably from the above figures.

The principal seaports from which cotton is shipped, given in the order of their importance, with the figures for the season of 1896-97, are as under :

New Orleans, 1,984,000 ; Galveston, 1,231,000 ; New York, 687,000 ; Savannah, Georgia, 436,000 ; followed by Charleston, South Carolina ; Boston, Massachusetts ; Wilmington, North Carolina ; Norfolk, Virginia ; Baltimore, Maryland ; Mobile, Alabama ; Port Royal, South Carolina ; Brunswick, Georgia ; Newport News, Virginia, and numerous minor ports.

About the end of September or the beginning of October, numerous tramp steamers, in addition to the regular liners, steer their course for the cotton ports, and from that time onwards, to the end of January, the wharves are very busy. Galveston is the port which begins to receive the cotton first in the largest quantities, as it draws its supply from the Texas cotton fields, where the season is early, but by the end of September or beginning of October, cotton is pouring into New Orleans, Savannah and other ports, in some cases by tens of thousands of bales per day. A view at Fig. 139 is a scene on a cotton platform in the port of Savannah, Georgia.

Most of the cotton shipped from the above named ports has been consigned from interior points to northern mills or European merchants on through bills of lading, which are in a form approved by the permanent committee on uniform bills of lading, and contain the usual spaces for the entry of the marks, price, class of article, weight, port of shipment, port of destination, the consignee's address, with of course the innumerable clauses in small type, which no one ever reads, but which make a bill of lading seem a very formidable document.

The charges for the European trade are usually entered in English sterling money, one pound sterling being considered

equal to four dollars and eighty cents United States gold currency. The method of dealing with these documents through the banks is mentioned elsewhere.

The principal cotton markets of the United States are considered as having great influence on the prices of the staple, being second only to Liverpool in this respect. The prices of cotton for the whole country are practically adjusted by New York and New Orleans, the New York market being by far the more important as regards future contracts, while the more important for spot cotton is New Orleans.

Spot cotton is sold in New York on the same terms as elsewhere in America, i. e., on gross weight, no allowance being made for weight of bagging and ties. In this market the terms are cash on delivery, the buyer being obliged to take it within ten days after date of purchase. The buyer can demand it at his option any time within the ten days, and the seller must then deliver it. It is customary to present the bill on day of delivery and for the buyer to pay it the next day, but if the bill is delivered by eleven o'clock of day of delivery, the buyer pays it on the same day.

In the season of 1895-96 only 168,000 bales of spot cotton were sold in New York, while in the same year 56,451,000 bales were the sales of cotton for future delivery, and in the same season, the sales of cotton for future delivery in New Orleans were 15,498,700. The crop was thus sold ten times over in these two cities, entirely disregarding European spot and "future" sales, and spot sales in other American cities. It will be seen from this statement how largely the element of speculation is connected with the cotton market.

Col. A. B. Shepperson, in his valuable statistical book entitled "Cotton Facts," in which there are probably more cotton statistics than in any other publication, gives the following details of contracts for cotton for future delivery, as dealt in at New York and New Orleans, and also of the methods of inspection and classification of cotton to be delivered on contracts for future delivery in New York : —



Fig. 139. A Cotton Wharf and Warehouses, Savannah, Georgia.

The New Orleans Contract differs from the New York Contract only in the following particulars, viz. :—

It is not required that the cotton shall be classed and weighed under the auspices of the Cotton Exchange.

When an original margin of \$5 per bale has been deposited, the margins for variations in the market are paid directly to the party in whose favor the market turns.

The New York Contract is for 50,000 pounds (gross) in about 100 bales of cotton, growth of the United States, to be delivered from a licensed warehouse in the port of New York during the month agreed. The delivery to be at seller's option upon five days' notice to buyer, and from one warehouse.

The cotton to be of any grade, from Good Ordinary to Fair, inclusive, and if stained, not below Low Middling.

Price to be for Middling, with additions or deductions for other grades according to the rates of the Cotton Exchange existing on the afternoon of the day previous to the date of the notice of delivery. Certificates of inspection, classification, and weights issued by the "Inspector-in-Chief of Cotton" of the New York Cotton Exchange, to be tendered with the cotton and made the basis of settlement. (For details see later pages.)

Payment to be made upon the day of delivery of warehouse receipts for the cotton.

Either party to have the right to call for margin, as the variations of the market for like deliveries may warrant. An original margin up to \$5 per bale, to remain in the Trust Company until settlement of the contract, may be required by either party, provided demand therefor is made within twenty-four hours after the transaction. The party demanding original margin must also deposit an equal amount himself. All margins are required to be deposited in a Trust Company or Bank.

The methods of inspection and classification of cotton to be delivered on contracts for future delivery in New York are as follows :—

On the 1st September, 1887, the new plan, for the inspection, sampling, weighing and classing of cotton to be delivered upon contracts for future delivery in New York, went into operation, and the following are its provisions as in force at present.

The inspection, sampling, weighing and classing of all cotton to be delivered upon contracts for future delivery is done under the auspices of the New York Cotton Exchange and under the supervision of the inspector-in-chief of cotton, an officer appointed by the Exchange to take entire supervision and direction of these matters.

Cotton intended for delivery upon "contracts" is inspected, sampled and weighed, under the personal supervision of an assistant inspector of cotton, by samplers and weighers duly licensed by the Exchange. No sampler can be employed who is in the service of any one interested in the cotton to be sampled.

The samples are submitted to the classification committee of the Cotton Exchange, who determine the grade, subject, however, to a revision by that committee upon appeal by any party interested. The decision reached upon this revision is final.

Not less than two members of the classification committee are competent to act upon an original classification, and upon an appeal from their decision not less than four members of the entire committee of five must act. Their decision is final.

The members of the classification committee are salaried officers of the Cotton Exchange, and are not permitted to be engaged, directly or indirectly, in any business connected with cotton. They cannot, therefore, possibly have any interest whatever in the cotton submitted to them for classification. The cotton is classed bale by bale, and a certificate is given by the secretary of the classification committee to the inspector-in-chief, stating how many bales there are of each grade in each lot of class mark.

After cotton has been sampled and weighed, negotiable warehouse receipts, stating the marks of bales and lot numbers, are issued to holders of cotton, no receipt to be for more than about 100 bales of 50,000 pounds. Receipts to be lettered or numbered by each warehouse, and no two receipts to be alike.

The inspector-in-chief of cotton stamps on these receipts the weight of the cotton in accordance with the records of his office. He also issues a certificate stating the number of bales of each grade in accordance with the decision of the classification committee.

The date of expiration of a certificate is one year from the date of inspection of the cotton.

Negotiable warehouse receipts, accompanied by the inspector-in-chief's certificate of grade, as above described, will constitute a good delivery in fulfilment of contracts for cotton sold for future delivery.

The weight, as stamped by the inspector-in-chief on the warehouse receipt, shall be accepted by all parties for one year from date of weighing, subject to an allowance of one-half pound per bale per month or fraction of a month.

The cotton exchange inspection fund is responsible for the correctness of the certificates issued by the inspector-in-chief as to the grade of the cotton certified to, but the claim must be made within one year after the date of the certificate upon which it is based and before the cotton leaves the port of New York. All liability ceases at the expiration of one year from the date of the certificate, or when the cotton leaves the port.

The New York Cotton Exchange does not assume, and will not be liable for, any claim growing out of the issue of certificates of grade by the inspector-in-chief of cotton, but such claims will be paid out of the cotton exchange inspection fund, — a fund derived from the fees received for inspection. Neither the Cotton Exchange nor the inspection fund



Fig. 140. The New York Cotton Exchange.

will be liable for loss in weight, it being considered that the allowance of one-half pound per bale per month will cover the shrinkage. A view of the New York Cotton Exchange is given at Fig. 140.

Mill Purchases of Cotton. The cities of Boston and Fall River are important markets for cotton, as many of the southern factors have agents or branch offices at these points. In the fall, the salesmen of these houses are very busy, together with special agents who are sent from the cotton belt, in offering cotton to the manufacturers, who buy in large quantities from October until March. The treasurers of the mills are usually the cotton buyers, and they select cotton from the samples which are shown and which have been sent from the cotton factor, showing the style of cotton that he is offering. Practically the whole of the cotton required for a year is purchased in the months named above, and very frequently it is shipped north immediately after the sale takes place. Arrangements are occasionally made for the shipment of so many bales per month. Money can be borrowed at very much lower rates of interest in New England than in the South, and consequently it is much cheaper to carry or hold cotton in the North, as in most cases the parties hold it on behalf of the banks that have loaned the money to enable them to carry it. For this reason most of the large cotton manufacturing establishments of New England have very large store houses connected with their mill buildings, and the winter is usually a very busy time in receiving this cotton, weighing, sampling and storing it for future use.

The terms on which northern manufacturers buy cotton are very simple. Usually the cotton is sold on cash terms, no discount being allowed and no allowance being made for bags or ties, the gross weight being invoiced. The cotton is usually purchased delivered in Boston or an equivalent point, the freight rate allowance being made by the shipper equal to the amount that the manufacturer has to pay for the freight on

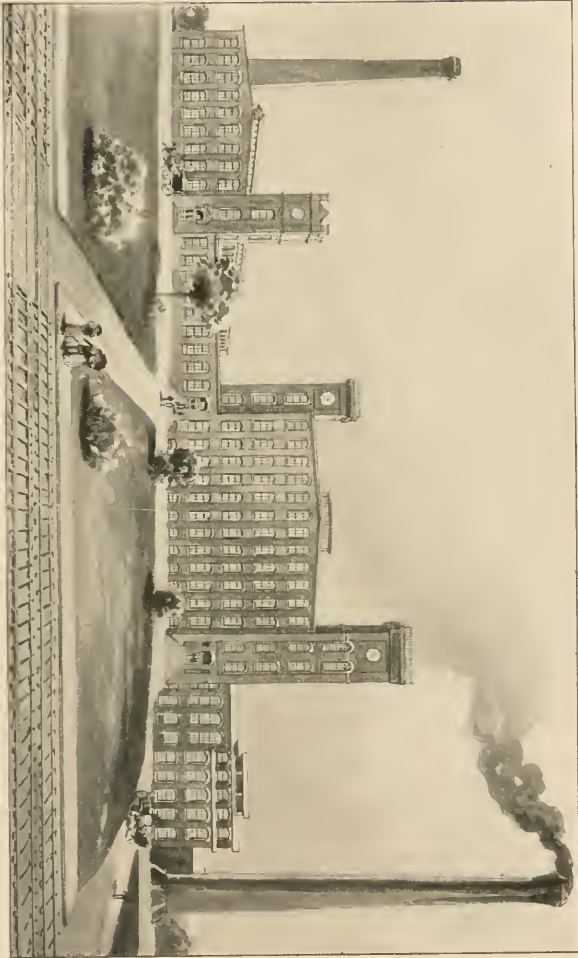


Fig. 141. The Goffney Cotton Mills, Goffney, South Carolina.

arrival of the cotton. It will be seen that the above system requires a very large stock of cotton to be kept at the mills for a considerable portion of the year.

While the above system is a general one, there are special cases which arise and which require that cotton shall be purchased as required, and in these cases it is not unusual for manufacturers to send mail orders to reliable southern houses who know what grade of cotton they are accustomed to use, and specify the length of staple, grade and style of cotton, leaving it to the southern merchant to ship suitable material.

It is said that the practice of sending salaried employees of the mill to the southern cotton market in the fall to remain there three or four months to purchase cotton daily from local dealers is growing in favor with the larger New England mills, as is also the practice of sending a salaried buyer directly from Liverpool or Bremen for a portion of the year to buy cotton directly from the local store-keeper in the cotton belt, for the English or German cotton merchant.

Cotton for the New England and Canadian mills is transported in about equal portions by land and by sea.

The maximum total takings in any one year are given in the figures for the season of 1894-95, when 2,120,000 bales were received by northern and Canadian spinners. The greatest weight of this movement in each year is in the months of November and December, especially November, and dwindles to insignificant figures in June, July and August. In the season above named almost exactly half of the total takings were carried overland amounting to 1,058,000, leaving 1,062,000 taken from the ports.

The following season, 1895-96, rather a large proportion was taken overland, and the entire takings amounted to 1,673,000 bales. This, of course, is exclusive of cotton of other growth, which is used to some extent, especially Egyptian and Peruvian cottons.

Owing to the continued increase of mills in the cotton growing states, a larger proportion of the crop is left in these

states each year. Although cotton manufacturing by water power has been carried on in the southern states for the last fifty years, and by hand from the earliest date of settlement in Virginia, it was not until the year 1884 that the number of spindles exceeded 1,000,000 in the whole of the South: by 1893 a total of 2,000,000 had been exceeded, and it is probable that the year 1898 will see that a total of 3,000,000 has been reached.

It will be seen that the growth of the cotton manufacturing industry in the South of late years has been very rapid, and as most of the mills are on coarse numbers, the number of bales used in the South is a point of considerable importance for the consideration of the cotton statistician, it being estimated that in the season of 1896-97 999,000 bales were consumed by southern mills. Several views of these southern cotton mills are given in this volume, including Figs. 50, 119, 141, 142, 143, 144, and 163. Figs. 141 to 144, inclusive, are used by the consent of the Saco & Pettee Machine Shop, of Newton Upper Falls, Mass.

The largest consumption of cotton in America is in the state of Massachusetts. The consumption of cotton other than American in the United States is rapidly increasing from a comparative point of view. Col. Shepperson, in the publication named above, gives the imports of Egyptian cotton into the United States for the season ending August 31st:

1889-90	. . . . .	10,470 bales
1890-91	. . . . .	23,790 "
1891-92	. . . . .	27,739 "
1892-93	. . . . .	42,475 "
1893-94	. . . . .	33,606 "
1894-95	. . . . .	59,418 "
1895-96	. . . . .	69,220 "
1896-97	. . . . .	79,385 "

Land Freight on Cotton. When the cotton leaves the hands of the farmer, the ginner, the compressor, or the merchant, it may be intended for many different destinations.

First of all, it has to be conveyed to the point from which it will be shipped to the country in which it will be manufactured. About three-fourths of the cotton is carried first of all to a seaport. The cost of getting cotton from the inland market town to the coast may be judged from the following freight rates current in 1897 in Georgia :

Macon to Savannah, 108 miles, thirty-four cents per hundred to the ship side or .17d. per pound.

Atlanta to Savannah, 294 miles, forty-three cents per hundred to the ship side or .21d. per pound.

Rome to Savannah, 371 miles, forty-five cents per hundred to the ship side or .22d. per pound.

Columbus to Savannah, 203 miles, forty-five cents per hundred to the ship side or .22d. per pound.

Out of this the railroad company has to compress the cotton without charge, the usual cost of compressing in Georgia being eight and one-half cents per hundred pounds.

A considerable amount of cotton is carried to the seaports by river steamers. In the case of the Mississippi River, cotton is carried from Memphis to New Orleans, 738 miles, for \$1.00 per bale. The cost of drayage in New Orleans is twelve cents per bale, and compressing fifty cents per bale, making a total of thirty-two and one-half cents per hundred pounds, or about 5-32d. per pound, to get cotton to the ship side from Memphis. The rate from Memphis is less than that charged from points *nearer* to New Orleans, Memphis being a competitive point. For instance, the distance between Greenville and New Orleans is 482 miles, but the rate from points between Memphis, Tennessee, and Greenville, Mississippi, to New Orleans, Louisiana, is \$1.25 per bale. The rate for cotton conveyed from any point between Greenville and the mouth of the Red River, including Vicksburg, Mississippi, 362 miles, and Natchez, 278 miles, to New Orleans, is \$1.00 per bale; below the Red River to New Orleans, seventy-five cents. The distance between the mouth of the Red River and New

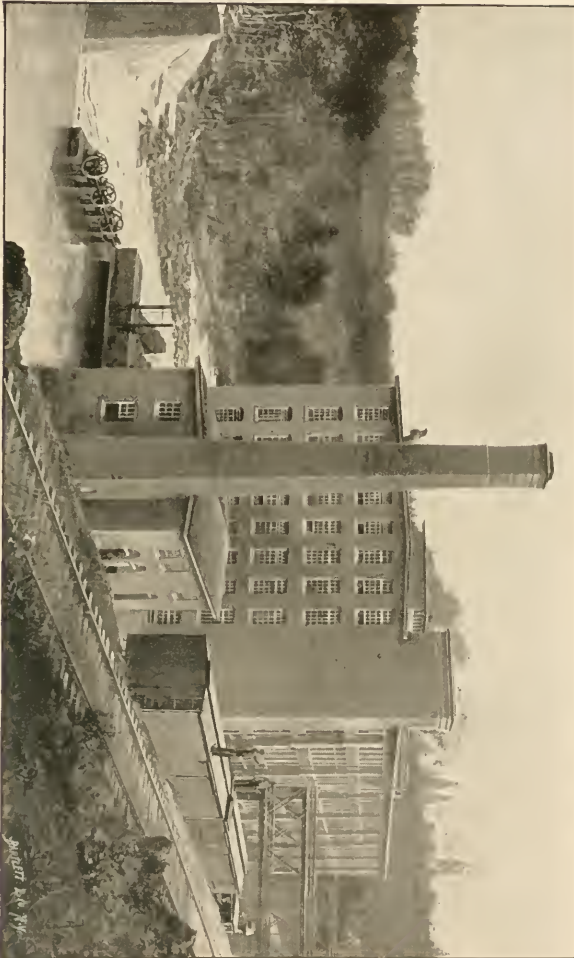


Fig. 142. The Pacolet Mill, No. 3, Pacolet, South Carolina.

Orleans is 198 miles. Cotton is landed in New Orleans at the cotton wharves of the river steamers.

A large quantity is shipped overland for the use of New England and Canadian mills, and in some cases shipped from Galveston, Charleston, or other southern seaports by boat.

The European Cotton Markets. By far the larger portion of the American crop is destined for European markets, the principal one, of course, being Liverpool, while a largely increasing business is being done at the ports of Bremen in Germany, Havre in France, and Genoa in Italy, and shipments are also made in smaller quantities to Spanish, Indian, and Japanese points. The Liverpool market, from its convenient geographical position, has long been the leading centre for the distribution of American cotton to the European manufacturing districts. In this market, there are seldom less than 500,000 bales in stock, and at times a stock is held approaching one and one-half million bales, not only of all varieties of American cotton, but of the fleecy lint from every cotton producing country in the world, including Egyptian, South American, Indian, Chinese, Japanese, West Indian, and African cottons.

The immense docks, extending for a distance of many miles along the river front, are utilized to a very large extent by cotton steamers, and the immense warehouses equipped with every conceivable appliance for convenient handling and safe storage of cotton, are not the least interesting of the commercial sights of Liverpool.

All, or almost all, the business in raw cotton in Liverpool is done under the control of the Liverpool Cotton Association, which is a combination of the older Cotton Brokers Association and Cotton Exchange. It is an association of not more than 600 members, consisting largely of cotton brokers, known either as buying brokers or selling brokers, some combining the two occupations. The articles of the association do not necessarily require that the active member of the association

[ALL RIGHTS RESERVED.]

THE LIVERPOOL COTTON ASSOCIATION WEEKLY CIRCULAR.
 Published under the authority of the Liverpool Cotton Association, Limited.
 THURSDAY EVENING, 31st MARCH, 1898.

Turner, Rowledge & Co. Printers.

This week.	This year.	Sa. time 1897.	FORWARDED TO CONSIGNEES.		1897.	This year.	SALES.		This week.	Description.	Prices Paid this Week.	CURRENT PRICES.		QUOTATIONS SAME TIME 1897.		TAKEN FROM THIS PORT BY TRADE IN 13 WEEKS.		This Day.	Sa. time 1897.	
			This year.	This week.			This year.	This week.				Ord.	Med.	Good Med.	Extra	Med.	Good Med.			1898.	1897.
70229	1270414	1143784	851081	11103	1066	1820	630	150	Sea Island	6% 9%	—	9	11	20	9% 10	11	862,184	816,904	1,081,940	1,147,150
1148	3024	18597	.....	.....	.....	2720	2110	80	Perma. &c.	4	—	—	—	—	—	—	6,889	14,342	11,140	14,940
.....	857	2439	.....	.....	.....	1240	700	20	Guara	3 1/2	—	—	—	—	—	—	.....	.....	.....	.....
.....	916	2700	.....	.....	.....	1980	1270	.....	Parrisa	.....	—	—	—	—	—	—	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	710	.....	.....	Rio Grande	.....	—	—	—	—	—	—	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	Balls, Aracajy, &c.	.....	—	—	—	—	—	—	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	580	530	.....	Maceio	.....	—	—	—	—	—	—	.....	.....	.....	.....
.....	1	140	.....	.....	.....	.....	.....	.....	Maranhm	.....	—	—	—	—	—	—	.....	.....	.....	.....
.....	.....	48	.....	.....	.....	.....	.....	.....	Total Brazilian	.....	—	—	—	—	—	—	.....	.....	.....	.....
1143	478	20434	6389	902	730	7230	4600	100	Egyptian, Brown	2 1/2	5%	8 1/2	4%	4%	5%	4%	144,803	113,488	67,830	71,440
8280	165882	181361	14403	4907	34170	41850	2,000	.....	Do. Upper	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	174	.....	.....	.....	290	200	.....	Smyma, Greek, &c.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	South Sea Island, &c.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
58	58	.....	.....	.....	.....	.....	30	.....	Tabiti	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	40	168	.....	.....	.....	130	100	.....	West Indian	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	250	.....	.....	Hayti	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	Peruvia	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	6380	8840	270	Do. Kord. Rough	3 1/2	7%	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	2590	8840	70	Do. Smooth	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	11072	11673	.....	.....	.....	2590	8840	80	Do. Sea Island	2	9 1/2	.....	.....	.....	.....	.....	.....	.....	.....	.....

THURSDAY, 31st MARCH, 1898.

shall be engaged in handling cotton, but as the membership of the association gives special advantages to the members for dealing in cotton in the city of Liverpool, the majority of them are so engaged.

The association is managed by a board of directors, with various subsidiary committees, and besides other work of the association is, first, the preparation of a daily report of the prices of cotton in the port of Liverpool, the preparation of a number of estimates throughout the day of the business being done, with a report at the end of the day of the actual turn over of cotton, the advance or reduction of the price of the different grades and growths of cotton by a committee which meets daily at twelve o'clock and decides on the necessity or otherwise of making any alterations in the price.

The association also controls arbitrations as to cotton contracts, conducts a clearing house business, issuing weekly reports and statistics of the cotton movement, and annually checks up the actual stock of cotton in Liverpool. A specimen of a recent weekly report is inserted with this chapter of the book, containing much valuable information. Although there has been a considerable change of late years in the method of handling cotton, it is still customary for the merchant who imports the cotton to employ what are known as selling brokers, who offer the cotton on behalf of the merchant, and in very many cases advance money on the cotton, or, as it is termed, finance the smaller merchants. The cotton is offered by the selling broker to the buying broker, who is the chief feature of the Liverpool cotton business. The buying broker is really the representative of the cotton spinner and manufacturer, although occasionally he acts as a selling broker but does not advertise this fact to his spinners. Each buys for a number of spinners, and either from the force of habit or from financial reasons, the spinner generally confines his cotton buying to one, or, at the most, two firms of buying brokers. The bulk of English cotton mills are situated within

sixty miles of Liverpool, and the buyer of cotton for the mill usually sets apart one morning during the week for the purpose of buying cotton, and, having notified his broker, there is awaiting him in the Liverpool office, scores, even hundreds, of samples of cotton representing bales lying in the port of Liverpool. These samples are the brown paper parcels with open ends that are so familiar to the visitor to Liverpool, and are carried by the messengers in the employ of the different brokers from one office to another.

In the course of a couple of hours, the spinner is able to examine the piles of samples which represent very many thousand bales, and to make a selection. The samples are followed from office to office by energetic salesmen representing the selling broker or the importing merchant, if he is his own broker. The last hour of the spinner's visit is devoted to making the best deal he can through his buying broker with the selling broker. It is very frequently the case that cotton purchased in the morning is forwarded in the afternoon and delivered at the mill with possibly a portion of it put in work within the next twenty-four hours. The contiguity to the mills of a large market with such an immense stock of cotton is of great advantage to the spinner at times when he does not wish to hold much cotton, nor to have a large quantity bought ahead.

When cotton is bought as above named, it is spoken of as spot cotton and is usually understood to be in the warehouse. It is subject to payment in ten days from the date of purchase and is invoiced to the spinner at the net weight, arrived at by deducting in the first instance, two pounds per bale known as double draft, then the bands or ties on the bale are counted and allowance made at the rate of thirteen pounds for each ten ties. From the remaining weight, four pounds per hundred weight of 112 pounds is allowed for the bagging, known in England as tares. A discount of one and one-half per cent. is allowed from this bill.

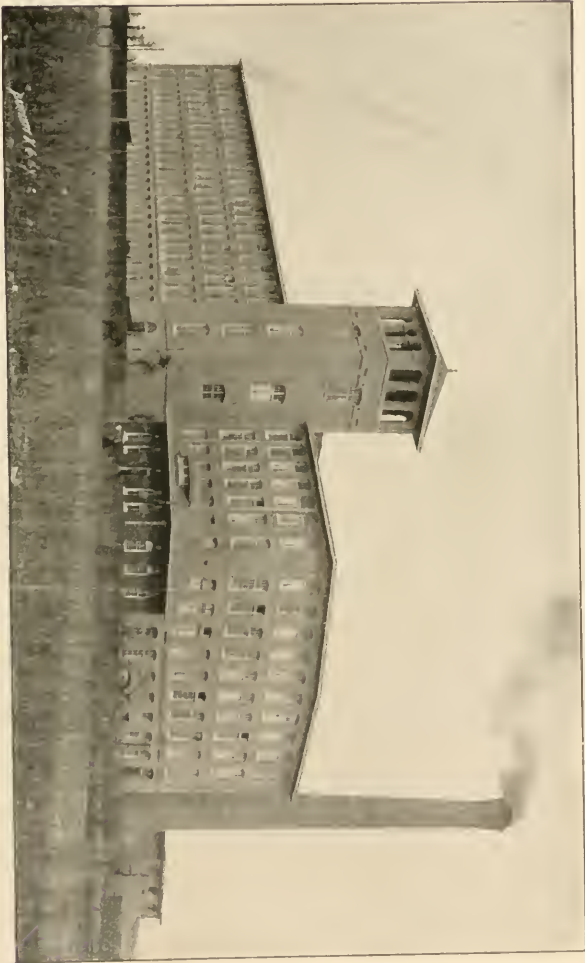


Fig. 143. The Lanett Cotton Mills, West Point, Georgia.

Forwarding charges from Liverpool are calculated at a shilling (twenty-five cents) per bale in case of five bales or less, nine pence (eighteen cents) per bale on from six to ten bales, and six pence (twelve cents) per bale on lots consisting of over ten bales.

Cotton is occasionally purchased ex-quay on spot terms, and in this case the buyer occasionally gets it at somewhat reduced prices, as the seller saves the cost of warehousing the cotton.

Cotton is purchased in Liverpool under the rules of the Liverpool Cotton Association on other systems than the above named, viz: (1st) under contract "for delivery forward," (2nd) C. I. F. and six per cent., (3rd) "futures."

The method of buying on delivery forward contracts may either be based on the delivery of cotton of a certain mark or marks, which run regularly in the Liverpool market and are recognized by the brokers, or maybe a contract based on the delivery of cotton equal to a certain type sample, which is sealed when the contract is made and the seal is not broken until the cotton has been delivered, when the type is opened in the presence of the buying and selling brokers. This method is very convenient for the manufacturer as he is thus enabled to cover sales of yarn or cloth and know exactly what class of cotton he may expect to have delivered to him. The month or months in which delivery is to be made is usually stated, and it is at the option of the seller whether the cotton shall be tendered for delivery the first of the month or the last of the month, or any time between. It is usually customary to make these contracts in multiples of 100 bales, with special clauses in the contract restricting deliveries to not less than fifty bales. After the cotton has been tendered and accepted, it is subject to payment in accordance with the Liverpool spot terms as previously named.

The system of C. I. F. and six per cent., which represents the cost of insurance and freight, is the system on

which cotton is bought by the English or continental manufacturer, to be equal to certain samples and to be shipped from a named American or other port at a named time. The seller provides the cotton, pays insurance and freight, thus practically contracting to turn it over to the buyer in the port of Liverpool on board ship; all succeeding charges, such as dock and town dues and portorage, are paid by the buyer. No discount is allowed from the invoice, but six per cent. is allowed from the gross weight of the cotton for ties and bagging. As a rule, bagging and ties do not weigh six per cent. of the gross weight, and this is a gain to the spinner. In case of the tare exceeding six per cent. the spinner is allowed no redress unless it exceeds seven per cent. The spinner practically puts himself in the position of an importer: he is to accept the bill usually dated sixty days from the date on which the cotton leaves the American port. Under this system there is some risk of a buyer not getting exactly the quality he stipulated for, as while the cotton is on the quay, only twenty-four hours are allowed in which to settle disputes.

This method of purchasing cotton is largely resorted to as a speculation in those seasons when the spinner anticipates a gradual increase in the price of cotton as the season advances. Almost all C. I. F. business is done early in the season.

At the price of four pence, the difference to the spinner between C. I. F. and six per cent. and Liverpool terms, with a fair weight outturn, is only about 1-16 d., viz. :

Discount	1½ per cent.
Landing charges	1 " "
Less rebate on prepayment	0¼ per cent.
Brokerage not charged on	
C. I. F.	0½ " "
	—
Net	1¾ per cent. = 0.07 pence or .14c. per lb.

In addition the spinner has the advantage of lighter tares when he buys on C. I. F. terms. It is not advisable to

dispense with the services of a broker in order to save one-half per cent., as suggested above. Employing a broker, the saving is .05 pence or .1c. per pound.

Another method of purchasing cotton, which is only used as a rule for hedging or speculative purposes, and seldom as a means of purchasing actual cotton, is what is known as "futures." In this case, the buyer purchases cotton in multiples of 100 bales at the price supposed to be the price of low middling American, and may specify in which month the cotton shall be delivered, the price varying according to the opinion of the market as to the price of cotton during the month named. The scale of prices for several months ahead is published many times daily by the Liverpool Cotton Association, the prices for different months being given in terms of 64ths of a penny. This is the favorite method of purchasing cotton for speculation, as the transaction may be closed by selling out the cotton purchased, and receiving or paying the credit or debit balance which remains after the adjustment of the price. As before stated, the contract is based on low middling cotton. This low-middling clause was originally inserted as a protection to spinners, who, it was then fairly argued, bought futures for their own use, and not on pure speculation or as a cover. This is not now the case. It is most exceptional for a spinner to use contract cotton, even should, by a rare chance, the cotton tendered be of his exact quality. He nineteen times out of twenty prefers to and does close his contract, buying actual cotton on the spot or equal to sample for delivery as required, which latter system is now almost universally adopted.

Class and color (but not staple and style) are alone taken into account in the arbitrations held for ordinary arrival contracts, the consequence being that values of Uplands, Texas, and Gulf or Orleans are now all quoted alike, the normal difference being fully one-eighth of a penny per pound.

The department of the Liverpool Cotton Exchange, devoted to the sale of "futures," is one of the most interesting sections of the building.

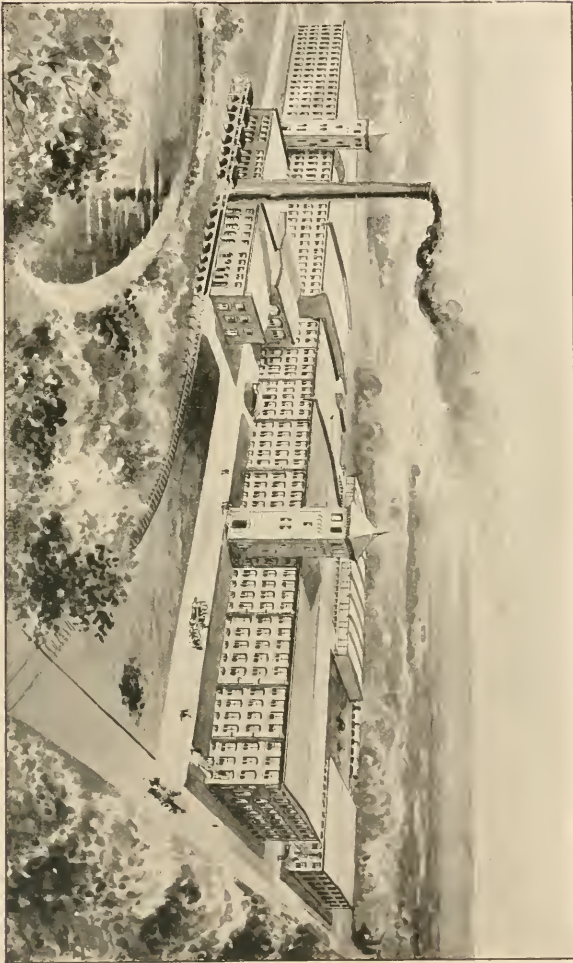


Fig. 144. The Dwight Cotton Mills, Alabama.

The sensitiveness of the market, the rapidity with which it responds to the slightest influence at home or abroad which may affect the price of cotton; the eagerness of buyers and sellers to gain an advantage of even half a point, or 1-128th of a penny per pound, the immense quantity sold in this manner, all tend to make it a most interesting picture commercially. One feature of the Liverpool market is that a tremendous business is done in futures in this way without the excessive noise and hubbub in the same line of business in the New York Cotton Exchange, which latter is only exceeded by the New York Stock Exchange or the Paris Bourse.

Continentál Markets. In addition to the market of Liverpool, the following large cotton markets have been established in various parts of Europe, more particularly for Egyptian, American, and Indian cottons: Bremen, in Germany; Havre, in France; Genoa, in Italy; Trieste, in Austria.

Bremen is the most important of these continental European ports. The terms of sale, arbitration, and so on are practically the same as in Liverpool, in most cases having been based on the Liverpool system. The spinners of each of the countries named buy considerable quantities of cotton at the above named markets, but they still, to a large extent, purchase in Liverpool. Formerly the whole of the cotton used in the European continental countries was purchased in Liverpool, but the tendency now is towards purchasing in Bremen and Havre.

The following statement of the method of handling cotton in Milan, Italy, may be taken as a description of cotton dealing in other European continental countries. Cotton is bought by Italian spinners through brokers, from merchants in America, England, India or Egypt. Each merchant has an agent in Milan, Genoa, or other cities. In Milan there are about forty-eight agents of different firms in Liverpool, New York, New Orleans, and so on, and the spinner deals with this agent, who usually receives telegraphic instructions from his

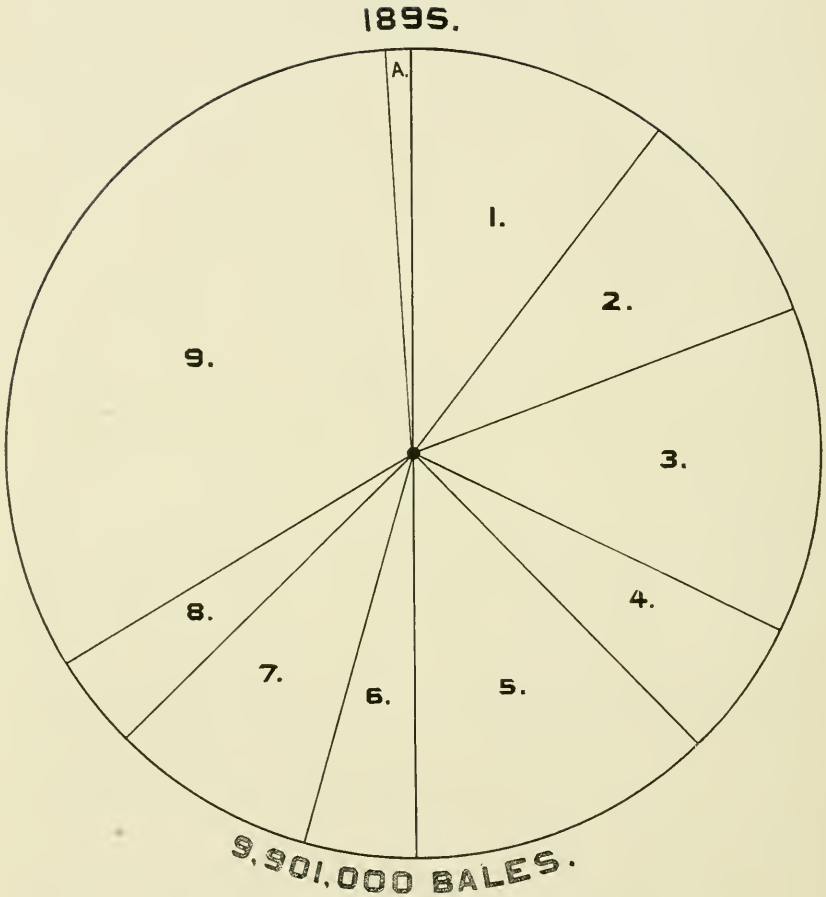
firm, and the spinner offers, or accepts offers by cable, through the agent. Cotton is shipped against documents, that is to say, an invoice, a bill of lading, and bill of exchange are sent to the bank of the spinner. The bank retains or negotiates the bill of exchange after it has been accepted by the spinner, and then sends the other documents to him, so that he can claim his cotton. The merchant is thus protected, but the spinner is frequently indebted to the bank for an over-draft. The agent, previously mentioned, has a commission, generally of one-half per cent. In England, Germany, and France, cotton is admitted free of duty, but it is dutiable in Russia, and also in Italy. The Italian Government imposes a duty of three lire per 100 kilos, equal to fifty-seven cents, or $28\frac{1}{2}$ d. per 222 pounds on the raw cotton received into the country from any other country. This duty was levied by a Royal letter on the 10th of December, 1894, and recognized as law by the Parliament, in July, 1895. An additional duty of ten centesimi per hundred kilos, equal to 1d. or two cents, was levied in the year 1896, as a charge for taking statistics. Consequently, raw cotton pays on entry to Italy a duty of 3.10 lire per hundred kilos, equal to .136 pence, or .272 cents per pound.

Ocean Freight. The cost of carrying cotton across the Atlantic is very low compared with the land freights of the United States. The following figures were supplied by the Louisville and Nashville R. R. Co., referring to the season of 1896-97. The highest rates paid ocean carriers this season on cotton shipments were:—

To Liverpool,	$\frac{9}{32}$ d	+ 5 per cent. primage per pound.
“ Bremen,	$\frac{5}{16}$ d	“ “ “
“ Havre,	$\frac{5}{16}$ d	“ “ “
“ Genoa,	$\frac{11}{16}$ d	“ “ “

And the lowest rates:—

To Liverpool,	$\frac{7}{16}$ d	+ 5 per cent. primage per pound.
“ Bremen,	$\frac{5}{32}$ d	“ “ “
“ Havre,	$\frac{5}{16}$ d	“ “ “
“ Genoa,	$\frac{5}{32}$ d	“ “ “



U.S. TREASURY DEPARTMENT BUREAU OF STATISTICS

Washington C. Ford

CHIEF OF BUREAU

Fig. 145. Diagram of the American Cotton Crop, Fiscal Year of 1895, in Bales by States, numbered on opposite page.

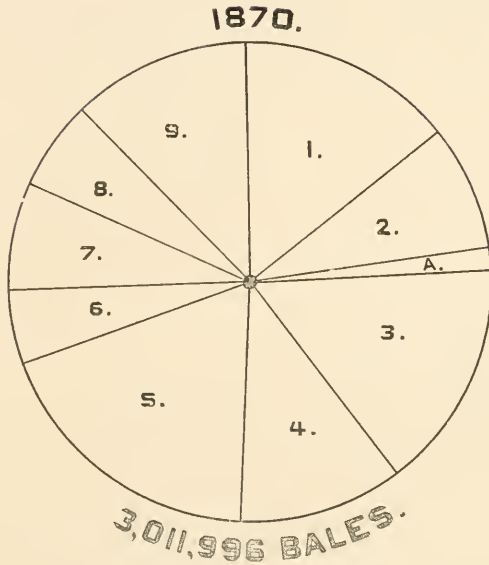


Fig. 146. Diagram of the American Cotton Crop, Fiscal Year of 1870, in Bales by States.

STATES.	1865.	1870.
1. Alabama	1,000,000 bales	429,482 bales
2. Arkansas	850,000 "	247,968 "
A. Florida and all others	60,000 "	42,937 "
3. Georgia	1,300,000 "	473,934 "
4. Louisiana	600,000 "	350,832 "
5. Mississippi	1,200,000 "	564,938 "
6. North Carolina	465,000 "	144,935 "
7. South Carolina	800,000 "	224,500 "
8. Tennessee	350,000 "	181,842 "
9. Texas	3,276,000 "	350,628 "

The above shows a greater fluctuation in rates than has been known for some seasons, the average of the above, including primage, being : —

Liverpool,	.205 d per pound,	or 41 cents per 100.		
Bremen,	.246 d “	or 49½ “	“	“
Havre,	.2378 d “	or 47½ “	“	“
Genoa,	.2625 d “	or 52½ “	“	“

Out of the above rates the shipper pays thirty-five cents a bale for loading the cotton into the vessel, which is equal to .035d per pound, or seven cents per hundred. The above rates are from New Orleans to Europe. The rates from small ports, even though they may be situated nearer to Europe, are sometimes higher, in consequence of less competition for the freight among the steamship companies.

Imports of Cotton into the United States. The imports of cotton into the United States are not very large, and are practically only of Egyptian and Peruvian growths.

During the past two years a few bales of Chinese, East Indian, and African cotton have been imported to be used by woolen manufacturers as a cheap substitute for Peruvian cotton, the entire quantity being only about 150 bales. A few bales of other growths have been brought to New York, Boston, and San Francisco for transshipment to Europe and Canada.

Egyptian and Peruvian Imports. The following table gives the imports of Egyptian and Peruvian cotton, and the quantity of American Sea Island cotton taken by American spinners for each year (ending August 31st) since 1889 :

All of the Peruvian cotton imported has been of the kind known as “rough Peruvian,” and very few bales of it have ever found their way into a cotton mill. Rough Peruvian is a peculiar kind of cotton, having such close resemblance to wool that its sole use is for mixing with wool in the manufacture of underwear, hosiery, and cloth, which are all sold to retail buyers as being made entirely of wool. The object of

its use is to cheapen the cost of the goods. Rough Peruvian cotton does not compete in the least possible degree with any description of American cotton in any market of the world. Its price has no relation whatever to the price of other descriptions of cottons, but is influenced by the price of wool and the supply of Peruvian cotton.

SEASON OF	Imports of Egyptian cot- ton.	Imports of Peruvian cot- ton.	Takeings of Sea Island cotton by U.S. spin- ners.
	Bales.	Bales.	Bales.
1889-90.	10,470	9,500	19,124
1890-91.	23,790	10,515	26,602
1891-92.	27,759	13,000	32,279
1892-93.	42,475	24,000	22,927
1893-94.	33,606	19,000	23,516
1894-95.	59,418	24,000	34,765
1895-96.	69,220	24,608	40,092
1896-97.	79,385	16,604	41,676

The figures are from custom house returns. For seasons previous the importations were much less. The present weight of Egyptian bales is about 724 pounds net, while Peruvian bales weigh about 175 pounds.

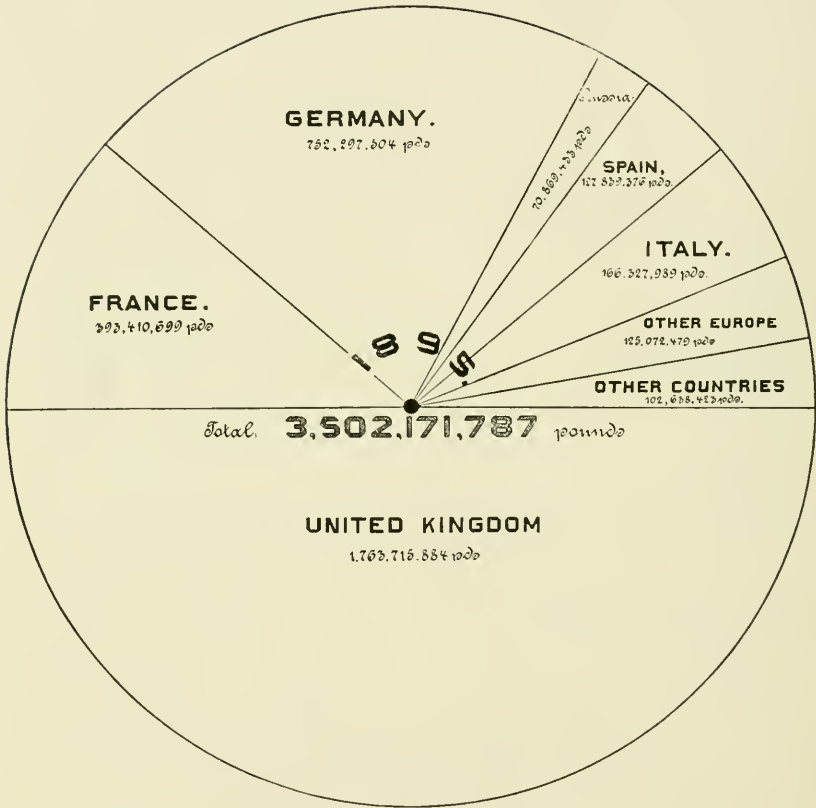
American imports of Egyptian cotton are now used in about the following manner :

Thirty-five per cent. for Balbriggan underwear and hosiery.

Thirty-five per cent. for fine cotton goods requiring a cotton of fine, strong and long fibre and absolute freedom from "nits" or other imperfections.

Thirty per cent. for sewing cotton and for fine yarns to be used in "silk and cotton," and also "worsted and cotton" goods; also for some other special purposes to a limited extent.

Figures 145, 146, 147, and 148 are from "Cotton in Commerce," by permission of Latham, Alexander & Co., of New York.



U.S. Treasury Department Bureau of Statistics

W. A. R. Fox

Chief of Bureau

Fig. 147. Export of American Cotton, Fiscal Year of 1895.



Fig. 148. Exports of American Cotton, Fiscal Year of 1867.

Cost of Raising Cotton. The following is an accurately kept account of the expense of raising cotton on a twenty-two acre farm in the upland region of North Carolina for two consecutive seasons.

The record for the first season was :

Preparing ground, planting seed, putting in fertilizers, bringing to a stand, hoeing, and cultivating	\$ 99.65
Cash cost of fertilizers	110.97
Picking 21,984 pounds of seed cotton	98.01
Interest on capital	72.00
Taxes	8.00
Bagging and ties	14.00
Transportation	10.00
	<hr/>
	\$412.63
Less the value of the seed	56.25
	<hr/>
Cost	<u>\$356.38</u>
Product per acre, seed cotton	999.2 lbs.
Product per acre, lint	322.1 lbs.
Total crop, baled cotton	7087 lbs.
Cost of lint cotton, per pound	5.3 cents.

The results of the second season were as follows :

Preparing ground, putting in fertilizers, planting, bringing to a stand, hoeing, and cultivating	\$ 97.34
Forty bushels of seed at 12½ cents per bushel	5.00
Cash cost of fertilizers	92.12
Blacksmith's work	3.00
Picking 22,013 pounds of seed cotton	90.69
Bagging and ties	15.00
Interest on capital	72.00
Taxes	8.00
Transportation	10.00
	<hr/>
	\$393.15
Less the value of the seed	56.25
	<hr/>
Cost	<u>\$336.90</u>
Product per acre, seed cotton	1000.6 lbs.
Product per acre, lint	332.6 lbs.
Total crop, baled cotton	7317 lbs.
Cost of lint cotton, per pound	4.6 cents.

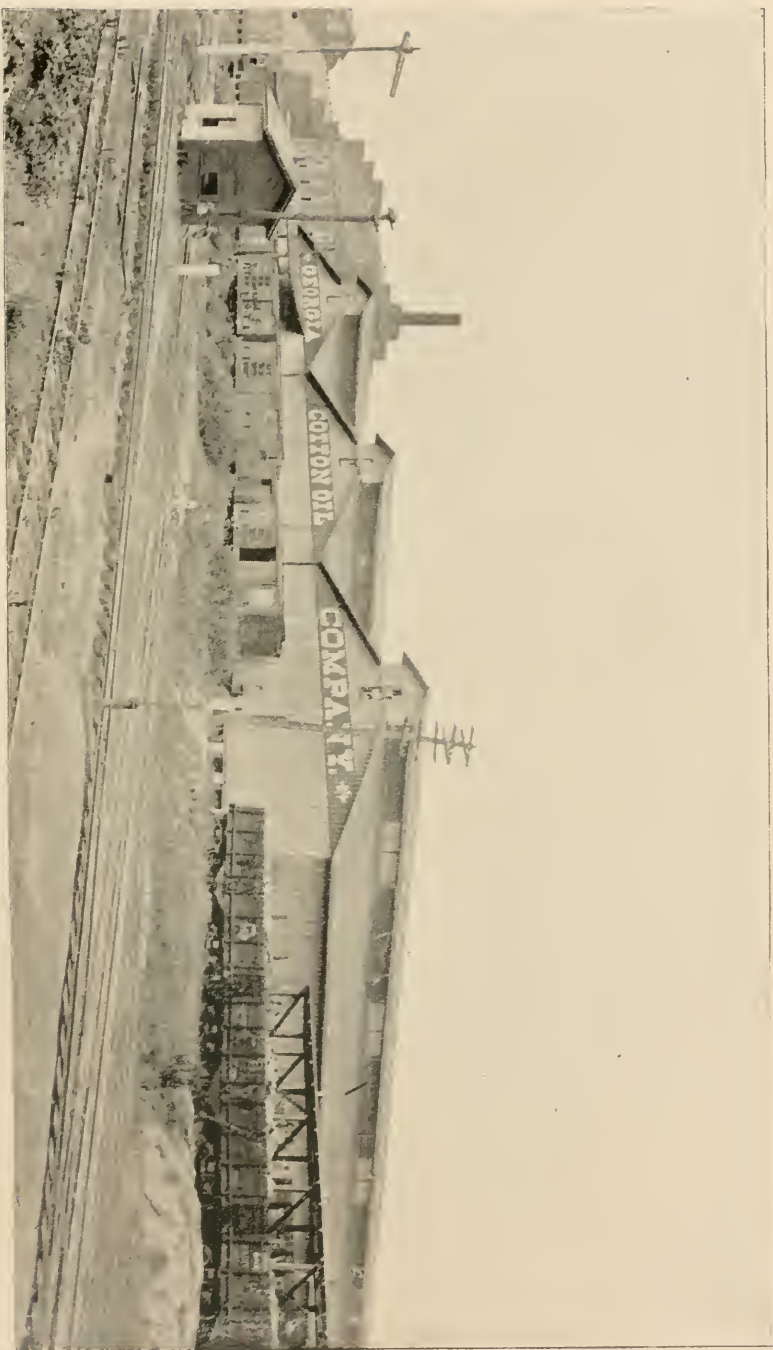


Fig. 140. Georgia Cotton Oil Company's Mill, Macon, Georgia.

The average cost of the cotton for the two seasons was 4.95 cents per pound. This included all expenses excepting the price of baling, which would bring the cost up to five cents or two pence half-penny per pound. The rent and similar expenses were charged as interest on capital, the land, implements, stock, etc., being owned by the farmer. There was, however, no provision made for the deterioration of the plant and loss of stock, which would be covered by a small fraction per pound. It will be observed from an examination of the foregoing statement that the cost per pound of raising cotton must depend upon the yield per acre; that the product per acre beyond the amount necessary to pay expenses is the measure of the planter's profit, and that the expenses incident to raising the crop are the same when yielding 500 pounds of seed cotton as when yielding 1,500 pounds, less the cost of picking, which is fully counter-balanced by the gain in seed.

The cost of growing cotton is an interesting problem, and statistics give almost any result on this point.

A farmer often claims to be able to prove that his cotton costs him seven, eight, or nine cents per pound. Many southern and other authorities claim that cotton costs nothing to raise, as it can be made a surplus crop, that is to say by the skilful management of his crops, the farmer can raise sufficient food, both animal and vegetable, for himself and his family, sufficient feed for his stock, and sufficient corn to sell, to provide clothing and other necessities, leaving a considerable quantity of cotton as a surplus crop. This argument is of course untenable, as there is no doubt that cotton costs something to raise, however little, if all the expenses of rent and labor are taken into account. From very carefully compiled information, collected in many different states, the writer has come to the conclusion that five cents per pound covers the average cost of cotton in an average season, including all expenses. On a small farm badly managed, and consequently having a small yield per acre, cotton may cost ten

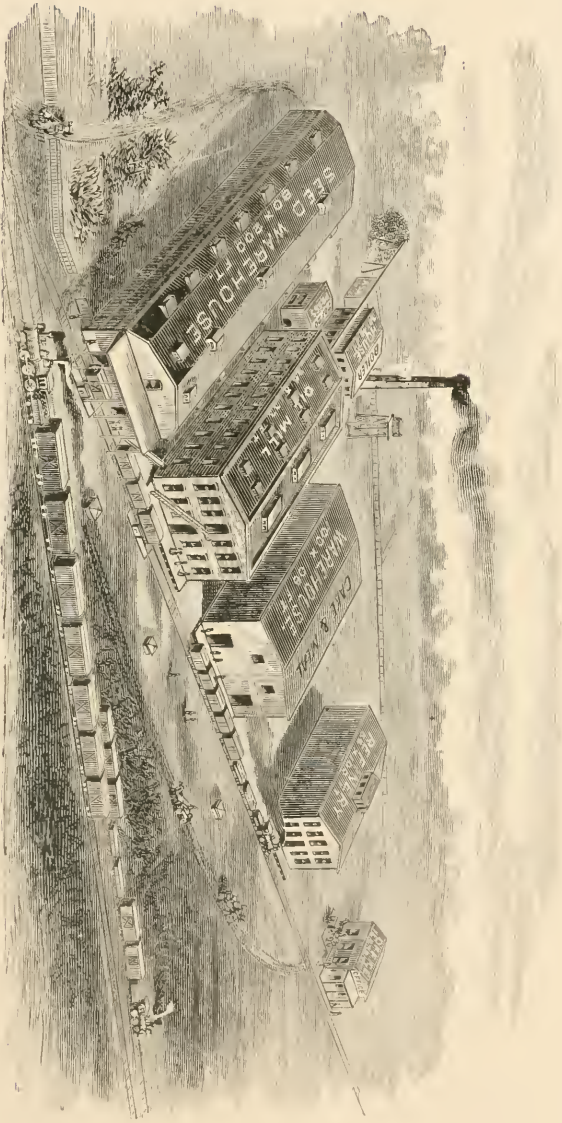


Fig. 150. A Cotton Seed Oil Plant.

cents per pound; on a large farm with the ground well cultivated, with a liberal use of fertilizer, and with the best machinery available, cotton can be raised for less than five cents per pound.

The state of the weather, of course, is the chief influence affecting the price of cotton. On the weather from April to September depends whether the American crop shall be a million bales more or less than the normal crop. Something is said in another chapter on the effects of weather; but this is not the only influence. The acreage is a matter of considerable importance. After a season of high prices of cotton and low prices of corn, an increase in the acreage of cotton may be almost always looked for the following season, and vice versa. Even in the season of lower prices of cotton and comparatively high prices of corn, the farmer is yet willing to plant his land in cotton the following season, as cotton is the favorite crop in the South. Not only this, but one large crop tends to cause another the following season. After a large crop the farmer's credit is unusually good, and he has more money to spare, consequently he is in a better position to purchase plenty of fertilizer for the following season, to use better implements, and more mules in cultivating. The reverse of this is also the reason why one poor crop, or a season of low prices, tends to cause a small crop the next season.

CHAPTER VII.

BYE PRODUCTS OF COTTON SEED.—COTTON SEED OIL MILLS.—THE MANUFACTURE OF COTTON SEED OIL.—COTTON SEED MEAL.—OIL REFINERIES.—USES OF COTTON SEED OIL.—COSTS.—COTTON SEED AND MEAL AS FERTILIZERS.—AN ENGLISH COTTON SEED OIL MILL.—DELINTING COTTON SEED.—PRICES OF COTTON SEED PRODUCTS.

Bye Products of Cotton Seed. The lint for spinning purposes is by no means the only product of the cotton plant. Many large industrial firms in the South are employed in the business of working up the cotton seed in different ways, and among their products are:—

Linters. This is the name given to the short fibres or fud that clings to the seed after the long fibres have been removed in ginning. This short fibre is removed by special gins and either sold as linters for spinning purposes or made into batting (wadding).

Hulls. These are the outer casings of the seed and are split off preparatory to expressing the oil. Hulls are largely used as cattle feed.

Cotton Seed Oil. This is the most valuable bye product and is expressed from the meats which form the center of the seeds.

Oil Cake. After the oil has been expressed, the meats are left in the form of a cake, which is broken into small pieces which are ground into meal. This is used either as cattle feed, or as fertilizer.

Fertilizer. The cake is broken and ground, then used either alone, or mixed with other substances, as a valuable fertilizer.

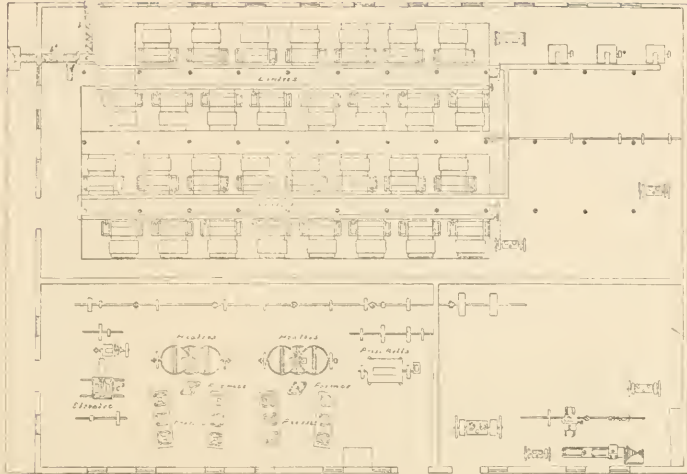
Cotton Seed Oil Mills. All of the above articles are produced in the larger oil mills, except batting, which is only made in a few mills. A ginning and oil refining business is generally conducted in addition. In the smaller oil mills, usually only the businesses of ginning, crude oil pressing, feed and fertilizer making, are conducted.

In the cotton growing states the average territory covered by the operation of each oil mill is 2500 square miles. This covers all kinds of country, whether under cotton or not, and the statement is made merely in order to indicate the distance from which seed has to be brought in order to be pressed, and to show the centralization of the oil mill business. Of course in states like Louisiana or Mississippi, where cotton is the staple crop, oil mills are situated more closely, while they are at greater distances apart in states like North and South Carolina.

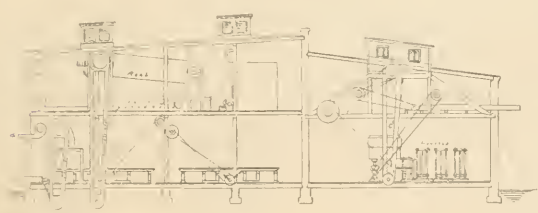
The cotton seed product of the South amounts to 5,000,000 tons annually, valued raw at \$35,000,000. In 1867 there were only four mills in operation; in 1897 there were over 300, with more than \$50,000,000 invested. This industry employs 10,000 people. In 1872 less than 5000 barrels of cotton seed oil were exported; in 1896 more than 300,000 barrels were shipped to foreign markets.

There are now annually crushed in the oil mills of the South about 2,000,000 tons of cotton seed, giving a product of 950,000 tons of hulls and 80,000,000 gallons of oil, besides meal and linters. More than 3,000,000 tons of cotton seed are not as yet hauled to the oil mills on account of the distance from the gins, or the desire of the farmer to use it for fertilizer in its natural form. The materials manufactured from the seed are valued at \$33,000,000.

The oil mills have buying agents at the stations on the railroads in their own districts and in the market towns. The seed is shipped directly into the oil mill yards in car loads. In addition to this, the oil mills handle the seed from their own ginneries and seed hauled in by road from local ginneries.



FLOORPLAN



TRANSVERSE SECTION THROUGH MILL

Fig. 151. A Cotton Seed Oil Mill. Plan and Section.

The seed on its arrival at the oil mill, if it cannot be handled and the oil expressed at once, is stored in a seed house—a building removed some distance from the oil mill, owing to the liability of fire.

In storing cotton seed it is important to keep it cool and dry, as the heat and other changes produced by fermentation are detrimental to the character of the oil and meal produced. Seed which has been trampled upon and crushed to any great extent before storing is prone to heat from oxidation of the exposed oil, and increases the danger of fermentation and undesirable changes in the seed. River cotton seed produces a little more oil than railroad seed, and there is often a corresponding difference in their values. Seed can be shipped by rail in bulk, but it has to be sacked when shipped by river. Mills must furnish river seed dealers with sacks, and besides the cost of the sacks, there is the expense of the labor in sacking and unsacking the product.

A two press mill with a capacity of thirty to forty tons of seed per twenty-four hours has the following equipment of machinery and plant :

- One sand and boll separator or reel, with magnetic field.
- One meat and hull separator or reel.
- Two fifteen-plate presses and fixtures.
- One set seventy-two inch heaters (2).
- One set chilled rolls, (four high) thirty-six inch.
- One cake former (steam carriage and track).
- One duplex hydraulic pump.

Also,

- One ninety horse-power boiler and fixtures.
- One seventy-five horse-power engine and fixtures.
- Four 106-saw linters.
- One huller.
- One cotton press.
- One cake cracker.
- One meal mill.
- Two oil tanks twelve feet by twelve feet.
- In addition to piping, shafting, pulleys and hangers, elevator fixtures, conveyors, belting, sprinklers and electric light plant.

Fig. 152. Sand and Boll Reel or Separator.

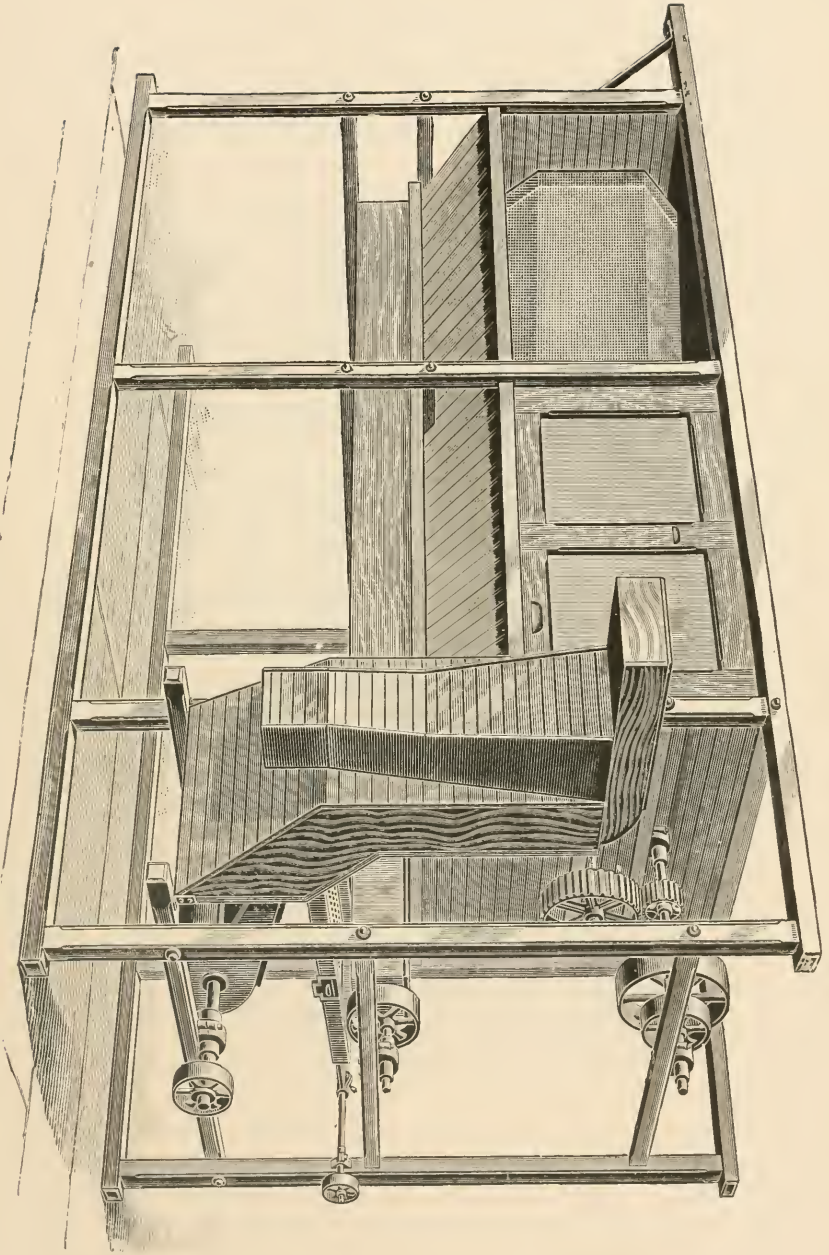


Fig. 149 is a view of the large mill of the Georgia Cotton Oil Company, Macon, Georgia, and at Fig. 150 is shown a group of buildings forming part of another cotton seed oil mill.

In the description of a cotton seed oil mill it will be unnecessary to enter into minute details, as mills vary somewhat in the methods by which they accomplish the same results. A general description of a successful, well-conducted mill will give a very fair idea of the general management and the principles involved in them all.

The Manufacture of Cotton Seed Oil. A plan and section of an oil mill is shown at Fig. 151, and the following description is given of the treatment of the seed in first class mills:—

The seed is removed from the cars by being shovelled into conveyors, which are spiral screws, as at *a*, Fig. 151, working in troughs with perforated bottoms, so as to provide for the removal of small stones, soil and sand. The seed is passed along the conveyor and the sand drops through the perforations. It passes into an automatic elevator, *b*, and is raised to the top of the building, two stories in height, and is deposited in a sand and boll reel or separator, shown at Fig. 151 in the transverse section of the mill, and also at Fig. 152, consisting of a large meshed screen, which allows the seeds to pass, but not sticks, bolls and other trash, and a small mesh screen, which prevents the seeds passing, but parts with sand and small dirt. In its course the seed passes one or more strong magnets, to which nails and other scraps of iron are attracted, and from which they are removed periodically. Some oil mills are three or four stories high, instead of two, as in the mill under description.

After the sifting and cleaning, the seed passes to the linter room. This room in the mill under description, Fig. 151, contains a number of linters, which are cotton gins specially adapted for removing the short fibre from the seed. The seed

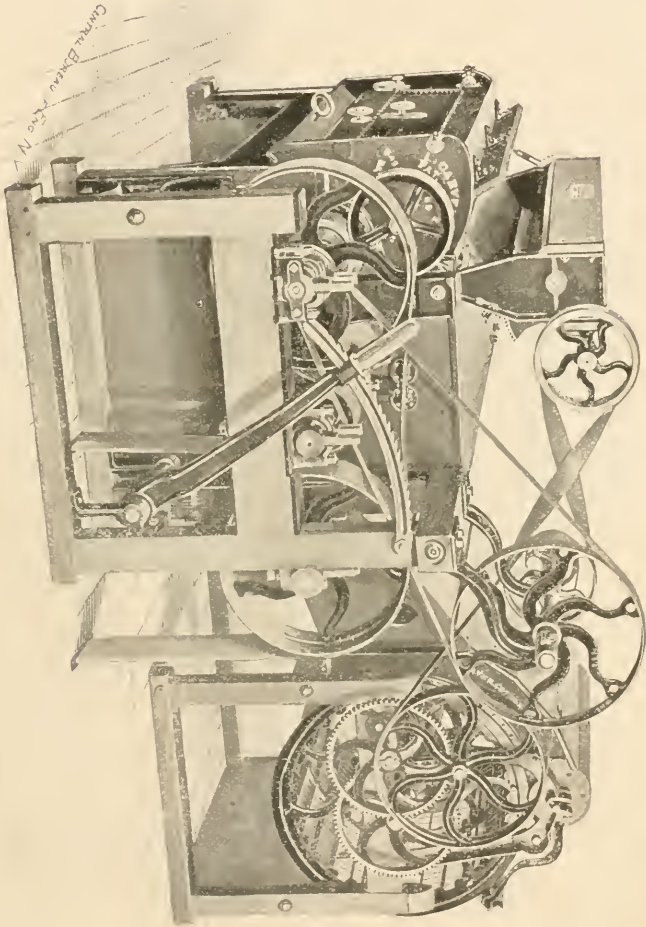


Fig. 153. Linter Gin for Cotton Seed.

is deposited in the roll box or seed box. In its general construction this linter gin has many points of resemblance to the ordinary saw gin described in Chapter IV, but the saws on the linter are set closer than in the cotton gin, the teeth are finer set, and in order to keep the mass of seed revolving in the seed box, a roller is inserted. A view of a linter is shown at Fig. 153.

The saws of the linter, like those of the gins in large mills, are sharpened by machinery, a saw sharpener or gummer, Fig. 154, being used for this purpose, operated by power. The last two illustrations are used by permission of the Carver Cotton Gin Co., of East Bridgewater, Mass.

The linting is completed in two operations, the lint from the first linting being of course better than from the second, and containing some long fibres not removed in ginning. The seed is not entirely delinted, it being the practice in American mills to leave a portion of the fud on the hull as it assists subsequent operations. The lint is delivered by condensers as a sheet and wound in a roll.

This lint is usually pressed into bales and sold, but some of the most advanced oil mill men manufacture it into batting on the mill premises.

This is done by a process of carding on Garnett machines, the fibres being laid crosswise in a layer or sheet, which is rolled into one pound balls on an automatic machine. Batting is largely used in the United States as a lining for comforters (lined quilts) and other purposes. When linters are sold in the bale, it is for the purpose of being spun into coarse carpet and other yarns.

This lint from the cotton seed is sold under the same name as that of the machines which remove it, that is, "linters." It would seem as if little lint cotton could be secured from a previously ginned seed, yet a large mill will obtain about eight bales a day of 500 pounds each.

The seed having left the second linter drops into a huller. This is a machine having for its object the cracking of the

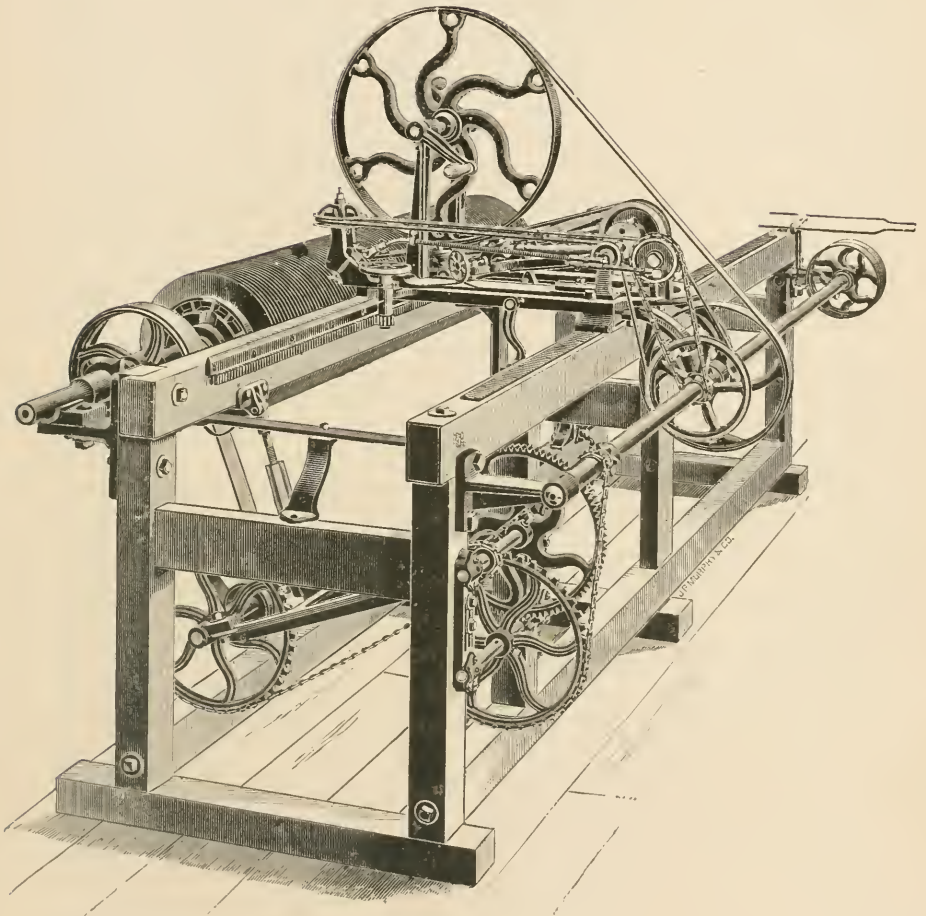


Fig. 154. Saw Gummer or Sharpener.

hull, which is the outer coating of the seed, and consists essentially of a cylinder carrying fourteen blades attached by radiating bars to a central shaft, revolving inside a grating formed of thirty adjustable bars parallel to the beater blades and only one thirty-second of an inch from them. The passage of the seed between the blades and bars effectively cracks the hulls and the meats are then free to drop out. The machine is shown at Fig. 156.

The meats and hulls together are again elevated to the top floor and passed through a hull and meat separator, shown at Fig. 158, when by shaking, the meats are effectively separated and pass along one conveyor, while the hulls go to another.

The hulls formerly were wasted, burned for fuel, or given away, but their value as cattle feed, especially if mixed with cotton seed meal, is now appreciated, and they are saved and sold, either loose or in little bales. These bales are pressed between boards and tied with wire, weigh 100 pounds, and are about fourteen inches wide by eighteen inches long and twenty inches thick.

The meats pass forward through heavy calender rolls to crush the oil cells, and thence into the cooking kettles or heaters. A set of these chilled press rolls for seed or meats is shown at Fig. 159. The seed is dropped into a box above the upper roll and passed alternately between each pair of rolls and effectively crushed.

Cotton oil may either be pressed from the seed as it leaves the calender rolls without being cooked, in which case it is called cold drawn oil, which is high grade, or as is commonly done, it may be heated for half an hour or more to expand the oil vessels in the meats and render the oil more fluid and more easily separable from the meats. The heater also drives off the moisture, if any, in the meats. Fig. 160 shows two heaters or "cookers," also a former and four presses.

Each of the two heaters in the above plant are steam heated pans, jacketed all round the sides to the full height as

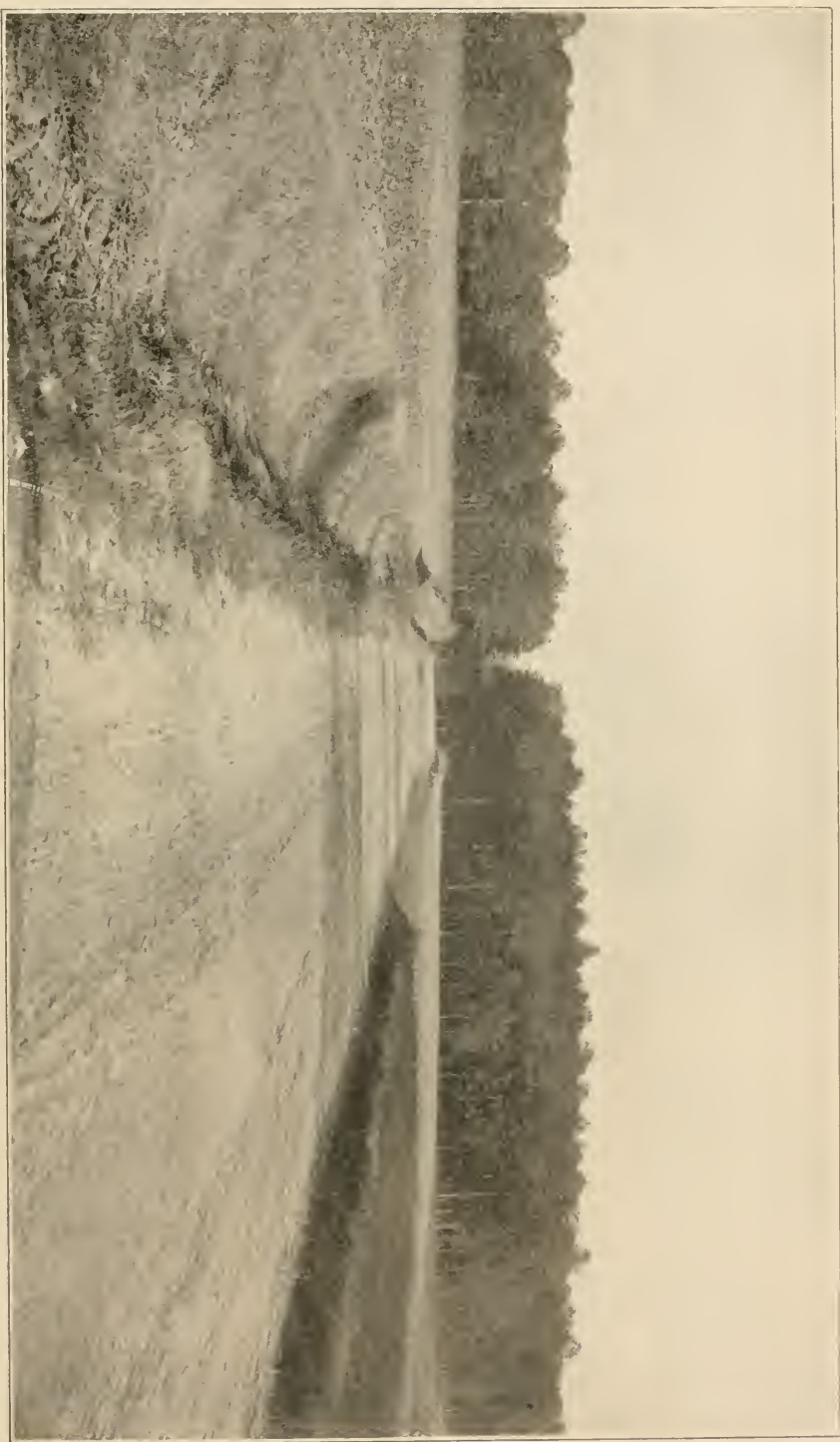


Fig. 155. A North Carolina State Road.

well as at the bottom. They are covered outside with a non-heat conducting material and the steam is usually kept at a pressure of 100 pounds. Each holds 700 pounds of meats.

The cookers are first charged with seed, each charge being cooked usually half an hour, the time given being at the discretion of the superintendent. In some cases where wet or frosted seeds are used, the time is extended to forty or forty-

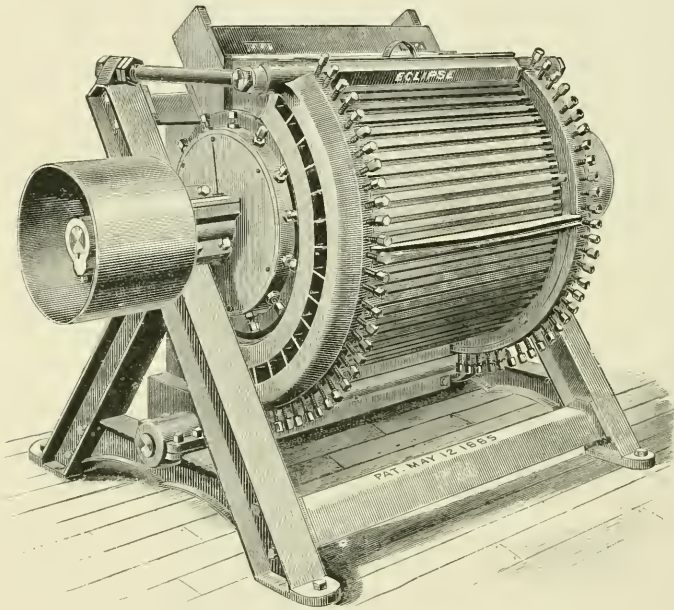


Fig. 156. Cotton Seed Huller.

five minutes: in no case even for dry seed is the time less than fifteen minutes. These cookers are watched over by a man called a cooker, and upon his judgment this part of the work depends: any failure upon his part to judge correctly means loss to the mill. The cooker charges each kettle by pulling a lever which delivers the proper charge into each, and an opening at the side of each kettle, closed with a slide, permits him at any time to withdraw a sample with a wooden

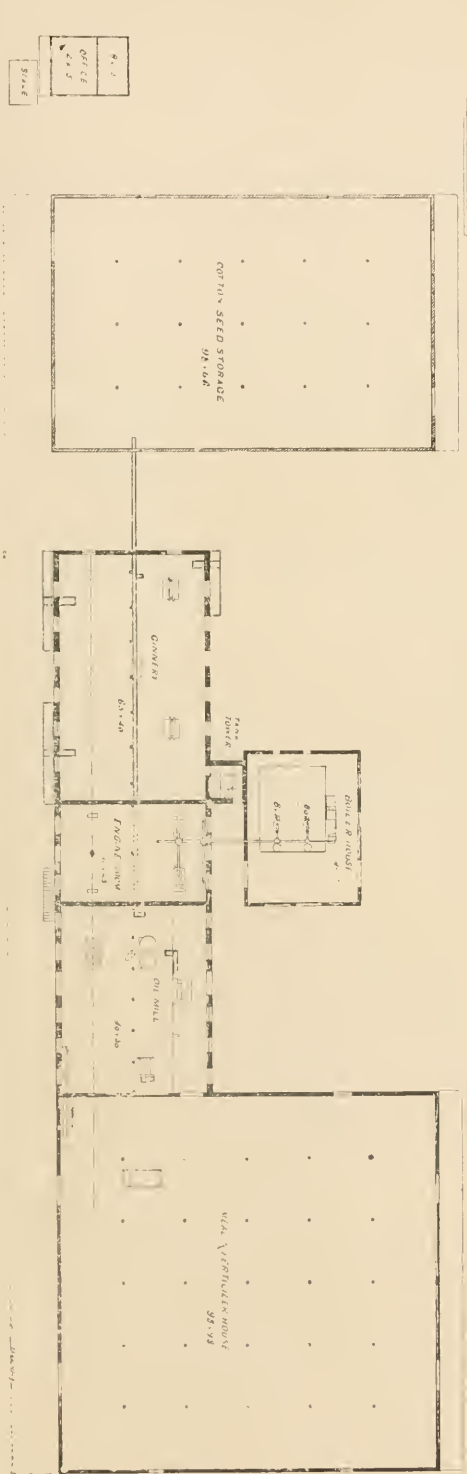
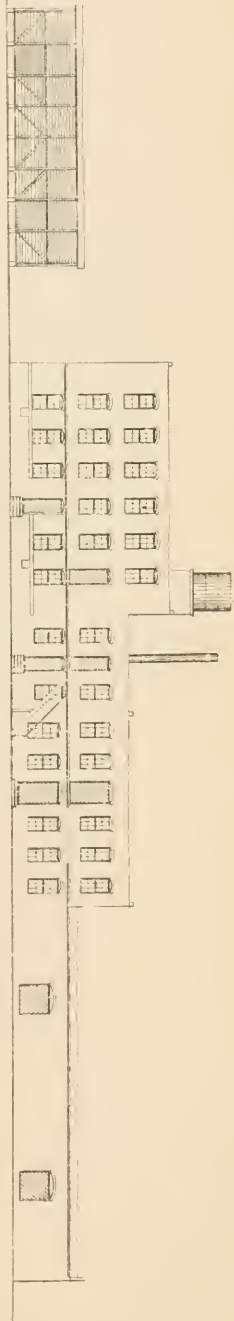


Fig. 157. Ground Plan and Front Elevation of a Cotton Seed Oil Mill Plant.

paddle used for the purpose, and judge of its condition. Either too little cooking or too much cooking gives a small yield of oil. The cooking must be just right for the best results. An under-cooked charge also appears to leave some water in the meats, which causes the cloths to burst in the oil presses, to the damage of these expensive fabrics. The heating renders the oil limpid, expands the oil cells, probably bursting them, and dries out the water, which is not only detrimental in the oil presses, but causes the meal to deteriorate much faster than is the case when more perfectly dry. Another style of cooker is shown in Fig. 162.

Fig. 164 gives a view of a portion of the interior of an oil mill, which is not a very attractive scene as a rule.

When properly cooked the meats are dumped into a conveyor, which carries them to the "former," shown on a small scale at Fig. 160, and on a larger scale at Fig. 165. At the former, experienced workmen work with clock-like regularity. Upon the platform of the former, which stands about waist high, a porter throws down a steel plate about one foot wide and about two and a half feet long. Two men stand at the former, and one throws a piece of camel's hair cloth, about six feet long and a foot wide, lengthways upon the steel plate. The second workman pulls a lever and a charge of meats three or four inches deep is deposited over the cloth upon a space almost as large as the steel plate. The other workmen immediately fold each end of the cloth over the charge, their surplus length causing them to lap. A lever is pulled and down comes the plunger, which is about the size of the platform. It immediately releases itself from the cake of meats and returns to its original position, leaving the meats pressed to a coherent mass or cake wrapped in cloth: this the porter seizes, with the underlying steel plate, which he uses as a kind of waiter to carry the cake, and places it in the hydraulic oil press, which is made to hold a number of these masses. The two workmen labor to keep up with the hot

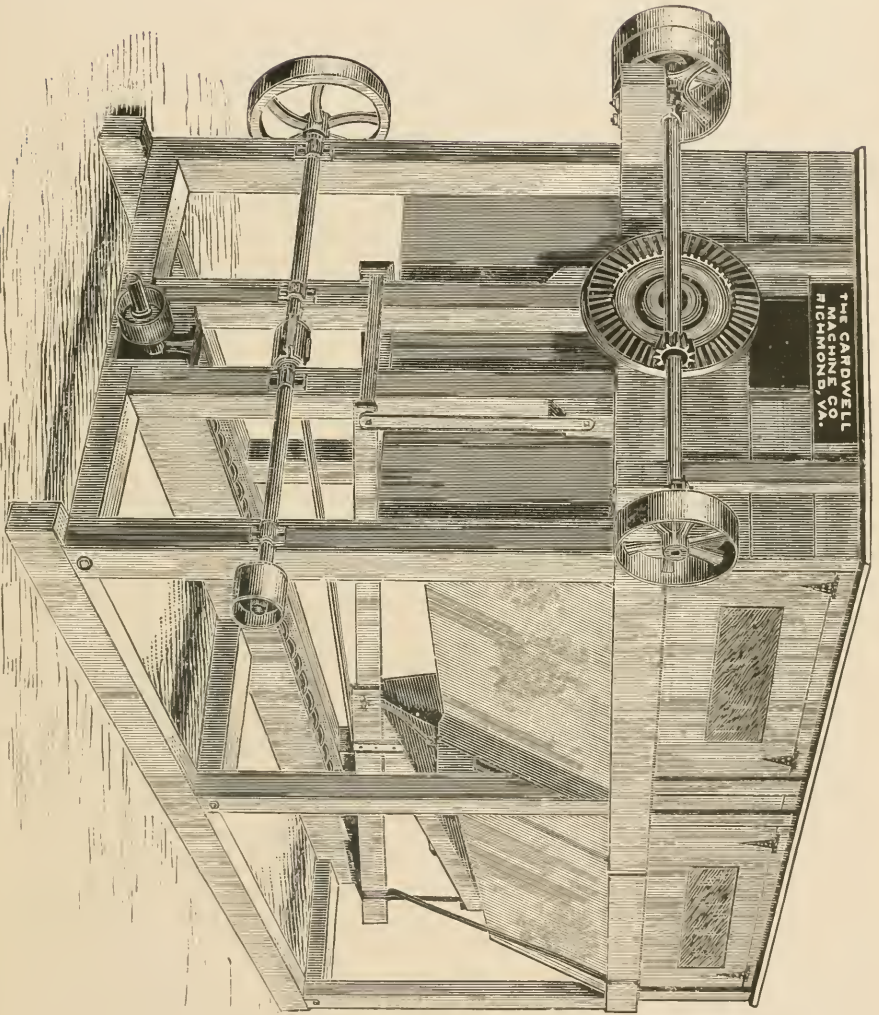


Fig. 158 Meat and Hull Reel or Separator.

meats as they come from the cookers, and the porters trot back and forth with their steel plates and loads of cake, rapidly filling the presses. As each of the presses, one of which is shown at Fig. 166, receives its twelve or fifteen cakes their attendant pulls a lever and the ram at the base slowly rises upward with an initial pressure of 300 to 400 pounds, gradually rising to a pressure of 3,000 to 3,500 pounds to every square inch on its surface of 201 square inches. The lower portions of the press, carrying the cakes with them, continue to rise slowly as the ram ascends. As the mass becomes more and more compact, the oil begins to flow, at first in tiny streams, and later gushes forth in torrents, a large stream pouring from the spout which delivers the oil as it spurts from every portion of the press. The dark, murky oil passes through pipes made to receive it into a large reservoir beneath the presses.

This oil is pumped from the reservoir into large settling tanks, where the various foreign substances are allowed to gradually settle and leave the oil in a somewhat clearer condition. After the full pressure has been reached in each press and the cakes of meats contract no longer, the chief portion of the oil has been pressed from the oil cells of the meats; the oil, however, continues to run in small streams from the inner portions of the meats, hence each press is allowed to drain as long as is convenient, usually about twenty minutes. While the operation is going on in one press the other presses are being filled, and one after another they are operated and allowed to drain, until the whole series are under pressure; then the first press is relieved of its pressure by a reverse movement of the lever, and the heavy ram slowly descends, carrying the lower parts of the press with it.

Cotton Seed Meal. The attendants now withdraw the compacted cakes of meats, still hot from their recent cooking. The pressure has been so great that each seems as solid as a piece of wood. The cakes are then quickly laid on trucks and carried to the "stripping table": there the workmen stand,

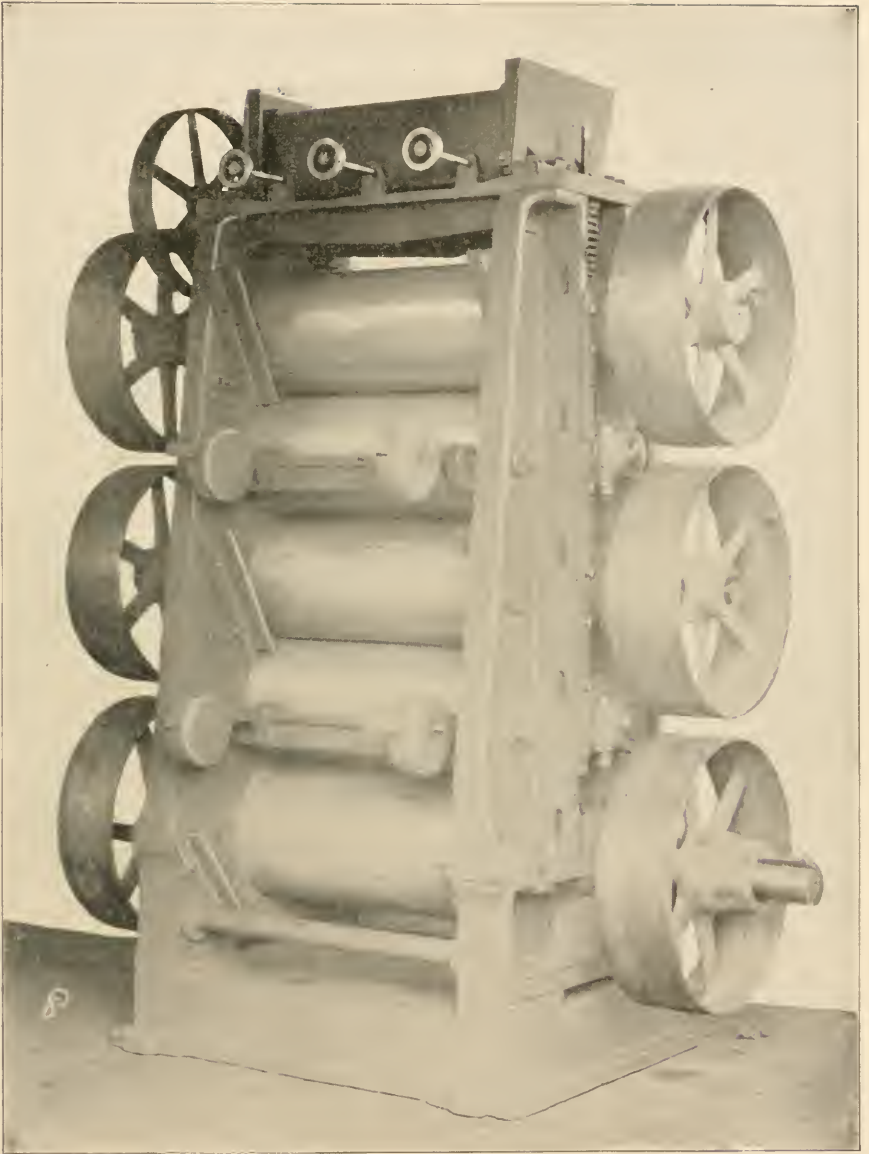


Fig. 159. Set of Chilled Rolls for Pressing Meats.

called "strippers" or "skimmers." They rapidly strip the camel's hair cloth from the cakes, throwing them over to the workmen at the "former," each cake still appearing, after the cloth has been removed, as if yet covered with the material, on account of the enormous pressure making a perfect impression of it in the mass of the cake.

The camel's hair cloth used for covering these cakes is made of very expensive material, hence the sewing machine is kept industriously at work to keep them in repair and to make them last as long as possible.

These board-like cakes are now thrown on trucks and rolled quickly away to the cooling room, where the cakes are pushed into racks to keep them separate from each other and allow them to cool as rapidly as possible, and to dry also, if there is any moisture remaining. After standing in the cooling room from twelve to twenty-four hours, the cakes are fed into a machine called the "cake-cracker." This cake cracker, shown at Fig. 167, is composed of two revolving rollers with spike-like projections; these, revolving in opposite directions, draw the cakes into the cracker rapidly, crushing them into a number of small pieces the size of a hickory nut. This machine breaks up the cakes in this manner that they may be more easily and cheaply conveyed by means of mechanical conveyors than could possibly be done by hand, and also that they may be in suitable form to feed into the grinder.

The work people in the oil mills, with the exception of the superintendent, master mechanic, overseers, engineer and so on, are almost exclusively colored. The atmosphere is usually so hot and oleaginous that a white man cannot endure it. Besides this the remuneration required by a colored operative is considerably less than that of a white man.

From the cake cracker the broken cakes are conveyed to either burr mills or roller mills, as the case may be, and ground into meal. This meal is then either packed into sacks for sale in that condition, or if the mill has a fertilizer

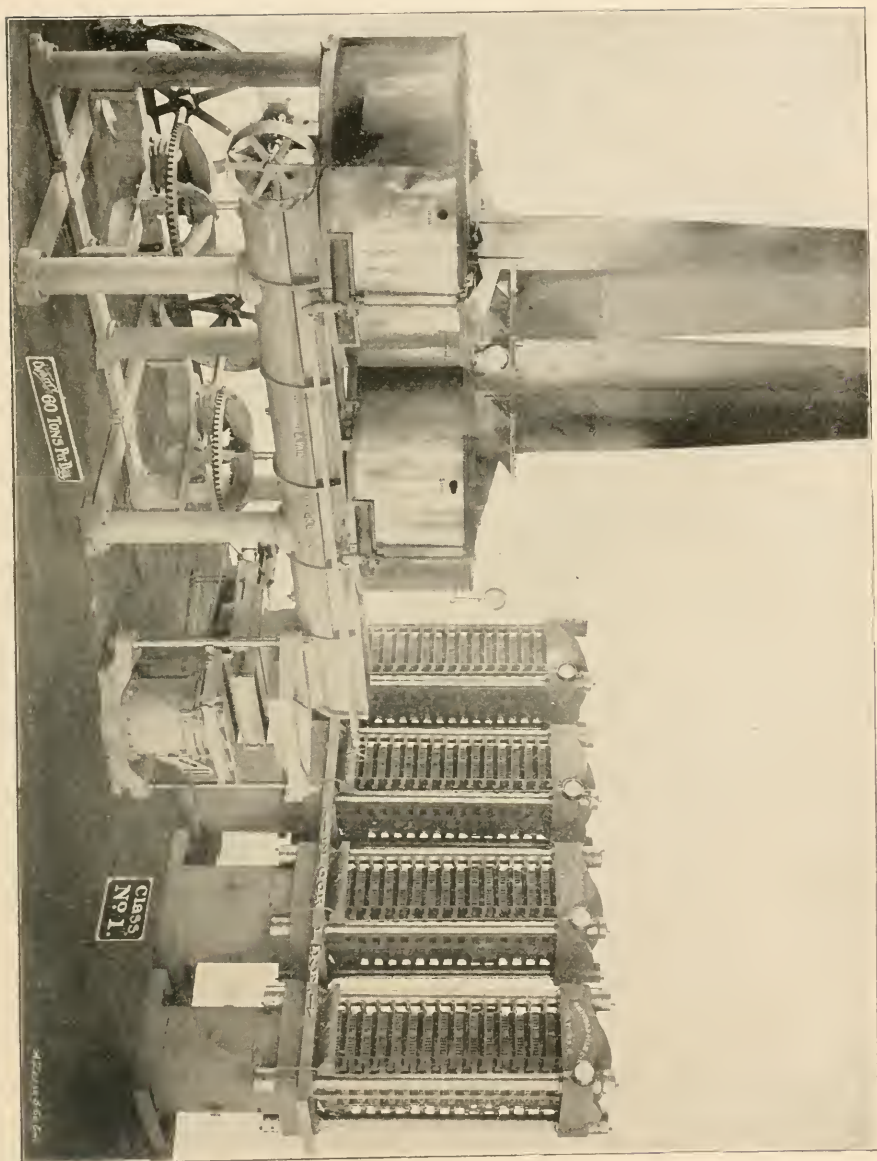


Fig. 160. Set of Heaters, Former, and Presses.

factory operated in connection with it, the meal is conveyed direct to the "mixers," where it is mixed with acid phosphate and potash, constituting a complete fertilizer.

The ingenuity of the inventor has been applied even to the mixing of this fertilizer, and the weighing of the sacks. The view at Fig. 168 not only shows an admirable arrangement of a duplex rotary apparatus, A, which mixes the fertilizer, allowing it to fall into a pit, B, from whence it is elevated to a sufficient height to fall into a bag already placed on a scale, F; the view also illustrates the construction of the elevator, C, which forms so important a part of cotton seed oil mill construction as a means of automatic transit of seed, hulls, meats, meal, and so on.

If the feed stuff has to be exported it is in the most convenient form in the cake, but the greater proportion remains in the United States, either for use as feed or fertilizer. In either case, the cake has to be cracked as described above, and then ground to a fine meal in a cake mill. The French burr grinder, represented at Fig. 169, is a popular type of cake mill.

It then forms the cotton seed meal of commerce. For feed purposes, it is usually made up in 100 pound bags, and sold along with the hulls, and the stock raiser blends the two to his liking. In other cases, the oil mills keep cattle and mix the hulls and meal for feeding purposes, preferring to sell them in the form of beef.

Cotton seed meal is used as a manure, either alone or with other ingredients, as it contains about three and one-third per cent. of phosphoric acid, two and one-fourth per cent. of potash, and over eight per cent. of nitrogen. It will be seen that it is valuable for the purpose.

A better plan would be to feed the meal to the cattle and use the manure as fertilizer, as eighty or ninety per cent. of the fertilizing ingredients of the meal are voided by the animals.

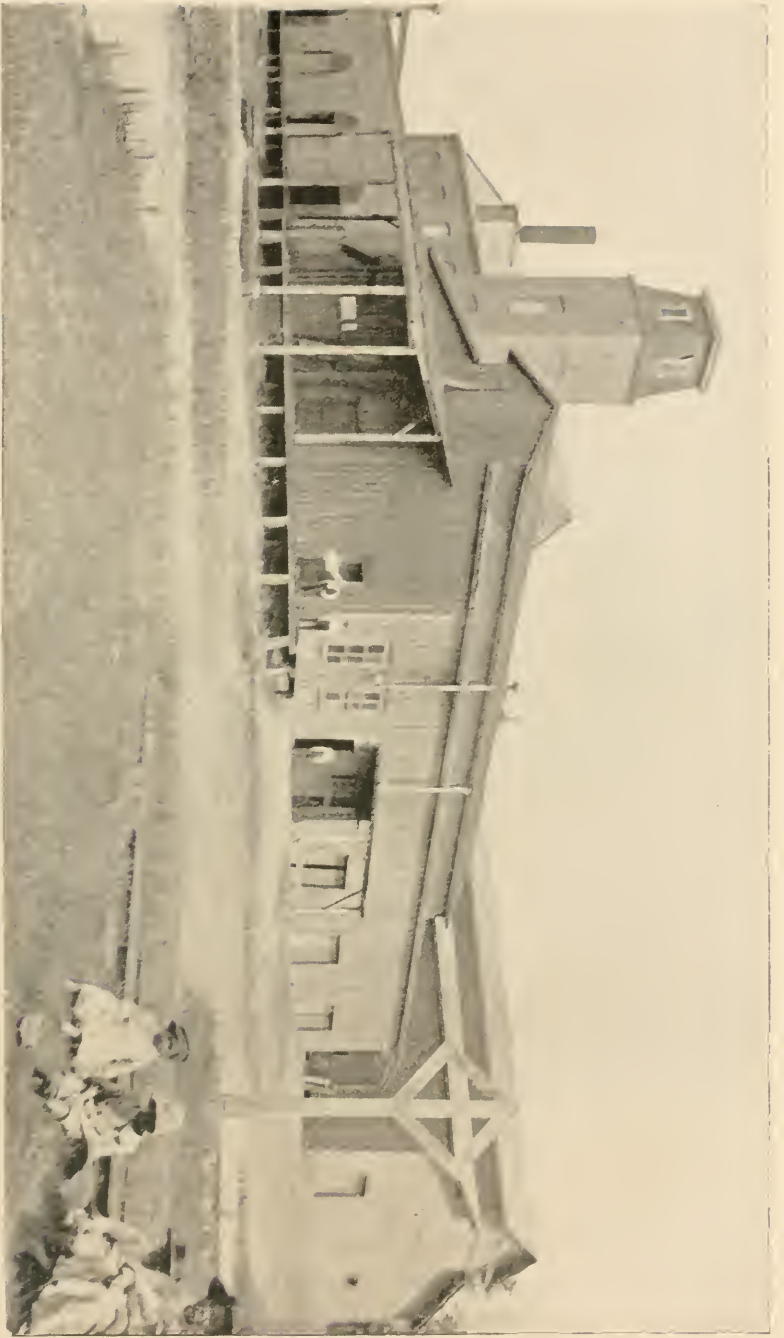


Fig. 161. Eufaula Oil and Fertilizer Company's Mill, Eufaula, Alabama.

In various states, particularly Texas, many thousand head of cattle are annually fed, and, with the addition of cotton seed meal, are fattened upon cotton seed hulls. Much of the Chicago and Kansas City dressed beef shipped to all parts of America in refrigerator cars is simply concentrated cotton seed meal and hulls. The price of hulls varies from two to three dollars a ton, which is far below their intrinsic value. Dairies near the larger southern cities, and many farmers near enough to the mills, are now feeding milch cows on them.

Oil Refineries. The crude oil in case of the smaller oil mills, called "crude oil mills," is barrelled and shipped to a refinery. In case of the largest mills, there is a refinery attached.

In the processes of refining, the impurities in suspension are usually allowed to settle, and the clear supernatant oil is drawn off. To the latter from ten to fifteen per cent. of caustic soda, according to the nature of the oil, is added, and the mixture agitated at a temperature of 100° to 110° F. for forty-five minutes, the precipitate being allowed to settle from six to thirty-six hours. The residues obtained are disposed of as for the manufacture of soap, stearin, and so on. The whole mass settling carries with it the albuminous and mucilaginous materials as well as most of the coloring matter. These substances collect at the bottom of the tank, leaving a supernatant oil of a light straw color.

The yellow oil resulting from this process is further purified by being heated and allowed to settle again, or by filtration, and is called summer yellow oil. Those portions of the oil which are not as bright and clear as desired are run through filter presses, in which the oil is forced by heavy pressure through filtering cloths. A filter press is shown at Fig. 170. Winter yellow oil is made from the above material by chilling it until it partially crystallizes and separating the stearin formed (about twenty-five per cent.), in presses similar to those used for lard. The latter constitutes the true cotton seed

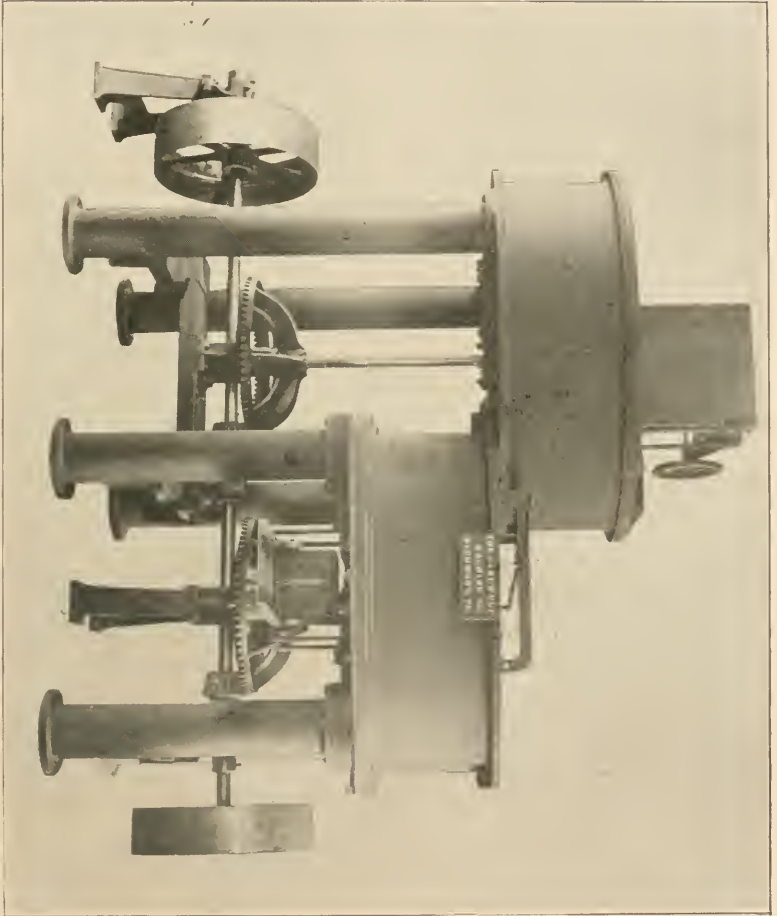


Fig. 162. Heater or Cooker for Cotton Seed Meats.

stearin of commerce, and is largely used in the preparation of butter and lard substitutes, and candles.

Another substance improperly called cotton seed stearin is obtained by distilling with superheated steam the mixture of organic acids formed when the mineral acid is made to decompose the "foots" obtained during the process of refining cotton seed oil by alkalis, and pressing out the "olein" from the distillate after cooling and solidification.

For the preparation of the white oil of commerce the yellow oil obtained as above is shaken up with two to three per cent. of fullers' earth and filtered.

Views of a Texas oil refinery are shown at Fig. 171. The three story building shows the portion devoted to storing the crude oil and treating it to get rid of the foots and soap stock. Tanks A, B, C, are used for this purpose, and D is the filter press. The oil from the filter press is deposited in the storage tanks for refined oil, E, F, and G.

A sulphuric acid chamber is frequently operated along with an oil refinery. A view of such a building is shown at Fig. 172.

Uses of Cotton Seed Oil. Broadly stated, refined cotton seed oil can be used for every purpose to which oil can be put, except household illumination and lubricating, for which latter, it is too mucilaginous. Yet for cooling hot journals and for electric insulation it has been found better than any other oil. Summer yellow is the ordinary staple of the cotton seed oil. The bulk of this goes to the manufacturers of a product used largely in cooking, and by bakers for "shortening." It is also bought in large quantities by laundry soap manufacturers, when its price is lower than tallow. It is an important article of export, being employed in Europe in the manufacture of butterine—and this because of the superiority of the American oil over that refined in England and France from Egyptian seed. The oil for butterine is made from selected seed, a still further selection being made in the crude oil.

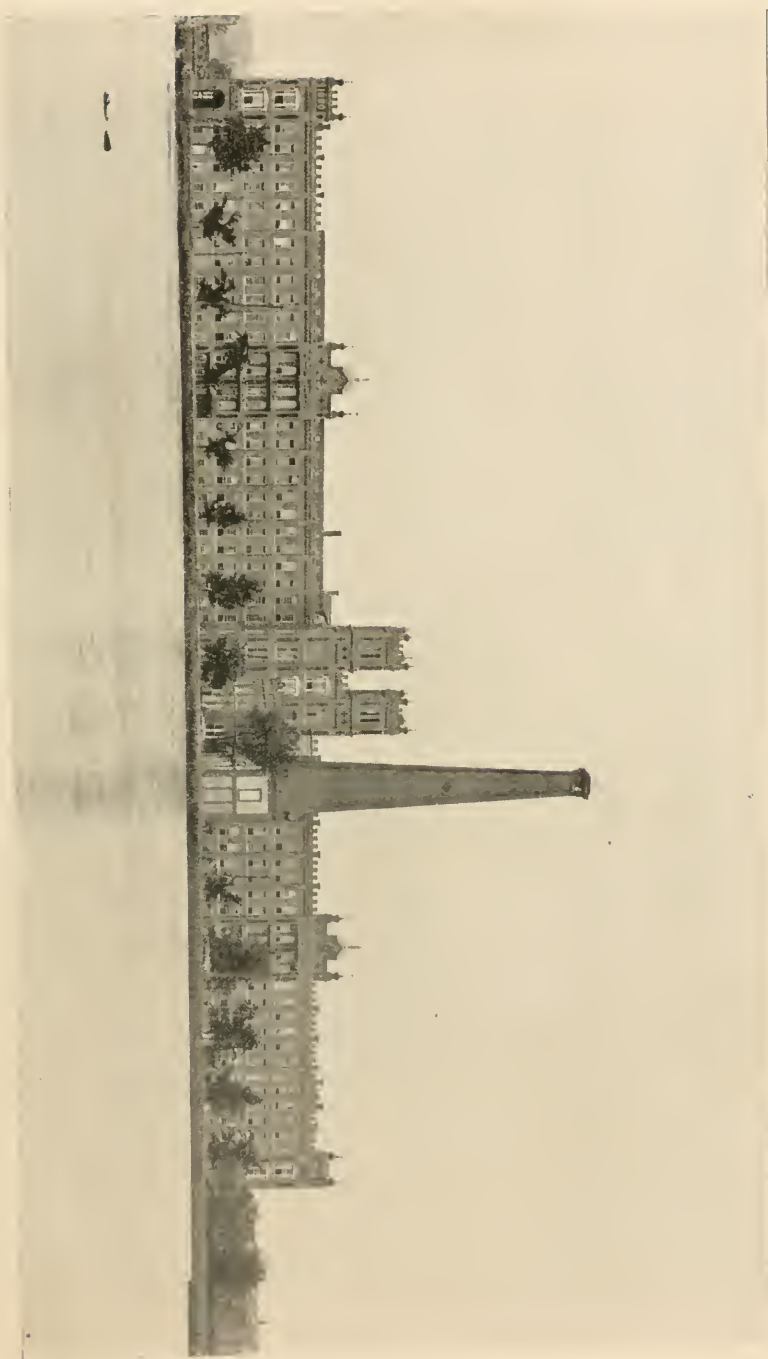


Fig. 163. Sibley Cotton Mills, Augusta, Georgia.

“Summer yellow” is also used by bakers, and by cooks in frying, in which latter culinary process it has the advantage that it can be used over and over again, with a little refreshing, for the same articles. The oil is also bleached to a “summer white” and a “winter white,” the latter strained so as not to chill in winter. “Winter white” is the staple cotton seed salad oil, used for that purpose in the land of the olive itself. It is also used largely in cooking by orthodox Hebrews, who naturally prefer the “cottolene” made from “summer yellow” cotton seed oil to lard made from hog’s fat, and druggists employ it for bases of liniments, salves and similar preparations instead of olive oil, than which it is from two-thirds to three-fourths cheaper. Though cotton seed oil cannot be used in chimney lamps, it is a free burning, smokeless, odorless oil in miners’ lamps, it being so excellent for this purpose, that in Ohio the law provides that cotton seed oil, pure lard oil, or their equivalent, must be used in mines. As the miner has to supply his own oil, it also commends itself to him for its cheapness. Cotton seed oil is also used for floating tapers in night lamps, and for altar lamps in Roman Catholic churches. It has been found valuable in preserving wood by saturation; for tempering steel, especially in the manufacturing of springs; and salt makers float it on the top of their tanks to prevent these from bubbling over. Paper manufacturers make a similar use of the crude cotton seed oil, as it is cheap and non-explosive. Machine makers use it in cutting threads on bolts, and it is mixed with putty and paint. The foots, the residue in the refining kettle, is sold for soap stock. It may be stated that the various table uses of cotton seed oil have been known and practically enjoyed abroad for many years, while in America it has been appreciated principally by pork packers. As the price of cotton seed oil became less, the pork packers discovered that by adulterating it with beef stearine it could be sold as lard. Since its introduction to this use large and increasing quantities have been consumed

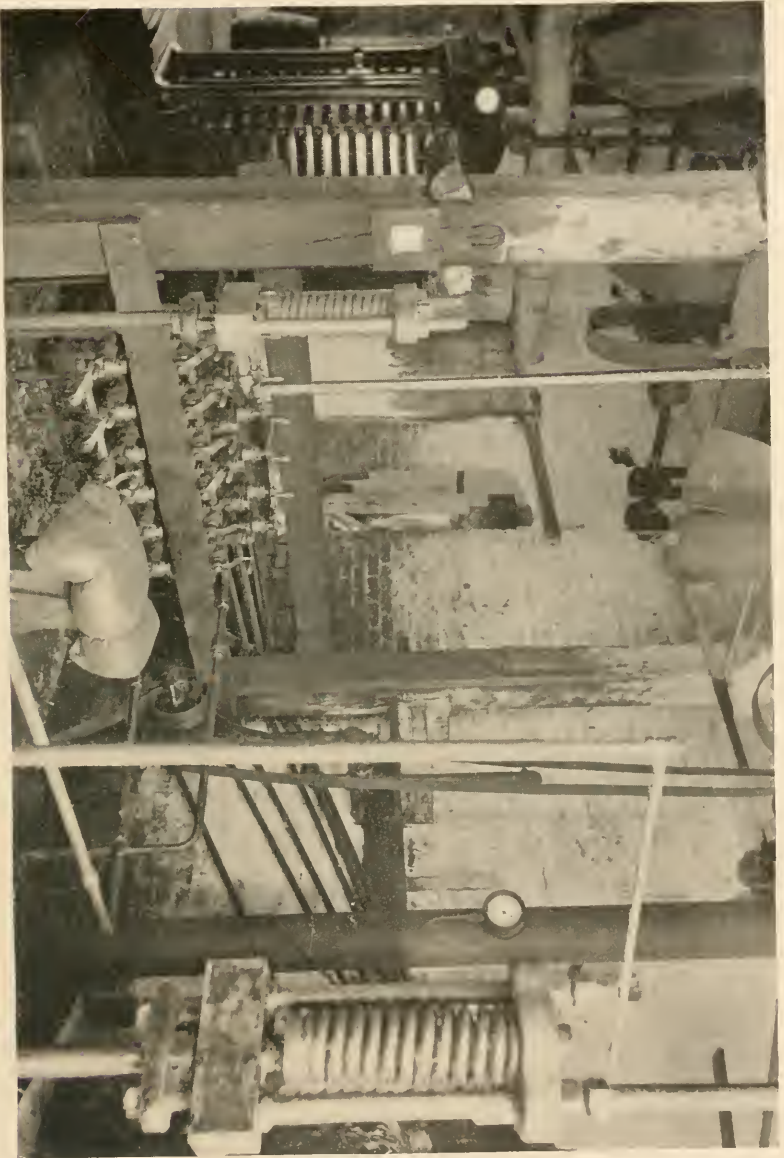


Fig. 164. Interior of Cotton Seed Oil Mill Showing Presses.

by the pork packers, and the price of hogs has considerable influence on the price of cotton seed products. Cotton seed oil is largely used for packing sardines on the coast of Maine, and for innumerable other purposes.

Costs. An approximate estimate of the cost of various sized oil mills, with or without ginnery or refinery, is given in the following table:—

	10 to 15	20 to 30	30 to 40	60 to 80	100 to 120	Capacity for 24 hours in tons.
	5,000	10,000	10,000	15,000	22,000	Buildings, including oil mill, boiler, seed, and meal houses.
	1,000	2,000	2,000	2,000	2,500	Land and railroad side-track, and water supply.
	4,500	6,400	8,200	12,500	18,500	Press room machinery, F.O.B. factory.
	5,000	8,500	10,000	22,000	34,500	All other machinery in oil mill to make crude oil.
	2,000	4,500	4,800	8,500	12,500	Freight and Erection.
	17,500	31,400	35,000	60,000	90,000	Total for oil mill, boilers, seed and meal house.
	11,600	15,000	15,000	25,000	35,000	Refinery, including building and all machinery.
	43,000	50,000	50,000	85,000	125,000	Total for oil mill and refinery.
	15,000	15,000	15,000	15,000	15,000	Ginnery, 6 stand gius and cotton warehouse.
	58,000	65,000	65,000	100,000	140,000	Total for oil mill, ginnery, and refinery.

Approximate estimates in dollars, \$5 = £1.

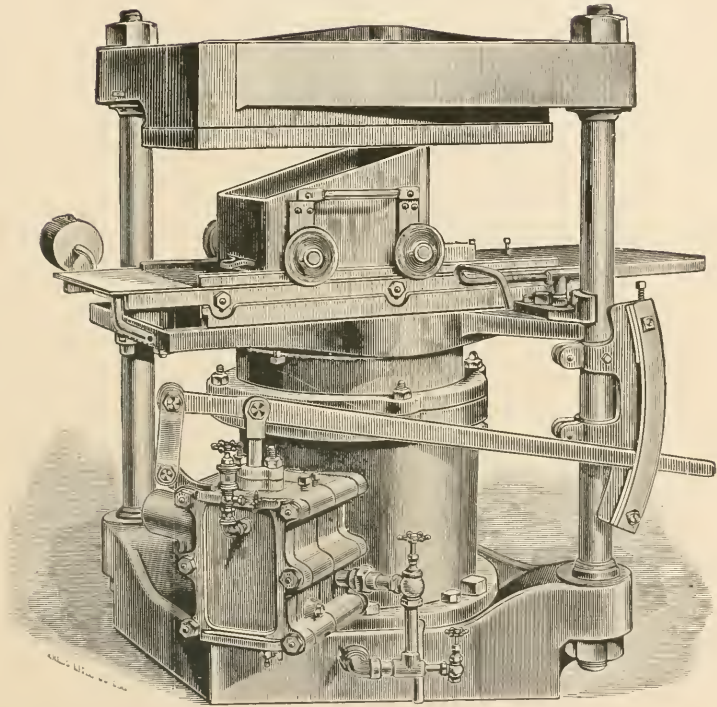


Fig. 165. Former for Cotton Seed Cake.

Estimates of the profits from a well designed mill in good and bad years are shown below:—

Product of one ton of seed, and the results in a good year :

Oil, 40 gals. at 20c. per gal.	\$ 8.00
Meal, 675 pounds at \$1.00 per cwt.	6.75
Hulls, 950 pounds at \$3.00 per ton	1.42
Lint, 30 pounds at 4c. per pound	1.20
Total	<u>\$17.37</u>
Cost of seed in mill	\$10.00
Cost of working, bagging, etc.	3.00
Cost of fuel . . . . .	.75
Profit	<u>\$3.62</u>

or say in round numbers \$3.50, which on 5,000 tons seed = \$17,500.

For the same mill in a bad year:—

Oil, 40 gals. 15c.	\$ 6.00
Meal, 675 pounds at 90c. per cwt.	6.08
Hulls, 950 pounds at \$2.50 per ton	1.19
Lint, 30 pounds at 3½c.	1.05
Total	<u>\$14.32</u>
Cost of seed in mill	\$10.00
Cost of working, bagging, etc.	3.00
Cost of fuel . . . . .	.75
Profit	<u>\$0.57</u>

In round numbers, say 50 cents per ton on 5000 tons=\$2500.

No provision is made for depreciation, and wear and tear of the plant: at least five per cent. should be estimated for this. The plant being worth about \$50,000, five per cent. on this would thus absorb the profit in a bad year, but leave thirty per cent. profit in a good one.

These figures all apply rather in the Atlantic states than west of the Mississippi river. They apply also to the oil mill business alone. As a matter of fact the best modern plants in the East comprise in one factory a ginnery, an oil mill and fertilizer works, each of which departments helps the others out.

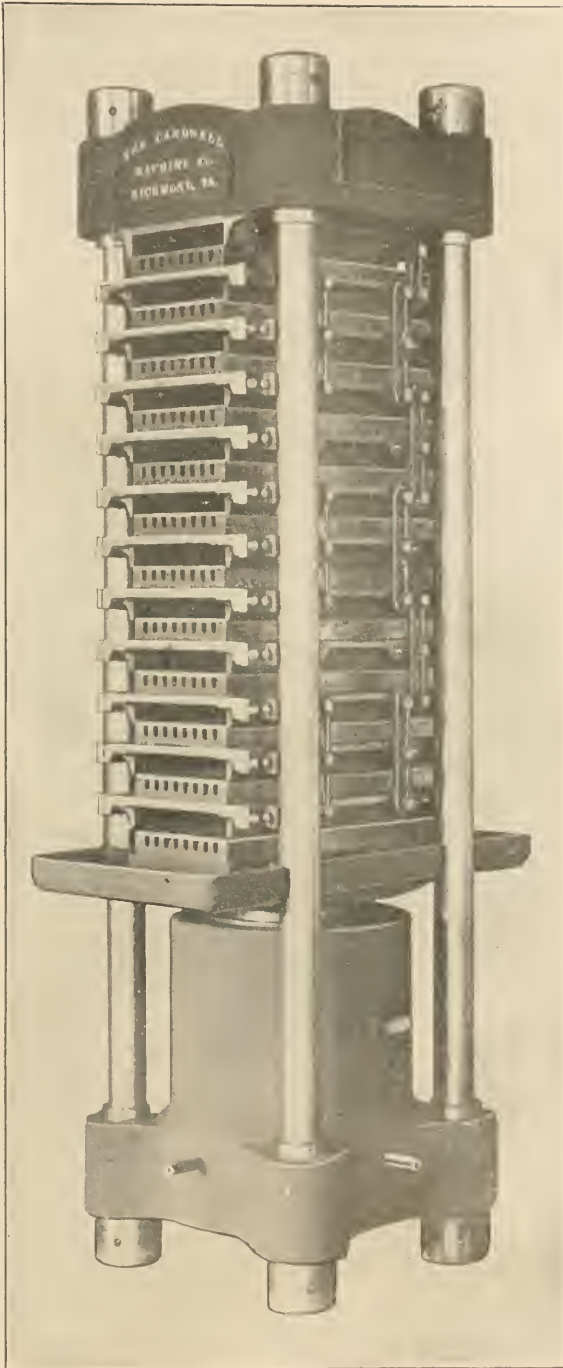


Fig. 106. Cotton Seed Oil Press.

I am indebted to the Stillwell-Bierce & Smith-Vaile Co. of Dayton, Ohio, for several illustrations in this chapter, Figs. 152, 159, 160, and 170; also to the Cardwell Machine Co. of Richmond, Virginia, for Figs. 158, 162, 166, 167, and 169, also to Mr. D. A. Tompkins of Charlotte, N. C., for some of the plans of mill plants.

Cotton Seed and Meal as Fertilizers. The rapid extension of oil mills has not been an unmixed blessing to the South.

In the lint itself, there is very little matter which impoverishes the soil by removal, but the seeds, especially the inner meats, contain much valuable plant food, and the removal of them from the land either means gradually reduced fertility or the replacement of these materials by artificial manures to keep the soil up to the required standard.

The colored, or for that matter, the white, tenant farmer, having an opportunity given to him by the establishment of an oil mill, now sells his seed regardless of consequences. His tenure of the land is uncertain; if he leaves the seed, it may be for the benefit of some one else; the temptation of \$4.00 to \$5.00 for the seed from one bale is more than he can resist in the usual state of his exchequer, thus the land suffers. This is especially the case with a negro, who will sell all he can and beg seed for sowing next season. He has to buy commercial fertilizers later which are charged up to him by his merchant on credit at a far greater price than he got for his seed.

The most logical and sensible system would be, as has been suggested by many students of this subject, for the farmer to loan his seed to the oil mill, for them to remove the hulls, and extract the oil, returning him the meal, with such adjustment of weights exchanged as would be mutually satisfactory. The greatest fertilizing constituents being in the meal, and the least in the lint, the hulls, and the oil, the farmer thus retains for his land that which is of the greatest benefit to it. This is already done in some instances, only 100 pounds of meal being given for each ton of seed.

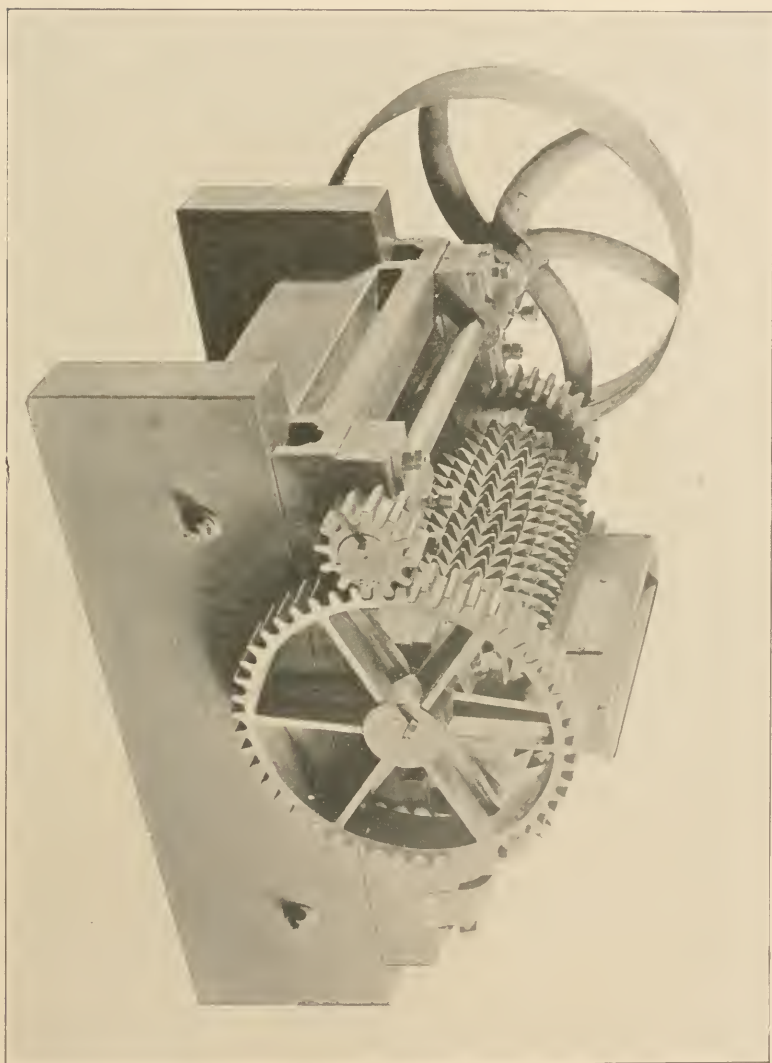


Fig. 167. Cotton Seed Oil Cake Breaker or Cracker.

Cotton seed meal contains the three important fertilizing elements, nitrogen, phosphoric acid and potash. It cannot be washed out of the soil like soluble fertilizers, yet its fine mechanical condition enables it to quickly decompose into such substances that the plant can rapidly avail itself of its contents of plant food.

One analysis of cotton seed meal showed : —

Water	7.50 per cent.
Crude fat	9.26 “
Albuminoids or protein	47.29 “
Nitrogen, free extract	24.39 “
Fibre	4.53 “
Ash or mineral matter	7.03 “
	<hr/>
	100.00

This seven per cent. and upwards of ash or mineral matter contains the phosphoric acid and potash. Out of the 7.03 per cent. of ash about two-thirds is made up of these two ingredients. Cotton seed meal contains about two and three-fourths per cent. of phosphoric acid and about one and three-fourths per cent. of potash. The protein or albuminoids contains nitrogen, which is such a valuable ingredient in fertilizers. Cotton seed meal usually runs from 6.6 per cent. of nitrogen to 7.8 per cent. of nitrogen. The latter figure is unusually high, but during a good crop year, when the seed is secured in the best condition, the nitrogen contained in it is inclined to run high. More thorough separation of the hulls from the meal, and more complete extraction of the oil, naturally give a higher proportion of nitrogen in the meal. The mills have now realized this, which is shown by the determination of nitrogen made in many cotton seed meals analyzed during the past few months by the State chemist of Georgia, the law in that State requiring in cotton seed meals at least seven and one-half per cent. of ammonia calculated from the nitrogen present. This seven and one-half per cent. requirement of ammonia is equivalent to 6.18 per cent. of nitrogen. Germau

observers have estimated the effect of cotton seed meal as a fertilizer as being fifty per cent. the first year, thirty per cent. the second year, and twenty per cent. for the third year. Of course, in very dry seasons the advantage of cotton seed meal is not so marked as with a fair amount of moisture; this, however, is true to some extent of all fertilizers. Cotton seed

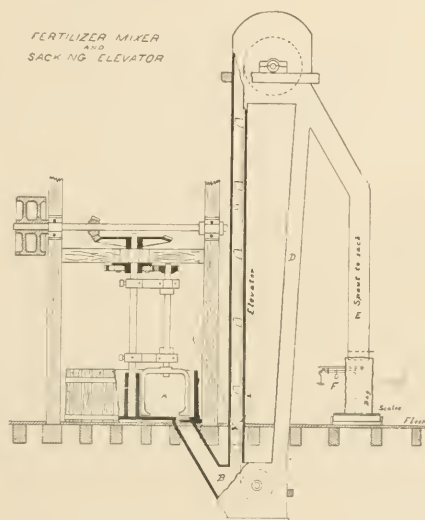


Fig. 108. Fertilizer Mixer and Sacker.

meal, as stated before, for the best results from an economical standpoint, should be first used as a feed and the resulting manure then used as a fertilizer. In feeding cotton seed meal alone, it is far too rich for that purpose, its nutritive ratio being very high. The percentage of protein present in cotton seed meal is quite large, and it has been ascertained that to secure the best results in cattle-feeding, the amount of

digestive protein fed should always be accompanied by a certain proportion of digestible non-nitrogenous material made up of crude fibre, fat and extractive. The crude protein is the nitrogenous portion of the food and is the most costly. Its chief work is the production of flesh and muscle. Cotton seed meal fed alone is apt to produce "scouring" and digestive disturbance, hence the necessity of feeding it with less rich food is well understood.

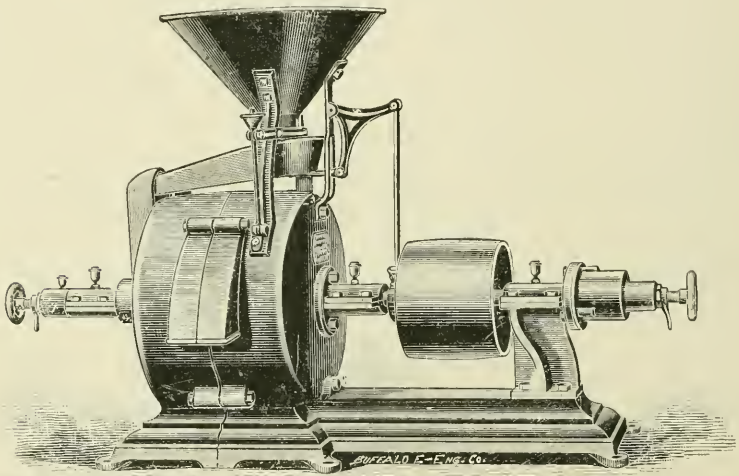


FIG. 109 Cake Grinder or Burr Mill.

Rich as the cotton seed meal appears and poor as the hulls seem in comparison, yet within the last few years cotton seed hulls have come to the front as a valuable cattle food. While apparently so dry, tasteless and devoid of nourishment, chemical analysis shows that they yet contain substances of much value.

The producers of cotton-seed oil formerly used their hulls as fuel, and do so now whenever the demand for the hulls is

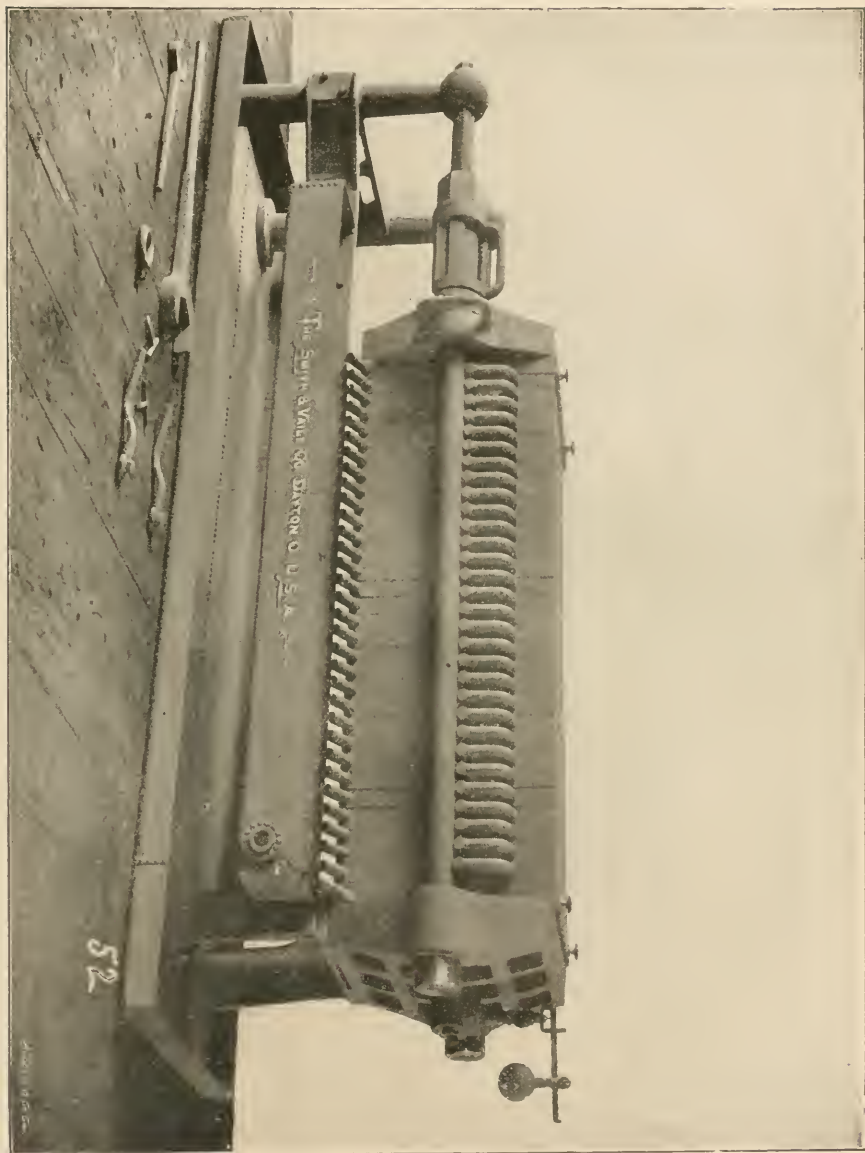


Fig. 170. Filter Press for Cotton Seed Oil.

not great enough to keep up with the supply. Cotton seed hulls contain in every 100 pounds according to one analysis :—

Moisture	7.25	pounds.
Ash	2.88	“
Crude protein	3.75	“
Crude fiber	42.83	“
Fat	1.54	“
Non-nitrogenous extractive matter,	41.75	“
	<hr/>	
	100.00	

An English Cotton Seed Oil Mill. It may not be inappropriate here to give a description of an English cotton seed oil mill. There is a large quantity of cotton seed shipped to England from Egypt, and also from Brazil, the United States, and other cotton growing countries. The Egyptian seed is black and smooth without the short fibres found on American seed. The Indian and Brazilian seed have this short fibre. Occasionally delinted seed is shipped to England, the object of removing the lint before shipment being to prevent the seed heating and firing in transit. The centres of the oil pressing industry in England are Hull and Liverpool. In one of the Liverpool cotton seed oil mills which has a floor area of about 25,000 square feet, and a capacity of dealing with thirty tons of seed in each twenty-four hours, the machinery is operated by a twenty-eight feet by eight feet Lancashire steel boiler working at 150 pounds pressure driving a 360 indicated horse power central valve engine. This engine at present only works eight presses, but is calculated to operate sixteen presses and cleaning machinery so as to treat sixty tons of seed daily.

The seed is first of all carried by a nine-inch worm conveyor to the cleaning reel, fifteen feet long. The seed passes from this reel to what is known as Crawford's patent cotton seed cleaning machine, or delinting machine, for removing the lint, which is a conically shaped circular brush covered with steel bristles six inches long. This brush revolves 650

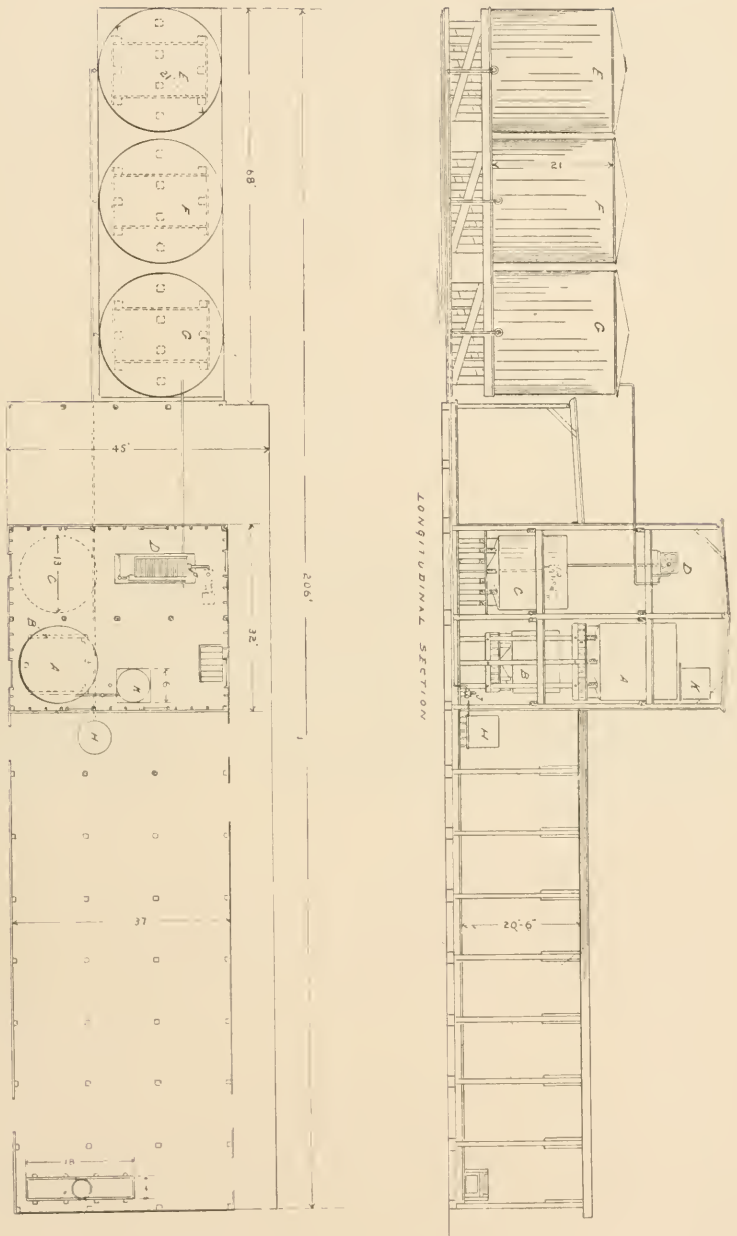


Fig. 171. Cotton Seed Oil Refinery—Section and Plan.

times per minute, is thirty inches in diameter at the upper end and forty-two inches at the lower end. It is entirely surrounded by a hood so arranged as to be set a short distance from the end of the bristles, and the interior of the hood is surfaced entirely with emery. By the high speed of revolution of the brush against the stationary cover, the lint is rubbed from the seeds, the latter drop down to a conveyor and are elevated to the highest part of the building. They are then allowed to fall by their own weight into what are known as Sutcliffe's centrifugal dressing machines, in which the lint is separated from the seeds by an air current. The lint passes forward to a gin following the centrifugals, while the seed falls through the centrifugals to a conveyor, and is again elevated to what is known as a juggler. These jugglers are merely perforated zinc or steel sieving tables which are given a reciprocating motion so as to separate cleaned from uncleaned seed. The clean seed is conveyed from the juggler to an automatic weighing machine which registers once for every sixty pounds of seed passing into the oil mill proper. The uncleaned seed which has not passed through the sieve on the juggler is gradually shaken into another conveyor which takes it back to the reel from whence it started and it goes through the whole of the processes again. It was stated above that the lint from the cleaners, after being separated from the seed at the centrifugals, was passed through a gin. There is one gin to each two centrifugals and their object is merely to run the lint through at a rapid rate and throw out any of the few seeds which may have escaped the centrifugals. The lint is then bagged up; as it has been removed by such a severe process, this lint is not as valuable as that obtained by a linter gin.

It will be seen that in this arrangement almost everything is automatic, that the conveyors and elevators require very little attention and yet perform their work in an admirable manner.

There are not many English mills equipped with this system of separating lint from the seed. Probably more of the mills have the ordinary saw linter, such as is in use in the United States, while a number of others do not consider the lint to be worth the trouble of removing from the seed, and merely pass the seed through a dilute acid bath afterward heating the seed. This takes off all the short fibres adhering to the seed, and it is then dealt with exactly as is Sea Island or Egyptian smooth seed.



Fig. 172. Sulphuric Acid Works.

The equipment in the oil mill proper is very similar to that in an American mill, and the description which has been given will apply almost exactly, excepting with reference to machinery for hulling the seed; this goes directly to two sets of press rolls, five high, forty-six inches wide, and sixteen inches in diameter. These are chilled rolls: the top one is fluted and the other four are smooth. After the seed has been crushed it is conveyed to an edge runner grinding mill, eight feet in diameter, twenty inches thick, made of grit stone rotating on a stationary iron pan, and, being of a tremendous

weight, effectively pulverizes the seed and hulls; thence these are carried by means of elevators to a cooker. There is only one of these cookers together with an automatic cake former. In connection with the cooker or kettle are operated eight hydraulic presses, each with sixteen plates three feet by seventeen and one-half inches, with sixteen-inch rams. After the cakes have been pressed they are removed to an automatic cake paring machine, three feet wide, with two traveling knives. The parings from the cakes drop into a conveyor and are automatically carried under the heavy pressure of an edge runner smaller than the preceding one, and after being pulverized are carried back to the cooker. As has been before stated this machinery is erected to deal with thirty tons per day while the cleaning mill machinery handles double that amount.

After the crude oil has been expressed from the seed it is pumped to a mixing tank where it is warmed and lowered to a bleaching tank. After this it is pumped to the storage tanks.

It is sometimes stated that English mills get more gallons of oil and pounds of meal than American, but it must be borne in mind that owing to the existence of different circumstances a fair comparison cannot be made. It takes nearly 3,000 pounds of seed, as it comes from the gin, to make a ton of seed in England, as there is first the loss of lint (about thirty pounds) and the English ton is 2240 pounds. Then English cake includes all the hulls, which is about fifty per cent. of the weight, and from a given amount of seed the yield of oil is less and the quality not so good from the delinted seed as from the decorticated seed. The first cotton seed oil mills in America used the English presses, but at the present time are using presses that are greatly improved, while English mills still follow the old system, and it would seem that it was more economical to manufacture the oil in America and ship only the oil and meal and save freight on the almost worthless hulls.

The oil mill business in England is not on the increase, as the risk of fire in cotton seed in transit to that country is



Fig. 173. Selling Cotton on the Street.

great, while another and perhaps a greater disadvantage is in the freight, which has to be paid on the raw seed instead of on the manufactured oil which occupies very much less bulk. The tendency is for oil mills to become established in the country where cotton is grown, just as is the tendency of cotton mills for the manufacture of coarse goods.

Delinting Cotton Seed. For several years past efforts have been made to export cotton seed from the United States, and to do this all the lint must be removed to prevent heating while in transit across the ocean. On its face the business looks very profitable, but there are many difficulties to overcome, and not the least of these is cleaning or delinting the seed. The oil mills remove a part of the lint, but to prepare seed for export it must be entirely denuded of lint, and present the appearance of the Sea Island cotton seed, or, as it is sometimes called, "black" seed, to distinguish it from the green seed of the short staple cotton. The saws of the gin alone will not do this, and the most successful machines so far have removed the lint by passing the seed through a series of emery or corundum discs. Many machines have been introduced for this purpose, but few are successful.

The oil mills in America do not want the seed entirely delinted, as the hulls and meats cannot be as easily separated as when there is a little lint left on the hull.

Prices of Cotton Seed Products. The prices on cotton-seed products in January, 1898, were:—

New York, cotton-seed oil crude, nineteen cents; crude, loose, f. o. b. mills, fifteen and one-half to sixteen cents; summer yellow, prime, twenty-two and one-half to twenty-three cents; summer, off grade, twenty-two cents; yellow, butter grades, twenty-five to twenty-six cents; white, twenty-five cents; winter yellow, twenty-eight to twenty-eight and one-half cents; salad oil, twenty-nine to thirty cents. All above prices per gallon. Cotton-seed meal, \$19.50 per ton. Soap stock, one-half cent to five-eighths cents per pound. Liverpool



FIG. 174. An Evening Scene near Atlanta, Georgia.

refined cotton-seed oil, 14s. 6d. per 112 pounds. American cake £5.10s.0d. to £6.0s.0d. per ton. Egyptian cotton-seed, £4.13s.9d. ton. New Orleans cotton-seed, \$7 per ton of 2,000 pounds net to the mills, no commission of any kind to be added; cotton-seed meal jobbing per carload at depot, \$16.50 to \$16.75 per short ton of 2,000 pounds; for export per long ton of 2,240 pounds f. o. b., \$18.25 to \$18.50; oil-cake for export, \$18.25 to \$18.50 per long ton f. o. b.; crude cotton-seed oil at wholesale or for shipment, strictly prime in barrels, per gallon, seventeen to seventeen and one-half cents; loose, per gallon, twelve to fourteen cents, according to location of mill; refined cotton-seed oil, prime in barrels per gallon at wholesale or for shipment, twenty-one to twenty-one and one-half cents; cotton-seed hulls delivered per 100 pounds, according to location of mill, ten to twelve cents; linters, according to style and staple two and three-eighths to three and one-half cents.

Prices of raw cotton of all varieties are given on the Liverpool price list inserted at page 288.



INDEX.

Where several page numbers are given for one subject the more important references are indicated by heavier type.

For references to different varieties of cottons see tables on pages 79 to 84.

For index of illustrations see pages 13 to 16.

A

Abbasi Cotton	66
African Cottons	64
Allan-Seed Cotton	57
American Cotton	56
American Cotton Belt	106
American Cotton Cultivation in 1832	102
American Locust	184
American Oil Mills	310
American Seaports Shipping Cotton	275
American Species of Cotton	22
Analysis of Cotton	39
Analysis of Cotton Seed Hulls	346
Analysis of Cotton Seed Meal	342
Analysis of Cotton Wax	42
Area of Available Cotton Land in the United States	126
Argentine Cotton	62
Ash from Cotton Fibres	39
Asia Minor Cotton	76
Australian Cotton	75

B

Bahia Cotton	61
Baling Cotton	202, 254
Baling Press	236
Bamia Cotton	66
Battery of Cotton Gins	224
Benders Cotton	57
Bengal Cotton	69
Biblical References to Cotton	95
Bills of Lading	275
Bloom in Cotton	89
Bolls	28

Boll Worm of Cotton Plant	172
Botany of Cotton	17
Boweds Cotton	58
Brazilian Cotton	60, 88, 262
Bremen Cotton Market	296
Breaking Up Land for Cotton	132
British and French Guiana Cottons	60
Branch Cotton	72
Bye Product of Cotton Seed	309
C	
✓ Cake Cracker and Grinder	326
Caterpillar of Cotton Plant	176
Cattle Feeding	328
Ceara Cotton	61
Cellulose	39
Chemical Composition of Cotton	39
Central American Cotton	59
Charges for Ginning	216
China Cotton	74
Chopping Out	152
Churka Cotton Gin	234
C. I. F. Cotton Contract	292
Classification of Cotton	85
Cleaning Cotton Seed	314
Clearing Land for Cotton	126
Climate of the American Cotton Belt	108
Coconada Cotton	77
Cold Drawn Cotton Seed Oil	318
Colored Cotton	77
Colored People of the American Cotton Belt	112, 162
Composition of the Cotton Fibre	39
Compressing Cotton Bales	246
Consumption of Cotton in the United States	285
Consumption of American Cotton in Europe	302
Continental Cotton Markets	296
Cooker	318
Cost of Cotton Seed Oil Mills	336
Cost of Raising Cotton	304
Cost of Raising Sea Island Cotton	199
Cotton as an Article of Commerce	274
Cottons According to Quality	54
Cotton Bagging	254
Cotton Baling	236, 258
Cotton Bale Dimensions	258
Cotton Batting	316

Cotton Belt of the United States	54, 106
Cotton Boll Weevil	186
Cotton Boll Worm	172
Cotton Caterpillar	176
Cotton Characteristics	78
Cotton Compress	248
Cotton Cost per Pound	304
Cotton Crop by States	128 , 298
Cotton Crops of the World	50
Cotton Cultivation, History of	92
Cotton Culture	129
Cotton Fables	96
Cotton Fibre	30
Cotton Fields of the World	49
Cotton Ginneries	214, 228
Cotton Gins	222
Cotton Imports into United States	300
Cotton Markets of Europe	288
Cotton Markets of the United States	274
Cotton Merchants	240
Cottons of the World	49
Cotton Picking	160
Cotton Picking Machines	166
Cotton Planting	142, 148
Cotton Rust	170
Cotton Seed and Meal as Fertilizers	340
Cotton Seed Meal	324, 340
Cotton Seed Oil Mill (English)	346
Cotton Seed Oil Mill Costs	336
Cotton Seed Oil Mills	310
Cotton Seed Oil Manufacture	314
Cotton Seed Oil Press	324
Cotton Seed Oil Refining	330
Cotton Seed Oil Uses	332
Cotton Seed Oil	309
Cotton Seed Oil Cake	326
Cotton Seed Products	310
Cotton Stalk Borer	184
Cotton Ties	256
Cotton Wax	42
Cotton Worm	176
Counts of Yarns for which Cottons are Suitable	78
Crop of American Cotton by States	128 , 298
Crop of Cotton per Acre	118
Cultivating the Cotton Plant	134, 156
Cultivation of Sea Island Cotton	188

Cut Worms	184
Cylindrical Bales	266
Cyprus Cotton	76
D	
Dacca Cotton	69
Damage to Crops	170
Damp in Cotton	41, 89
Dates of American Cotton Farming Operations	167
Delinting Cotton Seed	352
Dharwar Cotton	71
Dhollerah Cotton	72
Diameters of Cotton Fibres	78
Difference between Cotton and other Fibres	42
Dimensions of the Cotton Fibre	37
Diseases of the Cotton Plant	170
Dissolution of the Cotton Fibre	45
Distance Between Cotton Plants	134, 152
Distribution of American Cotton	284, 302
Duty on Cotton in Europe	297
Dye on Cotton, Effects of	48
E	
Egyptian Cotton	64, 87, 260
Egyptian Cotton in America	300
English Cotton Seed Oil Mills	346
English Mill Purchases of Cotton	290
Equipment of a Cotton Seed Oil Mill	312
European Cotton	76
European Cotton Markets	288
Exports of American Cotton	302
F	
Fertilizers and Fertilizing	137, 309, 340
Fibre Measurements	37
Fibres Other Than Cotton	42
Fire in Cotton Bales	264
Flax Fibres	42
Florida Sea Island Cotton	56
Flowers of Cotton Plant	28
Foreign Cotton Seed	146
Former for Cotton Seed Cake	322
Forward Delivery Contracts for Cotton, Liverpool	292
Freight on Cotton — Land and River	286
Freight on Cotton — Ocean	297
French Guiana Cotton	60
"Future" Cotton Sales in America	276
"Future" Cotton Sales in Liverpool	294

G	
Genoa Cotton Market	288
Genus of the Cotton Plant	17
Georgia Crackers	110
Gin Damage	226
Ginning	202, 214
Good Farming	129, 167
Gossypium Arboreum	17, 18, 21
Gossypium Barbadense	17, 18
Gossypium Herbaceum	17, 18, 23
Gossypium Hirsutum	17, 18, 21, 22
Gossypium Peruvianum	17
Gossypium Sandwichense	17
Gossypium Tahitense	17
Grades and Grading of Cotton	55
Greek Cotton	76
Gulf Cotton	57
H	
Handling Cotton	240
Havre Cotton Market	296
Heater	318
High Colored Cotton	77
Hindoo Cotton Gin	234
Hinghungbat Cotton	72
History of Cotton Cultivation	92
History of Cotton Cultivation in the United States	98
History of Cotton Ginning	202
Huller for Cotton Seed	318
Hulls	309, 318 , 346
I	
Immature Cotton	32
Imports of Cotton into the United States	300
Improvements in Baling	266
Indian Cotton	68 , 88, 260
Influence of Weather on Prices of Cotton	308
Inspection and Classification of Cotton in New York	279
Italian Cotton	76
J	
Java and Japanese Cotton	75
Judging Cotton	85
K	
Kidney Cotton	22
L	
Land Tenure in the Cotton Belt	114
Length of Staple	78
Levantine Cotton	76
Life History of the Cotton Plant	26

Linters and Linter Gins	309, 316, 348
Lint to Seed, Proportion	236
Liverpool Cotton Association and Cotton Market	289
Local Sale of Cotton	240
Long Stapled Cottons, Table of	79

M

Maceio Cotton	61
Machinery for a Cotton Seed Oil Mill	312
Mako or Maco Cotton	64
Maltese Cotton	76
Manures	137, 309, 340
Maranhm Cotton	61
Marks on Cotton Bales	272
Markets of the United States	274
Meal from Cotton Seed	324
Memphis Cotton	57
Methods of Baling Cotton	254
Mexican Cotton	59
Mexican Weevil	186
Microscopic Appearance of Cotton Fibre	30
Milan Cotton Market	296
Mill Purchases of Cotton, America	282
Mill Purchases of Cotton, England	289
Mitafifi Cotton	66
Modern Ginnery	230
Modern Ginning	214
Moisture in Cotton	41, 89
Mules on Farms	112

N

Nankin Cotton	77
Negroes in the South	112, 162
New Orleans Cotton	57
New Orleans Cotton Contract	278
New York Cotton Contract	278
Numbers of Yarns for which Cottons are Suitable	78

O

Ocean Freight	297
Ocean Shipment	252
Oil Refineries	330
Old-Time Ginning and Baling	203
Oomrawuttee Cotton	71
Operations of Cotton Culture	167

P

Paraiba Cotton	61
Peelers Cotton	57

People of the American Cotton Belt	109
Percentage of Lint	236
Persian Cotton	76
Peruvian Cotton	62
Peruvian Cotton in America	300
Picking Cotton	160
Planting Cotton	142, 148
Plant Lice	184
Plows	130
Poor Farming	167
Poor White Labor	110
Population of the American Cotton Belt	109
Preparation of Cotton for the Market	202
Preparing Land for Cotton	130
Product from One Ton of Cotton Seed	338
Production of American Cotton by States	128 , 298
Proportion of Lint	236
Pulling Staple	88
Purchasing Cotton in Liverpool	289
Prices of Cotton Seed Products	352

R

Red Cotton	77
Rental of Cotton Farms	114
Roller Gins	232
Rough Peruvian Cotton	63
Round Bales	266
Rust on Cotton Plants	170

S

Sampling Cotton	246
Sand in Cotton	40 , 89
Santos Cotton	61
Saw Gin, Construction of	222
Schweitzer's Solution, Action on the Fibre	45
Screw Press for Baling Cotton	204
Sea Island Cotton	55 , 87, 188
Seeds	142
Seeds in Cotton Pod	30
Selection of Cotton	85
Selection of Cotton Seed	142
Selling Cotton in New York	278
Selling Cotton in the Cotton Belt	240
Selling Cotton in Europe	288
Share System of Cotton Cultivation	116
Sharpshooters	184
Smyrna Cotton	77

South American Cotton	59
Southern Cotton Mills	116, 239
Spanish Cotton	76
Species of Cotton	17
Species of Cotton Grown in the United States	19, 22
Spot Cotton Sales in Liverpool	290
Spot Cotton Sales in New York	276
Staple of Cotton	88
Strength of the Fibre	48
Structure of the Cotton Fibre	30
Surat Cotton	73

T

Tables of Cotton Characteristics:	
Long Stapled	79
Medium Length of Staple	84
Medium to Long Stapled	80
Short Stapled	82
Tares of Cotton Bales	254
Texas Cotton	59
Thinning Out Cotton Plants	152
Tinged Cotton	89
Tinnivelly Cotton	72
Trade Names for Cottons	78
Tree Cotton	21
Trieste Cotton Market	296
Turkestan Cotton	74
Turkish Cotton	76

U

Unripe Cotton	32
Uplands Cotton	58
Uses of Cotton Seed Oil	332

V

Varieties of Cotton	54, 78
Varieties of the Cotton Plant	17
Vegetable Lamb	96

W

Weather, Influence on Prices	308
Weights of Cotton Bales	256
West Indian Cotton	60
Wool Fibre	42
World's Cotton Crop	49

Y

Yarns from Different Cottons	78
Young Cotton Plant	26

Crompton & Knowles Loom Works

WORCESTER, MASS.

LOOMS

FOR

COTTONS,
 GINGHAMS,
 WOOLENS AND
 WORSTEDS,
 CARPETS,
 SILKS,

AND

Every Variety of Woven Fabric.

BRANCH WORKS:

PROVIDENCE, R.I.

When writing to advertisers please mention this book.

WEAVING CALCULATIONS

FOURTH THOUSAND—Cloth, Crown, 8vo.

BY C. P. BROOKS.

Honours Medallist in Cotton Manufacture, late Examiner to the City and Guilds of London Institute for the advancement of Technical Education.

CONTENTS:

Cloth Calculations.	Winding, Spooling, Warping and Slashing Calculations.
Yarn Calculations.	Engine, Boiler, Shafting, and Speed Calculations.
Loom Calculations.	Specifications of Machinery.
Harness and Reed Calculations.	
Wage Calculations.	
General Textile Information.	

A complete work on the calculations required in the
Cotton Weaving Trade

Among the rules given are many never before published, and as no effort has been spared to make the book a complete collection of all Calculations whether intimately or remotely connected with the subject, it can be cordially recommended to those connected in any capacity with Cotton Manufacturing.

To be obtained in England, Price Five Shillings, from
E. and F. N. SPON, 125 Strand,
LONDON, E.C.

and in the United States of America, Price \$2.00, from
SPON & CHAMBERLAIN,
12 Cortlandt St., - NEW YORK CITY,

OR

C. P. BROOKS, LOWELL, MASS.

When writing to advertisers please mention this book.

Cotton Manufacturing.

SIXTH THOUSAND. Cloth, Crown, 8vo.

By C. P. BROOKS.

CONTENTS :

- The Weaving of Plain and Fancy Cloths. A Description of Looms, Tappets, Dobbies, Jacquards, Drop Boxes, and other Weaving Machinery.
Preparatory Process, Winding, Beaming, Ball, Sectional, and other Systems of Warping.
Sizing, Sizing Materials, Size Mixing, and Machinery.
- The varieties of Cloths, with particulars of the various Standard Makes of Plains and the production of Twills, Cords, Velveteens, Gauze, Leno, Pile Cloths, Double Cloths, Checks, Figured Dhooties, Jacquard Goods, etc.

...OVER SO ILLUSTRATIONS...

A work eminently adapted to the requirements of all engaged in the Trade, and invaluable to Technical Students in any Department of Textiles. It is extensively used as the Class Book for the subject of Cotton Weaving.

Price in England, Six Shillings, and in America, \$2.25.

To be obtained from the addresses named on previous page.

Josiah Gates & Sons,

MANUFACTURERS OF

Oak Tanned Leather Belting

Lace Leather. Picker Leather. Loom Strappings and Mill Supplies.

LOWELL, MASS.

When writing to advertisers please mention this book.

Wm. J. Matheson & Co., Ltd.

IMPORTERS OF

Diamine Colors

FOR

Cotton.

**New York,
Boston,
Philadelphia,
Providence,
Charlotte, N.C.
Montreal, Canada.**

Telegraphic Address :
"ASA," OLDHAM.

Telephone :
No. 7, OLDHAM.

ASA LEES & CO.

LIMITED.

Soho Iron Works,
OLDHAM.

MAKERS OF

ALL KINDS OF MACHINERY
FOR
Preparing, Spinning and Doubling
COTTON AND WOOL.

When writing to advertisers please mention this book.

Telegraphic Address—

"UNION"
MANCHESTER.

Postal Address—

BROOKS & DOXEY,
MANCHESTER.

BROOKS & DOXEY,
UNION & JUNCTION IRON WORKS,
MANCHESTER, ENGLAND.

Cotton, Wool and Cotton

Waste Machinists,

PATENT HOPPER FEEDS.

PATENT OPENERS AND SCUTCHERS, with self-lubricating pedestals and improved arrangement for setting the bars.

REVOLVING FLAT CARDING ENGINE, Flexible bend and improved setting arrangement.

DRAWING FRAMES.

SLUBBING, INTERMEDIATE AND ROVING FRAMES. Important Patented Improvements have recently been added to these frames, consisting of positively driven Differential Motion with spur gearing; improved construction of Cones, and Compensating Swing. The application of these improvements is very essential, as by their use a much more even roving is guaranteed.

RING SPINNING FRAMES for Warp and Weft, or Filling.

AMERICAN STANDARD RING TRAVELLERS for spinning and twisting, in steel or composition. Steel Flyers.

RING AND FLYER DOUBLING FRAMES, for sewing cottons, mendings, knittings, heald yarns, netting, etc.

FOR COTTON WASTE AND WOOL.

HARD WASTE BREAKERS.

BREAKER AND FINISHER CARDING ENGINES, with cross or other feeds, and improved Condensers.

SELF-ACTING MULES.

AGENTS:

W. L. HAINES & CO., 161 Pearl St., Boston, Mass.

FOR UNITED STATES AND CANADA.

When writing to advertisers please mention this book.

THE WHITIN MACHINE WORKS,

WHITINSVILLE, MASS.

S. W. CRAMER, SOUTHERN AGENT.

Builders of Cotton Machinery.

Cards, Railway Heads, Drawing Frames,
Spinning Frames, Wet and Dry
Twisters, Spoolers, Reels,
Long Chain Quilling
Machines, Looms.

STODDARD, HASERICK, RICHARDS & Co.,

BOSTON, MASS., & BRADFORD, ENG.

BANKERS

AND

IMPORTERS

ALL STYLES OF

Textile Machinery,
Mill Supplies,
Egyptian
Cotton.

CARVER & CO., CARVER BROS. & CO.,
Alexandria, Liverpool.

Correspondence Solicited.

TEXTILE MACHINERY.

SOLE REPRESENTATIVES FOR

PRINCE SMITH & SON, Worsted Machinery,
Preparers, Gillboxes, Drawing, Spinning,
and Twisting.

TAYLOR, WORDSWORTH & CO., Wool-
washers, Cards, Backwashers, Gillboxes,
and Noble Combs.

DOBSON & BARLOW, Ltd., Cotton Machin-
ery, "Simplex" Cards, Heilman Combers,
Self-Acting Mules, Fly Frames, Cone
Winders, Gassing Frames.

SAMUEL LAW & SONS, Ltd., Cotton, Wool-
en and Worsted Card Clothing.

SOCIETE ALSACIENNE DE CONSTRUCTIONS
MECHANIQUES, Worsted machinery
on French system.

W. H. WHITELEY & SONS, Woolen Mules,
Tentering and Drying Machinery.

J. & T. BOYD, Twisters, Spoolers and Re-
coublers.

And Many Others.

When writing to advertisers please mention this book.

WILLIAM FIRTH,

IMPORTER OF

Textile Machinery,

EQUITABLE BUILDING,

150 Devonshire St.,

BOSTON, MASS.

SOLE IMPORTER OF

Hetherington's Patent Revolving Top-Flat Carding Engines,

**Combing Machines, Drawing Frames, Roving Frames
and Self-Acting Mules.**

Curtis Sons & Co., Patent Worsted Card, Woolen Cards and Mules.

Also, Worsted Machinery, on French and English systems.

Wm. Tatham & Co., Vulcan Works, Rochdale, England, makers of Waste Machinery for Working Hard and Soft Waste, Cop Bottoms, etc.

James Yates & Son, Hardened and Tempered Steel Card Clothing for Woolen and Worsted Cards.

Joseph Stubbs, Manchester, England, Maker of Patent Quick Traverse Gassing Frames for Cotton, Worsted and Silk Yarns; Yarn Preparing Machines; also, Patent Adjustable Yarn Clearer for Winding Frames.

When writing to advertisers please mention this book.



THE AMERICAN DROSOPHORE CO.,

WM. FIRTH, Manager.

150 Devonshire Street, Boston.

The DROSOPHORE makes a perfect Spinning or Weaving atmosphere in any climate or weather. Any degree of Humidity is obtainable. Will warm the air in cold weather and cool it in hot weather. Purifies the air, and is healthier for the workpeople.

FOUR GOLD MEDALS AWARDED.

Amiens	1894
Reims.	1895
The only Humidifier that stood the test.	
Atlanta Exposition	1895
Rouen	1896

The Gold Medal Double Nozzle Drosophor

has no wearing parts, uses less water, gives a finer spray and more humidity than any other form of Humidifier.

The above Company has delivered since February, 1895,
over 6000 of these machines.



When writing to advertisers please mention this book.

T. C. ENTWISTLE,

MANUFACTURER OF

**PATENT WARPING, BALLING,
AND BEAMING**

MACHINES.

ALL KINDS OF

**Common Expansion Combs for Warpers,
Beamers, and Slashers, and Traverse
Wheel Card Grinders for Ameri-
can or English Cotton,
Woolen or Worsted
Cards.**

Cor. Market and Worthen Sts.,

LOWELL, MASS.

When writing to advertisers please mention this book.

FREDERICK GRINNELL, President.

F. W. HARTWELL, Treasurer.

FRANK B. COMINS, Vice President and General Manager.

THE UNITED STATES
Aerophor Air-Moistening and Ventilating Co.
PROVIDENCE, R. I.

Making a specialty of Humidification, we are prepared to advise as to the best introduction of a Humidifying System.

THE AMERICAN "VORTEX" HUMIDIFIER,
THE ONLY PERFECT SYSTEM

For moistening the air, and maintaining a proper "condition" in all departments of textile manufacture. It moistens, washes, cools or warms the atmosphere of a room. It has no moving parts and is rapid in action. The "Vortex" distributes a finer spray and is of greater capacity than any other moistener. Our Single Nozzle gives better results than any other form of Nozzle in the market. Can be applied to present systems having a feed and return pipe.

CORRESPONDENCE SOLICITED.

Incorporated June 4, 1890.

American Card Clothing Company,

GENERAL OFFICES:

WORCESTER, MASS.

SEND ORDERS TO FACTORIES:

WORCESTER, LEICESTER, NORTH ANDOVER, LOWELL, WALPOLE, MASS.,
PHILADELPHIA, PA., PROVIDENCE, R. I., MANCHESTER, N. H.

Manufacturers of every description of

CARD CLOTHING.

Exclusive American Licensees for the

PATENT FLEXIFORT CARD CLOTHS.

Special attention given to Clothing for Revolving Top Cards.
Experts furnished to clothe and start the same.

When writing to advertisers please mention this book.

THE METALLIC DRAWING ROLL CO.,

INDIAN ORCHARD, MASS.

Sole Manufacturers of

Patent Metallic Drawing Rolls,

In United States and Canada.

Used on all processes up to and including slubbers. We Guarantee 25 per cent. more production than can be obtained from the leather covered roll, rolls being same diameter and running same speed.

ALL WORK GUARANTEED.

For prices and particulars write to

THE METALLIC DRAWING ROLL CO.

INDIAN ORCHARD, MASS.

When writing to advertisers please mention this book.

COTTON

Feeders, Openers, Lappers,
Waste Cleaners, Automatic Cleaning
Trunks, Thread Extractors.

WOOL

Picker Feeders, Church's Patent
Wool Washers, Automatic Dryers and
Carbonizing Machines.

SHODDY

Pickers of Kitson, Butterworth and
English patterns, Rag Dusters.

KITSON MACHINE CO.

BUILDERS OF

PREPARING MACHINERY FOR

COTTON, WOOL ^{AND} SHODDY,

LOWELL, MASS.

STUART W. CRAMER, Southern Agent,
CHARLOTTE, N.C.

When writing to advertisers please mention this book.

ESTABLISHED 1856.

A. LINDLEY & SONS,
Leather Manufacturers,
STALYBRIDGE, ENGLAND.

SPECIALITIES :

Welsh and English Roller Skins,

For Low, Medium and Fine Numbers.

Persian Skins,

For Comber Rolls.

OUR CELEBRATED

Crown Brand Red Skin,

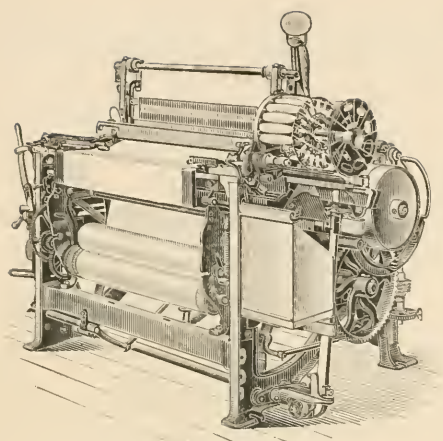
For all Speeder Rolls and for Spinning Rolls for low numbers.

When writing to advertisers please mention this book.

Those who equip new or
old cotton mills with
machinery for

Spinning,
Spooling,
Warping,
Twisting

OR



OUR NORTHROP LOOM.

WEAVING

must consult with us for their own best interests.

We have doubled the production of one room in the mill by the introduction of the Sawyer and Rabbeth types of Spindle, the Doyle and Rhoades-Chandler Separator, and the Double Adjustable Spinning Ring.

We are now engaged in DOUBLING the production per operative of another room in the mill by our Automatic and Self-protecting Loom.

Those who hesitated about the adoption of our Spindles have seen the error of their ways.

A word to the wise is sufficient,

THE DRAPER COMPANY,
HOPEDALE, MASS.

When writing to advertisers please mention this book.

The S. Blaisdell, Jr. Co.

EGYPTIAN AND PERUVIAN

COTTON

American Long Staple a Specialty.

Shipments direct to Mill from Egypt, Peru and all American Southern Points.

Cotton waste purchased on yearly contracts from mills. All grades cotton waste packed expressly for export.

CHICOPEE, MASS.

GEO. C. SMITH,

Cotton Commission

MILLEDGEVILLE, GA.

BRANCHES:

Covington,	Eatonton,
Gainesville,	Monticello,
Monroe,	Dublin,
Social Circle,	Sparta,
Louisville, Ga.	

Special attention to Spinners orders.

Correspondence Solicited.

WM. B. CHARLES

Cotton and Wool Merchant,

AMSTERDAM, N.Y.

Contracts made with Cotton and Woolen Mills for yearly waste production.

CORRESPONDENCE SOLICITED.

Cotton Wastes of all kinds packed for export. Selected Linters for the batting trade.

C. GRIESENBECK,

Cotton Commission,

SAN ANTONIO, TEXAS.

Address, Post Office Box 464.

THE BERLIN IRON BRIDGE CO.

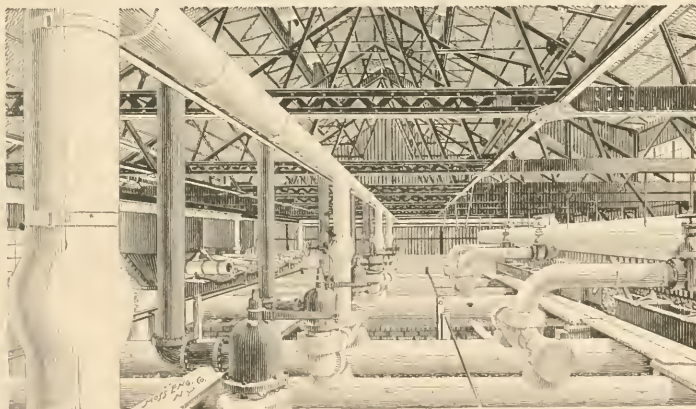


The above illustration is taken direct from a photograph and shows the construction of a Parabolic Truss Bridge designed and built by us connecting the cities of Saco and Biddeford, Me.

ENGINEERS, ARCHITECTS BUILDERS

OF

IRON AND STEEL BRIDGES, BUILDINGS AND ROOFS.



The above illustration is taken direct from a photograph and shows the construction of a Boiler House Roof designed and built by us for Cheney Bros., at South Manchester, Conn. The construction is entirely of Iron, the Roof being covered with our Patent Anti-condensation Corrugated Iron Covering, which we guarantee will not drip or sweat under all changes of temperature.

Office and Works: East Berlin, Conn.

When writing to advertisers please mention this book.

E. A. SMITH,
President.

J. P. WILSON,
Sec. & Treas.

The Charlotte Supply Co.

General Mill Furnishers

DEALERS IN

Machinery, Machinists' Tools

AND MANUFACTURERS OF

Leather Belting.



CHARLOTTE, N.C.

CABLE AND TELEGRAPHIC ADDRESS:
" PELICAN, BOLTON."

A1 TELEGRAPHIC CODE USED.

LOCAL ADDRESS: BULLOCK ST.

GEORGE FELL & SON,

Manufacturers of every kind of

Welsh, English, Persian,
and Calf Roller Skins.

PELICAN LEATHER WORKS

BOLTON, ENGLAND.

Sole Agents for the United States
STODDARD, HASERICK, RICHARDS & CO.,
BOSTON, MASS., U.S.A.

Talbot Dyewood and Chemical Co.

Works at
North Billerica,
Mass.

MANUFACTURERS OF

Extract of Indigo,

⌘ **Chemicals,
Acids,
Dyewoods.**

LOWELL, MASS.

When writing to advertisers please mention this book.

Saco and Pettee Machine Shops,

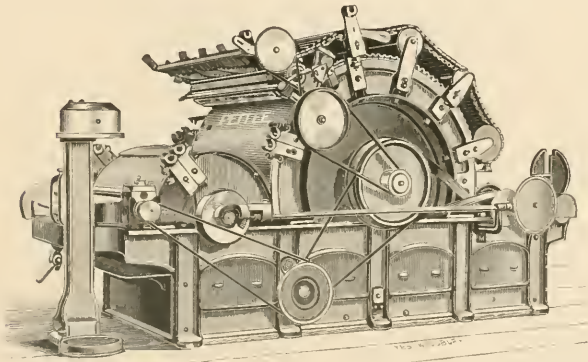
MAIN OFFICE:

Newton Upper Falls, Mass.

COTTON MACHINERY

OF THE

Latest Improved Pattern.



Revolving Flat Cards,
 Railway Heads,
 Drawing Frames,
 Spinning Frames.

Slubbing,
 Intermediate and
 Roving Frames,

WORKS AT

BIDDEFORD, ME.

NEWTON UPPER FALLS, MASS.

SEND FOR ESTIMATES AND PRICES.

When writing to advertisers please mention this book.

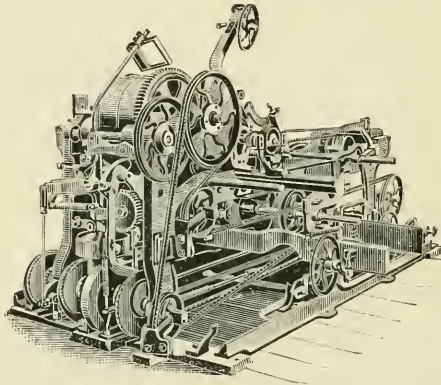
C. E. RILEY & CO.

281-285 CONGRESS STREET - - BOSTON, MASS.

SOLE IMPORTERS OF

Asa Lees & Co's Patent Self-Acting

COTTON MULES.



Over 600,000 Spindles at work in the United States.

These Mules are durable, simple to operate, free from Breakdowns and Stoppages.

They produce the greatest quantity and best quality and effect a great saving in cost of production.

They give universal satisfaction to both the manufacturer and spinner.

SEND FOR DESCRIPTIVE CIRCULARS AND LIST OF USERS.

SOLE IMPORTERS OF

HOWARD & BULLOUGH, Ltd., Cotton Machinery.

HALL & STELLS, Worsted Machinery.

HOYLE & PRESTON Noble Combs, Backwashers, etc.

J. HAIGH & SONS', Woolen Machinery.

T. BROADBENT & SONS' Hydro-Extractors.

F. J. GRÜN, French System of Worsted Machinery, etc.

J. GREENHALGH & SONS' Willows.

J. WHITELEY & SONS' Card Clothing for Cotton Cards.

L. M. TETLOW & SONS' Card Clothing for Woolen and Worsted Cards.

EGYPTIAN COTTON.

SOLE AGENTS FOR PEEL & CO., ALEXANDRIA SHIPPERS.

When writing to advertisers please mention this book.

HOWARD & BULLOUGH
AMERICAN MACHINE CO., LTD.
 PAWTUCKET, R.I.

BUILDERS OF

COTTON
MACHINERY.

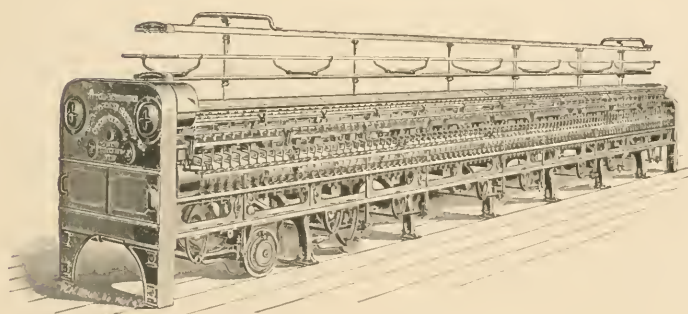
BALE BREAKERS.

FEEDERS.

SELF FEEDING OPENERS.

BREAKER, INTERMEDIATE AND

FINISHER LAPPERS.



REVOLVING FLAT CARDS.

DRAWING FRAMES.

SLUBBING, INTERMEDIATE AND ROVING FRAMES.

SPINNING FRAMES.

WARPERS AND SLASHERS.

WE INVITE INVESTIGATION AND COMPARISON.

When writing to advertisers please mention this book.

TELEGRAPHIC ADDRESS, "PLATTS," OLDHAM.

PLATT BROS. & CO., LTD.**HARTFORD WORKS, OLDHAM, ENGLAND,**

Makers of Machinery, in great variety for

**Ginning, Opening, Preparing, Combing, Spinning, Doubling
and Weaving****COTTON, WOOL, WORSTED, SILK WASTE, ETC.**

INCLUDING

Patent Macarthy Cotton Gins, for long or short stapled Cotton.
 Improved Cotton Bale Breakers or Pulling Machines.
 Hard Waste Breaking-up Machinery.
 Improved Self-Acting Willow.
 Patent Automatic Hopper Feeder, with Filling Apparatus.
 Improved Lattice Feeding Machines.
 Crighton's Opener, with Improved Feeder.
 Patent Exhaust Opener and Lap Machine.
 Dust Trunks, with Patent Traveling Ribbed Cloth or Grid.
 Scutchers, with Patent Pedal Regulators, etc.
 Roller and Clearer Carding Engines.
 Patent Revolving, Self-Stripping Flat Carding Engines.
 Carding Engines, with Condensers specially adapted for coarse yarns from cotton waste, etc.
 Carding Engines and Condensers for Wool, etc.: Martin's, Bolette's, Sachsische, and other systems.
 Card Grinding Machines.
 Patent Machinery for Carding and Spinning Silk Waste.
 Patent Burring Machines for Wool.
 Combing Machines, Heilman's, Patent; also Whipple's Patent.

Combing Machines for Wool, Worsted, etc.; Little & Eastwood's Patent.
 Dugdill & Kershaw's Patent Silk Combers.
 Drawing, Slubbing, Intermediate and Roving Frames.
 Ring Spinning Frames, for Warp and Weft.
 Patent Self-Acting Mules and Twiners.
 Ring and Flyer Doubling Frames.
 Boyd's Patent Stop Motion Twisters.
 Chapon's Patent Cup Spinning Frames.
 Reeling, Winding, Warping, Beaming, Sizing and Dressing Machinery.
 Power Looms, for Weaving Dhooties (Broadhurst's Patent).
 Power Looms of All Description, for Plain and Fancy Cloths, in Cotton, Linen, Woolen, Worsted, Jute, etc.
 Cloth Folding and Measuring Machines.
 Hydraulic and Cam Bundling Presses for Yarn and Cloth.
 Coleby's Patent Bundling Presses.
 Vigogne and Cotton Waste or Barchant Machinery.
 Machinery for Preparing, Spinning and Weaving Asbestos.
 Worsted Preparing, Combing, Roving and Spinning Machinery, on both French and Bradford Systems.
 Patent Brick Making Machinery.

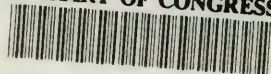
ETC., ETC.

**Agents for U.S.A.: MESSRS. EVAN A. LEIGH & CO., 35 & 36 Mason Bldg.,
BOSTON, MASS.**

*Manchester Office: 5 St. Ann's Square.**Glasgow Office: 109 Hope Street,***MR. RICHARD MURRAY, Agent.**

When writing to advertisers please mention this book.

LIBRARY OF CONGRESS



00009270498