Batch Fryers
for pre-fried French Fries

Advantages of Manually Operated DORNOW Batch Fryers of the „Industry“ Series, Models „150“, „151“, „300“, „301“ for the Production of Pre-Fried French Fries and/or Chips (GB: Crisps) as against Fully Automatic Fryers of the same Capacity

(by Dieter Dornow)

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1. Physical and technical facts existing and conclusions

1.1 Physical and technical facts existing

1.1.1 In all fryers (semi or fully automatic) water will be evaporated during the frying process. When frying potato pieces (sticks or slices etc.) the essential process consists in the evaporation of water. The evaporation of water costs energy.

1.1.2 To produce 1 kg of French fries with a 65 per cent residue moisture content, the requirement for energy will be approx. 500 kcal.

1.1.3 To produce 1 kg of potato chips (GB: crisps) you need abt. 2.500 kcal.

1.1.4 These relatively big quantities of energy must be put, via the heat transfer area, into the frying fat or oil in order to generate there the required rather high temperatures (from 130 to 160 degrees C or more).

1.1.5 It is well known that fats and oils only bear certain temperatures. If these fats/oils are exposed for long to too high temperatures they will get rancid. The consequences among other things: ugly colouring on the fried product, and the taste will be affected, too. Eating fat/oil gone bad can also entail health trouble (generally, the health authorities check frying fats which, in some cases, resulted in the closing down of plants.

1.1.6 Back to the „heat transfer area“ already mentioned. When heating a fryer directly, big quantities of energy have to be „pushed“ through small heat transfer areas. These heat transfer areas are, as a rule, arranged horizontally, which, moreover, brings about an enormous heat accumulation beneath those. The fat/oil lying on the heat transfer area is exposed to extremely high temperatures. Thus, the fat/oil gets affected and will soon go bad.

Dornow food technology GmbH, Willstätterstr. 12, D-40549 Düsseldorf - Germany, USt-Id.-Nr. DE119264470
Telefon++49(0)211-527060, Mobiltelefon ++49(0)172-2614932, Fax ++49(0)211-596883, E-mail office@dornow.de, Internet: www.dornow.de,
Commerzbank AG, Konto-Nr. 1452333, BLZ 300 400 00, Geschäftsführer Karl-Dietrich Dornow, Amtsgericht Düsseldorf, HRB 22597

1.1.7 Now it would be advantageous if the quantity of fat/oil contained in the frying vat were as small as possible, thus providing for a quick throughput of the fat/oil. By the constant replenishing of the fat/oil and its fast consumption it would be possible to maintain an acceptable fat/oil quality.

1.1.8 But: a continuously working fryer has e. g. conveyor belts with forward and return motion or reversing devices etc. so that the fat/oil content of the frying vat will necessarily always be relatively high, too high for keeping the quality of the fat/oil at an acceptable level.

1.2 Conclusions

1.2.1 Direct heating of continuously working fryers of all capacities for the production of potato goods has to be rejected for the above described reasons.

1.2.2 Indirect heating, however, is a practicable heating method. Here is a short summary of the features of an indirect heating method: a separate boiler is mounted. This boiler generates hot steam or a hot thermal (chemical) oil (also called contact oil). - The heating medium (steam or contact oil) is pressed, at a high speed, through tubular bundles. The surface of the tubular bundles has to be, in total, several times bigger than the horizontally arranged heat transfer area of the direct heating can be. - The fat/oil flows around the tubular bundles which can slowly release the energy contained in them, due to the fact that the heat transfer area is sufficiently large.

1.2.3 These tubular bundles (also called heat exchanger) are either mounted beneath the conveyor belt system, in the continuous fryer, or outside the fryer in an isolated casing. From here, the (slowly and carefully) heated fat/oil is pumped into the fryer. - The technical equipment described above in simple words is in reality a pretentious (expensive) construction with many safety attachments, control valves etc.

1.2.4 Conclusion 1: The use of the correct heating method requires an external (expensive) boiler and a heat exchanger with a lot of additional technical attachments. - The use of such a costly technology will by no means be worth while in case of small and medium throughputs.

1.2.5 Conclusion 2: For small and medium capacities the manually operated fryers of the „Industry“ series, integrated in a production line, will be paying. The especially constructed heating system (not applicable in continuously working fryers) and the low fat content in the frying vats guarantee a constantly good fat/oil quality, provided suitable natural fats/oils are used.

The sum of money to be invested is acceptable.

Dornow food technology GmbH, Willstätterstr. 12, D-40549 Düsseldorf - Germany, USt-Id.-Nr. DE119264470
Telefon++49(0)211-527060, Mobiltelefon ++49(0)172-2614932, Fax ++49(0)211-596883, E-mail office@dornow.de, Internet: www.dornow.de,
Commerzbank AG, Konto-Nr. 1452333, BLZ 300 400 00, Geschäftsführer Karl-Dietrich Dornow, Amtsgericht Düsseldorf, HRB 22597

2. Economic aspects

2.1 Continuous fryers constructed in accordance with physical laws (i. e. financially pretentious fryers), which are supposed to give a profitable service for a long time, will be worth while for the investor only in case of high throughput capacities. In the initial phase of production the investor ought to fall back on well tried batch fryers, even if these - not unreasonably - are operated manually.

2.2 There are, however, some other reasons that apparently suggest to keep investments on a low profile, above all in the initial phase of a potato refining production.

2.2.1 First it is important to gain experience regarding raw material: sorts, quantities, soil types, fertilization, crop agreements with farmers. Our know-how will be of help to you. But it is up to you to gain your own experience on the spot.

2.2.2 Experience in the field of commercial distribution (marketing) will have to be gained and analysed.

2.2.3 It must be seen how turnovers develop. As soon as you are able, after some years of experience, to estimate the possible turnover for the years ahead you can make reasonable investments in a large-scale fully automatic production line, provided a marketing study on this matter suggests a positive decision.

3. Advantages and disadvantages of manually operated DORNOW batch fryers of the „Industry“ series

3.1 One of the disadvantages seems to be, at first sight, the manual operation. However, the advantages appear to preponderate for an investor who is just going to start with potato processing:

3.2 The capital to be invested remains within certain limits.

3.3 The „Industry“ batch fryers can be integrated, if desired, in plants operated, as for the rest, entirely automatically.

3.4 They give a first-class service and the quality of the products is excellent.

3.5 With intelligent planning it will be possible to effect the „initial investment“, step by step, according to demand. You first buy, for instance, a batch fryer of the type „Industry 300“ or „Industry 301“ and don`t invest another fryer until you realise or expect a higher turnover. With four fryers of this size you can already produce about 500 kg/hr of pre-fried French fries (with an approx. 65 per cent residual moisture) or about 750 kg/hr of deep-frozen goods (with a higher water content).

Dornow food technology GmbH, Willstätterstr. 12, D-40549 Düsseldorf - Germany, USt-Id.-Nr. DE119264470
Telefon++49(0)211-527060, Mobiltelefon ++49(0)172-2614932, Fax ++49(0)211-596883, E-mail office@dornow.de, Internet: www.dornow.de,
Commerzbank AG, Konto-Nr. 1452333, BLZ 300 400 00, Geschäftsführer Karl-Dietrich Dornow, Amtsgericht Düsseldorf, HRB 22597

3.6 One labour can operate two batch fryers and produce, for instance, about 250 kg/hr of pre-fried French fries.

3.7 The technical construction is simple so that, as a rule, it will be possible to carry out repairs by yourselves or by local mechanics.

4. Experiences and references

4.1 The writer of this paper experienced at close range the initial efforts in the field of potato processing in Western Europe.

4.2 The physical laws of nature have not changed since then.

4.3 The author of this treatise supplied the „Industry“ batch fryers as initial equipment to the nowadays biggest French fries producers in Germany (Stöver´s Pommes frites, Agrar-Frost, Amberger, Helmer), in Switzerland (Kadi-Frites), in Denmark (Flenstedt). Not at least due to the good quality of their French fries these companies have undergone a fast development.

4.4 References are available and can be presented on request.

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The items described in the present paper are based on many years of experience.

They are published here without engagement for the author and for our company.

A list of interesting articles and essays regarding the topics of the preparation and processing of tubers and vegetables and associated specialist areas can be found at our Internet site at www.dornow.de, Treatises.

Dornow food technology GmbH, Willstätterstr. 12, D-40549 Düsseldorf - Germany, USt-Id.-Nr. DE119264470
Telefon++49(0)211-527060, Mobiltelefon ++49(0)172-2614932, Fax ++49(0)211-596883, E-mail office@dornow.de, Internet: www.dornow.de,
Commerzbank AG, Konto-Nr. 1452333, BLZ 300 400 00, Geschäftsführer Karl-Dietrich Dornow, Amtsgericht Düsseldorf, HRB 22597

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Dornow food technology GmbH, Willstätterstr. 12, D-40549 Düsseldorf - Germany, USt-Id.-Nr. DE119264470
Telefon++49(0)211-527060, Mobiltelefon ++49(0)172-2614932, Fax ++49(0)211-596883, E-mail office@dornow.de, Internet: www.dornow.de,
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