OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as "developed", "industrialized" and "developing" are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

05674

United Nations Industrial Development Organization

Distr.
LIMITED

ID/WG.172/4/Rev. 1
25 March 1974

ORIGINAL: ENGLISH

AFRIFOODS - Regional Consultation on Promotional and Technical Aspects of Processing and Packaging Foods for Export

Casablanca, Morocco, 23 - 28 June 1974

CONVENIENCE FOODS

A WAY OF LIFE[1]

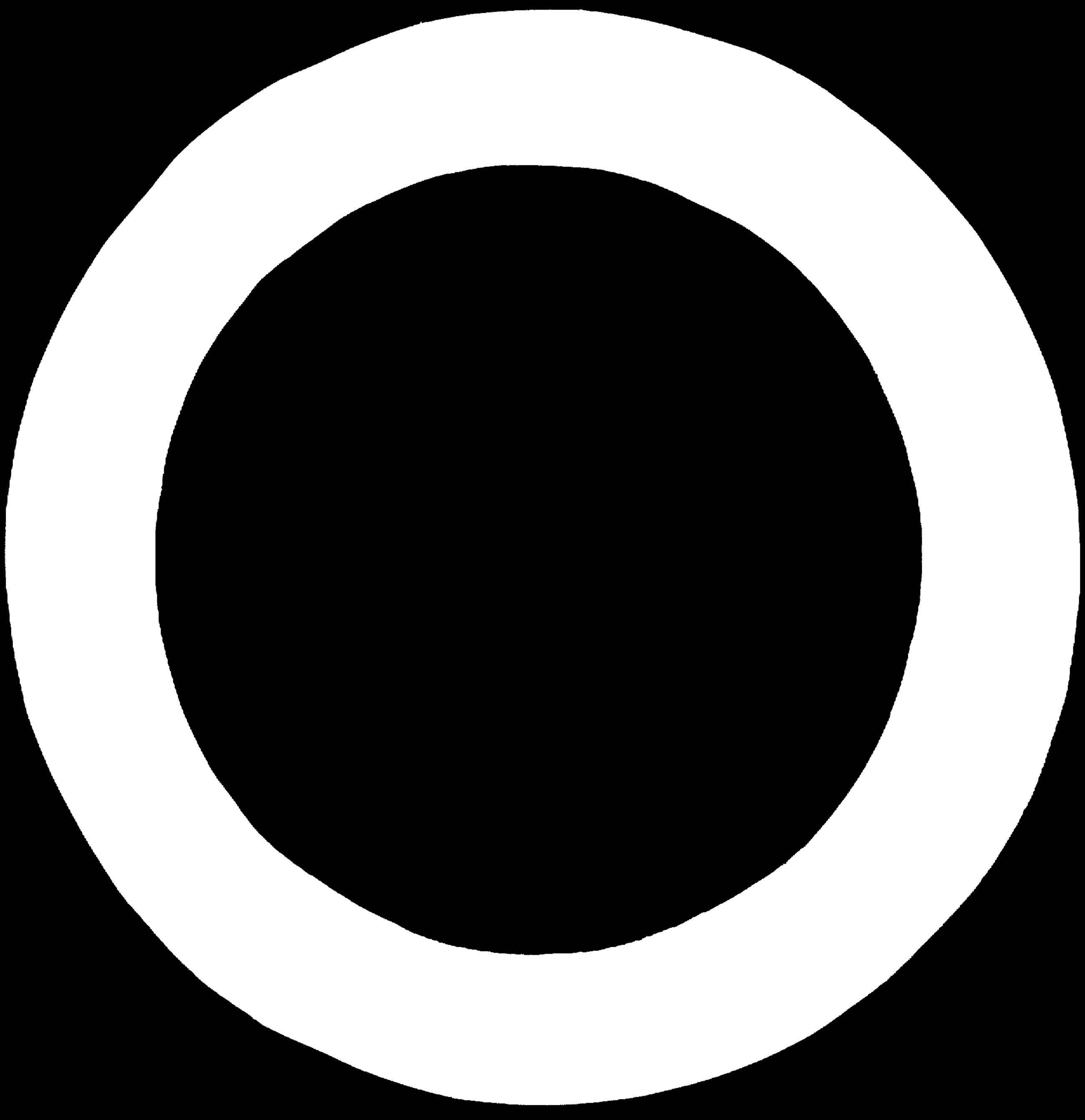
S.A. Mencacci*

* Manager, Convenience Foods Program, FMC Corporation, Santa Clara, California, USA

1/ The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the Secretariat of UNIDO. This document has been reproduced without formal editing.

id.74-3959

We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards, even though the best possible copy was used for preparing the master fiche.



CONVENIENCE FOODS - A WAY OF LIFE

In today's affluent society, convenience foods are sold in such abundance that they are hardly recognised as such. We only recognize these foods as something else to eat. Something else to buy at "your local grocer's." (Exhibit 1)

Such items as canned soups, canned beans, canned peas, frozen peas, frozen formulated foods, aseptically packed puddings, are all representative of the thousands of convenience foods that we encounter in our daily diet.

FLEXIBLE CONTAINERS FOR CONVENIENCE FOODS

Recently developments in the convenience foods markets, however, indicate a change utilizing other containers than the conventional frozen package or cans and glass for heat processed shelf-stable foods. The flexible container is the latest contender in this market and this new package could lead to a whole new area of product formulation and processing techniques. There are many types of flexible containers, and I shall not go into complete details, but only list some of the major developments.

- Laminated Aluminum Foil Pouches (Exhibit 2)
- Laminated Aluminum Foil Trays and Cups (Exhibits 3 & 4)
- Laminated Nylon and Cast Polyproplyene Transparent Films for Pouches
- Thermoformed Plastic Containers

Each of the above types of containers are in general use and there are variations in the material compositions and specifications depending on the manufacturer.

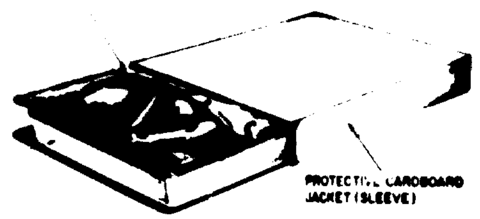
CONVENIENCE FOOD A WAY OF LIFE

Exhibit 1 - Convenience Food - A Way of Life.

Canned fruits, vegetables, soups, frozen packages, frozen dinners are part of our daily diet.

LAMINATED ALUMINUM FOIL POUCH
HEAT SEALED RETORTABLE (HEAT PROCESS)

LAMINATED ALUMINUM FOIL TRAY
HEAT SEALED AND RETORTABLE (HEAT PROCESS)



SOME CONVENIENCE FOOD TRAY SIZES

INDIVIDUAL SERVINGS	6 TO 8 OR 3 3/4"L X 2 3/4"W X 1 1/4" DEEP
SERVING FOR TWO	14-16 OR 5 3/4"L X 3 3/4"W X 1 1/4" DEEP
INSTITUTIONAL SIZE	60 OR 11 5/8"L X 9 1/2"W X 1 1/4" DEEP
1/2 TRAY INSTITUTIONAL SIZE	3 QUARTS 11 5/8"L X 9 1/2"W X 2 1/2" DEEP

LAMINATED OR COATED ALUMINUM FOIL CUP

NOMINAL SIZE 3" DIAMETER X 1 1/2" DEEP HEIGHT
CAPACITY WT. 6 OZ.

<u>Exhibits 2, 3, and 4</u> - **Types of Containers**

One well-known laminated film has, for example, 1/2 mil polyester on 1/3 mil aluminum foil with 3 mil C-79 polyolefin food contact film. The material is generally formed into pouches suitable for retort processing at 121° C.

Another well-known company manufactures a lacquer lamination of polyester film to aluminum foil which is laminated on the reverse side to the foil of polyproplyene copolymer film as the heat sealing component. Pouches made of this material are retortable and will withstand heat processing up to 260° F - 127° C.

Yet another company manufactures retortable material for drawn aluminum foil trays and cups. Their material is used for containers with peelable lids and has an epoxy-vinyl lacquer coating on the inside with protecting lacquer on the outside. For knife opening type containers they use copolymer laminated coatings on the inside surfaces and protective lacquer on the outside. Containers made of this material will withstand temperatures up to 122° C and 128° C respectively.

Most of the aluminum foil laminates have excellent gas and moisture barrier characteristics. The transparent films or thermaformed plastic containers have good gas and moisture barriers, but in most cases are not as satisfactory for long storage periods.

HOW THESE NEW CONTAINERS ARE USED

The aluminum foil containers, because of their shape and thickness, offer excellent opportunities for rapid heat transfer. Therefore, they provide possibilities for shorter overall processing times at higher temperatures with possible increase in quality. These new containers also provide the convenience of easy opening characteristics whereby certain types of laminated aluminum materials may be cut easily with a knife to open while other types of special lacquered coatings may be opened with the easy open feature.

In Europe, for example, this type of packaging and processing has already taken on, and many companies already are producing a variety of convenience foods for the retail and catering trade in heat treated, shelf-stable packages. A study in Japan indicated that their current rate of production is publicized at over 300 million pouches per year, mostly sauces and curries.

The nylon and cast polypropylene pouch may be used for processing foods for only limited shelf life. The thermaformed plastic containers are generally used for the aseptic method of packaging sterilized foods as well as for some hot fills. There are many other uses for transparent pouches and thermaformed containers, but we are concerned with heat processed foods in this presentation.

Aluminum foil laminates for pouches, trays and cups and lacquered aluminum foil for trays and cups are widely being used for heat processed food stuffs with a wide range of application from sauces to gourmet dishes. The exact number of these new convenience foods in flexible containers is not exactly known but a recent count indicates at least 100 different products currently being produced in Europe and Japan. Exhibit 5 illustrates a selection of off-the-shelf heat processed convenience foods packed in pouches. Exhibit 6 illustrates an off-the-shelf selection of heat processed convenience foods packed in trays and cups.

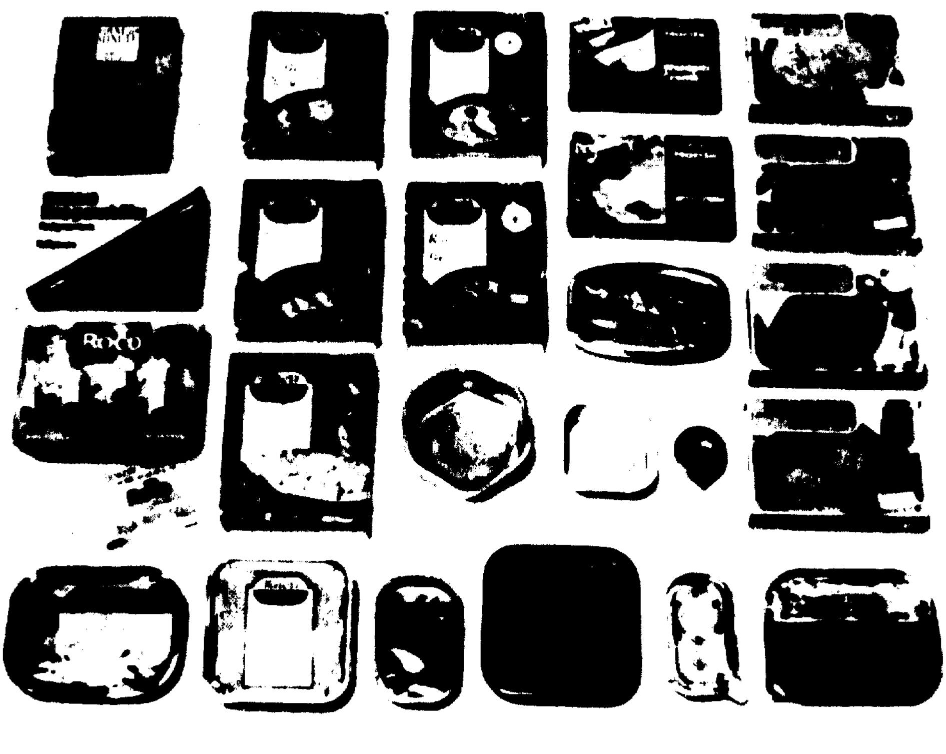
The USA is not yet an important producer of convenience foods in sterilized flexible packages, but in cans and frozen containers, the quantity of products currently being processed numbers more than 4,000.

I believe it is appropriate to note that the double seamed tin or aluminum can which has been the conventional container for heat processed foods may be produced in low silhouette tray or cup form, and should offer keen competition to the new flexible containers, particularly in the larger sizes.

CONVENIENCE FOOD PROCESSING TRENDS

A recent study made by my company for the USA and Europe indicates a very interesting growth rate for convenience foods. In Exhibit 7, which is the study made for the USA, you will note that the can food production growth rate between 1970 and 1980 is only about .9% per year. For conventional frozen foods over the same period, the growth rate is projected at about 5% per annum.

The current annual production of frozen foods in the USA, however, stands at approximately 18 billion pounds so a growth rate of 5% per annual is still a healthy situation.



Exhibits 5 & 6 - Off-The-Shelf Convenience Foods

For the new processes which include new types of convenience foods in flexible packages, aseptic packed puddings, and some new frozen food formulated products, there is indicated only a small production from about 1970 but a tremendous growth rate of approximately 26% is indicated between 1975 and 1980. Like most surveys, these figures are subject to criticism, and many of the comments we had from personal contacts with customers indicated that our numbers may be reasonably correct but that the timing might be plus or minus depending on individual products.

A similar study has been completed for Europe and in Exhibit 7 we project the growth through 1980.

- Canned Foods (except ready meals) — 5% annual growth
- Canned Foods - ready meals — 13% annual growth
- Frozen Foods (except ready meals) — 13% annual growth
- Frozen Foods - ready meals — 20% annual growth

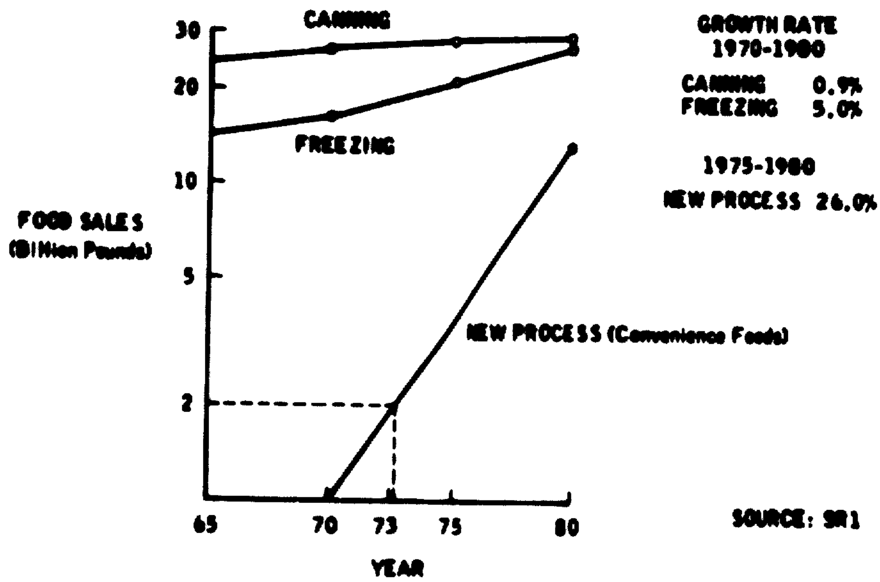
These figures listed are totals for all countries in Western Europe and will vary considerably from one country to another and from one product to another.

A detailed study has not been conducted in Japan although during my visit there last year, there were indications that the growth rate would be considerably higher than the USA or Europe. The actual change over a period of one year, however, indicates that their forecast was somewhat optimistic and further evaluations would indicate that a growth rate of somewhere between 25% and 50% per year would be more realistic.

The survey also indicated that frozen convenience foods will still play an important part in the future growth trend in the United States and to a greater extent in Europe, but there were also very important comments noted suggesting a trend toward heat treated shelf stable foods if quality is equal to or better than that of frozen foods, and if the new container designs are acceptable for heat processing and at competitive proces. Shortage of energy and super market space may be one of the contributing factors here.

The market studies also indicated that the growth of convenience foods in flexible packages would not be completely at the expense of existing frozen food or canned food products, but in all probabilities would develop by taking some from the list of canned foods, some from the list of frozen items, and with many new formulations.

FOOD PROCESSING TREND



FOOD PROCESSING TREND (Europe)

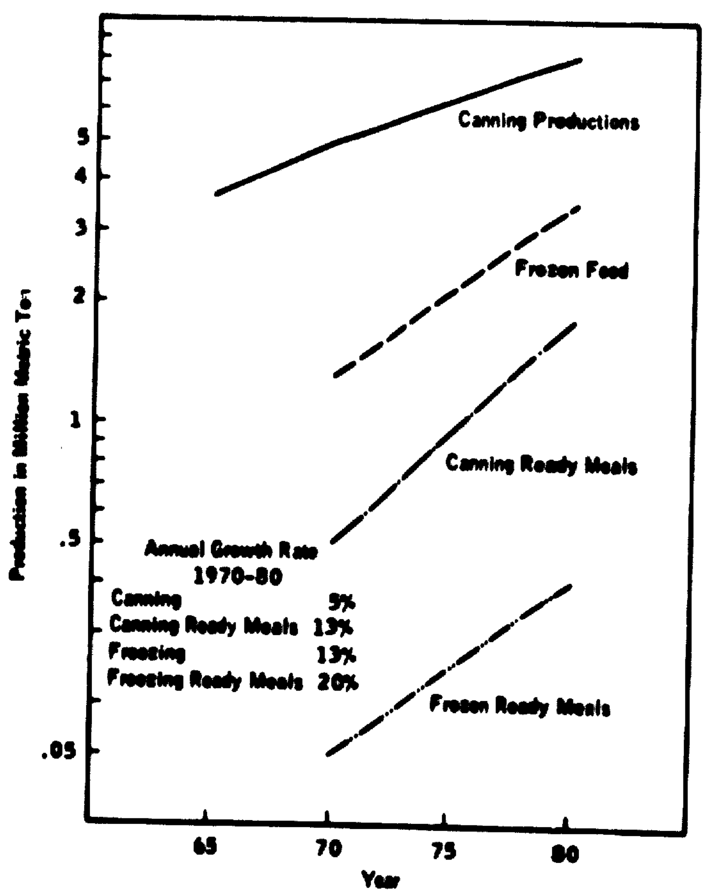


Exhibit 7 - Food Processing Trends in USA (top)
Food Processing Trends in Europe (bottom)

Our study also indicated a preference on the part of our customers for new shaped containers as well as a container that will withstand heat sterilization. There was no question as to the integrity of the can, either aluminum or tin. It is a question of shape, convenience, and the general desire for something new in the way of a container for the more sophisticated convenience foods as compared to commodity items.

A summation of the key points in our market study in the USA, Europe and Japan indicates that the trend for convenience food growth is indeed interesting, not only for the food producer but also for the food machinery manufacturer. The question as to product formulation, type of container, selection of specific processes, and developing equipment specifications is a matter for decision, but the opportunities are there.

WHERE DO WE GO FROM HERE?

The title of my presentation is "Convenience Foods — a Way of Life." This title may be interpreted in one thousand different ways, but I am directing my attention principally to the kind of research tools that will be required to develop new products, new processes, and new equipment, and what is more important, a system for integrating data developed in these areas into a practical production line.

I have seen a number of packing lines for convenience foods in flexible packages in a number of places throughout the world, and I must say they have done an excellent job, considering the tools and equipment which have been made available to them. In many instances, there were indications that it was time to modernize their lines for increased production or for more economic operations. In many other cases, new products were being considered and more sophisticated processing equipment would be required.

My company is interested (and I am sure this applies to other machinery manufacturers as well) in helping to develop the technology for producing shelf-stable foods packed in heat treatable pouches or semi-rigid containers, and we are optimistic about the part that such foods will play in the future U.S. and world markets. In this connection my company has for some years done applied research in the processing of foods in flexible pouches, and we are currently providing process research and equipment evaluations for semi-rigid aluminum foil trays and other types of metal containers.

For the purpose of doing applied research for processing and equipment development, my companyhas constructed a Laboratory Process Simulator that will be used in determining process data, package integrity, organoleptic values, and process equipment parameters.

It is hopeful that the laboratory process simulator will be one of the main planks in the bridge that will assist research in developing products and supplying processing equipment evaluation data to the production facilities.

LABORATORY PROCESS SIMULATOR

The Laboratory Process Simulator that has now been developed is very unique inasmuch as it has been constructed in such a manner that a number of different heat treating processes can be simulated. By the use of change parts that are provided, different size and shapes of packages such as pouches, aluminum foil trays and metal cans may be used in a wide range of process and equipment simulations. The more important simulations are listed as follows:

- Retort processing for pouches and trays using hot water with over-riding air pressure.
- Retort processing for pouches and trays using steam/air mixture.
- Retort processing for pouches and trays with special agitating features.
- A continuous processing system for pouches.
- A continuous filling system for pouches.
- A continuous system for trays (filling and sealing under pressure.)
- Hydrostatic - a water leg pressure system for pouches or trays.
- Containerized processing system - a continuous, non-agitating system for a wide range of container sizes and shapes.
- Cartridge system - a continuous processing system for agitating or non-agitating cooks.

Exhibit 8 illustrates the Laboratory Process Simulator. Instrumentation includes recording controllers for pressure and temperature within the processing vessel using air operated instrumentation.

Thermacouples are used for recording processing vessel temperatures as well as internal container temperatures and under certain conditions, internal container pressures.

A separate hot-water storage tank is provided for water processing with air operated temperature controller.

A complete system of control valves are conveniently arranged for the different processes.

A completely integrated electrical panel is provided for controlling and actuating the various electrical devices.

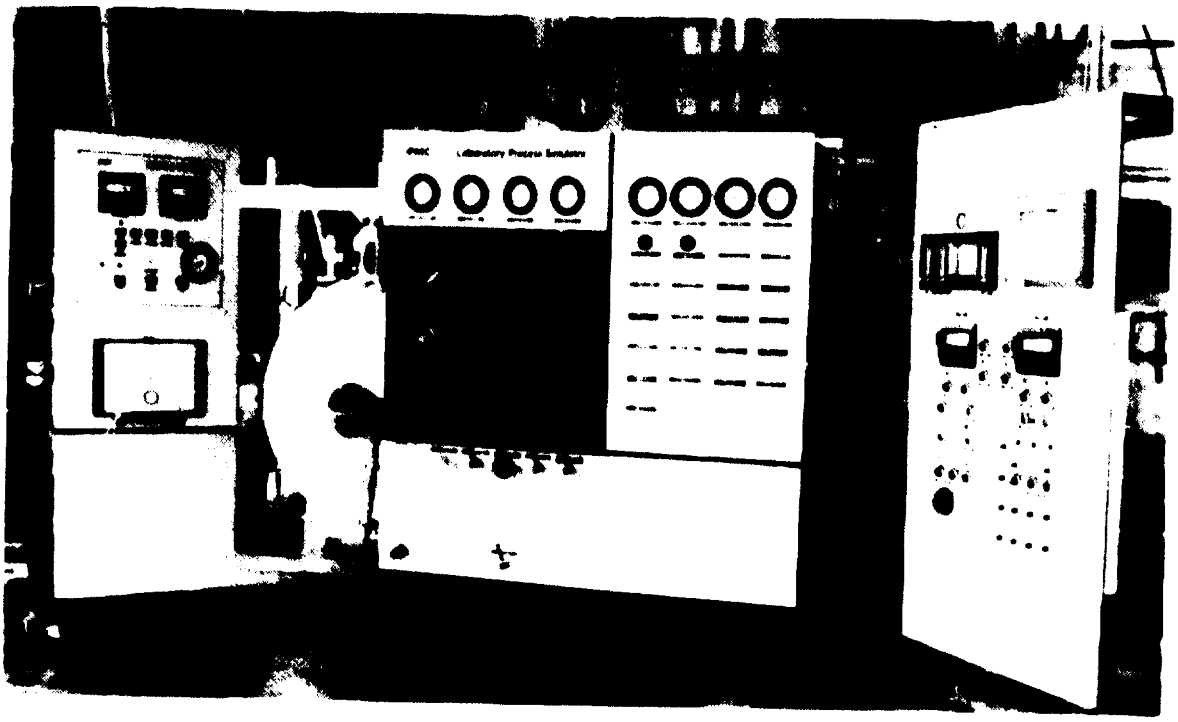
Sight glasses are provided on the processing vessel to permit observation of the containers during heat treatment.

LABORATORY HEAT SEALER

The laboratory heat sealer is used for sealing trays or cups and is a complimentary unit to the laboratory process simulator (see Exhibit 8). The heat sealing mechanism has been designed especially for laboratory work and provides an extra large platen for holding the large size dies for trays up to 24 cm W, by 29 cm L, by 6.3 cm H. This large size tray is the half size institutional tray which is currently under study by a number of food processing companies in the USA.

By changing the sealing dies, most of the common size trays may be heat sealed. The heat sealing unit has a separate control panel with control instruments for heat sealing temperatures, time and seal pressure.

The sealing unit is also provided with an enclosed housing making it possible to seal the containers under vacuum or completely vacuumising the chamber and flushing with gas prior to sealing.



TYPE OF HTST

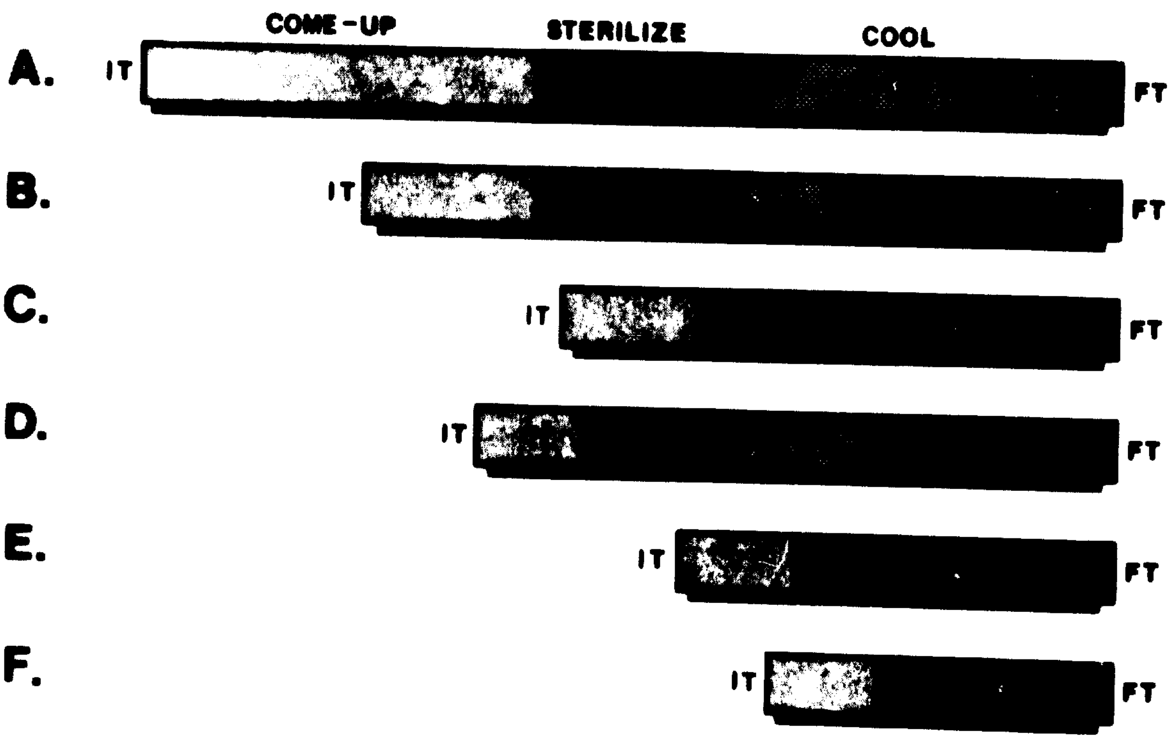


Exhibit 8 - Laboratory Process Simulator and Heat Sealer (top)
Type of HTST (bottom)

WHY SO MANY PROCESSES?

Earlier in this presentation it was mentioned that heat processed, shelf-stable convenience foods would be desirable if quality was comparable to frozen foods and if the new containers were acceptable and competitive.

A detailed cost analysis comparing costs of frozen foods with processed foods in the new look container are still in process, but there are already indications, when taking all factors into consideration, that costs may in some cases even show favorable trends towards the new package. When comparing the quality of convenience foods, however, many factors must be taken into consideration to properly evaluate this key point.

Frozen food quality, however, is a result of developing special formulas especially for freezing. It may not be possible, therefore, to use the same formula in a heat processed food. Alterations may be necessary to the formula to adapt specific items of convenience foods for heat treatment. Nevertheless, there has been a great deal of R & D done in this field and many excellent heat processed products are on the market.

In producing a shelf-stable flexible package for the more sophisticated convenience foods, one must be concerned generally speaking with low acid foods having a final equilibrium p.h. above 4.5. This situation generally requires a high temperature process in the neighborhood of 121° C for various periods of time, depending on the particular food in question.

The new packages mentioned earlier lend themselves, because of their thickness and shape, to rapid heat penetration, and as a result, it is possible to achieve HTST processing. We must, however, find the right process for each product, whether it is freezing or one of the heat treatment processes.

Most of us working in the food industry know and understand that higher temperatures, shorter times (HTST) usually provide for increased quality in any given product. Therefore, any process system that is selected for a specific product in a specific type of container for an HTST treatment could result in a higher quality than conventional lower temperature retort processing.

The bar chart in Exhibit 8 illustrates various types of HTST treatments. The yellow section of the bars illustrates come-up time, the red section sterilizing time, and the green section cooling time. The integration of the test data of the three items is the overall process time. The initial temperature IT and the final temperature FT are other factors to be considered.

In order to improve the quality of a given product, it would be desirable to reduce the overall processing time at a given temperature or shorten the length of the bars, as illustrated, as much as possible.

Line A, for example, may represent a typical retort cook or still cook as it is commonly called. A certain amount of time for a given product is required to get the product from the initial temperature up to the sterilizing temperature. A predetermined amount of time is required to sterilize the product. Finally, a specific amount of cooling time will be required, depending on cooling water temperature.

One way to shorten the overall cooking time would be to fill at a higher initial temperature. This would shorten the come-up time but the sterilizing and cooling times would remain essentially the same. This is a process change and is represented by bar B.

A mechanical system may be provided to reduce the overall processing time and this is illustrated by bar C. If, for example, we select an agitating type cooker and cooler, we would shorten the come-up time and the cooling time due to induced convection heating. The sterilizing time would remain essentially the same, but the overall process is shortened.

Preheating to and filling at the sterilizing temperature as illustrated in bar D will shorten come-up time and sterilizing time, but not affect cooling time. This type of process we are calling Super IT.

If we were to add mechanical motion to the container to provide agitation as well as higher filling temperature, then bar E represents a shortening of all three factors, come-up, sterilize, and cool. This process may be achieved with an agitating cooking cooler or with Super IT plus agitating cooler.

The shortest bar is F, and this represents aseptic processing where we use ultra high temperatures to achieve sterilization at 135° C to 149° C, for example. In aseptic processing, the product is heated for a very short period of time in special heat exchangers to shorten the come-up time and with an ultra-high initial temperature, the sterilizing times are concurrently shortened, and with the proper heat exchanger, the cooling times will also be shortened, resulting in the shortest overall process.

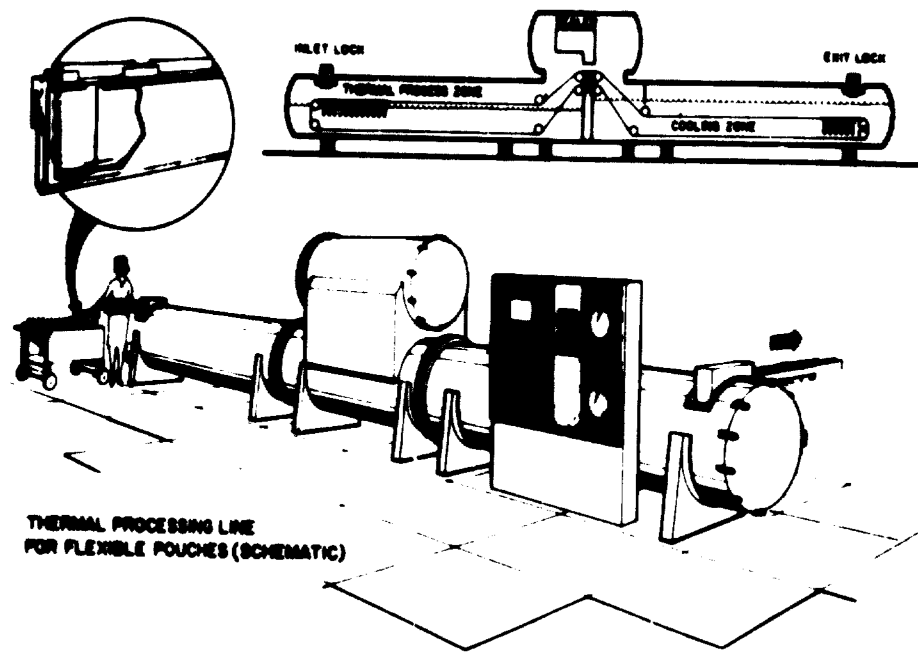
Although aseptic is the shortest HTST treatment illustrated in this chart, some products need cooking in order to have the desirable shelf life and organoleptic values. A variation of higher filling temperatures, mechanical agitation, or combinations depending on the product, may be more desirable for specific formulations in order to achieve the optimum quality.

CONVENIENCE FOOD PROCESSING SYSTEMS

Continuous Proohessing (pouches) The system provides for filling the product into the pouch at a desired temperature. The pouch is held in a carrier system with the top of the pouch unsealed, but stretched to a closed position.

In this manner, the pouch and the carrier pass through a lock into a pressure chamber for steam or hot water treatment until the product has reached the processing temperature (Exhibit 9). During this cycle, air in the head space of the pouch as well as most of the entrapped gases in the product have been liberated. It is held at the processing temperatures sufficiently long to effect sterility and then the carrier passes the pouch to the sealing section. The sealing is effected in an atmosphere of steam which in most cases improves the seal integrity. Exhibit # 9 illustrates seal reliability when the container is subjected to atmospheric steam and various times as compared to no steam.

Vaporpac System This system takes advantage of some of the features of the above system, but separates the preheating, head space- exhausting, and sealing operations from the sterilizing and cooling operation. The system comprises a filling operation followed by a headspace gas removal in an atmosphere of steam and then while still in the atmosphere of steam, the top of the pouch is stretched to a closed position and then heat sealed. A cooling operation on the seal follows if required. After sealing, the pouches may be heat processed in any one of the processing systems that will be discussed later.



CE 4402-110-06

TABLE I - PULL STRENGTH OF FOOD POUCH SEALS
AS A FUNCTION OF STEAMING TIME

POUCH TYPE: C-79

CONTAMINATION TYPE: #1

(Vegetable Oil and Tomato Sauce)

SEALING CONDITIONS

SEAL BAR		IMPULSE WIRE	
Lb./in^2 on seal surface	200	Watts per inch^2	64
Temperature	285°	Delay	0.2 sec.
Dwell	2.5 sec.	Dwell	1.0 sec.

RETORT TIME/TEMP. 20 min./250°

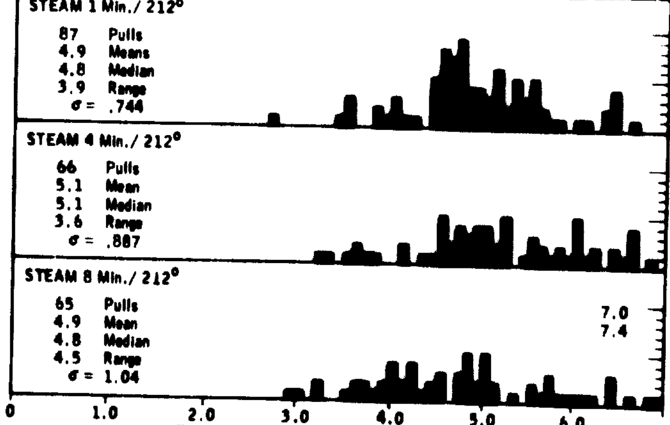


Exhibit 9 - **Process System for Pouches (top)**
Seal Integrity Tests (bottom)

Exhibit 10 illustrates a simple set of change parts for the Laboratory Simulator that may be used for processing heat sealable retortable pouches in the laboratory process simulator. The pouch will be arranged in the carrier as illustrated which simulates the continuous processing system. Time, temperature and pressures may be adjusted in the simulator according to the desired process. Thermocouples may be fitted in the pouch as well as in the processing chamber.

A schematic drawing, Exhibit 10, indicates our overall thoughts of a pouch filling and sealing line and how it would tie in with a retort processing system. Processing line speeds could be anywhere from 120 to 160 pouches per minute.

The proposed filling line starts with pre-made pouches, opens, fills with particulates, sauces and vapor seals. Mechanical aids for handling pouches and retort trays may be adapted as required.

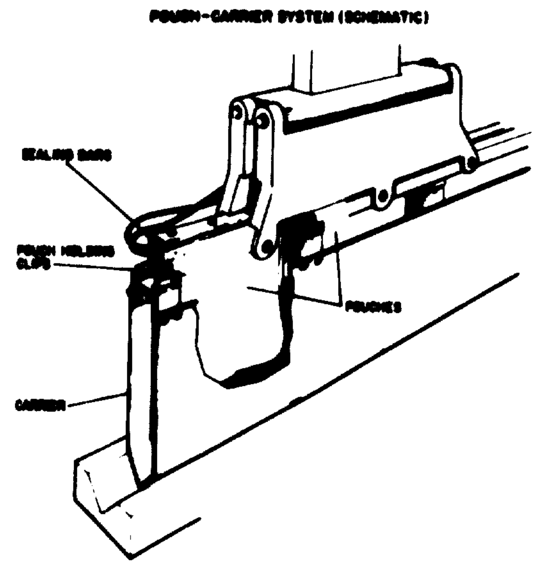
AGITATING PROCESSING SYSTEMS

In earlier discussions it was mentioned that the shorter processing times can be provided mechanically by agitating the product during the processing cycle. In order to handle trays or similar shaped containers and provide agitation, it is necessary to place these trays in a cartridge. The cartridge is illustrated in Exhibit 11.

A number of trays may be placed in the cartridge, locked into position, and then the cartridge may be handled as a large cylinderical container would be handled in a normal can handling operation.

Batch Agitating Retort System

A batch agitating retort system is illustrated in Exhibit 11. This provides for specially designed retort cars that have fixed cartridges in a cylindrical mounting on the individual cars arranged in such a manner that the cars may be tilted from horizontal position to vertical position for loading of the trays. When each of the cartridges is loaded, a cartridge cover is locked into position for further handling. A filled retort car is then rolled into a special retort with a drive located on the closed end. Individual cars are interlocked with the driving mechanism until the retort is loaded. A slow rotation of the cartridge car mounting provides sufficient agitation of large containers to induce heat transfer. Exhibit 12 illustrates F_h values of the large institutional tray processed in still cook as compared to an agitating cook.



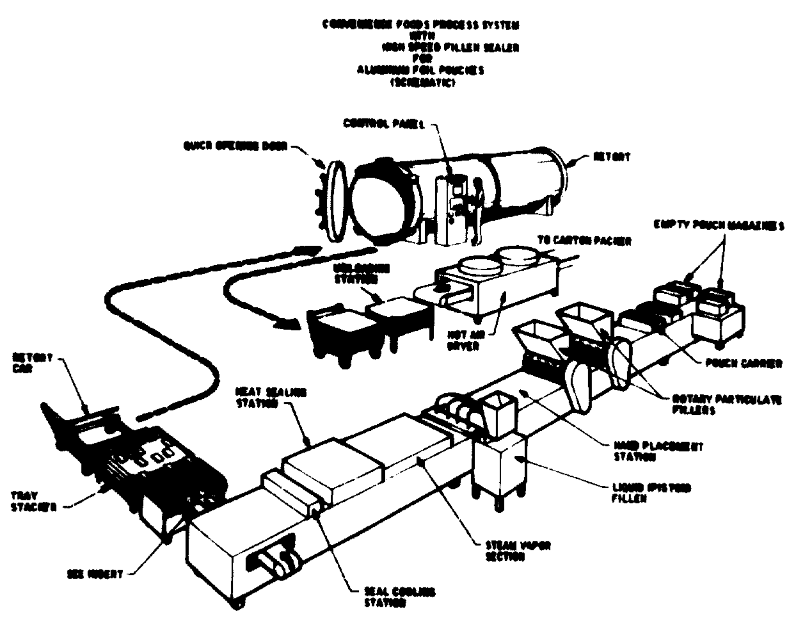


Exhibit 10 - **Simulator change parts (top)**
Proposed Pouch Fill Vapor-seal line with retort processing (bottom)

Continuous Agitating Cook

The continuous agitating processing system, provides for the use of individual cartridges filled with trays as illustrated in Exhibit 11 and these cartridges are handled through rotary pressure valves like large, cylindrical cans.

After transferring the cartridges through the pressure valve onto the conveyor mechanism, the cartridges will roll over a still plate or over a moving conveyor. The degree of agitation may then be controlled at will, or in fact, the agitation may be stopped completely by controlling the direction and speed of the lower belt. The sterilization is effected by rolling the containers through a bath of water with overriding air pressure for container protection. After the sterilization has been effected, the cartridges are transferred through a second pressure valve into the cooling section. Again, the cartridges are rolled through a bath of cooling water with over-riding air pressure. After the cartridges are cooled satisfactorily, they are transferred out into the atmosphere into a third pressure valve. The exact configuration of the equipment may not look as illustrated, but provisions will be made for proper control of water flow, water temperatures, and over-riding air pressure. (Exhibit 12)

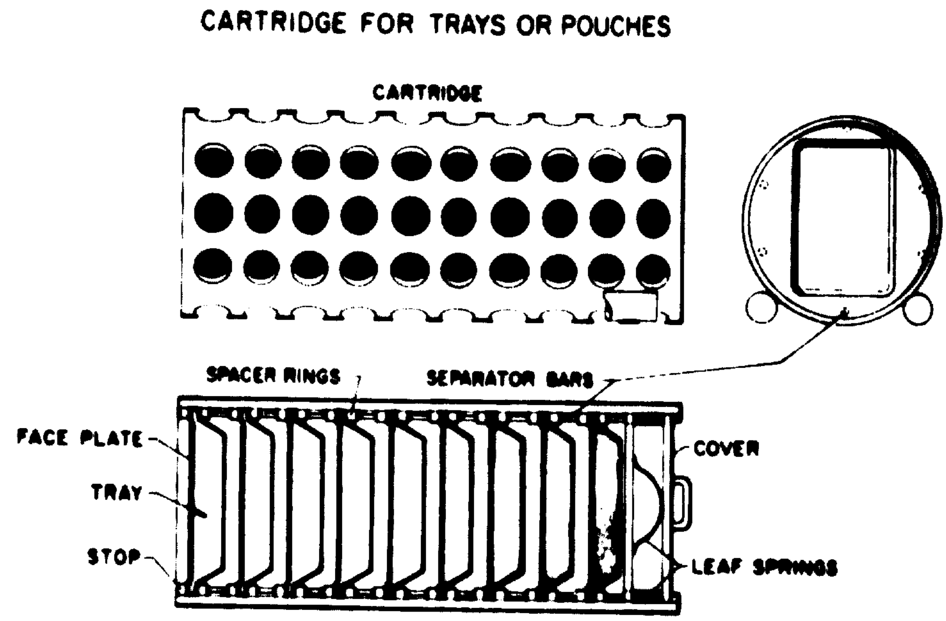
This process may be simulated in the laboratory process simulator by using the cartridge change parts as illustrated in Exhibit 13. The laboratory simulator cartridge is conveniently made for easy assembly and dis-assembly and will hold a number of trays, depending on the size. Agitation is provided in the simulator through a variable speed motor. The same set of change parts is used for simulating the batch agitating retort process mentioned above.

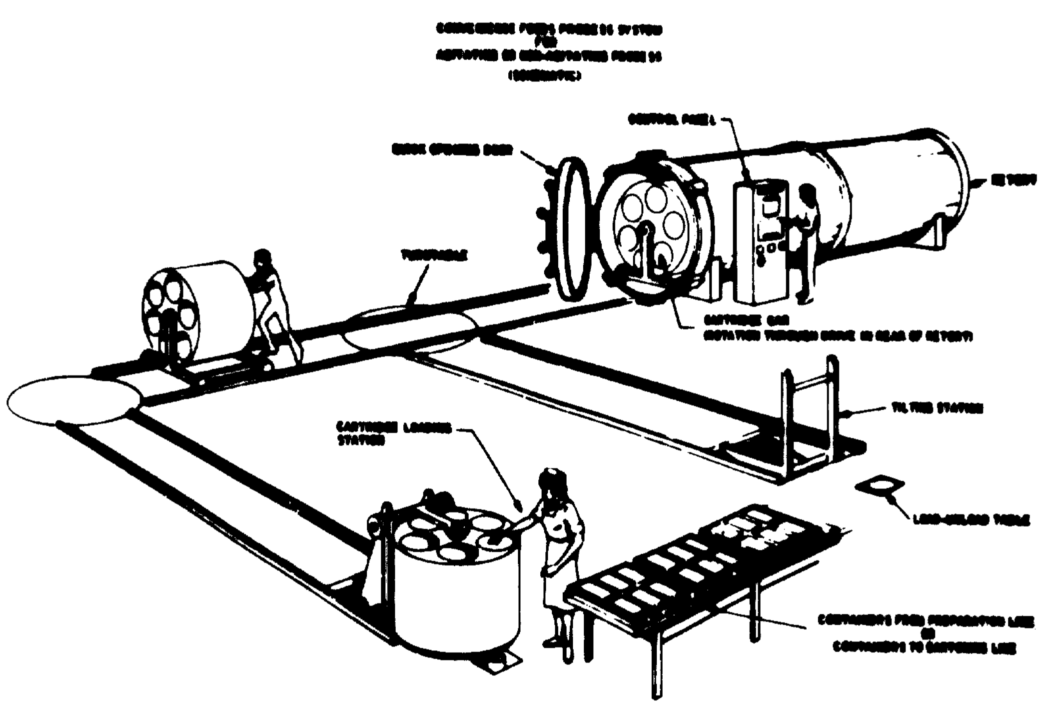
STILL COOK PROCESSING SYSTEMS

Batch Retort (Still Cook) Processing System

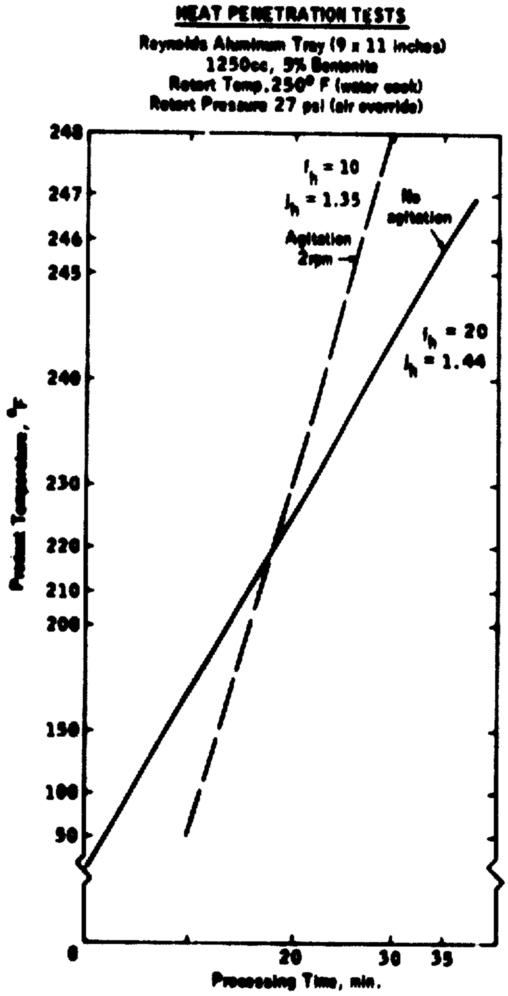
Exhibit 13 illustrates a conventional retort car which may be used for a batch retort process using water with overriding air pressure. Steam/air mixtures may also be used if desirable.

The retort tray is conventional tray and car arrangements and the trays are specially made to provide separation between trays for circulation of water. The trays are properly perforated, also for water circulation. Pouches or trays may be retort processed in this system.





<u>Exhibit 11</u> - **Cartridge for tray pack handling (top)**
Retort system for agitating process (bottom)



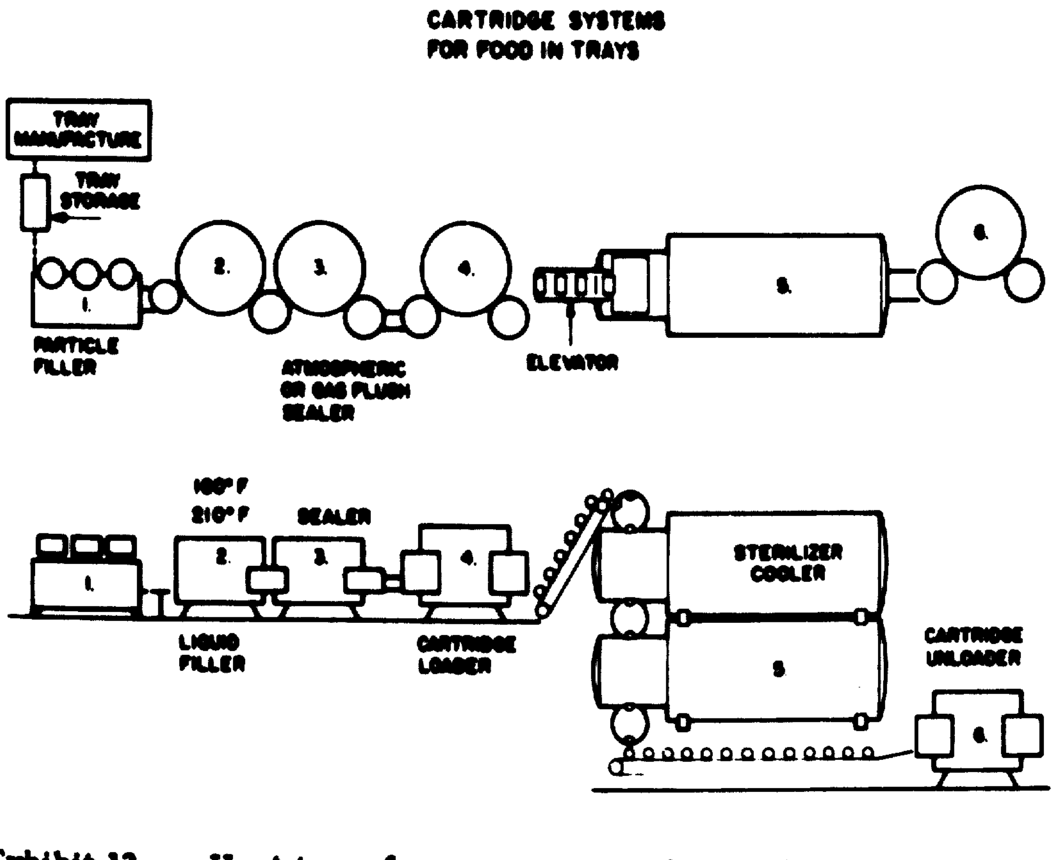
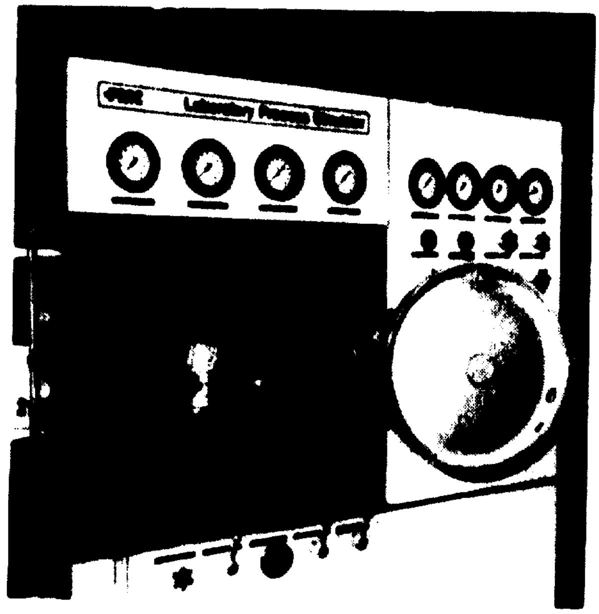


Exhibit 12 - **Heat transfer curve comparison agitation vs non-agitation (top) Cooker and Cooler Line (bottom)**



TYPICAL RETORT CAR
FOR
ALUMINUM FOIL TRAYS OR POUCHES

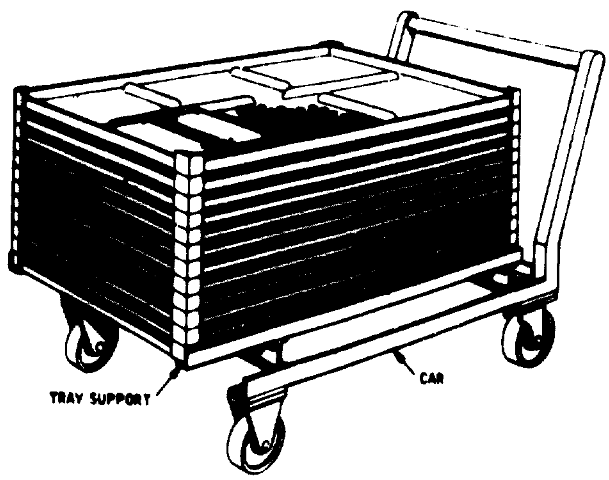


Exhibit 13 - **Simulator change parts for agitating cooks (top)**
Retort car with trays for still cooks (middle)
Simulator change parts for still cook (bottom)

The change parts for a still cook are illustrated in Exhibit 13. These change parts consist of expanded metal trays which can be loaded with the containers and placed in the laboratory process simulator for processing.

Containerized Processing System — The containerized processing system is a completely mechanized container handling system that provides for handling the container through the basket loading station and transferring the baskets through the hydrostatic legs of the processing system, and eventually transferring the baskets through the processing leg and finally through the cooling hydrostatic leg and spray cooling legs for final cooling. The containerized system is illustrated in Exhibit 14.

Typical baskets for the containerized as used for cans are shown in the same Exhibit.

It is easy to see that with this system a wide variety of container sizes may be handled with only a minimum number of change parts required at the feed and discharge stations. Special baskets for water processing with overriding air pressure are required for trays or pouches but illustrations are not available at this time.

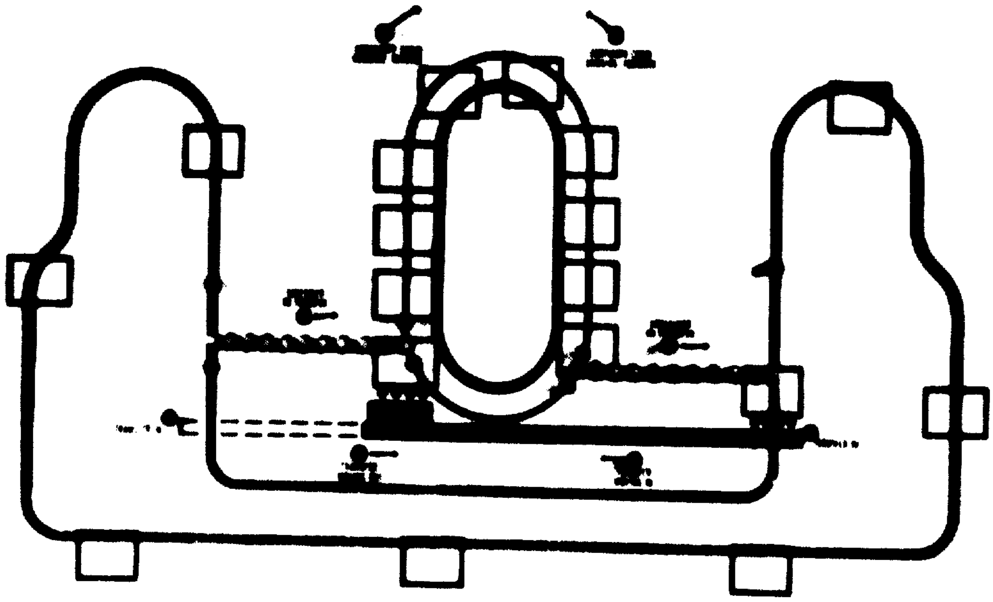
The same change parts as mentioned above for still cooks in retorts would be used in the laboratory process simulator to simulate the containerized processing system as well as hydrostatic systems.

HYDROSTATIC PROCESSING SYSTEMS

I am sure that everyone is familiar with the hydrostatic cooker that is used for processing cans. The same system may be used for semi-rigid trays if adequate carrier systems can be provided. It is also necessary to provide overriding air pressure or steam-air mixtures as some people are using.

A proposed filling and sealing line for the aluminum foil trays is illustrated in Exhibit 15.

The line starts with a conventional type of tray filler "dinner line for frozen foods," with tray dispenser and conventional particulate fillers, one or more, depending on the number of individual products to



CONTAINERIZED PROCESSING SYSTEM SCHEMATIC

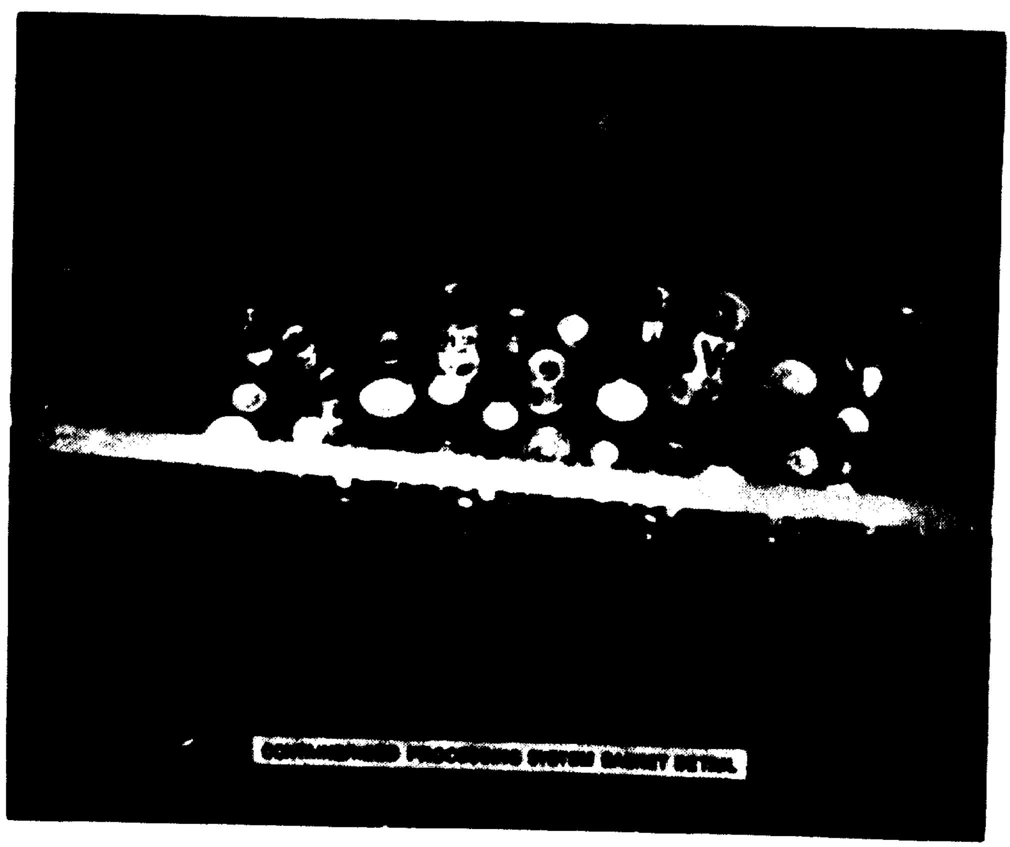


Exhibit 14 - **Containerized Processing System (top)**
Container Basket (bottom) Container baskets are handled in a continuous manner through the operation.

CONVENIENCE FOOD
CONTINUOUS ALUMINUM FOIL TRAY
FILLING AND SEALING LINE
WITH
RETORT PROCESSING

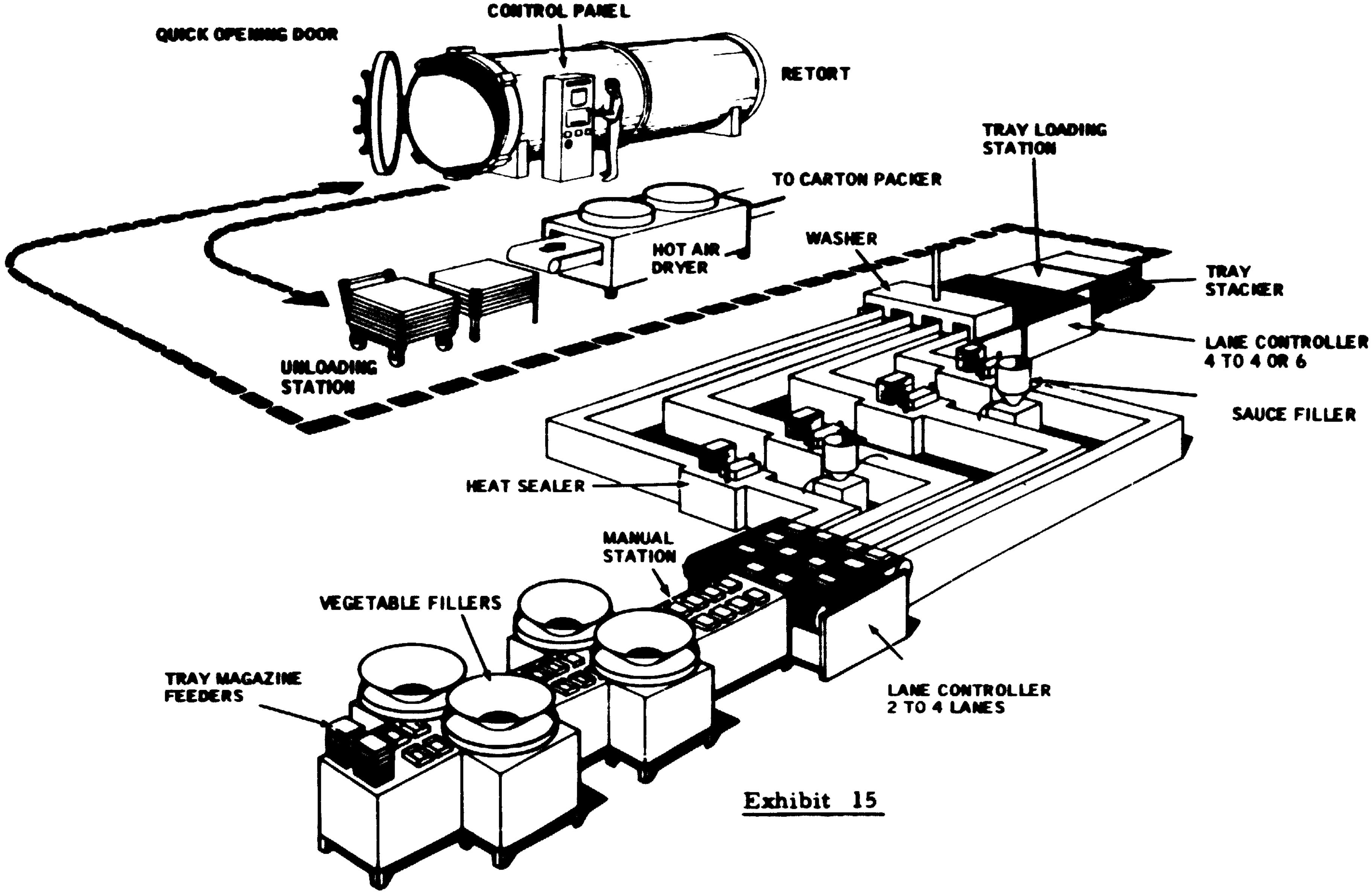
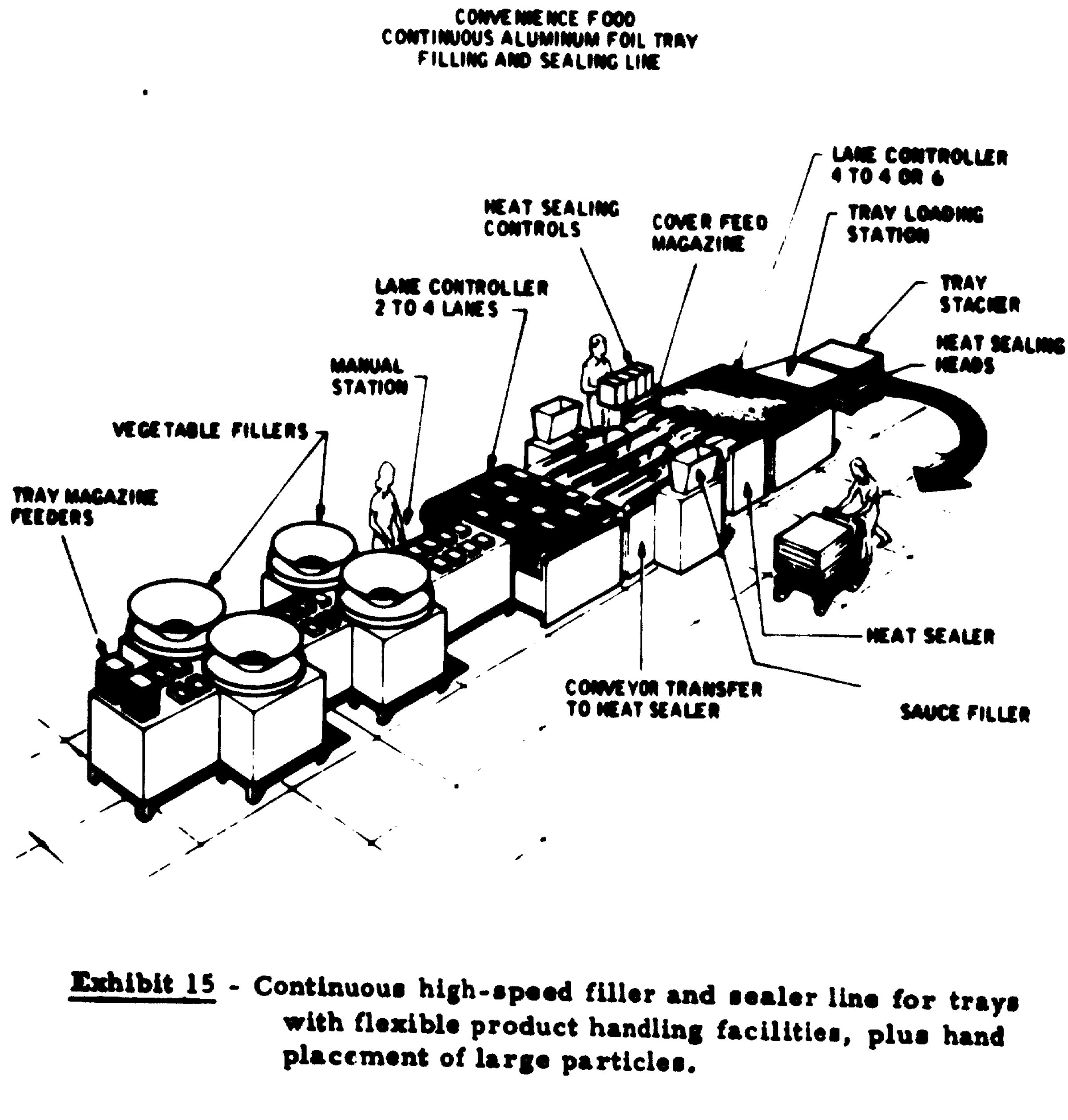
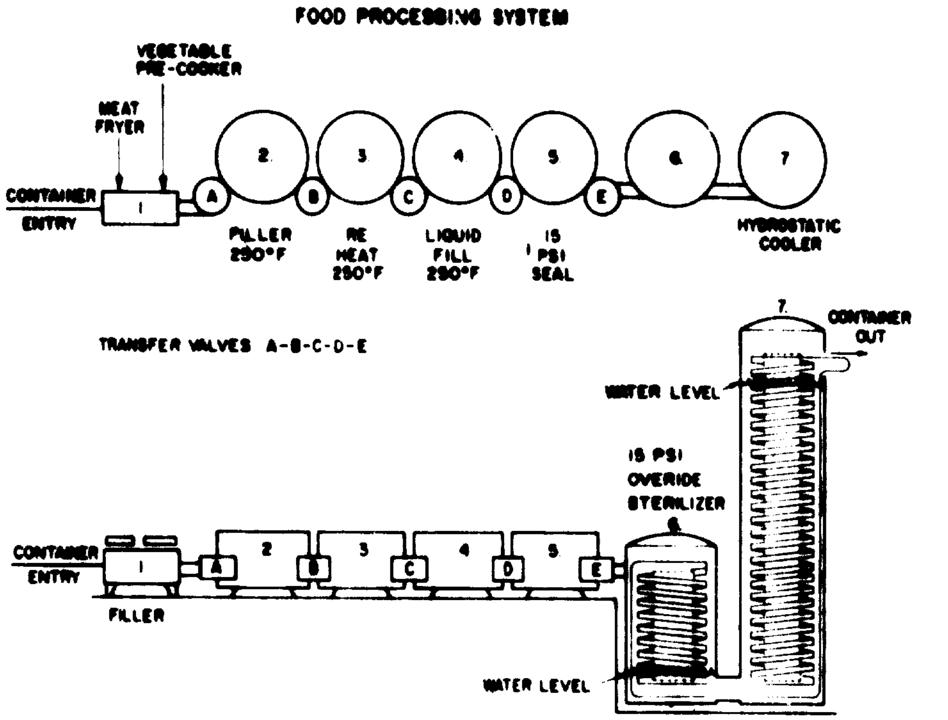
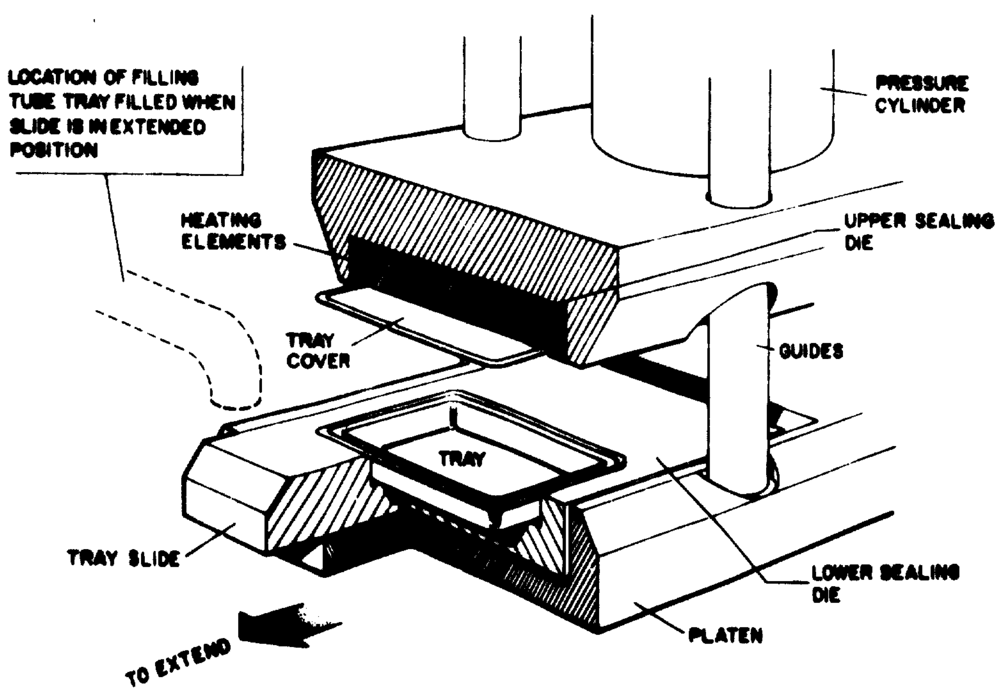


Exhibit 15



<u>**Exhibit 15**</u> **- Continuous high-speed filler and sealer line for trays with flexible product handling facilities, plus hand placement of large particles.**





SYSTEM SEALING UNIT (SCHEMATIC)

Exhibit 16 -
Simulator change parts (bottom)

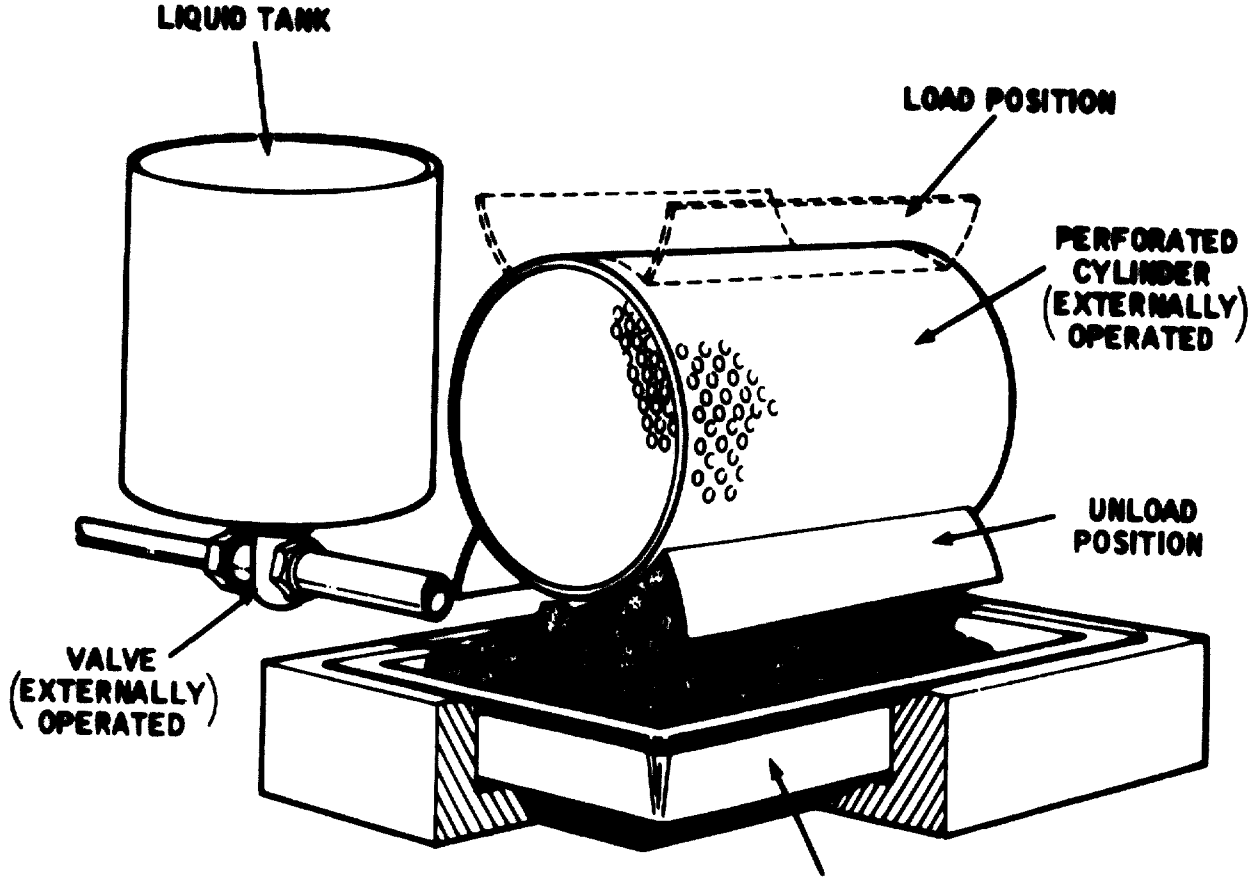


Exhibit 16 (Continued) - Simulator heat exchanger

be measured, and with conventional sauce fillers andhand placement stations as required.

Following the particulate fillers and hand placement stations, the line would be divided by a lane control system into a multiplicity of lanes depending on the type and speed ranges of the heat sealing units selected. The sauce filler would be placed on the infeed mechanism of the sealing units to minimize spill.

After heat sealing, the lanes would then be converged into tighter arrangements or spread into a greater number to facilitate tray loading. Tray loading could be mechanized if desired.

PROCESSING SYSTEM

The Super IT processing system that I shall discuss is not entirely new. This type of processing was developed more than 20 years ago, but because of the complexity of the equipment involved, it was not commercialized until about ten years ago. Commercial installations are known and provide for filling the product at elevated temperatures in a pressurized room. Closing and further processing and cooling is also done in a pressurized room. Operators are required to pass through an air lock into a pressurized chamber at about 20 psi. The basic principle of this system which consists of rapidly bring the product up to high temperatures, filling, sealing, and holding these elevated temperatures until the product is sterile and then cooling, is basically a sound system. It provides for complete controlled sterilizing of the product as well as the container and offers opportunities for high temperature-short time processing and ultimate quality improvements.

In the system that I will discuss, an attempt is made to eliminate the mechanical objections to the system used hitherto.

In Exhibit 16, which is a simple schematic outline of the system, you will notice that the containers are taken through pressurized valves at point A. Additional valves located at B, C, D, and E may be provided in order to zone off different functions such as filling, sealing, and sterilizing. By enclosing the functional equipment such as fillers and sealers within the pressurized chambers between valves, it is possible to have a continuous operation with the operator located outside of the processing equipment.

In the event of a jam at any of the stations, transfer pressure valves A, B, C, and D, may be stopped, for example, and the trouble cleared without stopping the following part of the line.

In this schematic sketch we have shown a spiral type holding and cooling section which may be possible for some types of containers, but the whole system is still under study and further details of construction are not available at this time.

It is contemplated, however, that this partioular prooessing system may be simulated in the laboratory process simulator. A set of change parts is being developed for the simulator that provides for a heat sealing unit for heat sealable aluminum foil trays to be mounted within the simulator or processing chamber as illustrated in Exhibit 16. In addition to the heat sealing unit, it is also contemplated that a heat exchanger for particulates and sauces will be provided also to be located within the simulator chamber so that vegetables and sauce could be processed, filled and sealed under elevated temperatures and pressures as well as meat particulates with sauce.

Exhibit 16 illustrates the two heat exchangers. Other types of heat exchangers mounted externally of the system could be provided if required. With the heat exchangers illustrated, however, it is possible to heat the product within the perforated cylinder with direct steam injection. The atmosphere of steam is provided within the process simulator chamber and provides the necessary pressure as well as temperature.

Measured amounts of sauces in the sauce container are heated also by steam heat exchange through the outer wall of the sauce container as well as through a cylindrical tube mounted inside of the sauce container to provide heat transfer there as well.

Only one container at a time may be processed in this manner, but it does provide the opportunity for evaluating container characteristics when processed under these conditions as well as organoleptic conditions of the product itself.

ASEPTIC CANNING

The Laboratory Process Simulator will not simulate aseptic processing. A separate process simulator for this type of process is being contemplated in the future.

CONCLUSIONS

I have covered in a general way such topics as market trends, containers, filling and sealing lines, processing techniques, sterilizing equipment, the laboratory heat sealer and process simulator, all key components for a successful R & D and implementation program for a new high quality convenience food product ready for delivery to the corner grocer. Perhaps some of this material will be helpful to you in one way or another in your particular program.

SUPPLEMENT

CONVENIENCE FOODS - A WAY OF LIFE

- **Pilot Lines, and**
- **Rigid Containers (Standard Can Type, Double Seam)**

Rigid vs Semi-Rigid

The rigid metal container made from either aluminum or steel and deep drawn into a low silhouette tray or dish, appears to be a promising container for heat processed convenience foods, particularly the large one half steam table tray.

The double seam (can type seam) is already accepted in the canning industry and there would be no problems with USDA approval.

The large one half steam table serving tray, for example, when filled with the same amount of product as a number ten can, or more, is already acknowledged as being difficult to handle. Therefore, there is some justification for considering a form of rigid metal container as compared to semi-rigid units to facilitate handling.

Easy Open Feature

A special single stroke can opener (USDA approved) is already available for round number ten cans and we plan to build a similar unit for the rectangular one half steam table size container. This type of opener will provide the desirable easy open feature with the seal integrity of the double seam for the large containers.

Seaming Equipment

A vacuum closing machine for laboratory testing is being developed which will handle flat and rectangular containers up to the half steam table size. Speed ranges are from five to ten cans per minute, depending on whether it is operated with or without vacuum (see Exhibit VI).

Heat penetration data developed in the process simulator for foil trays can easily be adapted to rigid metal trays and the double seam equipment, as illustrated in Exhibit VI, can easily replace the heat sealer in our proposed pilot lines.

Pilot Lines

Also available are pilot lines for filling, sealing, and processing retail size aluminum foil trays. The basic pilot line for retail size aluminum foil, heat treated trays consists of a filling unit, heat sealer and a container-washer. Exhibit VII illustrates a typical arrangement of the major pieces of equipment.

Following the filling, sealing, and washing operation, a retort processing system with high volume water circulation can be set up.

The number of retorts will depend on production requirements. Processing with still cook or agitating cooks is possible depending on container size and selection of retort cars (see discussion, main text - page 11 etc.).

A pilot line for rigid trays with double seams using a double seamer instead of a heat sealer would be the same as described above, but the heat sealer would be replaced with the double seamer.

Modified Pilot Line

Under study at the present time is a new pilot line which would consist of a modified double seamer (Exhibit VIII) with suitable inlet and outlet valves making it possible to take containers into a pressurized system and at the same time fill a product into the container under pressure, seal the container under pressure, and provide holding and cooling time before removing from the pressurized system. This is a typical processing system as described earlier in the main text, page 14, for heat sealed trays. The difference here is the consideration for using a rigid metal tray with double seams.

There appear to be certain advantages to this type of processing system and it lends itself to a continuous system utilizing our expertise in continuous cooker manufacturing, where rotary valves eventually could be used to admit and discharge containers for filling, processing and closing in a pressure system.

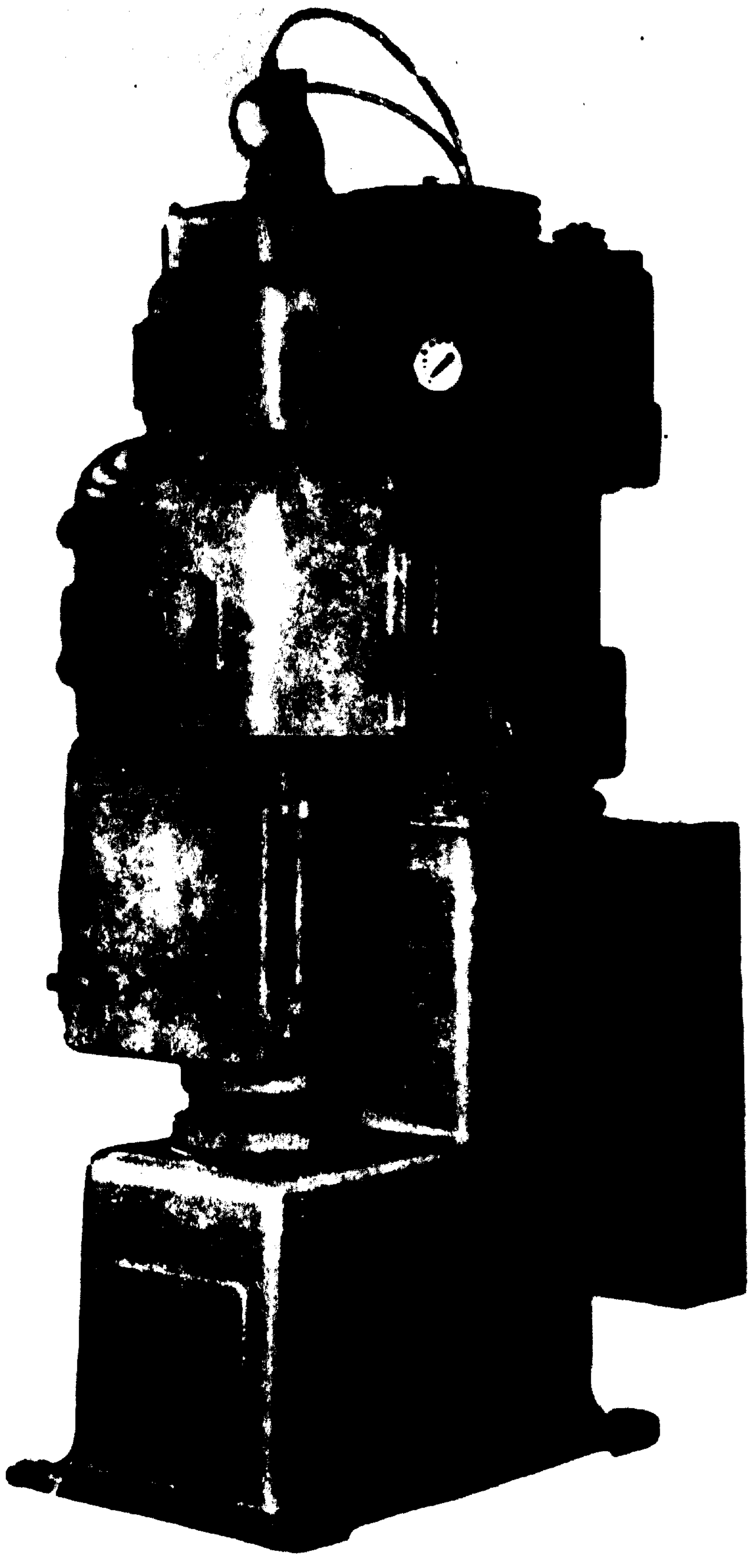


Exhibit VI
RECTANGULAR CONTAINER VACUUM CLOSING MACHINE

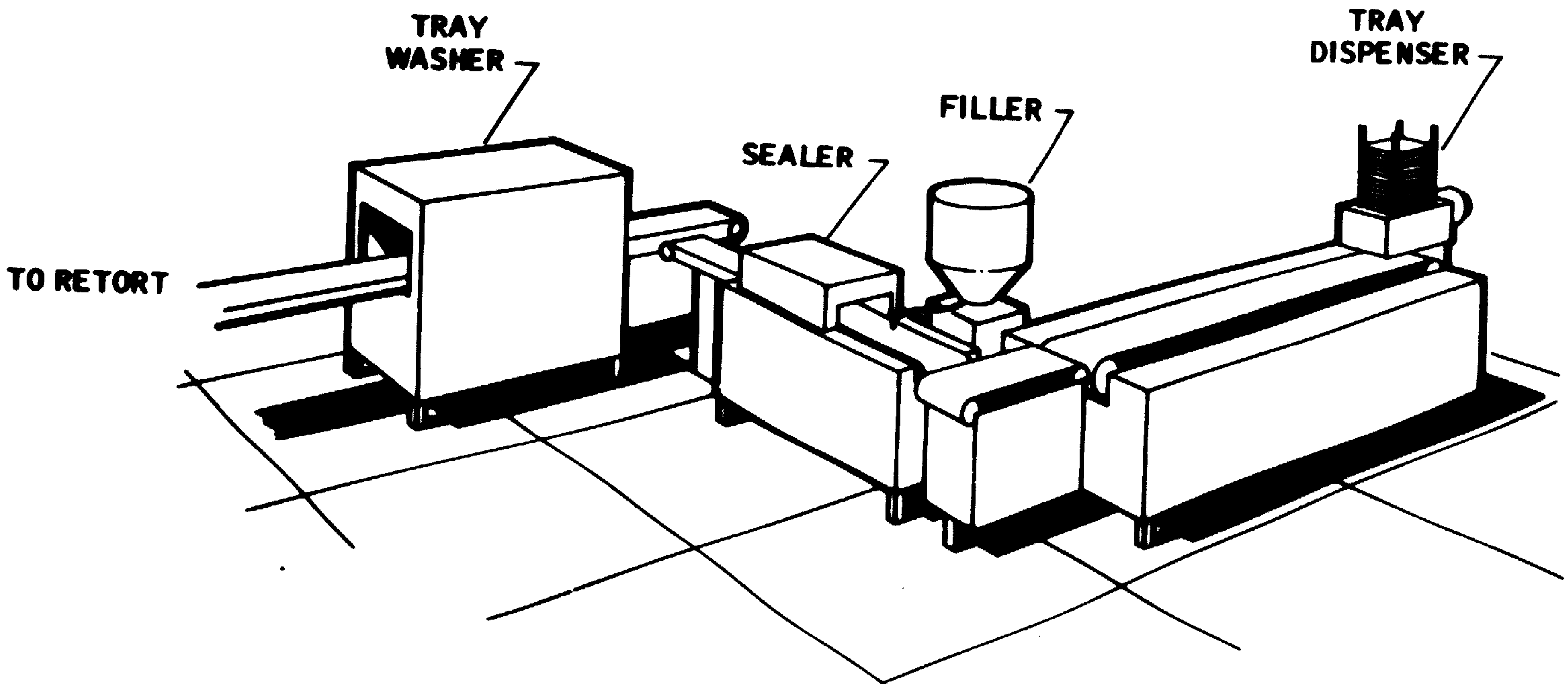


Exhibit VII
PILOT LINE TRAY FILLING AND SEALING

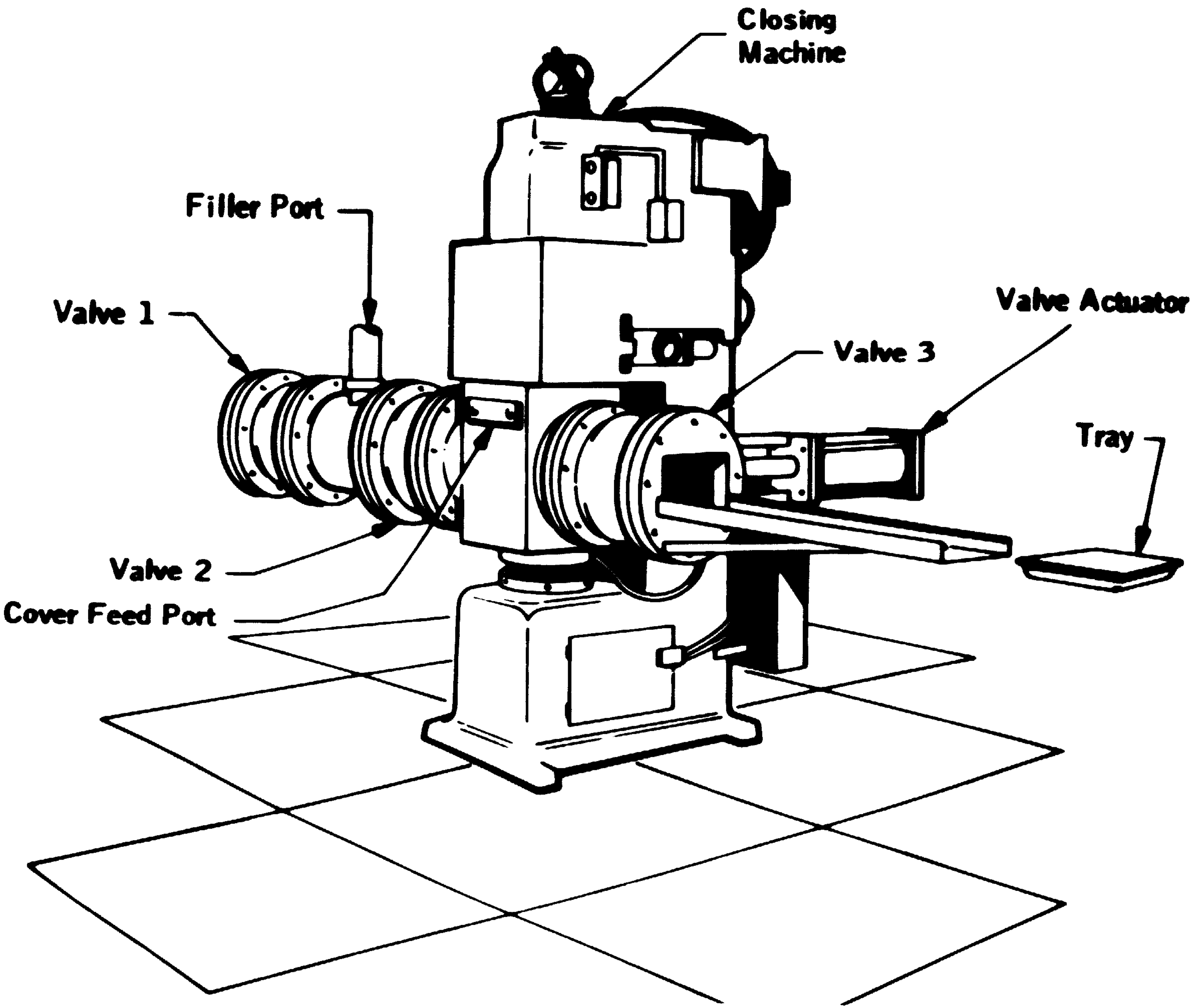


Exhibit VIII

SUPER IT SIMULATOR OR PILOT LINE FOR
RIGID TRAYS WITH DOUBLE SEAM COVERS

74. 10. 10.