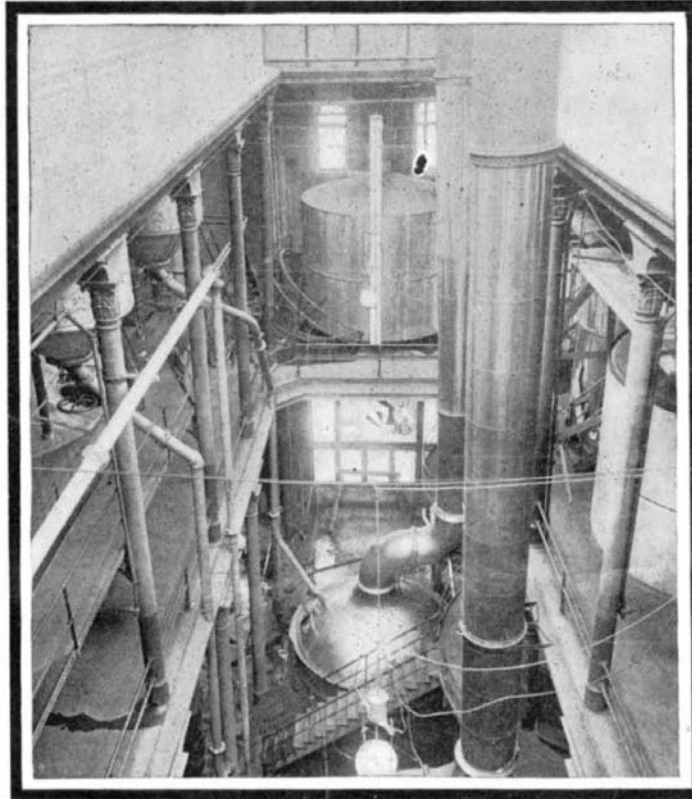


**MALTING AND BREWING CONDUCTED ON SCIENTIFIC PRINCIPLES.—II. BREWING.**

In a recent issue we described malting as carried on at the Pabst Brewing Company's establishment at Milwaukee, Wis. We will now describe their process of brewing. We left the finished malt in the moisture-proof storage bins.

When wanted the malt is again scoured, and is ground or rather crushed in specially-constructed malt mills, which press the grains so that the hulls remain intact while the interior starch body is finely powdered. It is now termed "malt-grist," and it is stored in grist hoppers, where it is kept in readiness for the mash-tub underneath. All the previous operations have been carried on with a view to the chemical reactions which now occur, assisted by mechanical means.

In the huge mash-tubs the malt-grist is brought into contact with water of a certain temperature, varying according to the brew. About 16,000 pounds of malt constitute one brew, and the mashing operation requires one and one-half hours, during which time the mash is agitated by raking machinery, which is revolved by power. Automatic recording thermometers indicate the temperature at all times. After the mashing process is finished, the mash is pumped by means of centrifugal pumps to the filtering tubs, which are provided with a false bottom of bronze plates, having

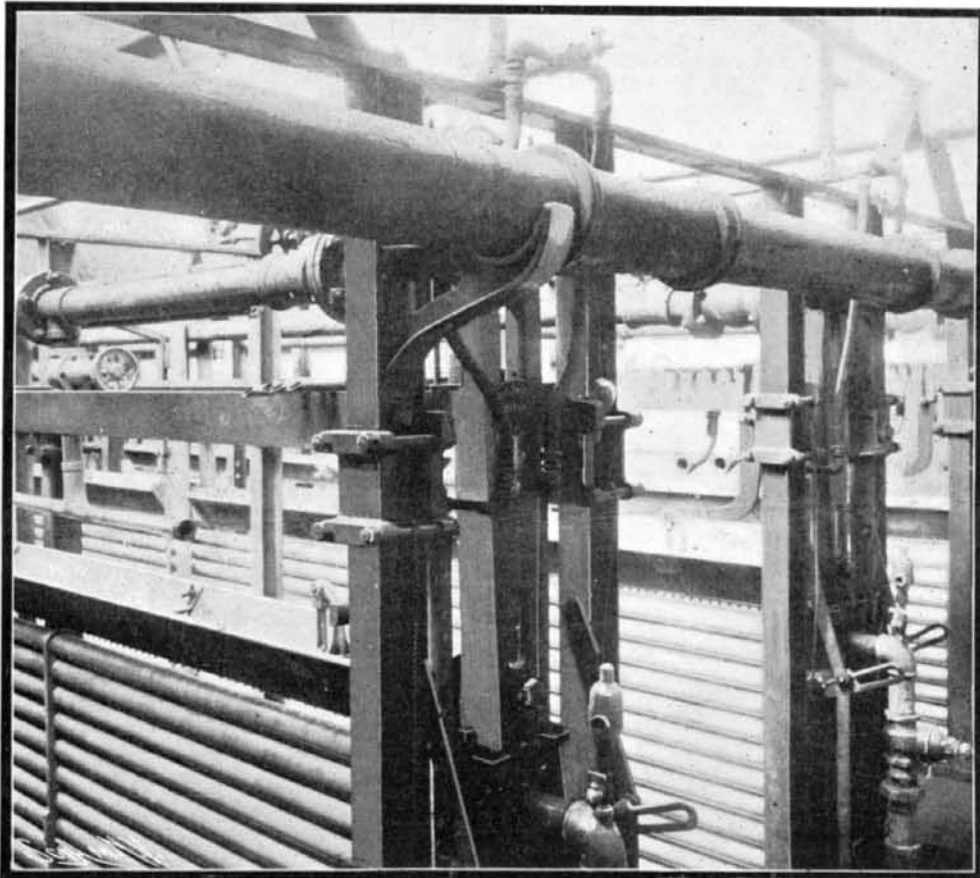


Looking Down in the Brew House.

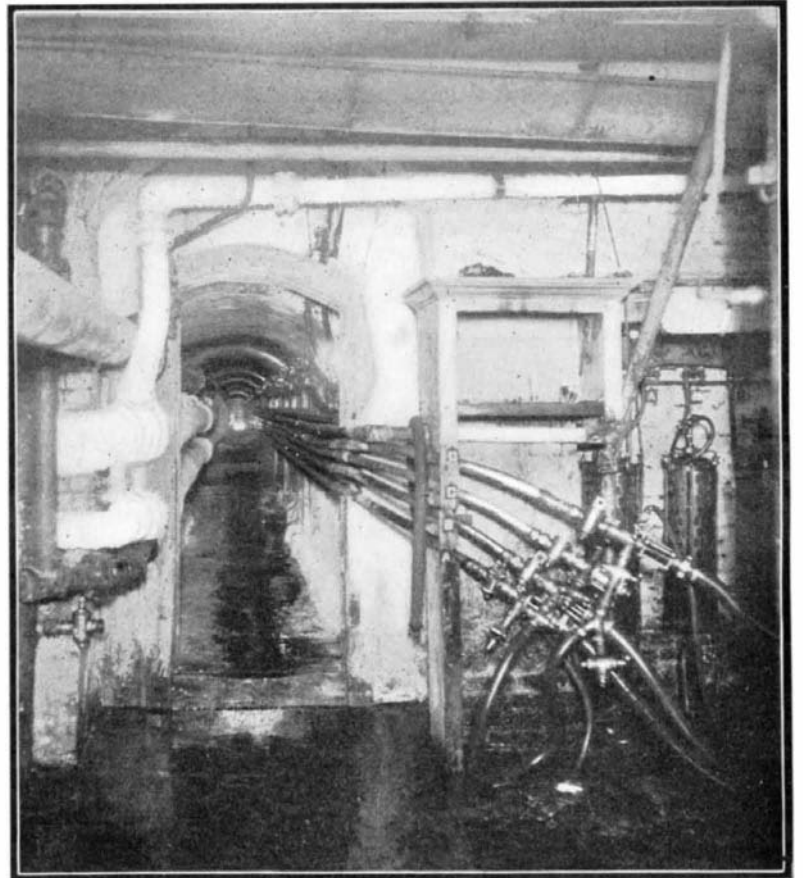
9,500 holes per square foot. This filtration occupies from four to five hours. The malt extract thus obtained is called "wort," and runs directly to the copper brew kettles, of enormous size and perfect cleanliness, holding 350 barrels each. The wort in these steam-jacketed kettles is boiled for several hours together with hops, which are introduced into the brew at this stage.

The hops give a slightly bitter and agreeably stimulating taste to the beer, and in addition they contain constituents which promote the keeping qualities of the product. The hops contain aromatic resins, which assist in the preservation of the beer.

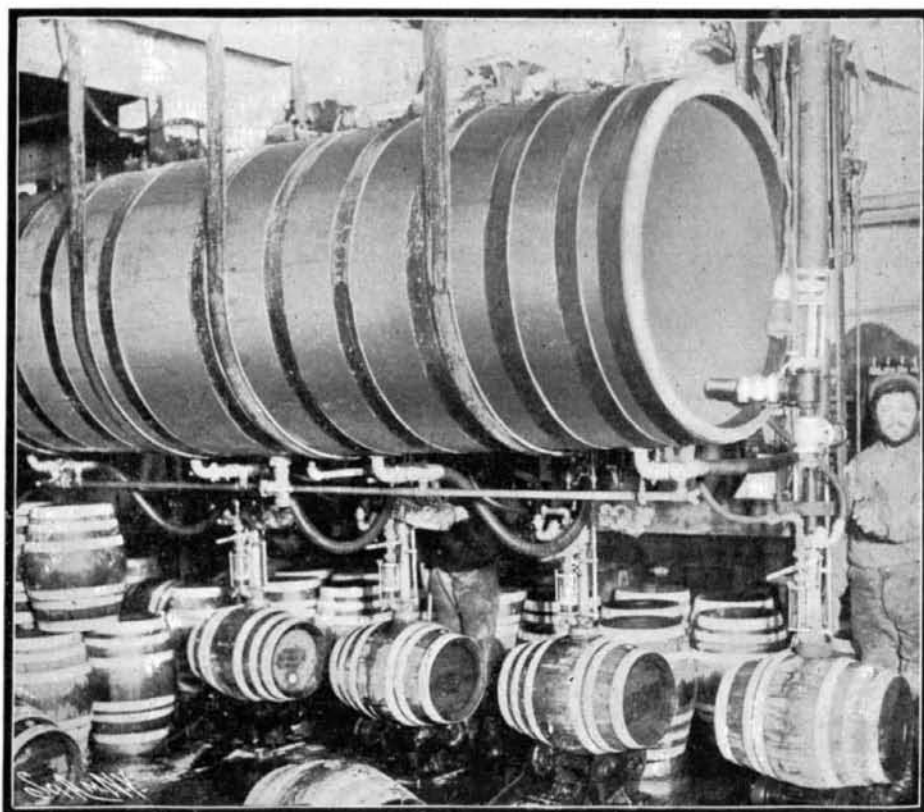
When it is stated that there are six brew kettles, each having a capacity of 350 barrels per brew and four brews each a day, some idea can be obtained of the enormous capacity of the Pabst brew house. From the brew kettle the hopped wort is run into the "hop-jack," or filtering tub, which separates the spent hops from the wort. From there the wort is conveyed by pumps to hot wort reservoirs, from which the wort runs through the hermetically-closed aerating coolers, which are several in number. Each cooler consists of 54 pipes arranged horizontally in a vertical bank. The upper ones are of copper, the lower ones of steel. Cold water flows through the copper pipes, and liquid ammonia is expanded in the steel pipes. The hot wort is distributed over



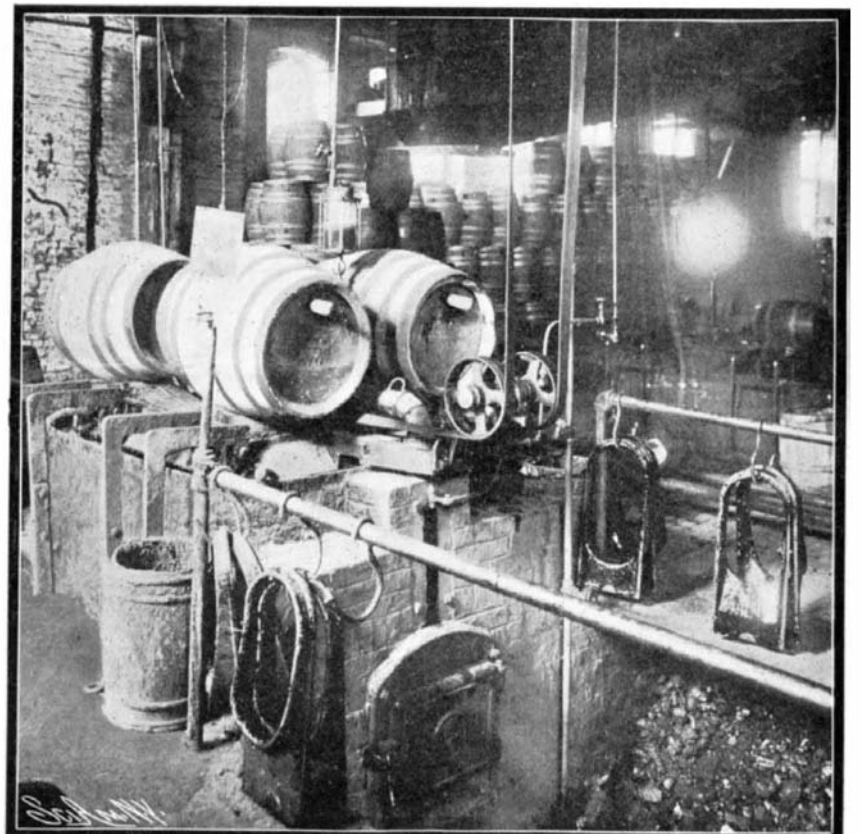
Cooling the Fresh Wort.



The Refrigerated Pipe-Line Tunnel.



Filling the Kegs.



Pitching the Kegs.

**MALTING AND BREWING CONDUCTED ON SCIENTIFIC PRINCIPLES.**

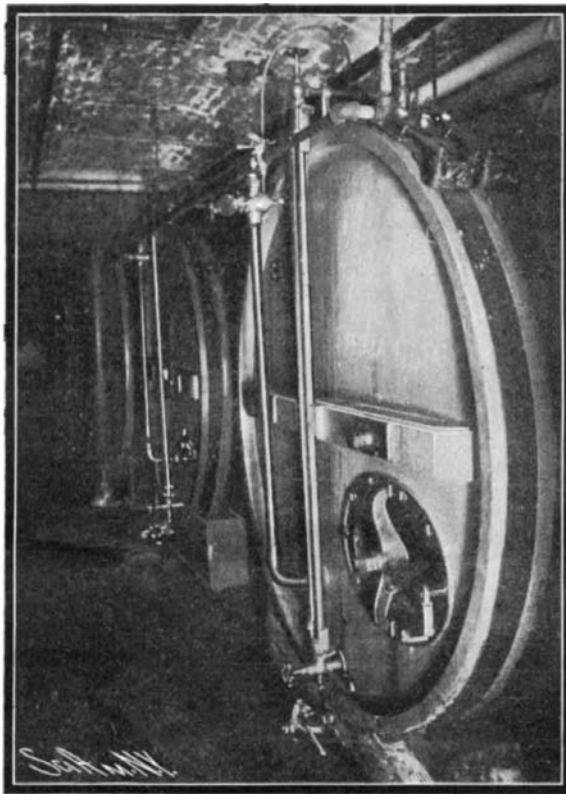
the whole length of the pipes by a self-regulating feeding trough. The sides of the cooler are adjacent to the pipes, and are composed of copper.

Sterilized air is blown against the wort, so that it absorbs the proper amount of oxygen at all stages of temperature from the boiling point to 40 deg. F., which is the temperature at which the wort runs off from the cooler through the copper pipe line leading to the cool wort vats in the fermenting cellar.

Fermentation is caused by a microscopically-small plant called yeast (*Saccharomyces cerevisæ*). There are thousands of different varieties of the yeast plant to be found in nature. In order to obtain an absolutely uniform fermentation and final product of a desired character, a special variety most suitable for the purpose is selected, and cultivated on a large scale from a single cell in a special department called the "pure yeast plant." The yeast thus obtained is used to start the fermentation of the cooled wort in the large fermenting cellar. In the Pabst brewery the fermenting vats are hermetically sealed for a double purpose; first to prevent infection from germs in the atmosphere, and second to collect the gas of fermentation. This gas is almost chemically pure carbonic acid gas, and is led off under a slight pressure to a gasometer, and eventually liquefied after purification, and used for carbonating and elevating beer from the cellars. Five million pounds of this by-product were produced and utilized at this brewery last year, effecting a great economy. The main fermentation takes from ten to twelve days in the fermenting vats. Considerable heat is developed, which is taken away by cold brine circulating through copper cooling pipes. The product can now be called "beer," but it is necessary to mature and ripen the beverage by cold storage in large vats for a period of from three to four months at a temperature a little above the freezing point. During the storage period most of the yeast cells settle to the bottom of the tanks, thus effecting a clarification of the beer. The liquid is then drawn off, and either conveyed to the shipping barrels or the bottling department. On its way from the storage vats to the filling machines, the beer is saturated with the pure carbonic acid gas obtained from the main fermentation, and it is then filtered through sterilized pulp filters, which render the beer absolutely brilliant before it enters the barrels or bottles. In all cases the filling is done under carbonic-acid-gas pressure.

For bottling purposes the beer is conveyed through sterilized copper pipes, which extend from the storage houses to the basement of the bottling department. The pipe lines are conducted through a long underground tunnel, which is refrigerated throughout its entire length, keeping the beer at a temperature a little above the freezing point. This tunnel is large enough to walk through.

The beer enters the so-called measuring tanks, which few breweries possess. A special act of



The Measuring Tanks Where the Government Collects Its Revenue.

Congress was necessary to legalize the system, as the old law required that there be no connection between the brewery and the bottling house, so that brewers were required to first place the beer in a small barrel, cover the bung with an internal revenue stamp, and

cancel it. By this new system, the beer is kept in its original condition and purity. The revenue is now collected in another way. The measuring tanks are gaged by the government, and while the tank is being filled, the outlet cock is locked by an Internal Revenue officer, who visits the brewery daily. Seventy-three barrels of beer are run into each of the twenty measuring tanks. The officer reads the quantity of beer as shown by the glass gage; he then releases the outlet cock after he has been paid the tax of a dollar a barrel, and locks up the inlet cock, so that only the seventy-three barrels can be used for bottling.

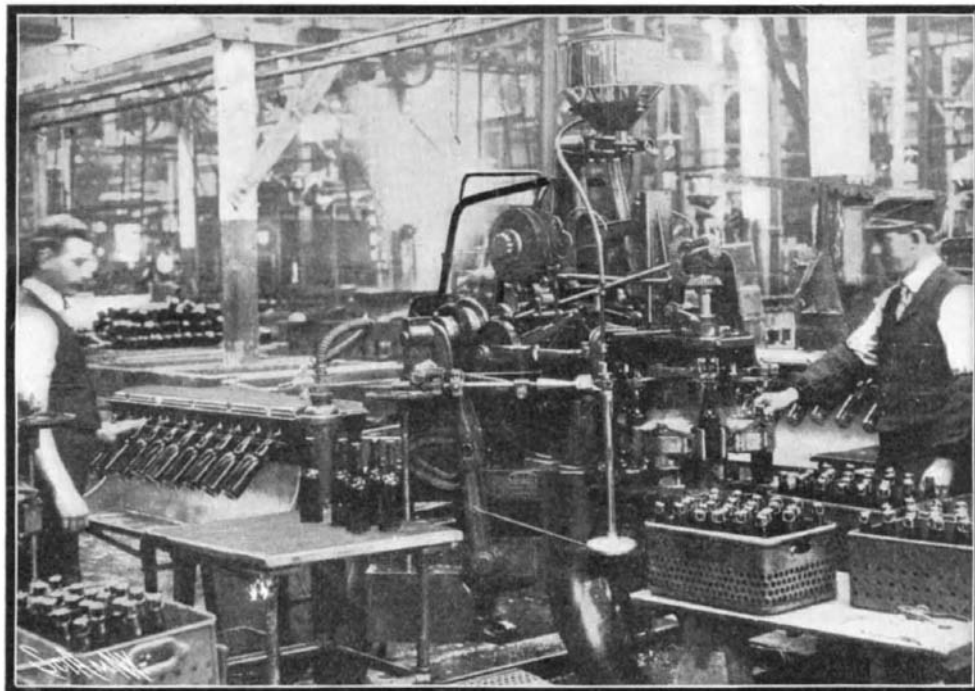
Pure carbonic-acid gas is used to force the beer up to the bottling machines on the main floor. The bottles are received in train loads, and are first soaked in a diluted caustic-soda solution, and then dropped out automatically into fresh-water tanks, and from there they are put on washing spindles rotating 3,000 times a minute, thereby removing any trace of impurity. The bottles are then rinsed with filtered water and are filled with beer; immediately after filling the bottles are corked or covered with aluminium stoppers.

The corking and wiring machines are most ingenious. The filled bottles are fed into the machine at the rate of eighteen a minute, the cork is forced into the neck of the bottle, a tin disk covers it, and the wires are placed around the neck fourfold, cut, and finally twisted into a knot by the machine. The bottles are then placed in small cases holding twenty-four bottles each. The cases then go upon a traveling table, which takes them to the pasteurizing machines. The temperature is carefully regulated by an automatic heater, which insures a proper pasteurization of the beer. The highest temperature applied for this purpose is 150 deg., to which the bottles with their contents are exposed for about thirty minutes. The bottle enters in a cold condition, and it leaves the apparatus at the same temperature. The bottles are then labeled by machines and are ready for packing, the date of bottling being branded on the cork, and the same date perforated upon the label. The capacity of the bottle house is over 500,000 bottles a day, and last year over 90,000,000 bottles were filled.

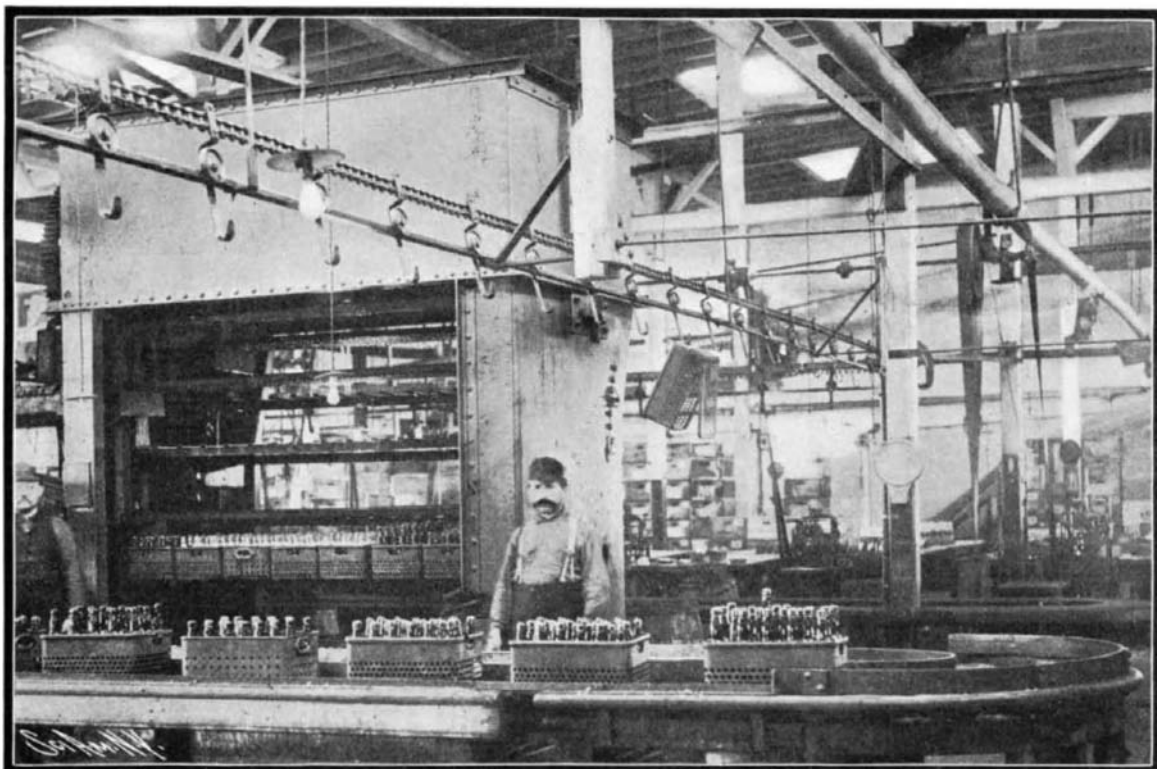
The advantage of brewery bottling is apparent. The beer never for a moment loses its life by the loss of gas and comes to the consumer in prime condition, the sterilization also providing for the proper keeping of the beer under all conditions.

The process described in this and the previous article, the result of years of study and experience, show that the brewing industry is placed upon the highest scientific level.

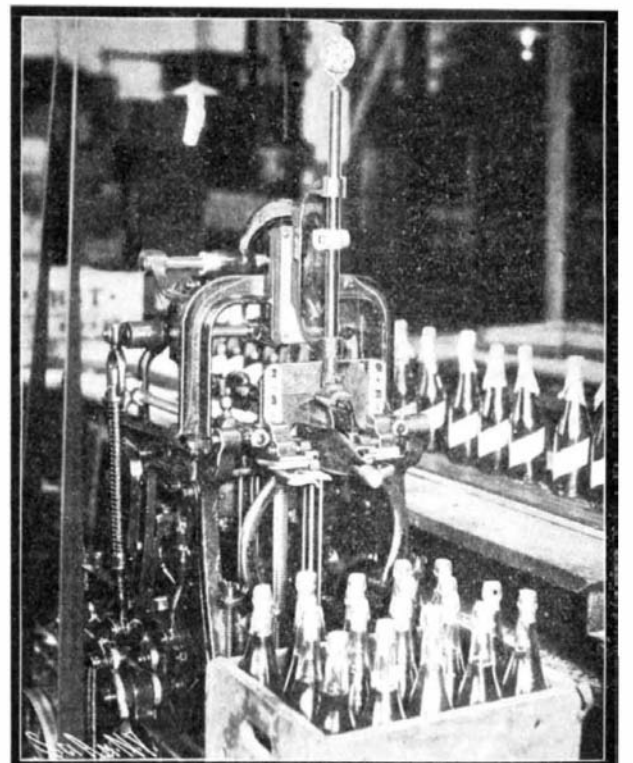
The railway line from Hanoi to Vietry, in French Indo-China, has been open to traffic for some months; the section to Thanba, half-way to Yenbay, was finished a short time ago, and the continuation to the last-mentioned place is far advanced.



Filling and Corking Bottles.



Pasteurizing Bottled Beer.



Labeling Beer Bottles by Machine.

MALTING AND BREWING CONDUCTED ON SCIENTIFIC PRINCIPLES.

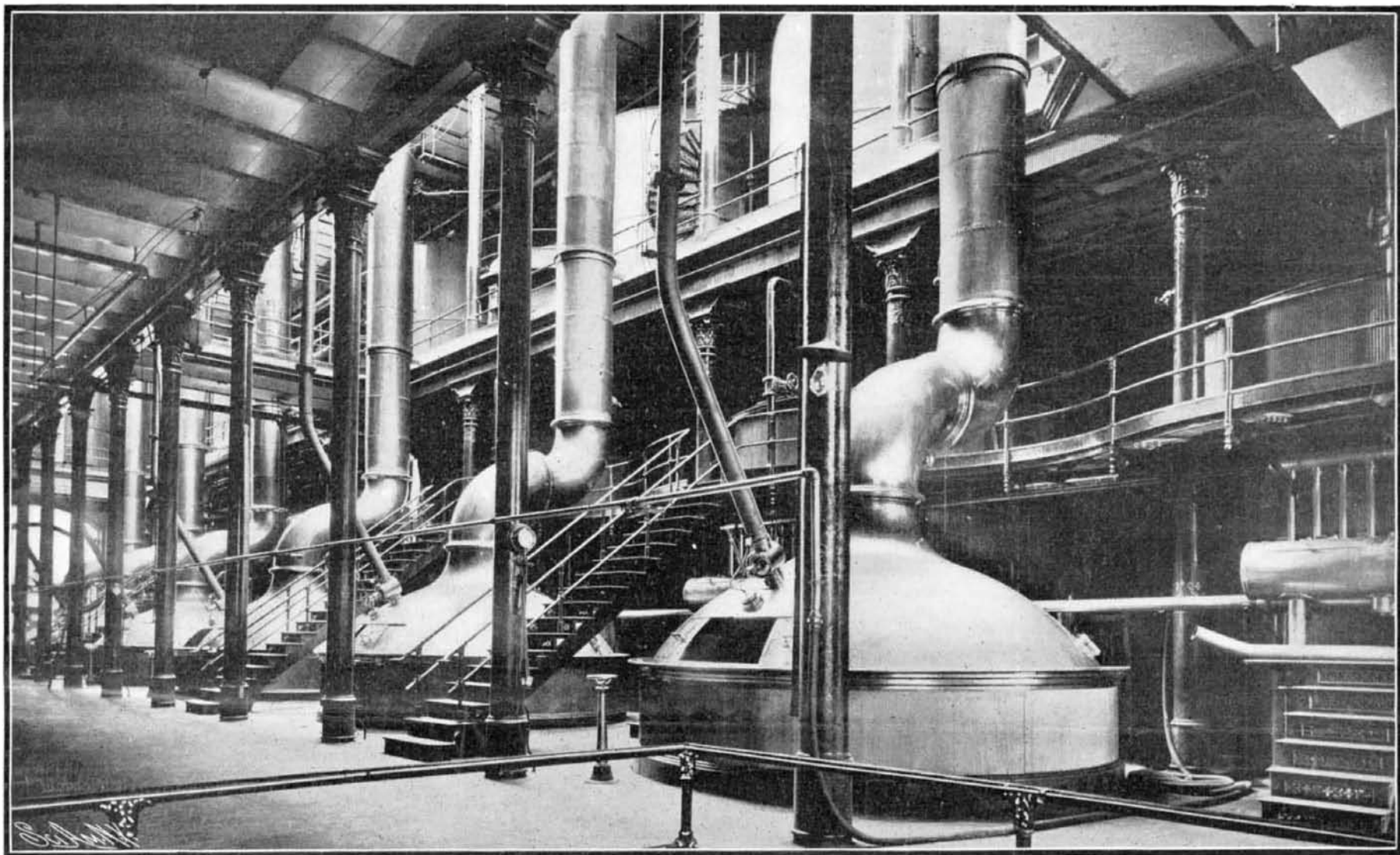
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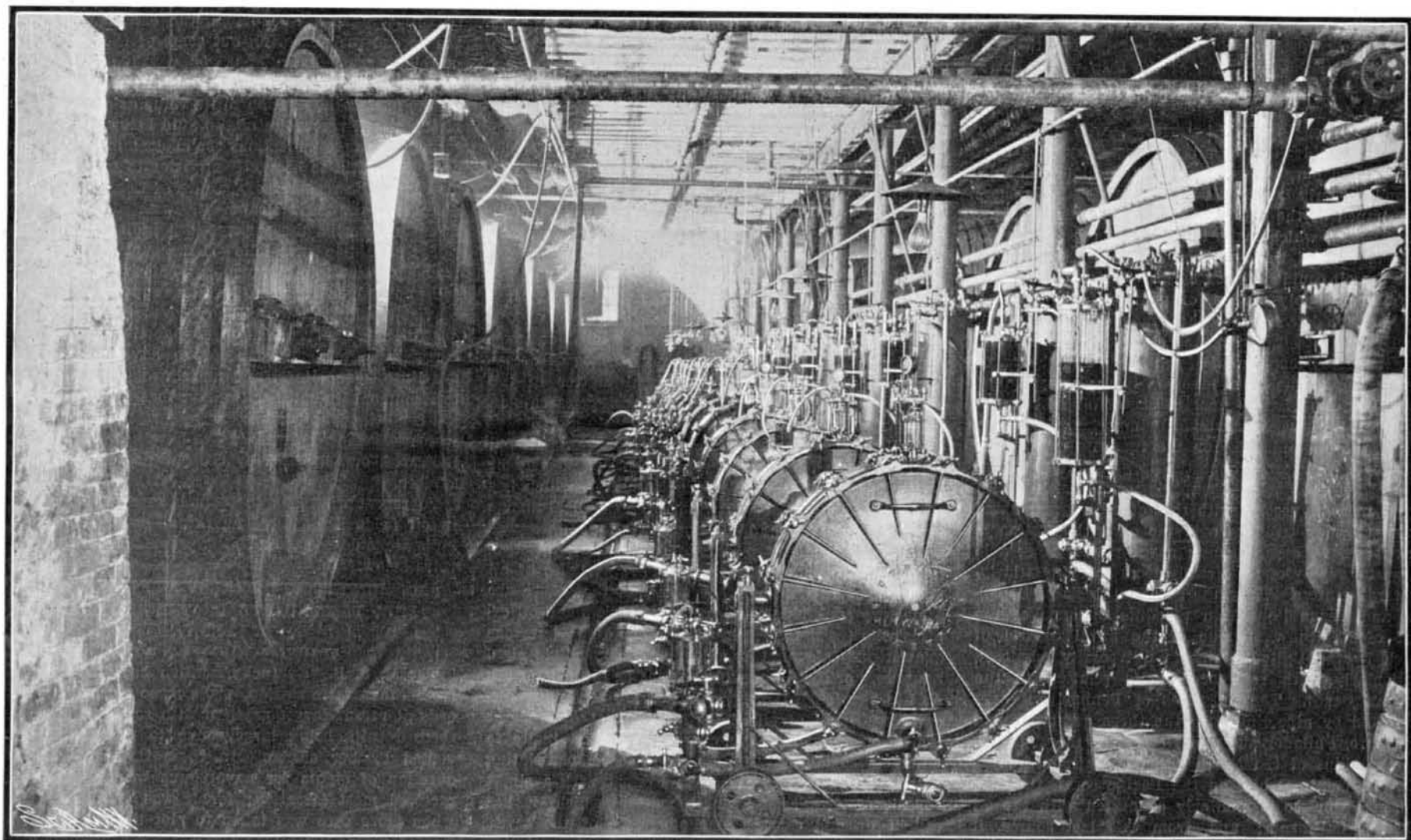
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MALTING AND BREWING CONDUCTED ON SCIENTIFIC PRINCIPLES.—[See page 490.]