

THE BOTTLING DEPARTMENT OF A MODERN BREWERY.

There are few departments that have received less special attention by brewers than that concerned with the bottling of their product. Formerly this department was considered by most brewers, especially by those having smaller plants, as a necessary evil, and was often installed simply because the brewer's competitor had done so, or because a few good customers had demanded bottle beer, rather than because there was any hope of making this department self-sustaining or a source of profit to the brewery.

This condition has changed, as the demand for bottle beer in private families, hotels, railroad trains, and even in saloons is steadily on the increase, and a first-class bottling department is considered a necessity with many a modern brewery plant.

When special attention was given this department it was found that the old shed used as a bottle shop, with its meager appliances, would no longer answer, and the deficit in the department due to breakage and loss of bottles and boxes, and the loss of time of the men by "soldiering" or otherwise (because it did not pay to employ a competent special foreman to keep track of them), could be avoided by improving and properly managing the department. In fact, there are to-day a considerable number of brewers who reckon on their bottle trade returns as no small portion of their yearly revenue.

To accomplish this requires economical arrangement and the most improved appliances and machinery.

REQUIREMENTS OF BOTTLE-SHOP MACHINERY.

The requirements of bottle-shop machinery are of the most rigid order. They must operate not only economically, but very thoroughly. For instance, a soaking device that does not soak

a bottle properly does not soak it at all; that is, the bottle must be run through again, and the time required in handling it during the first operation is time practically wasted. A defect becomes still more costly in the pasteurizing or steaming tank, for if it does not furnish an even, gradual rise or fall of temperature it is likely to cause breakage of bottles and loss of contents. What is still more detrimental is to not give an even temperature throughout the tank, so that some bottles never reach the final pasteurizing temperatures. This may result in their spoiling afterward, while in the possession of the consumer, which may mean not only loss of time and material, but possibly loss of trade besides. Similar defects are liable to occur at nearly every stage of the process, and will be detailed more fully under the separate descriptions of the machinery and devices employed at each individual step of the work.

ARRANGEMENT OF BOTTLE SHOP.

One of the first points to be considered is the general arrangement, which is as important in bottle shops as in the brew house and cellars. The arrangement should be such that there is absolutely no useless or double handling of any bottle or case, and benches or machines should be so placed in relation to each other that they form an unbroken line from the dirty returned bottle to the capped and labeled bottle in the case for delivery.

The bottles should first be placed in the soaking device (tank or wheel), from which the man should, when all labels, tin foil, etc., are removed, place them directly on the rack at his side and between him and the bottle-cleaning machine. From here the man at the machine takes them, runs them through the machine and places the rack on a bench at the opposite side of the machine, where a boy takes out the bottles, examines them as to cleanliness and places them on the adjacent rack next to the man operating the filling machine. This operator places the empty bottles in the machine with one hand and removes filled ones with the other, placing them on a bench, where they are either closed and examined, if patent stopper bottles, or taken by the man who operates the stopper machine. When closed, they are again placed on a bench, where they are likewise examined, clamped or wired, and put in a crate previous to going into the pasteurizing tank. After being steamed they are labeled and capped with tin foil, etc.

clean water, which, in bottles containing sediments of a gelatinous or soapy nature, greatly facilitates cleaning.

Multiple Shot Machines.—Another style of multiple machine, using shot, washes 12 bottles, 6 in a reel, at one operation. The machine consists of a shaft carrying at each end 6 pockets for bottles, to which is given a rotary and longitudinal motion, hurling the shot against all parts of the inner surfaces of the bottles.

Another type of multiple machine using shot is similar in its operation, but of much larger construction and capacity and washes 18 bottles at one time. The length of time the bottles are scoured is regulated by the foreman changing a set-screw, and is not left to the boy operating the machine. Once set, the machine will continue to make the same number of vibrations and revolutions till set again by the foreman. When scoured, the bottles are automatically inverted and rinsed with a jet of clean water to remove any particles of sediment and impurity adhering to the bottles. The bottle crate holds 18 bottles, and after rinsing, the crate of cleaned bottles is replaced by a crate of dirty ones in a few seconds. The capacity of this washer is from 150 to 180 dozen bottles per hour. It will wash quarts, pints or half pints, and bottles with any and every kind of patent stoppers.

The shot or slugs used in shotting machines are generally made of steel, and in shape resemble a double pyramid with bases together. The sides of the shot are also curved inward, so as to present as many points or sharp edges to the glass as possible, thus increasing the abrasive or scouring action of the shot and also lessening their tendency to stick to the wet interior surfaces of the bottles, or choke the mouth in falling out.

Small steel punchings, about 1-16 inch in diameter, are also used and give satisfactory results.

ADVANTAGES OF THE DIFFERENT WASHING MACHINES.

Comparing the different styles of washing machines with each other, it is seen that different types have advantages peculiarly their own, which may be summed up as follows:

Brush machines are practically noiseless in their operation. The time of washing the bottles can be lengthened or shortened to suit the conditions of the bottles, and they require comparatively little power, as the spindles only are revolved and not the heavier bottles. They, however, require frequent re-

newal of the brushes if the machines are to work to the best advantage.

Shotting machines are more vigorous in their cleansing action upon hard resistant crusts, the shot is cheap and remains in good condition for a long time. Shot machines, on account of their unbalanced motion, require a good foundation and make considerable noise. This very noise, however, according to some bottle-shop foremen, gives a control of the whole line of work, as the bottles are placed in the machine in crates or racks, and the machine once started operates automatically until the necessary turns are made, and then stops, when it is the attendant's duty to remove the crate, put in another and at once start the machine. Should the machine remain silent too long, which can be heard from any part of the bottle shop, the foreman knows that somebody is not keeping up with his work, and investigates the cause.

BOTTLE-RINSING DEVICES.

After a bottle has been scrubbed on the washing machine it generally contains, adhering to its inner walls, some of the wash water in a more or less dirty condition. This water must be removed before the bottle can be filled with beer, and to accomplish this end the bottle is rinsed, or, in other words, this dirty water is displaced by clean water, entering in the form of a jet or spray so arranged as quickly to come in contact with every part of the inner surface of the bottle.

In washing machines, on which bottles are held in an inverted position with their mouths downward, the washing spray of water also acts as a rinsing spray at the moment when the brushes cease revolving, or the shot has fallen out of the bottle, but in machines where the bottles are held in a horizontal position while being washed, this combination feature cannot be applied. Here the bottles must be taken from the washing machine and placed on a rinsing device, which involves another separate manipulation.

The general form of rinser, now in use, consists of a series of upright tubes, each having a hole or nozzle at its upper end for the emission of the water spray. Around each of these tubes is attached a bottle support, consisting of a claw or ring, made to fit around the mouth of the bottles and placed at such a distance below the upper ends of the tubes that the latter will extend about halfway into the inverted bottles placed

over them. All of these tubes, whatever their number, are inserted at their lower ends into a connecting header, and this header is placed over, and attached to a plug of a stop cock or valve in such a manner that, after the rinsing device is filled with bottles, it is given a quarter turn, whereby the water supply is turned on, allowing the water to pass through the tubes and perform its rinsing duty. In order to prevent chipping of the mouth of the bottle, the supporting claws or rings are often made of or lined with rubber, because it happens that the bottles are often quite carelessly placed upon the rinser.

COMBINED SOAKING, WASHING AND RINSING DEVICES.

Very convenient forms of combined outfit for bottle soaking, washing and rinsing are now on the market, and are well adapted for use in bottle shops where compactness is a desired feature. These outfits consist of a wooden soaking tank of convenient size, to the sides of which are attached a horizontal single washing machine, a rinsing device, also a tin-foil remover and cork extractor, all of these being conveniently arranged, and the whole forming a very compact outfit so that one man can handle the bottles without much loss of time in moving about.

TAPPING OF BARRELS.

In tapping barrels care must be taken not to lose any beer or gas, and for this purpose a special device is used. This consists of a tube reaching to the bottom of the barrel and having side openings at its lower end for the passage of the beer. This tube passes through a bushing, having a side opening with check valve, for passage of the air pressure to the surface of the beer necessary to force the beer through the tube and into the filler. In practice several barrels are thus tapped at one time, and their delivery pipes connected whereby a more even and long flow to the filler is obtained, and at the same time less time is lost by the filling operator waiting for a new supply.

One style of these tapping devices employs a special bush that must be screwed into the barrel permanently. This has the advantage that such a barrel will always be at the disposal of the bottling department, and not used for customers or shipment.

When feeding back pressure bottle filling machines a drawback and annoyance is often experienced when tapping and running a new barrel to the filler. This happens when the air or

gas contained in the connecting tube or hose is forced through the filling machine, causing the latter to "sputter." In order to overcome this defect there is now a device on the market so constructed that a new barrel can be attached without the operator taking notice of the change, and this is accomplished by an arrangement whereby several barrels are cross-connected to a main header, or manifold, so that one barrel can be disconnected and another replaced without the flow of beer being interrupted.

The essential feature of the device consists of a "lantern" or observation glass placed between the barrel and the header. At the lower end of the lantern the supply and discharge pipes are attached, while the upper is supplied with a blow-off cock and the opening closed or opened by means of a float or rubber ball.

The operation is as follows: When the beer is discharging the lantern is full so that the ball floats at the top and closes the air cock. As the flow diminishes the lantern empties and at the same time the float descends to a point below the opening to the header, whereupon the cock to same is closed so as to prevent back pressure when the barrel is disconnected. The empty barrel is now replaced by a full one (the other barrels supplying the flow during the operation) and as long as the air or gas from the barrel or tube passes into the lantern, so long it passes over the float and out of the air vent. As soon as beer is discharged into the lantern the float rises until it is pressed against the air cock, when the cock to the header is opened and the beer flows to the filling machine, and by placing the barrels so that they empty alternately a continuous flow is obtained.

BOTTLE FILLING.

The bottles having now been properly prepared, the next operation necessary in the bottling process is the filling of the bottles with beer.

The two principal precautions to be here observed are, first, to guard against the escape of the carbonic acid gas contained in the beer, and, second, to prevent an infection of the beer by foreign micro-organisms, while it is being transferred from barrel to bottle.

TROUGH SIPHON FILLER.

The form of bottle-filling device now in most common use is the trough siphon filler. This consists of an oblong trough-shaped receptacle, with a cover fitting more or less tight and

supplied internally with a float indicator so that the surface of the beer, when in this filler, can readily be kept at the desired level. Through one of the long sides of this filler are inserted a number of siphon tubes, each bent in a shape similar to a letter J. The curved part of this tube is placed inside of the trough and the straight part outside of same, the tube being attached to the walls of the trough and pivoted at the point where it passes through, in such a manner that its ends can be raised and lowered a few inches. The tube is open at its curved inside end except when this end is depressed, in which case the opening is closed by being forced against a rubber disc or washer. The outer straight part of the tube is tapered at its end and closed, a small slot or opening, however, being cut a short distance above this end.

The operation of this siphon tube is as follows: By placing a bottle over its outer straight end and depressing it, the slotted opening is lowered and at the same time the inner curved end is raised away from the rubber closing disc, which allows the beer to flow or siphon into the bottle, the flow continuing until the surface level of the beer in the bottle has reached the same height as the surface level of the beer in the trough. After removing the filled bottle the tube is again closed automatically by means of either a spring or a weight forcing down the inside opening of the tube against the rubber closure. In regulating the height of the level of the beer in the fillers allowance should be made for the quantity of beer displaced by the tube while in the bottle. This can be done by filling the bottle to the brim, when, upon removing the tube, its displacement will usually equal the unfilled space desired in the bottle. This air space is of great importance, as it furnishes a cushion for the expansive force of the beer when subjected to a higher temperature than that prevailing at the time of bottling. In the event the bottle were completely filled with beer, any such expansion would tend to expel the stopper or burst the bottle, and would certainly do so during the subsequent steaming process wherein the temperature and pressure of the beer in the bottle become quite high.

As the beer before it reaches the bottles is usually, during this transfer, brought more or less in contact with air, which means a possible chance of infection by foreign micro-organisms,

all modern fillers are constructed in a manner tending to reduce this contact to a minimum.

Porcelain-lined or Enameled Trough Filler with Air Filter.—A neat and practical system for bottle filling employs purified air. This system consists of a trough bottle filler, which possesses the novel feature of having its inside, with which the beer comes in contact, porcelain lined or enameled (making an easily cleaned filler), preventing the beer from coming in contact with metal surfaces. To this filler is attached an air filter for the purpose of removing any foreign substances from the air while the latter passes from the air reservoir, also a part of this system, to the supply barrels.

BACK OR COUNTER PRESSURE BOTTLE FILLERS.

The different styles of trough bottle fillers now on the market possess, as a class, a drawback in the feature that they allow more or less carbonic acid gas to escape from the beer during the filling operation. Since the quantity of carbonic acid gas that a liquid will contain or hold in solution depends partly upon the amount of pressure resting upon its surface, it follows that, when this pressure is reduced, a corresponding escape of gas from the liquid takes place.

In order to overcome this loss of gas or reduce it to a minimum some styles of bottle fillers are constructed so as to operate in such a manner that the beer, during the time it is being filled into the bottle, is continuously subjected to a pressure sufficiently great to prevent the escape of any of its contained carbonic acid gas. The principle, however, by which the beer flows into the bottle, or by which this flow is started or interrupted, is that of the siphon above described, and not the employment of the force of any extra pressure, as this pressure is practically the same upon both the beer in the filler, in the reservoir and in the bottle, and any excess pressure, due to the displacement of the air in the bottle, is blown off automatically from the back pressure chamber.

A disadvantage, however, of this form of back pressure bottle filler lies in the fact that the contents of bottles that may be chipped, cracked or partly broken during any of the different stages of the bottling process, and which contents may amount to a considerable quantity during the course of the day, cannot be returned or poured back into a filling device, as can be done with the open trough style of bottle filler.

The most universally used of this kind of bottle fillers operating upon the back-pressure system consists of a stand supporting two air-tight brass tubes or cylinders. The lower and larger one of these is used as the beer reservoir, corresponding to the trough of the trough filler, and has attached to it the siphons, bottle-holding clamps and shut-off valves or cocks. The upper or back-pressure reservoir is connected with the bottles to be filled and is used as a receptacle for containing the pressure producing air or gas; it is supplied with a diaphragm by-pass or blow-off regulating valve for the purpose of automatically regulating the back pressure and blowing off the displaced air from the bottles after they are filled. The siphons operate similarly to those of the ordinary trough filler described; the bottle-holding claws and the beer and pressure shut-off valves are so constructed that, when the siphon tubes are raised, the claws open and release the bottles, and, at the same time, the shut-off valves close and simultaneously interrupt both the flow of the beer and the back pressure, so that the bottles can be removed without loss of either.

This filler is also made of a round revolving pattern, offering the advantage of compactness and requiring less moving about on the part of the operator.

Another style of rotary back-pressure filler is fed from below and has a glass lantern, containing a float ball, to regulate the flow and back pressure.

BOTTLE CLOSING OR STOPPERING.

After the bottle has been filled with beer, the next operation necessary is to close the bottle as quickly as possible. This has in view a double purpose—namely, to prevent any escape of carbonic acid gas and to avoid subjecting the beer to the chances of an infection by germs floating in the air.

CORKS.

The oldest form of bottle closure is the cork, which still maintains its standing at the present time, and which is too well known to require description. The cork, however, has the following disadvantages: That it is often difficult to extract the cork from the bottle, causing, by the attempt to do so, the beer to be agitated and to foam excessively when poured out; that pieces of cork often fall into the beer if a dull corkscrew is used; that, in compressing the moist cork, which happens just previous to its insertion, a juice or liquor is squeezed out which usually

drops into the beer and may afterward affect its appearance; and, lastly, that if a poor quality of cork has been used the bottle may not be hermetically closed thereby, allowing the escape of the carbonic acid gas, and, in extreme cases, even spillage of the beer.

In order to overcome these defects, and for the purpose of cheapening the cost of bottle closures, various devices have been put upon the market, of which the following are the principal ones in use:

PERMANENTLY ATTACHED STOPPERS.

Patent Stoppers.—The form of closure most commonly used on bottles containing beer of which a high degree of durability is not required and which is supposed to be consumed soon after leaving the brewery, is the "patent stopper." It consists of a rubber button or plug, through which passes a wire loop, inserted at its ends into a movable wire lever or clamp, fastened permanently around the neck of the bottle. By depressing this clamp the wire loop is lowered and at the same time the rubber plug clamped tightly over the mouth of the bottle.

The advantages of the patent stopper over all other closures lie in the facts that the bottles supplied with it can be opened by hand, require no corkscrew or other tool, and that they necessitate no renewal of the closure each time the bottle is refilled, thus effecting a considerable saving in the cost of closures.

The disadvantages, on the other hand, possessed by the patent stopper, are that the disc of rubber which covers the opening of the bottle comes in contact with the beer, and is not very easily thoroughly washed and sterilized. This washing, etc., is rendered more difficult by the crevices in the rubber disc; furthermore, bottles having patent stoppers offer a temptation to the customers to keep them for use for other purposes, as the closure is always at hand, ready for use and easily applied.

Porcelain Stopper.—In order to overcome some of the disadvantages possessed by the ordinary patent stopper having the rubber seal, other styles employ a conical porcelain plug, to which is attached as a seal a smooth rubber washer, easily replaced when it shows any wear, and affording a perfectly tight closure on account of its tapering position on the plug.

SINGLE-USE STOPPERS.

All other forms of stoppers in use are of the "single-use" kind; that is, the stoppers are not permanently attached to the bottle,

but are thrown away and not re-used after the bottle has been opened. This style of stopper does away with the possibility of any impurities from any former contents of the bottle finding their way into the bottle, since at each filling a new stopper is inserted. These stoppers possess the advantage of more universally supplying a tight closure, which is not the case with some of the old style patent stoppers in which the rubber becomes worn or hardened. These stoppers, although more expensive, further allow the bottle being capped or wrapped with tin foil, etc., affording an opportunity for preparing a neater appearing package.

Metal Plug Stoppers.—One style of these single-use stoppers consists of a hollow cup-shaped plug, made of aluminum. After insertion into the mouth of the bottle the sides of the stopper are expanded into a special groove or recess in the inside of the mouth of the bottle, a rubber ring or gasket having been previously placed around the stopper, so as to form an additional air-tight seal between metal and glass.

Flanged Disc Stoppers.—Another style of single-use closure consists of a flat tin-plate disc, having a flanged and crimped edge and containing a thin disc of cork on its inside for the purpose of supplying the closing seal when affixed to the bottle. The cork disc employed is specially treated for the elimination of impurities and is then saturated with a neutral and inert water-proofing compound. Between this cork and the metal disc proper a sheet of prepared paper is inserted to prevent its contact with the tin. The flange and corrugations on the metal are compressed by a machine which secures them around the bottle head and under a shoulder formed thereon, thus insuring the proper compressions to the cork disc to make a gas-tight joint and holding the metal disc firmly in place. With this closure there is no possibility of injecting objectionable residual liquids into the contents of the bottles from the cork in the act of crowning, or of such dissolving out thereafter, as is well known to be the case in the compression of ordinary corks, old or new. That part of the cork disc which is placed under compression never comes in contact with the contents of the bottle; and the body of the cork which is in contact is extremely thin as compared with the length of the ordinary cork.

Another style of closure consists of a cup-shaped tin capsule,

similar to the lid of a round pill box, containing a disc or washer of cork. This capsule is secured to the neck of the bottle by a circular strip of tin, the top edge of which is bent at right angles, so as to form a flange over the capsule.

In affixing the same the capsule and circular strip are compressed over the bottle, and while in this compressed state four wheels gather together and revolve and turn inward or "spin" the other edge of the circular strip under the shoulder or offset of the lip of the bottle.

The main feature of this closure is, however, that the closure can be removed from the bottle by hand, requiring no tool. This is accomplished by having one end of the circular strip pass through a slot in the other and protrude or extend therefrom. To open the bottle this tin protrusion is bent back, by which the circular ring is opened and the closing capsule loosened and removed, a movement similar to loosening a strap from a buckle.

Another style of similar closure consists of a cup-shaped capsule containing a disc of cork, like the above described closure, but having its sides or cylindrical part much longer. These sides have three indentations which fit into spiral recesses in the lip of the bottle. In affixing the closure the capsule is compressed over the bottle and then given a turn by which the closure is simply screwed on by about a turn of one-sixth revolution. By the reverse turn by hand the closure can be readily removed from the bottle.

Rubber Disc Stoppers.—Another closure consists of a disc of rubber, about one-third of an inch in thickness, coated upon the side coming in contact with the contents of the bottle with a specially prepared textile fabric, saturated and covered with an inert, tasteless and odorless compound, to prevent contact of the rubber with the liquids. This rubber seal is elastically forced by machines into a specially prepared groove formed in the mouth of the bottle. It contains a wire loop, projecting from the top surface, by means of which it is readily extracted by suitable openers or by any stout-pointed instrument. When about to be inserted in the bottle the rubber disc is tapered up by the machine so as to enter the neck readily, expanding after insertion so as to fill the full width of the neck. In steaming it will expand or contract with the bottle.

Economical advantages gained by the use of these types of

single-use closures lie in the facts that the extra operation of wiring, and that of the two operations of affixing and removing the steaming caps before and after pasteurization is entirely done away with since these closures have been found to remain immovable at the pressures generated in the bottles during the steaming process. Another and considerable advantage possessed by these closures is that they can be removed from the bottles with ease by use of special accompanying openers, or, in fact, with any pointed instrument, or by hand, and thus prevent agitation of the beverage while the bottle is being opened.

BOTTLE-CLOSING MACHINES.

The machines employed for inserting or affixing the different closures described are, with the exception of corking machines, manufactured especially for use with each style of closure.

Corking Machines differ little from each other in the principle of operation, which is as follows: The corks are thrown into a funnel, and drop one by one into a cylindrical clamp, where, by means of a horizontally-acting plunger, having a circular-shaped recess, the cork is compressed to a size somewhat smaller than the opening in the bottle. While in this state a vertically descending round plunger forces the compressed cork into the bottle, where it expands and conforms in shape to that of the inside of the bottle, thereby effecting an air-tight seal.

CORK-CLEANING, SOFTENING AND WASHING MACHINES.

Cork-cleaning, softening and washing machines consist of a revolving horizontal drum, having its cylinder constructed from slats or strips of wood, arranged with spaces between them. The corks are placed in this cage-like cylinder, which is then revolved, whereby the fine, powder-like substances contained in the outside veins of the cork, and which might otherwise find their way into the bottle, are removed or shaken out by the concussion of the corks against each other. Other forms have this cylinder placed over a tank so as to partly revolve under water for the purpose of soaking or cleaning the corks, or else have a central water pipe with perforations lengthwise as a means of sprinkling the corks for soaking and washing purposes.

TREATMENT OF CORKS.

A cork, when properly treated, should be elastic and when in the compressed state previously to insertion into the bottle, should

not give off any pressed out liquid, since this liquid is likely to drop into, or come in contact with, the beer, and affect its brilliancy.

The corks are first rumbled dry in a revolving drum for several hours in order to remove the brown cork dust in their veins. They are then further rumbled with a spray of water for about 30 minutes or, where the apparatus has no central perforated shaft for water to spray, the corks can be placed in a vessel and the water changed continuously for about 30 minutes. The corks are then put into water of 178° F. (65° R.). Higher temperatures, especially boiling water, may injure the corks. Bisulphite of lime is added to a distinct odor (about one pint to 6 gallons of water) and the corks allowed to remain until soft, which usually requires from 15 to 30 minutes. The corks are then transferred to a wire basket and immersed in a glycerin solution of 156° F. (55° R.) and kept here for about 30 minutes. This glycerin solution is made by adding one volume of glycerin to about three to five volumes of water, according to the quality of the corks used or softness desired.

The corks are finally allowed to drain, and then stored in a clean perforated barrel, that is, one having holes bored through the sides, bottom and cover. By this treatment the corks will be ready for use in about 24 hours and will remain in condition for immediate use for three to four days.

CORK PREPARING APPARATUS.

As it is a difficult and slow operation to impregnate wet or soaked corks, that is, such as have their pores full of water, with a different kind of liquid or solution by contact, a special apparatus for rapidly and thoroughly accomplishing this process has lately come into use.

The principle here employed is that the dry corks are placed in a vacuum, whereby most of the air contained in the pores is extracted and subsequently replaced by the impregnating fluid with which the corks are allowed to come in contact.

The operation of this apparatus is as follows: The corks, after being rumbled to remove any loose powder contained in their pores, are placed in a drum-shaped receptacle into which live steam is then allowed to enter until all the contained air is displaced. The drum is then hermetically closed, and cold water sprayed over its outside, whereby the steam inside the drum is

condensed and a vacuum formed. Through a valve the proper amount of impregnating fluid is then admitted, and the drum revolved so that the corks will be thoroughly moistened or covered with the liquid. Another valve is then opened so as to let air into the drum and relieve the vacuum, whereby the liquid is forced into the pores of the corks by the atmospheric pressure on their surface.

CORK-BRANDING MACHINES.

Cork-branding machines are rapidly coming into more general use among bottlers since the branding of corks with the name of the brewer and date of bottling possesses desirable features in both furnishing an advertisement for the brewer and giving a control as to the date of bottling. The branding machines now in use employ either gas, gasoline or electricity as a heating agent, and are so constructed that the corks, placed in a hopper, drop through a tube and are forced between revolving pulleys or rollers, which pass or revolve the cork over or across a heated metallic die similar to a small branding iron. The operation is very rapid and sufficient corks can be branded for daily use in a comparatively short time.

WIRING.

In order to prevent the corks from being expelled from the bottle by internal pressure, caused by the carbonic acid gas, or by the extra pressure generated during steaming, bottles closed with corks are generally wired; that is, a wire loop is placed around the ring flange of the neck of the bottle and the ends bent upward and spirally twisted together over the opening of the bottle, thus keeping the cork in position. In order better to keep this wire clamp in an immovable position, and to give the package a neater appearance, variously shaped corrugated stamped discs of tin are placed between the wire and the cork.

Bottle-Wiring Machines.—Wiring bottles, when done by hand, is a laborious operation, and a machine has been designed and constructed to accomplish this manipulation in an even, neat and rapid manner. This machine operates automatically, it being necessary only to press the bottle against the wire loop held by the jaws of the machine, when, by depressing the foot lever, the bottle is wired, the wire trimmed, and another loop made and held in position ready to be put on the next bottle. The capacity of this machine, when properly operated, is about 1,000 bottles

per hour, which is approximately four times the number usually finished when done by hand.

BOTTLE CAPS.

A style of bottle cap much used and easily affixed and removed from the bottle consists of a flat tin disc, to which three strips are attached and bent downward at right-angles. The strips are again attached at their lower ends to a circularly-bent tin band or strip having a slot cut at one end, and the other end tapered so as to fit into this slot. In affixing the cap, the tapered end is inserted through the slot and its protruding part bent backward, whereby the circular strip is tightened or clamped around the flange on the neck of the bottle, for the purpose of holding the disc firmly over the cork.

CORKING, CAPPING AND WIRING MACHINES.

In order to bring the cost of corking, capping and wiring to a minimum, an automatic machine, combining these three operations, has been designed and placed on the market. In the operation of this machine the bottles are placed into a revolving attachment holding six bottles, in which they are successively corked, capped with a disc and wired automatically at the rate of about twenty bottles a minute by but one operator. This machine adjusts itself to take any size bottles, and the corks need not be handled, as they discharge automatically from a hopper to where wanted. The machine has another advantage in the fact that the cork is compressed before the bottles come under the compressor, preventing the troublesome cork juice from dropping into the beer.

BOTTLE BOXES.

These are so well known in general appearance as to require no detailed description. Attention should, however, be called to the construction of the cross-partitions separating the bottles, which should either be raised from the bottom of the box or tapered downward. This causes the bottles, when the case is placed on end, as is a common custom of the consumer for the purpose of economizing space, to assume a slanting position, with bottoms lower than the necks, and thus prevent them from falling out.

PASTEURIZATION, OR "STEAMING."

The process in the bottling department known as pasteurization is the manipulation of heating the beer in the bottles to a

certain temperature, holding this temperature constant for a certain length of time, and, finally, cooling to nearly ordinary atmospheric temperature. The object of this heating of the beer is to kill any yeast cells or other micro-organisms that may be contained in it, or to weaken their vitality to such an extent as to render them inactive, and thereby prevent any further fermentation or decomposition of the bottled beer which might otherwise have taken place.

In order to carry out this pasteurization manipulation, the bottles containing the beer are placed in a tank, which is then filled with cold water. This water is gradually heated to the desired temperature by means of injected live steam (hence the more popular term "steaming") and the warm water afterward gradually cooled by being mixed with an incoming stream or jet of cold water. By this means the beer is gradually heated by taking up heat from the surrounding water, and, later on, giving off this heat to the cold water.

IMPORTANCE OF PASTEURIZATION.

There is no part of the bottling manipulation of more importance, nor one which, if improperly executed, can give rise to more serious annoyances and loss of money or reputation for excellence of the bottled product, than this process of "steaming" or pasteurizing. During all of the many stages or processes through which the beer passes while being manufactured, any abnormal change in its quality or appearance can be readily detected by a competent and careful brewer, and the proper remedies applied before the product has left the brewery. An exception to this, however, is the pasteurization of the bottled beer, since this part of the process takes place just previous to shipping or placing the beer in the market, and it is, therefore, practically impossible to test it in the time at disposal. Hence, any deterioration of the beer, due to improper or incomplete pasteurization, usually manifests itself while the product is in the hands of the consumer. The results, in this event, are, almost universally, that the brewer is blamed for having produced an inferior beer, even though, in reality, the beer may have been of excellent quality and the greatest care and skill possible been exercised during every stage of its production in the brewery.

At the present time, instances where all the beer contained in the "steaming" tank has proved to have been improperly heated

are not of such frequent occurrence as was formerly the case. There is one trouble, however, that quite frequently presents itself, and has puzzled many brewers. This is where the beer from the same chip cask has been filled into bottles and "steamed" in the same tank at the same time, with the result that a few of the bottles of beer proved to have been improperly "steamed," while the others had been properly treated. The cause of this trouble has usually been found either in the defective construction of the tank or heating apparatus, causing the lower tiers of bottles or those in the corners of the tank to be insufficiently heated on account of defective circulation of the water, or else in an improper arrangement of the bottles themselves, being placed either too close together when the tank was filled with single bottles, or being put in wooden boxes made of solid boards and allowing practically no circulation of the water through them.

PRECAUTIONS IN PASTEURIZING.

In order properly to carry out the steaming or pasteurizing process in the most economical manner, the following precautions should be observed:

1. The raising and lowering of the temperature of the water surrounding the bottles should be done gradually in order to reduce the liability of breakage of bottles.

2. The length of time for holding beer at the desired pasteurization temperature should be such that all the contents of the bottle are subjected to the same maximum temperature. As the beer in the bottle remains at rest during steaming, there is practically no circulation or mixing of the warmer beer from the outside with the colder inside portion. Furthermore, as the bottom of the bottle is usually of thicker glass than the walls, and rests upon the wooden grate or support, thereby coming only partly in contact with the warmer water, it is evident that up and down circulation is prevented and it takes considerably longer for this central portion to warm to the desired degree of heat.

3. The beer in the bottle should not be heated for a longer time or to a higher degree of heat than is necessary to pasteurize it, on account of the liability of the product to acquire the objectionable so-called "steam" or "bread taste." Furthermore, such heating is apt to coagulate and precipitate some of the albumen contained in the beer, causing haziness or turbidity or con-

sequent sediment. Excessive heating also involves the danger of forcing out corks or stoppers, or of exploding the bottles, since the pressure of the carbonic acid gas, in such event, becomes very great, and some bottles will break which would otherwise have withstood the pressure at the normal temperature.

ERRORS TO BE AVOIDED.

The success to be obtained in the process of pasteurization of bottle beer depends not only upon a proper construction of the "steaming" tank, but also, to a very large extent, upon the manner in which the water is heated.

A very common hindrance to a proper steaming process lies in the use of improperly constructed wooden steaming trays or boxes for holding the bottles while in the tank. In order to have such boxes strong and durable, they are often constructed of heavy lumber, with practically no spaces or holes in their sides, ends and bottom to allow the circulation of the heating water through them.

Where these boxes are not employed, it is customary to place the bottles in the tank singly, which is a preferable but more time-consuming method. Here, also, an error in manipulation is frequently met with, in the fact that the bottles are placed too close together, because it is much easier for the workman to place the bottles touching each other than to place them apart in every direction, which requires care and mental effort on his part.

A further cause of improper pasteurization of the beer, besides the mechanical defects mentioned, is an insufficient length of time of holding the maximum temperature in the water, so that the beer in the centers of the bottles does not reach this maximum temperature at all, or for too short a time.

In order to determine the time when the beer in the center of the bottle reaches the maximum temperature, a series of tests were carried out, the averages of the results being given in the table on next page.

In these tests, made with "export" size bottles, the beer was heated from 41° F. (4° R.) and the water from 68° F. (16° R.) these representing average temperatures. The water was in every test raised to 140° F. (48° R.) in 30 minutes.

From these results it will be seen that pints require 20 minutes and quarts 35 minutes longer heating before all their contents

reach 48° R. than does the water, while, when the cooling begins, the decrease in temperature is quite rapid. It is also seen that the opinion of some bottlers, that the beer will hold the highest temperature for as long a time after cooling begins as it took to gain it after the water had reached it, is incorrect. For instance, at ten minutes before the time quarts reach 48° R., their temperature is 47.5° R., while that of the water is 48° R., a difference of half a degree, whereas during the first ten minutes of cooling there is a difference in temperature between the beer and the water of 8° R.

TEMPERATURES DURING PASTEURIZATION.

| Time. | Temperature of Water. | Temperature of Beer in Center of Bottle. | |
|-----------------------|-----------------------|--|---------------------|
| | | Pints. | Quarts. |
| Start heating..... | 68.° F. 16.° R. | 41.° F. 4.° R. | 41.° F. 4.° R. |
| 15 minutes..... | 104.° F. 32.° R. | 87.8° F. 24.8° R. | 82.4° F. 22.4° R. |
| 30 minutes..... | 140.° F. 48.° R. | 125.6° F. 41.6° R. | 121.6° F. 39.6° R. |
| 35 minutes..... | ..... | 133.7° F. 45.2° R. | 129.2° F. 43.2° R. |
| 40 minutes..... | ..... | 138.2° F. 47.2° R. | 134.7° F. 45.6° R. |
| 45 minutes..... | ..... | 139.6° F. 47.8° R. | 136.4° F. 46.4° R. |
| 50 minutes..... | ..... | 140.° F. 48.° R. | 137.85° F. 47.° R. |
| 55 minutes..... | ..... | ..... | 138.68° F. 47.5° R. |
| 60 minutes..... | ..... | ..... | 139.65° F. 47.8° R. |
| 1 hour 5 minutes..... | ..... | ..... | 140.° F. 48.° R. |
| Start cooling..... | 140.° F. 48.° R. | 140.° F. 48.° R. | 140.° F. 48.° R. |
| 5 minutes..... | 131.° F. 44.° R. | 138.2° F. 47.2° R. | 138.7° F. 47.4° R. |
| 10 minutes..... | 122.° F. 40° R. | 132.8° F. 41.8° R. | 134.7° F. 45.6° R. |
| 15 minutes..... | 113.° F. 36° R. | 122.° F. 40.° R. | 125.9° F. 41.6° R. |

OPERATING THE STEAMING APPARATUS.

In the manipulation of a steaming apparatus, the attendant very often, after having properly filled the tank with bottles, and also gradually heated the water, will leave the tank to itself the moment the water shows the desired maximum degree of heat, and attend to other work. When he comes back he finds that the water has considerably cooled. He then again turns on the steam, quickly heats the water and again leaves. This is an improper procedure. It is evident that when the water reaches the maximum temperature, the beer, being then considerably cooler, instantly takes up heat from the water, cooling the latter, and especially the small columns of water between the bottles, which cool the most rapidly, since their volume is small in pro-

portion to the volume of surrounding beer. In order to dislodge these cooler, stagnant columns of water, the circulation should be kept up continually during the entire time of holding the maximum temperature, and the attendant should stand by, with thermometer in hand, and keep the temperature of the water constant.

In order to hold this temperature automatically an automatic temperature control is now on the market. This is operated by compressed air and has a thermostat, serving to turn on or shut off the air, operating the steam valve by inflating the diaphragm above it.

The water can be safely heated a degree or two above the maximum temperature desired for the beer during the first third or half of the time for holding, since during that time the beer is not warm enough to run the risk of overheating, and, furthermore, in many styles of tanks the water at the top, where the temperature is taken, is generally a degree or two warmer than the water at the bottom, or between the bottles, even when proper circulation is kept up. Care should be taken not to allow the water to rise above the maximum temperature during the last part of the holding period.

The minimum time which the highest temperature, 140° F. (48° R.) should be held is 30 minutes for pints and 45 minutes for quarts, in both cases heating the water gradually to that temperature or slightly above, as described, in 45 minutes.

Tonic or malt extract pints, on account of their somewhat larger diameter, were found, by tests, to require 5 minutes longer heating than export pints.

The cooling can be done as rapidly as the bottles will allow without breaking, but should not be done in less than 20 minutes.

Steaming Caps.—In order that the corks may not be forced out of the bottle by the increased pressure generated during steaming, metal clamps, made of sheet iron, or differently bent wires, are clamped over the necks of the bottles previous to placing them in the tank.

Steaming Trays or Boxes.—As wooden boxes, to hold the bottles during steaming, almost universally present the defects above mentioned, later styles are constructed of galvanized perforated sheet steel, which allows considerable opportunity for water circulation without loss of the necessary rigidity or durability.

Another style consists of a basket made of woven wire, the whole being galvanized.

Whatever style of tray is used, they should never be packed in the tank so as to touch each other at their sides or ends. Even though the spaces may be sufficient, it may happen, if perforated or slotted boxes are placed against each other, that the openings in one box are covered or closed by the solid parts in the next box. A space of at least two inches all around the boxes should be allowed in placing them in the tank.

STEAMING OR PASTEURIZING DEVICES.

The almost universal form of steaming device now in use is the tank consisting of a square or rectangular wooden box, sometimes made of iron, but each style employing a differently constructed heating device or means for circulating the water in the tank or of moving the bottles. The principles underlying their operation are, however, in the main, two: In one type the bottles of beer to be pasteurized remain stationary and the surrounding water is heated, circulated and cooled, and in the other type water having different temperatures is contained in different subdivisions or compartments of the tank and the bottles are passed through them.

Operating on the former principle are the following:

Single Steam-Pipe Tank.—One of the simplest construction of tanks consists of an ordinary wooden tank, having a heating device made on the injector principle. A piece of 3-inch iron pipe, open at both ends, is bolted or clamped to the bottom longitudinally, this pipe being about 18 inches shorter than the tank so that it reaches to about 9 inches from each of the tank ends. At one of the open ends is inserted a smaller steam pipe, extending several inches inward. When the steam is injected into this larger pipe, it draws the cold water in with it, heats it in the tube, and forces it out at the other end warmer than the bulk of the water in the tank, thus causing a circulation as well as heating of the water.

Perforated Steam-Pipe Tank.—In another style the heating device consists of a number of perforated steam pipes branching out from a main supply pipe. Above these pipes a perforated false bottom of wood is placed for the purpose of further distributing the water and holding the bottles.

Upright Steam Injector Tank.—In another, the heating appa-

ratus consists of an upright tube, having its steam injector at its lower end, which allows the water to be drawn from all directions toward the center or tube. The water then passes upward, is heated and flows outward again in opposite directions through two series of openings at top of the tube.

Bottom Injector Tank.—Another device employs a central tube injector heating apparatus, but differs from those described in the fact that the steam enters the tube at the top, thus delivering the warmer water to the bottom of the tank, where it spreads and rises among the bottles to the upper part.

Overflow Water.—In all these steam injector heating devices the same water is circulated; that is, the water passes through the injector, is heated, passes out, circulates to where it was taken from, again passes through the injector, is heated somewhat more, etc., etc. The surplus water due to the condensation of the injected steam runs off through an overflow pipe. When it is desired to cool the water, the steam is simply supplanted by cold water, and the cooling and circulation proceed in the same manner as in heating, except that there is more overflow water.

Spiral Conveyor Tank.—Another style accomplishes the mixing of the water by means of a spiral conveyor screw, placed lengthwise through tank at about the center of its depth. The steam heating coil is placed at the bottom, and the cooling pipe for sprinkling cold water is placed at the top. The temperature of the water is equalized by agitating the water by means of the conveyor screw, both during heating and during cooling.

Brass Ejector Tank.—Widely different from the devices above described is one which has for its chief feature a specially constructed brass ejector or pump. To this ejector is connected a system of piping, one branch of which is placed at the bottom of the tank and forms the discharge through which the water, heated or cooled in the ejector is evenly distributed throughout the tank. The other branch of piping is placed outside of and near the top of the tank and is used as an overflow to the water. After the bottles are placed in the tank and this vessel is filled with water to a height sufficient to submerge the return or overflow openings and fill the connecting pipes, steam is turned on. The steam in entering the ejector or pump at once propels the water in it forward, and at the same time heats its. The heated

water is then forced through the bottom perforated system of piping upward through the water and bottles, thereby slightly raising the temperature of the bulk of water in the tank. As the heated water passes upward, an equal volume of the cooler water from the top of the tank passes downward into the ejector, is there heated, and in turn passes upward as described. This continuous circulation and gradual heating is kept up automatically until the desired temperature of the water is obtained. In cooling off the water the same manipulation takes place, except that, instead of steam, cold water is run through the ejector, whereby the cooling proceeds in the same gradual manner as the heating. A little above the return overflow openings another opening is placed, through which an increase in water by condensation of steam during heating or injected water during cooling can escape.

The advantages of this system are, first, economy of steam, as no live steam whatever enters the tank, but is all absorbed and condensed before being introduced and distributed into the bottom of the tank. The steam required to operate the pump is so small in proportion to the immense amount of water it moves that a sudden rise in temperature and overheating of bottles is an impossibility. The cooling of the beer is conducted very rapidly and evenly, no cold water striking the hot bottles to cause unequal contraction of the glass and consequently loss by breakage is reduced to a minimum. Another advantage of this system is that the ejector and pipe connections can easily be attached to a tank already in place, as they can be made to fit any size or shape of the tank. The ejector is capable of moving from 60 to 100 gallons of water per minute, in proportion to size of tank and apparatus, with moderate steam pressure.

A steaming device employing the second principle, viz., to move the beer through the water, is of quite recent date.

Water Compartment Pasteurizer.—This apparatus consists of a long, narrow and shallow tank, subdivided into three smaller tanks or compartments, the middle one being the largest. These are filled with water of different temperatures, the first compartment containing water of about one-half the pasteurization temperature; the middle, or largest one, water at pasteurization temperature, and the last one the same as the first. Over and through the tank pass two link belt endless chains, connected by means of

rods, so as to be in appearance more like an endless flexible ladder. To the cross-rods are attached brass wire spring hook clamps for holding the bottles by their necks during their passage through the tank. At the contact between the middle and the end compartments are placed two sprocket pulleys, so that the passage of the bottles through the tank is as follows: The bottles are submerged into the first compartment containing water at about one-half pasteurization temperature, are partly heated and then pass into the middle tank, where the pasteurization takes place. From here the bottles pass into the second tempering tank, where they are partially cooled. After emerging from this place they are further cooled, and at the same time rinsed by a spray of water.

The advantages claimed for this tank are the following: A saving of labor, as only two boys are necessary to load and unload the racks; the regularity of the pasteurization process, each bottle receiving exactly the same treatment as the next; the smaller percentage of loss by breakage, due to the fact that the temperature in the various baths can be controlled and sudden variations of temperature thus prevented. Another advantage, which is a considerable one in the cost of operating the bottle shop, lies in the fact that the water in this tank is not heated, cooled and run out at each steaming, preventing a waste of water and fuel. The water remains the same, and all the heat and water that must be supplied is only such as is lost by radiation and evaporation, which is comparatively little, and that heat absorbed by the beer.

FINISHING THE PACKAGE.

BOTTLE LABELING.

Even though all the necessary precautions may have been taken, in both the brewery and bottle shop, for the production of a sound and durable bottle beer, there still remains another feature which quite often considerably influences the product's popularity, or often unjustly enhances or detracts from its quality in the imagination of the consumer. This is the general appearance of the bottle or package as put upon the market, which is generally determined by the style of label and cap, or the neatness with which these are affixed. This is especially the case with export or "shipping" bottle beer, which quite often finds its way

into the hands of distant consumers possessing little or no judgment as to quality, and who, if they are not influenced in their choice by the reputation of the brewer, are entirely so by the appearance of the package, preferring those which are nicely put up.

In most bottle shops the labeling of the bottles is still done by hand, which offers many drawbacks as to neatness and economy. Such work may be defective in that, if performed by a careless workman, even though a fine label be used, the neat appearance of the bottle can greatly be detracted from by his pasting on the labels in a crooked position, at unequal heights on different bottles, or by smearing paste upon the label or bottle.

In order to overcome these defects and to lessen the time necessary to affix the labels, machines for that purpose are now used in many of the larger bottling departments, which, by the uniformity and speed so far attained, certainly recommend their general use.

The principle of operation of the different labeling machines now on the market is very much the same, and in a general way is the following: The labels are held in large numbers by a label plate or holder, from which they are taken one by one by a picker and placed upon the bottle. This picker, before taking up a label, passes over a roller, or other device, holding paste, by contact with which it is covered with the proper amount of paste, and transfers it by contact to the label, which it picks up. When the label touches the bottle the pickers are disengaged and the pressure necessary to tighten the label is supplied by a set of rubber wipers. These are similar to the well-known window-cleaners, and in their action much resemble the wiping done by hand. The whole operation is automatic; all that the operator need do is to have a bottle in position when the picker and label come toward it. The bottle rest is adjustable as to the depth to which the bottle can be inserted, thereby regulating the height at which the label is put on the bottle. The rest is also adjustable as to height, so that bottles of different diameters can be centered.

The general advantages to be derived from the use of automatic labeling machines are: Speed of operation, no experience of operator being necessary to properly run machine; cleanliness of finished bottle, since no paste can get upon the label or the hands

of the operator; labels are all affixed uniformly; that is, at equal height from, and with lower edge parallel to, bottom of bottle, or if slanting labels are used, the slant on all labels is of the same angle.

CAPPING.

Although but a slight expense for each bottle, a cap of tin foil greatly adds to the finished appearance of the package. It has a further advantage, in that it protects the lip of the bottle from dirt or other matter settling on it after the bottle has stood in an upright position for some time. As this dirt is not removed by the drawing of a cork or the removing of a seal, it sometimes happens that it is washed into the glass while pouring out the contents of the bottle.

STORAGE AND DELIVERY.

The proper storage of bottled beer is of as great importance as any of the manipulations to produce it.

Light. Beer contained in white or clear glass bottles should never be exposed to direct light as it will quickly deteriorate in flavor and brilliancy.

Patent stopper or unsteamed beer should be stored cold, that is, the same as beer in kegs.

Pasteurized beer, on the other hand, should not be stored too cold, but preferably at ordinary room temperatures.

Corks.—Bottles closed with corks should not be stored in an upright position, but lying upon their sides so that the corks will be moistened by the beer and prevented from drying out, which would permit the escape of gas.

PIPE LINES.

In larger breweries the filling from barrels, which entails the troublesome operations of taking care of the packages—filling, cleaning, pitching, stamping, etc.—is being replaced by filling from government casks, connected by pipe line from the chip casks directly.

Here the casks or tanks, placed in a separate refrigerated room under the bottle shop, are filled and gauged under control of a government inspector.

This system has the advantage of rapidity—saving the repeated tapping of barrels—also a more uniform delivery, besides a saving of labor in the general handling of the beer. (See “Legal Relations.”)

FIGURING IN THE BREWERY.

(Temperatures in this chapter are given in degrees Reaumur only because calculations are simpler than with Fahrenheit degrees, and the Reaumur thermometer is more generally employed for these purposes in American breweries.)

CALCULATING THE YIELD OF EXTRACT OF BREWING MATERIALS.

By “yield of extract,” or “yield” simply, is meant the number of pounds of extract which is obtained from 100 pounds of a material used in brewing.

The yield is, therefore, always given in per cent. Thus, if we say the yield of a malt is 64 per cent, or a malt yields 64 per cent of extract, we mean that we obtain 64 pounds of extract from 100 pounds of malt.

In order to calculate the yield of extract of a material we should know:

1. Balling (B.), i. e., the saccharometer (Balling) indication of the wort in the cellar or in the kettle at 14° R.
2. Specific gravity (Sp. G.) of the wort.
3. Bbls., i. e., the number of barrels of wort in the cellar or in the kettle.
4. Materials, i. e., the amount of material used, in pounds.

In order to find the number of pounds of extract obtained from 100 pounds of material, i. e., to calculate the yield, we must first figure out how many pounds of extract were obtained altogether from the total materials used, i. e., how many pounds of extract are contained in the total wort. This is done as follows: