to maintain a small flame, relieve N and push down E until the flow of gas through F just ceases; then slide the index I almost to the lower end of E, and upon the paper mark the point corresponding to the temperature of the bulb A. Place bulb A and a thermometer in a water-bath, with the burner beneath, and raise E. When the temperature of the bulb A is, say 50° C, lower E until the flow of gas through F just ceases, and make a mark on the scale for 50°, similarly fill out this scale to 100° C., and for higher temperatures employ an air-bath, or preferably a paraffin bath.

In using the apparatus, E is lowered until the gas through F is just cut off and the index is moved up or down the tube until it points to the figure marking the temperature of the atmosphere in which A is exposed. Having fixed the index, the tube E is raised until the index marks the temperature at which it is desired to maintain the bulb.

This adjustment of the index, whenever the regulator is used, eliminates the effect of the thermometer and barometric pressure upon the volume of air confined in A, B and C, and so corrects a defect existing in most instruments of this kind.

UNIVERSITY OF VIRGINIA.

INSPECTION OF COTTON FOR USE IN THE MANUFACTURE OF GUNCOTTON.[1]

BY CHARLES E. MUNROE.

Received August 2, 1895.

WHEN converting cotton into guncotton by immersion in mixed acids, as practiced in the Abel process, it is essential that the cotton should rapidly absorb the acid for if the portion that is taken for immersion be but slowly absorbent, it is likely when but partly saturated to rise to the surface of the acid and on exposure to undergo the rapid decomposition technically called "firing" To secure the desired result the cotton should be free from oil, grease, and any protecting body. Their presence not only diminishes the absorptive power of the cotton but they, in common with the knots, tangles, cops, hulls, seeds, or similar foreign bodies, promote decomposition. It is a common practice to

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[1] Read at the Brooklyn meeting.

use weaver's waste, or waste from the cotton gauze factories, in this manufacture on account of its cheapness and because it is found also that the thready form permits of ready handling in the hand-dipping and its compactness diminishes the amount of air which becomes entangled in the mass, as compared with that entangled in a similar mass of cotton "in the wool," and consequently the bouyancy of the mass is less.

Such waste necessarily becomes soiled with oil or grease, to a greater or less degree, during the carding and spinning, and it may contain besides knots, cops, tangles, and foreign bodies of various kinds, which latter are removed by means of the picker, while the oil and grease are removed by boiling with soda lye. Hence in determining the relative value of various samples of cotton offered for purchase, the relative amount of the grease, foreign bodies, and waste to be removed and of knots and tangles present, together with the general cleanliness of the sample, are to be considered.

Based on considerations such as these, the method of inspection is as follows:

1. Optical examination for color, cleanliness, presence of cops, knots, tangles, and foreign bodies, and for relative length and strength of fiber.

2. Odor.

3. Moisture, which is determined by drying a portion at 100° C. to constant weight.

4. Ether extract, which is determined by subjecting the weighed sample to the action of petroleum ether (boiling-point 50°–80° C.) in a Soxhlet extractor until the sample ceases to lose weight. The method of procedure is to expose the weighed sample in a light glass basket to ten automatic exhaustions, when it is removed, dried, and weighed. It is then returned to the extractor and subjected to five automatic exhaustions, when it is again dried and weighed. If it has lost weight by the last treatment the basket and contents are again returned to the extractor and exhausted three times and this treatment is repeated until the weight becomes constant.

The weight of the samples taken in the experiment varied between one and one and a half grams and the extractor had a capacity of forty cc. for each automatic exhaustion. The ether extracts the oily matters in the cotton, both those which occur naturally and those which it has absorbed in the processes to which it has been subjected.

5. Soda-lye extract, which is determined by boiling the weighed sample for eight hours in a solution of sodium hydroxide of the same strength and in the same proportions as that used in the factory in the first boiling tub. For this purpose the waste, if in long bundles, is cut into pieces about one inch long, and ten grams of it placed in a beaker of about a half liter capacity, 104 cc. of a solution of caustic soda containing 17.305 grams to the liter (thirty-five pounds to 250 gallons of water) are poured upon it and the boiling carried on for eight hours, fresh water being added from time to time to keep the solution at constant volume. At the end of eight hours the liquid is poured off and the sample placed in a cotton filter, where it is squeezed and washed with hot water until the wash water gives no alkaline reaction. The sample is then dried to constant weight.

6. Ash, which is determined by placing from one to one and a half grams of the sample in a weighed platinum crucible pouring melted paraffin upon the mass, igniting it from the top, allowing it to burn slowly until the flame dies out and then igniting the residue to constant weight.

7. Rate of absorption of water. In making this test a sample of the material is thrown or dropped lightly on the surface of distilled water and the time between when it touched the surface and when (through absorption of the water by capillarity) it sinks to the bottom noted. One of the requisites for cotton suitable for making smokeless powder is that it shall sink in two minutes. In these experiments the cottons were tested not only in the condition in which they were received but also after treatment with ether; after drying for moisture, and after boiling with soda-lye; all being in the dry state. The vessel used varied in diameter from three to six inches, while the temperature of the water varied from 20° to 25° C. These differences or that of the size and form of the pellet seemed to produce no effect, but special attention must be paid to having distilled

water with a perfectly clean surface. With the same sample of cotton there were considerable variations in the time of sinking to the bottom of the vessel although the time of becoming thoroughly saturated so as to become submerged at the surface was fairly constant. The fact that the mass remained at the surface after saturation was found usually to be due to a bubble of air entangled in the mass which bouyed it up, or, less often, to a small portion of the mass being non-absorbent. This condition was evident on inspection as the non-absorbent portion of the sample remained opaque, while the absorbent portion appeared translucent. When the absorption failed to begin at once it usually did not take place at all, even after twenty-four to forty-eight hours exposure, or even when the whole mass was forcibly plunged beneath the water, in fact in these cases there seemed to be an actual repulsion between the water and the fiber. As what we seek to learn by this test is the relative rates at which the cottons tested will suck up the mixed acids during dripping, it would seem sufficient to note the moment at which they become thoroughly wet and submerged beneath the surface.

The detailed results obtained with five samples submitted at one time are as follows:

1. *Sample 1.*—Off white, yellowish tint. Cop waste. No cops in sample. No knots. Long threads, somewhat tangled. Free from dirt and rust spots. Strong fiber.

Sample 2.—Off white, yellowish tint. Cop waste. No cops in sample. No knots. Long threads, somewhat tangled. Free from dirt. Very strong fiber.

Sample 3.—Off white, yellowish tint. Long threads, freer from tangles than *1* or *2*. Free from dirt. Strong fiber.

Sample 4.—White. Partly short threads and partly loose fiber as if picked. Has evidently undergone special treatment. No cops, knots, tangles or dirt, but a few rust spots.

Sample 5.—White. Whole fibrous and wooly, as if picked, the fibers being not over an eighth of an inch in length. Has evidently undergone special treatment. No cops, knots, tangles or dirt, but a few dark specks.

2. *Sample 1.*—Faint odor of oil.
" *2.*—Very faint odor of oil.
" *3.*—Marked odor of oil.
" *4.*—Very faint odor of oil.
" *5.*—Very faint odor of naphtha (?)

The percentages of moisture, ether extract, soda-lye extract, and ash, (*3*, *4*, *5*, and *6*) are given in the following table:

Sample No.	Moisture.	Ether extract.	Soda-lye extract.	Soda-lye extract less moisture and ether extract.	Ash.
1.	4.93	0.97	9.16	3.26	0.86
2.	4.79	0.49	10.36	5.08	0.75
3.	5.17	1.20	9.26	2.80	0.80
4.	4.36	0.53	13.69	8.80	0.61
5.	4.69	0.09	7.58	2.80	0.40

7. The rates of absorption of water found was as follows:

Sample No.	Original condition of sample.	After exhaustion with petroleum ether.	After boiling in soda-lye.	After drying for moisture determination.
	Min. Sec.	Min. Sec.	Min. Sec.	Min. Sec.
1.	∞	∞	2 00 1 00 2 00	∞
2.	∞	∞	2 00 1 00 1 40 50 3 30	∞
3.	∞	∞	∞	∞
4.	3 15 5 15 1 15	60 45	10 8 7 4	3 00 4 00 7 45
5.	∞	45 45 20 43	10 4 4	∞

∞ No submersion after twenty-four hours' exposure.

The appearance of the ash and of the soda-lye after extraction are worthy of notice. In samples 1, 2, and 3, the ash obtained was of a light green color, the green portion being soluble in water, leaving a yellowish residue, which was insoluble. The ash of samples 4 and 5 was reddish. The color seemed to be due, in each case, to iron, it being in the ferrous condition in the first three cases and the ferric in the last two. As the latter evidently have been bleached with chlorine, this treatment would naturally oxidize the iron.

Soon after boiling the lye with the cotton began, the former, which was colorless at the start, began to acquire a color which increased in intensity for some hours. In the case of samples 1, 2, and 3, the lye, when the operation was finished, was of a pale sherry wine color, No. 4 was of a port wine color, while No. 5 was of a deep sherry wine color.

From this examination the samples are divided into two classes, *viz.*: cop waste and short fiber, treated cotton. Samples 1, 2, and 3 being in the first class and samples 4 and 5 in the second.

The short-fibered cotton cannot be nitrated successfully with the usual appliances and the presence of chlorine is objectionable as the cellulose nitrates produced from such cotton cannot be washed neutral.

Of the cop wastes, which are adapted to our present methods of manufacture, sample 1 seems on the whole to be the best, though it is but little superior to sample 2.

From the observations made it was found that in eighteen samples of cotton waste—

The moisture varied from 3.38 to 8.40 per cent.

The ether extract from 0.00 to 7.10 per cent.

The soda-lye extract from 3.53 to 5.36 per cent.

The ash from 0.05 to 1.79 per cent.

The rate of absorption after soda-lye extraction from one second to over twenty-four hours.

A sample of cottonseed lint gave—

Moisture.	Ether extract.	Soda-lye extract.	Ash.	Rate of absorption.
6.16	2.35	28.54	4.83	∞

A sample of waste cotton gauze gave—

Moisture.	Ether extract.	Soda-lye extract.	Ash.	Rate of absorption.
7.37	0.50	3.89	.95	7 seconds.

The rates of absorption quoted are for samples dried after receiving the soda-lye treatment. As indicated above, observations were also made on the original sample and after treatment with ether, both after drying. The highest rate was obtained after boiling with soda-lye; many samples being still non-absorbent after treatment with ether.

Treatment with the soda-lye even improved the absorbent power of the samples of "Absorbent Cotton" submitted for testing the rate being increased from three seconds for the dried, untreated cotton, to one second for that which had been treated.

Experiments were made on the absorptive capacity of the cotton, and in one case a six-gram sample of absorbent cotton was found to retain ninety-three grams of water or 15.5 times its own weight.

[CONTRIBUTION FROM THE JOHN HARRISON LABORATORY OF CHEMISTRY
No. 8.]

REDUCTION WITH MAGNESIUM AMALGAM.

BY HERMANN FLECK AND LEWIS L. BASSETT.

Received August 21, 1895.

THE subject of neutral reducing agents has been taken up in a recent publication by J. B. Cohen and R. Ormandy.[1] The study of the same subject has been carried on in this laboratory during the past year. For this purpose magnesium amalgam, two per cent., was prepared in the following manner:

The required amount of mercury is placed in a small Hessian crucible and half covered with magnesium powder. The lid is put on loosely and the blast applied until a loud hissing noise begins. Once begun the reaction takes place by itself. This is repeated until the requisite quantity of magnesium powder has been added. A more uniform mass is obtained by boiling mercury in a hard glass tube, open at one end; then adding the magnesium in small quantities and shaking vigorously after each addition. The product is a silver white, crystalline, pasty mass which decomposes water with great energy and evolution of heat, and which upon exposure to air becomes covered with a black mass; probably a lower oxide of magnesium.

MAGNESIUM AMALGAM AND HYDROCYANIC ACID.

Two hundred cc. of ninety-six per cent. alcoholic solution of hydrocyanic acid containing eight grams of the acid were placed

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[1] *Ber. d. chem. Ges.*, 27, 1505.