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PROBLEMS REGARDING CONTAINERS FOR THE CANNING
OF FISH IN CENTRAL AMERICA ✓

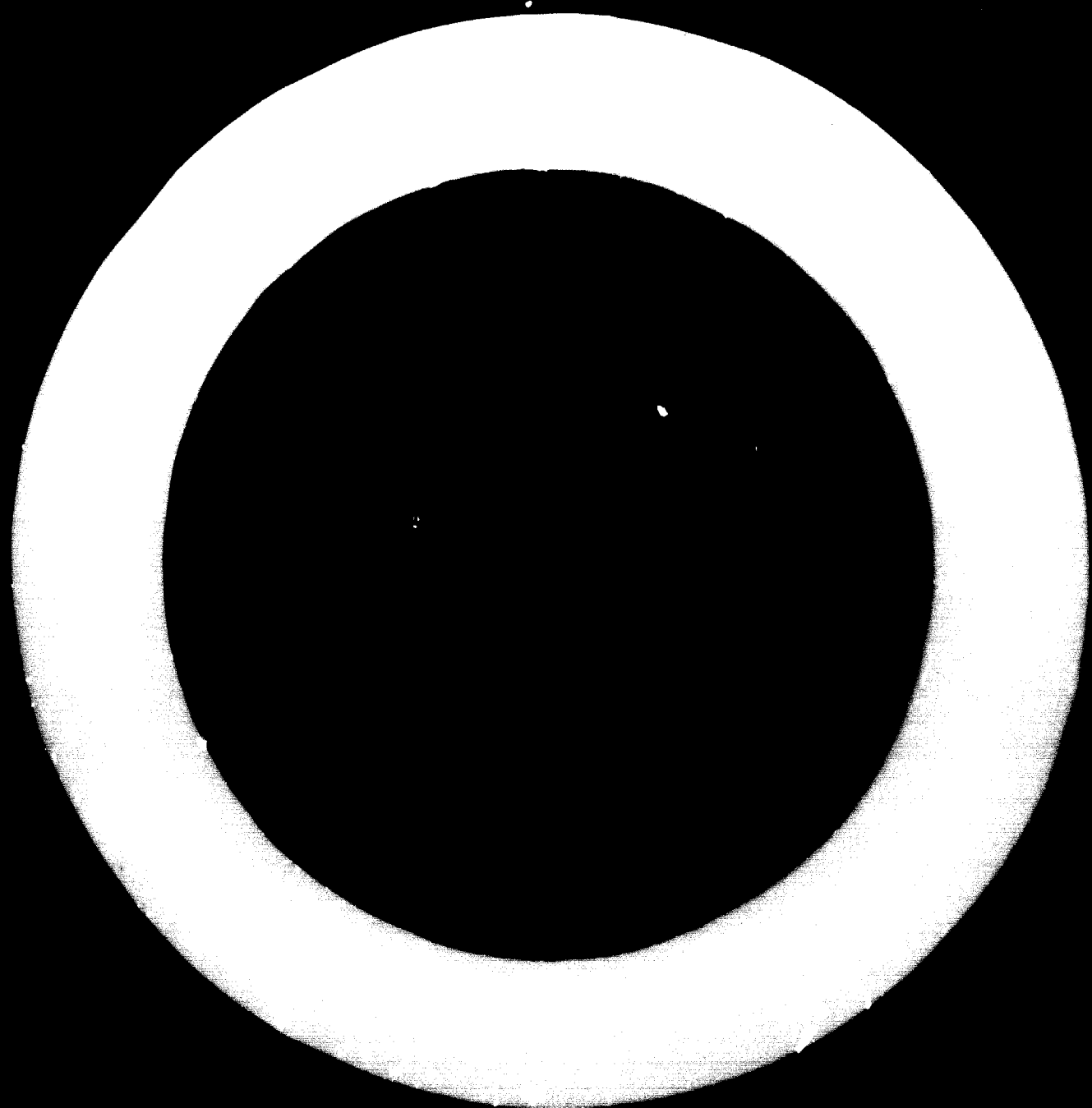
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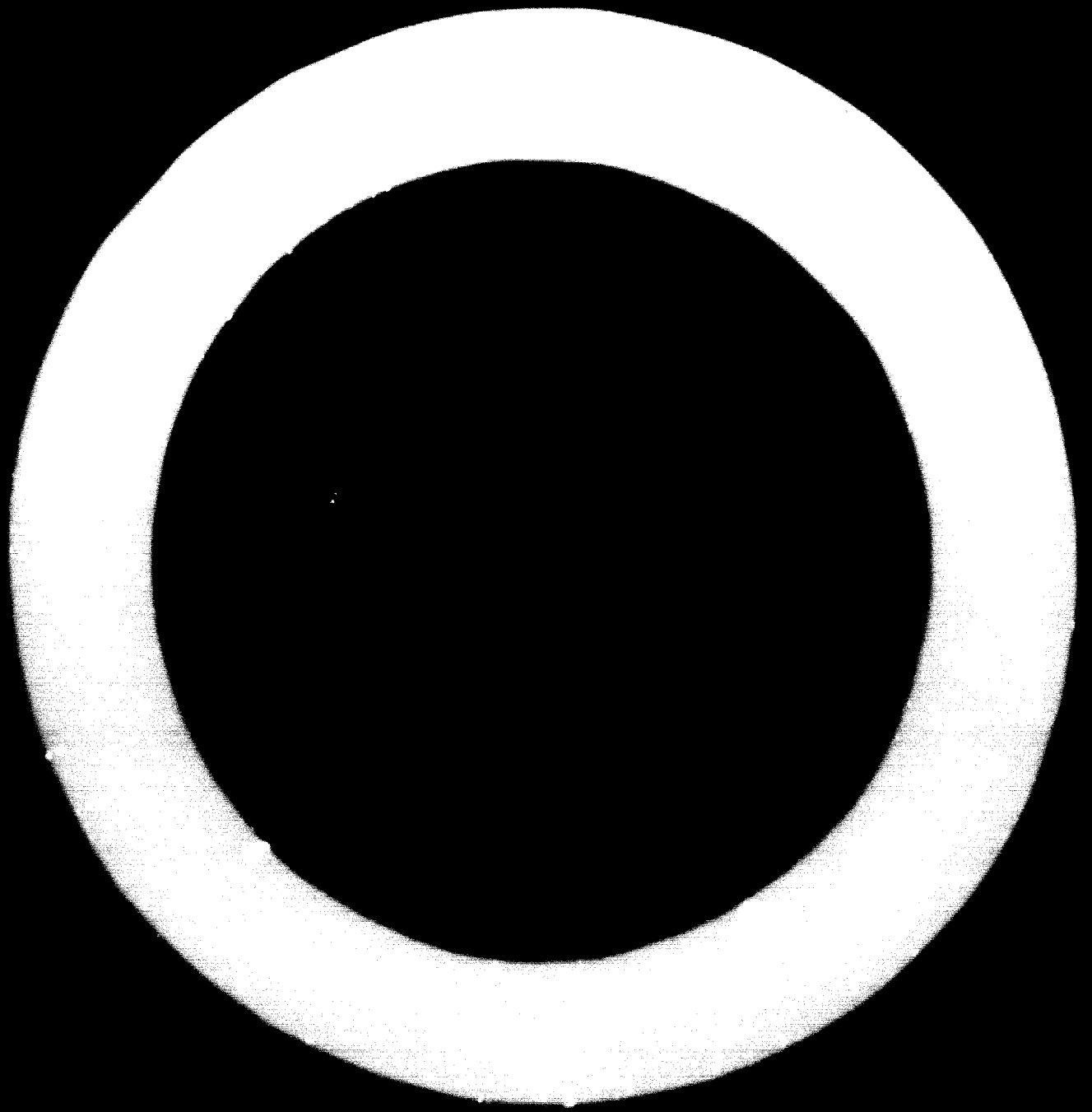
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We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards, even though the best possible copy was used for preparing the master fiche.



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1 INTRODUCTION

I believe that, on this pleasant occasion of meeting with you again, I should begin by emphasizing that the aim of this first conversation is mainly one of opening a dialogue. For this reason, I shall endeavour to pinpoint the questions which I imagine are of concern to you, regarding a subject of such scope that everyone's assistance will be required if we are to arrive at realistic conclusions.

Before getting to the heart of the matter, I should like to say that, both as an individual and as a professional, I should have found it easier to give a lecture on some specific technical aspect of the problem rather than venturing forth into the elusive area of economic implications. However, when I brought up the matter of this Seminar about a month ago in Vienna, our Director, Mr. **Olebov**, very rightly suggested that I should deal with the subject within a wider and more general frame of reference and address myself to the more controversial economic or production-related aspects of the problem, since those of a purely scientific nature (although certainly essential) are more amenable to quiet, individual study than to the kind of open dialogue which is our purpose here today and for which I should like, in advance, to express my gratitude.

An additional argument in favour of this approach is the fact that at the present time - regardless of whether we speak of Central America or any other area - with the initial severe difficulties of personnel training and the mechanical problems of ensuring the proper day-to-day operation of the machinery safely behind us, the market is the sole factor on which the profitability of can factories and therefore their survival and growth depend. Let me make it clear that I am not ignoring or minimizing the technical problems, but the fact is that, however paradoxical it may appear, those technical problems are more readily solvable than those of an economic nature, in contrast to the situation in other industrial branches. One need only compare, for example, the uniformity of production that is characteristic of a factory producing cans with the changing problems confronting the canning factory which uses those same containers.

2. THE COST OF THE CONTAINER AND ITS IMPORTANCE IN CANNING

According to the regulations of the Spanish Food Purity Code (Código Alimentario Español), canned goods are defined as "products obtained from perishable foodstuffs, contained in appropriate containers, hermetically sealed, and heat-treated in a manner such as to ensure their preservation". There is nothing new in this definition, because, in point of fact, the Spanish Code is copied from those of other countries. More than a century and a half ago Nicolas Appert stated that to preserve food it was essential that the corks should be fitted snugly (his original containers were glass bottles). In other words, through the action of heat and air-tight sealing we are able to preserve perishable comestibles with virtually no danger of their deterioration - for we can all remember very old cans produced more than one hundred years ago. I make this point because I intend to underscore the economic importance of the container, but however much value we attach to this factor, there will always be one absolutely essential condition - namely, the air-tightness of the seal. Let us remember that a microbe may measure between 0.5 and 1.0 microns in length, (a micron being one thousandth of a millimetre) up to a maximum of 100 microns, and that therefore, in view of its mobility, the slightest imperfection in a seal represents for it a wide-open avenue of access. Add to this the fact that, compared with the twelve minutes required in the last century to produce a sealed container manually, today this container is produced, or sealed, in less than a tenth of a second (600 a minute) and that, as a result, a few moments of misaligned machine running can mean many ruined cans. My purpose, then is not to minimize the importance, from the qualitative standpoint, of the seal, especially when we are dealing with sealing facilities (it is not a question of just a single machine) turning out as many as a thousand cans a minute.

2.1 Seal defects

My intention is to emphasize that normal container production - and, to a lesser extent, sealing at the cannery - no longer presents the slightest difficulty and that the problems are easily solved, or at any rate capable of solution, by specialists such as those gathered here today, while some twenty years ago, because of the quality - or rather the lack of uniformity - of the tinsplate, canned goods spoilage due to defective seals was the most widely encountered fault. This is an important point because experience confirms that spoilage caused by faulty sealing always affects more units than other forms of can defect. In Spain, for example, before the present

electrolytic tin-plating and lamination facilities were installed, I observed in the case of damage to canned fish proportions up to 75 per cent of the lots spoiled traceable to a particular factory or production run.

Of course, all countries and plants suffer from a shortage of technically qualified personnel, especially during a period of technological evolution; however, we might bear in mind that even working with a traditional assembly line a good worker can turn out 350 containers a minute over several working hours each day. How many food processors are required to consume this same production?

2.2 Proportional cost of the container

While the qualitative aspect of the container is of fundamental importance to the canned product, no less important is its economic aspect, for the fact is that, based on actual average figures for Latin America and despite the variations in fish prices (due to the uncertainties of the catch), for most canned fish types the container accounts for almost 50 per cent of the production cost and always for more than the other ingredients. This is illustrated in percentages by the following table.

Product	Giant squid Chile	Ancheveta Anchovy Sardine Herring	Pacific bonito Sawfish Atlantic mackerel	Shrimp Albacore Lobster
Fish	5	20	40	65
Container	85	55	40	20
Labour	5	10	10	5
Other	5	25	10	10

Despite its general character, the foregoing table makes it clear that for some of the more popular fish products the throw-away container costs more than its edible contents; however, as far as we are concerned, this striking fact has another interpretation.

Let us take, as a more familiar example, a canned product such as the sardine or pilchard (which, incidentally, is to be found off the Central American coasts although it is often neglected by the fishing industry) and assume that tomorrow the price paid

to the firmness of metal. The price of the metal is a significant factor in the price of the finished can and profit. The firmness of the metal is also a factor other than the price of the metal in the cost of the finished can. It compensates for the price increase resulting from the firmness of the metal. If the price of the metal were to increase, it would be necessary to reduce the cost of the container by 25 per cent. This decrease ought not to be considered startling since, for instance, the difference in the amount of tinplate used for a three-piece container (body plus top and bottom can-ends) and a drawn can amounts to about 10 per cent. Moreover, there is the historic example of what happened during the postwar period, in the domestic North American market, when canned meat was sold at a virtually constant price despite unavoidable increases in other costs, since all other increases were offset by reductions in the price of the container made possible by technical advances (electrolytic tinplate and subsequent improvements in coating, protective varnishes, greater process mechanization, non-corrosive fluxes, and the like).

3. UNIFORMITY, ON THE INTERNATIONAL LEVEL, OF THE CONTAINER AND ITS COMPONENTS

3.1 Can standardization

It is not my intention to discuss here the complex and long history of can standardization. It is worth while mentioning, however, that the first AFRIC Standard, legally binding in France, dates back to 1932. We are at the headquarters of the Central American Research Institute for Industry (ICAJI) which promote standardization out of devotion and knowledge of the circumstances rather than as a result of a legal obligation. The problem, however, is a real one, and here in Central America it must be approached from a broader commercial standpoint - that is to say, on a regional level - since even within the Central American Common Market containers are free to circulate unrestrictedly. It is possible that, although with ever less justification, some other countries, with highly developed canning industries, may want to defend their "own" national systems of standards; in our area, however, there is no question as to the need for standardization on a regional basis or, more yet, within, or along the lines of, the Pan American Standards Commission (COPANT) - which is itself linked with Technical Committee 52 of the International Organization for Standardization (ISO) - or even for an effort to bring the system into line with that of the countries that supply the machinery or purchase the canning goods. Much has been done in South America in this area; however, while in no way questioning the

importance of container standardization as an efficient factor in the development of the canning industry, I should also like to mention a few other aspects which are as important as standardization and which, I believe, ought not to be regarded as subjects for future discussion:

- (a) Truth and honesty in labelling
- (b) Minimum standards, backed up by commercial liability, for final quality (already stipulated in many contracts) suitability, methods for determining quantities, etc.
- (c) Technical factors relating to the container, which may affect the value of commercial liability. Examples are: maximum storage (under normal conditions); internal lacquers, lithography, external labelling; filling conditions and, especially, head space; proportions of waste, etc.
- (d) Qualitative standards concerning the supply of tinplate which is imported or nationally distributed by importing wholesalers, and the control of these standards. The great importance of standardized tinplate supply is reflected in the fact that in Spain there were formerly as many as one hundred different standards, and today seventy-five are found to be more than adequate.

When standardization systems - which may frequently work against particular interests - are being advocated, mention is made of the collective benefit to be derived from uniformity of container size. On the other hand, certain of the points outlined in the preceding paragraphs are of far greater importance than the possible interchangeability of containers or standardization of outer dimensions.

The matter of standardization is very complex and subject to a number of variables; it also has particular implications for each country. Allow me to cite a concrete case: Spain can obviously not ignore, as in fact is even tending to do so, the systems employed by the European Economic Community (EEC). However, if we restrict the problem to canning, we see that, however important may be the standardization system followed by the EEC countries, that of Portugal and France, Spain's principal competitors abroad, is no less so.

However, that is not all. In our specific case of canned goods there is another factor which we must take into consideration. While it is true that Spain is not, to a lesser extent, its neighbour France has good prospects as producers of canned fish, these products are of proportionally little importance compared to the very promising picture regarding fruit juices, vegetables, oils and the like - that is, standardization in the canned goods industry must be extended to all products.

3.2 Uniformity in size, machines and systems

Continuing our discussion, we come to the point that today we have already achieved industrial uniformity in the supply of tinplate, which can be easily understood in view of the standardization of production and tinplating processes. Agreement exists as to sizes, packages, commercial labelling, composition of the base steel, purity of the tin, and the like. Standards such as those of the United States of America or the EEC (Europe) are recognized and necessary even when the tinplate does not originate in these countries. Under the effect of this trend towards international uniformity we are witnessing the disappearance of such time-honoured traditions as the British tinplate terminology and measures, which are giving way - even in the United Kingdom itself - to the decimal metric system, although for the moment the sixteenth of an inch, used for can sizes in the United States, is still very much with us.

However, this uniformity applies not only to the tinplate, but also to the can-making machinery at the metalworking plant and the machinery which seals the cans after they have been filled with fish at the cannery. The sealing machines in use today were first developed at the beginning of the century, and although major mechanical advances have been made during the last seventy years, the basic principles have remained the same. As proof that I am not oversimplifying the problem, I invite your attention to the fact that in the simplest sealing operation, "clinching" (a necessary operation when beginning the folding back of the rim of the top end, which is an extremely beneficial canning technique), of the 360 degrees completed by a full rotation of the sealing head, only 133 are in fact involved in the actual "clinching" procedure, with the other 218 being consumed in upward, downward and lateral motions and other mechanical manipulations which are of a purely secondary nature with respect to the sealing or "clinching" operation per se.

By way of concluding this portion of my presentation, I should like to make a few remarks which may be of interest particularly with respect to the construction of canneries. In addition to its value to the national economy, and even its social value, container cost reduction can also be one of the most effective means of progress in development plans. In Spanish industry, between 60 and 80 per cent of the cost of the container is accounted for by the price paid for the tinplate. This means

that an increase of one per cent in the price of the template - or in the tax on it - means an increase of 0.5 per cent in the cost of the finished product. The point, I think, is clear. On the other hand, there are very few branches of the food industry (I would say the sole exception might be kettles) where there is as much competition as in the area of sealing machines; here machines having only very minor mechanical differences compete in a market which is often saturated by equipment produced on a small scale by domestic manufacturers.

3.3 Die-making: sealing rollers

Within this general trend towards uniformity there is one distinctly favourable area: the production of these small but vital sealing wheels, knurls, rollers, reels, or whatever other names they may be known under, which are now common everywhere in the world. There has been a great deal of progress from the first German standards of 1931 to the specialized plants of the present day which produce these components, often on a general basis for several machinery manufacturers. An entire talk might be devoted to this subject alone, but for the time being suffice it to say that the problems have been completely solved, because the formerly chaotic situation where each producer made or modified (often manually) his own sealing roller has been replaced by one in which there are a few common designs on both sides of the Atlantic based on special steels, machines, high-precision treatment and machinery, etc.

Nevertheless, while the situation with respect to sealing rollers may be encouraging, the die-making picture, on the other hand, with which many of you are familiar, gives genuine cause for economic alarm, and although there have recently been some improvements on the local level, it is safe to say that the situation as a whole is a bleak one. Over these last few years that area of the metallurgical industry where prices have risen most steeply has been die-making. This is due not only to the fact that this activity requires very highly trained workers (veritable precision craftsmen), very costly materials and highly sophisticated equipment, but also to the fact that a large number of modern industries (some as extensive as plastics, light diecasting and mechanical moulding, metal stamping, bolts and nuts, etc.) require that dies be changed on a daily basis. The shortage which exists in machinery and tools of this kind is truly alarming - at least in Europe and the United States, which is now even placing orders in Europe. Please note also that this situation is not the result of lack of foresight; in Spain, for example, where there is a clear shortage of specialized precision die-making shops, there has, on the

contrary, already been a government decision no longer to encourage the training of traditional lathe operators, for the reason that there is not enough future for this profession to justify continuing to increase its ranks. This observation might well serve as a warning, because it will be extremely difficult to take any serious steps with regard to containers unless this diemaking problem is first solved. And if within the diemaking area in general one thinks of the expanding market for "easy-open" tops, the implications are even more alarming for the reason that today a single press for tops of this kind - a subject dealt with by other colleagues more knowledgeable than myself - can cost as much as a can-making facility of the former type, which is not surprising when one stops to think that, despite the precision of its operation, such a press can turn out 500 tops a minute.

3.4 Tinplate pricing

We said earlier that international standardization of tinplate had already been achieved. It should be noted that the problem is more complex than merely one of comparing prices, since container quality is affected by factors which might appear secondary such as the direction followed in the lamination of the steel coil or the cutting of the tinplate sheet. We shall have something to say regarding corrosion. But let us turn our attention away from technical matters and, in keeping with the principles laid down by UNIDO, take up the broader industrial aspects of the problem. How are we to explain the international variations in the price of tinplate since the processes and characteristics are the same? Or additionally: is there not a European Iron and Steel Club whose purpose is to achieve uniform international pricing? For example, at the time of the sterling devaluation of 1967 the Club raised the price in the United Kingdom and lowered the price in dollars in order that international supplies might remain on the same level. There are a number of factors, but in my view, disregarding those of a local or political nature, there is one which provides a general explanation for this apparent abnormality. As you are aware, tinplate is produced in a continuous manner (the first pilot production dates back to the 1920's and I believe the last traditional plant to close in Europe was one in Spain) at high speeds and with equipment which (as with any electrolytic assembly line) requires several months before proper uniformity of work, tension, temperatures, speeds, setting etc., can be achieved. Under these conditions, stopping a tinning line is an extremely costly proposition, and production must continue, if only for storage. Now,

the principal purpose of tins is to provide cans (in Spain the figure is one third, which is less than what it was some years ago), which is to say, cans that are subject to the vicissitudes of nature, and there will always be some country which, because of a poor crop, low fish takes or other causes (in Spain a rainy summer means less consumption of crown caps or bottle caps), has a surplus of tins and will attempt to export it in any way possible, at minimum prices (in a kind of dumping action), in order to cover costs until the next harvest. To this should be added the fact that tin grades of limited demand are often produced and that here too export is desirable, especially since, as marginal items, they may not be serially produced in other countries. A characteristic case in point can be seen in Spain, where until last year only about 40 per cent of national consumption was domestically produced, with the required remaining supply imported at below national prices, under regulations permitting temporary import for subsequent export in the form of canned goods. In other words, the Spanish price is above the international level; nevertheless, small lots of thickly coated and heavy-gauge tin are exported.

Naturally, these seasonal price differences are more conspicuous in the case of seconds (the general term used to designate "menders", "wasters", "cut-downs", "waste-waste", etc.), which are left over following the selection of the first-quality products, and the production and consumption of which is highly irregular.

This leads us to another conclusion: no country or firm should ever limit itself to a single tin supplier, especially if a variety of quality grades are required, for there are reasons to believe that the possibility always exists of a better offer on the international market.

As a curiosity, I might mention that costs may even be influenced by incidental factors of a local nature. In Spain, for example, in the farming areas, there are metallurgical industries which, as a profitable side-line, convert their already dented tin scrap into iron sulphate, (its steel base, in view of its high surface, low thickness, chemical composition, etc., is excellent), which they then sell for the treatment of fruit trees.

3.5 Tinplate gauge and coatings

It would be an error to single out the price factor alone as the figure to be used in international comparisons; disregarding such things as duties and taxes, transport costs, conditions of payment, etc., there are still other considerations

and as the combined factor of gauge and tin coating which also affect the price. The great importance of this factor becomes clear when one recalls that, according to the pricing system of the European Economic Community, tinplate with a thickness of 0.26 mm is priced at 12 per cent above plate of the same quality measuring 0.21 mm in thickness, while there is a difference of 18 per cent between tin coatings of 1.0 lb/box base and 0.8 lb/box base.

If we remember that tinplate is the only product of the iron and steel industry sold not by weight but by square metre (formerly box base), we will realize why there is a constant trend towards smaller gauges. Ten years ago, in Spain, the average gauge was 0.27 mm and today it is 0.24 mm (down by 12 per cent), while in the United States, where twice-rolled tinplate is available, the average gauge over the last eight years has decreased by no less than 45 per cent!

Although the discounts granted for large-lot purchases are tending to grow constantly smaller, the manipulation of all these variables, together with tempers, protective lacquers, maximum sizes (today in France the average size of the tinplate in use is twice what it normally was five years ago), etc., may be the best price-lowering technique.

However, the price of tinplate cannot be considered in isolation. What is really of interest is how much a kilogramme (or tonne) of tinplate costs in terms of the working hours of the average metallurgical worker. Today in Spain 10 kg of tinplate is approximately equivalent to one man-hour of an unskilled worker, while in France almost 20 kg are required to pay for that same man-hour. The full utilization of tinplate in Spain - for example, when squaring, producing top can-ends, etc. - is far more important than its recovery in France. This is a fundamental consideration, particularly for plants starting up, which must operate with small profit margins. We are all familiar with the family-run enterprise, producing crown tops or bottle tops, which can stay in business only with cheap labour and expensive tinplate and which is, consequently, tending to fade from the scene, since it must be remembered that, compared with the cost of living, the price of tinplate has not gone up to the same degree as that of other industrial products.

A great number of seasonal or local factors affect the market. Without going into any detail, we might mention regularity of consumption, with no periods of peak demand; transport; demand for year-round products, which in the future will particularly include

aerosols, aerated soft drinks, beer, etc.; recovery thereof; and realistic legislation (there are certain countries which will limit the use of tin-plated cans or require internal lacquering for all of them, and so forth).

However, the purpose of a container is to contain something, and turning our attention to the canned goods area we are confronted with the fact that, with identical tinplate prices, container cost is directly affected by the method of production. This point can never be over-emphasized; it is easy enough to grasp at the can-making level, but it tends to elude the more conservative food-packers who are always looking for the "all-purpose" can. The problem must be viewed in a much broader context in order to realize that what appear to be trifling matters can in fact be decisive: the composition of the water (actually steam) which is fed to the autoclave, and even the type of autoclave (conventional, with superpressure, rotating, etc.); sealing systems (heat, vacuum, steam blast, etc.); non-corrosive water; the product or, more accurately, the filler liquid used (a neutral oil is not the same as a tomato sauce or pickle); characteristics of the storage facilities where the containers are to be kept before and after filling, etc., etc. - the effect of all these factors may be that a can which will do for a well-equipped food-processor may be unsuitable (or even dangerous) for another packer next door. The idea of a "total production" can is out of date. There are also to be considered such factors as the destination of the product, for it is one thing to make a container for products intended for rapid consumption and another to make one intended for long shelf life. Even assuming that the requirements in regard to storage time are comparable, the conditions of storage must be taken into account, because if a can is stored in a high-humidity climate with wide-ranging temperature fluctuations it will not offer the same shelf life or results (including nutritional value) as if it were kept in a carton or wooden box (providing they were quite dry) and in a warehouse offering uniform and low humidity and temperature. Today, when even the summer and winter takes of pilchard and herring are kept separate because of differences in their chemical composition and, consequently, their behaviour in the container, we should be fully aware of the fact that each product must have its own specially tailored container and that the can-maker and the food-processor must work hand in hand to find the best solution.

4. FUTURE TRENDS. CORROSION OF TINS IN ACIDIC FOODS AND CONTAINERS

In my former paper, I reviewed the progress of corrosion problems in tins (in particular, in acid fruits, pickled fish, and other acid foods); but may I say that the big drive in corrosion research goes with the use of computers for the first time, and with the fact that the point of view on corrosion problems has changed, and that things that can be solved, however expensive they may be, even if they do not give any very dramatic consequences. On the other hand - to cite a single recent example - the problem of corrosion is extremely difficult to predict, study, and solve. Many, standard, and tests are being introduced for the detection and evaluation of internal corrosion; these are very expensive because of the large number of samples required for statistical processing. Although the literature on the subject goes back a long time, even to the 1920's, assessment is difficult since the phenomenon ranges from a faint discoloration to the extreme case of "chemical" deformation or perforation of the container, involving the production of hydrogen. Obviously, in a tin of highly acidic fruit or pickled fish, corrosion easily occurs, but it is still difficult to measure. Therefore, disregarding the traditional tests in which the sole way of determining the behaviour of tinned goods under given conditions or with a specific type of tinplate was to observe them after prolonged storage, we can state that modern corrosion research had its scientific beginnings around 1950 with the development of accelerated methods to replace these long storage tests and to make available comparative data. The problem is an extraordinarily complex one, involving, for example, electron-microscope measurements of the orientation of the crystal formations along the iron-tin alloy interface formed between the steel base and the outer tin coating.

Consider if you will the varieties and combinations which may arise in any instance of corrosion, dependant as they are on such characteristics as the following:

The quality of the base steel in terms of its chemical aspects (composition), mechanical aspects etc. Its thickness will depend on the gauge of the tinplate, which is tending to grow smaller.

The layer constituted by the iron-tin alloy (approximately 0.2 thousandths of a millimetre in thickness); this layer is between the steel base and the tin coating and is formed during the tinplating process.

The tin coating, considered particularly with respect to its two variable aspects: thickness (one thousandth to two millimetre, depending on the application) and uniformity or continuity. It is precisely these last-mentioned characteristics that are the principal reason for the quality of modern "K"-type tins.

Normal passivation treatment, during the process.

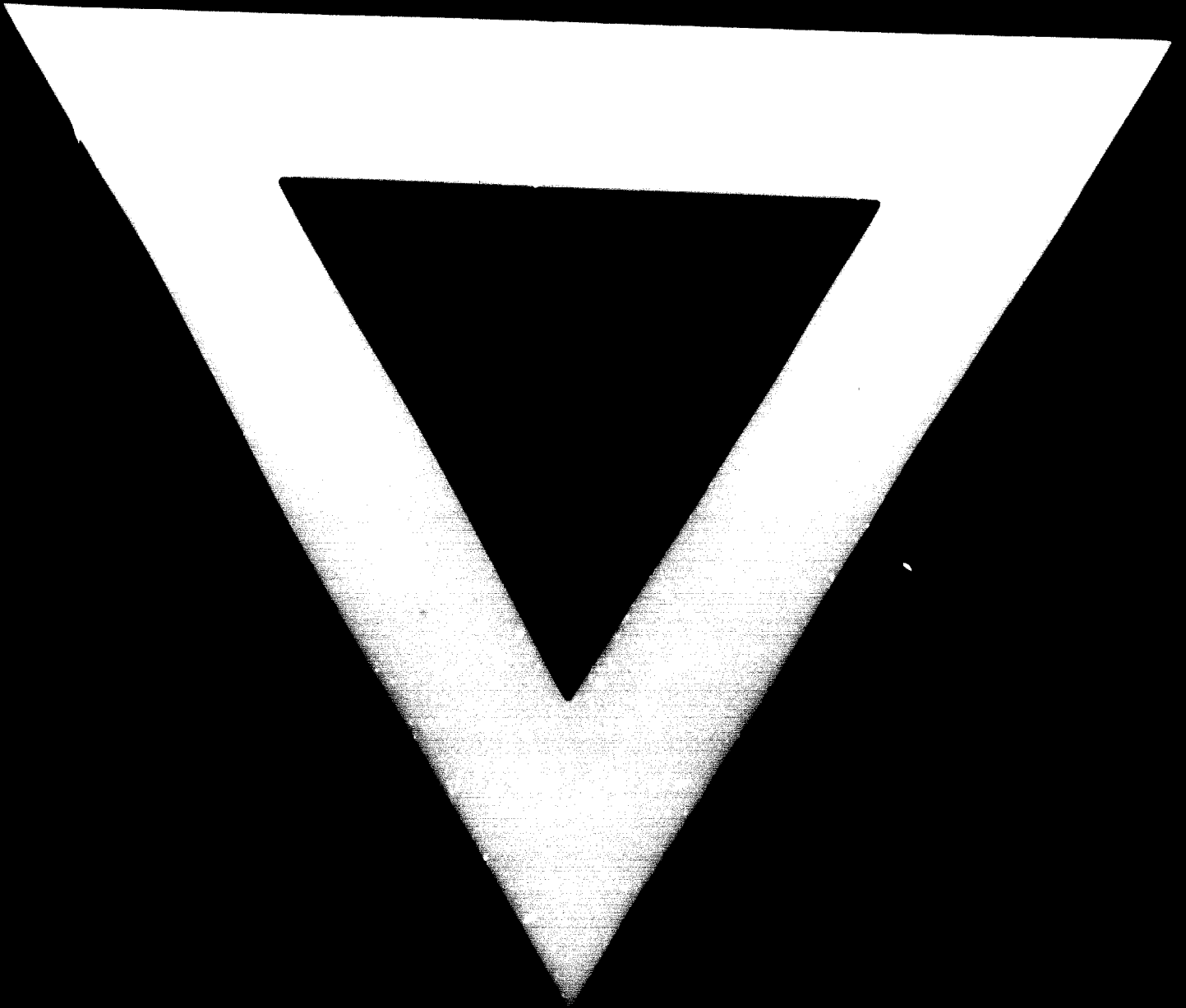
Complementary factors, including some, such as the use of protective lacquers, regarding which complete information is available.

Miscellaneous factors unrelated to the tinplate, but which affect its behaviour.

All of this is linked to the natural properties of the foodstuff contained in the tin and to its manner of preparation, there being no such thing as identical behaviour from one day to the next; for example, two tins of fruit or fish, even from the same family, may behave differently depending on their origin, degree of maturity, manner of cooking, etc. A more recent concern is the possible presence of pesticides occasioned by human intervention.

If, then, the problem area of corrosion is so many-sided and if, within this problem area, the product to be tinned and its conditions of processing play so vital a role, we have here a general subject of almost unlimited scope for Central American technology to tackle: the study of corrosion under local industrial conditions, given the products and the climatic and transport factors operating in this region; the treatment procedures, more or less appropriate and more or less modern, generally in use at the canning plants; the legal requirements and export standards to be met; the detailed study of regional processing and raw materials; etc., etc. I believe that this represents a great challenge that should be taken up for the technological and economic benefit of those concerned. For my own part, I am very happy to know that you have found the subject interesting and that the seed thus planted may bear useful fruit.





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