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Modern block-freezing equipment for meat

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The recent years a pressing demand has arisen to planing an up-to-date, possibly continually working freezing process and equipment which gives better meat quality results as compared to the conventional method of freezing and meets the economical requirements as well.

According to our recent knowledge the one-phase freezing should be realised which is more advantageous in comparison with the two-phase freezing, from the point of view of meat quality and keeping and of weight-loss reduction as well. From the same view points the increase of freezing rate should also be achieved.

The decrease of freezing time depends on the thickness of product, on the temperature of cooling medium and on the surface coefficient of heat transfer. The decrease of medium temperature is a very expensive solution, consequently the less economical one. Improving on the surface coefficient of heat transfer is also not cheap but mostly used. In this field much better value can be achieved by making contact between the product and the cooling medium directly or by means of a plate, as compared with the air blast freezing. The decrease of the thickness of product is the best and from refrigerating point of view the simplest means of decreasing the freezing time and improving the frozen meat quality. This factor wouldn't nevertheless be varied because of the obstinate adherence to the meat freezing in big pieces, in halves or quarters.

The freezing of boned meat is a more advanced method from the view point of modernity because previous boning effects important savings during the freezing, storage and transport in every respect of refrigeration load, volume and weight. The boned meat is suitable

to be frozen in blocks.

The large-scale increase of block-meat production can be expected the next year in several countries. It can be stated that the block-meat freezing method becomes common practice of the meat conservation.

In order to meet the above-mentioned requirements we have designed a quick-freezing equipment for block-freezing of meat.

The essential element of this equipment is a double wall cell with cross-section of 250 x 150 mm and 600 mm in height. According to the production capacity the freezing cells may be connected in any number in line and collaterally. The equipment is of direct expansion system. 20 kg meat-block can be frozen in each cell. The upper and lower side of the cell is provided with covers. The cells will be filled in the upper side. The frozen meat blocks are removed by means of defrosting so that hot gas will be conducted into the cell-wall that effects momentary surface melting. The meat-block slips therefore from the slightly conical cell as a result of the gravitation.

The automatic change of the freezing and defrosting periods will be performed by means of a special control valve. Several cells connected in line can simultaneously be kept in motion by one control valve. These cells with one control valve are connected collaterally to the ammonia line system. The connecting scheme can be seen on the figure 1.

The average freezing time of 20 kg meat-blocks frozen in one phase is 4 hours, until a core-temperature of -8°C .

For industrial-scale equipment several lines made of 10 cells are placed collaterally. One cell-line may be filled and emptied at the same time because each one has a control valve which provides for the automatic change of the freezing and defrosting periods by means of a time-relais and a solenoid valve.

The functioning of the equipment is continuous, because the filling of the cell-lines is performed one after one. E.g. a block-

freezing equipment with a capacity of 10 tons/8 hours needs 25 cell-lines /namely 250 cells/; thus the defrosting of the cell-lines comes at 10 minutes intervals successively.

The filling of meat is performed by means of a filling machinery and the removed frozen blocks are transported to the storage room by a conveyor.

As a result of our examinations accomplished with the experimental equipment a linear freezing speed /according to PLANK/ of $s_{lk} = 12-16$ cm/hour can be achieved that means a very rapid freezing. There were no weight losses practically.

The surface of blocks defrosted after freezing thaws but in a slight film and freezes again some minutes later. Thus the blocks can be transported and stored with a dry surface.

The block freezing equipment will expediently be located at a technological cold store settled close to the slaughter-house, after the raw material preparing workshop, by means of that a continuous production can be accomplished. The arrangement plan of the equipment can be seen on Fig. 2.

The frozen block-meat needs a minimum storage place. The standard load is limited by the loading capacity of the roof only. The transport and the loading of blocks can be mechanized and load plate material handling can be used.

The equipment is very compact and utilizes well the inner room. It can be set up even in non-cooled room. The equipment operates continuously and semiautomatically. For its functioning -30°C . evaporating temperature is required.

The meat can be placed in freezing cells directly or in wrapper. If necessary, the after-wrapping is more advantageous because the freezing slows down by using wrapping material.

The block-freezing equipment is suitable for freezing of industrial meat, of meat for consumption and of viscera. It can well be used for quick-freezing of organotherapeutic organs as well.

Because of the therapy value of the products there is an urgent need to stabilize them by quick-freezing immediately after slaughtering.

In our country the first industrial scale equipment will be in action this year.

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Moderne Blockgefrier-Anlage für Fleisch

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Die durch die Verfasser konstruierte Blockgefrier-Anlage ist ein Direkt-Expansions-System, dessen Grundbestandteil eine, aus Stahlplatten hergestellte doppelwandige Zelle ist. Die gefrorenen Fleischblöcke werden mit Hilfe eines Steuerventils durch Abtauen mit Warmgas aus der Zelle entfernt. Das Beschicken und Entfernen des Fleisches kann halb-automatisiert werden. Der Betrieb arbeitet kontinuierlich. Den Leistungsanforderungen entsprechend kann die dazu nötige Zahl an Gefrierzellen nacheinander oder parallel geschaltet werden.

Die Anlage ist in der Ausführung kompakt und der innere Raum derselben gut ausgenützt. Sie kann in ungekühltem Raum aufgestellt werden und zu ihrem Betrieb reicht eine Verdampfungstemperatur von -30°C aus.

Gemäss den mit der Anlage durchgeführten Messungen, ist bei einem Block von 250 - 150 mm Querschnitt eine $s_{lk} = 12-16$ cm/Stunde durchschnittliche lineare Gefriereschwindigkeit zu erreichen. Die durchschnittliche Gefrierzeit des Einphasen-Gefrierens von 20 kg Fleischblöcken beträgt bis zum Erreichen einer Kerntemperatur von -8°C 4 Stunden.

Die Anlage dient zum Gefrieren von Fleisch und Innereien für Industrie- und Verbrauchszwecke. Sie kann auch vorteilhaft zum Schnellgefrieren von organotherapeutischen Organen benützt werden.

Современное оборудование для заморажива-
ния мяса в блоках

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Оборудование для замораживания мяса в блоках ра-
ботает по системе непосредственного испарения, основ-
ным элементом которого является двухстенная, изготов-
ленная из листовой стали блок-форма. Удаление замо-
роженных блоков осуществляется оттаиванием путем го-
рячего газа при помощи управляющего вентиля. Заполне-
ние мяса в блок-формы и удаление его из них могут
быть автоматизированы. Для удовлетворения пропускных-
потребностей можно параллельно или последовательно со-
прягать любое число морозильных блок-форм.

Оборудование является очень компактным, с очень
хорошей эксплуатацией внутреннего пространства. При-
менение его возможно и в неохлажденном помедении. Для
обеспечения работы оборудования необходимо -30°C тем-
пературы испарения.

На оборудовании линейную скорость замораживания
на блоках с размером сечения порядка 25 - 15 можно
достичь при значении $S_{1k} = 12 - 16$ см/час.

Упомянутое оборудование может быть использовано

для быстрого замораживания мяса для промышленных целей, мякоти и субпродуктов.

Выгодна применение упомянутого оборудования и для быстрого замораживания органолептических органов.

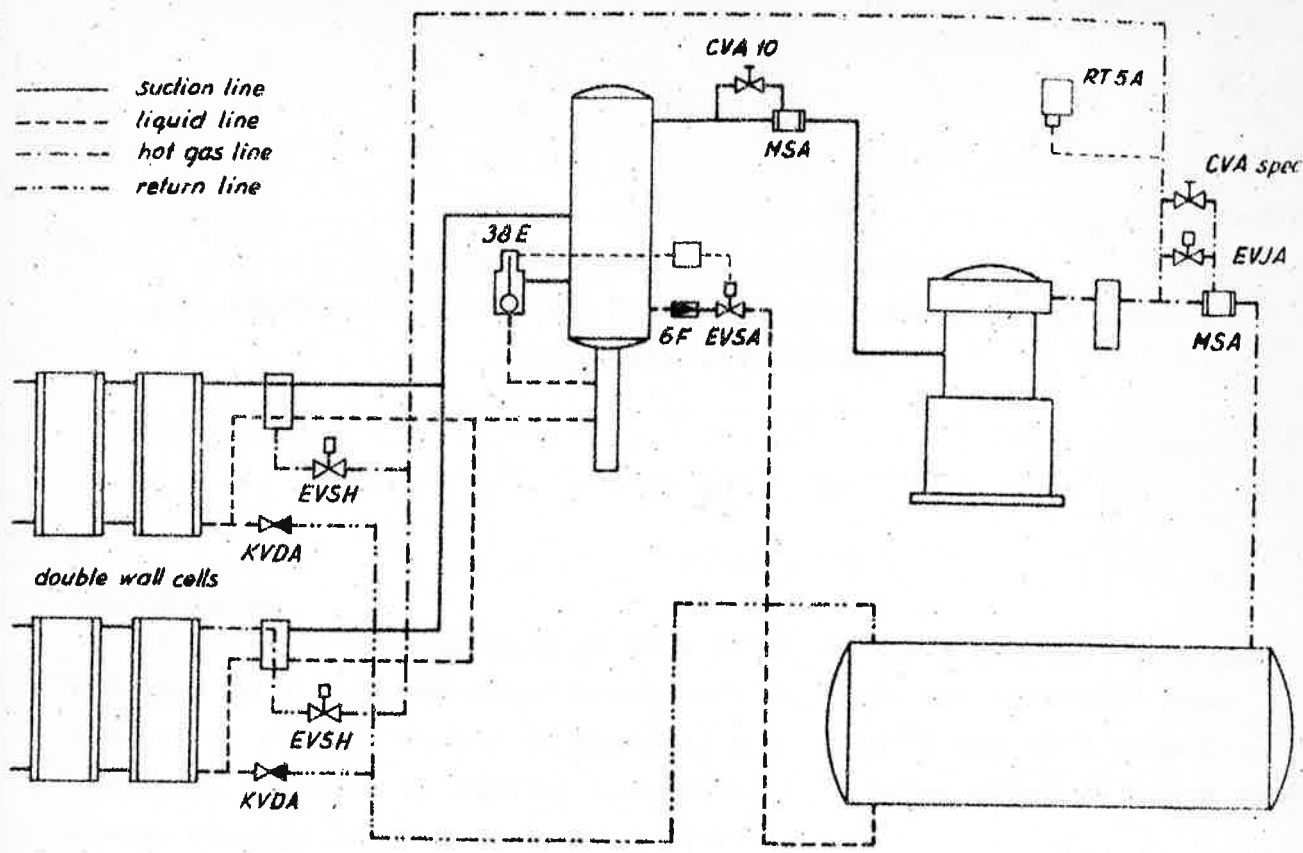


Fig. 1. Connecting scheme of the freezing and defrosting system

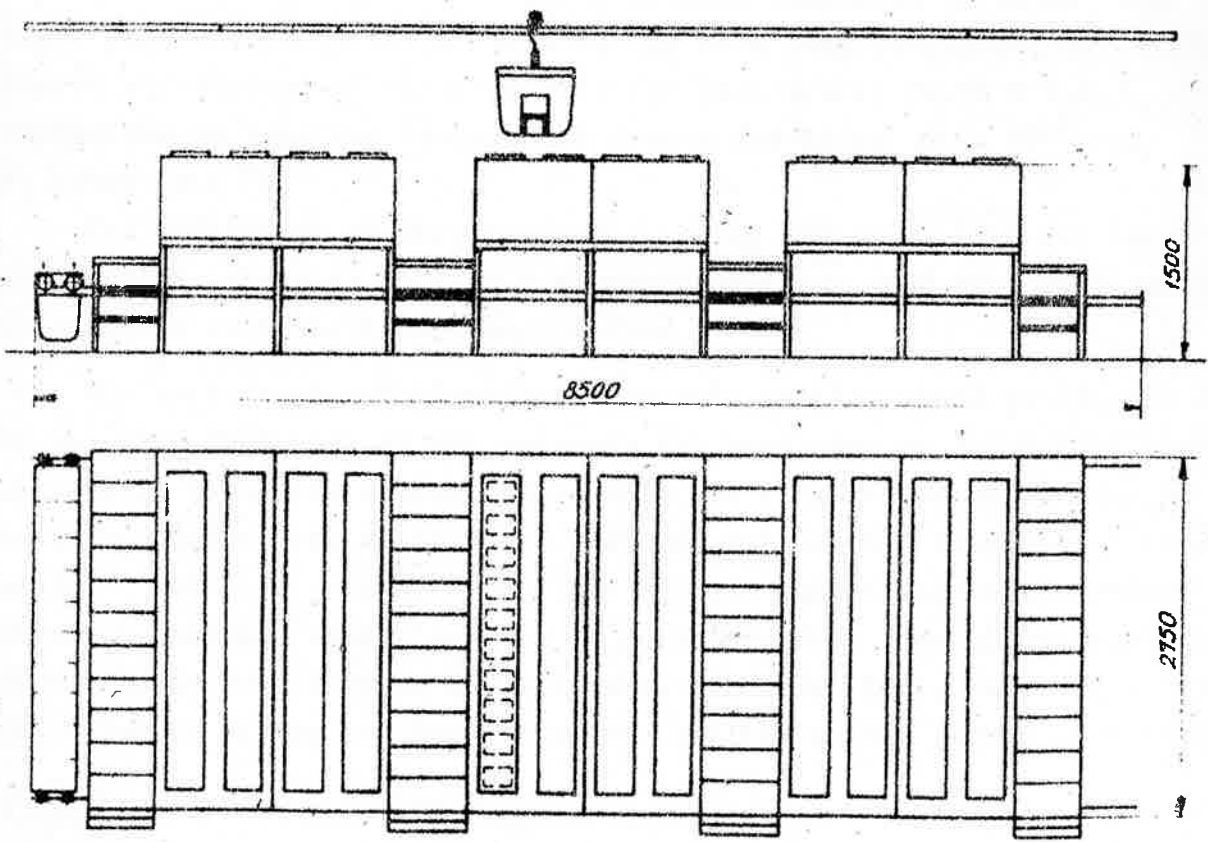


Fig. 2. Arrangement plan of the block-freezing equipment (4,8 tons/8 hours capacity)