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**Datasheet for the decision
of 4 October 2023**

Case Number: T 0169/22 - 3.2.04

Application Number: 12788775.0

Publication Number: 2714203

IPC: A62B7/02, F17C1/00

Language of the proceedings: EN

Title of invention:

HIGH PRESSURE AIR CYLINDERS USED WITH SELF-CONTAINED BREATHING APPARATUS

Patent Proprietor:

Scott Technologies, Inc.

Opponent:

Draeger Safety UK Limited

Headword:

Relevant legal provisions:

EPC Art. 56

Keyword:

Inventive step - (no)

Decisions cited:

T 0570/91, T 2197/09, T 0410/87

Catchword:



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Case Number: T 0169/22 - 3.2.04

D E C I S I O N
of Technical Board of Appeal 3.2.04
of 4 October 2023

Appellant: Scott Technologies, Inc.
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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 15 December
2021 revoking European patent No. 2714203
pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman A. de Vries
Members: J. Wright
K. Kerber-Zubrzycka

Summary of Facts and Submissions

- I. The appeal was filed by the appellant (patent proprietor) against the decision of the opposition division to revoke the patent in suit.
- II. The opposition division decided that the subject-matter of the claims of the main request as amended during the opposition proceedings did not involve an inventive step.
- III. Oral proceedings before the Board were duly held on 4 October 2023.
- IV. The appellant-proprietor requested that the decision under appeal be set aside and that the patent be maintained in amended form according to the main request, refiled with the statement of grounds of appeal.

The respondent-opponent requested that the appeal be dismissed.

- V. Claim 1 of the main request reads as follows:

"A self-contained breathing apparatus, comprising: a compressed gas cylinder (10; 12; 14; 16) comprising a pressure volume portion for containing a volume of gas pressurized to a service pressure, the pressure volume portion having a length (L), a diameter (D), and a water volume (V) selected according to the formula:

$$L = \frac{4\left(V - \frac{\pi d^3}{6}\right)}{\pi d^2} + d$$

where: L = length, V = water volume, and d = diameter; wherein the service pressure is substantially 38 MPa (5,500 psig); and wherein the cylinder (10; 12; 14; 16) further includes a gas transmission port; a first regulator valve coupled to the gas transmission port for receiving compressed gas from the pressure volume portion, the first regulator valve for reducing a first pressure of gas received from the pressure volume portion to a second pressure that is lower than the first pressure;

a second regulator valve in fluid communication with the first regulator valve for receiving compressed gas from the first regulator valve, the second regulator valve for reducing the pressure of gas received from the first regulator valve to a third pressure that is lower than the second pressure; a mask portion in fluid communication with the second regulator valve, the mask portion for providing gas at the third pressure to a user; and a frame portion having a user support portion to enable a user to carry the compressed gas cylinder; and wherein the pressure volume defines an operational parameter of the compressed gas cylinder, the operational parameter being a relationship between free air capacity of the compressed gas cylinder in liters and a rated service time in minutes, the operational parameter being selected from the group consisting of: 1200/30; 1800/45, 2400/60, and 3000/75; for the operational parameter consisting of 1200/30, the length of the pressure volume portion is substantially 37.6 cm (14.8 inches) to substantially 43.9 cm (17.3 inches), the diameter of the pressure volume portion is substantially 10.9 cm (4.3 inches) to substantially 11.9 cm (4.7 inches); and the cylinder has a weight of substantially 2.6 kg (5.7 pounds) to substantially 3.0

kg (6.6 pounds); for the operational parameter consisting of 1800/45, the length of the pressure volume portion is substantially 42.9 cm (16.9 inches) to substantially 49.5 cm (19.5 inches), the diameter of the pressure volume portion is substantially 12.7 cm (5.0 inches) to substantially 13.7 cm (5.4 inches); and the cylinder has a weight of substantially 3.5 kg (7.8 pounds) to substantially 4.1 kg (9.0 pounds); for the operational parameter consisting of 2400/60, the length of the pressure volume portion is substantially 45.5 cm (17.9 inches) to substantially 51.6 cm (20.3 inches), the diameter of the pressure volume portion is substantially 14.5 cm (5.7 inches) to substantially 15.5 cm (6.1 inches); and the cylinder has a weight of substantially 4.5 kg (10.0 pounds) to substantially 5.3 kg (11.6 pounds); and for the operational parameter consisting of 3000/75, the length of the pressure volume portion is substantially 46.7 cm (18.4 inches) to substantially 53.3 cm (21.0 inches), the diameter of the pressure volume portion is substantially 15.7 cm (6.2 inches) to substantially 17.2 cm (6.8 inches); and the cylinder has a weight of substantially 5.7 kg (12.5 pounds)."

VI. Reference is made to the following document(s):

D3: US 2010/0024822

D8: Technical Drawing of Techplast gas cylinder
AS1-01-00,

D8A Technical Drawing of Techplast gas cylinder
AS1-01-00, in Polish

VII. The arguments of the appellant-proprietor can be summarised as follows: The Techplast 6.8 Litre cylinder, as disclosed in D8/D8A, is an invalid starting point from which to consider inventive step of

the main request. Even if the skilled person were to consider Techplast, the subject matter of claim 1 of the main request involves an inventive step when combined with D3 and the skilled person's general knowledge.

VIII. The arguments of the respondent-opponent can be summarised as follows: The opposition division were correct to find that claim 1 of the main request lacks inventive step starting from the Techplast 6.8 litre cylinder.

Reasons for the Decision

1. The appeal is admissible.

2. Background

The patent relates to self-contained breathing apparatus (SCBA) having an improved air cylinder configuration that is smaller than conventional air cylinders while providing desired air capacity (see published patent specification, paragraph [0001]). In particular, the patent proposes a gas cylinder for storing gas at a higher service pressure than is known in the prior art, so that the cylinder can be made more compact, amongst other things (see published patent specification, paragraph [0014] and claim 1).

3. Main request, claim 1, inventive step

3.1 Suitability of D8, D8A as a starting point from which to consider inventive step

- 3.1.1 In accordance with established jurisprudence (see Case Law of the Boards of Appeal, 10th edition, 2022 (CLBA) I.D.3.6 and the decisions cited, in particular T570/91, reasons 4.4 and 4.5), although a person skilled in the art is completely free in choosing a starting point, they are then bound by that choice.
- 3.1.2 In the present case, D8 and D8A are technical drawings relating to the same series of high pressure air cylinders AS1-01-00 from the company Techplast, and submitted as evidence together with other documentation of a prior use. The opposition division in section 5 found that public availability had not been challenged and (see its impugned decision, reasons 6.1) considered that the 6.8 Litre Techplast cylinder, which the Board will refer to as *Techplast*, was a suitable starting point from which to consider inventive step because the type of cylinder was not defined in the claim and so could play no role in choosing a starting point for inventive step.
- 3.1.3 In appeal, the appellant-proprietor has argued that Techplast is not a suitable starting point because it discloses a cylinder that is of a fundamentally different type from the one claimed and in that it does not disclose an SCBA breathing apparatus. Since the skilled person (and the opponent) are free in choosing their starting point, both arguments are predicated on the idea that, if the skilled person were to start from Techplast they would not arrive at the claimed invention because this would mean fundamentally changing the nature of Techplast, namely by changing its cylinder type and area of application. In the Board's view, both arguments fail.

3.1.4 Firstly considering cylinder type, the appellant-proprietor argued (see its appeal grounds, page 4, points 1.8 and 1.9) that the claim was implicitly limited to a so called type 3 cylinder because of the claimed cylinder weight which was much higher than Techplast, which is a type 4 cylinder.

3.1.5 It is not disputed that a type 3 cylinder has a gas-tight metal liner whereas a type 4 has a non-metallic liner, making it lighter. Claim 1 does not define any cylinder type or state anything about the construction of the cylinder, let alone the material of its lining. The Board agrees with the opposition division (see reasons, point 6.1), that the claimed cylinders having particular dimension and weight ranges does not imply that they have a metal lining. This is because other factors, such as other wall components inevitably contribute to the overall weight of a gas cylinder.

Nor is there any indication in the description which might suggest a different result. The patent does not mention cylinder types. At most, paragraph [0036] mentions that cylinders of the invention may have an inner liner, but without specifying its material. Therefore, the claimed cylinder is not implicitly a type 3 cylinder, it could indeed be of any type. Consequently, the skilled person can start from a [type 4] Techplast cylinder and potentially arrive at the claimed subject matter without implying the need to fundamentally change its type.

3.1.6 Turning now to the argument that Techplast is not a suitable starting point because it does not disclose a SCBA apparatus, this hinges on the idea that Techplast is inherently *unsuitable* for use in a SCBA system. The Board considers this not to be the case.

As the appellant-proprietor explained at the oral proceedings before the Board, the use of a cylinder in a SCBA system, for example providing air to a firefighter, does not imply it to have any different technical characteristics compared to one providing breathing air in other situations. However, so the appellant-proprietor argued, these different uses imply differences in the peripheral elements of the system, such as mask type and, in the case of a SCBA apparatus, a carrying frame, which would not be necessary in a hospital if used for supplying air or oxygen, say.

In the Board's view, since Techplast discloses only the compressed air cylinder without any such peripheral elements, it is a suitable starting point for potentially arriving at any system that uses such cylinders, including a SCBA system. In the present case, the Board considers it all the more appropriate to start from a cylinder, such as Techplast, rather than any other part of a SCBA system, since the invention (see published patent specification, paragraph [0001]) relates specifically to improvements to the cylinder, rather than to any peripheral element such as an improved mask.

The Board also has no compelling reason to believe that the Techplast cylinder would inherently not be suitable for use in SCBA systems. That it might be for hospital use, as argued belatedly at the oral proceedings, is an unsubstantiated allegation.

- 3.1.7 Therefore, the Board considers that Techplast, as disclosed in D8/D8A, is a valid starting point from which to examine inventive step.

3.2 Before looking in detail at what D8/D8A discloses, the Board finds it useful to look at the features of claim 1.

The first part defines the internal length of the gas cylinder L in terms of its water volume V (which is another way of saying its internal volume), and its internal diameter d . The equation is based on the mathematical formulas for the volume of a cylinder of length $(L-d)$, with two half spherical ends of diameter d (volume of the cylinder = $\pi d^2 (L-d)/4$ and the total volume of the two half spheres is $\pi d^3/6$). Therefore, the first feature is just another way of expressing that the gas cylinder has the shape of a cylindrical part (of length $L-d$) and two hemispherical end parts.

The second part of the claim (mask, regulator valves, frame) defines elements exterior to the gas cylinder. The claim then defines operational parameters for four discrete gas cylinders in terms of the volume of free air they can provide in litres and the rated service time in minutes based on 40 litres per minute (cf. published patent specification, column 5, lines 20-21). Of these the Board will concentrate on the 1800/45 cylinder.

The last part of the claim defines ranges of length, diameter and weight for the four discrete gas cylinders (the same data is presented in table form in the lower table of figure 10).

3.3 The opposition division (see impugned decision, section 6.3) considered that the (6.8 litre) Techplast gas cylinder supplied 45 minutes of air, and this is not disputed (cf. proprietor's appeal grounds, point 1.6). Thus the Board considers it to deliver 1800 litres of

air as does the second alternative cylinder of the claim.

- 3.4 Techplast has the shape of a cylinder with two hemispherical ends (see D8 and D8A figures), thus it has a length L defined by the formula given in the claim. It also has a gas transmission port (shown at the right of the figures), but there is no disclosure of a mask, regulator valves or a frame. Dimensions and weight (see table at the bottom of D8 and diameter of 158 mm in the figure) as well as service pressure (300 bar) lie outside the ranges claimed. Thus, the claimed self-contained breathing apparatus of claim 1 of the main request differs from D8 by the features of the mask, regulator valves, frame; the specific claimed ranges of length, diameter and weight claimed; and the service pressure of 38 MPa.
- 3.5 The Board agrees with the opposition division that the differing features of mask, valves and frame on one hand, and dimension, weight and service pressure on the other have different unrelated effects and it is appropriate to consider these groups of features separately for inventive step. Nor has it indeed been argued that there would be a synergy between these groups of features.
- 3.6 As regards the use of a mask, valves and frame and as already touched upon, it is undisputed that these are usual features of any SCBA system, which are per se well known (cf. the patent specification, paragraph [0002]). D3, figures 1 and 3 and paragraphs [0019] and [0020]), for example, shows a cylinder with a mask, first and second regulator valves, and carrying frame. For the skilled person, an engineer designing cylinders for compressed air SCBA's are, if not the main

application, then one of a limited number of obvious applications . Thus, using the Techplast cylinder to this end and equipping it to that end with a mask, double regulator valves as in D3 and a carrying frame is an obvious known use which cannot represent an inventive step. Therefore, these claim features do not contribute to an inventive step.

3.7 It follows from the above that inventive step hinges on the characteristics of the gas cylinder itself. Claim 1 (1800/45 variant) differs from, say, the Techplast 6.8 litre cylinder in its dimensions, weight and service pressure. For ease of comparison of the relevant parameters, these are presented in the table below:

Gas cylinder with operational parameter of 1800/45	Weight (Kg)	Length of pressure volume (cm)	Diameter of pressure volume (cm)	Service Pressure (MPa)
Claim 1	3.5-4.1	42.9 - 49.5	12.7 - 13.7	38
Techplast 6.8 litre	2.8	51.1	14.3	30

As is apparent from the table, the claimed weight range is higher than Techplast but the claimed internal diameter and length are smaller (the former is directly disclosed in D8A and the latter can be calculated taking wall thickness into account). Thus the claimed gas cylinder is more compact than Techplast. Moreover, the claimed service pressure is higher.

3.8 As far as weight is concerned, claim 1 defines a weight considerably higher than that of Techplast. This is of itself manifestly disadvantageous, as the user must carry the device with them, as confirmed by the patent,

(published specification, paragraph [0003]). In accordance with established jurisprudence (see CLBA I.D.9.21.1 and the cited decisions, for example T2197/09, reasons 5.4), an inventive step cannot be acknowledged on the basis of a purely disadvantageous modification of the closest prior art. In this regard, the appellant-proprietor has argued that a higher weight [range] compared to Techplast can also be advantageous because it allows [heavier] more conventional cylinder materials to be used which are more robust and less expensive (see letter of 10 August 2023, page 9). Firstly, the claim does not include any indication of the particular materials used, as may be inferred from the discussion regarding the cylinder type above. Secondly, for the skilled person designing air cylinders it is a matter of routine design practice to have to balance opposing common design parameters such as weight, strength, volume and cost depending on specifications and circumstances. Thus, if the conditions require - e.g. because light-weight, high strength materials are too costly - they would as a matter of obviousness consider cheaper, heavier materials that offer a similar strength. Therefore, the argument is moot, and no inventive step can be attributed to the claim feature of the cylinder having a minimum weight that is considerably higher than that of Techplast.

3.9 Turning now to the aspects of service pressure and dimensions, at 38 MPa the claimed service pressure is higher than Techplast's 30Mpa, whilst the length and diameter as claimed are slightly shorter than Techplast.

3.9.1 According to the patent (see published specification, paragraph [0014]) this higher service pressure results

in a reduced space envelop, in other words the air cylinder is more compact. This makes it easier to maneuver. The objective technical problem associated with this difference can be expressed as: How to modify the Techplast cylinder to make it more maneuverable.

3.9.2 If the skilled person from their high school knowledge of Boyle's law, that the volume of a given mass of a gas is inversely proportional to its pressure, will not already realize that they can accommodate the same mass of gas in a smaller volume but at higher pressure, then they will find this teaching spelled out to them in D3. In paragraph [0031], D3 teaches that increasing the pressure of single SCBA cylinders to 62Mpa (9000 psi) allows a reduction in profile whilst maintaining the same capacity. The skilled person, a mechanical engineer specialising in breathing apparatus and thus well versed in fluid mechanics, would immediately realise that this is in direct application of Boyle's law. Thus, the skilled person will know if not already from their high school knowledge then at least from D3 that raising the pressure *by any amount* will inevitably reduce its volume by an amount Boyle's law dictates, and thereby solve the problem of making the Techplast cylinder more maneuverable, without changing the amount of air stored. The skilled person will also know from their general geometry knowledge (cf. equation in the published patent specification, paragraph [0009] and claim 1), that reducing the volume can only be achieved by reducing the cylinder's length and/or radius. In solving the problem posed, the skilled person will therefore increase the pressure and reduce at least one physical dimension of the cylinder, as a matter of obviousness.

In this regard, the Board notes that the problem solution approach does not require a problem to be solved to any particular degree. Therefore, D3's teaching that, for a single SCBA cylinder arrangement, an increase in pressure achieves a *modest* reduction of envelop [volume] presents the skilled person with an obvious way of solving the objective technical problem, however small the improvement may be. This is not rendered non-obvious, in other words inventive, by D3's teaching in the same paragraph that an even greater improvement can be had by using a double instead of a single cylinder arrangement.

3.9.3 This leaves the questions as to how far the skilled person would increase the pressure and what dimension or dimensions they would reduce. In other words, whether it would be obvious to arrive at the particular working pressure of 38MPa and the particular length and diameter ranges claimed. In the Board's view, it would.

3.9.4 As already stated above the skilled person when designing air cylinders for SCBA systems must strike a balance between opposing design parameters, which include among others weight, volume - i.e. cylinder dimensions, material strength and cost. The particular balance they strike will depend on the circumstances. Unless it can be associated with an unexpected technical effect or other surprising benefits or advantage, the particular choice of design parameter values or ranges is normally the obvious result of such routine design considerations. In the present case the Board is unable to identify such a surprising effect or advantage.

- 3.9.5 With respect to the pressure, the patent teaches (see paragraph [0008]) that the choice of working pressure of between 37 and 39 MPa optimises size and weight whilst being compatible with [existing] charging infrastructure for conventional air cylinders.
- 3.9.6 The Board has no reason to doubt the respondent-opponent's statement (see letter of 19 August 2022, point 3.4.8), that a 41Mpa [6000psi] compressor belongs to such conventional infrastructure, and that when used at its maximum rating together with the so called overcharging method, would result in a maximum cylinder pressure of 38Mpa after the compressed air had cooled. Moreover, D8 itself discloses a test pressure of 450 Bar (45MPa), well below the minimum burst pressure of 900 Bar (90MPa), therefore a service pressure of 38MPa is safe to use with Techplast.
- 3.9.7 The Board sees nothing inventive in using existing conventional infrastructure to charge a conventional cylinder to as high a pressure as these constraints allow. Nor, in this regard can it come as a surprise to the skilled person (cf. the appellant-proprietor's letter of 10 August 2023, page 4 and figure 5 of the patent) that each increase in pressure yields diminishing potential for volume reduction. This is merely dictated by Boyle's law, with its inversely proportional relationship between pressure and volume. At most it gives the skilled person all the more reason to continue using existing infrastructure and apply a service pressure of 38MPa to achieve almost the same reduction in volume as a considerably higher pressure would achieve at the expense of requiring non-conventional infrastructure. Therefore, the argument of the appellant-proprietor that D3, paragraph [0031] would teach the skilled person to raise Techplast's

service pressure from 30Mpa to 62Mpa but not to any intermediate pressure is moot.

3.9.8 For these reasons, a working pressure of 38MPa appears to be an obvious choice for the skilled person.

3.9.9 Having made this choice, the skilled person will need to reduce the volume of the Techplast cylinder by the amount dictated by Boyle's law, thus they must reduce Techplast's length and/or the diameter.

Both the claimed uppermost length and diameter are 6mm less than the corresponding dimensions of the Techplast cylinder. Moreover, the claimed cylinder has a length to diameter ration of between 3 and 4. The ratio for Techplast is roughly in the middle of this range. Thus the claimed cylinder appears not to characterise a new envelope profile but to approximate a slightly shrunk down version of the conventional Techplast cylinder.

Such a shrinking down of the length and diameter of Techplast would appear to be an obvious compromise for these parameters when reducing volume. In this regard, contrary to how the appellant-proprietor has argued, modifying Techplast by reducing the diameter as well as the length does not appear to be surprising when reaching such a compromise: When a firefighter uses a SCBA apparatus, in the one situation it may be better to have a shorter cylinder, in the other a smaller diameter may be more critical. Thus, the relative choice of length and diameter to achieve a certain volume (dictated by Boyle's law) would appear to be no more than the optimisation of these physical dimensions to reach an acceptable compromise. In accordance with established jurisprudence (see CLBA, I.D.9.17 and for example T410/87, reasons point 3.4) such an

optimisation belongs to the normal activities of the skilled person.

- 3.9.10 The appellant-proprietor has also argued that the skilled person would not modify Techplast by changing the diameter because D8/D8A teaches to always keep the diameter constant irrespective of the length of the cylinder. This it derives from the fact that D8/D8A discloses four cylinders of differing volume and length but of the same diameter.

The reason why D8/D8A discloses cylinders of different capacities but of the same internal diameter (14.3mm), be it for standardisation of the hoops or any another reason, is a matter of pure speculation, because D8/D8A are technical drawings that do no more than state these dimensions. Therefore, the skilled person will not directly and unambiguously derive a teaching from D8/D8A that, however the skilled person might modify Techplast, its internal diameter must always be 14.3mm. Therefore, the appellant-proprietor's argument is moot.

- 3.10 For all these reasons, claim 1 of the main request lacks inventive step starting from Techplast (D8/D8A) in combination with D3 and the skilled person's general knowledge.

4. The Board thus confirms the decision's finding of lack of inventive step for the present and sole remaining request. Since, at the end of the oral proceedings before the Board, the appellant-proprietor had no further requests, its appeal must fail.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



G. Magouliotis

A. de Vries

Decision electronically authenticated