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

FAIR USE POLICY

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

Distr.
LIMITED

ID/WG.152/3
28 March 1973

ORIGINAL: ENGLISH

United Nations Industrial Development Organization

Seminar on Food Processing
and Packaging

Guatemala City, Guatemala, 7 - 12 May 1973

ALUMINIUM PACKAGING CONCEPTS FOR PROCESSED FOOD AND LIQUIDS[1/]

by

Dr.D.Altenpohl
Director of Technology
Swiss Aluminium Ltd.
Zurich, Switzerland

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.73-2076

with C4834

United Nations Industrial Development Organization

Distr.
LIMITED

ID/WG.152/3/Add.1
25 April 1973

ORIGINAL: ENGLISH

Seminar on Food Processing
and Packaging

Guatemala City, Guatemala, 7 - 12 May 1973

ALUMINIUM PACKAGING CONCEPTS FOR PROCESSED FOOD AND LIQUIDS 1/

by

Dr. D. Altenpohl
Director of Technology
Swiss Aluminium Ltd.
Zurich, Switzerland

Addendum

Appendix 1: Brief case history of a Steraloon line in Chile

Appendix 2: Detailed description of Steraloon packaging lines

---

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.73-2641

Appendix 1: Brief case history of a Steralcon line in Chile

Chile like other countries in the southern hemisphere or in tropical areas has an abundance of certain food stuff which up to now can either be used fresh, which means in loco, or can be deep frozen if a deep freezing plant exists. The deep frozen food stuff is then often shipped as raw material to other countries where the final product is manufactured with considerable added value.

A number of developing or already industrialized countries desires now to have the added value to their local food stuff in their own country to improve their balance of payments and to have valuable products for exports. In order to achieve this goal, two main conditions have to be fulfilled:

- packaging line and food processing plant must be installed in small increments of investments, what means the necessary budget for the first unit should be modest and not exeed approx. $ 200 or 300'000;

- in order to be usable for exports, the product must have a first class customer appeal.

Under these considerations, a packaging line to put shrimps and other seafood products into Steralcon was erected in Chile. In Fig. 55 we give a schematical description of the Chilean Steralcon line located at Fireland.

As already mentioned, the packaging plant in Chile is mainly designed for packing shrimps and mussels.

As you can see from the schematic lay-out, the packaging plant is built very close to the sea so that the sea-food can be packed as fresh as possible. The mussels for instance, coming from the ship, are taken out from the nets at the pier and put on a transportation belt. On this belt they pass a washing station where they are washed with a sharp water-ray of about 50 atmospheres. Subsequent to this washing, the mussels are killed by being exposed to steam which also opens their shells. The meat of the mussel is now taken out from the shell by women, washed again in fresh water and sorted out into various baskets according to the size of the mussel. These baskets are then transported to the filling lines where the mussles are filled in the Steralcon containers. The filled containers are provided with a lid and sealed at the sealing-station, then washed in a special washing installation and finally brought to the autoclaves for sterilization.

By this organization, it can be guaranteed that normally less than 24 hours are needed to take the mussels out of the sea and to fill them into the final containers, thus achieving an excellent fresh quality.

The season for packing mussels is from February to October. From November to February, on the same packaging lines meat of shrimps is packed. Also coming directly from the ship to the packaging plant, the shrimps are first cut open under a sharp knife, then washed and boiled for 3 minutes at 90°C. After that, the meat is taken out from the shells in a special equipment and then directly filled into Steralcon containers.

Besides the packing of mussels and shrimps as described above, the packaging plant can also be used for packing some kind of a herring into Steralcon. For this purpose, a special filleting machine has been installed. The filleted herring can either be packed with tomato or other sauces or can be smoked and then packed with oil. The packing of herring is always done when no mussels or shrimps, respectively, are delivered. Located near the filling lines, 2 deep-drawing presses are operating to produce the Steralcon containers and lids. Each press is equiped with 2 sets of deep-drawing tools. The Steralcon laminate is supplied in coil form.

The plant is operating at a 10 hour shift per day. The output per filling line varies between 18 and 22 containers per minute, depending whether the sea-food is filled in a salt-brine or in oil. The normal output of the packaging plant ranges at about 50'000 containers per day.
The total number of people working in this packaging plant is around 200. The sealing machines are operated by 1 man each, whereas 10 women are working on each filling line.

In the following figure we show a few typical products of the Chilean packaging line which are mostly intended for export.

Having been put into operation successfully, there are now plans underway to expand the capacity* and to include in the production program prepared meals with fish. For this purpose, the installation of a third filling line is being planned.

* of the plant

There are several similar plants under consideration for packaging of sea-food, meat-products, baby-food or fruit products. In the countries in question, the incentive for the interest in a Steralcon line is always the same: similar as in Chile, these countries wish to to add value to their local food products which up to now could not be exported with added value. Steralcon provides an excellent tool to achieve this goal.

Appendix [illegible] packaging [illegible]

As already mentioned in the [illegible] on Steralcon, there are two possibilities to use Steralcon for packaging food-stuff:

The first one is to buy the empty containers from a special container-manufacturer, the second to produce the containers directly at the packaging plant. The choice whether to use number 1 or 2 mainly depends on the total volume of the production.

1. Use of empty containers

Empty containers in a large variety of different sizes and shapes are already available from specialized container producers. In using containers from them, it is therefore possible to avoid an own container production in a first period of introduction and smaller production. This can be recommended if the annual production of the client does not exceed about 4 million containers, or if for the first introduction only small pilot plant is to be used. The empty containers are ready to be used in the packaging line just as they are supplied. After filling, lidding, sealing and washing the containers are transported to the autoclave for sterilisation.

In using Steralcon, the sterilisation process is one of the most important factors to achieve an unobjectionable quality. This is true not only for the food-stuff inside the container, but also for the quality of the container itself with regard to deformation or delamination. For the sterilisation of Steralcon containers, counter pressure autoclaves are required which are able to keep constant pressure of about [illegible],9 atmosphere during the sterilisation process.

Any deviations from this pressure during the sterilization process may cause problems such as e.g. deformation or delamination as mentioned above. As for the sterilization temperature, there exist in principle no difficulties and the client can use those temperatures which he has found to be optimal. It is preferable, however, to keep the water temperature in the autoclave below about 140°C. There are already existing on the market a whole series of autoclaves which are highly suitable for the use with Steralcon.

2. Own production of containers

The production of containers directly at the packaging plant normally is only of interest in those cases where the client needs more than about 4 million containers a year. The machinery in this case has to be extended to include 1 - 2 deep drawing presses and the appropriate deep drawing tools.

The deep drawing presses offered on the market are working at various speeds. For the example described below, we refer to a mechanical press which can produce about 60 containers or lids per minute.

If only one press is available for fabricating containers and lids, the rate of utilization will normally be below 70%, as very often the tools for making containers and lids have to be changed. Based on a 8 hour shift at 240 days a year, the annual production capacity of such a press would be:

30 x 60 x 8 x 240 x 70 = 2,4 million containers including lids.

Practice has shown that it is more advantageous to have 2 presses, one for the production of containers and one for the production of lids.

In this case the rate of utilization [illegible] [illegible], more than 80 [illegible]. Based on this combination, the annual production capacity would be:

60 x 60 x 8 x 240 x 80 [illegible] 5,6 million containers including lids.

The containers produced in this way can than be used in the packaging process as described above, with the difference, however, that this time the sealing station is not a pilot machine but a fully automated washing and sealing machine.

The sealing machines offered on the market have more or less all the same output of about 25 containers per minute. There are two types of sealing machines available:

- pilot sealing machines (semi-automatic)
- fully automatic sealing stations.

Under a simply technical point of view, the pilot sealing machines are able to achieve about the same output as the fully automatic machines. Whether this technically feasible output can actually be reached, however, is mostly dependent on the skill of the operators, as these machines are charged manually. Therefore, the practical output of such pilot machines should not be assumed to the higher than about 15 containers per minute which would equal an annual production of about 1,7 million containers.

Regardless of this limitation, it very often has shown to be advantageous to start a smaller production first with a pilot machine which allows both the operators and the customers to get acquanted with the use of Steralcon containers.

Another advantage in using a pilot machine is the opportunity to explore the actual market possibilities without high investments. The risk of carrying out such a market test is relatively low, as the investment cost of a pilot sealing machine is only about 4000 - 5000 $. This calculation assumes, however, that a suitable autoclave is available at the client.

After a successful introduction of the container in the market, the next step would be the installation of a fully automatic production line which can actually use the full capacity of about 25 containers per minute in the sealing stations.

In the case of a fish packaging plant, the following combination of equipment has proven to be highly suitable:

container fabrication:
- 2 deep drawing presses including several tools

packaging line consiting of:
- container de-stacking
- transportation belt for the filling of the containers
- sealing unit, consisting of washing, lidding and sealing station
- washing station for the filled containers
- counter pressure autoclave.

Some possibilities how to combine several filling and sealing units to complete packaging line are demonstrated in fig.57

In order to give a first impression of the investment cost required for the installation of a complete Steralcon packaging line, some average prices of the required machinery are listed below.

These prices were initially put together for European clients and it might therefore be possible that they are not directly applicable to countries outside Europe, but at least it should be possible to use them as a rough guide. Besides that, they are calculated as an average of various European machine producers and it might well occur that one or the other machine of a special producer will fall outside the normal range of about ± 10 - 15%. As already mentioned above, the cost for a pilot sealing machine is about $ 4000 - 5000. It is therefore not contained again in the list below.

The following prices are based on a fully automated packaging line for fish products as described above. One has, however, to keep in mind that this is only one example of various possibilities and that there is a lot of room to adapt the line to the special requirements of the client.

2 mechanical deep drawing presses without tools, $ 20'000 each	$ 40'000
1 set of tools (containers and lids) for above presses, including automatic container- and lid-stacking	$ 25'000
1 machine for destacking the containers onto the transportation belt	$ 1'000
1 transportation belt, working synchronised to the filling station, length about 6,6 m	$ 7'000
This transportation belt consists of units of 1,2 m each; it can be shortened or lengthened as suitable; the maximum length is about 10 m; the price of each unit is about $ 1'300	

1 sealing unit, consisting of

- washing station
- automatic lidding station
- sealing station
- container throw-out unit,

completely equipped with all necessary accessoires — $ 20'000

1 washing station for the closed containers without own transportation device — $ 1'000

1 counter-pressure autoclave for about 1'500 containers per charge, usable for rotation or oscillating during sterilization — $ 18'000

Total of the investment cost about — $ 113'000.

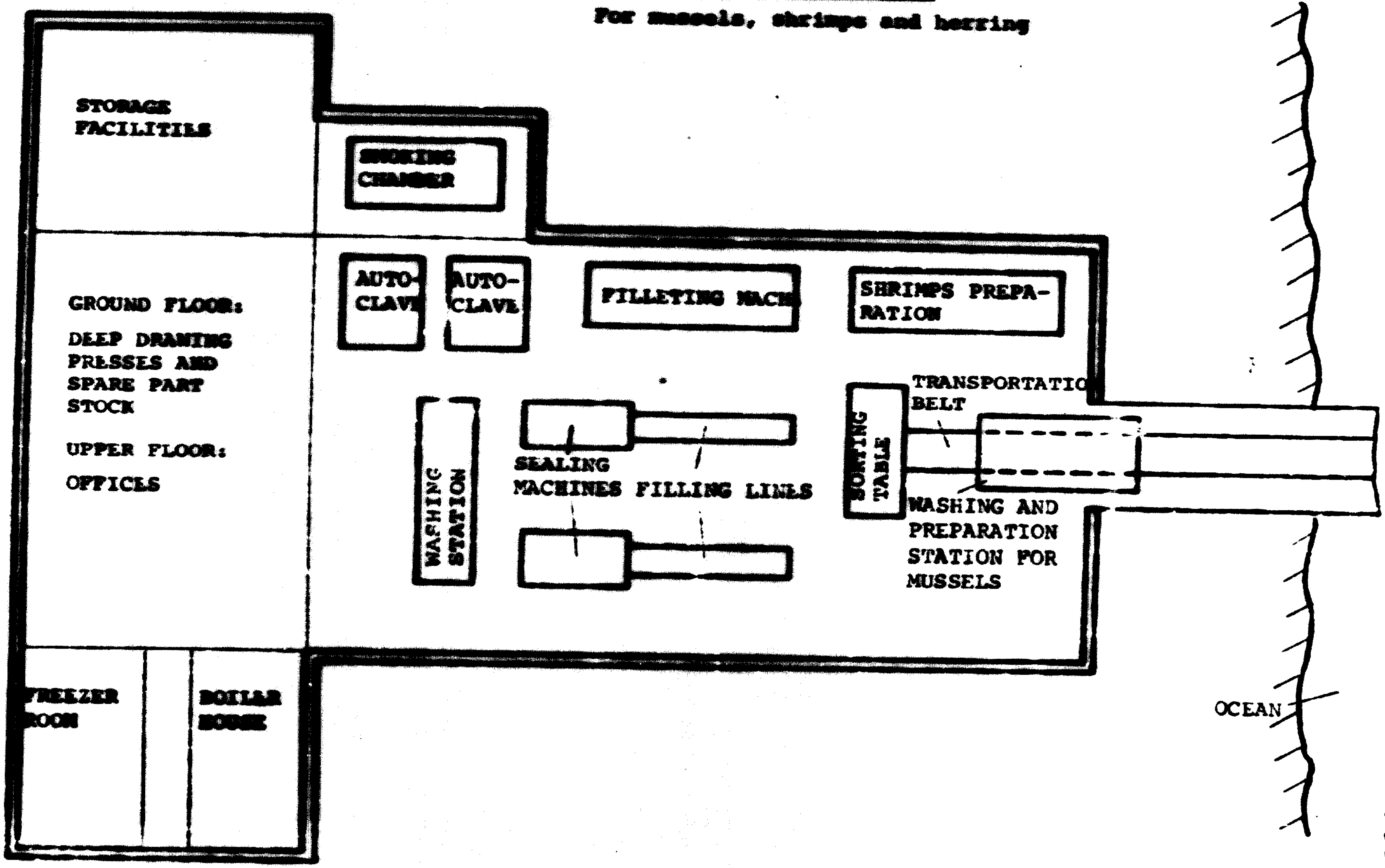
These prices are fob German Northsea-harbour, including sea-going packaging, excluding other duties.

As already mentioned, these prices should only be understood as a rough guide. It should also be pointed out very clearly, that there exists a lot of possibilities to build up Steralcon packaging lines which range between the simple pilot-line mentioned first and the highly automated and sophisticated line described above. Thus, Steralcon offers the opportunity to adapt the packaging plant as close as possible to the local requirements, such as annual output, capital investments or use of laborer.

FIG. 55

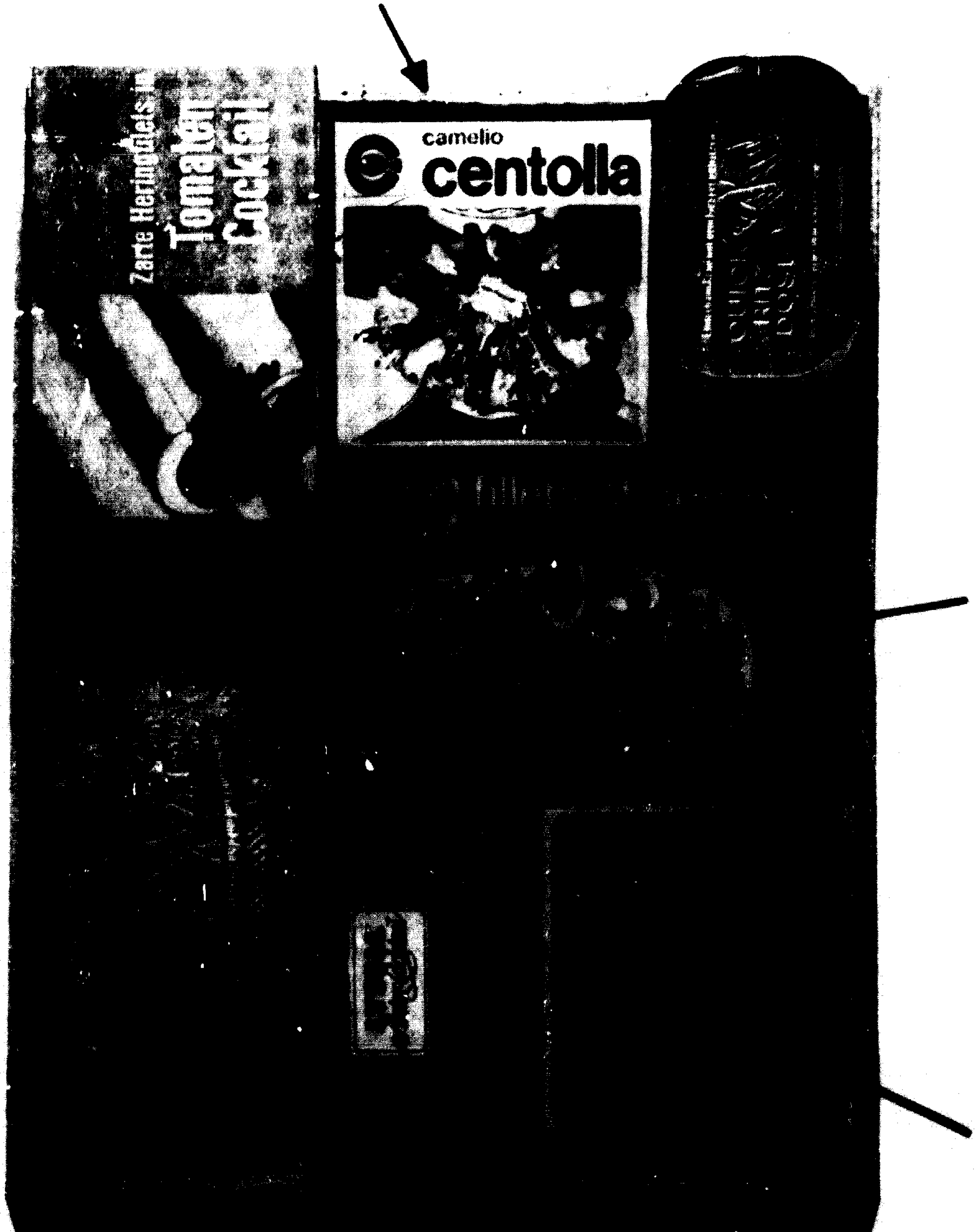
STERALCON PACKAGING PLANT

For mussels, shrimps and herring



STERALCON Dekotip

FIG. 56



THREE POSSIBLE LAYOUTS OF A STERALCON PACKAGING LINE

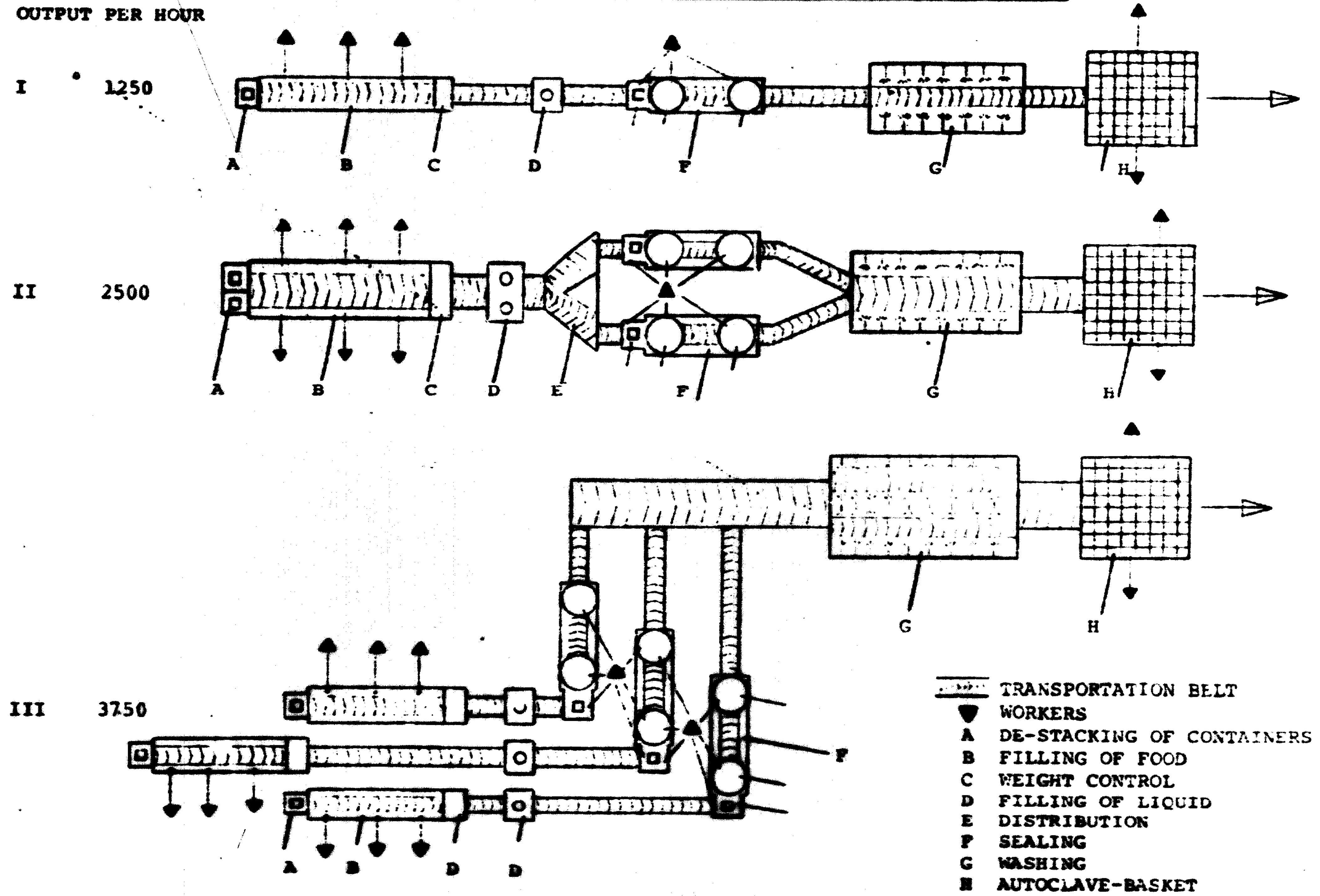


FIG. 5

Content

1. Summary

In 1965, a new food packaging concept emerged in Europe. This concept utilized sterilization in combination with a shallow, lightweight container holding from 10 to about 500 ccm. The packaging material is a laminate of aluminium strip (thickness approx. 0,1 mm) and a heat-sealable plastic film which faces the food-stuff. This coating ensures a hermetic seal between the lid and body of the container, it withstands the deep-drawing operation and resists attack by the processed food.

This semi-rigid, sanitary container has been introduced under various names. The original invention was called Steralcon. Therefore, we will frequently use that name to describe the containers in question.

The Steralcon packaging system is best suited for special products and provides a method of entering the food processing business through small increments of investment. The following examples have been most useful for application of the Steralcon packaging concept:

- pre-cooked menus, the Steralcon container can be used to serve the food in many cases,thereby eliminating the need for dishes,
- fish-products, shrimp and other seafood.

The Steralcon system has increasing importance in developing countries where the complete deep-freezing chain between the food packer and final consumer does not exist or in many cases would be difficult to establish. In addition, it is well suited to complement the conventional "tin-can" and opens new markets

for pre-cooked dinners as well as for fish products, meat and paste products, baby-foods and similar food-stuff.

Steralcon is only one of a number of semi-rigid packages made from multi-layer laminates where aluminium foil or thin strip provides the basic component for preventing the permeation of light, gases and bacteria into the package. These are often pouches and packages which are self supporting and therefore can be used for a variety of fruit juices and other fruit products. These heat-sealable packages are of growing importance in the convenience-food market. All of these aluminium laminate packs are certainly in competition with other packaging materials around the world. In many countries, the packages containing aluminium have gained increased importance because they can be produced in small units and give the product excellent protection and at the same time provide good customer appeal to make a product suitable for export. The development of such multi-layer aluminium packaging is by no means at a standstill. Every year we can see new packages and/or improved processing treatments which extend their use to an ever wider range of food products.

This paper gives a brief survey on the present status and concentrates on packages with a background of broad usage.

2. Sterilizable semi-rigid aluminium containers

2.1 Introduction

Over the years the tin-plate container has proved a safe and efficient vehicle for food preservation and one that is extremely economical to produce. Standardization, the price we have had to pay for these benefits, seemed of little account in the past compared with the advantages of cheap long-term storage for a great variety of perishable foods.

Today, there are signs that this situation is beginning to change: an affluent public, with higher expectations of variety and convenience, has grown up creating new demands on the product and its container. New developments in heat-and-serve meals and the widening choice of luxury foods are aspects of a trend towards higher quality and service that are reflected in packaging as well. Features such as easy-opening, novel shapes and attractive finishes are no longer unessentials but factors that are going to require more attention in the future.

The advantages of aluminium for packaging - light weight, easy-formability, attractive appearance and food compatibility - looked highly suitable for application in many areas and encouraged a number of post-war attempts to replace tin-plate by aluminium. A direct substitution of one material for another proved, however, to be an uneconomic proposition. To utilise aluminium, it is necessary to appreciate and use its advantages to the maximum. This appreciation has lead to a variety of possibilities, and the easy-open can end was a spectacularly successful example. In the field of aluminium foil, the popularity of the semi-rigid, wrinkle-wall container over the past ten years, for a variety of food packaging applications, was the starting point for work to develop a foil container suitable for sterilized foods. This search led to the introduction of a smooth-wall foil container having a heat-sealable coating of either lacquer or plastic film that could be lidded and sterilized and that offered a smooth attractive outside surface for printing and lacquering coupled with broad design possibilities regarding container shape.

In other areas this search to fully utilize aluminium's advantages, has led to the establishment of the principle that a foil pouch, comprising a complex foil/film laminate could provide a sterilizable container.

2.2 Composition of Steralcon

Several years of research and development work have been devoted to the establishment of techniques and materials for producing a smooth-wall foil container that could withstand commercial high temperature sterilizing processes and would be suitable for the widest range of applications.

From the beginning the concept was adopted that as the aluminium required a protective coating to withstand attack from a number of food-stuffs, it would be desirable to have a double-purpose coating - namely, one that would protect and would also provide a sealing medium.

The successful outcome of this research was the "Steralcon" (= sterilizable aluminium container), known in the UK as "Stera-Pak", which proved itself in laboratory trials and has now been tested for several years in a number of small-, medium- and large-scale commercial applications.

For the production of these lightweight containers an Aluminium-plastic-laminate is used. The stiffness of the containers is provided by an aluminium strip of 0,05 - 0,18, preferably 0,09 - 0,14 mm thickness, depending on the size and application conditions of the containers (Fig. 1). Pure aluminium is used as well as an AlMn-alloy. This strip is coated on the outside with an stove lacquer based on epoxy or phenolic-epoxy resins. This 4 - 6 µm thick coating resists sealing and sterilizing temperatures. The other side (inside) of the aluminium strip is coated with a polyethylene or polypropylene film of 40 - 74 µm thickness. For the lids, 12 - 20 µm thick biaxially pre-stressed polypropylene film, is also being used. These plastics have proved to be most suitable in providing a sealing medium, and protection against agressive juices of the filled food. In the meantime also sterilizable and sealable lacquers have been developed which can be used instead of the plastic films as the interior coating.

2.3 Production of the containers

The good forming properties of the aluminium allow a wide variation in the shape of containers. It is possible to produce not only round or rectangular containers but also such shapes which are specially fitted to the contour of the food to be packed. The forming is done by deep-drawing on commercially available presses (Fig. 2). The precision requirements for the tools are very high. The maximum ratio of the blank-diameter to the height of the container is about 1,8 - 2,0. Volume of the containers varies between 10 - 500 ccm. For larger sizes it is necessary to use thicker strip in order to have the adequate stiffness. The containers can either be produced directly in line with the packaging machine or separately and shipped to the packaging plant. The capacity of modern deep-drawing presses ranges from 60 - 90 strokes per minute, depending on the type of machine, the type of tools as well as on the size and shape of the containers.

2.4 Filling

For filling the containers, standard filling equipment can be used. Only the installation to transport the empty containers to the filling stations and of the filled containers to the sealing stations have to be modified in a way as to avoid any damage of the containers. The containers can be filled with either hot or cold food-stuff. The head space of the filled container has to be kept as low as possible (maximum 6%). The fulfillment of this requirement is facilitated by the use of shouldered lids.

For best results the seal area should be free from product contamination and for this reason filling equipment with absolutely clean cut-off is needed. Laboratory tests and commercial experience has shown, in some cases, however, that fully reliable seals can be obtained even through a portion of the packed product. As an example of this, it can be stated that in extensive laboratory trials on the packing of sardines in olive oil, completely hermetic seals were obtained even though in all cases the seal area was 100% contaminated with olive oil.

2.5 Sealing

Steralcon containers are closed by the welding of two heat-sealable surfaces. The actual seal area is an annular ring 2-3 mm wide between the horizontal rim of the container and the superimposed lid. At temperatures of about 150°C, the plastic begins to flow and at this point the pressure that is applied round the rim during the sealing operation results in the formation of a continuous bead at both the inner and outer edges of the seal. Provided temperature, pressure and dwell times are accurately adjusted, a completely fused, hermetic and bacteria-resistant seal is obtained. Fig. 3 shows a cross-section through such a seal.

Pressure, temperature and dwell times are functions of the container size, foil thickness and product temperature.

Considerable experimental work was carried out on plastic flow during varying conditions of sealing temperature and pressure. It was found necessary to have differential heating on the top and bottom tools and to control pressure accurately so as to avoid too much flow of the sealing compound.

The following figures indicate the range over which effective sealing takes place for different sizes of container:-

Top tool temperature	230° - 280°C
Bottom " "	120° - 150°C
Sealing pressure	40 - 60 Kp/cm2
Dwell time	0,5 - 1,0 sec.

Fig. 4 and 5 show a schematic cross section through a sealing tool and the machine in operation.

2.6 Sealing machines

For test purposes, laboratory scale sealing machines were developed and later adapted for semi-automatic pilot and medium-scale operations. One of these models (Fig. 6) is a compact, mobile unit which handles any of several standard container shapes at an output of 800 packs an hour.

In a fish canning line, in which the containers are overfilled, a station has to be incorporated for pressing down the lids of the containers and rinsing before the sealing cycle begins. A combination of two semi-automatic units was designed for this purpose and integrated into a single system which is successfully processing around 1,000 containers an hour. (See Fig. 7)

For large scale commercial operations several leading machinery manufacturers are offering automatic sealing machines which can reach an output of up to 1500 containers per hour (one sealing station).

2.7 Sterilization

Because of the tendency of thermoplastic materials to soften and weaken during high temperature sterilizing, counterpressure autoclaving for Steralcon containers is essential.

For good results, counterpressure must be applied as soon as heating starts and maintained during cooling down to a temperature of at least 40°C.

A schematic representation of the required pressure/temperature variations during the sterilization of Steralcon containers is given in Fig. 8. For specific containers and fillings, the counterpressure figure will vary considerably so that the curve can only serve as a rough guide. The upper curve shows a counterpressure which is constant throughout the sterilization process and has also been found to give satisfactory results (Fig. 8). Fig. 9 shows a commercially available autoklave which can be used for sterilizing Steralcon.

Sterilizing cycles, of course, must be worked out individually and will depend on such factors as the pH value of the fill, the F_o value required, the heat transfer properties of the fill and the shape and size of the containers.

Aluminium has rapid heat-transfer properties and these, combined with the relatively shallow depth of the containers, suggest that it may be possible to shorten sterilization times for some products generally packed in squatter containers of glass or tinplate. Any shortening of sterilization time that is possible would have the effect of improving the flavor and/or color of the product.

2.8 Packaging lines

The whole process from the coil to the closed containers is illustrated in Fig. 10. As shown, this process can be divided into the following 6 steps:

1. The containers are formed from the coil by punching and deep drawing.

2. The containers are filled manually or automatically.

3. The filled containers are covered with a lid which is also punched from the coil.

4. The containers are sealed by applying heat and pressure.

5. The closed containers are sterilized in autoclaves.

6. The sterilized containers are prepared for shipment./

All these steps can be carried out by special machines which have proved their reliability in several years of application. These machines can be set up in a way which to a high extend allows automatic transportation of the containers between the single steps. The output of such a line usually is in the range of 40 - 50'000 Steralcon containers per day (2 shifts). The investment cost for the machines of such a line would be approx 100' - 150'000 $. In Fig. 11, a typical lay-out is shown for such cases where the forming of the containers is not included in the packaging line.

There have also been developed special machines which combine several of above steps. Thus, as an example, Fig. 12 shows the concept of a machine for forming, filling, lidding and sealing. Fig. 13 gives a view of the complete equipment ready for use. Such a machine can produce up to about 80 sealed containers per minute, depending on the size of the container.

2.9 Test procedures

A number of procedures have been developed for testing the quality of Steralcon seals.

Experience has shown that for a container to withstand sterilization successfully, a seal strength of 4-8 kg/cm2 is requires. The burst pressure test measures that strength.

The procedure consists in placing the container in a frame so that it is supported at all sides except at the seals. An air-inlet needle pierces the bottom of the container, the unit is closed, immersed in a water bath and the air pressure turned on. This pressure is increased until seal failure occurs. A representation of the testing apparatus is shown in Fig. 14 and 15.

This test is destructive and hence of value in research but not for providing a quality control procedure in a production plant. The so called seal thickness test is non-destructive and so has a commercial value.

The technique consists in measuring the thickness of the foil/plastic/foil rim of the container. For any given thickness of foil and plastic coating, there is a given deformation that must take place for a good seal. This can be measured e.g. by a simple instrument which is shown in Fig. 16. There have been developed several other test procedures to ensure save application of Steralcon, but it is not possible to describe them all in this short overview.

2.10 Easy-opening-lidding

As the lightweight container consists of a relatively thin strip it can be readily cut open with a knife. (Fig 17) Recently combinations of lid and container material have been developed which also permit the lid to be pulled from the container along the sealing-line (Fig. 18).

It is evident, however, that the burst strength of such a seal, if it fulfills the easy-open requirements, must be lower than that of a normal seal. Nevertheless, a sufficiently high strength has been obtained to enable the container to withstand sterilization with an adequate margin of safety.

2.11 Product acceptability

Tests have been carried out on a wide range of products and good results achieved for all but a few products.

As already mentioned, the sterilizable lighweight aluminium/ plastic-composite containers gained their first major success in the fishpacking-industry (Fig. 19). Since then, several million containers have been brought onto the market and have been accepted readily by the consumer. In addition, the lightweight container has been successfully used for packing various types of meet and sausages, concentrated soups, prepared fruits, desserts etc. (Fig. 20 - 30).

In Switzerland e.g. the Steralcon packaging system has found broad application for all kinds of meat products and prepared meals. The amount of interest generated by the success of these operations has attracted the attention of leading international food manufacturers, some of whom are now introducing Steralcon for their products.

2.12 Advantages and disadvantages

The main advantages of Steralcon can be listed as follows:

- Lightweight

  Size for size any number of Steralcon containers weigh approximately one-fifth the same number of tin-plate cans. (Fig. 31)

- Impervious to light and odors

  The outer foil skin makes the container completely impervious to light and odors.

- Space saving

  Nested, when empty, containers occupy only a fraction of the space needed for straight-sided cans. Handling, transport and storage costs are thus lower than with glass or tin-plate. (Fig. 32)

- **Easy opening and disposal**

  No key or can-opener is needed. The lid can be quite easily cut open with a knife, or can be supplied in a tear-tab version that simply peels off. There are no sharp corners and the container can be crumpled up for disposal.

- **Individual shapes and sizes**

  Containers from 10 ml. - 500 ml. capacity can be made in round, oval, triangular, square or asymetric shapes, and can also be contoured to the shapes of individual products (28.4 ml. = 1 fl.oz)

- **Attractive appearance**

  The good looking, smooth-walled, seamless container can be produced in a range of colors that retain their attractive finish after exposure to the high temperatures of sealing and sterilization. Work is in progress to extend the range of colors, and to develop decorative printed finishes.

- **Good display features**

  Conical shapes permit stable stacking of filled containers with consequently better use of valuable display space.

- **Non-corroding**

  Corrosion, due to temperature fluctuations and condensation, which can be a problem with tin-plate containers, does not occur with the aluminium container.

- <u>Shorter processing</u>

  Due to rapid heat penetration of the shallow foil container, it may be possible to cut sterilizing time for certain products, with resulting improvements in flavor and color.

- <u>Resistance to breakage</u>

  The foil container, although easily deformable, does not break.

The main disadvantage which has to be mentioned here is the low-stiffness of the containers which results in a low bump-resistance, especially of containers with a content of more than 200 ccm. To circumvent this difficulty it is possible to use an additional pasteboard-box which, although it adds somewhat to the cost, it enriches display possibilities. (Fig. 33 and 34)

2.13 Conclusion

For selected applications where there is a demand for attractive, easy-open containers, the semi-rigid sterilizable aluminium foil container offers advantages not possessed by other materials.

It is not a universal alternative to the tin-plate can but one which is likely to command considerable interest for the packaging of fish and meat products.

Extensive research followd by experience in commercial operations has helped to perfect this system to the point where it can be confidently offered to food processors around the world.

3. Pouches

As we already mentioned in the introduction, the semi rigid containers described here are only one sector of the whole spectrum of Aluminium food packages. In looking at Fig. 35 we can see that on one side of this spectrum are the rigid aluminium cans which will not be discussed in detail in this paper. On the other side are the soft packages such as pouches, bags, tubes or simple wrapping.

I woul like to continue with a short description of soft packages for food and then switch over to Aluminium packaging systems for beverages and especially fruit juices which again can belong to the semi-rigid as well as to the soft type of package.

If we look now at pouches, it is reasonable to distinguish between 4 different types:

- The first, and in some way the most simple one is a flat pouch with seals along all four edges (Fig. 36). This type of pouch can relatively easily be produced (Fig. 37), its main disadvantage is its high ratio of packaging material requirement to volume content.

- Another frequently used type is the so called hose pouch, which has only one seam in the lengthwise direction and two in the cross direction (Fig. 38 and 39). A typical machine-concept how to produce such pouches can be seen on the next slides (Fig.40a and 40b).

- The hose pouch can also be made with a special fold on the sides. In this case, the resulting package is able to stand. The ratio of packaging material requirement to volume content is optimal (Fig. 41 and 42)

- It is also possible to produce 3-dimensional pouches with more than 2 seam in the lengthwise direction. These are also able to stand and can be made for large volume contents (Fig. 43 and 44).

A typical composition of laminates used for the pouches discussed above would be: polyethylene film 75 μm thick on the inside - aluminium foil 12 - 20 μm thick as an intermediate layer and approx. 12 μm thick polyester or viscose foil on the outside. The aluminium foil provides an excellent protection against penetration of all kinds of gases, vapors, or odors.

Costs for typical machines to produce such pouches are in a range of about 30'000 - 50'000 $. Typical output of such machines is about 60 - 70 packages per minute, depending on the size and type of food to be filled.

4. Containers for beverages and fruit juices

The first type of container to be described here is a semi-rigid pack with an rectangular shape. Its body consists of a cardboard/aluminium/plastic laminate, for the bottom and top lid plastic coated Aluminium is used. (Fig. 45)

These composite materials can be heat sealed, resulting in a package which is impervious against water or gases. This container is also remarkable because of its low weight, its low space requirement for storing and its easy-opening-possibilit[y] (See Fig. 46 and 47).

An additional feature is its attractive design because it is possible to print on the entire body of the package (Fig. 48). For these reasons it is easily understandable that this type of container has been introduced for a wide variety of fruit-juices and other beverages.

Another type of aluminium package for beverages resembles in some way, the previously described hose-pouches (Fig. 49). By special design of the bottom area, this package is able to stand. It is also impermeable, extremely light and can be opened very easily by cutting one edge. A typical machine which can be used for filling these pouches can be seen on the next slide (Fig. 50).

Finally I would like to come to a type of packages which consists mostly of cardboard/plastic composites, but which can include also aluminium foil if better protection is required. These are folded containers which were initially used for milk packaging. There exist a lot of different machines for making these packages in various sizes and shapes. I want to show you only a very limited number of examples (Fig. 51 and 52) from which you will also see that the use of these packages has now been extended to all kind of food and even non-food products. A typical machine to produce these containers is shown in Fig. 53.

I hope I have given you an impression of the whole spectrum (Fig. 54) of packaging applications where the favorable properties of aluminium can successfully be used.

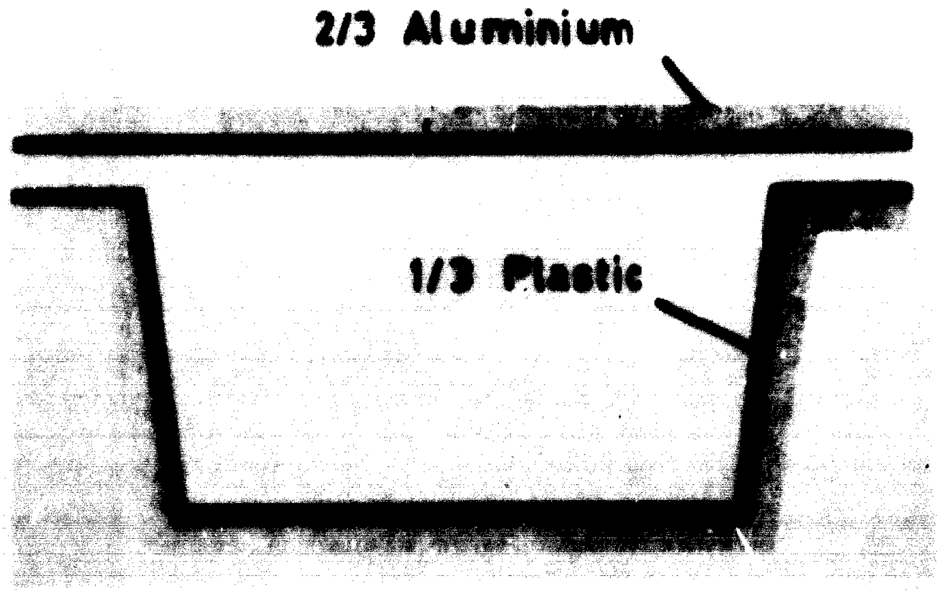


Fig. 1: Section through the container (schematic)

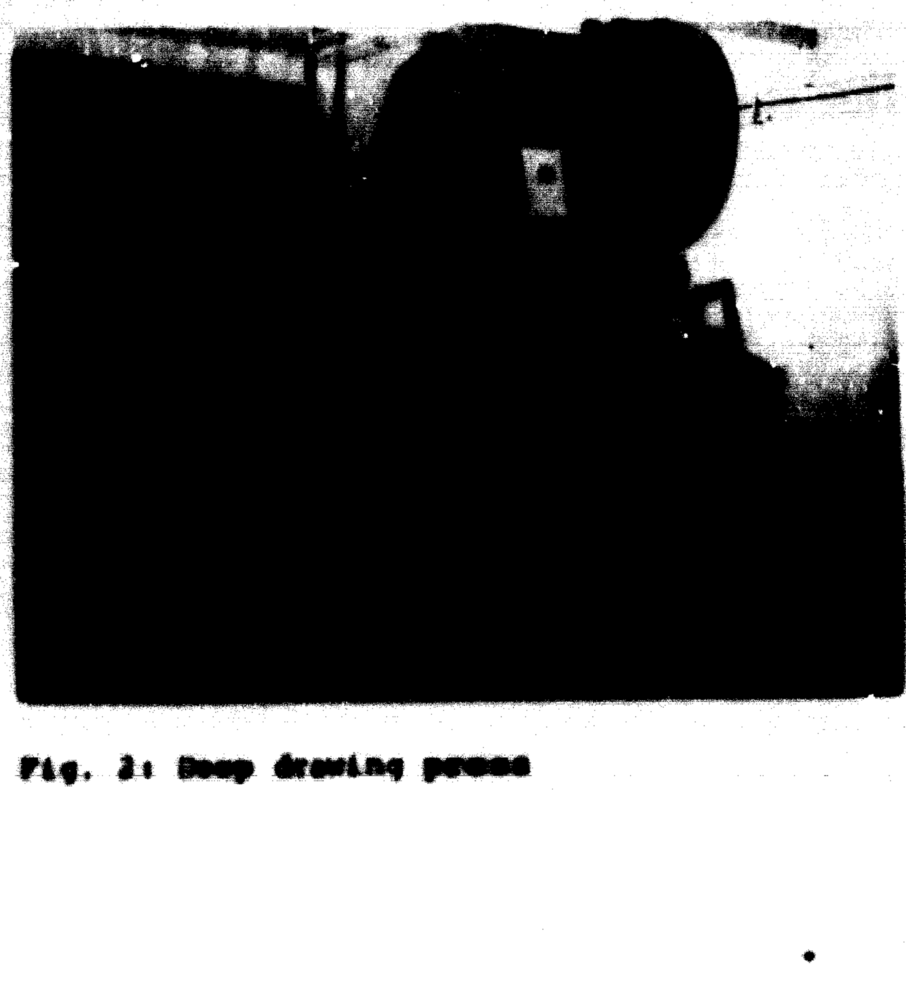


Fig. 2: Deep drawing press

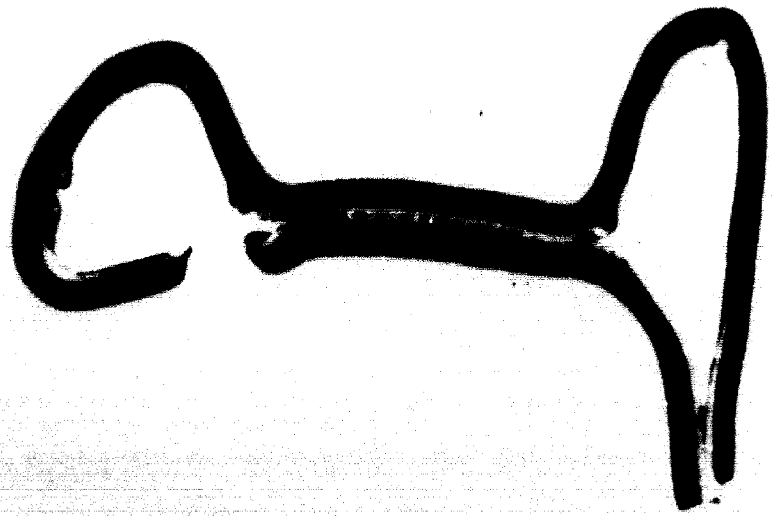


Fig. 3: Magnified section through the seal area

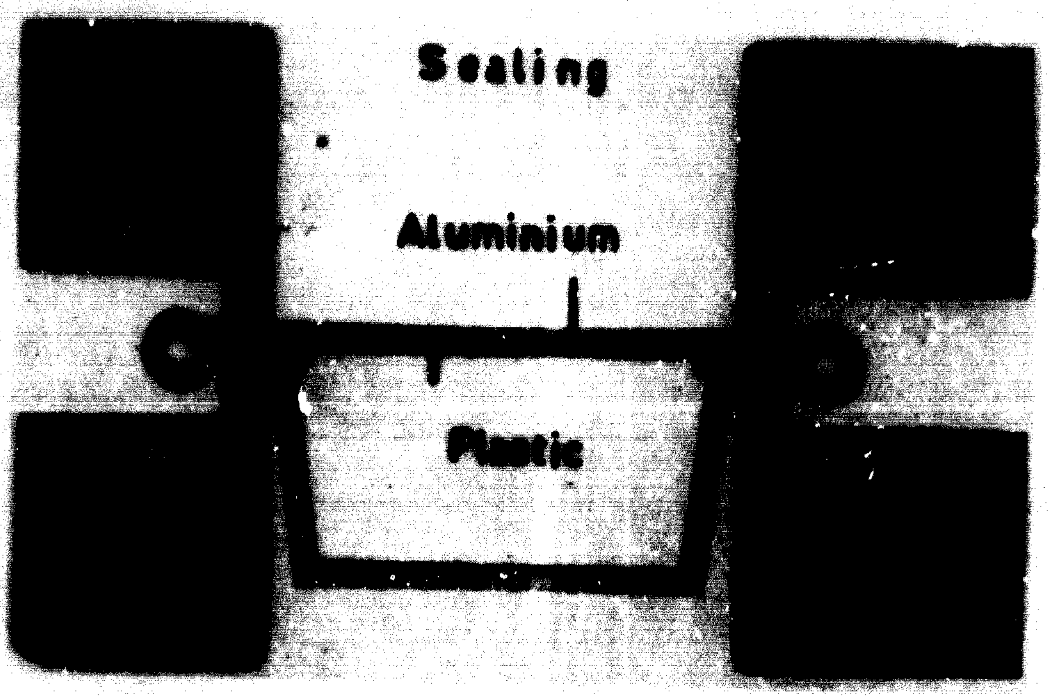


Fig. 4: Sealing operation

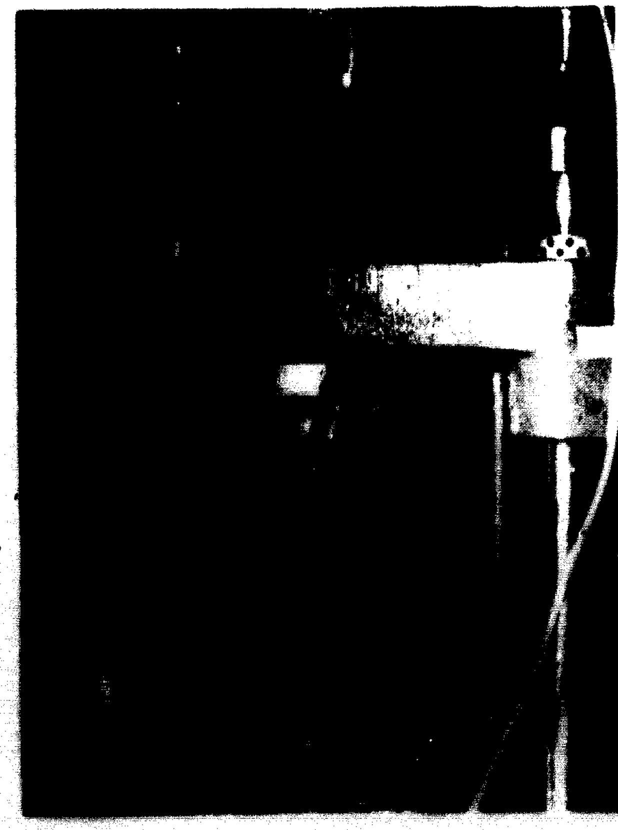


Fig. 5: Sealing machine in operation

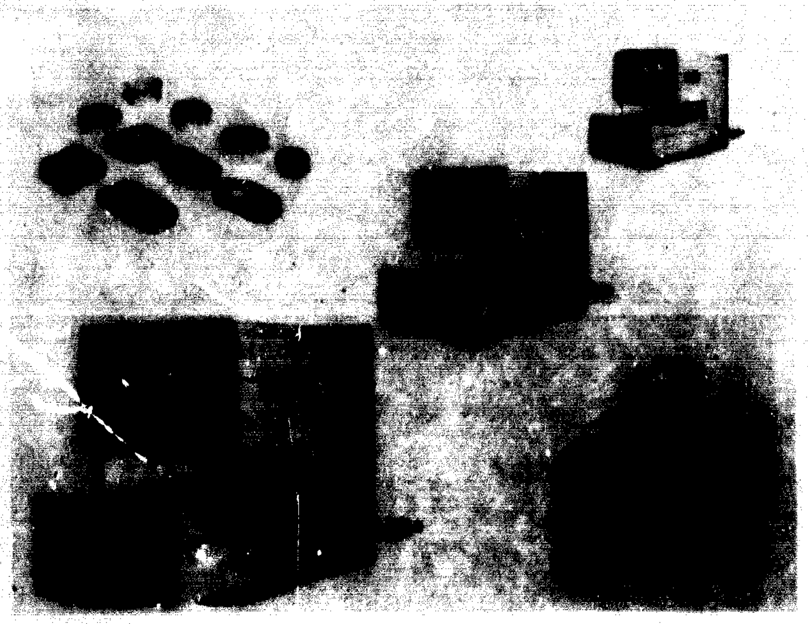
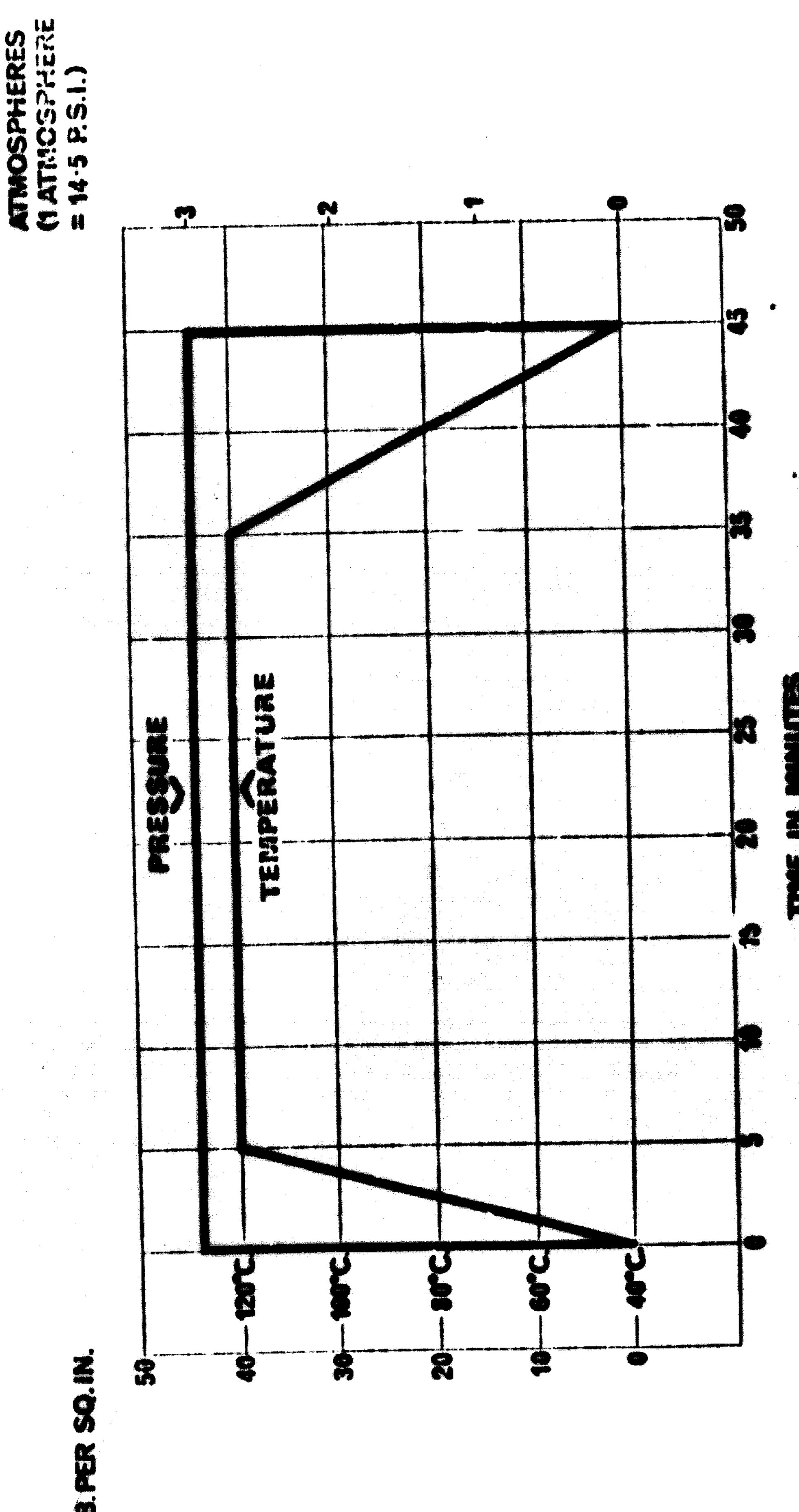


Fig. 6: Semi-automatic sealing machine for pilote operations

Fig. 7: Washing and sealing machine used in packing fish

Fig. 8

SCHEMATIC DIAGRAM OF PRESSURE AND TEMPERATURE VARIATIONS DURING STERILIZATION



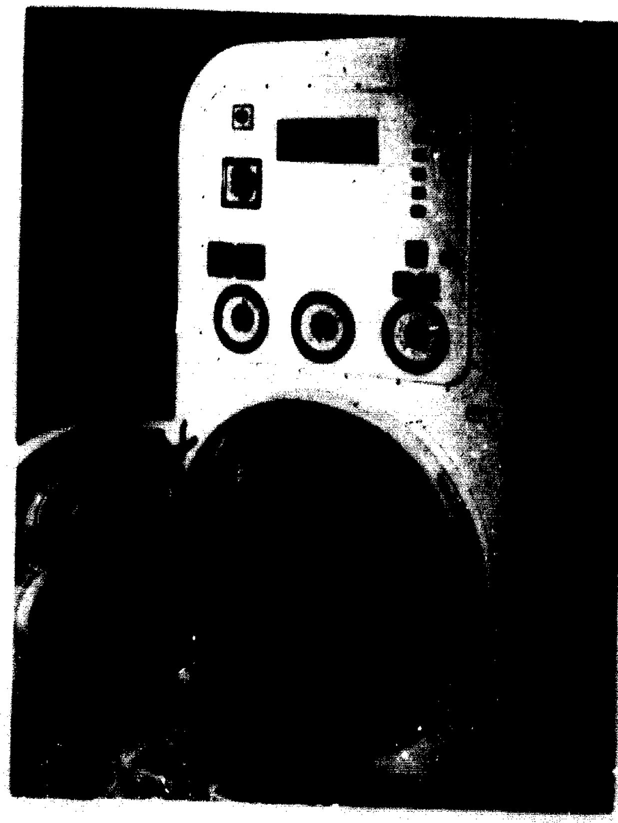
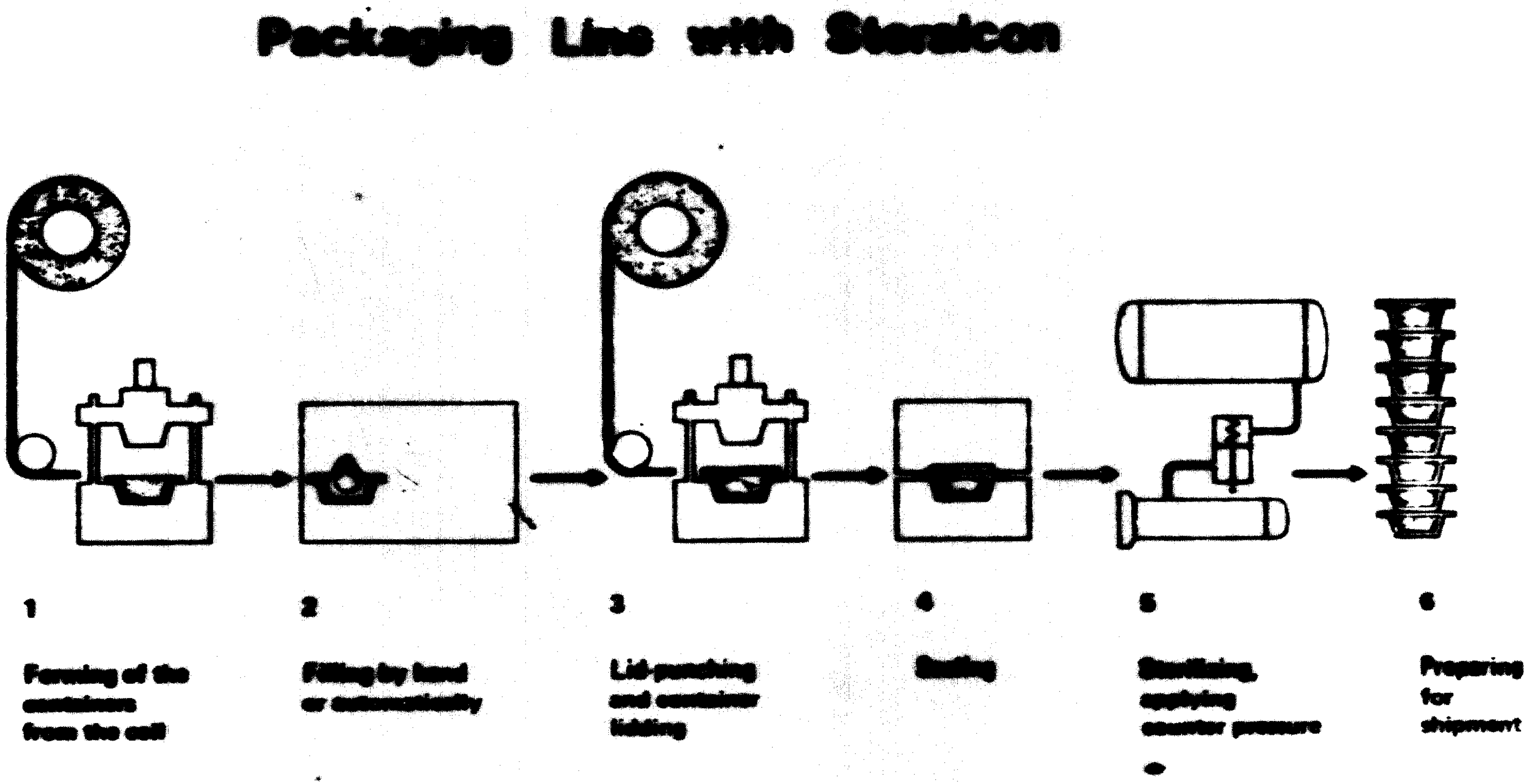


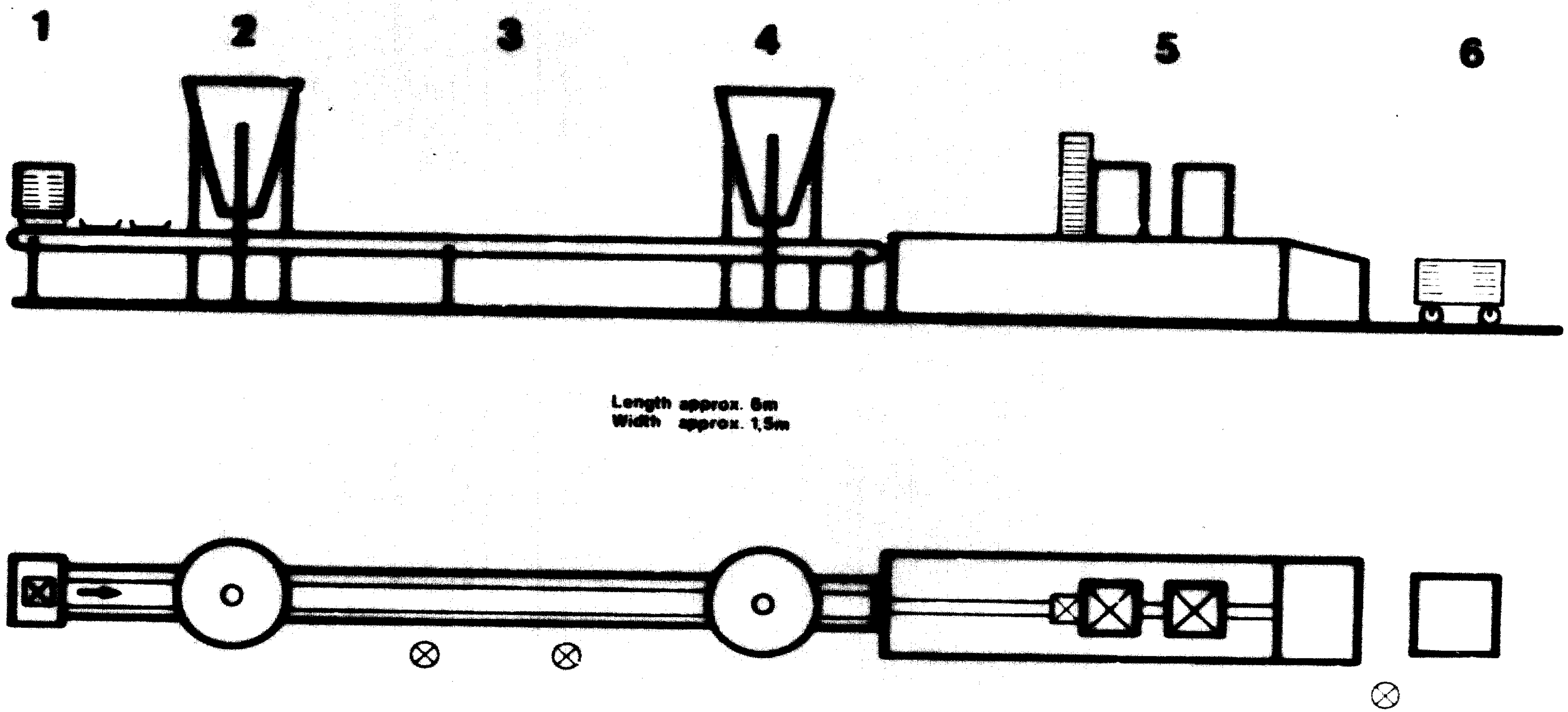
Fig. 9: Autoclave used for sterilizing Steralcon

Fig. 10


Packaging Line with
1
2
3
Lid-punching
and container
lidding
4
5
6
Preparing
for
shipment

FILLING – SEALING LINE

20 UNITS/MIN



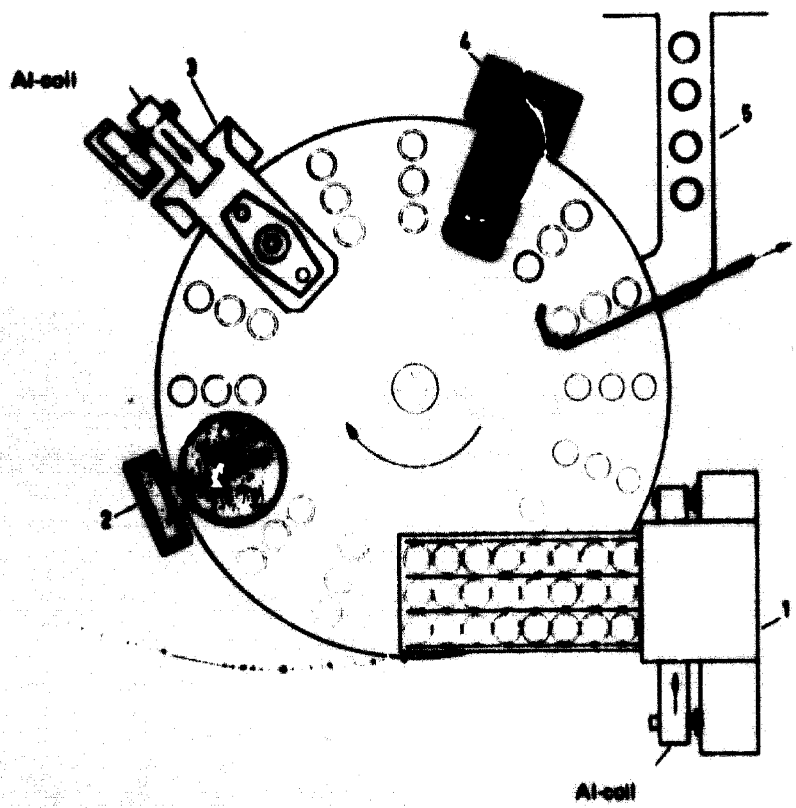
1 Destacker
2 Pre-Filler
3 Hand-Filling
4 Top-up Filler
5 Lidding-Sealing
6 Retort-Basket

ALUSUISSE AVP

Fig. 11

Fig. 12

SCHEMATIC SHOWING THE OPERATION OF
A PACKAGING MACHINE FOR STERALCON



1 Container forming
2 Filling
3 Lidding
4 Sealing
5 Transportation belt

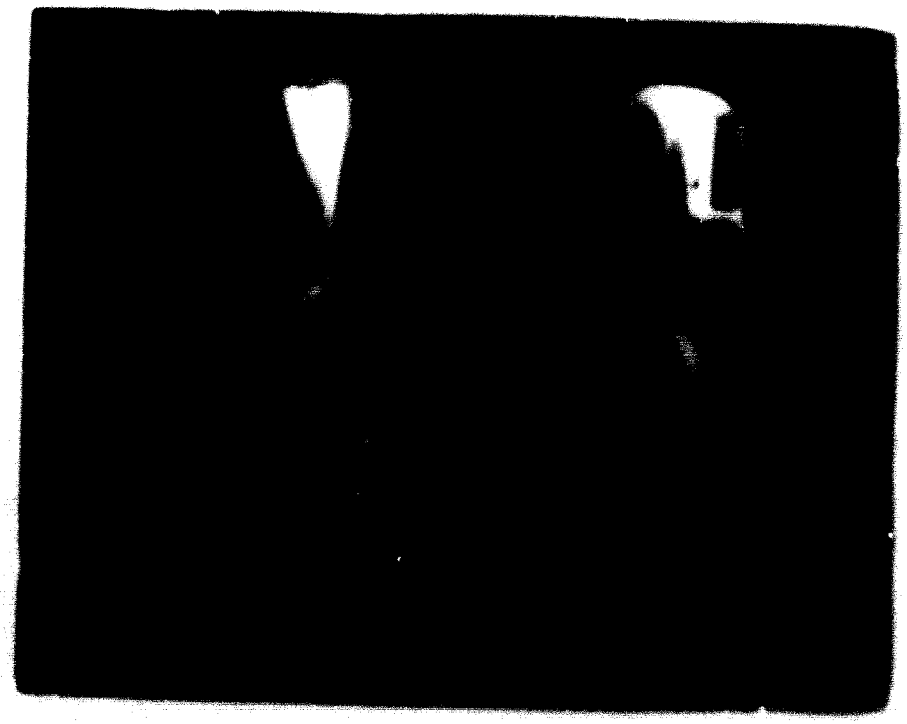


Fig. 13: Packaging machine for container forming, filling, lidding and sealing

Fig. 14: Seal strength measurement test

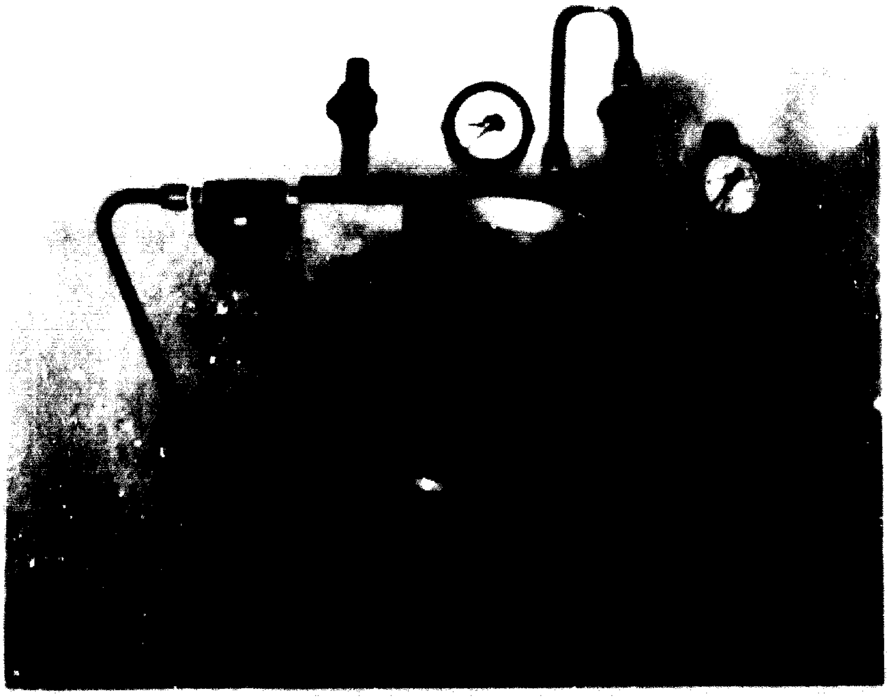


Fig. 15: Seal strength measurement test

Fig. 16: Seal thickness test

Fig. 17: Knive opening

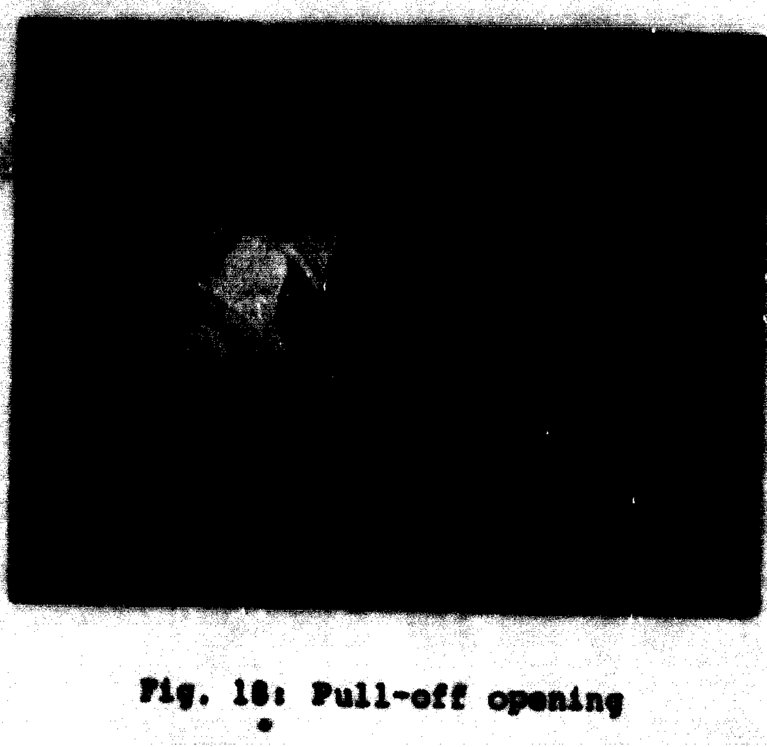


Fig. 18: Pull-off opening

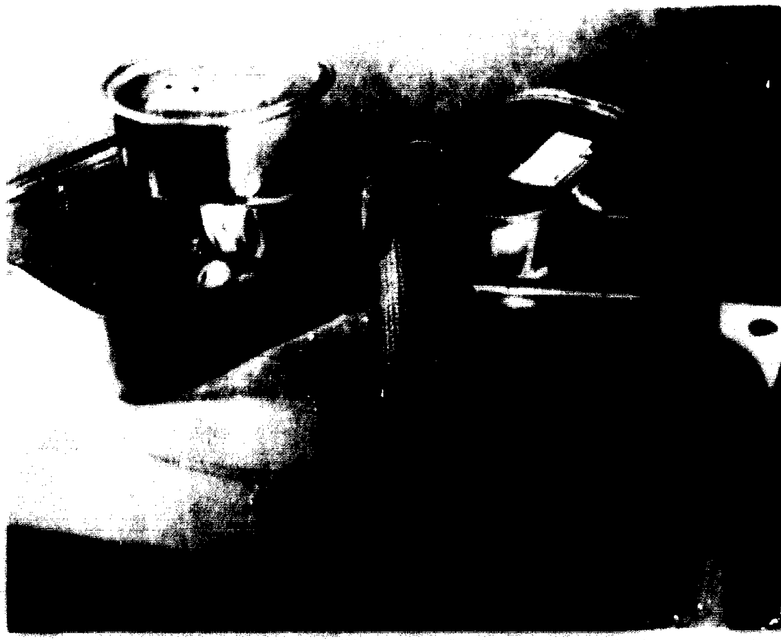
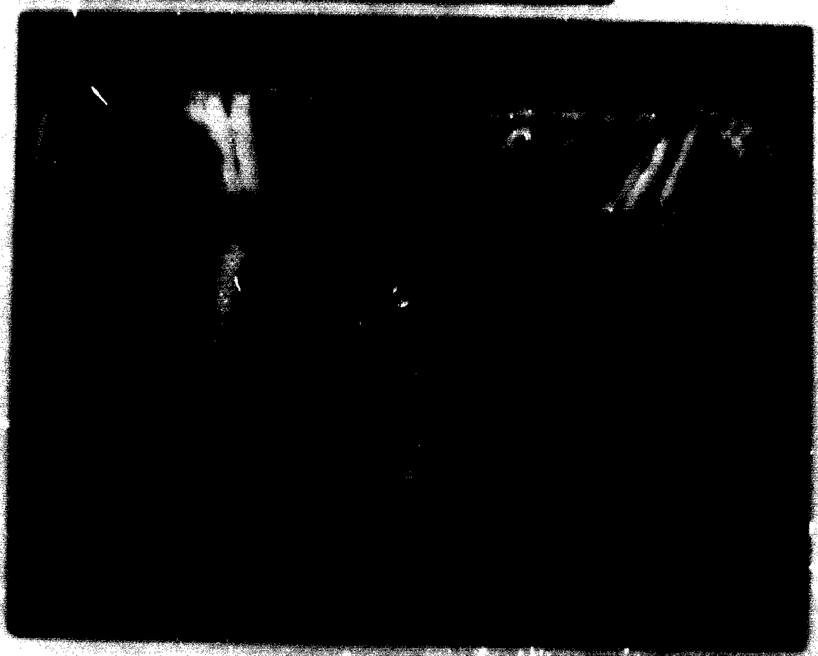


Fig. 19 - 21: Selection of recent uses



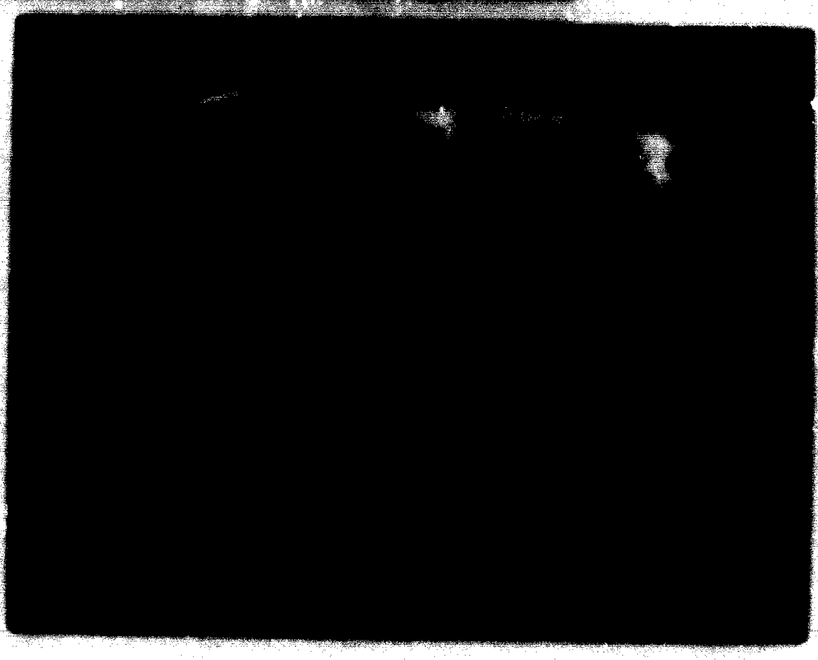
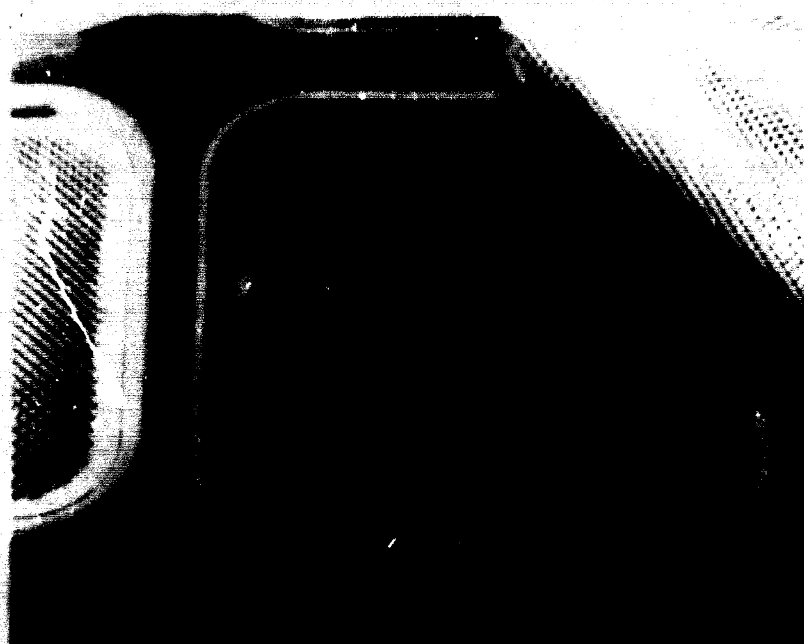


Fig. 22 - 24: Selection of recent uses



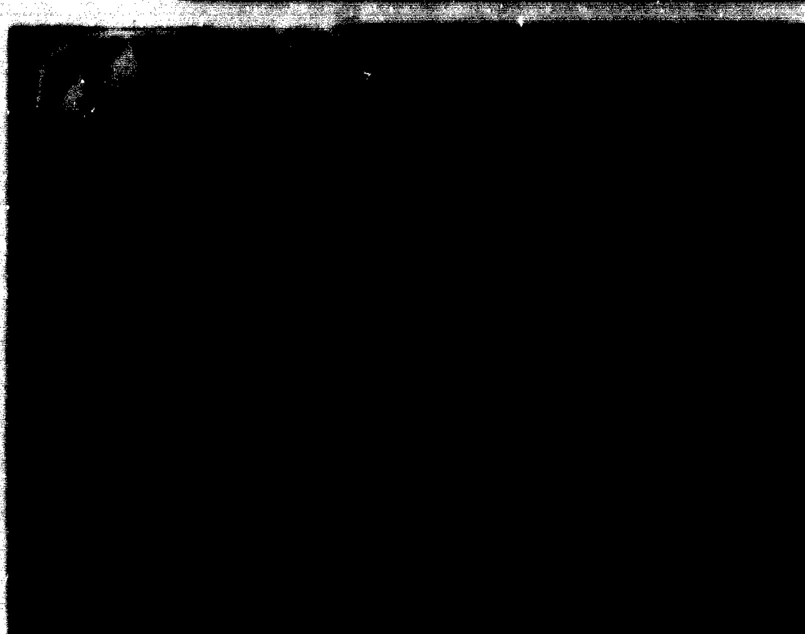


Fig. 25 - 27: Selection of recent uses

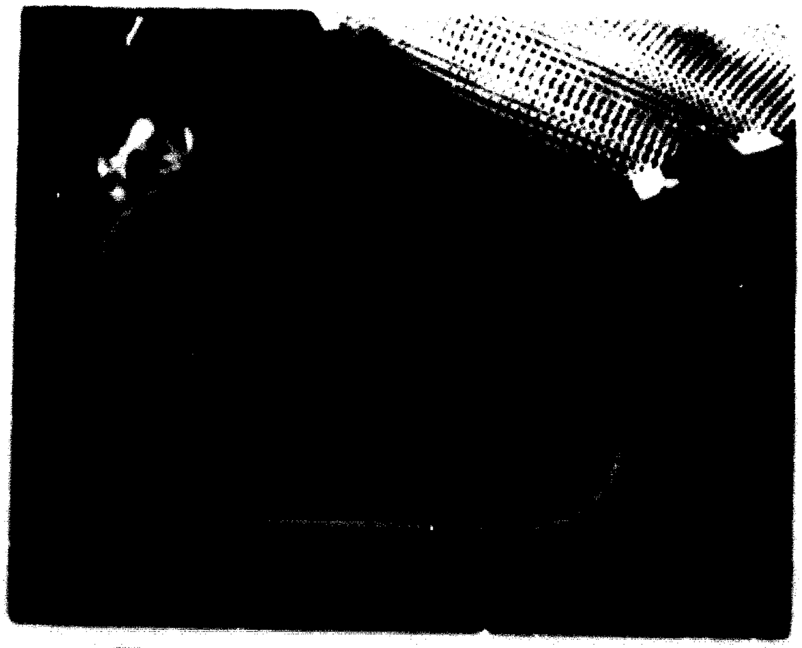


Fig. 28 - 30
Selection of
recent uses

Fig. 31:
Demonstration of
the light weight
of Steralcon

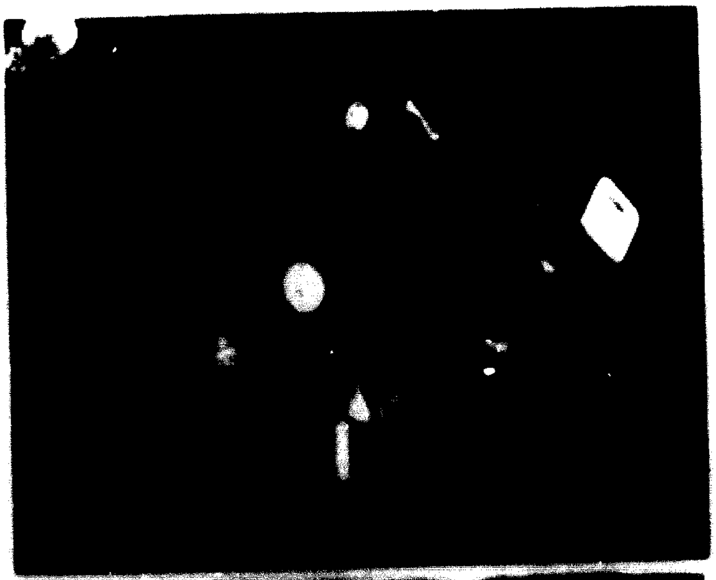
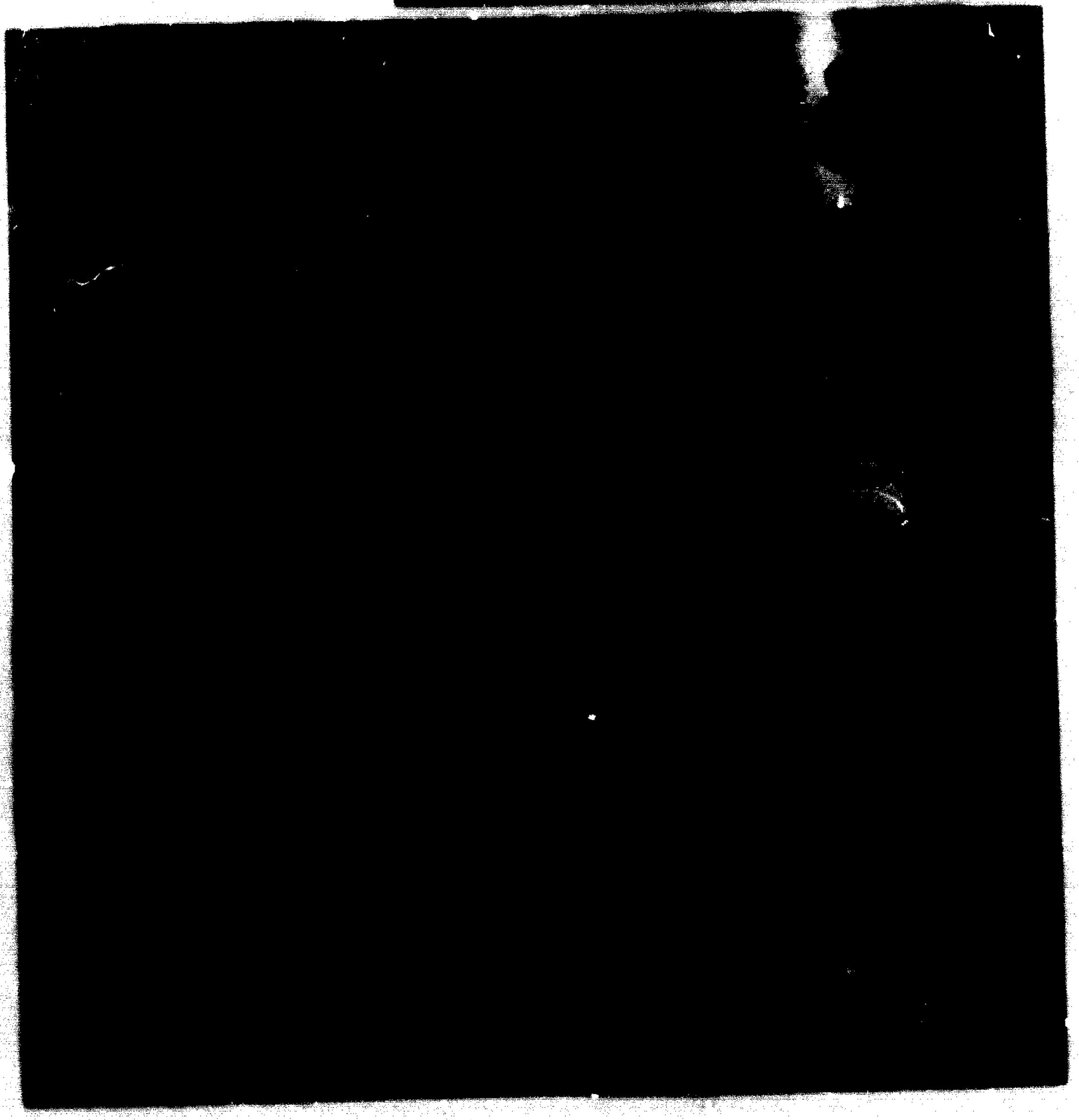


Fig. 32:
Space saving in
storing Steralcon



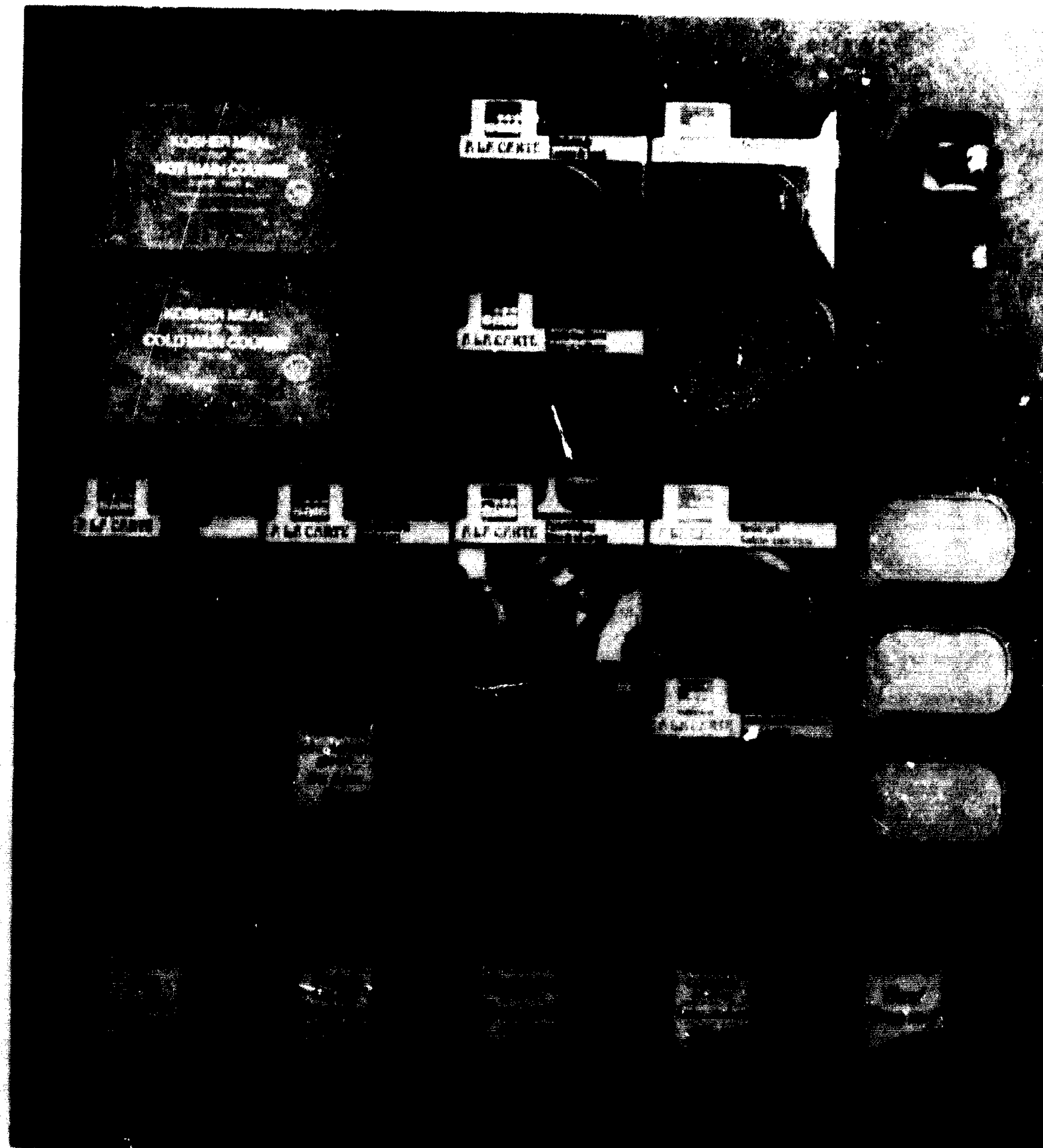


Fig. 33: Steraloon with pasteboard box

Fig 34: Steraloon with pasteboard box

Fig. 35

ALUMINIUM PACKAGES

rigid containers

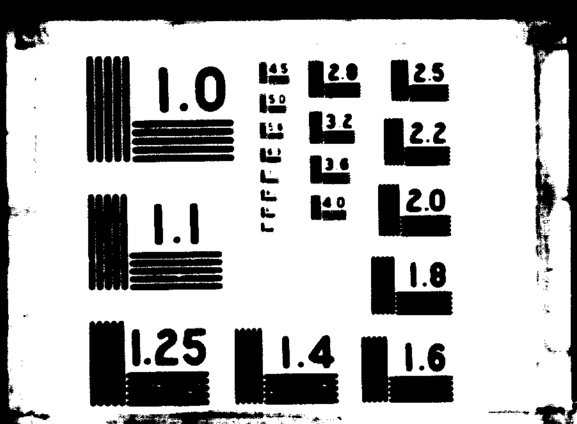
semi-rigid containers

soft containers

8. 8. 74

2 OF 2

04834



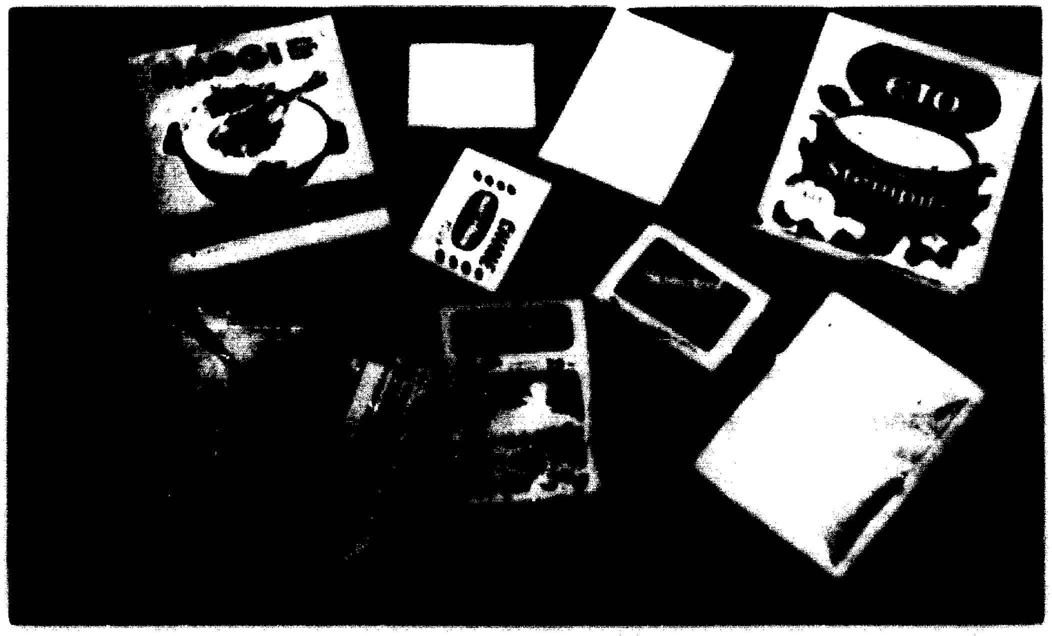
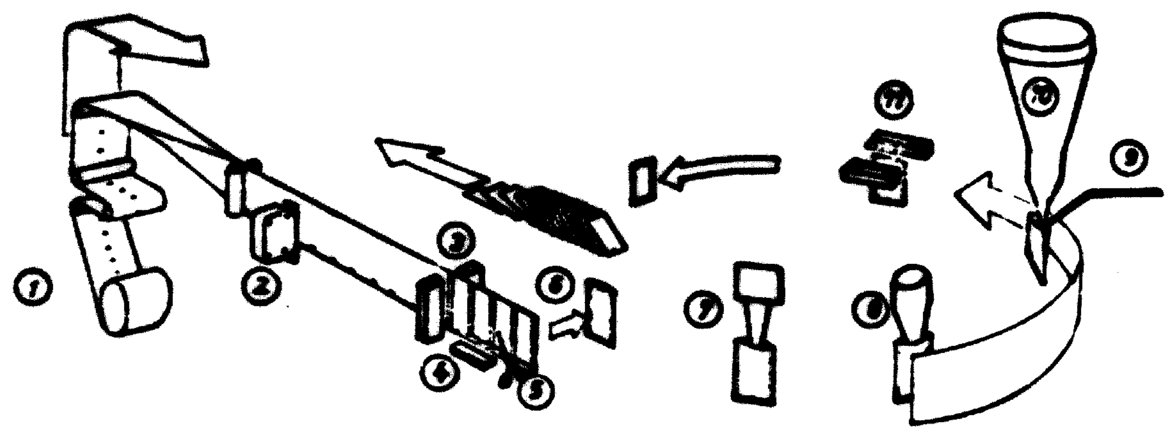


Fig. 36

Fig. 37



SCHEMATIC SHOWING THE PRODUCTION OF FLAT POUCHES

Fig. 38

Fig. 39

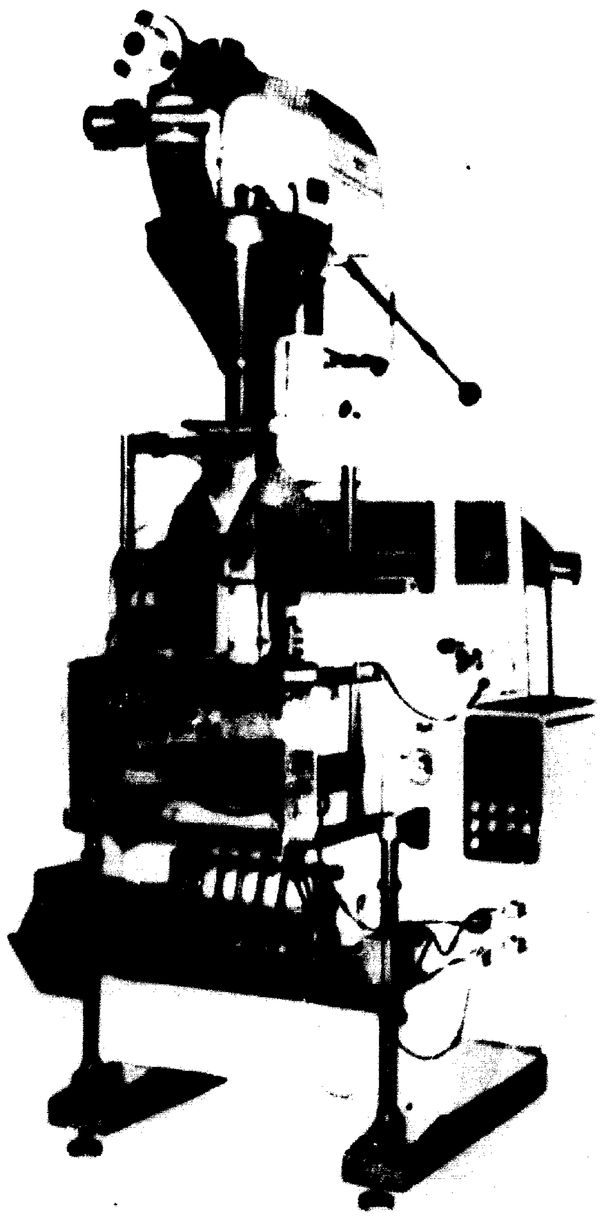
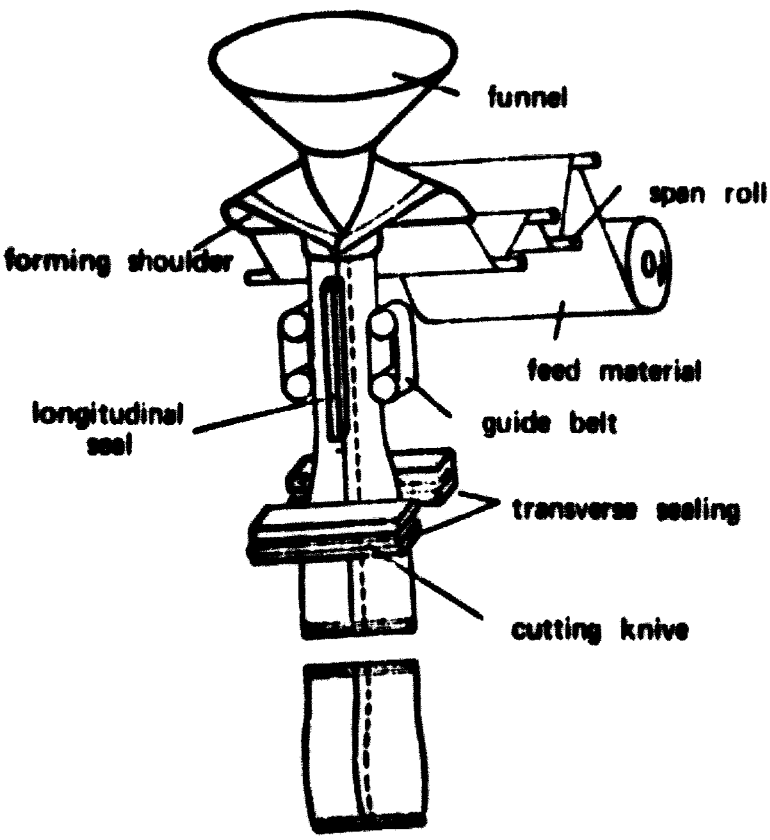


Fig. 40 a: Machine for the production and filling of hose pounches

Fig. 40 b



SCHEMATIC SHOWING THE PRODUCTION OF HOSE POUCHES

Fig. 41

Fig. 42

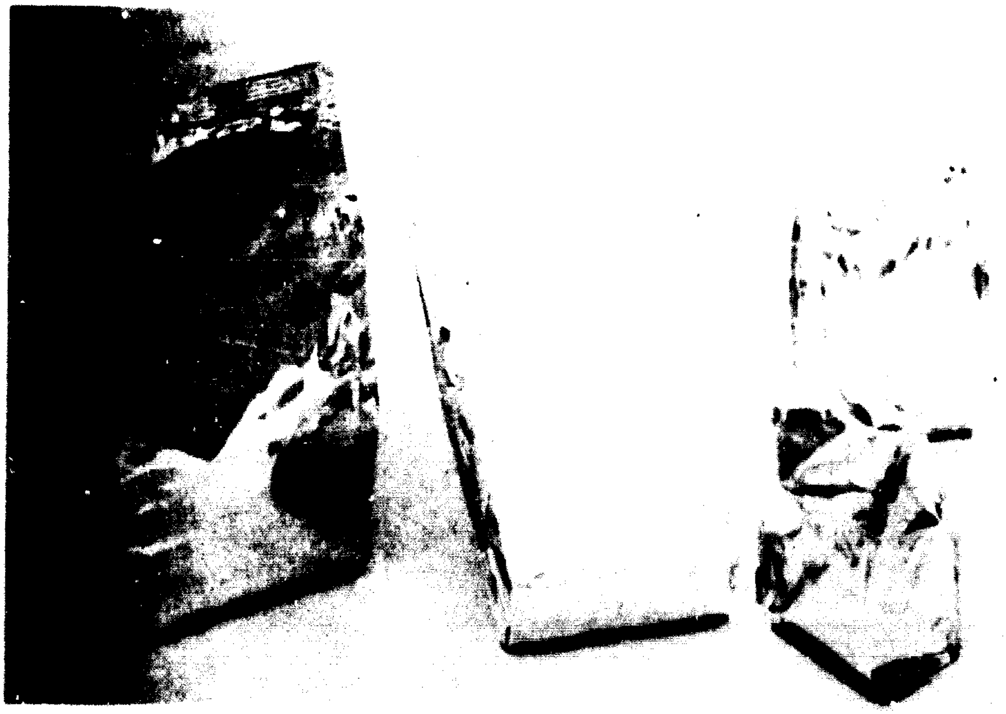


Fig. 43 + 44

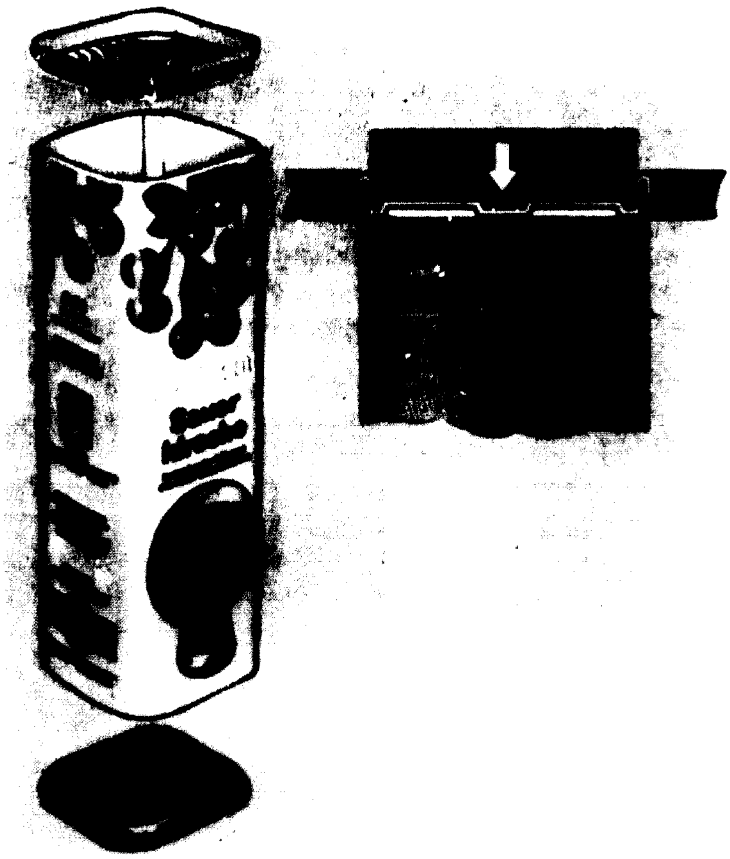


Fig. 45: Composition of a semi-rigid aluminium-container for fruit juices

Fig. 46: Easy opening of the container

Fig. 47

Fig. 48

Fig. 49: Standing pouch for beverages

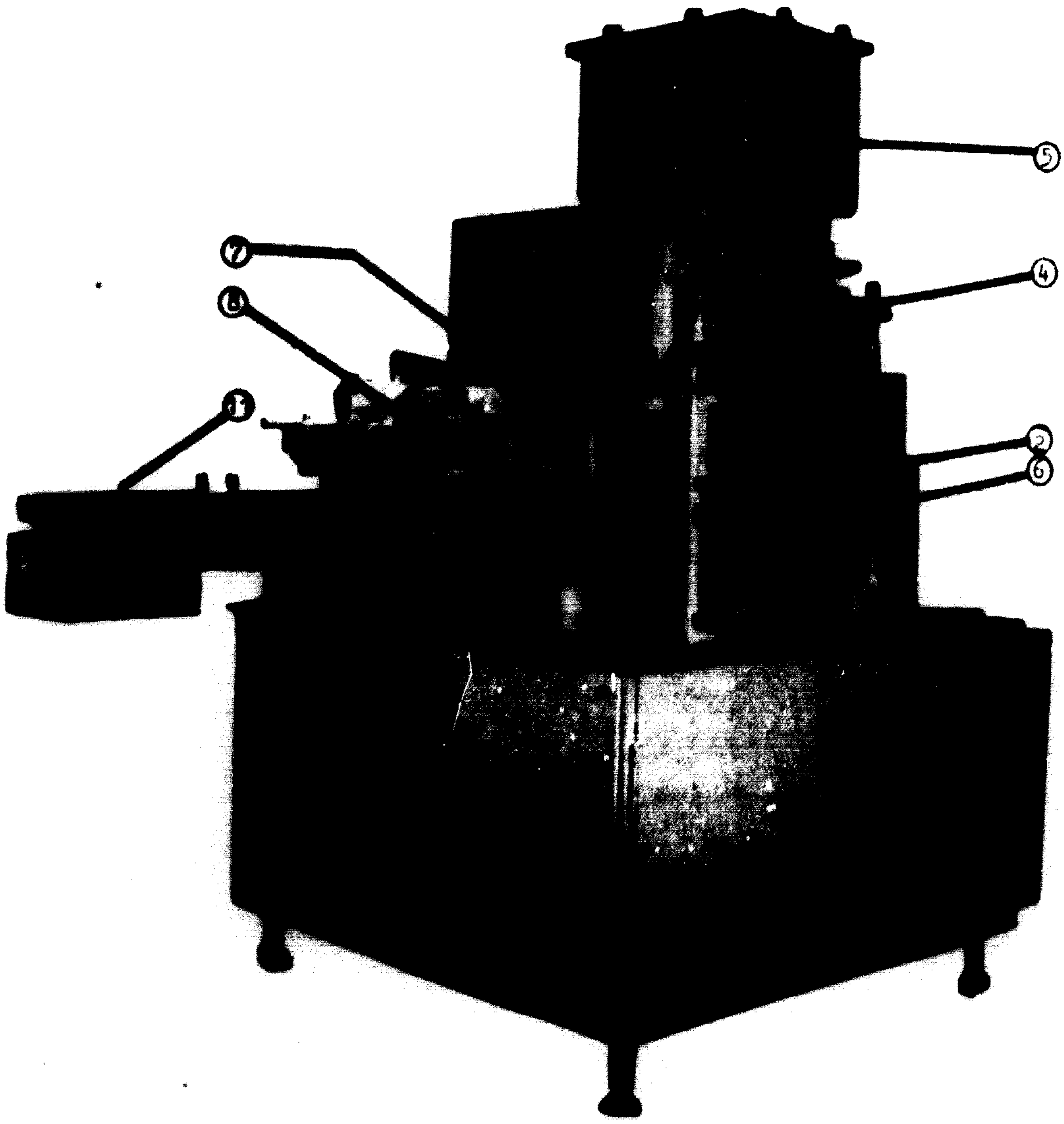
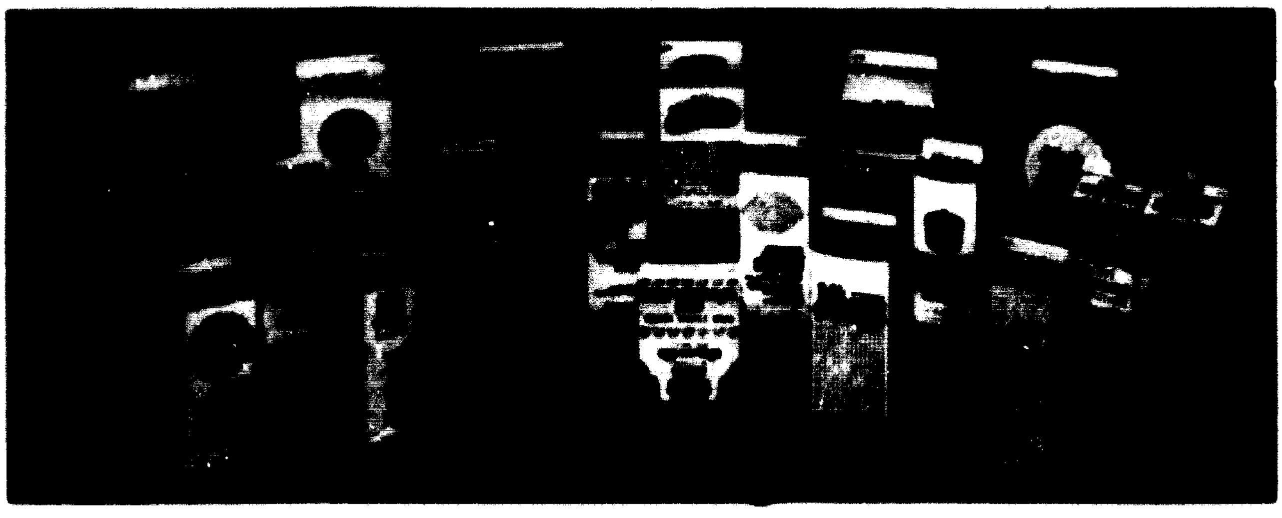


Fig. 50

Fig. 51 + 52: Composite packs for milk and other beverages



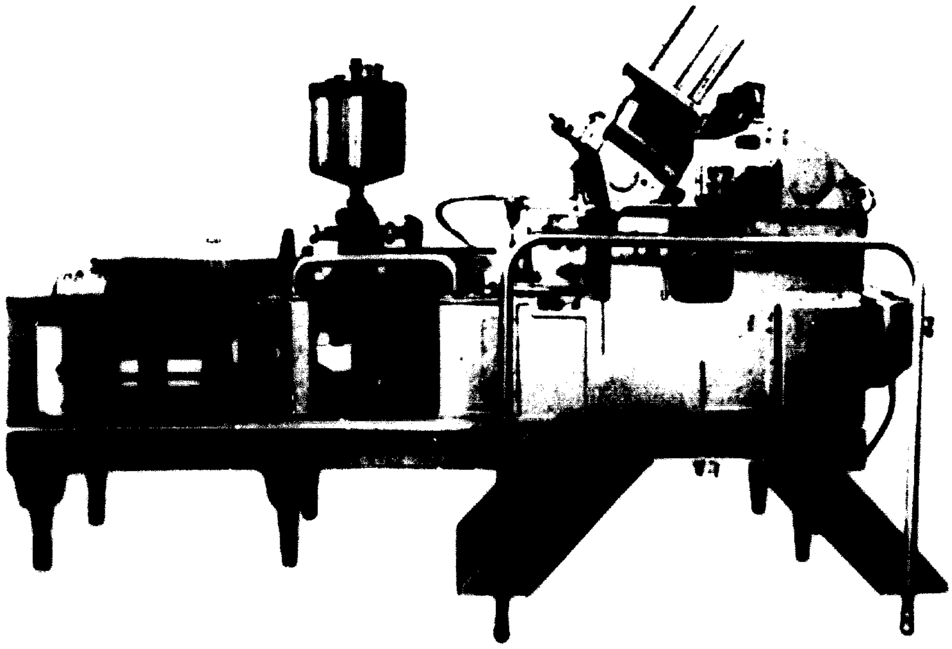


Fig. 53: Machine for producing composite packs

Fig. 54: Spectrum of Aluminium packages

8. 8. 74