THE MANUFACTURE OF BREAD BY THE DATHIS PROCESS.

By CLEMENT VAN DE VELDE.

Like other manufacturers in this age of progression and cheapness, the bread baker is compelled to turn his attention to mechanical appliances for the purpose of improving the quality of his product, increasing the yield from the raw material, lessening the waste, and reducing to a minimum the cost of manufacture.

The patent mechanical appliances of Mr. Dathis have been devised to effect such improvements. They have lately been perfected and are now in use in several of the large continental bakehouses with a success so marked, that they bid fair shortly to revolutionize the trade.

Mr. Dathis' invention necessarily deals with the two operations of kneading and baking, towards the perfecting of which he has devoted much attention.

KNEADING.

Kneading is, without a doubt, the most important operation in the manufacture of bread. The mechanical means hitherto adopted to take the place of hand labour at this work having not resulted satisfactorily, the latter is still generally resorted to.

Hand kneading entails a certain amount of dexterity and a very considerable display of muscular energy. In large cities the workmen are no doubt skilled, and are highly paid, but it is quite otherwise in country places and in factories at distances from important centres, where they are obliged of fabricating the bread necessary to the daily alimentation. As regards cleanliness and regularity of manipulation, hand kneading offers many inconveniences. Besides, there is always some danger that the germs of contagious diseases may be communicated to the dough, and frequently the temperature of the oven is not

sufficiently high to destroy their activity. Considerations like these are of material importance from a hygienic point of view and wherever possible, mechanical kneading is much to be preferred.

Dough, prepared for bread, should be soft, light and smooth, a state only attainable by a thorough mixing and peculiar style of kneading, the expanding or drawing out of the dough without any fulling action —a sort of teasing—so as to ærate it in a thorough manner.

Hand kneaded dough rarely presents these qualities, and the best proof to be given is that the bread from it often mildews, a sure sign that the treatment has been insufficient or imperfect.

Such also is the grave fault of the mechanical kneaders hitherto designed, these are mixers pure and simple, and though they stretch and draw out the dough, there is always a subsequent compressive action. As a consequence, the dough is not raised enough, the ærification is imperfect, and the bread produced from it is oftentimes heavy and sad. The arrangements of the apparatus, too, are bad, difficult, not to say impossible to clean, and fermentation hurtful to the quality of the bread is produced.

It is these great drawbacks Mr. Dathis has surmounted by his ingenious contrivance, which, subjecting the dough to a continuous expansion or drawing, and exposing each part of it to the action of the air without any after compression or fulling, fulfils the desired conditions for the preparation of wholesome bread.

The Dathis' kneader (Plate II.) is composed of a trough A, seated secure in a second basin B, revolving upon an axis, so as to present every part of the dough contained in A to the action of the kneading instrument b, having the shape shown upon the accompanying plan. These lift the dough constantly by capillarity, to mix it and knead it by stretching, ærating and blowing without ever compressing, an operation which gives to the dough an incomparable suppleness and lightness.

The trough with its motion and the shaft bearing the motive pulleys, fly wheels, and the crank to work the kneading fingers, are all fixed upon a cast-iron frame work.

The kneading fingers b are fixed to the extremity of levers c by means of regulating screws d. These levers are worked by cranks e, fitted to shaft F, put in motion either by belting or crank. The extremity f of these levers is joined to the hinged shank h which serves as a resting point to part f oscillating around the extremity g of the rod h. This point f can, by means of the groove k with which the lever is articulated at this spot, and of the pression screw l, be raised or lowered so as to regulate the depth of the motion of the fingers b in the trough A. Owing to this disposition, the ends of the fingers describe at each revolution of shaft F—a closed curve of elliptical form.

The trough A, intended to contain the dough, rests upon the basin B of greater concavity. This basin bears at its lower part, a toothed crown m, worked by a spur wheel n, placed at the end of the horizontal rod t. This rod t carries another spur wheel p, geared with a spur q, placed at the lower extremity of an oblique shaft, receiving its motion at the upper part by means of a spur wheel geared with the screw v placed upon the shaft bearing the crank.

The leaven used in the preparation of the dough is kept in an apparatus consisting of a small vessel of wood a (Fig. 1 plate II.I) or any other material with a lid b having an air-tight joint c (this lid may be of glass, so that the growth of the leaven may be watched) ; in the centre is arranged a bung-hole d, screwed upon this lid b ; the empty space in the middle of the bung is filled with cotton which filters the air admitted into the apparatus and prevents the fermenting molecules to enter and decompose the leaven.

The process of working the trough is as follows :—

1st.—A certain quantity of tepid water is put in the lower basin B to keep the dough, which is to be kneaded in the trough at a suitable temperature.

2nd.—In the trough A are put the leaven, the flour, the liquid, and the accessories, in varying quantities.

3rd.—The fly-wheel is turned from left to right ; at first very slowly to allow the flour to absorb the liquid, then a little faster until a speed of 70 revolutions per minute is attained.

4th.—At the end of 10 minutes, the dough is left at rest for two to three minutes, thereafter kneaded for a further 10 minutes ; it is then ready.

5th.—Put the dough to rise in a convenient vessel.

6th.—After each operation be careful to thoroughly wash the trough with plenty of warm water.

Dough for bread-making can be prepared by three different processes :

1st.—With *leaven*, i.e. by taking the dough of a previous day's preparation as a ferment.

2nd.—With *leaven and yeast*, combined, i.e., by utilising a portion of fermented dough, to which is added a portion of yeast, so as to obtain a more regular and more rapid fermentation.

3rd.—With *yeast alone*, using only this body as agent of fermentation.

1st Process.—The first process is the oldest ; the product employed is economical, as the ferment costs nothing, but it is the most expensive as regards labour ; it is also less rapid and safe.

The lack or excess of fermentation of the dough at each operation, the variations of temperature, the bad preservation of leavens, and the imperfect rehandling, are all so many causes of failure. Besides, the leavens which are too old, or badly worked, give to the bread a nasty taste.

2nd Process.—This process is safer, especially when young leavens are used. It is the one generally employed for making common bread, named household bread.

3rd Process.—Is the most costly as regards product, but the most rapid and economical as regards labor. It is also more reliable and is used in preference for the manufacture of fancy bread with or without the addition of milk.

Rise of Bread Dough.—The dough should be put to rise after kneading in a recipient fitted with a moveable piston resting upon the dough, with an electric bell ; as soon as the dough has risen to the height wanted, the bell sounds. (Pl. III. fig. 2.)

In this recipient the first, second and last leaven can be put to rise.

The capacity of the troughs is as follows:

There are 3 sizes of the Dathis' trough

1st—Trough with 2 arms.
2nd do 4 arms.
3rd do 6 arms.

Below are given the maxima quantities of dough which can be obtained with the troughs, and the corresponding quantity of flour.

Designation.	Trough with two arms.	Trough with four arms.	Trough with six arms.
Diameter of trough	1 ft. 9⅝ in.	2 ft, 9½ in.	3ft. 11 2-8in.
Quantity of flour employed	40 lbs.	108 lbs.	242 lbs.
Quantity of dough obtained	66 lbs.	176 lbs.	396 lbs.

BAKING.

General Considerations.—Bread is almost exclusively baked in brick ovens, which vary in shape; in these wood is burned to raise the walls to a suitable temperature, the radiation from which produces the required heat.

Among the numerous inconveniences of this system of ovens, the following may be mentioned:

1st.—Owing to the disposal given to these ovens, it is necessary to heat them before baking.

2nd.—It being necessary to develop in the oven a much higher temperature than is required for the baking of the bread, the result is a great waste of fuel.

3rd.—The radiation of the heat is very irregular.

4th.—The loaves being placed directly upon the floor of the oven, the lower part of the bread is generally badly baked, hard, and tastes bad.

5th.—The difficulties of putting the loaves in the oven and taking them out of the same, an operation which has to be done several times, and during which the door of the oven re-

maining wide open, the bread receives the cold air, and its steady development is stopped.

6th.—Putting the loaves in the oven becomes a difficult matter when small loaves have to be baked. Not being able to do this operation with the desired rapidity, it often happens that those put in first are already baked or burned when the last ones are put into the oven ; hence a great loss in the manufacture.

7th.—Taking out the wood after heating the oven causes a considerable amount of smoke and disagreeable smell, and the partly consumed wood which is taken out of the oven and laid upon the soil for extinguishing it, may in some cases be the cause of fire. Besides, the heat left after taking out the bread is utilized to dry the wood for the next baking. This dried wood may also be a danger of fire.

The use of the Dathis' oven, of which a complete description is herewith, does away entirely with the inconveniences we have just mentioned. With it is obtained a concentrated heat, radiating upon the whole periphery of the objects submitted to its action. This oven is fitted with a separate and distinct fireplace, which allows of the use of any combustible as coal, coke, wood, &c., by which the oven is kept constantly hot. One hectolitre (about 22 gallons) of good coke is sufficient for heating an oven of 6' 6½" during 12 hours.

The loaves can be put in and taken out of the oven at once ; this avoids the loss of heat, and consequently produces a great economy of combustible. The furnace can be easily cleaned or repaired by removing the cylindrical part of the oven, which only rests upon the lower part that comprises the furnace.

The Dathis' oven is composed of three parts :—(Plate IV.)

1st.—The lower part forms a pedestal and comprises the furnace and the chimney.

2nd.—The oven proper.

3rd.—The lid with its fittings for lifting in, &c.

The lower part is supported on short iron legs for the ovens of 1' 8" and 3' 3" diameter, and by four cast iron columns for the ovens of

6' 6" diameter, and is formed of a circular bottom of fire-proof plates b b, resting upon a sheet-iron plate c; this bottom has a cylindrical double border composed of fire proof plates d and ceramic plates f, held together by an iron corner plate. The furnace F is in front of the centre of this circular bottom and below it. It is composed of a flame bridge j, of flues k, and of an ordinary horizontal grate with ash box. The chimney occupies the position z shown upon the plan.

The oven rests upon this lower part, and is composed of a sheet-iron cylinder g, closed at the bottom by a convex sheet iron h, with a double plate i, forming a metallic lense. This sheet iron receives in a direct manner the heat of the furnace, the flame-bridge of which is applied against the double partition i, so as to compel the flame to form a double crown of fire, embracing the whole surface of the sheet iron h; the hot gases escape through the chimney, filling the conduct k. The caloric rays are then stored in the cylinder, according to the curve of the bottom h.

Above the sheet-iron h, is disposed another hollow diaphragm l, open at the middle l', and intended to distribute the heat in the whole extent of the oven.

A cup or a cock m, fitted to a pipe m', allows the introduction of water into the sheet-iron basin l'', placed upon the sheet h, concentrically to the opening l'.

The introduction of this water, which can be made at any desired moment, and particularly at the time the bread is put into the oven, produces a hot mist, which spreads upon the object which is cold at the beginning, and aims at glazing the loaves and facilitating their development.

Over this diaphragm l, is the superior plate A, formed by the concave sheet y, and of a flat sheet X, containing between them a layer of air for the purposes of :

1st —Equalizing the heat over the whole surface of the partition X.

2nd.—To oppose to the passage of the heat a more or less amount of resistance, according to the amount of vacuum between the partitions y and X.

3rd.—To establish in this manner a sure equilibrium between the direct heat and the reverberatory heat.

Above the flat partition X is placed the tray intended to receive the loaves. This tray rests upon rollers fixed to the sheet-iron X, which allows of its being turned so as to select the loaves wanted first.

The use of this tray gives the following advantages—

1st.—Putting the whole batch in the oven at once.

2nd.—Taking out in like manner.

3rd.—The mist can reach the bottom of the loaves, hence facility in their development.

4th.—Suppression of the sprinkling of the bottom of the loaves with flour or sawdust, so as to prevent their sticking to the shovel used for the putting them into the oven, as under the old system.

5th.—Isolation of the loaves from the floor of the oven, and consequently suppression of the dirt the oven contains generally after having been cleaned in an imperfect manner.

The cover P in sheet-iron, has the form of a flattened ellipsoidal cap, and is fitted upon the whole of its outside surface with an isolating envelope ; the effect of this is to reflect the heat upon the outside surface of the loaves. This cover can be raised or lowered by means of a lever B, with equilibrating weight B', supported by a column D. This cover is fitted with handles q, q, with glass peepholes r, r, to watch the inside of the oven, and with a thermometer t.

When convenient, an electric lamp can be disposed upon this cover, to light up the inside of the oven, so that the progress of baking may be observed.

The cover of the ovens of 1' 8" and 2' 5"$\frac{1}{2}$ diam. is taken off by hand, and also the tray that receives the loaves.

For the ovens of 3' 3" and 6' 6"$\frac{1}{2}$, the covers are taken off by means of the system above described. The loaves are placed in position by hand only for the ovens of 3' 3".

As regards the ovens of 6' 6" diameter, the taking out of the tray bearing the loaves can be done by means of a special apparatus, fixed with hinges, n, n, on to the column D, and having claws worked by hand lever.

The latter ovens are fitted with turning tables placed before, and mounted upon a spindle or upon a truck destined for the service of the ovens.

Upon those tables the trays are placed to arrange the loaves as required before baking.

The working of the oven is as follows :—

1st.—The loaves prepared to be baked are placed upon the trays which are introduced into the ovens when the desired temperature is obtained.

2nd.—Follow the indications of the table given below concerning the temperature.

3rd.—Put 3 oz. of water in the injector as soon as the apparatus is closed, and $1\frac{1}{2}$ oz. of water three or four minutes afterwards, for the ovens of 3ft. 3in. diameter. For the other ovens, the quantity of water to be employed is in proportion to the surface of the tray.

TABLE OF TEMPERATURES TO BE FOLLOWED :—

	Temperature of the oven in Fahrenheit degrees.			Time for baking (min.)
	When putting in.	Half baking.	When taking out.	
Large loaves unsplitted of 4 lbs.	414	396	396	50 min.
Large loaves splitted of 4 lbs.	414	396	396	50 ,,
Loaves unsplitted of 2 lbs.	432	414	414	40 ,,
Splitted loaves of 2 lbs	432	414	414	40 ,,
Fancy bread	450	432	432	25 ,,
Rolls	468	432	432	20 ,,
Cakes made with thin dough and put into a mould	432	396	396	45 ,,

There are 4 sizes of ovens of the Dathis' system, namely, of 6 ft. $6\frac{1}{2}$in. ; 3ft. 3in. ; 2ft. $5\frac{1}{2}$in. ; and 1ft. 8in. diameter.

The following table shows the quantity of bread these ovens can turn out in one baking :

	Ovens of			
	6 ft. 6½ in.	3 ft. 3 in.	2 ft. 5½ in.	1 ft. 8 in.
Splitted loaves of 4 lbs. ...	15	4	2	...
Unsplitted loaves of 4 lbs ...	17	5	2	...
Splitted loaves of 2 lbs. ...	20	5	2	...
Unsplitted loaves of 2 lbs. ...	22	6	3	...
Rolls, each one made with 2oz. of dough	200	46	24	12

The paper was accompanied by several diagrams, from which Plates II. to V. have been prepared.

The President informed the members that Prof. Warren had resigned his seat on the Council, on account of pressure of business, and that Mr. G. A. Key had been elected a member of the Council in accordance with By-law 3, Section IV.