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

Casablanca, Morocco, 23-28 June, 1974

ALUMINIUM AS PACKAGING MATERIAL FOR THE FISH CANNING INDUSTRY [1/]

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Corrigendum

Page 4: Table No.2

The table should read:

Mechanical value of aluminium alloys

Alloy	Ult Tensile Strength Kg/mm2	0,2 % Proof Stress Kg/mm2	Elongation 10%
NAB 3 S	21 - 25	17 - 21	2 - 10
NAC 3 S	16,5 - 21	14 - 18	3,5 - 10
NAM 57 S	21 - 26	18 - 24	7 - 14

Page 11: References

The bibliography should read:

Zaitsav, V and others — Fish Curing and Processing, Moscow Mir Publishers 1969

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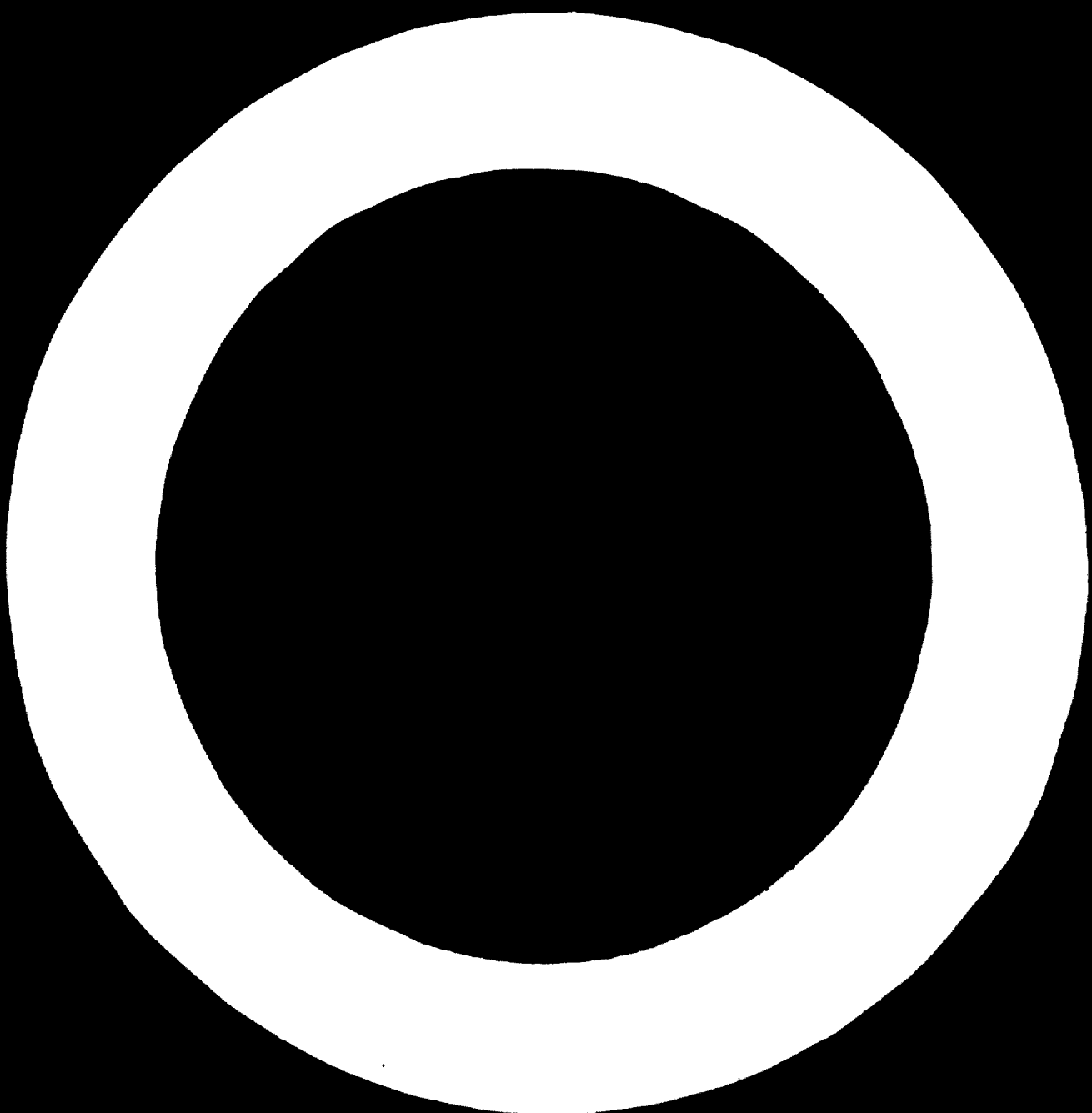
Perovic, V., Lisak. Dj. Dobrovic, N. — The possibility of Production of Aluminium Sheet for Food Industry in Yugoslavia, Zadar, Not published 1972



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Leaflets and information were kindly provided by the following producers of equipment or aluminium packaging materials:

Aluminium-Walzwerke Singen GmbH, Singen, Federal Republic of Germany

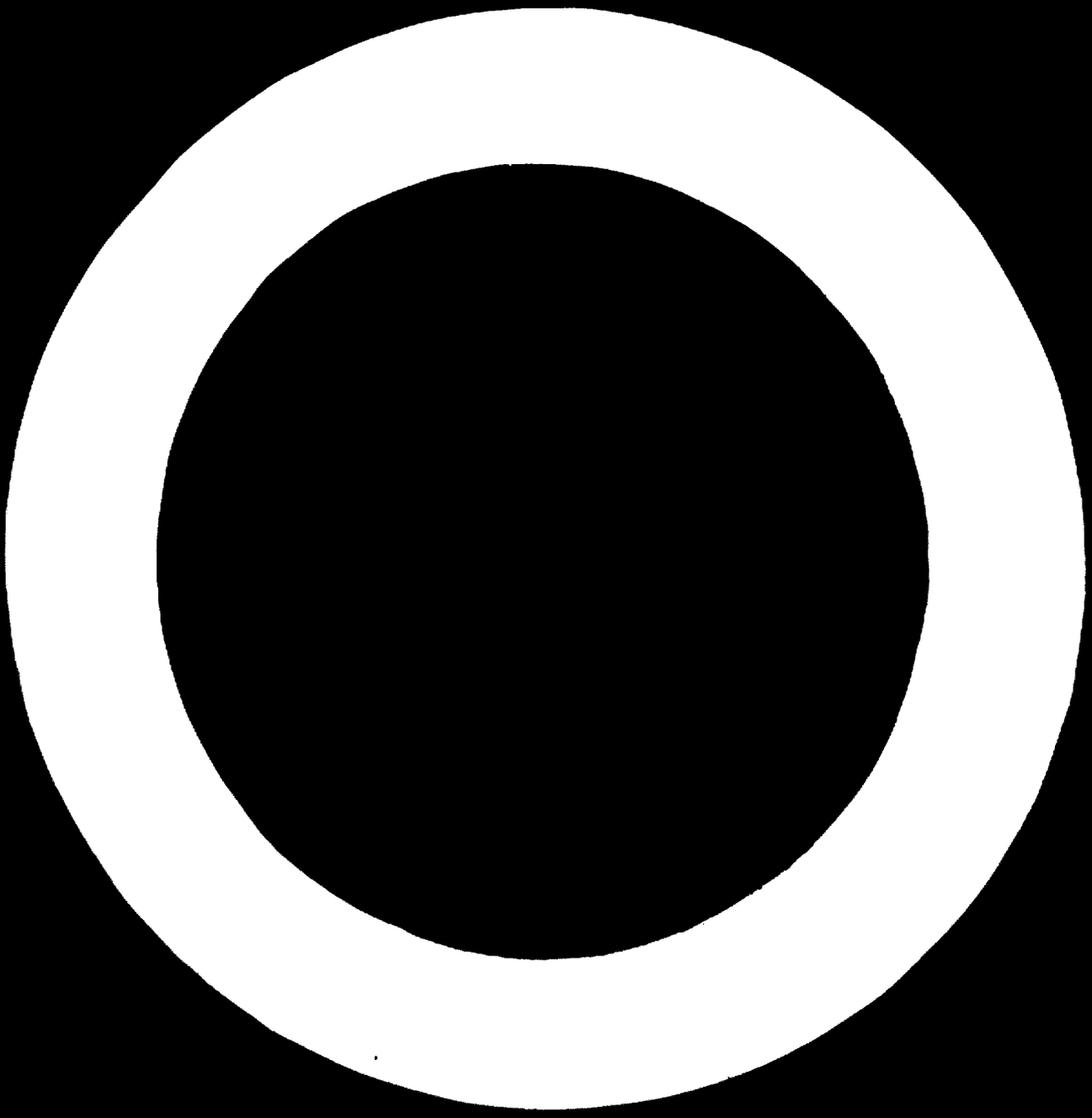
Nordische Maschinenbau Rud. Baader, Lübeck, Federal Republic of Germany

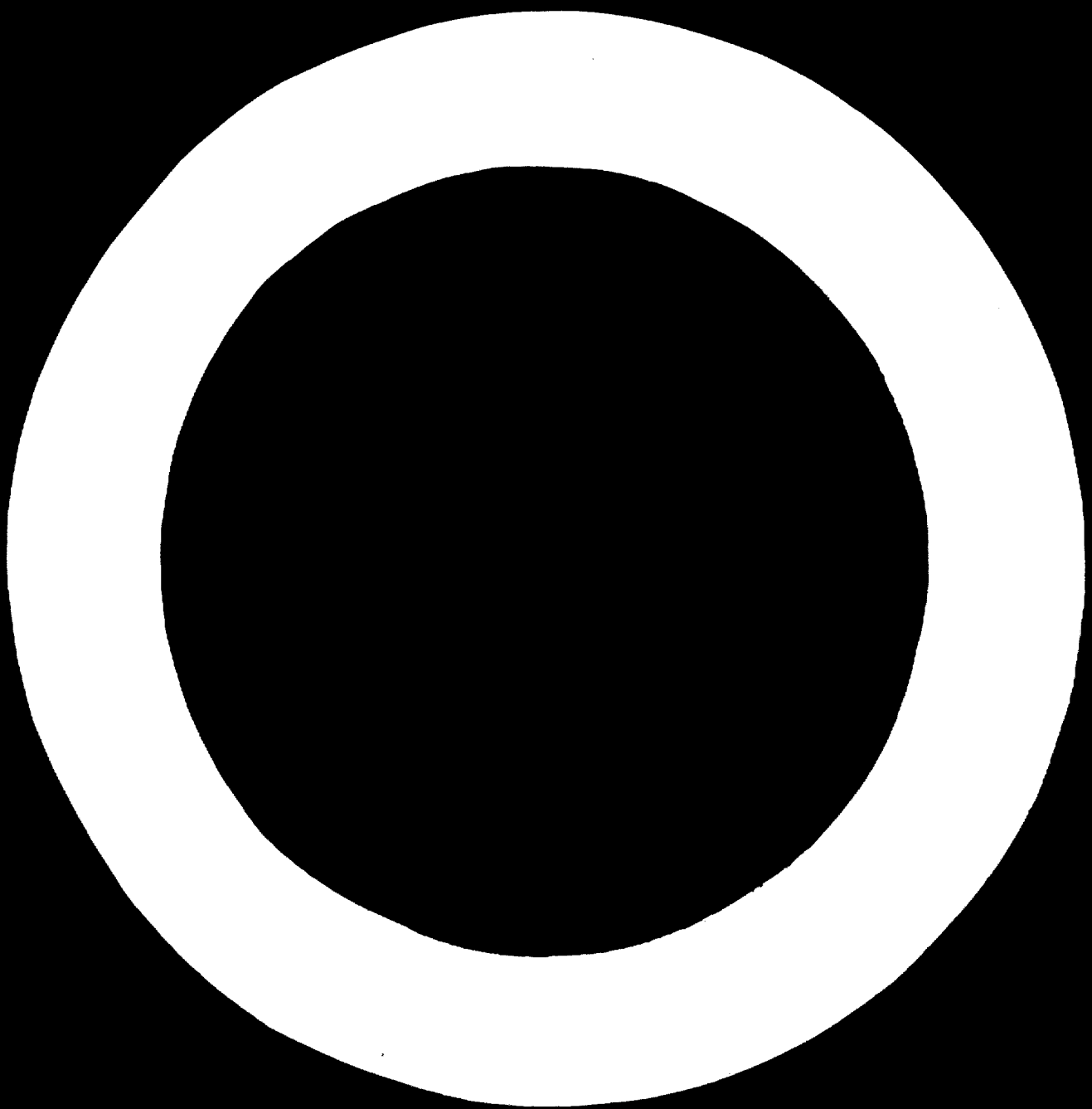
Hamac-Hansella GmbH, Viersen, Federal Republic of Germany

Jedinstvo, Manufacturer of Fish Processing Equipment, Zagreb, Yugoslavia

Nordisk Aluminiumindustri Holmestrand, Holmestrand, Norway

Trio Maskinindustri, Stavanger, Norway





Introduction

A few years ago aluminium started to be one of the most important packaging materials in the food industry. Thanks to its attractiveness and several mechanical and chemical characteristics, aluminium is displacing tin in several branches of the food industry in many countries.

Utilization of aluminium in the canning industry did not start suddenly; it required considerable funds and many years of research to develop adequate alloys, sheets and foils, as well as methods for treating their surfaces. Today, there are many packaging materials using an aluminium base, which can be applied to different types of food products, including canned fish products.

Aluminium is generally considered a packaging material for first class, higher priced products, but also for mass-produced products, such as canned sprats or sardines. Developed countries, especially the U.S.A., are the largest consumers of aluminium for food packaging purposes. Many developing countries, on the other hand, approach aluminium with scepticism. The higher price of aluminium as compared with tin, as well as a certain initial investment, are primarily responsible for this scepticism. In the final analysis, it may be shown that containers with an aluminium base are actually equivalent in cost to those based on tin.

The original interest in aluminium as a packaging material was largely a result of the following discoveries:

- Aluminium is a hygienic material, non-toxic, and odourless Aluminium salts are non-toxic, colourless, devoid of smell and taste. Neither aluminium nor aluminium salts change the organoleptic characteristics of food, alter the vitamin content or reduce its biological value.

- Aluminium is an attractive packaging material. Its characteristic light silver aspect is very pleasing, especially after anodisation. Aluminium easily accepts the application of colours and decorations.

- The surface of aluminium reflects 90 - 95 % of incident radiation. For this reason, undesirable heat penetration into the can is reduced.

- It is possible to produce aluminium cans or containers by the same drawing processes currently used for making other metal containers.

- The natural layer of Al-oxide formed on the surface of aluminium provides protection against the atmosphere, some chemicals, and some food products. This protection can be increased by anodisation, chemical methods, or by lacquering. The latter in particular is easily applied and provides effective protection.

- Aluminium is a light-weight metal. This characteristic is very important for packaging materials. The weight of aluminium is only one third of that of tin.

- Another positive characteristic of aluminium is the relatively short half-life of its radio-active component, only 2,3 minutes as compared to 47 days in the case of steel.

The above attributes of aluminium suggest its usefulness as a packaging material. However, it is no more a universal packaging material than any other material.

Growth in the use of aluminium for packaging purposes in the food industry has been noticeable and rapid: consumption of aluminium in the U.S.A. for this purpose was about 140,000 metric tons in 1960, and more than 500,000 tons in 1970 - a 3 ½ fold increase in ten years.

The application of aluminium to the packaging of food has developed along two lines:

Aluminium sheet;
Laminated aluminium foil.

As each of these materials has different characteristics and methods of application, they will be described separately.

Aluminium sheet

Aluminium sheet was fist introduced in Norway, in 1919, when shallow drawn aluminium containers were used for fish canning. The original cans were made from commercially pure aluminium which gave average results. Aluminium sheet was improved continuously thereafter with regard to its hardness and protective qualities.

Parallel to the introduction of aluminium sheet in the canning industry, equipment and technological procedures in the industry as a whole were improved with the introduction of better canning and seaming machines, and over-pressure autoclaves.

The hardness of aluminium sheet was improved with the development of Al-Mg-Si-Mn-type alloys.

Many different types of aluminium alloys are currently available on the world market for packing canned products. The aluminium alloys cited in table No. 1 and No. 2 are used to pack canned fish in Scandinavia, USSR, and in some other European countries.

Table No. 1

Composition of aluminium alloys expressed as percent by weight.

Alloy	Fe	Si	Mg	Mn	Al
NAB 3 S	0,40	0,30	0,25-0.55	0,8-1,3	Remainder
NAC 3 S	0,40	0,20-0,30	-	0,5-0,7	Remainder
NAM 57 S	0,70		1,7 -2,1	0,20-0,35	Remainder

Table No. 2

Mechanical value of aluminium alloys.

Alloy	Ult Tensile Strength	0,2 % Proof Stress	Elongation
NAB 3 S	21 - 25	17 - 21	2 - 10
NAC 3 S	16,5 - 21	14 - 18	3,5 - 10
NAM 57 S	21 - 26	18 - 24	7 - 14

Aluminium is relatively resistant to the influence of various food substances, but this resistance can be improved by chemical treatment, increasing the natural oxide coating by electrolytic methods, or lacquering the surface. It is possible to combine the above methods.

Many chemical methods are now used to protect the aluminium sheet surface. This usually involves dissolving the natural oxide with acids and immediately forming a new film containing salts of various precious metals. These processes are mostly patented and are known under a variety of names.

The electrolytic process or anodic oxidation is a well-known procedure by which the natural oxide is increased electro-chemically.

There are several different types of electrolytic processes, depending on the nature of the electrolyte and characteristics of the electricity used. The oxide layer is normally between 4 and 5 microns thick, but can be only 0,2 - 0,7 microns if lacquer is to be applied after anodization. One process that has been developed combines anodization and lacquering, the materials giving excellent results in packing canned fish.

Anodization is replaced in the USA by chemical methods. The chemical treatment is primarily a preparation for lacquering, chromatization and phosphorization being among the methods used.

Lacquers used for aluminium sheet are usually based on phenolresins which harden at increased temperatures. The sheet may be lacquered both inside and out. A golden-yellow lacquer is usually applied to the inside. The outside is usually protected by a transparent colourless lacquer. The lacquers must be able to withstand deep drawing during the production of the cans or containers. Normal canning material has 3,5 - 5 gr/m2 of lacquer.

The aluminium packaging material for canned products is available in sheets or in coils of various dimensions, depending on the equipment for which it is designed. It appears that coils, and equipment based on their use, are of greater market significance today. The typical diameter of the coil is about 500 mm, though some factories produce coils with diameters greater than 1,000 mm. The thickness of the sheet used in the fish canning industry is between 0,20 and 0,40 mm.

Many types of aluminium sheet cans are used for packaging fish. They may be divided into two groups: shallow and deep drawn cans. The common shallow cans are rectangular or cylindrical. These types of cans are used for packing sardines, sprats, herrings and tuna (fillets, solid-pack, chunks), fish with vegetables, fish paste, etc. in oil or in tomato sauce. Deep drawn cans can also be used for packing tuna, solid-pack.

The list of fish products packed in aluminium cans is becoming increasingly long and an ever larger number of countries are using this excellent packing material.

It is important to stress that the introduction of aluminium cans does not require major changes in the equipment or technological processes used. It is, however, necessary to install an over-pressure retort to protect aluminium cans from deformation, and to handle them carefully.

The idea of "easy opening" has developed hand-in-hand with the use of aluminium. An aluminium can with an ordinary lid is not difficult to open, but facility is further enhanced by the use of an "easy open" system. This advantage can be very important, as witnessed by the wide acceptance of the system.

Following the canning operation, aluminium cans are usually packed individually in light cardboard boxes which provide protection from mechanical damage during transport and storage.

Laminated aluminium foil.

A new packaging material based on aluminium has been used during the last few years in Europe. A base consisting of aluminium foil is laminated with thermo-resistant polymer films. There are several types of laminated aluminium foils, depending on the kind of polymer film used. The aluminium foil may be laminated on both sides by polypropylene, or by polypropylene on one side and thermoresistant lacquer on the other.

The total thickness of the laminated aluminium foil may be about 150 - 170 microns: aluminium foil 100 - 110 microns, polypropylene 50 - 60 microns and lacquer 5 - 7 microns.

Containers made from laminated aluminium foil do not have the characteristic firmness of containers made from tin or aluminium sheet. This new packaging is soft; under pressure, it may lose its form, but remains hermetic.

The application of laminated aluminium foil to the canning industry is in fact a revolution in packaging practice. This new packaging material has all the advantages of aluminium and is even lighter. The ease with which lettering and colours may be applied gives this material the potential of becoming one of the most attractive packaging materials for canned food. It is expected that this material will play a large role in the near future.

The introduction of laminated aluminium foil to the fish canning industry demands a certain amount of new equipment and some adaptation of technological procedures. The bodies and lids of containers are punched and drawn by a machine that may have interchangeable dies and operates at a rate of about 80 strokes per minute. Container production is synchronized with the canning operation in order to minimize storage area for empty cans. Cans from the press may be filled immediately. Machines for closing cans or containers made from laminated aluminium foil function on a quite different principle from those designed for tin or aluminium sheet cans. Sealers for light-weight aluminium containers join the polymer film from the body of the container with excess film from the lid by means of high temperature in the sealing section of machine. The containers and lids are usually punched by a toggle lever mechanism against an electrically heated sealing plate which applies the desired sealing pressure. The sealing temperature can be adjusted from 50° to 400°C, the sealing pressure is about 800 kp, and sealing time varies from 0,4 to 6 seconds.

The handling of cans must be adapted to this soft material, especially during filling, precooking, washing and placing in baskets for sterilization.

Over-pressure autoclaves are necessary, just as in ordinary aluminium cans made from aluminium sheet. Canned fish or other canned products packed in light-weight aluminium containers are placed after production in small cardboard boxes or in special carriers to protect them from mechanical damage during transport and storage.

Opening of the containers is achieved simply by pulling the tongue on the lid or by cutting the lids with any type of knife.

As can be seen from the above, laminated aluminium foil is an excellent material for canning fish and other products, but introducing this type of material requires investment in new equipment and the adaptation of existing technological processes.

Possibility of introducing aluminium packaging materials in the fish canning industry.

Morocco is the leading producer of canned sardines in the world with a production of 3,078,300 cases of 100 cans in 1972. The total production of canned fish in that year was 3,409,997 cans.

Production shows an upward trend and Morocco should continue to be the most important producer of canned sardines.

What type of packaging material is used in Morocco for this excellent product? The reply is very simple, because there is only one packaging material - tin. Some factories have begun to use 1/ club cans made from aluminium sheet, but not on a large scale.

It was noted in the introduction that many developing countries are afraid of introducing new packaging materials : Morocco appears to fall into this category. Producers of canned fish are of the opinion that aluminium cans are more expensive than cans made from tin. Although it is difficult to compare prices effectively, because they depend on factors which vary from country to country, the experience of one Yugoslav fish (sardine)canning factory which started to use aluminium cans a few years ago is presented below.

A comparative cost analysis of tin cans supplied by a specialised producer of empty cans versus containers made from aluminium sheet and laminated aluminium foil was made in 1969.

Results of this analysis are shown in table No. 3. The factory has a capacity of 20 million cans per year.

Table No. 3

Comparative cost analysis of containers (½ club) made from tin, aluminium sheet and laminated aluminium foil

Type of packaging material	Price before paying off loan in ,	Price after paying off loan in ,
Tin plate	100	100
Aluminium sheet	120	110
Laminated aluminium foil	125	120

From table No. 3 one sees that cans made from tin are slightly less costly than aluminium ones, but this drawback of aluminium cans could be off-set by larger production: about 30,000 cases per year. Advantages of aluminium were so impressive for the above-mentioned canning factory that it decided to switch to an aluminium package for sardines. A choice was made in favour of cans from aluminium sheet as opposed to aluminium foil because it required less investment, and it was not necessary to acquire additional equipment or to change the technological process.

The results of the new aluminium packaging system were those predicted by the original cost analysis. The higher price of the aluminium cans did not reduce profit. The market immediately accepted the new type of packaging and demands for sardines in aluminium cans was greater than the original expectations of the factory.

It is recommended that the same study, on a governmental or private level, be undertaken in Morocco or in any other country that wishes to develop fish processing or other branches of the food industry.

In making a packaging and marketing analysis, the following factors should be taken into consideration:

Advantages of aluminium as packaging material;
Availability of raw material for packaging;
Transport problems;
Increase in production;
New types of products on domestic and foreign market;
New forms of cans or containers;
Advertising based on new packaging material and better quality of canned products.

The introduction of new material for packaging will probably bring increased production, new products, higher productivity, and an improved economic situation.

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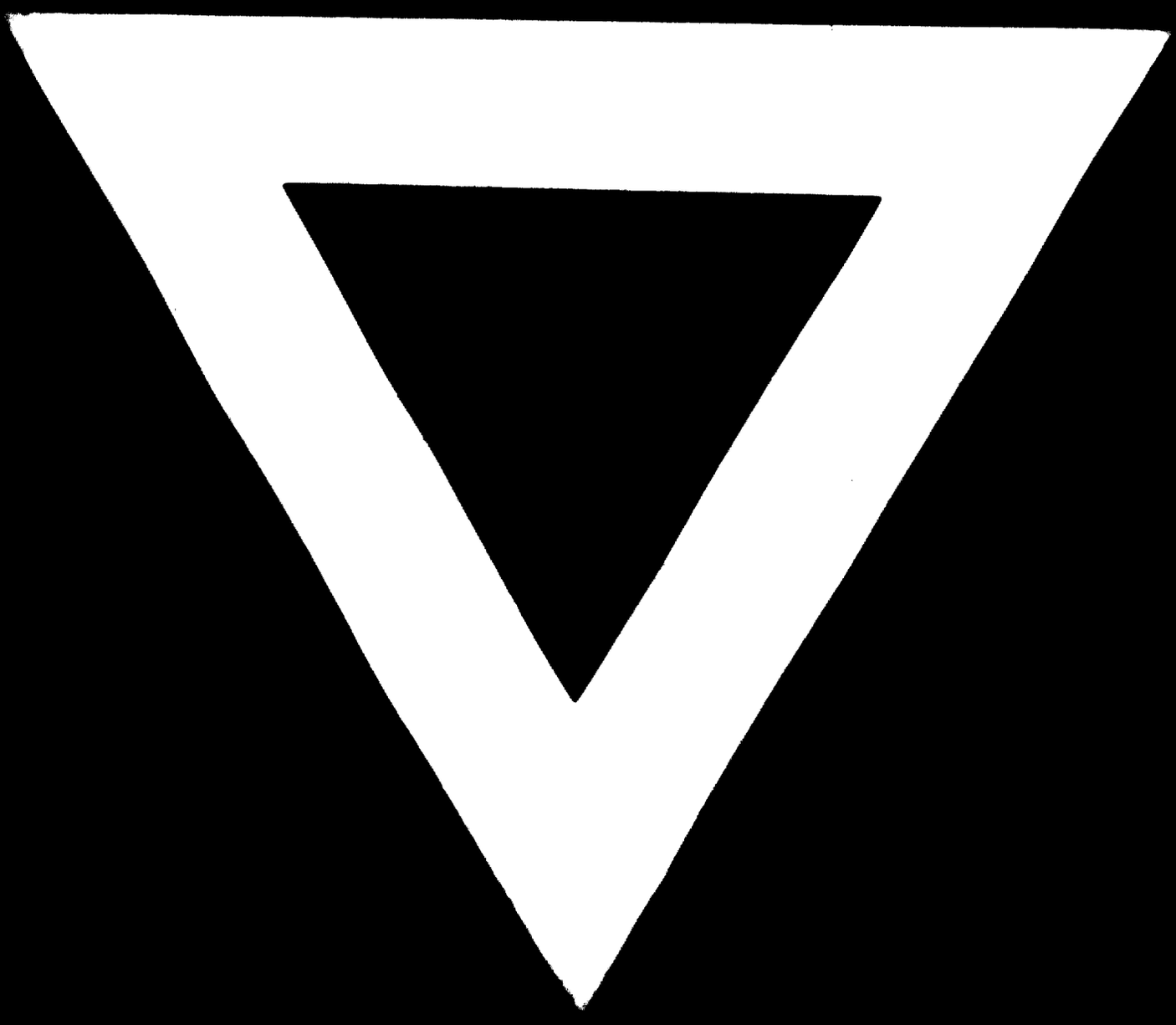

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