

I“The Race for the Seaming Machine”

Jørg Hviding

“THE RACE FOR THE SEAMING MACHINE”

Stavanger

ISBN no.

Published by the Stavanger Museum/Norwegian Canning Museum
With the kind support of Norconserv Ltd.

Acknowledgments

The Norwegian author is deeply indebted to John Gunnar Johnsen, former Curator of the Norwegian Canning Museum, for all his assistance with regard to original source material, proof reading, and editing of this publication. He is also very grateful to the Engineer Lars Egeland and many others for their help in many ways.

Foreword

“THE RACE FOR THE SEAMING MACHINE”

Norwegian Canning Museum – Stavanger

“The Race for the Seaming Machine” deals with the exciting development that took place in the area of mechanical engineering in Stavanger, Norway, in the beginning of the 20th century. At that time, a large number of very competent designers were concerned with responding to the challenge set by the rapidly growing canning industry. One of the main problems was how to produce machines that could manufacture and seal the millions of cans of sardines which were produced annually. The solution was found in Stavanger, and patents began to be taken out for viable companies with export to a number of countries.

Jørg Hviding shows in this booklet the stages of this development, and the key people involved in it. Most attention is paid to the first ten years of the 20th century, but he traces the history through up to the present.

Jørg Hviding has excellent qualifications for shedding light on this story. He was employed at the Research Laboratory of the Norwegian Canning Industry (later Norconserv), from 1948 until his retirement in 1990. For the last 25 years he was the leading researcher for the machinery division.

Amongst other achievements, Hviding is the inventor of a number of sardine canning machines which are still in use in the sardine canning industry. He has also been very occupied in building up the Norwegian Canning Industry Museum from its beginnings, and continues to be a Member of its Board.

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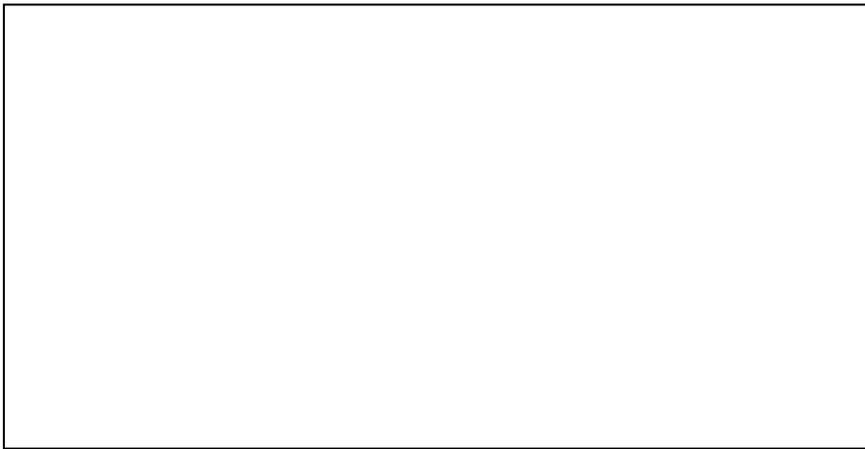
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INTRODUCTION

It is Captain Johan G. B. Mejländer, who was the manager of the Stavanger Preserving Company, who has the chief honour of having started the Norwegian sardine industry in 1879. For that reason he was awarded the Royal Norwegian Order of Saint Olaf in 1904.

In the last years before 1900, sardine production increased comparatively slowly. One of the reasons for this was that the production of cans was very labour intensive, as was also the case with the sealing of the cans. Both of these operations were carried out with hand soldering.

From 1900 to 1915, however, the records show an amazing increase in production. Favourable conditions of the market would be an adequate basis for that. But the increase would hardly have been possible without a range of inventions that radically mechanised and rationalised the manufacture of cans.

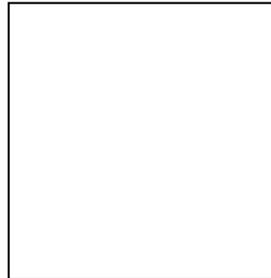


Thus in the period 1880-1915 about 300 patents were granted with reference to canning. Amongst these, the invention of a seaming machine for “non-round” cans was the most significant.

The presentation of the earliest history of the sardine industry tells us something of the people behind the scenes in this innovative work. But little or nothing is told of the race that developed to make the best seaming machine for sardine cans. This publication has as its aim the telling of the story of this race and bringing into the light the conditions and people who are the most important in the development of the Norwegian sardine industry.

NICOLAS APPERT “ THE INVENTOR OF CANNING”

The invention of the technique of canning can be traced right back to 1810 when the Frenchman Nicolas Appert (1749-1841) published his famous book *L'Art de Conserver pendant plusieurs années Toutes les Substances Animales et Végétales* (*The Art of Preserving all Animal and Vegetable Substances for several years*). For this he received a payment of 12,000 francs from the French government (with Napoleon I at the head), and is considered thereafter to be “The Inventor of the Technique of Canning”.



Nicolas Appert

To begin with, Appert used ceramic and glass jars, which he filled with food and corked very thoroughly before boiling them in a water bath. The corks were then covered with wax and pitch and finally fastened with steel wire.

THE ROUND CAN

In 1813 Appert began to use the round metal cans which had been patented in 1810 by the Englishman Peter Durand. These were made of tinfoil, soldered together to make a cylindrical can with almost the same diameter and volume as present-day cans.

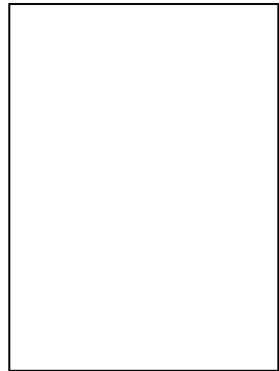
The manufacture of cans, which to begin with was carried out by hand, was gradually mechanised. Even though around 1870 there was an advance in soldering machines which carried out the joining of the lid and the base of the can to the sides, the seaming machine was taking over this operation some time before the turn of the 19th century.

The technique of seaming derives from a technique which tinsmiths and coppersmiths had used from time immemorial for joining two sheets of thin metal. Fig.1.



The first seaming machine for lids and bases was the so-called “Rotary Machine”, in which the cans rotated. The machines had a comparatively simple construction with the seaming wheels brought in manually by the machine operator with the help of a lever. Such machines were called “Hand Machines”. Fig.2. But it was not long before the seaming wheels were brought in “automatically” in the so-called “Semi-automatic Seaming Machine”.

The next stage was that the cans were fed in automatically to the machine, leading to the description “Wholly automatic Seaming Machine”



Hand seaming machine for round cans

HAGBART THORSEN, OF SUNNHORDLAND, WAS THE FIRST IN NORWAY

In Norway, August Thorne had already begun producing cans in the town of Moss during the 1840s. But it was a fish-canner producer by the name of Hagbart Thorsen in Sunnhordland who was the first to make use of a seaming machine. It was designed for round cans and was imported from Tøreboda in Sweden in 1886. A Swedish engineer, Axel Nilsson, ran a workshop there and produced, among other things, seaming machines for round cans,. The factory was the first of its kind in Sweden, and there is an example of a Seaming Machine from the Tøreboda factory on display at the Vikarvets Bohusmuseum in Sweden.

The other Norwegian canning factories followed Thorsen’s example, and seaming of round cans for anchovies, meat and fish was common throughout Norway by the year 1900.

SARDINE CANS

However, for “non-round” cans, such as sardine cans, no satisfactory seaming machine had yet been invented. So sardine cans still had to be soldered together, with the limited capacity that this provides. This led to great problems in the capacity of the sardine industry, which was faced with a steadily increasing demand for Norwegian sardines.

The shape of the sardine can, its design, and, not least, its contents, were to a great extent a copy of the French product “Sardines à l’huile” (Sardines in oil) which had begun to be produced in France in the 1830s. The difference lay in the type of fish and the treatment of the fish before packing in the cans and being sealed. In France the sardines were boiled

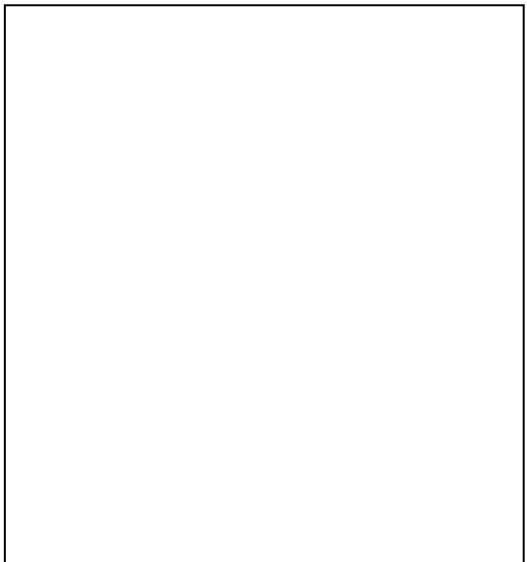
in olive oil before being packed in tins and sealed. In Norway brisling were smoked before being packed in cans. But Norway gave the product almost the same name, “Røgede norske sardiner i olje” (“smoked Norwegian sardines in oil”).

It can be said in addition that at one time so-called sardines were produced in Norway by the French method. This was called “fransking” (“Frenchifying”), in which unsmoked, raw brisling were placed head down in special net baskets. These were then lowered into a vat of boiling oil.

As many are aware, and as is comprehensively explained in Carl Frederik Kolderup’s *Blad av hermetikkindustrien’s historie (Magazine of the History of the Canning Industry)* no.1, the French brought a number of legal actions against the Norwegian sardine industry during the years 1905-1910. They demanded that the term “sardines” should be used only on products which were derived from the Mediterranean sardine. The French sardine industry was upheld in its demand. From that time, Norwegian sardines have had to be marketed in Europe under the correct term of “brisling”. In the U.S.A., Australia, and other overseas countries, however, the term “sardine” can be used.

HANDMADE CANS

In the first period after “Røgede norske sardiner” had begun to be produced in Stavanger, the cans were manufactured by hand with the help of simple hand tools such as metal shears, a soldering iron, and a small hand-operated spindle press (Fig.3.) The side of the can, the so-called “sarie”, was cut out by hand, shaped around a block, and soldered together. The lid and the bottom of the can were pressed out of a rectangular piece of sheet tinplate with the help of the spindle press. Their size and shape fitted the inside of the sides. Under this operation the lid also acquired beads which could absorb the expansion of the can during the sterilisation process,

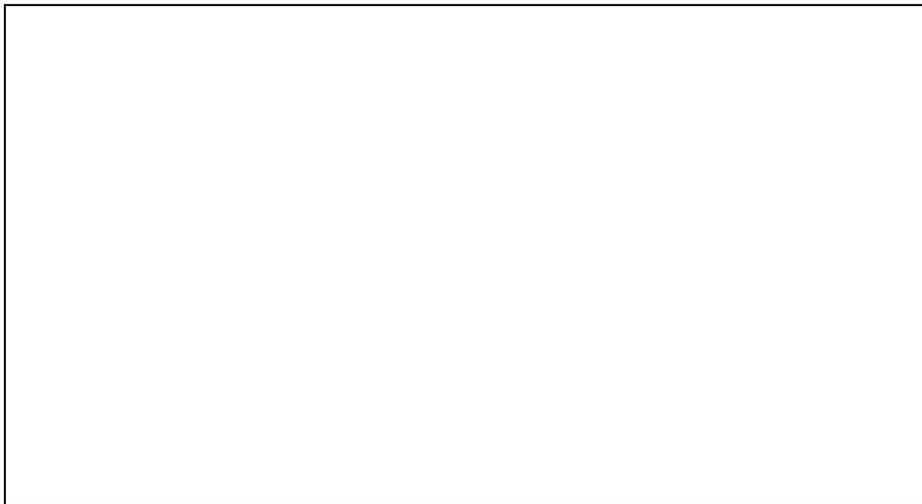


so that the lid and base did not warp. (When the can cooled, it would return to its original shape). After cutting off the superfluous material on the corners with ordinary metal shears, the base was fitted into the sides and soldered to them. At this stage the empty can was ready for use in the factory. (See Fig.4)



Section of a so-called "loddeboks" (soldered can).

The cans were made according to contracts by the tinsmiths' workshops with the different sardine factories, and were transported to them at the beginning of the sardine season.



Solderers at work – Stavanger Preserving Co 1873 - 1973.

Soldering the lids on to the cans was done at the sardine factories by specially trained solderers, after the cans were filled with smoked brisling and covered with olive oil. Then the cans were “steamed” (sterilised). The product was called “røgede norsk sardiner” (smoked Norwegian sardines).

The solderers who were very trustworthy and sought-after men, were called “knights of the soldering iron”. They were employed by the tinsmiths’ workshops and went between the different sardine factories. The work was very labour intensive, and continued nearly 24 hours a day in order to produce the necessary number of cans. But because even a skilled solderer could not manage to solder more than about 600 cans in a day, the solderers’ capacity was the bottleneck in the production line and thus limited the capacity of the factory. This can best be illustrated by comparison with a present day medium-sized sardine factory. As an example, the Norway Foods factory in Skånevik has a production capacity of about 50,000 cans per day. To sustain such a capacity without today’s seaming machines, the factory would have had to employ 110 solderers.

The largest tinsmiths’ workshop in Stavanger before 1900 was managed by Jacob J. Helvig. He employed as many as 50 solderers during the sardine season. Helvig was one who always had an eye open for new ways of working which could rationalise the production of cans. Among many other innovations, he devised a machine for cutting off the superfluous metal from the corners of bases and lids.

The cans which were manufactured at that time had no opening device, and had to be opened with a so-called “spretteåpner” (“kick-opener”), or something like it, which was a very difficult operation, especially since the metal of the cans was about 40% thicker than today’s.

STRIP OPENING

Many attempts were made to find an easier way of opening cans. One of these was known as “strimmelåpning” (“Strip opening”), in which a small strip of metal (tongue) was soldered to a double scoreline along the upper part of the body of the can.

Strip opening was not very successful and was not much used.

THE FRENCH CAN

So around 1890 the so-called “Franske boksen” (the French can) came into use. This had a lid with an opening tongue which was an extension of the lid at one corner (Fig.5). With the help of an ordinary can-opening key the lid could be rolled back and the solder broken.



Opening keys were produced by, amongst others, Stavanger Traadstiftfabrikk (Stavanger Nail Factory), established in 1890. Other suppliers followed, among them Lendes Mekaniske Verksted & Nøgelfabrik (Lendes Mechanical Workshop and Key Factory). They invented and produced their own key machines, which they also had available for sale.

As Fig.5 shows, the can type is different from the older cans in that the lid was soldered to flanges on the can body. The flanging tool was invented by J. Helvig.

In the same way as with the old soldered cans, the bottom of the French cans was soldered on at the sardine factory in connection with sardine production.

THE RACE FOR THE SEAMING MACHINE

But although the “French can” provided a good solution for the problem of opening, there still remained the soldering work for closing the cans at the sardine canning factory. This was still the serious bottleneck in production. The local “Heath Robinsons” began to wonder whether there could be a way to seam (rectangular) sardine cans in the same way as round cans. So began the race to develop a seaming machine for “non-round” cans. Some of the big names in the race were Torkel J. Lende, Søren Opsal, Henrik Jørgen Reinert, Wilhelm Nessler, and Ivar Rødder.

The first to take out a patent for a seaming machine for rectangular cans was Torkel J. Lende (stepfather of Lars H. Lende). This was around 1899-1900. A study of his patent Application shows that this machine was constructed to pinch together the body flanges and lid flanges in a traditional way without using seaming rolls. This solution differed in this way from the traditional design of a seal for a can, and was of no practical use.

OPSALE WAS FIRST

Søren Opsal was another active inventor at the time, and his seaming machine was more successful. It was demonstrated for the first time on 17th May (Norwegian Constitution Day) in 1900. The demonstration, which certainly took place in the factory of Klaus Andersens Enke, was such a success that the news spread like wild fire through the city that it was now possible to seam rectangular cans. With Opsal’s seaming machine the seaming wheels rotated round the can in the now traditional way.

Opsal’s patent (no.9217) for his seaming machine was granted on the 12th May 1900, and he deserves the honour for the invention of the first practical machine for the seaming of “non-round” cans.

The machine was manufactured at W. Nessler’s Mekaniske Verksted where Opsal was the foreman. His two sons also worked there. To begin with, the seaming machines did not perhaps have the highest quantity or quality. But in co-operation with his sons, the owner of the workshop and the inventor, the workshop steadily developed and improved to a production level of about 3,000 rectangular cans per day. This replaced 6-7 solderers and was well received by the leaders of the sardine industry. The seaming machine was produced by Nessler’s workshop, and was sold both in Norway and overseas.

In newspapers of the time, sometimes the mention is of Opsal’s seaming machine, at other times of Nessler’s. In all probability both refer to the same machine, which will therefore from now on be referred to as the Opsal/Nessler machine.

Even though a way had now been found to solve the problem of seaming, and eliminate the narrowest part of the bottleneck, the “French lid” was still being soldered on. Even if time could be taken to help produce empty cans through the winter, the tinsmiths’ metal workshops still had problems with satisfying the demand for cans.

THE PRESSED CAN

This was another problem that needed solution. In 1901 tools were ready which could draw a can out of a piece of sheet metal, in the same way as they had previously done for the lids. (Fig.6)

But the supposed advance was much greater for cans than for lids, and production had to happen in three stages. First, the cutting of blanks; second, the drawing of the can, and thirdly the cutting of the edges. The solution was certainly a result of the relatively high technical level which gradually developed in Nessler’s workshop. It became a specialist workshop for dies and presses with fully 40 employees. Here it was that the owner Wilhelm Nessler, together with his foreman Søren Opsal, and their fellow workers, gave a considerable contribution to development in the pioneering days of the canning industry. Between 1900 and 1915 Nessler and Opsal registered 7 patents each.

THE LID WITH THE SOLDERED TONGUE AND SCORELINE

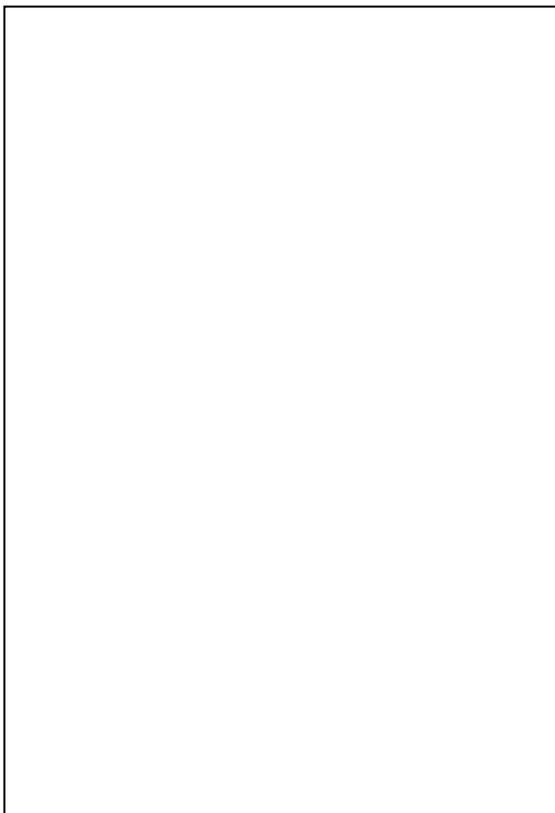
Both the lid and can could now be produced by die tools and everything was in place for industrial production. The Stavanger Packaging Factory Co. (Stavanger Blikkemballagefabrik A.s), founded in 1896, had earlier produced mainly boxes and cans for cocoa, tobacco and chemical supplies. Now they fixed their eye on the production of cans and lids for the sardine industry, and took over more and more of that market.

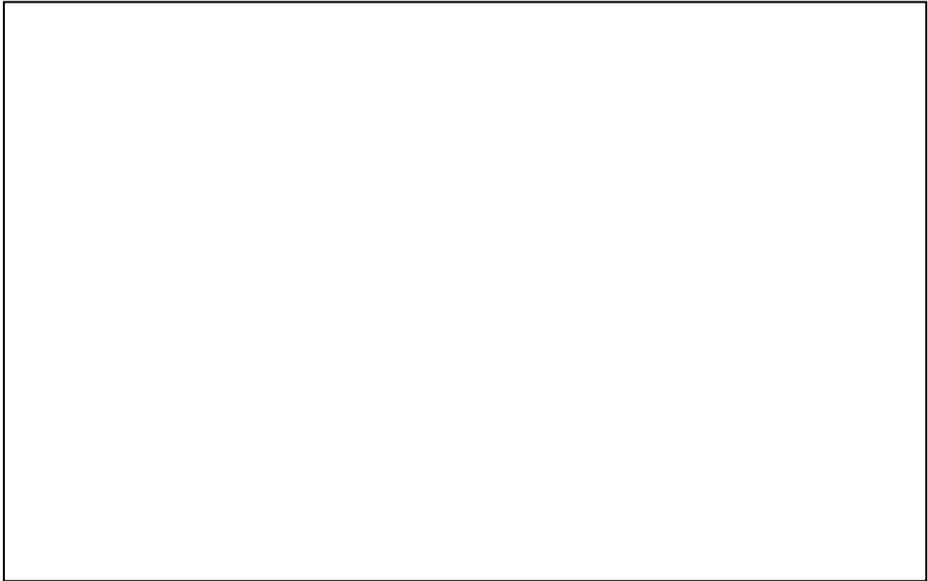
The Managing Director, Manager, and Foreman were respectively Henrik Finne, Paul Scholtz and H. Abel Lunde. In 1902 they obtained a patent for an opening arrangement which was characterised by the use of a tongue (a small piece of sheet metal) soldered to the lid, and combined with the scoreline. In that way, the can could be opened with an ordinary opening key, see Fig.7. The same figure shows (Figs.1 & 3) how the scoring was carried out. This type of scoring was called a “dobbelsvekk”. This tool had the disadvantage of being difficult to set to the correct depth for the scoreline.

Stavanger Blikemballagefabrik A.s started production of the lid with this opening arrangement as early as 1902 and completely knocked out the “French can”. This brought an end to the craftsmanlike production of sardine cans, and the glory days of the tin smiths faded away.

Scholtz and Abel Lunde were not entirely in agreement with their employer about the economic profits from the patent. In 1903 they sold it to Chr. Bjelland & Co. and Stavanger Preserving Co. for 3,000 Kroner, including 4 presses, stamping machines and tools. This suggests that they did not have the usual conditions of appointment with Stavanger Blikemballagefabrik A.s, but also had been kind of co-owners in the business. After a time, however, they regretted the deal and tried to have it reversed, but without success.

In 1904 P. Scholtz and Abel Lunde obtained a patent for a new joint type, called the “skråsvekk” (“diagonal joint”) Fig.8a, patent no.14445, in which the tool had only one “knife” which cut against an angled plate. By this technique the adjusting or setting the depth of the scoreline became much easier and more secure than before. Additionally, along the line of the joint there was a bead to designate the correct opening. This was incidentally removed later. That was the patent they took with them when they founded the Stavanger Blikktrykkeri og Maskinværksted A.s (Stavanger Metal Press and Machine Workshop) with the businessman Albert Barstad. The patent was a good initial foundation when they came into competition with the Stavanger Blikemballasjefabrik A.s about the supply of cans and lids for the sardine factories.





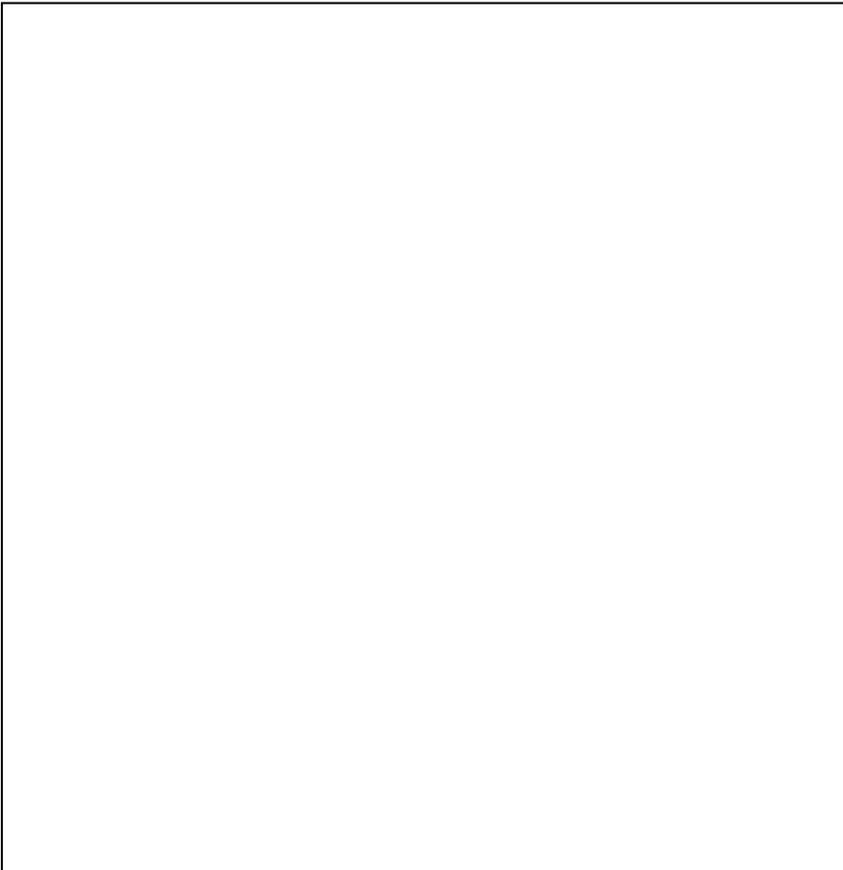
Henrik Finne continues as manager for Stavanger Blikemballagefabrik A.s. He must have been quite angry with his earlier colleagues, Scholtz and Abel Lunde, for the sale of the patent which they had jointly owned. This was because he had sold the same patent to a German company in Lübeck in 1905. This brought about a mass of scurrilous newspaper articles about who owned the rights to what. A conclusion to the matter was brought about by the agreement that patent No.11773 was owned by Chr. Bjelland and Co. and the Stavanger Preserving Co., while patent No. 14445 belonged to Stavanger Bliktrykkeri og Maskinværksted A.s to whom Scholtz and Abel Lunde had sold the patent referred to above.

This type of scoreline was however little used since the quality of the steel at the time led to too much wear and tear on the blades. The quality of steel today, on the other hand, is so good that the “knivsvekk” joint has come back into use for the modern “ring-pull”, which is also used for sardine cans.

Additional information about these different types of joints, and the tools used to form them is provided in Internal reports 1/58 and 1/62, together with Internal publication no.28 from Hermetikkindustriens Laboratorium (The Research Laboratory of the Norwegian Canning Industry).

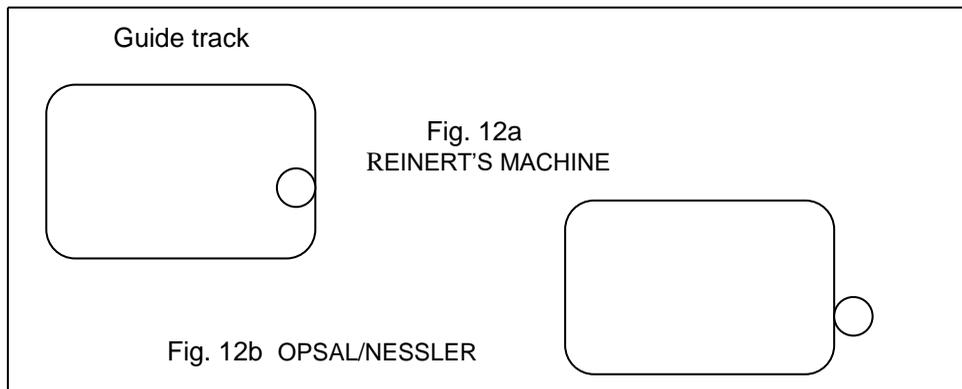
THE REINERTS MACHINE (“REINERTSMASKIN”)

Back to 1902. The situation was that the “French can” was being used with either a soldered or a seamed can body. The drawn can with a seamed lid and a soldered opening tongue was launched and it gradually won against the “French can”. Seaming was carried out with Opsal/Nessler machines with a seam quality and a capacity which possibly was not entirely satisfactory. It was therefore welcome when the later renowned Reinerts Machine came onto the market. (Fig.11)

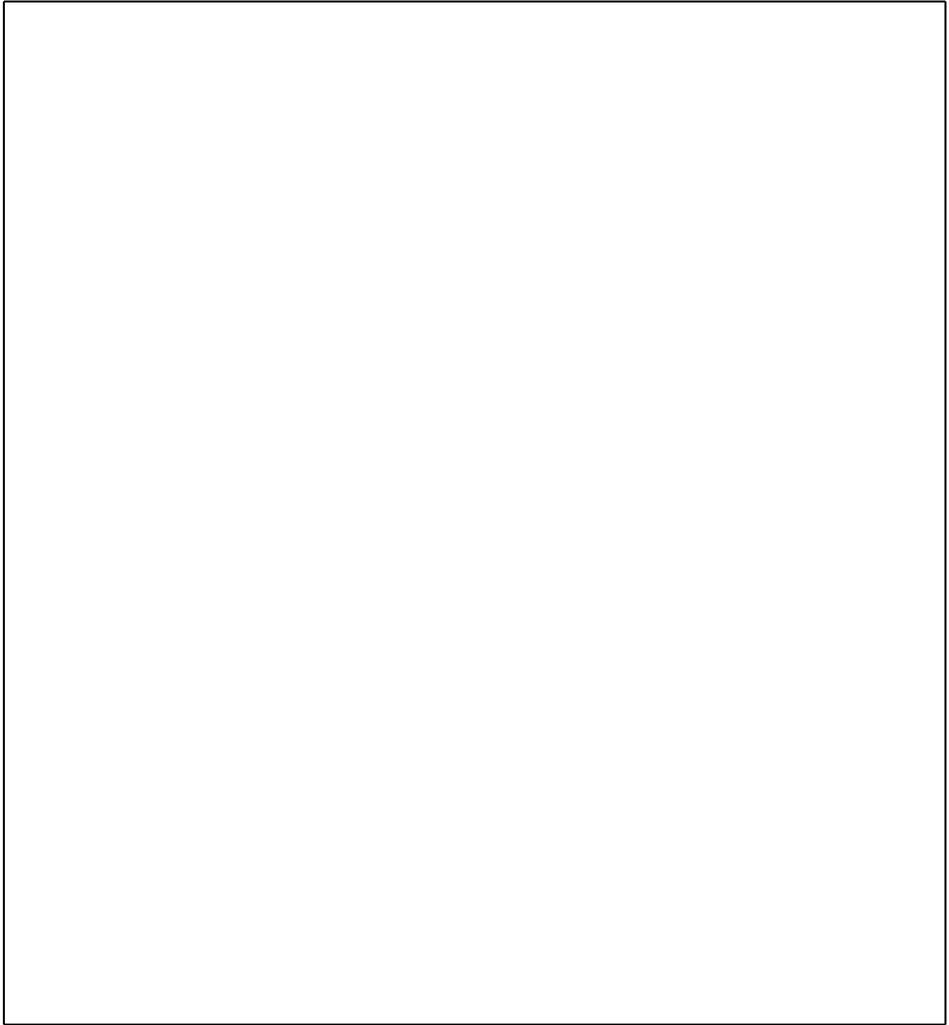


This was based on two inventions, patented in 1902 and 1903 by the engineer, Henrik Jørgen Reinert, at the Rosenberg Mekaniske Verksted (Engineering Works). The Reinerts Machine surpassed its predecessors in capacity, quality of seaming, and reliability. An experienced seamer could seam between 8,000 and 10,000 cans in the course of a 10 hour working day. However, it took 2-3 years before production and sales really got going. We need to wait until 1905 until it was in common use, and was the deciding factor in the final breakthrough for the drawn can with a lid equipped with a soldered opening tongue. The two first Reinerts machines went of course to the Stavanger Preserving Co.

The main reason for the success of the Reinerts Machine was that it was distinct from its predecessors in the way that the seaming wheels were guided round the can. Fig.12a. The wheels which guided the seaming wheels pressed against the inside edge of the guide track, and centrifugal force helped the guiding wheels follow the guide track around the corners on the can. (Fig.12a). In the Opsal/Nessler machines the guiding wheels pressed against the outside edge of the guide track, with the result that centrifugal force had the effect that the guiding wheels had a tendency to leave the track, unless prevented from doing so by strong springs. (Fig.12b).



Even so, the Nessler company had good sales of the Opsal/Nessler machines in the first years of the 20th century. A paragraph in the newspaper *Vestlandet* of 22 November, 1907 indicated that it was clear that up to that time, 70 of the machines had been sold to – amongst other countries – Sweden, Germany, France, England and Canada. The success of these sales is a good indication that significant improvements were made, and the machine could approach a seaming capacity which could rival that of the Reinerts Machine. In addition, it was equipped with automatic leading in of the seaming wheels, and so could be marketed as an automatic seaming machine.



The seaming machine in the foreground is probably an Opsal/Nessler machine. The two machines in the background are Reinerts machines.

The archives of the Norwegian Canning Museum hold several photographs which show similar conditions where the seaming machine section comprised both the competing machines. Reinerts machines are usually in the majority. The conditions were certainly typical for the era (c.1906) when the Opsal/Nessler machines which were first on the market were however forced out by the Reinerts machines.

THE OPSAL DIE TOOL

In 1905, a number of things happened which were to have great significance for the sardine industry. The indefatigable inventor Søren Opsal invented the press which in one action cut out, pressed and trimmed an empty can. (Fig.13). With this, it was possible for one man to produce 20,000 cans in one day, a capacity which could hardly even have been dreamt of in the days when men sat and soldered 600 cans a day at the very most.

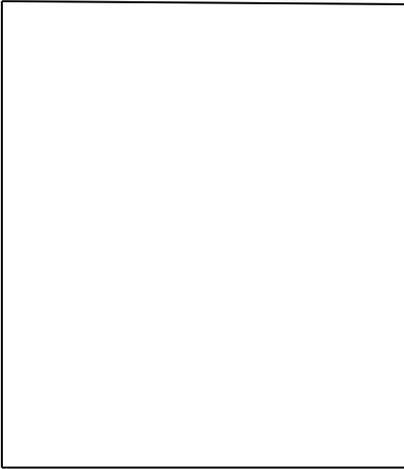


Fig. 13 *Opsal's Die Tool*

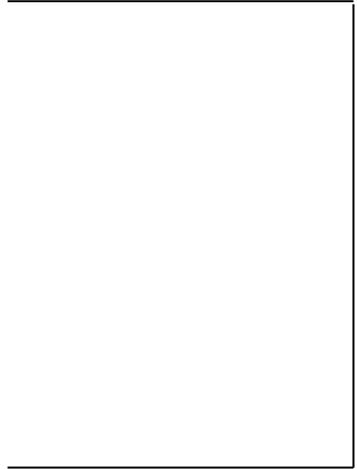


Fig. 14 *The Varde Press*

The Opsal Press was moreover completely unique in its class, and spread all over Europe, continuing in use well into the middle of the 20th century. Even the advanced presses of today still use the principals of the Opsal Press.

However, one cannot mention the Opsal Press without mention of the Varde Press at the same time. This was invented by H. Varden in 1910 (Fig.14). It is of interest that it is Varden's trimming system combined with Opsal's spring-loaded over-press is still in use in today's modern presses.

"The Bjelland tongue"

Many important things happened in 1905. Chr. Bjelland was granted a patent (no. 15162) for his "attached tongue" - the so-called "Bjelland-tongue" (fig.15). This was made in one piece with the lid and eliminated the time-consuming soldering work of the soldered

tongue. In 1906 C. Middelthun became a partner in the patent, which was sold to Stavanger Preserving shortly afterwards. The patent description does not mention the inventor.

T. Fjermestad, former Director of the “Brisling Centre”, tells however that the attached tongue was invented by the factory foreman Ole Andreas Rasmussen at Bjelland’s “Møller” factory. This is supported by an article in the Stavanger *Aftenblad* (7.02.1925) on the occasion of his 50th birthday. Rasmussen’s grandchildren say the same. They also say that Rasmussen received a small contribution and a silver spoon or a silver dish for the invention. The “Bjelland tongue” along with the key and the seam line were the solution to the problem of opening the Norwegian tin of sardines. It has been patented the world over and used for over 90 years on all Norwegian tins of sardines.

The Ring-pull opener

In the 1970s the ring pull opener came onto the market and was used a great deal for beer cans and soft drinks. It was also tried with sardine tins. But the time was not ripe, and another twenty years passed before Norway Foods A/S, the only producer of Norwegian sardines, used the ring pull on their tins.

It is interesting, perhaps even sensational, that the ring pull probably was invented in Stavanger about 95 years ago. In one case at the Norwegian Canning Museum there is a lid on display with a very similar look to today’s ring pull openers. It was made around 1910 by the Stavanger Bliktrykkeri and maskinverksted A/S.

The fact of the invention of the ring pull in Stavanger is supported by patent no. 23753: “Fastening of an opening tongue to the lid of a tin”, owned by the mechanic Johan Thorkildsen and the press-operator Thoralf Thorsen, in which the way in which the opening “tongue” is fastened to the lid is very similar to today’s ring pull.

STAVANGER BLIKTRYKKERI AND MASKINVÆRKSTED A/S (THE STAVANGER TIN PRINTING WORKS AND MECHANICAL WORKSHOP)

The production of cans and lids had now become so much simpler that the largest sardine factories actually found it possible and more convenient to produce their own cans and lids. They provided presses and dies and thus had their own small packing factory connected with the canning factory. It was particularly the can bodies - “tomboksene” (=“empty cans”) - which the canning factories produced. It was more complicated to produce the lids, with their scorelines and rubber rings (sealing rubber) than draw the can bodies which could now be done in one operation with the new die-tools. So the lids were delegated to the specialist packing factories.

Since the sardine industry was experiencing good growth, there was need for yet a further packaging factory apart from the Stavanger Blikemballasjefabrikk A/S (Stavanger Tin

Can Factory Company Ltd.). This was the reason for the establishment of the Stavanger Bliktrykkeri and Maskinværksted A/S in 1905.

The founders were the aforementioned P.Scholtz, H. Abel Lunde and A Barstad. The two first of these were specialists who amongst other things, owned a patent for opening a sardine can with a key. Barstad was the businessman who looked after the business side of the company.

SEALING RUBBER

To make sure that the seam was as tight as possible, there needed to be a kind of sealing rubber in the seam. Very early on, patents were taken out specifying powder for that purpose. The patents register shows that a type of liquid rubber was used for the same purpose. But it was the so-called “faste gummi” (rubber rings) which was used in Norway and was replaced by liquid rubber packing in 1948.

The rubber rings were applied to the lid flange by a heated steel ring, with the result that the rubber ring was fastened to the flange.

The machine which carried out this operation was called a “Pakningspresse” (“packaging press”) Fig.16. The patent register shows that Torkild Lende had a patent on this type of packaging press from 1910 onwards (Patent No.23284). It was the type which was to come into normal usage. The foreman Torger Kristiansen and the can-maker Joakim Jonasen from Stavanger in the same year took out a patent on an attachment to a packaging press which bent down the opening tongue at the same time as the rubber ring was attached to the lid. This had previously been done in two separate operations.

The packaging presses that were on the market could be found in a range of different designs. The machine illustrated in Fig.16 was supplied by C.Middelthon. It was made according to a system which was invented in 1919 by the craftsman G.A.Mällberg and the mechanic G.Guthormsen. The machine was produced by Trio Fabrikker’s Stavanger branch. The first producer of rubber rings registered in the Norwegian Canning Museum’s index of patents is B.T. Kleiberg. Later, among others are to be found the Stavanger Gummi-industri A/S and the Vestlandske Gummi-industri. These were founded respectively in 1924 and 1939.

The production of rubber rings was done by gluing a thin sheet of rubber into a “rubber stocking” (cylinder) of a diameter corresponding to that of the lid. The “stocking” was then cut into thin rings with a scissor-like machine.

So-called “flytende gummi” (rubber compound) was first used in Norway in the years following the second world war. The first machines for this purpose arrived at the Stavanger Bliktrykkeri og Maskinværksted A/S in 1948. The compound was either sprayed on, or stamped on the flange of the lid, and the rubber was then dried in an oven. The technique is almost exactly the same as that still in use.

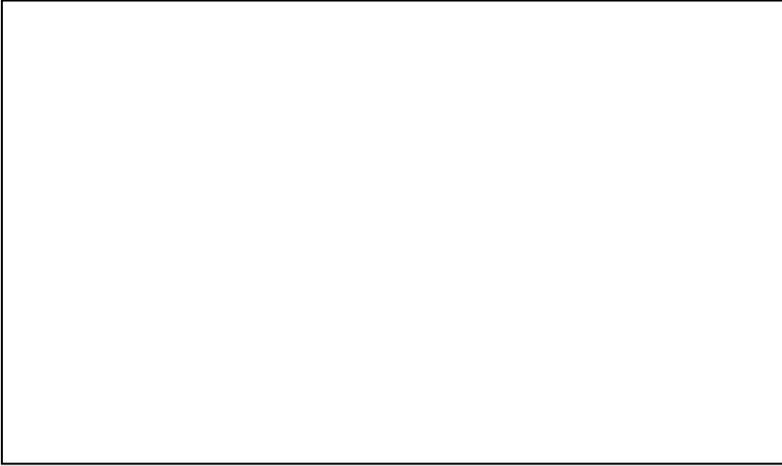


Fig.16: Automatic machine for applying the rubber ring to the lid flange.

REINERT WON THE RACE

The rights to the patent of the Reinerts Machine were taken over by the C. Middelthon company, which arranged for the production and sales of the machine both within Norway and overseas. The sources tell that in 1912 the total number of machines sold was 600, covering sales to Norway, Sweden, Denmark, England, Belgium, France, Spain, Portugal, Japan, Brazil and elsewhere.

However the Norwegian seaming machine was not equally well received everywhere. In Carl Frederic Kolderup's "*Blad av hermetikkindustriens historie*" volume 3, we find the story of how the French canning workers smashed and destroyed the seaming machines when the attempt was made to introduce them. The slogan of the day was "Pas de machines" ("No machines"). In Portugal too the workers strongly opposed the introduction of seaming machines. One of the grandchildren of Søren Opsal tells how his grandfather had to have bodyguards when he was exhibiting some of his machines in Portugal in 1906. The workers were obviously afraid of losing their jobs. The reaction is similar to that known in England at the end of the 19th century when mechanical looms were introduced.

The success of Reinert's machine spurred on Nessler and his co-workers Opsal and Rødder to continued efforts. In 1912 they obtained the patent for a special feature of a

new seaming machine to which they gave the name “Record”. Fig.17. They exhibited it at the Fisheries exhibition in Copenhagen in the same year that they received honourable mention and a Diploma of Honour. In an article entitled “Fra det moderne Stavanger”, in the journal *Farmand*, issue 40, for 1912, we read that there was great excitement over the result of the competition between The “Record” machine and Reinert’s machine. The first-mentioned was semi-automatic and quite advanced and thus had a certain advantage over its competitor. Despite this, history shows that it was the Reinert’s machine which won the race.

There was an interval of no more than two years before C. Middelthun launched the Reinert’s machine in a semi-automatic version, Fig.18, based on an invention of the foreman Mällberg. In 1921, fully automated working was introduced, Fig.19, with a patent for automatic can-feeding which had been bought from the company Rydberg and Petterson.

No information about the further fate of the “Record” machine has been found. Still less has any actual machine been discovered. On the other hand, Reinert’s machine continued

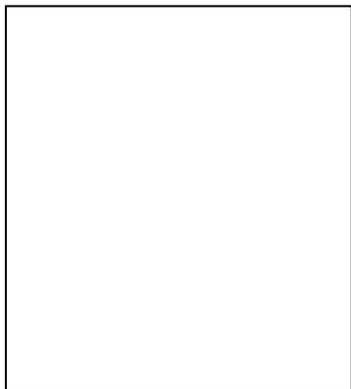
its triumph and was produced and sold in almost its original design way into the 1950s. By then, 1,800 of the machines had been sold.

Translations of captions for Fig.17:
The only Norwegian fully automatic SEAMING MACHINE. Each one does the work of nearly two ordinary ones. WATTNE’S NEWEST OPENING METHOD. Saves thousands of Kroner per year.

THE ONLY PATENTED CAN-PRESS. Draws and trims cans in one operation.

Inventors: Messrs OPSAL, W. NESSLER. RØDDER Manufacturer: Mr. W.NESSLER

Owner of Patent: Mr. FRED. WATTNE



C. MIDDELTHON'S MACHINE DEPARTMENT

As is apparent from the account above, the history of the Reinert's machine is closely connected with the firm of C. Middelthon of Stavanger. In the beginning, this was an ordinary business company, founded in 1845. In 1903, they began the development and selling of canning machines. The background for this was that the founder of the Stavanger Beslagfabrik, Fredrik Racine, had bought the patent for Reinert's first seaming machine in 1902. He began work on producing and launching the seaming machine, but died as early as 1904. His widow took over the rights to the patent, together with his two brothers-in-law, Cornelius Middelthon and Sigval Bergesen. In his direction of the company, C. Middelthon continued the production and marketing of the Reinert's machine.

C. Middelthon gradually took up the production of can presses, presses for lids, dies and a variety of other canning machinery. This was how the company came to be the leaders in the field where W. Nessler had earlier held sway.

The company's machines were based mainly on inventions of people from Stavanger from different trades. They preferred to come to C. Middelthon with their inventions to have them put to practical use. In this way the company bought many inventions for which they had paid contributions towards the patents and development. C. Middelthon had altogether 90 patents both in Norway and abroad, but only a few of these proved to be a commercial success.

The company allowed all its machines to be produced by A.s De Forenede Norske Laase- og Beslagfabriker's branch in Stavanger. This was later named Trio Fabrikker A.s. C. Middelthon himself was responsible only for the sales and marketing of the machines. C. Middelthon's interest in canning machinery was bought in around 1950 by Trio Fabrikker AS. With this there came to an end Middelthon's 50-year activity in the world of canning machinery.

THE NEXT GENERATION – THE FULLY AUTOMATIC SEAMING MACHINE

The Reinert's Machine in its semi- and fully automatic versions did not achieve the same success as their parent machine. There were no further new Norwegian machines, and so the sardine factories decided to use their Reinert's machines into the mid 1930s. Thus there were no further developments in Norway for over twenty years.

In other countries in Europe, however, development proceeded rapidly. Catalogues from (among others) the larger French and German manufacturers of packaging machinery, show that in the 1920s there were advanced automatic seaming machines with up to three times the capacity of the Reinert's machine.

LUBIN-WEIFFENBACH

The agent B. Løvas Svensen saw the need for more advanced seaming machines and so in 1928, he launched the French automatic seaming machine, the Lubin-Weiffenbach, on to the Norwegian market. (Fig.20). It was a modern machine with two seaming heads and four seaming wheels to each head.

In contrast to the Reinert's machine, which had to be operated by a specially trained male "sealer", the French machine could be operated, according to the advertisement, by "anyone you please". It had a capacity of as many as 16,000 cans in an 8-hour day, and thus was vastly superior to the Reinert's machine, and naturally increased in popularity quite rapidly. In the year when it was introduced, the companies of Chr. Bjelland & Co. A/S and E.M. Nielsen Moe, Oslo, each bought six machines.

(Translation of texts in Fig.20): *The world's best automatic SEAMING MACHINE* supplied by **LUBIN & WEIFFENBACH Clichy (Seine) France**.

Around 300 machines installed in France, Spain and Portugal by the first of January of this year. The new Norwegian factories have also had their eyes opened to this incomparable machine. Four of them have already been installed and several orders are in the process of delivery. Seals up to 2,000 ¼ dingley cans per hour. No waste of cans. Can be operated by anyone you please, male or female workers. Seaming tools can easily be changed from one shape of can to another, by a non-specialist, in a few minutes.

Almost silent operation.

General Agent for Scandinavia: **B. Løvas Svensen**

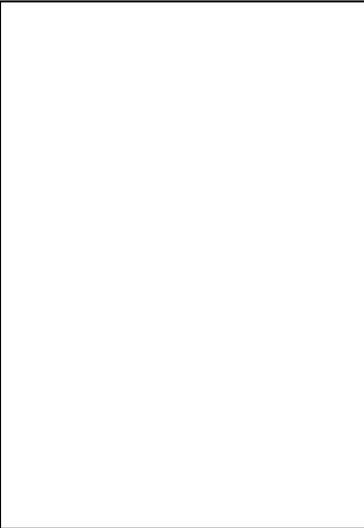
Agents for: Rogaland District: **Sverre Henriksen**

Trondhjem: **Wilh. Kavli A.s**

Østland: **Jonas B. Øglænd A.s.** (address): Øvre Vollgate 2, Oslo.

TRIO

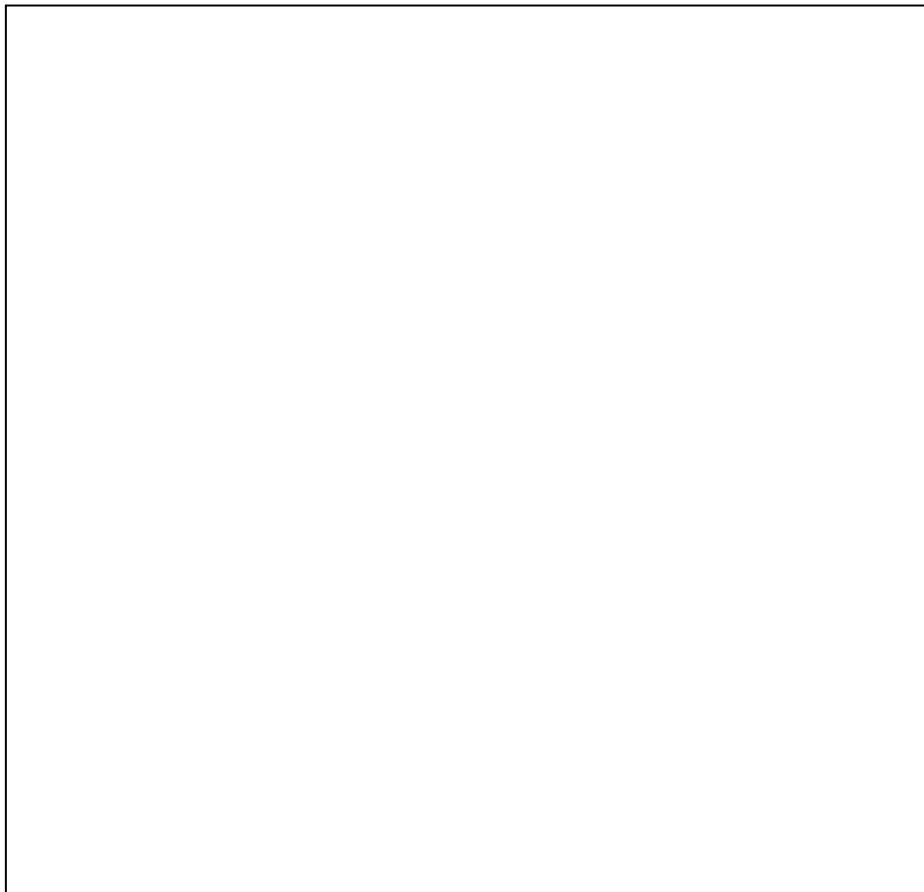
C. Middelthon took up the challenge from the French, and in 1930 launched a new automatic seaming machine which was called the “TRIO”. Fig. 21. However, this had only one seaming head, and so was not at the same level as its French competitor. In spite of this, it had quite wide distribution, and 41 examples of it had already been sold by 1933. The reason for this was firstly that it was cheaper than the French machine by a long way, and furthermore it had an open shoe in its lower seaming plate such that the cans could easily be pushed in to it while the machine was being “fed”. It is also a fact of history that C. Middelthon did not patent this important detail, and so it was not long before the French machine also had an open shoe on its lower feeding plate.

	<p>(Translation for text for Fig. 21): Stavanger-Maskinen “TRIO” The ideal fully automatic seaming machine. 2,000-2,500 cans per hour. Silent operation. Can be operated by a boy or girl without specialist knowledge. “TRIO” is the result of a year-long experiment to produce the ideal fully automatic seaming machine for Norwegian canning factories. It is:</p> <ol style="list-style-type: none">1. Labour-saving2. Fast-working3. Adjustable to different can-patterns4. Reliable and accurate5. Strong and solid <p>Made in Stavanger by the workshop at Beslagfabrikk, where it can be seen in action.</p>
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TRIO-B

The Second World War came to the rescue, and C. Middelthon had the seaming market to himself for some years. Straight after the war TRIO MASKININDUSTRI (the market name for the Trio factory’s branch in Stavanger) tried to strengthen its position by modernising the ageing TRIO machine. It became more simple to operate, with

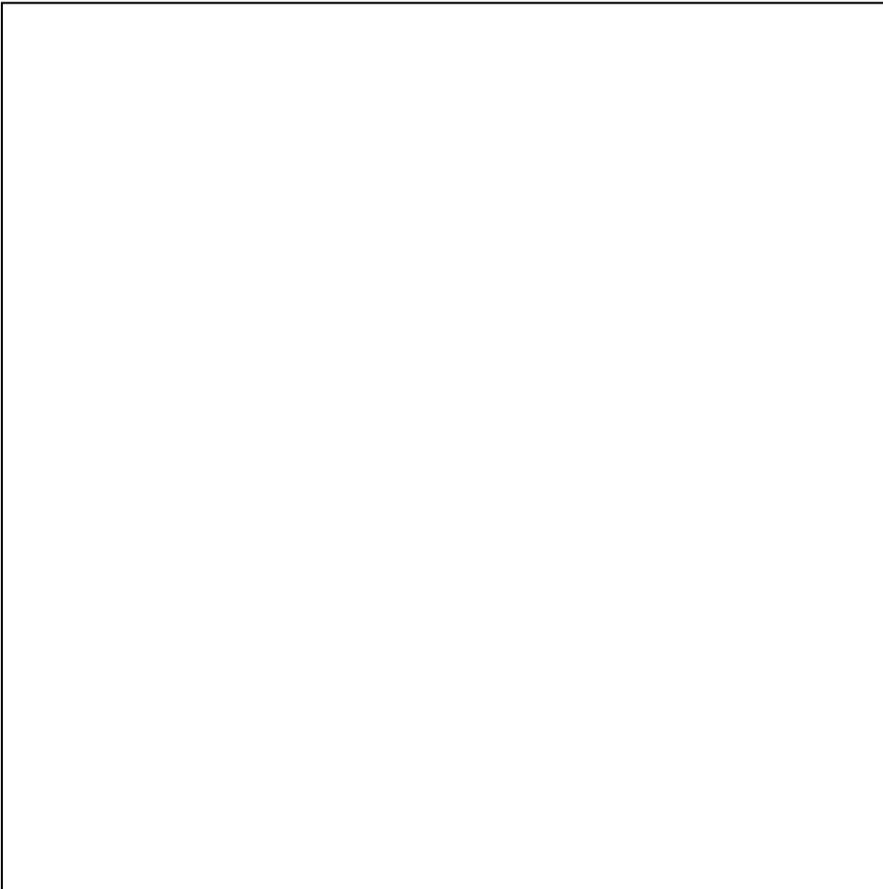
individual drive, and was given new bodywork, and particular details were improved. The model was named the “TRIO-B”. Fig. 22.



None of the machines mentioned earlier had automatic feeding in of the cans. This was dealt with by a man from Stavanger, the amateur inventor Trygve Birkeland. In his factory, the Vestland Såpefabrikk (“Soap Factory”), in Badehusgate (street name), he constructed a simple attachment for putting on lids and feeding in cans, which could be equally easily mounted on the French machines as on the TRIO-machine. This led to the feeding of the machines being easier, safer and faster, and was very widely used.

LW 303

The competition was however not over yet. A short time afterwards, in 1948, the German company LUBECA-WERKE GmbH (= “Company Limited”) entered the Norwegian seaming machine market with its fully automatic seaming machine, the LW 303. Fig. 23. In its essential features, this was copied from the French “LUBIN-WEIFFENBACH” machine. The LW 303 both put on lids, and fed in cans, automatically, and was a great deal more advanced than the TRIO-B. Consequently it quite quickly gained the superior position in the seaming machine area for the Norwegian sardine industry in the 1950s.



TAF-3

But Trio Maskinindustri could hardly calmly watch this happen. They did what the Germans had done before them. They copied their competitor's machine and in 1953 came out with the "TAF-3" fully automatic seaming machine which was relatively well received both on the home market and elsewhere in the world. Fig. 24. This has been updated several times and is still on the market under the name of the TAF 4.



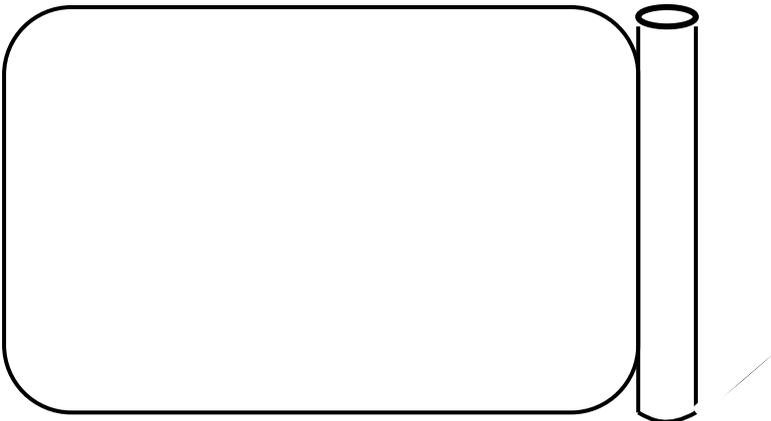
OTHER COMPETITORS

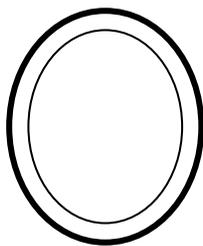
Early in the 1950s the Americans entered the seaming machine market with a machine from the International Machinery Corporation (IMC). This was a large and expensive machine which was not well suited to Norway. Nevertheless between 10 and 20 machines were sold, mostly to the larger factories.

At the same time a new Norwegian competitor came on the scene. The “Hydraseam” was launched by the Director of the Bergenhuis Canning Co. A.s., Olav Johnsen. It was a hydraulically operated machine, technically very simple, and cheap. Johnsen installed the machines in a number of his factories, but it had no success in the sardine industry as a whole.

THE END OF THE RACE

Sadly, the great days of the Norwegian sardine industry are over. In the years around 1970 the volume of production was about 160 million cans per year, shared by some 40 factories. Today, the volume is about 30 million cans, produced by three factories. The Norwegian sardine industry is thus no longer interested in the suppliers of seaming machines. The competition for the market for the seaming machine has moved overseas. Although the “Race for the Seaming Machine” sadly seems to be finished from Norway’s side, the contribution of her pioneers will for ever be inscribed upon the history of the canning industry.



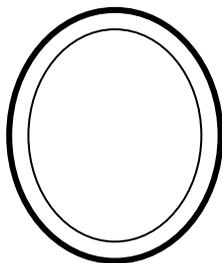


Søren Opsal

Born in Vikedal (near Stavanger) in 1856, died in Vikedal in 1937.
Foreman with W. Nessler mek. Verksted. 7 patents before 1915. Inventor of the first seaming machine for non-round cans, and the best known – the “Opsal Press”

He did so well by his invention that by the age of 60 he went back to his ancestral home where he bought a small farm.

Here he occupied himself with growing crops, particularly fruit, which he preserved.

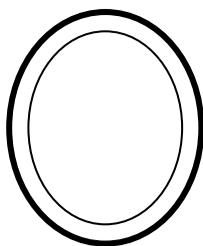


Henrik Jørgen Reinert

Born in Kristiania (Oslo) in 1870, died in Sandefjord in 1936.
Horten technical school in 1888. Silver medal from The Society for the Promotion of Norwegian Fisheries (“Selskapet for de norske fiskeriers fremme”) for the invention of Reinert’s Seaming Machine.

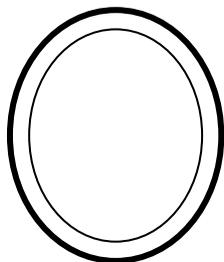
4 patents before 1915 relating to seaming.

After his achievements in Stavanger he travelled with his family to Sandefjord, where he started a machine workshop.



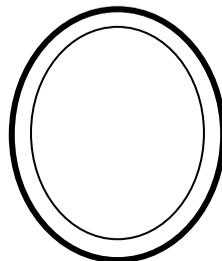
Wilhelm Nessler

Born in Hamburg in 1836, died in Stavanger in 1926.
Stavanger's first authorised plumber. In 1856 he established W. Nessler Mek. Verksted, which around 1908 was Stavanger's leading workshop and producer of presses and stamping tools for the canning industry. 7 patents before 1915.
Co-inventor of the Opsal/Nessler seaming machine.



Paul Richard Scholtz

Born in Berlin in 1869, died in Bergen
7 patents before 1915 in 1950.
Co-inventor of the first opening system or device for drawn cans using the soldered tongue and scoreline.
Co-founder of Stavanger Bliktrykkeri and Maskinværksted A/S and Bergen Bliktrykkeri, United Sardine Factories and Bergen Blikvalseverk.



Henrik Abel Lunde

Born in Hamar in 1864, died in Stavanger in 1956. 3 patents before 1915.
Co-inventor of the first opening system or device for drawn cans using the soldered tongue and scoreline.
Co-founder of the Stavanger Bliktrykkeri and Maskinværksted A/S.

CHRONOLOGICAL SUMMARY

- 1810 Nicolas Appert, France, discovers the art of preserving. As containers he uses ceramic and glass jars, tightly corked and sealed. Peter Durrand, England, takes out a patent on “three piece” round cans.
- 1813 Appert begins to use cans in his production of canned goods.
- 1830 Production of canned sardines begins in France. Sardines are cooked in oil before being packed in cans. (“fransking”/“Frenchifying”)
- 1840 Christian August Thorne, from Moss, begins the production of anchovies and then later, other canned products in round cans.
- 1860 The first seaming machines for “three piece” round cans begin to be used elsewhere in Europe.
- 1879 Stavanger Preserving Co. begins the production of “Smoked Norwegian Sardines in oil”, in soldered “three piece” rectangular tin cans.
- 1886 Hagbart Thorsen, from Sunnhordland, uses a Swedish seaming machine for round cans.
- 1890 The soldered “three piece” “French can”, also known as “Decollage” comes into normal use. In one corner is an extra piece of metal to which to attach the key for opening the can.
- 1900 Søren Opsal, from Stavanger, launches the first practical seaming machine for rectangular cans. This is used for seaming the bases of “French cans”.
- 1901 Søren Opsal and Wilhelm Nessler launched an improved version of Opsal’s first machine. The capacity was limited to 3,000 cans in a 10-hour working day.
- One-piece forming of cans begins. The cans are pressed out from one piece of tin with three different operations using three different tools.
- The technician H.J. Reinert at Rosenberg Mek. Verksted was granted a patent for a seaming machine for “non-round” cans. The patent was improved in the following year, and laid the foundation for the extensive production of the so-called “Reinert’s Machine”. Seaming capacity was up to 10,000 cans per day.
- 1901 Henrik Finne, Paul Scholtz and H. Abel Lunde acquire the patent for an opening device with soldered tongue and scoreline.
- Stavanger Blikemballagefabrikk A/S begin production of that device.
- Søren Opsal and Wilhelm Nessler introduce to the market the first semi-automatic seaming machine for “non-round” cans. Capacity is about 9,000 cans per day.

- 1905 Christian Bjelland & Co. acquire the patent on the so-called “Bjellandhempe” (Bjelland opening-tongue), which is made of one piece with the lid.
Søren Opsal launches the combined cutting, pressing and trimming tool. This simplifies can production considerably. Daily production from each press reaches 20,000 cans.
C. Middelthon is under way with the production and marketing of the Reinert’s machine.
Norwegian inventions revolutionise the production of sardine cans. The “French can” is forced out of the market, and the high point of the tinsmiths’ workshops fades away.
- 1906 Nessler’s workshop has delivered in total 70 semi-automatic seaming machines, for sale in Norway and overseas.
- 1912 600 Reinert’s machines have been sold on the home and overseas markets.
Nessler launches a new semi-automatic seaming machine, the “Record”. This receives a Diploma of Honour at the Fisheries Exhibition in Copenhagen.
- 1913 Reinert’s machine comes out in a semi-automatic version.
- 1921 Reinert’s machine comes out in a fully automatic version.
- 1928 The French Lubin Weiffenbach fully automatic machine is introduced on to the Norwegian market and is well received. The capacity is 2,000 cans per hour.
- 1930 C. Middelthon launches an entirely new fully automatic seaming machine, the TRIO.
Capacity is 2,000-2,500 cans per hour.
- 1946 C. Middelthon modernises the TRIO machine. It is designated “TRIO-B”.
- 1948 Lubeca-Werke GmbH arrive on the Norwegian market with their fully automatic seaming machine, the LW 303, with a capacity of 3,600 cans an hour.
- 1950 The American machine, the “IMC”, was imported by some of the larger factories.
- 1953 Trio Maskinindustri, Stavanger, launches its new fully automatic seaming machine called the “TAF 3”.
Bergenhuis Canning acquires the patent for an hydraulic seaming machine. Several examples are made for the factory’s own use. It is given the name “Hydraseam”.

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 - 1926:3, p.65, "Reinerts falsemaskiner"
 - 1926:10, pp.231-232, "En meget interessant katalog med verdifulle opplysninger".
 - 1928:3, p.50 is the original for Plate 20, the first advertisement for the Lubin and Weiffenbach Seaming machine.
 - 1929:11, p.208 carries a further advertisement for the same machine, with letter of approbation from United Sardine Factories, Bergen, as a testimonial.

1930:4, p.83 carries the first (half-page) advertisement for the TRIO fully automatic seaming machine. (See Fig.21) On p.95 there is a short review of the machine.

1930:8, p.200 the machine is also advertised.

1931:1, p.6 there is a full-page advertisement with endorsement from Stavanger Preserving Co., and announcement of their intention to order “several” more machines of the same type.

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1937:8, pp.272-3, “Fra hermetikkindustriens barndom” (part 2)

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Appendix

John G. Johnsen:

PATENTS IN THE CANNING INDUSTRY BEFORE 1916

John G. Johnsen:

PATENTS IN THE CANNING INDUSTRY BEFORE 1916

Early on in my time at the Canning Museum the question of patents cropped up. It came from one of the visitors to a special Sunday event, who wanted information about a patent which his grandfather had helped to develop. It was not the only question of this type, and I gradually began to suspect that a significant number of patents had developed in the environment of the workshops in Stavanger.

For the museum as a research institution it was thus necessary to put together a systematic compilation of these patents. This task fell into place along with Jørg Hviding's systematic survey of the history of the Seaming Machine, and so it was natural to print a list covering the oldest patents. The index has been put together on the basis of the "Index of Norwegian Patents", and provisionally covers up until 1915.

In order to survey the patents, the following categories in the Index were investigated:

7. Tinplate and wire manufacture
47. Machine parts
49. Metal working
53. Food
64. Bottles
81. Transport

For every one of the patents which are in that index an archive card has been made, containing the key information. These are kept at the Norwegian Canning Museum (Norsk Hermetikkmuseum). It is possible to obtain further information about all patents, by studying the actual patent documents at the Board for Industrial Legal Protection (Styret for det industrielle rettsvern) in Oslo. The address is: Københavngate 10 (or Postboks 8160 dep.), 0033 Oslo, Norway.

The index is built up chronologically according to the date of preparation of the letters patent. That date can be very different from the date at which a patent was sought. All patents have a number, based on a consecutive numbering system. This has been used as the classification principle.

In the period up to the end of 1915, altogether 316 patents were prepared in the above-mentioned categories. The assumption about the dominance of Stavanger has been fully documented, with 202 of the patents being taken out by Stavanger people. That speaks volumes for the creative environment in the city, as well as emphasising the significance of the canning industry which encouraged a range of supporting businesses.

One issue is the patents which were registered; it is another question completely when it comes to which patents were actually used, and had significant impact on the canning industry. Jørg Hviding's extensive coverage provides a good survey for part of the subject. In time to come it would be natural for the museum to extend the survey to cover further patents and the mechanical industry as a whole.

Patents categorised according to patent number and date of registration

Heading A	Heading B	Owner	Place	Date	Number
Seaming	Seaming Machine	Marquet	—	05.01.1878	—
Autoclave	Valve	Marquet	—	25.02.1879	—
Gadget for lids	Can lids	Halfstad	—	25.02.1879	—
Gadget for lids	Soldering	Griffin	—	08.04.1881	—
Canning	Preserving equip.	Specht	—	23.01.1883	—
Smoking	Smoking Kiln	Leach	—	02.11.1883	—
Canning	Cans + heating equip.	Prævet	—	06.11.1883	—
Containers	Can	Torkildsen	Trondheim	12.05.1887	00549
Preserving	Improvements, fish	T.N.C.L.B.H.	London	22.06.1887	00595
Preserving	Improvements, fish	Steenberg	Denmark	29.06.1887	00608
Preserving	Canning	Smith	Oslo	06.07.1887	00618
Closing	Cans	Ewers	Germany	20.06.1888	00965
Containers	Die	Paulsen	Oslo	30.06.1888	01101
Canning	Improvements	Poehl	Russia	19.09.1888	01188
Preserving	Improvements, fish	Marmont	Oslo	18.02.1889	01341
Sorting	Sorting machine	Neeraa	Denmark	15.06.1889	01433
Preserving	Canning	Schøning	Stramsund	27.05.1889	01454
Closing	Cans	Kirsch	Riga	06.11.1889	01560
Closing	Cans and lid	Asche	Paris	04.08.1892	02805
Preserving	Improvements	Dosmond, Rozes	Paris	04.08.1892	02832
Closing	Sardine can lids	Mydland	Stavanger	27.10.1892	02897
Containers	Cans	Zimmerman	U.S.A.	02.12.1892	03018
Cans	Can production	Fjelstrup	Denmark	12.07.1893	03264
Preserving	Improvements	Hausler	Germany	—	03407
Mincing machine	Minced fish	Foss & Olsen	Bergen	03.02.1894	03583
Preserving	Improvements	T.P.S.L.	London	10.02.1894	03842

Containers	Cans	Lunds Factory	C'hagen	01.08.1894	03844
Containers	Soldering	Peltier	Paris	13.08.1894	03845
Closing	Cans	Asche	Paris	30.08.1894	03846
Opening device	Cans/lids	Merton	Australia	17.01.1895	04077
Closing	Soldering	Gersant	England	14.01.1896	04208
Opening device	Scoreline	Ewers	Lübeck	11.04.1896	04432
Opening device	Can and lid	Brown	Sidney	27.04.1896	04490
Opening device	Can lid	Fellows	U.S.A.	11.05.1896	04524
Opening device	Can lid	Erikson	Sogndal	06.06.1896	04620
Containers	Can	Holje	Sweden	25.06.1896	04672
Soldering	Closing of cans	Asche	Paris	04.01.1897	05125
Opening device	Opening/closing	T.N.M.C.	Oslo	25.01.1897	05191
Threading	Threading equip.	Andersen	Stavanger	23.08.1897	05624
Opening device	Opening wire	Nilson	Tøreboda	01.11.1897	05746
Containers	Joining	St. Blikemb. Fac.	Stvr	08.11.1897	05786
Threading	Threading device	Andersen	Stavanger	07.02.1898	06015
Cutting	Cutting machine	St. Pres. Co.	Stavanger	07.03.1898	06081
Cutting	Cutting machine	Tjaaland	Stavanger	28.05.1898	06133
Opening device	Scoring	Stepina	Chicago	08.08.1898	06490
Opening device	Can	Sandvikens Fac.	Sandvikens	03.10.1898	06640
Finishing	Can washing	Tjaaland	Stavanger	17.10.1898	06676
Fishball machine	Fishball moulds	Seglem	Haugesund	28.11.1898	06814
Cans	Cans + opener	Thiis	Stavanger	05.12.1898	06845
Sealing	Can sealing	Ams	U.S.A.	27.12.1898	06884
Fishball machine	Fishball moulds	Gundersen	Stavanger	06.02.1899	07009
Cleaning	Cleaning fish	Birkedal	Stavanger	13.02.1899	07015
Cans	Can + heating device	Rehse	Germany	13.02.1899	07017
Fishball machine	Fishball moulds	Mydland	Stavanger	08.01.1899	07107
Containers	Closing	Carlsen	Stavanger	24.04.1899	07219
Containers	Conical can	Sandvikens Fac.	Sandvikens	01.05.1899	07234
Threading	Fish on rods	Helliesen	Stavanger	29.05.1899	07327
Fishcake tongs	Fishcakes	Bjelland	Stavanger	12.06.1899	07362
Soldering	Closing of cans	Asche	Paris	26.06.1899	07378
Cutting	Cutting machine	Andersen	Stavanger	03.07.1899	07407
Containers	Scoreline	T.C.M.	Canada	04.09.1899	07550
Fishball machine	Moulds, fishballs	Bjelland	Stavanger	25.09.1899	07584
Fishball machine	Moulds, fishballs	Omdahl	Stavanger	02.10.1899	07606
Threading	Threading brisling	Ommundsen	Stavanger	16.10.1899	07623
Cutting	Cleaning fish, etc.	Lende	Stavanger	13.11.1899	07720
Threading	Threading of brisling	Olsen	Stavanger	13.11.1899	07724
Fishball machine	Moulds, fishballs	Rønneberg	Stavanger	02.01.1900	07854
Fishball machine	Moulds, fishballs	Bjelland	Stavanger	02.01.1900	07865
Containers	Can production	Sunde	Stavanger	08.01.1900	07904
Seaming	Seaming machine	Lende	Stavanger	29.01.1900	07974
Smoking	Smoking of fish	Sætre	Stavanger	26.02.1900	08073
Soldering	Clamping device	Tjaaland	Stavanger	07.05.1900	08295
Containers	Cutting out	St. Pres. Co.	Stavanger	21.05.1900	08340
Soldering	Clamping device	Nessler	Stavanger	05.06.1900	08385
Soldering	Can lids	Gundersen	Stavanger	02.07.1900	08476

Seaming	Can lids	Ams	U.S.A.	02.07.1900	08483
Finishing	Washing cans	Gundersen	Stavanger	02.07.1900	08493
Smoking	Smoking of fish	Repenning	Stavanger	09.07.1900	08502
Containers	Can lids	Netland	Stavanger	09.07.1900	08509
Smoking	Smoking frames	Mejlænder	Stavanger	09.07.1900	08511
Fishball machine	Moulds, fishballs	St. Pres. Co.	Stavanger	20.08.1900	08622
Sealing	Sealing cans	Bjelland	Stavanger	24.09.1900	08702
Smoking	Smoking of fish	Bjelland	Stavanger	24.09.1900	08703
Sealing	Sealing cans	Netland	Stavanger	19.11.1900	08884
Seaming	Seaming machine	Sunde	Stavanger	03.12.1900	08951
Seaming	Seaming machine	Opsal	Stavanger	25.02.1901	09217
Threading	Metal rods	Inter. Harpun	Stavanger	25.03.1901	09306
Threading	Threading device	Helliesen	Stavanger	28.05.1901	09532
Containers	Drawn can	Racine	Stavanger	27.01.1902	10396
Containers	Tool for cans	Ewers & Co.	Lübeck	10.03.1902	10530
Soldering	Soldering machine	Jacobsen	Stavanger	04.01.1902	10612
Containers	Soldering of sides	Ingebretsen	Stavanger	14.04.1902	10656
Labelling	Labelling machine	Lunde	Stavanger	16.06.1902	10835
Containers	Assembled can	Tjaaland-Opsal	Stavanger	27.10.1902	11202
Containers	Dies for cans	Helvig	Stavanger	24.11.1902	11335
Seaming	Seaming tool	Reinert	Stavanger	22.12.1902	11404
Opening device	Cans	Pedersen	Oslo	12.01.1903	11484
Sealing	Sealing cans	Voss	Braunschweig	19.01.1903	11504
Soldering	Closing cans	Finne	Stavanger	19.01.1903	11506
Seaming	Seaming tool	Lende	Stavanger	06.04.1903	11734
Closing	Cans	Valves Limited	London	20.04.1903	11769
Opening device	Scoreline + tongue	Scholtz, Lunde	Stavanger	20.04.1903	11773
Seaming	Double seaming	E.W.B.C.	U.S.A.	08.06.1903	11915
Can opener	Can	Brockmann	Hamburg	29.06.1903	11964
Closing	Vacuum pump	Dreyer	Oslo	13.07.1903	12045
Seaming	Seaming tool	Opsal	Stavanger	25.01.1904	12606
Opening device	Can	Lunde	Stavanger	07.11.1904	13075
Seaming	Seaming machine	Reinert	Stavanger	04.06.1904	13117
Seaming	Seaming tool	Lunde	Stavanger	07.11.1904	13433
Opening device	Can	Finne	Stavanger	19.12.1904	13624
Can	Can with cooker	Calorit	Berlin	16.01.1905	13729
Smoking	Smoking of fish	Birkedal	Stavanger	03.04.1905	13969
Seaming	Seaming cans	B.A.B.	U.S.A.	01.05.1905	14037
Seaming	Seaming machine	Lende	Stavanger	13.06.1905	14176
Opening device	Can	Scholtz	Stavanger	03.07.1905	14245
Opening device	Can	Scholtz	Stavanger	11.09.1905	14445
Can	Can tool	Brambani	Sandviken	27.11.1905	14682
Opening device	Can	Finne	Stavanger	04.12.1905	14698
Opening device	Can	Bjelland	Stavanger	04.12.1905	14713
Opening device	Can	Lye, Holmens P.C.	Stavanger	04.12.1905	14723
Sealing	Sealing cans	Hammer	Germany	18.12.1905	14738
Soldering	Soldering under vacuum	Røitergaard	Oslo	30.04.1906	15145
Opening device	Scoreline and tongue	Bjelland	Stavanger	07.05.1906	15162
Opening device	Can	Danielsen	Stavanger	14.05.1906	15188

Seaming	Seaming machine	Wattne	Stavanger	24.09.1906	15603
Seaming	Seaming machine	Steward	U.S.A.	18.06.1906	15304
Opening device	Can	Opsal, Mydland	Stavanger	03.09.1906	15521
Containers	Scoreline	Lende	Stavanger	17.09.1906	15560
Seaming	Seaming machine	Wattne	Stavanger	24.09.1906	15603
Opening device	Strip opening	Ewers & Co.	Lübeck	03.12.1906	15797
Packing fish	Automatic packing	Romsø	Stavanger	03.12.1906	15826
Seaming	Seaming tool	Nessler	Stavanger	24.12.1906	15861
Containers	Press tool	Lende	Stavanger	31.12.1906	15882
Containers	Press tool	Lende	Stavanger	31.12.1906	15884
Sealing	Can sealing	Schiønning	Køben	07.01.1907	15907
Containers	Scoreline	Gesellschaft für Pat.	Lübeck	04.02.1907	16007
Opening device	Can	Rønneberg	Stavanger	04.03.1907	16108
Containers	Scoreline	Lende	Stavanger	13.05.1907	16350
Opening device	Key-machine	Garland	England	22.07.1907	16582
Cutting	Cutting machine	Haagensen	Bergen	22.07.1907	16589
Closing	Fastening of cans	Nessler	Stavanger	29.07.1907	16598
Cutting	Cutting machine	Rønneberg & Kielland	Stavanger	05.08.1907	16645
Threading	Threading tool	Andersen	Stavanger	30.09.1907	16806
Sealing	Sealing of cans	Plinatus	Russia	07.10.1907	16844
Closing	Cans	Rødder	Stavanger	14.10.1907	16866
Closing	Soldering cans	Farquhar	London	02.12.1907	17098
Opening device	Side with tongue	Wattne	Stavanger	20.01.1908	17282
Sealing	Sealing of cans	Plinatus	Russia	30.03.1908	17545
Cans	Production/conserving	Palmyra	Oslo	06.04.1908	17574
Threading	Threading device	Finne	Stavanger	06.04.1908	17575
Cutting	Cutting machine	Tjaaland	Stavanger	06.04.1908	17587
Sealing	Sealing cans	Plinatus	Russia	06.04.1908	17587
Opening device	Closing/opening	Meiniche-Bache	Stavanger	27.04.1908	17631
Containers	Cutting die	Opsal	Stavanger	18.05.1908	17689
Sealing	Top and bottom of can	St. Bliktr. Mv.	Stavanger	25.05.1908	17732
Seaming	Closing can	Høiland, Halleland	Stavanger	22.06.1908	17819
Threading	Threading device	Bjelland	Stavanger	29.06.1908	17828
Seaming	Seaming machine	Ams	U.S.A.	13.07.1908	17864
Seaming	Seaming mach. Doub. seam	Varden	Stavanger	13.07.1908	17865
Oil filling	Oil filling device	Haagensen	Bergen	08.03.1908	17959
Cutting	Cutting machine	Malde	Stavanger	17.08.1908	18014
Cutting	Cutting machine	Lende	Stavanger	17.08.1908	18015
Container	Cutting die	Opsal	Stavanger	31.08.1908	18060
Opening device	Cans	Petersen	Stavanger	31.08.1908	18084
Opening device	Cans	Erik Bjelland	Stavanger	19.10.1908	18191
Container	Protective lid	St. Bliktr. Mv.	Stavanger	02.11.1908	18280
Seaming	Can/lid	Høiland	Stavanger	23.11.1908	18361
Smoking	Smoking equipment	Moe	Stavanger	30.11.1908	18380
Closing	Cans	Bjelland	Stavanger	07.12.1908	18433
Closing	Cans	Opsal	Stavanger	07.12.1908	18434
Closing	Cans	Kielland	Stavanger	07.12.1908	18437
Seaming	Cans	Hansen	Copenhagen	25.01.1909	18556
Oil filling	Oil filling equip.	Stvg. Pres.	Stavanger	03.01.1909	18671

Opening device	Cans	Finne	Stavanger	03.01.1909	18683
Threading	Threading device	Bache	Stavanger	08.03.1909	18712
Seaming	Seaming machine, cans	St. Bliktr. Mv.	Stavanger	22.03.1909	18732
Threading	Smoking rods	Tjaaland	Stavanger	14.03.1909	18824
Threading	Threading device	Irgens	Bergen	13.04.1909	18825
Cleaning	Fish cleaning machine	Lund	Trondheim	13.04.1909	18826
Cutting	Removal of heads	Furø	Kopervik	26.04.1909	18864
Opening device	Cans	Rødder	Stavanger	26.04.1909	18873
Oil filling	Oil filling device	Berggraf	Stavanger	05.03.1909	18887
Containers	Cans	Barlow	England	05.03.1909	18897
Oil filling	Oil filling device	Tjensfold et al.	Bergen	06.01.1909	18975
Seaming	Seaming wheel	Tostensen	Stavanger	07.06.1909	18992
Opening device	Cans	Erik Bjelland	Stavanger	21.06.1909	19050
Containers	Die	Wattne	Stavanger	19.07.1909	19144
Containers	Cutting die	Kampe	Stavanger	09.08.1909	19212
Seaming	Seaming device	Reinert	Sandfjord	20.09.1909	19326
Seaming	Seaming device	Nessler	Stavanger	27.09.1909	19337
Seaming	Seaming device	Reinert	Sandfjord	27.09.1909	19339
Smoking	Smoking chamber	Laase & Beslag F.	Stavanger	27.09.1909	19371
Seaming	Seaming device	Nessler	Stavanger	01.11.1909	19449
Smoking	Equipment	Finne	Stavanger	08.11.1909	19492
Seaming	Automat. seaming machine	Middelthon	Stavanger	29.11.1909	19547
Smoking	Equipment	Jacobsen	Stavanger	27.12.1909	19639
Smoking	Smoking of brisling	Helvig	Stavanger	03.01.1910	19680
Cutting	Removal of heads	Knudsen	Stavanger	10.01.1910	19709
Opening device	Cans	Rødder	Stavanger	14.02.1910	19837
Seaming	Seaming device	Nessler	Stavanger	21.02.1910	19842
Threading	Threading rods	Tjaaland	Stavanger	07.03.1910	19914
Cutting	Removal of heads	Larsen	Stavanger	07.03.1910	19915
Threading	Device/tool	Stvgr. Sardine Co.	Stavanger	14.03.1910	19937
Opening device	Cans	Varden et al.	Stavanger	29.03.1910	19964
Seaming	Cans	Oulii	Stavanger	04.04.1910	19995
Containers	Die cutting	Kampe	Stavanger	20.06.1910	20209
Smoking	Smoking chamber	Tønnesen	Stavanger	20.06.1910	20219
Containers	Die and Pattern machine	Thompson	U.S.A.	27.06.1910	20233
Seaming	Cans	Stvgr. Bliktr. Fac.	Stavanger	29.08.1910	20470
Seaming	Seaming device	Jacobsen	Stavanger	24.10.1910	20617
Containers	Rhomboidal can	Dybberg	Bergen	24.10.1910	20653
Containers	Can lid	Kristiansen	Stavanger	19.12.1910	20887
Seaming	Seaming device	Jacobsen	Stavanger	09.01.1911	20944
Smoking	Smoking Kiln	Oftedal	Stavanger	23.01.1911	21060
Opening device	Cans	Rydberg et al.	Stavanger	30.01.1911	21099
Opening device	Cans	Stvgr. Bliktr. Mv.	Stavanger	?????????	21100
Containers	Lid die	Middelthon	Stavanger	20.02.1911	21170
Cans	Can opener	Ingebrigtsen	Bergen	20.02.1911	21196
Smoking	Hot air equip.	Oftedal	Stavanger	27.02.1911	21248
Smoking	Smoking chamber	Olsen	Bergen	27.02.1911	21249
Cans	Can opener	Berntsen et al.	Dal st.	07.10.1911	21565

Opening device	Cans	Stvgr. Bliktr. Mv.	Stavanger	10.02.1911	21752
Opening device	Anchovy kegs	Lende	Stavanger	23.10.1911	21810
Containers	Cutting die	Skjeveland	Stavanger	27.11.1911	21861
Containers	Cutting die	Skjeveland	Stavanger	27.11.1911	21862
Containers	Cutting die	Varden	Stavanger	04.12.1911	21884
Containers	Opening device/cans	Delpeut	Lissabon	02.05.1912	22000
Containers	Lid with sealing ring	Weck	Germany	05.02.1912	22001
Containers	Sealing device	Weck	Germany	02.05.1912	22002
Seaming	Closing of cans	Ingebritsen	Bergen	12.02.1912	22013
Cutting	Head-cutting	Jacobsen	Stavanger	12.02.1912	22018
Containers	Lid	Stvgr. Bliktr. Mv.	Stavanger	19.02.1912	22039
Cutting	Cutting machine	Viking Sardine Fac.	Stavanger	22.04.1912	22153
Threading	Threading of fish	Bøe, Kleppe	Stavanger	06.05.1912	22194
Containers	Opening cans	Markgren	Sweden	28.05.1912	22254
Sealing		Lende	Stavanger	05.05.1913	23284
Opening device	Device for cans	Scholtz	Bergen	05.1913	23304
Containers		Sandviken Blik. Fac.	Bergen	26.05.1913	23373
Containers	Inner lining	Barstad	Stavanger	26.05.1913	23379
Seaming	Seaming device	Jacobsen	Stavanger	02.06.1913	23380
Containers	Seaming	Lauritz Lea	Stavanger	02.06.1913	23402
Can opener	Cans	Carlsen	Kopervik	06.02.1913	23403
Washing	Washing machine	Nilson	Sweden	08.04.1913	23634
Opening device	Cans	Stvgr. Bliktr. Mv.	Stavanger	29.09.1913	23714
Opening device	Cans	Stvgr. Bliktr. Mv.	Stavanger	06.10.1913	23751
Opening device	Cans	Stvgr. Bliktr. Mv.	Stavanger	06.10.1913	23752
Opening device	Ring opener	Thorkildsen	Stavanger	06.10.1913	23753
Seaming	Auto. seaming machine	Record	Stavanger	13.10.1913	23779
Containers	Sealed can lid	Kampe	Stavanger	13.10.1913	23781
Fishball machine	Moulds	Nessler	Stavanger	20.10.1913	23881
Opening device	Cans	Stvgr. Bliktr. Mv.	Stavanger	27.10.1913	23947
Sealing	Sealing of cans	Scholtz	Bergen	27.10.1913	23957
Soldering	Closing of cans	Aanensen	Stavanger	10.11.1913	24004
Opening device	Cans	Kristiansen	Stavanger	10.11.1913	24009
Opening device	Cans	Clementsén	Stavanger	29.12.1913	24084
Containers	Scoreline die	Braun, Jonasen	Stavanger	19.01.1914	24159
Drying room	Drying fish	Hertevig	Stavanger	09.02.1914	24230
Seaming	Seaming device	Brynie	Stavanger	16.03.1914	24362
Opening device	Cans	Smedsvik	Haugesund	30.03.1914	24431
Opening device	Cans	Smedsvik	Haugesund	27.04.1914	24532
Smoking chamber	Frame holders	Spandow	Stavanger	15.06.1914	24687
Seaming	Seaming mach. attachment	Hinna	Stavanger	29.06.1914	24733
Cleaning	Cutting/cleaning mach.	Berggraf	Stavanger	13.07.1914	24793
Containers	Cutting die	Malde	Stavanger	24.08.1914	24954
Seaming	Seaming machine	P.V.C.C.	U.S.A.	05.10.1914	25041
Seaming	Seaming machine	Malde	Stavanger	05.10.1914	25042
Containers	Lid production	Rydberg	Stavanger	12.10.1914	25091
Threading	Threading machine	Schive	Stavanger	12.10.1914	25119
Washing	Washing chamber for cans	Lode	Stavanger	26.10.1914	25174
Sealing	Cans and lids	Berggraf	Stavanger	09.11.1914	25202

Seaming	Seaming machine	Jenssen	Stavanger	21.12.1914	25274
Opening device	Cans	Gilsvik	Stavanger	04.01.1915	25353
Threading	Threading device	Halleland	Stavanger	25.01.1915	25446
Threading	Threading device	Berggraf	Stavanger	25.01.1915	25447
Threading	Threading device	Berggraf	Stavanger	25.01.1915	25448
Threading	Threading device	Halleland	Stavanger	01.02.1915	25479
Cleaning	Cleaning mach.	Kloster	Stavanger	08.02.1915	25519
Sealing	Lid sealing	Stvgr. Blikemb. Fac.	Stavanger	01.03.1915	25613
Keys	Opening key	Berggraf	Stavanger	08.03.1915	25646
Seaming	Seaming machine	Middelthun	Stavanger	12.04.1915	25753
Cutting	Splitting fish	Kloster	Stavanger	26.04.1915	25812
Sorting	Sorting equip.	Moe	Oslo	26.04.1915	25813
Washing	Washing/drying mach.	Norland	Stavanger	26.04.1915	25816
Washing	Washing/drying mach.	Hetland	Stavanger	26.04.1915	25817
Seaming	Seaming attachment	Jenssen	Stavanger	03.05.1915	25824
Closing	Closing cans	Hermansen	Kristiansand	28.06.1915	26010
Containers	Multiple can pressing	Scholtz	Bergen	05.07.1915	26017
Sealing	Sealing machine	Evertsen	Stavanger	19.07.1915	26059
Cutting	Cutting machine	Norland	Sunde	08.09.1915	26158
Containers	Cans	Larsen	Stavanger	13.09.1915	26222
Containers	Device for cans	Davidson et al.	Scotland	13.09.1915	26223
Closing	Closing cans/lids	Varden et al.	Stavanger	13.09.1915	26224
Smoking	Smoking kiln	Ludberg	Kopervik	27.09.1915	26265
Cooking	Automatic cooking	Nordland	Lunde	10.11.1915	26335
Laying	Tray	Michelsen/Doksæter	Bergen	18.10.1915	26349
Washing	Washing mach. for cans	Jensen	Stavanger	18.10.1915	26353
Containers	Pressing	Rødder	Stavanger	01.11.1915	26394
Seaming	Seaming attachment	Bjelland, Erik	Stavanger	06.12.1915	26476
Containers	Cutting die	Evertsen	Stavanger	19.07.1915	26476
Containers	Lid production	Opsahl	Stavanger	06.12.1915	26477