

CURRENT TRENDS IN COSMETIC PRESSURE PACKS

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Current trends are discussed in the light of the latest U.S. sales figures. Reference is also made to development projects which could alter some of the present concepts.

No ONE will deny that sales of pressurized packs in the United Kingdom have increased tremendously during the last few years, and in fact the rate of growth in this country has exceeded that of the U.S.A., as will be noted from *Table 1*.

Table 1
Annual sales in million units

	1958	1959	1960
U.S.A. and Canada .. (according to CSMA)	470	575	670
U.K. (estimated)	16½	25	45-50

Table 3
Percentage changes in sales between 1959 and 1960, based on *Table 2*

PRODUCT	CONTAINER				
	Glass and plastic, all sizes	16 oz. but over 12 oz.	12 oz. but over 6 oz.	6 oz. and less	Total
Shaving lather ..	—	+720%	— 3·8%	—11·3%	— 6·1%
Hair sprays and dressings	—	+ 75·3%	+35·2%	+12·6%	+40·4%
Dental cream	—	—	—	—	—83·3%
Colognes					
(a) Over 1 oz. ..	+2·33%	—	—	—10·9%	— 2·24%
(b) 1 oz. and less ..	+123%	—	—	+83%	+98%
Other personal products	—	—	—82·4%	+22·1%	—17·6%

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Table 2
 Extracts from Survey of Pressurized Products filled in 1960 and 1961 in the U.S.A. and Canada^{2,3}

PRODUCT	NUMBER OF UNITS FILLED									
	Glass and Plastic Containers All Sizes		Metal Containers				Total			
	1960	1959	16-Ounce but Over 12		12-Ounce but Over 6		6-Ounce and Less		1960	1959
Shaving Lather ..	*	—	2,506,908	306,138	19,579,415	20,352,663	46,088,108	51,952,158	68,174,431	72,610,959
Hair sprays and dressings ..	1,891,229	*	39,429,557	22,360,817	35,329,333	26,128,270	35,211,140	31,198,387	111,861,259	79,687,474
Dental cream ..	*	—	—	*	2,784,968	*	*	11,241,523	2,784,968	11,241,523
Colognes and Perfumes										
(a) Over one ounce ..	19,018,940	18,586,393	—	—	—	—	8,732,276	9,798,833	27,751,216	28,385,226
(b) One ounce and under ..	4,896,015	2,211,201	—	—	—	—	6,373,287	3,481,634	11,269,302	5,692,235
Other personal products ..	*	666,622	*	542,704	568,005	3,239,335	9,513,199	7,792,377	10,081,204	12,241,638

*Too revealing to be released.

The tremendous spurt of 1960 over 1959 is undoubtedly due to the increasing number of different products which are now utilizing the pressurized pack, particularly cosmetics and polishes. Cosmetics (mainly hair sprays and perfumes) account for between 20 and 25 per cent of the total sales¹. While the United Kingdom figures are mainly guesses, however well informed, the United States figures (which include Canada) are based on the annual surveys conducted, and published, by the CSMA, and it behoves us to study these more closely as they may give a clue towards the future of cosmetic pressure packs in this country.

In the opinion of the CSMA Committee the totals actually reported (*Table 2*) should be adjusted upwards as follows:—

Table 4

Product	Million Units	
	1960 ²	1959 ³
Shave Creams	—	5
Hair Spray	5	20
Dental Cream	—	4
Cologne	3	5

As these adjustments refer only to totals they have not been taken into account in the comments that follow below.

SHAVING CREAMS

It will be noted that the total has decreased by 6.1%. At the same time, however, there has been a growth of 720% in the "over 12 oz." (i.e. 14 oz. and 16 oz.) size resulting in an actual growth of the market based on weight of shaving cream sold.

In the United Kingdom, however, pressurized shaving cream certainly does not account for almost 10% of the total sales as our shaving habits appear to differ from those prevailing in the U.S.A. in so far that the stick is still preferred to the brushless type. A pressurized shave cream is, after all, only a more convenient pack for a brushless cream. It is, of course, true that most ranges of men's toiletries now include a pressurized shaving cream, but one fears that this is intended primarily in order to complete the range and in order to be as good as the competitor, rather than as a definite entry into the pressure pack market. The high prices of some of these products surely confirm this thought. In any event, even the popularly priced brands are experiencing rather lean sales. Perhaps the use of 16 oz. containers, without a proportional increase in price, may help

pressurized shaving cream to achieve part of the popularity which it enjoys in the U.S.A.

HAIR SPRAYS AND DRESSINGS

The U.S. figures reveal an increase of 40% based on *Table 2*, which might only amount to 16% if the adjustments referred to in *Table 4* are taken into consideration. There is a marked increase in the 6 oz.-12 oz., i.e. 8 oz., and in the 12 oz.-16 oz., i.e. 14 oz. and 16 oz. sizes. For the first time, the number of units packed in glass and plastic containers is of sufficient magnitude to escape the "too revealing to be released" classification. Despite the tremendous increase in these two sizes, the smaller containers have also increased in total and this must surely be attributed to the handbag size of container, particularly as in this grouping there was a 70% decrease from 1958 to 1959³. Without any further subdivision it is difficult to assess how popular the handbag size really is, but there is no doubt that it indicates a potential market development. The increase in the "8 oz. and over" size in the U.S.A. is also reflected in the tendency towards the 8 oz. size in this country. Containers with a capacity of 12 oz. and over, which normally have a diameter of $2\frac{11}{16}$ in. (211) must be considered as too difficult for women to handle, and the $2\frac{1}{8}$ in. (202) diameter dispenser is certainly more in keeping with the smaller female palm. The convenience of the purse pack is obvious. It offers the possibility of a touch-up spray to the hair while away from home, i.e. at a show, dinner, after the Test Match, etc. In the U.S.A., the prices of the purse size pack and of the 8 oz. size of hair lacquer, are virtually identical around \$1, and this does put a high premium on the convenience of the smaller pack. One such pocket size hair lacquer has recently been marketed in this country, retailing at 3/11. This indicates that it is considered worthwhile to market a pressurized pack which offers an added convenience, even if the price is proportionally high. At the same time, let it not be forgotten that hair lacquers were made by pressure packs.

So far as the product itself is concerned, there is a tendency to provide for different conditions, i.e. lacquers with high fixative properties, lacquers with low fixative properties, high gloss, low gloss, etc. Although shellac, PVP, and copolymers of the latter predominate as film formers at the moment, the use of alternatives is being actively pursued, particularly in the U.S.A., where the La Maur owned U.S. patent covering sprayable, water-free, alcoholic PVP hair preparations, was sustained earlier this year⁴. That decision recognised the patent as a basic one in the pressurized hair spray field, seemingly pointing to the conclusion that all practical sprays containing *Freon* (i.e. fluorocarbon)-type of propellant, alcohol and PVP are covered by that patent. It was also ruled that copolymers of PVP,

such as PVP/VA, are simply diluted forms of PVP and therefore also covered. So far as is known, no similar application for a patent has been filed in this country. A number of alternative resins have been developed, and although samples of some are at the moment only available in the U.S.A., in due course they will no doubt also find acceptance over here.

An alternative to PVP and the copolymers of vinyl pyrrolidone and vinyl acetate P(VP/VA) which suffer from the fault that they take up too much moisture in a humid atmosphere, is the use of polyvinyl imidazole (PVI)⁵. The lacquer obtained is claimed to yield a film which is said to be substantially tack-free at relative humidities of 50% to 90%. This new resin is soluble in water and also in alcohol. The pressurized formulation is covered by a patent⁶. From tests described it is noted that mixtures of PVP and PVI are less hygroscopic than PVP/VA copolymers in the same proportions. It is not necessary to include a plasticiser or special detackifying agent in pressurized hair lacquers based on this resin. Alcohol is needed as a solvent when utilizing propellants 11 and 12, in which 11 makes up 20-25% of the mixture. PVI is soluble in chlorotrifluoroethane, and if this relatively new propellant (*Arcton 133a*) were to be used then an alcohol-free spray could be prepared.

Another alternative would be the use of polymers of substituted N-vinyl oxazolidinones^{5,7}. For pressurized hair sprays PVO-E is suggested and this is poly-N-vinyl-5-ethyl-2-oxazolidinone. Yet another alternative is PVO-M (*Devlex 130*) in which the ethyl group has been replaced by methyl. Details of hair setting preparations based on these resins are found elsewhere⁸. PVO-E has the advantage of being more soluble in alcohol-propellant mixtures than PVO-M. It is, however, less soluble in water, and might not wash out of the hair very easily. At the moment PVO-E is not produced commercially. A copolymer of PVO-M and PVA is marketed as *Devlex A515*. This copolymer is more compatible with organic solvents than PVO-M, but it is not very soluble in alcohol-propellant mixtures. In order to prepare a satisfactory pressurized lacquer from *Devlex A515*, it is necessary to make use of cosolvents such as methyl chloroform (*Chlorothene*), or methylene chloride⁵.

Altogether the number of patents dealing with hair spray compositions^{9,10,11} is on the increase, particularly in the U.S.A., and marketers will do well to ascertain that their intended formulations cause no patent infringements.

The trend to market tinted hair lacquers is also on the increase and recently a range of temporary hair colours was announced by a British firm¹². This particular range is available in shades of pastel pink, lilac, black, pastel blue, auburn, chestnut brown, gold, smoky grey, and green.

There would also appear to be considerable scope for expanding the

sale of hair preparations for men. One British firm is already producing a hair lacquer, but no hair creams have yet been marketed in this country. A well-known hair dressing has been marketed only quite recently in the U.S.A., though in the unconventional piston-type of pressure container¹³. Although somewhat more expensive than the conventional container, it does offer the possibility of keeping the propellant and product apart, where such separation is considered necessary. In some European countries, brilliantine is now being marketed in the conventional pressure pack, i.e. with fluorocarbon propellant. One particular product is available either with a standard valve or with a metering valve, though for both types a mechanical break-up spray actuator is employed¹⁴.

Geary's work on low cost water based pressure packs could also have a tremendous influence on future expansion of pressurized hair lacquers. According to Geary¹⁵, a satisfactory spray can be obtained when using as little as 14% *Ucon 12*. It is, however, necessary to ensure that the corrosion inhibitor, which may turn out to be the most satisfactory from a functional point of view, has no deleterious effects on the performance of the lacquer.

DENTAL CREAM

The sales of dental cream, both in the U.S.A. and in the U.K., continue to decline. In the U.S.A., as will be noted from *Table 2*, there is a decrease of over 70% in total units sold from 1959 to 1960, and even if one assumes that all dental cream sold was packed in 12 oz. dispensers then there is still at least a 50% decrease in total weight of dental cream. In this country, the total sales of pressure packed toothpaste probably never exceeded 1 million units, and the sales are also declining despite the recent introduction, by a multiple store, of its own new brand¹⁶. Pressure packed toothpaste is one of the few products where the packing principles involved offer no specific advantage over the conventional collapsible tube, and this underlines the fact that a successful pressure pack must offer at least one distinct advantage over conventional packing, be it ease of application, convenience of handling, a.s.o. That is not to say that nitrogen-propelled packs have no future; quite the contrary, as will be discussed below.

COLOGNES AND PERFUMES

No one can fail to be impressed by the substantial increase in the one-ounce-and-under cologne and perfume group, as revealed by *Table 2*. Although glass containers have increased to a greater extent than metal containers, many of the former are in fact protected by metallic outers, and very handsome looking packs they do indeed all turn out to be. No one in this country has yet managed to reproduce the elegance of the many

perfume and spray cologne packs which are sold in the U.S.A. and in France. As the metallic outers almost invariably utilize aluminium it is possible to achieve a variation in appearance, and judicious resort to embossing, and similar processes, inevitably enhances an already excellent presentation ever further. Moulded plastic outers have also been utilized to great effect. The increase of glass packs has already been referred to above, but it is gratifying to note that even in the U.S.A., unprotected glass dispensers are being treated with greater seriousness and one of the C.S.M.A. committees is conducting a survey in order to ascertain whether internal pressures in excess of 15 p.s.i.g. are being employed, the aim being to ensure that such a pressure be considered a maximum. The majority of U.S. companies engaged in marketing refills for packs having metallic outers, utilize plastic coated glass containers for this purpose.

SUNTAN PREPARATIONS

With suntan, i.e. sunscreen preparations, there is a definite tendency towards the foam pack, which is certainly more pleasant to use than the spray. Some products also incorporate insect repellants, but it is doubtful whether there is much advantage in such a combination, as mosquitoes, and the like, are generally not in evidence in bright sunshine.

PERSONAL DEODORANTS

Personal deodorants are just making their debut on the British market¹⁷, though some have been available abroad, both in the U.S.A. and in various European countries. This type of product, if properly formulated, does present corrosion problems to metallic containers and there is a tendency of valve blockage, particularly when using aluminium salts. This may well explain why such a useful product has not been previously marketed to the extent that one might have hoped. There are indications, however, that many of these difficulties are gradually being overcome.

NITROGEN PACKS

The fact that nitrogen-propelled toothpaste is a failure does not mean that nitrogen as a propellant must be thought of in the same way. It is, however, necessary to ensure that definite advantages accrue to the user before embarking on the packing of a nitrogen-propelled product, be it in the conventional manner or through use of the piston-type dispenser. Nitrogen-propelled handcream^{18,19}, hair cream¹³, and hand lotion have been marketed, and this is indicative of the direction in which future developments will be found.

CONTAINERS AND VALVES

With cosmetic products, appearance of the finished pack is probably as important as the successful function of the pack itself. With tinplate containers, presentation will depend very largely on the external decoration or on the label, and on the style and type of protective cover employed. Aluminium containers offer the possibility of fluting, bulging and other fancy shapes, which coupled with better external finishes, such as anodising and flock coating, stimulate the interest of marketers for whom individuality is more important than costs. The *Delrin* acetal container, already utilized in the U.S.A. for a hair spray²⁰, may soon give rise to the first British pack in a plastic dispenser. It, too, offers individuality.

The valve varieties now or soon available in this country will be almost equal to those obtainable in the U.S.A. Metering valves, for liquefied gases and compressed gases, will undoubtedly lead to an increase in the pocket size dispenser not only for hair lacquers, perfumes and colognes, but also for personal deodorants, insect repellants and breath deodorants.

TECHNICAL DEVELOPMENTS

Reference to Geary's¹⁵ work has already been made. It is important to appreciate that future research is necessary before many of Geary's suggestions become of practical significance. On the other hand, once the problems outstanding have been solved, it should be possible to produce low cost cosmetic pressure packs. For those unfamiliar with Geary's work, it should be explained that Geary has carried out extensive solubility studies of the ternary systems of water, fluorocarbon propellants and co-solvents, as a result of which basic, low cost, water based, cosmetic formulations have been developed. These are all two-phase systems, i.e. the water, the solvent, the liquid propellant and the active ingredients form a homogeneous liquid phase. A number of inhibitors have also been evaluated.

West²¹ has been engaged in research on powder packs, and has suggested a method whereby the amount of powder in a pressurized pack might be increased to as much as 25 per cent compared with the present maximum of approximately 8 per cent. This is achieved by the addition of a small amount of bulking powder.

CONCLUSION

It will thus be apparent that cosmetic pressure packs will be able to benefit not only from an expansion in general sales, but also as a result of the various development projects now in progress be they purely scientific or otherwise.

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- ⁴ *Drug and Cosmetic Ind.* **88** 277 (1961)
- ⁵ *Schimmel Briefs* **310** (January 1961)
- ⁶ U.S. Pat. 2,953,498
- ⁷ U.S. Pat. 2,919,279
- ⁸ U.S. Pat. 2,948,656
- ⁹ U.S. Pat. 2,956,927
- ¹⁰ U.S. Pat. 2,957,838
- ¹¹ *Parfümerie und Kosmetik* **42** 8 (February 1961)
- ¹² *Chemist and Druggist* **175** 8 (27th May 1961)
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- ¹⁴ Geary, D. C. *Technical Service Department Report* (1960) (Union Carbide Chemicals Company, New York)
- ¹⁵ *Soap, Perfumery & Cosmetics* **34** 277 (1961)
- ¹⁶ *Chemist and Druggist* **175** 542 (1961)
- ¹⁷ *Chemist and Druggist* **174** 569 (1960)
- ¹⁸ *Soap Chem. Specialties* **36** 127 (November 1960)
- ¹⁹ *Modern Packaging* **34** 87 (December 1960)
- ²⁰ West, R. D. Private communication (1960)

DISCUSSION

Introduction by the lecturer

I have recently come across 1960 production figures which disagree with the ones cited.* Cosmetic and toilet goods are thought to account only for 10% of the total, and it is also stated that 13 different products are concerned.

I have referred to the piston-type container¹³. I now know that it is not correct to state that the product and propellant are completely separate. With the particular hair cream, the product is in fact saturated with nitrogen, which has by-passed the piston.

MR. C. BLOOM: (1) I agree entirely with the lecturer that the toothpaste pressure pack is an example where the packaging principles involved have no real advantages over existing packs and I would say that this sort of development does harm to the aerosol industry. I do, however, believe that hair cream pressure packs have the same disadvantages and it seems to me that the newer non-pressurized forms of packaging of these products are admirable. But no doubt there are people here today who can reply to this one. Are there possible cost and convenience advantages for such a pressure pack?

Mfg. Chemist* **32 282 (1961)

(2) Can the lecturer please expand on the method of increasing the amount of powder in a powder aerosol spray ?

THE LECTURER : (1) I do not think that the nitrogen-filled dental cream pack harms industry in any way. Bad products which break down and deteriorate harm the industry, but if a product is formulated correctly, it cannot possibly harm us.

In normal circumstances, hair cream is taken from a jar and usually an excessive amount is withdrawn, but with a compressed gas propelled product, and with stream ejection, the amount of product extruded can be better controlled. When a material is too thin to be packed in a tube, and too viscous to be packed in a bottle, a nitrogen pack is ideal.

(2) West bases his formulations on specific gravities and specific volume. He commences with a given volume of propellant, and a given percentage of powder and then bulks his powder with some material such as *Snowfloss* or *Santocel 54*. Only a further small amount of powder to fill the remaining volume is needed and in theory the two powders remain suspended indefinitely. I have, however, not succeeded in verifying these results.

West, in conjunction with an American valve manufacturer, has laid down a specification for a special powder valve with large passages which are few in number in order to aid the rapid exit of powder, and to avoid clogging.

MR. H. S. FORBES : (1) Can the valve be designed to act as a safety device ?

(2) What is the position concerning hydrocarbon propellants? (Cost vs. inflammability vs. corrosion).

THE LECTURER : (1) I presume you wish to prevent explosions in the event of excessive pressures. The valve must be sufficiently secure to prevent the contents from escaping, and it must also be able to pass the hot water test. Safety devices of a sort are being tested in the United States, where they are necessary because of the number of incinerators, and the number of explosions which do occur. A fusible plug is being considered for this purpose. The plug will melt at a temperature below the explosion limit. If the container were to be subjected to a temperature which is not extreme enough to explode the container, but of sufficient temperature to melt the plug, the latter could be activated without necessity. Nevertheless, this will probably be employed in the United States.

(2) Hydrocarbon propellants are cheaper than *Arcton* propellants, and more expensive than the compressed propellants. Butane, *isobutane* and propane are included in this class and are somewhat odorous ; this aspect

has to be taken into consideration. Corrosion presents no problem if the product itself is safe.

MR. R. CLARK : Are there any laws concerning the use of hydrocarbon propellants ?

THE LECTURER : Butane is not contained in the Petroleum (Consolidation) Act 1928 because its flash point cannot be determined by standard methods. At present, therefore, there are no regulations against using it.

There are, however, local bye-laws concerning filling equipment, etc. For pharmaceutical products which come into intimate contact with sensitive membranes, non-chlorinated hydrocarbon propellants are probably far more suitable than the halogenated ones, because of possible hydrolysis.

MR. H. S. FORBES : Do you distinguish between corrosion arising from the nature of the product and that arising from the decomposition of the propellant ?

THE LECTURER : A product which is inherently corrosive to a container, e.g. with a low pH or containing rust promoting substances, will undoubtedly attack the container in its own right. Some propellants, because of their very nature, and possibly in combination with a product, will also attack the container. Sometimes, however, the corrosion may be due entirely to the propellant alone. It is usually difficult to distinguish the two. Many theories have been proposed with regard to corrosion by the alcohol/water/propellant system.

MR. H. S. FORBES : Could you indicate reliable tests which can be used to measure lacquer adhesion and how do you interpret the observed results ?

THE LECTURER : Lacquer adhesion is usually tested by the rule of "thumb nail" where the lacquer is scratched to see if it will come off. Alternately Cellotape is applied, and the ease with which the lacquer lifts on pulling the tape is assessed. When testing various lacquer systems, the container would be cut open in an attempt to make a flat surface out of what is normally a curved one, thereby damaging the lacquer and subjecting it to stresses which it is not meant to withstand.

MR. K. DUDLEY : In our laboratory tests, we examine the tinplate as it is cut, apply Cellotape, etc., but it is very difficult for us to define scientifically what we are looking for. We have tried very objective means of doing this, using methods which involved trying to assess the amount of energy required to remove areas of lacquer from metallic surfaces, but there is no correlation or reproducibility.

MR. W. A. WOODWARD : Have you any experience of the "two pack"

aerosol, the product being in one container and the propellant in a separate container?

THE LECTURER: I have not handled these personally. There are some perfume dispensers of this type in France. These have very complicated valves which increase the cost of the pack considerably. An alternative is the "Jet Pack", which has been licensed to one of the contract fillers in this country. A plastic handle incorporates a nozzle and a container of propellant is utilized. A refillable product container is fitted, and on operation the propellant passes towards the nozzle, and simultaneously draws up product from the reservoir; in fact similar to the old-fashioned perfume atomizer. This type of pack is used mainly for paints. The U.S. Nebu-Halent pack for asthma sufferers is very similar in action.

MR. W. A. WOODWARD: In pressurized packs of toilet powders, the particle size must be very important. Could you give us details of the range required for successful formulation?

THE LECTURER: Approximately 325 mesh. It all depends on the valve, and the amount of powder in the container. 8 per cent is the maximum with the majority of valves. I would also refer you to the work of Geary and West [*Aerosol Age* 6 25 (August 1961)].

LETTER TO THE EDITOR

Sir,—I refer to J. S. Jellinek's paper "Evaporation and the Odor Quality of Perfumes", in page 168 of the April 1961 issue of the *Journal*. I would like to comment that all these experiments show is that the rate of evaporation is influenced by the composition of the bulk. They do not indicate any reason for this, although conjecture is permissible, but fixation is not necessarily a result of molecular association as is advanced in this article. A substance completely inert to one of the smells covering say, $\frac{9}{10}$ of the surface of the perfume would decrease the odour concentration or balance of odour to approximately $\frac{1}{10}$ due to the reduction of the uncovered surface under the conditions of the described experiment and thereby act as a "fixative".

The relative factors in fixation are the extent of the surface available to the bulk molecules for their evaporation, the energy of their evaporation and the molecular reflexion properties of the surface, although this latter will not apply to the experiments described. [*J. Soc. Cosmetic Chemists* 7 69 (1956)].

Yours faithfully,

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