

Specific gravity.....	1.260
Water and volatile substances	47.90 per cent
Dry extract	52.10 per cent
Consisting of:	
Total albuminoids (49.33 per cent of dry extract).....	25.70 per cent
Ashes (19.79 per cent of dry extract).....	10.31 per cent
Glycerin, succinic acid, caramel, dextrin, gly- cogen, bassorin (30.88 per cent of dry extract).....	16.09 per cent
The albuminoids consist of:	
Albuminoids precipitated by sulphate of zinc (albumoses)	3.37 per cent
Albuminoids precipitated by sodium phosphotung- state minus precipitate of zinc sulphate (pep- tones proper)	9.25 per cent
Albuminoids not precipitated (amides by differ- ence)	13.08 per cent
The ash contains:	
Magnesium and calcium phosphates.....	0.63 per cent
Potassium pyrophosphate	6.99 per cent
Chlorine	0.19 per cent
Calculated as:	
Sodium chloride	0.31 per cent
Sulphates	a trace
Potassium carbonate (formed by ignition from organic potassium salts)	2.38 per cent

This liquid yeast extract can be readily evaporated to dryness, and forms a rather hygroscopical brown, lustrous mass which is obtainable either in flakes, when dried in thin layers on glass, for instance, or as a powder, which can readily be compressed into lozenges, tablets, etc. The similarity of the product with beef extract is remarkable, not only as to composition, but also as to general appearance and flavor. In regard to the flavor, however, it may be said that the yeast extract more closely resembles fresh beef broth than does beef extract itself.

PURE YEAST CULTURE.

By pure yeast is meant a yeast derived from a single cell by methods excluding the possibility of infection.

If yeast is mixed with the wort in the brewery and allowed to ferment in open tubs, it is evident that bacteria, wild yeasts and mycoderma that may be present in the air are apt to fall into the fluid, where they have opportunities to develop and subsequently settle, in part, in the yeast sediment.

The Old Way.—In former years, no special pitching yeast was employed, the wort being simply left to spontaneous fermentation. Frequently the fermenting tubs were not cleaned out, and the new wort was pumped on the old sediment. This operation being repeated a number of times, the sediment would acquire a certain characteristic composition. If the beer turned out satisfactory, the yeast was not thrown away when the tubs were cleaned, but was transferred to other vessels. In that way the barm gradually grew up. What this barm really was, no one knew.

Investigation of Yeast.—Inquiry into the nature of this body grew active with the improvement of the microscope, which about the beginning of the nineteenth century became an important factor in scientific research. Being applied to yeast, this mass was found to be composed of countless numbers of very small cells, each of which constitutes a living being very prolific in multiplication and endowed with the peculiar power of inciting fermentation.

PASTEUR'S PURE YEAST.

The full import of these investigations was not realized until Pasteur startled the scientific world with his classical experiments which demonstrated conclusively that the yeast mass is mixed

with large numbers of cells still smaller than those of the yeast proper, and that these minute cells were bacteria. He described several varieties or species of these micro-organisms as being capable of causing beer diseases, and he advised brewers to seek to keep them out of their yeast, for which purpose he devised a method to remove them or make them harmless. This method consisted in treating the yeast with tartaric acid, which killed the bacteria and resulted in what was, in a sense, a pure yeast, that is, comparatively free from bacteria.

Pasteur's pure yeast, however, never acquired any practical importance. This was due to the fact, not at first understood, that this mass, while consisting practically altogether of yeast without any appreciable admixtures of ferments of other classes, was by no means of uniform composition, but contained different varieties of yeast, many of which, present in large quantities, were just as dangerous to beer as the bacteria, although in different ways. These yeasts were afterward called wild yeasts. They are able to produce certain beer diseases, as turbidity and offensive odor and taste.

HANSEN'S PURE YEAST.

Wild yeasts were first found to be the causes of beer disease by Hansen, who traced turbidity in certain Danish beers to their presence.

Hansen set himself to discover means to produce a yeast that should be absolutely free from any admixture of wild yeast, and came to the conclusion that the only way to produce such a yeast with absolute certainty was to develop the yeast from a single cell under conditions that excluded the possibility of infection. This is what is known as Hansen's pure yeast. (For methods of preparing pure cultures see "The Brewer's Microscopical Laboratory.") For obtaining pure cultures of yeast Hansen's moist chamber method is preferable.

Selecting the Type.—The peculiar character of a beer yeast is due mainly to that variety which preponderates in the yeast, and among the pure cultures obtained from the propagation of a number of individual cells taken from such yeast it is natural that a majority should have the characteristics of the original yeast. Each pure culture is examined first as to the degree of attenuation, whether high or low, next as to clarification, whether rapid

or slow, and also as to the taste which it imparts to the beer. If among the pure cultures are found several that show the same degree of attenuation and the same clarifying power and taste of beer that was observed in the original yeast, the conclusion will be justified that these are the ones that exert the desired influences, and it will be proper to select one of them for propagation.

Propagating the Yeast.—The yeast type that has been thus selected is propagated as described in connection with the pure yeast apparatus, until a sufficient quantity has been developed to start a fermenter in the brewery with it. Since it is not always certain that the first fermentation will take a strictly satisfactory course, it is advisable to finish the beer from this fermenter and judge the yeast by the character of this beer when finished. If the beer gives satisfaction, the yeast is introduced for permanent use.

Before this is done, a standard culture is prepared for future reference. A few drops of the yeast are placed in a vial with a sterilized 10 per cent sugar solution, and kept in a dark place. In this way the yeast can be kept unchanged for years.

Advantages of Pure Yeast.—The great advantage of pure yeast in brewing operations consists mainly in the fact that the brewer has at all times at his disposal the same identical yeast type. Consequently, he is able, other things being equal, to produce a beer of constant, uniform character. Even if the yeast should become infected or deteriorate from any other cause, a fresh batch of the identical original yeast can be developed in a few weeks from the reserve culture, and a yeast of the same properties as was possessed by the first lot be once more introduced, the reserve culture having been derived from the same original cell as the first lot of pitching yeast.

Pure yeast, however, is valuable in other ways also. It is a rule that admits of general application, that micro-organisms of one species will crowd out organisms of another species contained in the same nourishing liquid, the more effectually, the greater their relative number. In the same way, a pure yeast containing no foreign organisms, is much more resistant to disease and infection than a common mixed yeast. A pure culture yeast can be infected only by uncleanness or by germs contained in the air, while common brewers' yeast is in itself a most prolific hotbed of infection, being frequently contaminated with bacteria, wild yeast

and mycoderma, which spring into action at slight changes of temperature or composition of yeast food, while a pure yeast will adapt itself more readily to such changed conditions.

PURE YEAST APPARATUS.

An apparatus for the development of pure culture yeast was devised by Hansen. His own description, from "Practical Studies in Fermentation," follows:

HANSEN'S APPARATUS.

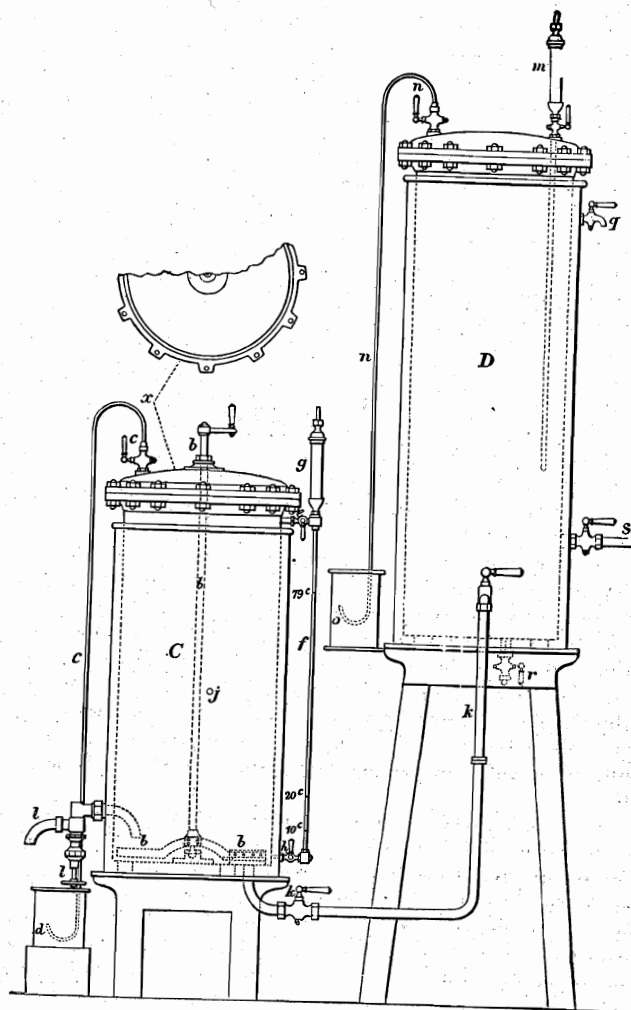
As shown in the accompanying illustration, the apparatus consists of two main portions and the connecting tubes, namely: The fermenting cylinder C, and the wort cylinder D. Air pump and air holder are not shown in the drawing.

The pump A is driven by machinery and draws the air through a filter in order to effect a preliminary purification. The air-holder B is provided with a pressure-gauge and a safety valve. It is charged with air under a pressure of 1 to 4 atmospheres. The pipes must be fitted with cocks at suitable points for removing the water which collects in them. This is of especial importance in the case of the pipe between the air-holder B and the filters g and m. These are best united by metal tubes with the air pipes. If metal tubes are used, they should naturally possess some degree of elasticity and must be so arranged that the filters can be readily fitted and disconnected.

Through the top of the fermenting cylinder C passes a stirrer b, the lower end of which is fitted with two blades, one carrying a sheet of rubber cut in such a way that when rotated it comes into contact with both the bottom and the sides of the cylinder. From the top there passes a doubly bent tube c, and by opening its cock, connection is made with the inside of the cylinder. The lower free end of the tube dips under water in the vessel d.

A little below the top is a horizontal tube e provided with a cock, and by means of which the inside of the cylinder is connected with the vertical glass tube f. This is connected at its upper end with the filter g and at its lower end with a second cock and similar horizontal tube h to that described above.

The top mark on the glass tube is 31.3 in. from the bottom of the cylinder, the next 8 in. and the lowest 4 in. from the bottom of the cylinder. When filled to the top mark, the cylinder holds about 1½ barrels. The glass tube is fixed into the cocks



Hansen's Pure Yeast Apparatus.

e and *h* by a packing of hemp or cottonwool with vaseline; rubber is not suitable, as it is hardened by steam.

The filter *g* consists of a metal capsule containing a tightly packed plug of cotton-wool 8 $\frac{1}{2}$ in. long and 1 $\frac{1}{2}$ in. in diameter. This plug consists of at least one-thirteenth pound of cotton-wool; the addition of a little more is immaterial. If firmly pressed in, the capsule will hold one-ninth pound and more, but this is not necessary. The filter is closed above by means of a cover which is screwed on and which is connected with the tube from the air-holder. Before the filter is screwed on, it is sterilized by heating it for two hours at a temperature of about 302° F. (120° R.).

At the opposite side of the cylinder there is a small tube *j* scarcely $\frac{3}{8}$ in. long and fitted with rubber tubing, the latter being closed by means of a pinch-cock and a glass stopper. Passing from the bottom of the cylinder is a tube *k* through which connection can be made with the wort cylinder D; this tube is made in two pieces to prevent too great rigidity, and in addition to the two large cocks shown, it is provided with two smaller ones which are made use of during the process of steaming described below, partly for running off the condensed water and partly for introducing the steam.

The cock shown at *l* is for withdrawing the beer and the yeast. The valve is screwed down in opening the cock and is screwed up when this is closed. In the figure it is closed. Its construction prevents infection from occurring whilst the liquid is being drawn off, as the liquid cleanses the cock on passing through it. The pipe carrying the cock is carried through the side of the cylinder and is bent toward the bottom, its end being 1 $\frac{1}{2}$ in. above the latter. It is, in short, so arranged that no air from without can enter the cylinder whilst the contents are being drawn off.

The wort cylinder D must be raised somewhat above the level of the fermenting cylinder. (The wort can, of course, also be forced into the fermenting cylinder by means of compressed air, but in this case the wort cylinder must be provided with a safety valve.) Its height is also greater than that of the latter, but its diameter is the same. At the top is a filter *m* exactly as at *g*, and connected with it is a pipe (indicated by the dotted lines) passing inside the cylinder. The lower closed end of this pipe has some small perforations through which the air finds an exit

after passing through the filter. The tube *n* corresponds with the tube *c* of the first cylinder, and like the latter its open end dips into a vessel of water *o*. In the case of the wort cylinder it is very important that the bore of the tube *n*, and of its cock, should not be too small, in order that they may not become choked by hops or other matter; a suitable diameter for the tube is $\frac{1}{2}$ in. Around the upper portion of the cylinder, a little below the top, there is a pipe in the form of a ring *p*, the inner side of which is provided with small perforations. One end of this pipe is closed and the other is connected with a cold-water tap. In addition to the cocks on the connecting pipe *k* between the two cylinders, the wort cylinder has three others *q*, *r*, *s*. The cock *s* is for the introduction of the wort, and is put in connection with the wort main *u* between the copper and the cooler. The cylinder stands in a shallow tray provided with an outlet *t* for the water which flows over the sides of the cylinder, whilst the latter is being cooled. The dotted lines at *t* show the bars on which the cylinder rests, and also the ring-like portion and bottom of the cylinder.

If the fermenting cylinder is not standing in a room with even temperature it is necessary to arrange the fermenting cylinder in such a manner that the temperature of the liquid contained in it could always be controlled, and that it could be lowered when desired. This is done by means of the jacket, shown in C, which surrounds not only the sides but also the bottom of the cylinder; the bottom of the jacket is fixed with screws and can without much difficulty be removed when it requires cleaning. For the introduction of a thermometer there is a tubular aperture through the jacket and the side of the cylinder. The jacket is provided with a tap near the bottom, forming the inlet for the cold water, and another near the top and on the opposite side for its exit; a third tap at the bottom serves for removing the sediment which is gradually deposited by the water.

The wort cylinder is here also provided with a jacket, which, however, can very well be omitted, as the perforated ring serves the same purpose sufficiently well. Nevertheless the jacket has the advantage that it encloses the water from the ring so that the operator is not liable to be splashed. It adds, however, considerably to the cost of the cylinder, and it makes it less simple to manipulate.

The middle portion of the cover is made of copper and is provided with a brass flange with twelve bolt holes. Between the cover and the collar of the cylinder a rubber washer is inserted and fits into a groove; a perfectly air-tight joint is thus ensured.

In order to prevent the stirrer being raised out of its bed at the bottom of the cylinder whilst in use, a ball-socket is provided. The axis ends in a ball which rests in a hemispherical socket, and two pieces accurately fitting the upper portion of the ball are bolted on; the axis can be rotated but cannot be raised from its socket.

With regard to the tinning of the cylinder, it must be pointed out that the tin should not contain an appreciable amount of lead. If this is the case, the yeast grown in the apparatus will, according to Prior, be unsatisfactory.

In putting up the apparatus, it ought above all to be borne in mind that it should remain in its position undisturbed. When possible, it will generally be best to place it in the fermenting cellar. There is then, as a rule, no trouble with regard to regulating the temperature, and in drawing off the beer and the yeast there will also be less work involved, for those occupied can, in the interval, do other work close at hand. If the temperature of the fermenting cellar is below 43° F. (5° R.) it is advisable to have the fermenting cylinder jacketed. In putting up the apparatus it is, of course, necessary at once to consider whether one or two fermenting cylinders are to be employed; in any case a single wort cylinder will suffice.

The apparatus having been fixed, it is necessary in the first place to test whether the cylinder is tight. To do this, steam is cautiously introduced through *k*, whilst the other cocks are closed; water-pressure may also be employed.

STERILIZING THE APPARATUS.

Before the apparatus is set working it is necessary thoroughly to sterilize the two cylinders, the pipe which unites them, and also the pipe through which the wort passes on its way to the wort cylinder. This is done by blowing a strong current of steam through the whole. The filters are sterilized, as already mentioned, in a sterilizing oven. The fermenting cylinder is sterilized by steam, admitted through one of the cocks on the

pipe *k*. Whilst the high tension steam is passing, the different cocks are opened from time to time, so that it can escape through these as well as by the bent tube *c*; this operation takes half an hour. Shortly before this the filter is screwed on, and then all the cocks are closed except that on the bent tube. Simultaneously the cock of the filter is opened in order that air may pass through the filter *g* and the tube *h* into the cylinder. The latter cools down as the air enters and the steam is gradually turned off. In short, the cooling is effected by the current of air, which mixed with the steam escapes through the bent tube *c*. So long as a current of steam is seen to escape, the vessel of water *d* is not required; this is only required as an indicator at a later period. If the steam were shut off suddenly, there would be a danger of the filter not admitting a sufficient volume of air to prevent a diminution of the pressure due to cooling, and the result would be either that impure air would be drawn into the cylinder, or the latter might collapse from the external pressure of the atmosphere. Under the conditions mentioned and at the ordinary temperature of the fermenting cellar, the cooling takes about two hours.

With regard to the small vessels of water *d* and *o* at the bottom of the bent tubes, it may be stated once for all that their only object is to indicate the direction of the air current, whether outward or inward.

OPERATION OF THE APPARATUS.

The wort cylinder and its two pipes *s* *u* and *k* are sterilized in the same manner, but the process of cooling is here omitted. When the steaming is nearly finished, the cock of the air-filter is opened and the wort is admitted. The wort employed is the ordinary hopped lager beer wort, which has been sterilized by boiling in the copper, and is run as hot as possible through the pipe *u* and the cock *s* into the cylinder. Shortly before the steaming is finished the pumping of the boiling wort on to the cooler is commenced, and ten minutes later the cock *s* is opened. The wort is allowed to run into the cylinder until it reaches the upper cock *q*, and the cock *s* is then closed. It is advisable to place a small bucket under the cock *q* to catch the wort which runs out, and when this occurs the cylinder is known to contain the desired volume of wort. The hot steam and air escape partly through *q*

and partly through the bent tube *n*. It is advisable to run off the first small quantity of wort which enters the cylinder by means of the cock *r*, as it is mixed with water from condensed steam, which gives it a disagreeable taste. When the desired quantity of wort is in the cylinder the cocks *q* and *s* are closed. Air, sterilized by passing through the filter, is now forced through the hot wort for an hour before the cooling is commenced, and the aeration is also continued during the process of cooling. Generally, a pressure of from 1 to 2 atmospheres in the air-holder suffices. It is merely necessary that the sterile air in the cylinder should always exert a slight pressure in excess of the atmospheric pressure, and thus prevent any impure air being drawn in, and ensure the full amount of oxygen being taken up by the wort. It is evident that the operator must not forget to first open the cock *n*. If this is not done, there is a risk of injuring the apparatus.

As soon as the wort is ready for cooling, the perforated ring *p* is connected with a water tap and the sprinkler allowed to play against the sides of the cylinder until the temperature of the wort is reduced to about 50° F. (8° R.). In an ordinary fermenting cellar this takes about an hour; the further cooling must be effected by means of iced water. The air is passed through the liquid continuously, and in escaping through the bent tube carries some of the wort with it; the rousing of the wort produces a good deal of foam, but this never gives rise to contamination. The aeration must not, however, be very vigorous or there may be too great a loss of wort. It is only when the wort has cooled to about 52° F. (9° R.) that the foam comes through the tube; this is rendered less troublesome by introducing warm water into the vessel *o*. The wort, now ready for undergoing fermentation, is run through the pipe *k* into the fermenting cylinder.

In order to avoid rousing the wort by the aeration whilst it is passing into the fermenting cylinder, the filter may be connected with a forked tube, one limb of which is a continuation of the air-tube mentioned above, whilst the other only just passes through the top of the cylinder without coming into contact with the liquid. These two limbs must be so arranged that either can be opened or closed by a cock. The air admitted whilst the wort is being run off has, of course, to pass through the last-mentioned limb. This arrangement is not, however, essential.

If it is thought desirable that the wort should deposit its sedi-

ment, an hour can be allowed for this to settle. To guard against impure air being drawn in, the filter must not be completely closed, the current of air being merely checked. There is, however, no objection to the sediment remaining in the wort, which may therefore be transferred to the fermenting cylinder as soon as it is cooled. By this time a very considerable sediment will have formed, and as the mouth of the pipe *k* is at a moderate height above the bottom of the wort cylinder, only a small portion of the sediment is carried through.

The wort at first introduced should not reach above the small tube *j*, through which the yeast is introduced. The yeast is previously collected in large two-necked glass flasks or tin cans, and in the transferring operation a spirit lamp may be made use of if a gas flame is not at hand.

The stirring apparatus is now set in motion and the yeast well mixed with the wort. As soon as this is done the remainder of the wort is added until its level rises to the upper mark on the glass tube *f*, the volume then measuring about 1½ barrels. The column of liquid in this tube is forced by the pressure of the air passing through the filter into the cylinder, the cock on the upper horizontal tube *e* being closed, and the cock on the lower tube *h* opened. When it is not desired to continue the aeration during the fermentation, the latter cock is, of course, also closed, but only after the cock above the filter has been closed.

After about ten days the desired portion of the newly formed yeast can be drawn off. It is here assumed that the cylinder has been exposed to the ordinary temperature of the fermenting cellar; if the temperature has been higher, the yeast will naturally be ready for removal in a shorter time. The beer is run off at the cock *l*, and when froth appears this is closed. Some wort from the wort cylinder—which by this time has been recharged with wort for a new fermentation—is now passed in until the level rises to the second mark from the bottom on the glass tube *f*. The yeast is now well stirred up by means of the stirring apparatus, and the mixture of yeast and wort is drawn off into a perfectly clean vessel (cleansed with hot water and then steamed). When the level of the liquid has sunk to the lowest mark on the glass tube, the cock is closed and wort again run in to the second mark. The yeast is again stirred up and drawn off to the lowest mark; the amount withdrawn now

measures about 13 gals. The portion remaining behind is sufficient to start a new growth.

It is advisable to have two marks in the vessel into which the yeast is drawn off, one indicating $6\frac{1}{2}$ gals., and the other 13 gals. Great accuracy is not required in these measurements.

The yeast obtained is sufficient to pitch 8 barrels of wort, and a new fermentation is started as soon as possible in an ordinary and well-cleaned fermenting vessel. If this cannot be done at once, the vessel containing the yeast must be covered over and set aside in a cool and clean place.

Whilst the wort and the beer are being drawn off from the two cylinders, care must naturally be taken that sufficient air is continuously passing through the filters. Otherwise the liquids will not run freely and air will be drawn in from without. As soon as the yeast has been withdrawn from the fermenting cylinder, wort is run in until it reaches the top mark on the glass tube; the contents of the cylinder are mixed by means of the stirrer, and the new growth then commences.

OTHER PURE YEAST APPARATUS.

Other pure yeast apparatuses were constructed by Bergh and Joergensen, Brown and Morris, Elion, Kokosinsky, van Laer, P. Lindner, Wichmann, Wahl and Henius, and others. Nearly all of those apparatus showed only slight modifications of the original Hansen apparatus.

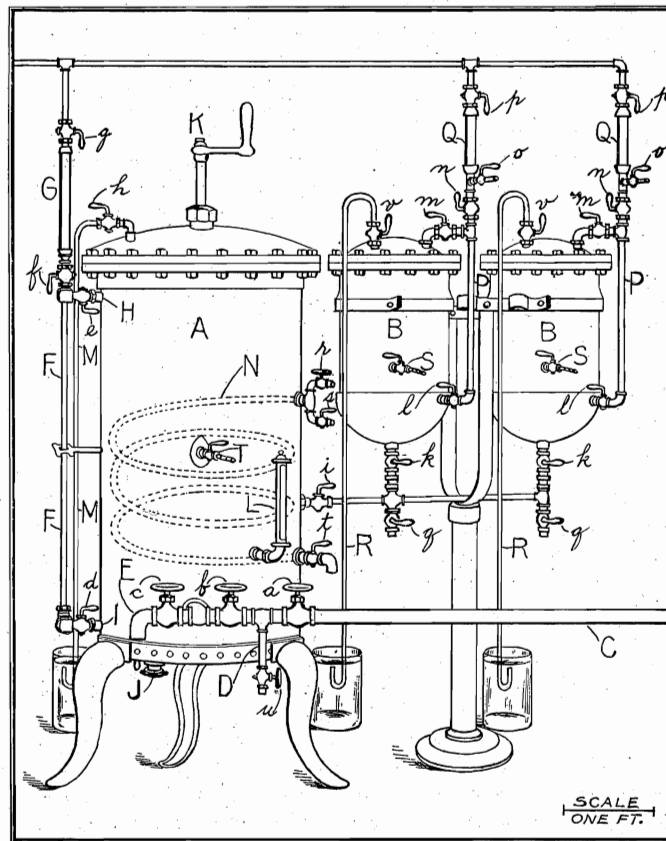
Joergensen was the first to construct an apparatus consisting of a small pitching cylinder and a larger one to be used as a sterilizer and fermenter. The Lindner and Wichmann apparatus were made on the same lines, and so was the Wahl and Henius apparatus.

WAHL AND HENIUS' APPARATUS.

This apparatus is composed of a fermenting cylinder and sterilizer of a capacity of 48 gallons, and pitching cylinders and yeast reservoir of a capacity of 8 gallons.

In the illustration A is the fermenting cylinder; C, the wort conduit with two valves (*a, b*); D, steam connection; E, vent-pipe for the beer; F, glass tube, which is connected with the cylinder by H and I (inside of the cylinder the pipe I terminates in a ring-shaped perforated tube); G, air-filter (connected with the air-pump); M, doubly bent pipe; K, agitator; L, thermome-

ter; a connection between the fermenting cylinder and the pitching cylinder or starter B; P, glass tube (connected with the cylinder in the same way as F); Q, air-filter; R terminates like



Wahl and Henius Pure Yeast Apparatus.

M in a doubly bent pipe; S, small pipe with rubber tube and glass stopper.

The fermenting cylinder A contains a coil through which either

steam, water or brine can be made to circulate, and has at its bottom an outlet pipe with valve and cap for the yeast.

The apparatus, having been tested for tightness by means of water or steam, is sterilized in the same manner as the Hansen apparatus, the steam entering through D into A, and through N into B, which is sterilized first. When sterilization is over *a* is opened, and the wort conduit thoroughly sterilized with steam before the wort is allowed to enter it. The boiling hot wort now runs into the cylinder, and when the latter is three-fourths filled, *a*, *b* and *e* are closed, and the air allowed to enter the cylinder through *d*. After a few minutes the water (or brine) is sent through the coil, and the wort cooled, care being taken that air is passing through it all the time.

Part of the cooled wort is forced under air-pressure up into B, the pure culture added through S and thoroughly mixed by forcing the air in through *l*. According to the temperature of the wort and the room, B will start to ferment in a day or two, whereupon it is filled up with wort from A. A few days later, when B is in full fermentation again, it is stirred up (with air through *l*), and while air still is entering through *l*, and R is closed, is run down into A and mixed carefully with the wort remaining in that vessel. Part of this mixture is forced back into B and now both are allowed to ferment.

When the fermentation is over the beer in A is removed through E—the air entering through *e*—and, *c* having been closed, the yeast is stirred up by the stirrer K and air that passes through *d*. Now the total yeast is taken out through the bottom opening, the wort conduit C is again sterilized, and the hot wort run into the cylinder to be cooled. This accomplished, the yeast in B is stirred up, air being admitted through *l*, and let down into A, mixed with the sterilized wort, part of which is then forced back into B, and both left to ferment as above. In this manner the apparatus may be kept in continuous operation.

The principal advantages of this apparatus are: It occupies little space, is not very expensive, and yields comparatively a larger amount of pure yeast.

MALTHOUSE OUTFIT.

TRANSFER OF GRAIN.

The machinery used in transferring or conveying the different grains in the storage elevators or barley and malt in the malt-house and brewery is practically the same in construction and operation.

The grain, etc., is unloaded from the wagon or railroad car by gravity, that is, it is dumped or shoveled into a chute delivering to the "boot" of the elevator or to the conveyor.

A power shovel is often used when unloading cars. This consists of a wide shovel or scoop, propelled or drawn forward by means of a rope attached to, or running over, a power windlass or shaft. This windlass is supplied with a friction wheel, or clutch, to allow the alternate winding and unwinding of the rope, whereby the shovel is drawn forward or the rope unwound so as to allow the shovel to be moved backward for the next operation. Corners and angles between the windlass and shovel are overcome by having the rope pass over swivel pulleys or blocks and tackles, enabling the shovel to be operated at various points surrounding the windlass.

These power shovels are now in general use in floor malthouses to transfer the barley or green malt from any part of the floors to the openings through which the malt falls into the elevator for further transfer.

This shovel has the advantage over the old method of loading the malt upon a truck or wheelbarrow, wherein the malt is carted to the opening, that the shovel is much more rapid in operation, and crushing of the malt berries by the wheels of the truck is practically avoided. (For illustration of power shovel see next page.)