Dyeing, Bleaching and Finishing

THE PROCESS OF CARBONIZING.

BY A. GANSWINDT.

Another machine for drying and carbonizing loose stock, shown in Fig. 17 and 18, is built on the same principle as machine last described. The stock is carried by endless aprons through a single chamber. The first model, Fig. 17, is built entirely of iron and provided with a short feed apron. The second model, Fig. 18, is enclosed in mason work and

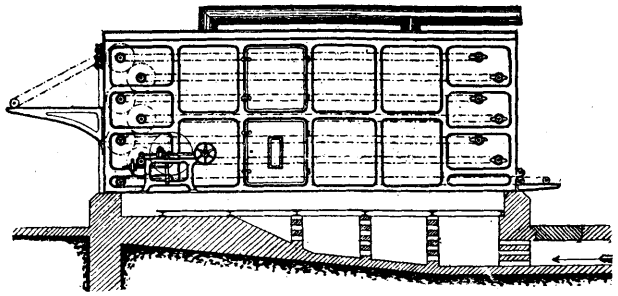

FIG. 17.—CARBONIZING MACHINE.

has a long feed apron. Each model is built with from seven to nine aprons. The operation of the machine will be clear from the illustration without further explanation.

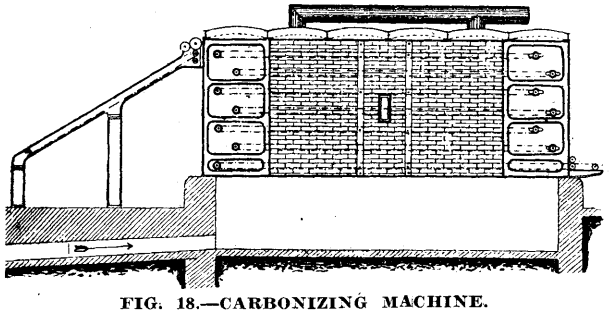

FIG. 18.—CARBONIZING MACHINE.

The Lekeux carbonizing machine, Fig. 19, is based on the principle of a traveling apron. It consists of balanced shelves F attached to a chain work which moves up and down in an enclosed chamber. These shelves take the stock

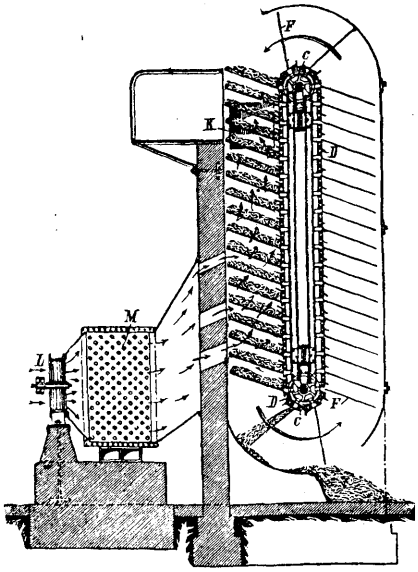

FIG. 19.—CARBONIZING MACHINE.

at the top of the chamber and carries is slowly down to the bottom, where the material is automatically discharged. During this passage a current of air generated by the fan L and heated by the heater M passes upward through the stock and escapes through the opening K. This current of air is divided so that it is strongest at the bottom of the carbonizing chamber and weakest at the top. The shelves are carried by the chain D, which passes over the sprocket wheels C.

A special machine for carbonizing with a mixture of muriatic acid gas, coal gas and air forced through a revolving drum in which the material is placed will be described in detail when we take up the carbonizing of rags.

THE ALKALI BOIL.

BY LOUIS M. TAILFER.

There are two methods of boiling-out cotton goods. The older process is done in open boilers, using a large quantity of lye in relation to the weight of the goods in view of the necessity of keeping the cotton submerged. Later closed kiers were adopted in order to keep the heat in better and to boil under pressure at a higher temperature. The lye is circulated by means of steam injectors which heat the lye but at the same time dilute it. To obtain a more active circulation centrifugal pumps are used. The quantity of lye used is very large in order that the material shall be always immersed.

About 1885 Mather and Platt recommended another method of boiling-out. This consists in using a relatively small quantity of lye, but much more concentrated, and giving it a forced circulation through the goods. They invented a system of kiers which bear their name. They have a large output and give excellent results.

Koechlin also suggested a process using a small quantity of lye. Thies worked out a similar process but with a variation, and made a very complete study of the phenomena of boiling-out with a short lye.

The Thies process differs from those already known and particularly from Koechlin's in the fact that the treatment with carbonate of soda and that with caustic soda are given separately. The result of this is that the caustic lye can be used at a temperature and degree of concentration hitherto unattainable because there were no means of protecting the cotton fiber, whereas in the Thies process this preventive action is furnished by the preliminary treatment with soda and steam. By this preliminary treatment the use of very concentrated caustic lye is rendered possible and without danger to the fiber. It has an energetic action of short duration. Moreover, the use of boiling caustic soda lye diminishes the mercerizing effect on the fiber and the contraction that would be the result of the use of cold lye. A third distinctive feature of the process of Thies as compared with preceding methods, and in particular that of Koechlin, is that the action of the boiling caustic lye is kept up almost constantly during the boil. Thus the tendering action of the lye is prevented by its saponification as a result of drawing off the steam in the course of the operation. This evacuation of the steam not only gives a rapid circulation but keeps up the concentration of the lye. The process is in four complementary stages:—

(1) Separate treatment of the fibers with alkalis (carbonate of soda).

(2) Treatment with steam after No. 1.

(3) Treatment of the fibers, after they have been freed from imprisoned air, with boiling caustic soda lye.

(4) Concentration of the caustic soda lye by means of a special device giving constant circulation.

The actions of these successive steps complete the process reciprocally, and are justified by the following considerations:

(*a*) The fibers contract in cold caustic lyes according to their degree of concentration, and if the lye is very strong mercerization results. This contraction does not take place in the boiling solution. In the cold bath even diluted caustic soda solutions act in the same way in filtering through the layers of cotton. These are not mercerized by the boiling lye.

(*b*) By the presence or introduction of air into the kier, or if it is imprisoned in the fibers or introduced with the steam the boiling lye has a destructive action on the fiber in the presence of oxygen.

(*c*) The alkalies precipitated on the fiber by the alternate action of caustic alkali and alkaline carbonate cannot be removed by boiling water and steam. They cling to the fiber during steaming and give strong indications of catalytic action.

(*d*) By greatly diminishing the volume of the lye a uniform circulation is set up if the lye and the steam traverse the material rapidly and together and can be separated below the goods.

The liquids collect by gravitation in the lower layers of the goods and are drained out. Only a pump can put these filtering liquids into circulation, whereas the boiling liquids cannot be aspirated because of their vaporization.

The rapid circulation of the lye is set up by the extraction of the steam at the bottom of the kier and by the removal of the lye by means of a pump, and by the addition of lye at the top of the kier over the goods under treatment the uniform division of the lye is thus obtained and also the mixed circulation of the lye and the steam and the uniformity of their action.

In the boiling kiers the fibrous materials impregnated with liquid fill a space which is four times that of their specific bulk. For instance, if the density of cotton is 1.5 then 1,500 lbs. occupy a volume of 300 British gallons of which 300 gallons is liquid. In the old processes of boiling-out therefore it needed 300 gallons of lye for 1,500 lbs. of cotton, and if for instance 50 lbs. of Solway soda were used hardly a one per cent. solution was obtained. In the Thies process only 50 to 60 British gallons of lye were used, which by boiling with resin soap gives a concentration corresponding to a 6 to 7 per cent. soda solution.

For the caustic soda boil and steaming a cylindrical autoclave is used, similar to those ordinarily employed for boiling under pressure. The material rests on a perforated false bottom. Over this the cylinder slightly diminishes in diameter and the height of the part over the false bottom is about a quarter of that of the part below.

At the top of this smaller part is a pipe pierced with holes and this communicates with the atmosphere or with a condenser. Thus the steam from the lye which has gone through the goods is evacuated, whereas the lye falls to the bottom of the kier. It is drawn from here by a pump with a reheater and is forced again into the kier over the material. The reheater is a vertical tube containing a steam coil which heats the lye without weakening it. This arrangement quickens the circulation because all the pressure is from the top of the kier and the liquor falls to the bottom by gravity, by the aspiration of the pump, and by the depression caused by the escape of steam.

The saponification of the fats and resins in the cotton is effected by the energetic circulation of the lye at a high temperature. In proportion as the saponification proceeds its detergent action is weakened. The arrangement of the the strength of the lye is diminished, and in consequence kier remedies this as the steam is drawn off continuously and the lye is thus concentrated.

As an example take the treatment of printing cloths. The dry fabric is steeped in a solution of acid equal to its weight: 10 parts by weight sulphuric acid, 60 per cent., or 16 parts hydrochloric acid, 30 per cent. and ½ part hydrofluoric acid, 75 per cent.

The goods are left in this solution for four hours, then steamed for half a minute and then washed in the open washer. They are next given a bath of soda, one-half per cent., at 122° F., and left in this bath twelve hours or over night. For this bath old saponified lye which has served for boiling-out under pressure can be used.

If the goods are very hard, for instance if they are loaded with pectic matters, this operation is repeated several times. In the washing machine 1 part of chloride of magnesium is added per 1,000 20,000 of water.

The pieces are whizzed so that they retain their own weight of water and are put into the kier with a sufficient free space left above them. The lid is closed down and the steam is turned on from the system of pipes in the reheater. This treatment is with the aim of bringing the goods to a temperature of 212°, and its duration depends upon the capacity of the kier. It may require two hours and a half. The water and the air are drawn off from time to time at the bottom of the kier. In this way the material is well prepared; it is free from air, spongy, and can be uniformly impregnated with caustic soda.

The boiling lye is forced in so that all the material is evenly impregnated. For 1,500 lbs. of cotton 50 lbs. of Solway soda are used, which mixed with quick lime give 60 British gallons of caustic soda lye. Before introducing this mixture 10 lbs. of rosin are put in for the purpose of saponification. The lye is heated by means of the steam coil in the reheater and circulated, keeping the temperature at about 260° F. This circulation and reheating is kept up for about five hours, and by constantly expelling the steam the lye becomes more and more concentrated. Then the goods are washed in boiling water.

The chloring is done with a third of the chloride of lime hitherto necessary. The goods are then washed, soured and the process finishes with a thorough washing.

The process and the arrangement of the kier allow a very strong caustic lye to be used without fear of mercerizing or tendering the cotton. By this means chemically pure cellulose is obtained. The preliminary treatment with acid is not absolutely necessary, it can be suppressed in the case of easily bleached goods. The addition of a little hydrofluoric acid makes the action more energetic. By steaming the goods treated in a cold acid bath an economy in acid is effected. The acids destroy the inorganic compounds in the fiber, and if these are not present this step of the process can be left out, leaving any souring for the final operations.

In this case the first step is the treatment with alkaline carbonate or a weak lye which is sufficient to free the goods from lightly adhering or easily soluble matter. Moreover the alkaline carbonate not being easily soluble remains in the fiber in spite of the washing, and on the steaming which precedes the caustic soda it absorbs the oxygen from the air imprisoned in the fibers, and the goods thus freed from air are able to stand the strong lye.

To sum up, the ordinary process is reversed; a weak lye is first used to remove the easily soluble matters, followed by a strong lye to remove the remaining matters, and this is a more rational procedure.—*L'Industrie Textile.*