BAMA

BRITISH AEROSOL MANUFACTURERS' ASSOCIATION

20 April **2022**

Innovation Day

AER BEATHA LTD

Agenda

1. Introduction
2. History
3. Problem
4. Solutions
5. Automotive Case Study
6. Summary

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Introduction

Aer Beatha

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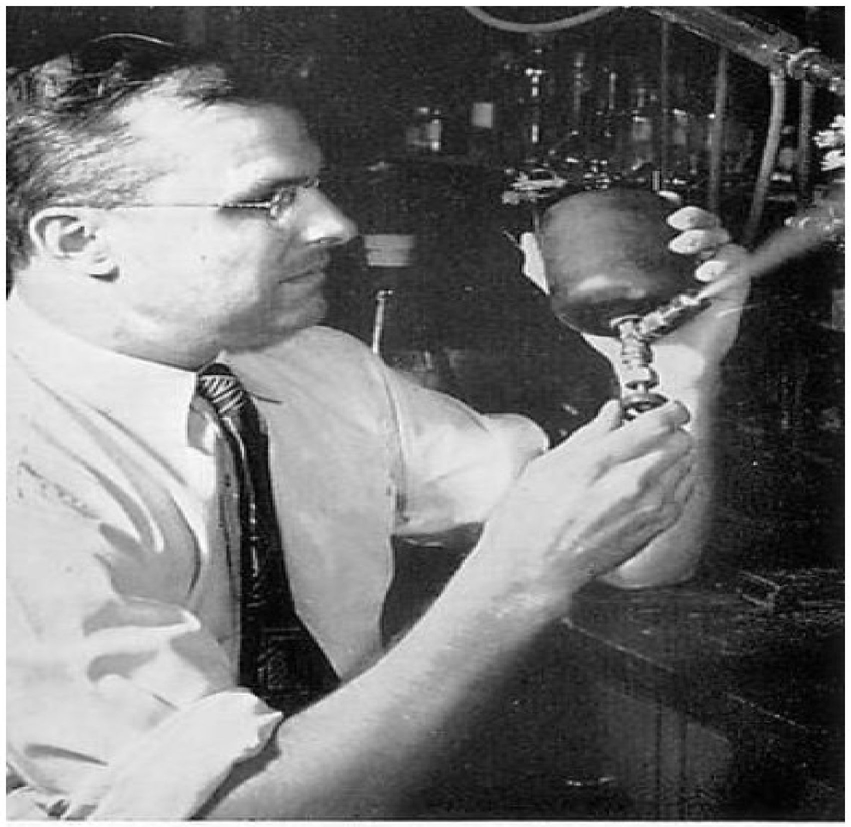
History

History



Dr. L. D. Goodhue
tests early insecticide aerosol.

Lyle D Goodhue testing an early aerosol insecticide. | Photo Credit: Lyle D Goodhue and U S Government Wikimedia Commons

Figure 15. Aerosol Cans of "Flit" and "Aerosect"
A Continental Can Company "double concave" aerosol can of FLIT Insect Spray (Esso Oil Company, now Exxon) made in 1951 and still functional in 1981. Also illustrated is an AEROSECT "bomb", an insecticide filled for Pennsylvania Engineering Company in 1946.

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History

Patented Oct. 5, 1943 2,331,117

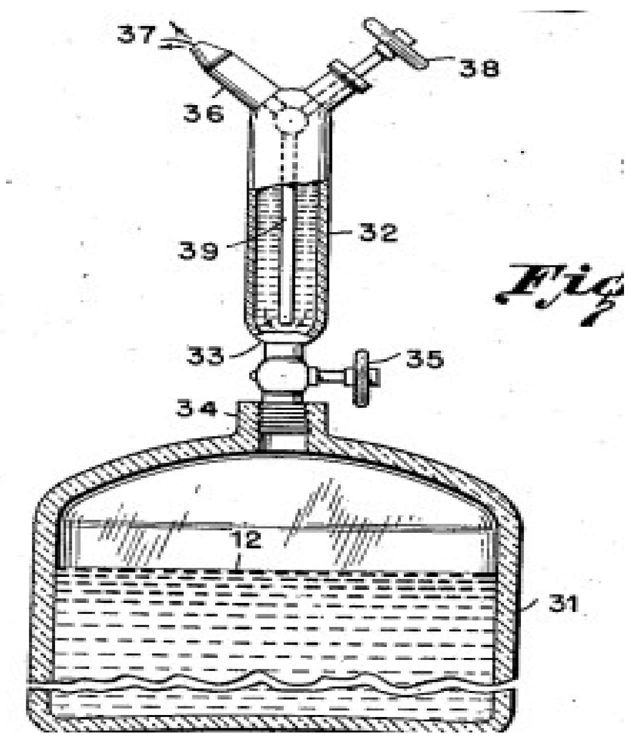
UNITED STATES PATENT OFFICE

2,331,117

DISPENSING APPARATUS

Lyle D. Goodhue, Berwyn, Md., and William N. Sullivan, Washington, D. C., assignors to Claude R. Wickard, as Secretary of Agriculture of the United States of America, and to his successors in office

Application October 3, 1941, Serial No. 413,474



Refill-Reuse

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History

TABLE XXV.

Propellent Selection for Aerosols Filled in 1979 (%)

Country	Fluorocarbon	Hydrocarbon	D.M.E.	$CO_2/N_2O/N_2$*
U.S.A.	1	90	0	9
England	68	30	0	2
France	70	25	0	5
West Germany	67	23	0	10
Italy	60	30	0	10
Denmark	55	40	0	5
Belgium	50	28	18	4
The Netherlands	20	62	15	3
Canada	11	82	0	7
Mexico	47	51	0	2

*In the approximate ratio of 85:14:1.

The graph suggests a loss of about 4.33 billion units up to 1990, after which it is assumed the controversy should have no further impact on aerosol usage, even it it has not been resolved scientifically by that time. Using the *CSMA* figure of 2.165 billion units for 1980, this loss of business adds up to two full years of production. Actually the analysis shown in Figure 9 is extremely conservative; other econometric studies point to losses of two to five times this amount.

The U.S.A. position against chlorofluorocarbon gases has been the subject of endless debate. Aerosols were the first target of the EPA and FDA. The effect of their regulations, plus the international activities of the EPA in trying to achieve wider bans on chlorofluorocarbons, is shown in the following Table XXIV, from which it is apparent that sales diminished after 1974 on a worldwide basis.

Despite the increasingly obvious defects and shortcomings of the Rowland-Molina theory, where these researchers tried to explain three-dimensional atmospheric phenomena using a one-dimensional computer study, the EPA strove vigorously to export the U.S.A. position on banning CFC aerosols to a variety of other nations. They received mixed reactions, more generally on the negative side. About 1979 Canada agreed to a partial ban on fluorocarbon propellents, where they were used as true propellents for hair sprays, personal

History

Aerosol Production

A majority of marketing analysts believe that the aerosol industry has reached the point of saturation in the U.S.A., Canada, many Western European countries, and so forth, and will not continue to grow beyond the increments related to population growth unless significant new products are developed. Perhaps the highest aerosol sales density ever recorded took place between about mid-1973 and mid-1974 in the U.S.A., when a volume of significantly over 3 billion units per year drove per capita consumption to 14.1 units per year. In contrast to this, the per capita use during 1979 in various major markets is shown in Table XXIII.

The 28% decrease in per capital usage between the peak year and 1979 in the U.S.A. is due largely to the exceedingly bad publicity and government regulations that followed in the wake of the CFC/ozone controversy that surfaced in 1974. (The added effect of the 1980 recession widened this to a 35% decrease, since per capita usage was only 9.15 units.)

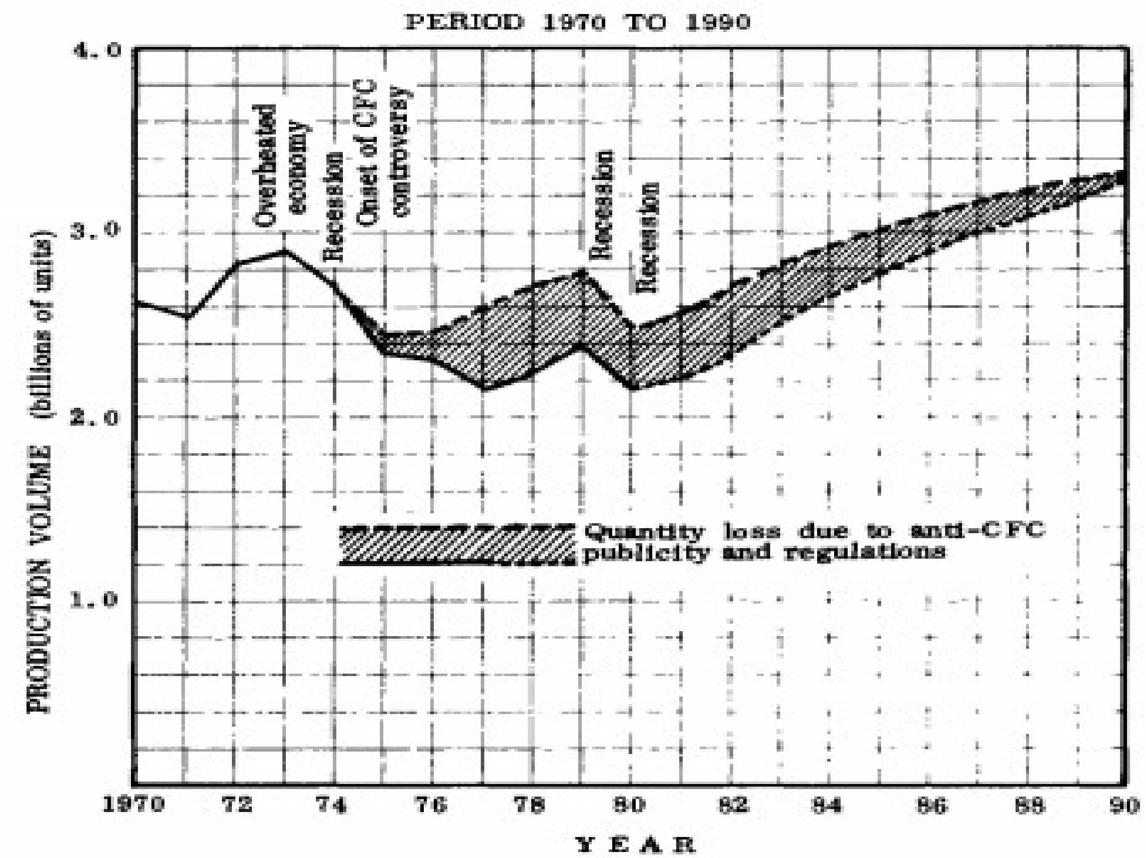

Figure 9. Difference between Demand in the Absence of CFC Regulation and Demand with Regulation

History

TABLE VII

Total Unit Hair Spray Market in The U.S.A.

(Expressed as number of aerosol hair spray can equivalents; 1973 - 1980.)

	Market Share (Per Cent)			Actual Units (MM)		Equivalent Units (MM)				
Year	Aerosols	Pump Sprays	Other (as dips)	Aerosols	Pumps (etc.)	Aerosols		Aerosol Equiv.*		Total
1973	97	3	0	453	14	453	+	25	=	478
1974	96	4	0	376	16	376	+	29	=	405
1975	87	13	0	308	44	308	+	79	=	387
1976	79	19	0	285	76	285	+	137	=	422
1977	71	28	1	223	89	223	+	160	=	383
1978	66	33	1	224	115	224	+	207	=	431
1979	63	36	1	238	140	238	+	252	=	490
1980	62	37	1	252	154	252	+	277	=	529

*Expressed as the actual number of pump-sprays, dips and other non-aerosols, multiplied by a factor of 1.8.

Problem

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Aerosol Spray Generation

Aerosol with LIQUEFIED PROPELLANT

Aerosol with COMPRESSED PROPELLANT

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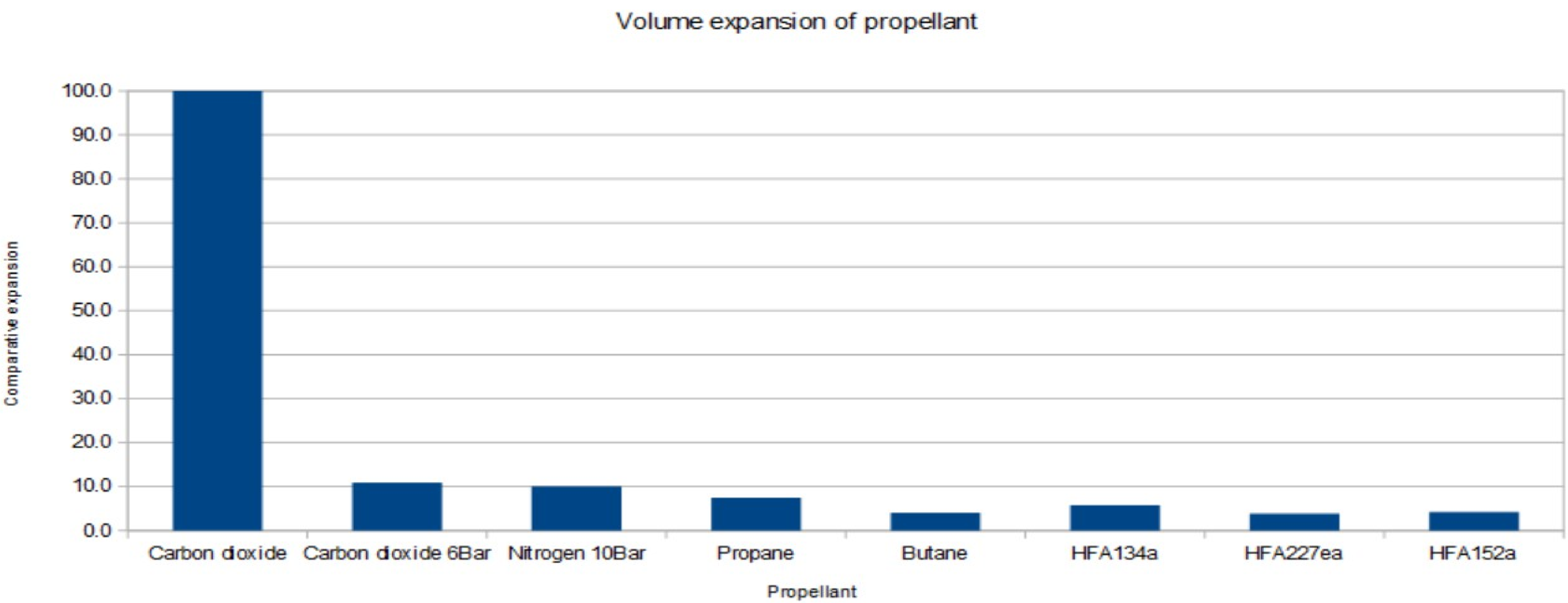
Propellants

	DME	HFC152a	HFC134a	Propane	I-butane	N-butane	N2	Air	CO2	N2O
Boiling point (°C)	-25,1	-25,1	-26,1	-42,1	-12,2	-0,5	-195,8	-194,1	-78,4	-88,5
Vapour pressure (21°C)	4,3	4,3	4,9	7,5	2,1	1,2	n/a	n/a	58,2	52,4
Liquid density (21°C)	0,66	0,91	1,21	0,51	0,56	0,58	0,00114	0,00129	0,713	0,913
Flammability in air (LEL)	3,3	3,9	n/a	2,2	1,8	1,9	NO	NO	NO	NO
Flash point (°C)	-41	-50	NO	-104	-83	-74	NO	NO	NO	NO
Solubility in water (%wt)	35,1	1,7	1,1	0,007	0,008	0,008	0,015	0,018	0,759	0,588
Flammability	YES	YES	NO	YES	YES	YES	NO	NO	NO	NO
Toxicity	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW
Environmental	VOC	No VOC	GWP	VOC	VOC	VOC	LOW	LOW	LOW	LOW

Propellants Volume Expansion



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Aerosol VOC emissions

Fig. 5. Total NMVOCs (wt%) within selected aerosol sprays with LPG propellant.

Environment International 146 (2021) 106152

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Aerosol VOC emissions

(2002). Taking the UK as likely representative of other countries in Europe in terms of consumer behavior and habits, the fraction of UK national emissions represented by aerosol propellants grew from around 2.0% of national emissions in 1990 to around 6.1% in 2017. Although this may superficially appear to be still a relatively modest contribution, put in perspective, the official inventory estimated UK emissions of VOCs from aerosol use in 2017 (approximately 60 kt pa) were greater than the total VOC emissions arising from all passenger cars in the UK (estimated as approximately 30 kt pa in 2017, Office for National Statistics UK, 2019).

Yeoman, AM and Lewis, AC. 2021. Global emissions of VOCs from compressed aerosol products. Elem Sci Anth, 9: 1. DOI: https://doi.org/10.1525/elementa.2020.20.00177

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Solutions

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Solutions

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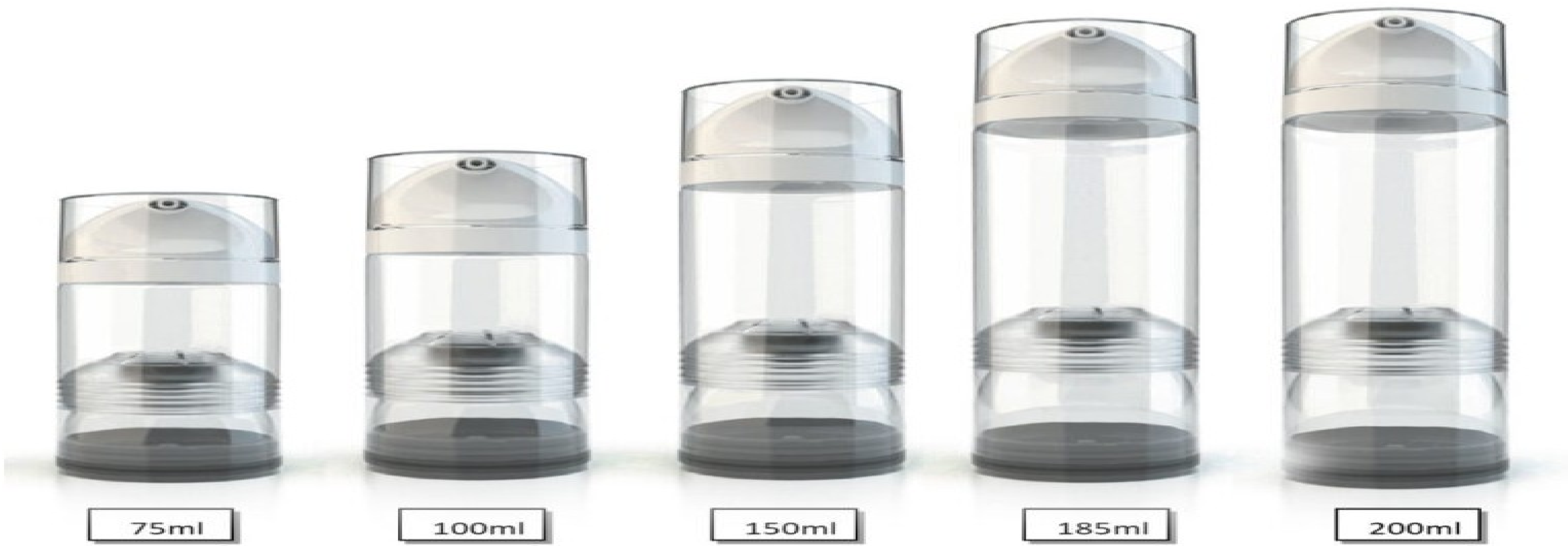

Solutions

DITY SPRAY

Solution

Refill – Reuse Spray System

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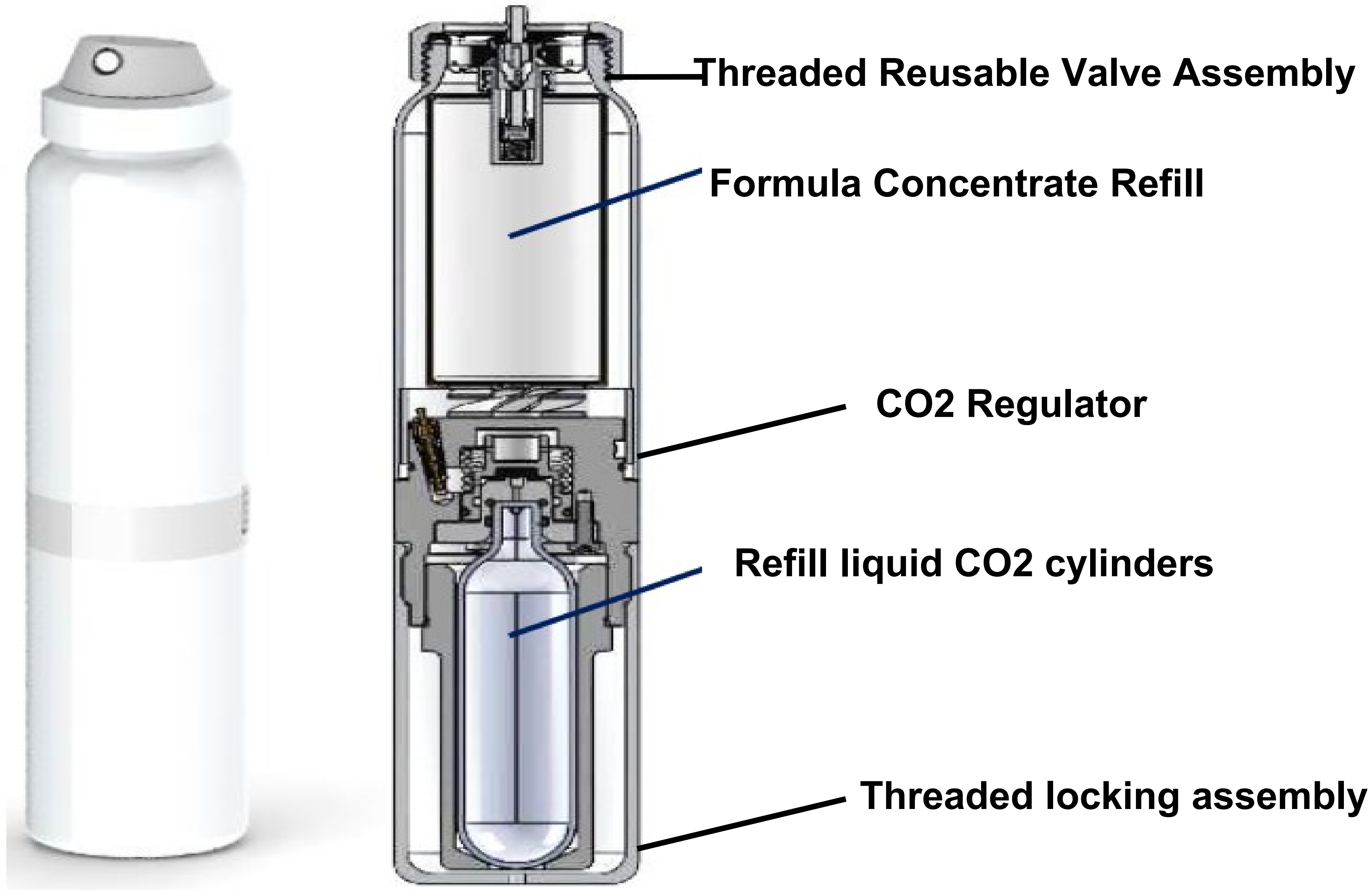
Stage 1



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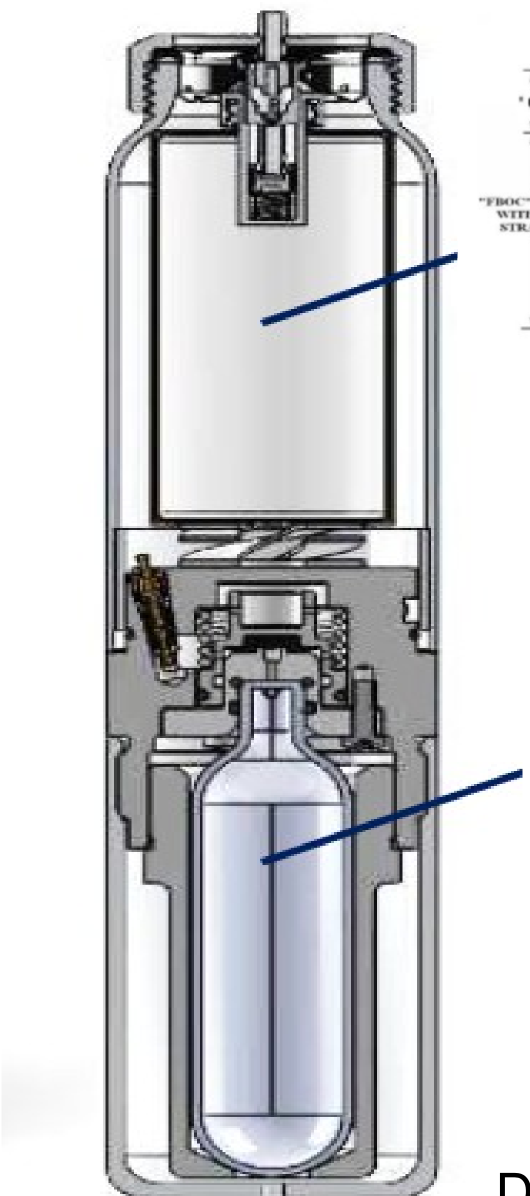
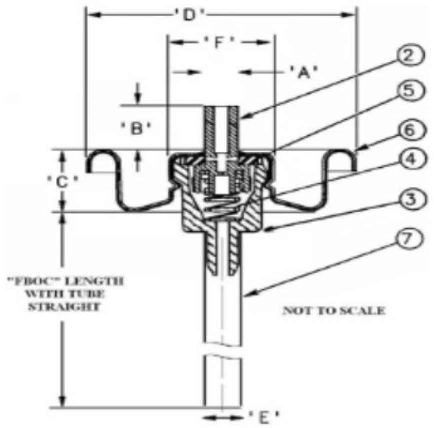
Stage 1
Standard 1" Valves Performance





Aqueous formulation	Stem	Pressure/Bar	Actuator			
			753050	753013	753054	751007
Spray rate g/s	45241	3	0.8	1.0	1.1	1.4
Spray rate g/s		5	0.9	1.4	1.4	1.7
Comment			VFS	WS	FS	WS
Spray rate g/s	45242	3	0.8	1.2	1.3	1.7
Spray rate g/s		5	1.0	1.5	1.7	2.2
Comment			VFS	FS	FS	WS
Spray rate g/s	45243	3	0.8	1.1	1.2	1.8
Spray rate g/s		5	1.0	1.5	1.6	2.3
Comment			VFS	FS	FS	WS
Spray rate g/s	45244	3	0.7	1.1	1.2	1.5
Spray rate g/s		5	0.9	1.4	1.5	1.8
Comment			VFS	FS	FS	WS
Spray rate g/s	45245	3	0.8			
Spray rate g/s		5	1.0			
Comment			VFS			
Spray rate g/s	45246	3	0.8			
Spray rate g/s		5	1.0			
Spray rate g/s		7	1.2			
Comment			VFS			
FS-Fine Spray						
VFS-Very Fine Spray						
WS-Wet Spray						

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Aerosol Spray Generation

PHYSICAL REVIEW X **8,** 031019 (2018)

What Determines the Drop Size in Sprays?

Stefan Kooij,[1] Rick Sijs,[1] Morton M. Denn,[2] Emmanuel Villermaux,[3,4] and Daniel Bonn[1]

VII. DISCUSSION AND CONCLUSION

We have found that the droplet-size distribution depends on the liquid surface tension, nozzle type, and flow rate of the spray, but it is independent of the viscosity of the liquids used. The average drop size can be changed without altering the overall shape of the distribution significantly by simply changing the nozzle or pressure or by adding ethanol to lower the surface tension. In the latter case, however, there remains an unexplained increase for the biggest droplets, although this increase is not very significant in an absolute sense.

Because of the relatively weak dependence of the median droplet size on the spraying parameters, the most effective and practical way of changing the median droplet size is by changing the pressure and, hence, the flow rate. Changing the surface tension has a limited effect, since for most fluids, the surface tension cannot be changed significantly, without adding a substantial amount of another liquid. Even

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Application Areas

Household sprays
Industrial sprays
Healthcare & Consumer
Paint & Adhesive
Professional & Janitorial (Pest Control)

Switch back from trigger to spray

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Benefits

Low or Zero VOC
Low or Zero GWP

Guaranteed supply & price → CCS CO_2
In line with circular economy

No aerosol plant needed

Low or Zero abuse
Non-flammable (handling, storage, shipping & user)

Long shelf life
New formulations possible

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Challenges

Legislation - Reuse
Consumer acceptance – education
Risk – misuse of device
Investment
Supply chain

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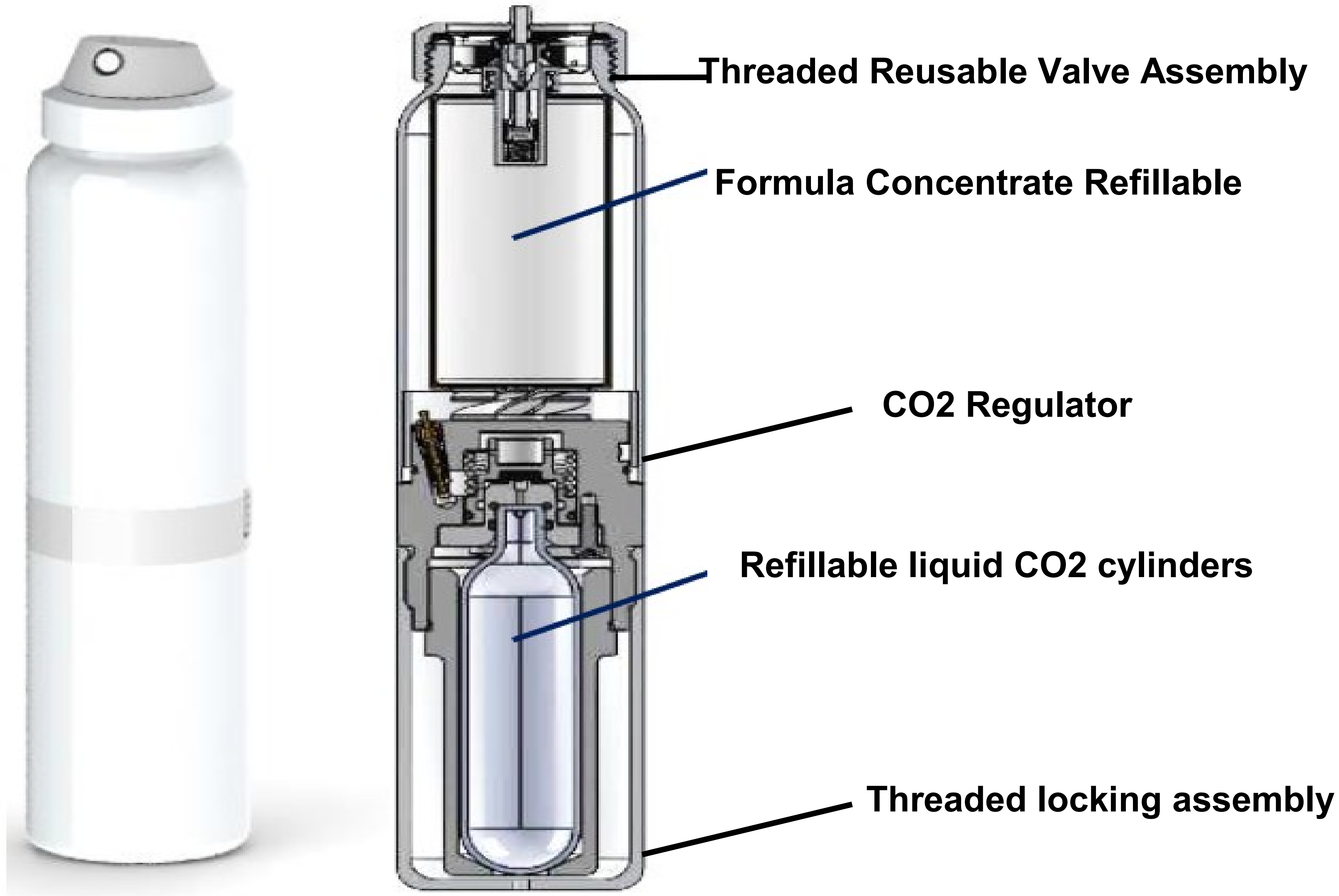
Stage 2



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Automotive Case Study

Automotive Case Study

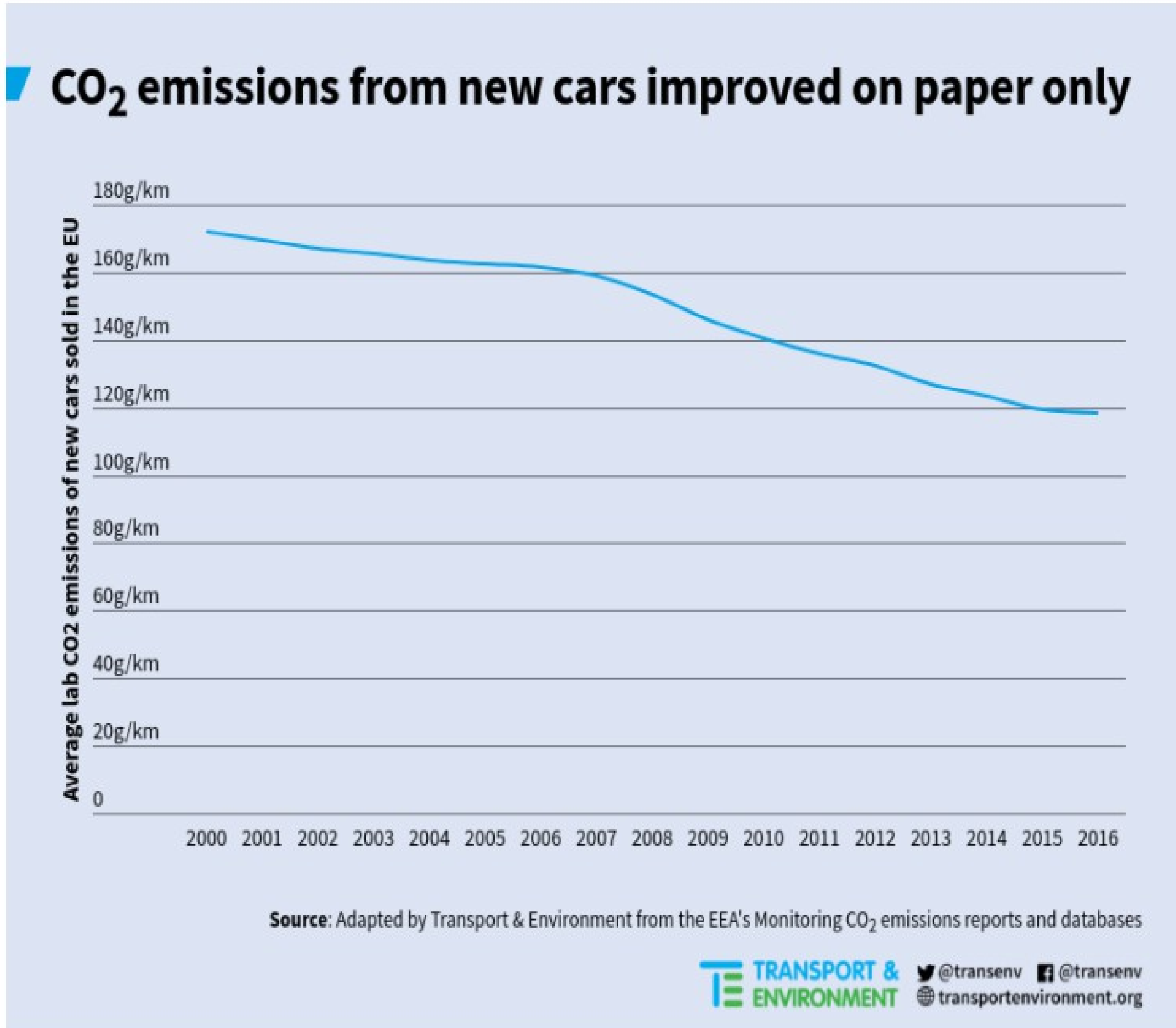

Figure 13 – Evolution of the CO_2 emissions of new cars sold in the EU from 2000 to 2016

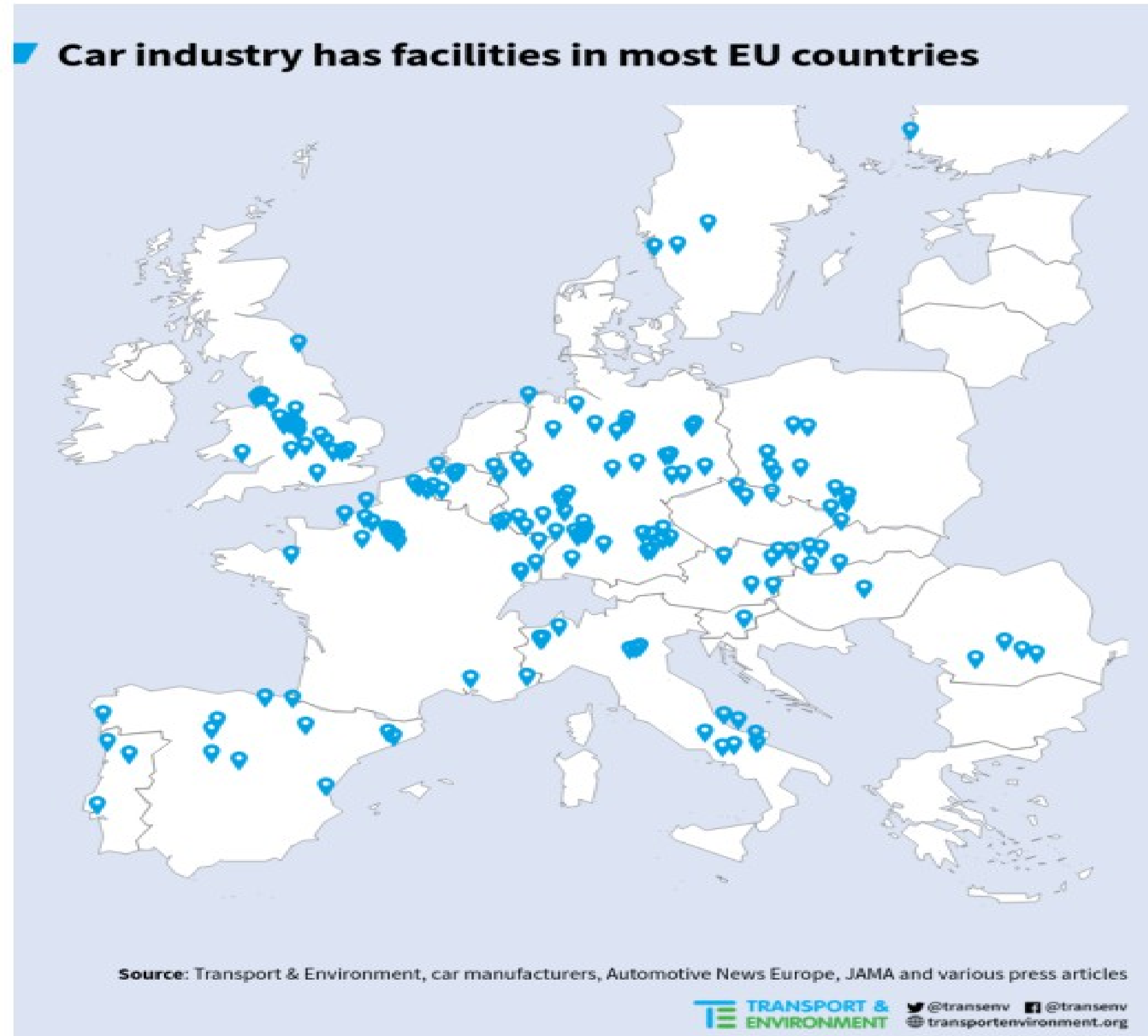

Figure 29 – T&E's map of manufacturers' European facilities

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Automotive Case Study

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Science & Environment

Ban on new petrol and diesel cars in UK from 2030 under PM's green plan

By Roger Harrabin
BBC environment analyst

18 November 2020 | Comments

Shift to electric cars will need 'Herculean' effort, says industry

By Theo Leggett & Daniel Thomas
Business correspondent, BBC News

18 November 2020 | Comments

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Thank you for your attention

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