COMMISSIONER'S DECISION

NON-STATUTORY - S.2: Mental Step; Mathematical Formula.

Method of designing a spray nozzle of given flow rate and cone angle of known type, by operating a plurality of nozzles and measuring the parameters and formulating equations is not an invention within Section 2. While a new article may be distinguishable in terms of the process of making, such process must particularize "novel physical" steps rather than "mental steps" only such as a mathematical equation formulated from pluralities of measured parameters.

FINAL ACTION: Affirmed.

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This decision deals with a request for review by the Commissioner of Patents of the Examiner's Final Action dated May 29, 1973 on application 078,277 Class 299 - Subclass 15. The application was filed on March 24, 1970 in the name of Frederick F. Polnauer and is entitled "Spray Nozzles With Spiral Flow Of Fluid."

In the prosecution terminated by the Final Action the Examiner refused claim 1, which is directed to a spray nozzle, for lack of patentable subject matter over the art cited. He also refused claim 2, which is directed to a method of designing a spray nozzle, for lack of patentable subject matter over the art cited and common knowledge, and for being outside the ambit of subject matter patentable under Section 2 of the Patent Act.

The application relates to spray nozzles and the method of designing the nozzle for the distribution of fluids, such as liquids, gases and other sprayable materials, into a cone-shaped spray of very fine droplets that are discharged in a uniform pattern. The "abstract of the disclosure" submitted by the applicant reads:

A logarithmic spiral flow nozzle for spraying fluids in which concentric alignment is achieved between the axis of the swirl chamber body and the outlet orifice. Further, constructions and methods of design of logarithmic spiral flow type nozzles are disclosed having ratios of nozzle parameters held within certain ranges which enable such nozzles to be constructed with a considerable degree of predictability of spray performance and by which the patternation index of the nozzles can be described and predicted.

In the Final Action the Examiner stated (in part):

The rejection of all claims is maintained and the reasons for such rejection are set out below.

References Re-Applied:

British Patent:

760,972 Nov. 7, 1956 Breinl et al

United States Patent:

2,904,263 Sept. 15, 1959 Cl. 234-494 Tate et al

Claim 1 is rejected as failing to define patentable subject matter in view of each of the cited references taken singly. Each reference shows the structure recited in the claim. The structure disclosed in each patent has an actual weight flow rate of the fluid, a spray cone angle, a nozzle inlet area and a nozzle outlet area. The two former variables are related to the ratio X of the two latter variables by the mathematical formulae recited in claim 1. There is no new spray nozzle recited in claim 1 nor is there any unexpected result inherent in the nozzle recited and consequently there is no patentable subject matter recited in claim 1.

Claim 2 is rejected as failing to define patentable subject matter in view of the cited patents and common knowledge and as being outside the ambit of Section 2 of the Patent Act. The structure recited is known as shown by each cited reference. The structure disclosed in each cited patent has an actual flow rate and a spray cone angle related to the ratio X of the swirl chamber inlet area to nozzle outlet area. The method of determining parameters for a spray nozzle is simply the well known scientific method comprising experimentation with actual or model units, measurements of interesting variables, and finally determination of sought-after relationships from resulting data. The step of operating a plurality of nozzles having different parameters, at different fluid inlet pressures is analogous to testing fans, pumps, and other mechanical or hydraulic elements and is not unobvious. The step of measuring the actual flow rate and the spray cone angle is known since applicant admits that the "....two criteria are usually specified by the purchaser for whom the design is being made". The production of equations is a well

known scientific step. Also the method recited in claim 2 is considered to be a non-manufacturing method since it merely provides statistics. Since the method results in the provision of statistics and not in any new nozzle and since the method does not treat a physical object to alter the object in any manner, it resides outside the ambit of Section 2 of the Patent Act. Additionally the subject matter is directed to the exercising of professional skill and resides in the ambit of professional skill and outside the ambit of Section 2 of the Patent Act.

The applicant in his response dated August 28, 1973 to the Final Action stated (in part):

Applicant strongly contends that the inventor in the present application, Dr. Polnauer, was the first to recognize that the ratio

$$\frac{B.H}{\frac{\pi Dor^2}{4}} = \frac{\text{Inlet Area}}{\text{Outlet Area}} = (X)$$

must be considered when designing a nozzle for the two given parameters of flow rate (W_{act}) and spray cone angle (2Υ). Prior to him, for example, it was the practice to change the spray cone angle merely by changing D_{or} (orific diameter). However, if D_{or} alone was changed the flow rate would also change. In a typical practical case, it is desired to provide a series of nozzles with different cone angles, all of which operate at the same flow rate. This cannot readily be accomplished without the recognition of the interaction of the parameters that make up the ratio (X).

...

Applicant believes that the recognition that the single inlet logarithmic spiral flow is governed by the area ratio (X), is unique and constitutes a basic invention which cannot be derived from systematic experimentation. On the contrary, the whole experimentation is based on this recognition.

Furthermore, the method of selecting the appropriate ratio

$$\frac{B.H}{\frac{\pi Dor^2}{4}}$$

for a given 2Υ and W_{act} is also unique and a part of this invention. For example, as seen from the charts, if D_{or} is increased, the ratio (X) decreases and spray cone angle 2Υ increased. But at the same time, the coefficient of discharge K decreases with an increased D_{or} and both 2Υ and W_{act} cannot be maintained. A change in BH is required to restore 2Υ and W_{act}.

> Similarly if it becomes necessary to change 2 Υ alone, but maintain W_{act}, the interactive function of the area ratio must be utilized.
>
> Therefore, Dr. Polnauer's contribution was the recognition of the interplay between the parameters B, H and D_{or} of the equation. That is, to design a nozzle for a given 2 Υ and W_{act} the parameters of both the numerator and the denominator of the equation must be selected.
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> With respect to the rejection of claim 2 under Section 2 of the Patent Act applicant again cannot agree with the Examiner. The results achieved by practicing the method claimed produce a beneficial result which is certainly of a commercial or economic value and is related to a form of manufacture. The results of the method permit the product of claim 1 to be properly manufactured. Practicing the method of claim 2 will lead to a new nozzle, namely that of claim 1.

The question to be decided is (a) whether amended claim 1, which is directed to a spray nozzle, defines patentable subject matter over the art cited, and (b) whether amended claim 2, which is directed to a method of designing a spray nozzle, defines patentable subject matter over the art cited and common general knowledge, and comes within the scope of subject matter patentable under Section 2 of the Patent Act. Amended claim 2 reads:

> The method of designing a spray nozzle having a specified actual flow rate (W_{act}), and a specified cone angle (2Υ), said spray nozzle being of the type having body means formed with an inlet passage for receiving the fluid to be sprayed and a bore, swirl chamber means having a portion which is in the shape of an arc of a curve and an inlet opening, said swirl chamber means also having an inlet means for communication between said bore and said inlet opening of said swirl chamber, said inlet means having a portion which is generally tangential to a portion of an arc of a curve of the swirl chamber at said inlet opening and orifice means having an outlet in communication with said swirl chamber, said nozzle when operating also having an actual flow rate (W_{act}) and a spray cone angle (2Υ) in degrees which are both interrelated to the ratio (X) of the swirl chamber inlet area (B.H) to nozzle outlet area $\frac{\pi D^2}{4}$ where
>
> B is the width of the tangential inlet portion of the inlet close to said opening thereof into the swirl chamber,

D is the diameter of orifice means outlet,

H is the height of the swirl chamber,

comprising the steps of operating a plurality of nozzles having different D, B and H parameters at different inlet fluid pressures which produce different actual pressure drops through the corresponding different nozzles,

measuring the actual flow rate (W_{act}) of each of the nozzles operated at the different pressures to determine the respective nozzle discharge coefficient at the different pressures,

measuring the spray cone angles (2Ψ) of the different nozzles at the different pressures,

producing from the measurements made the functions f_1, f_2, f_3 and f_4 of the following equations:

(1) $K_{ref} = f_1 (X)$

(2) $C_p = f_2 (\Delta P)$

(3) $2\Psi_{ref} = f_3 (X)$

(4) $C_{2\Psi} = f_4 (\Delta P)$

and selecting as per at least equations (1) and (3) the parameters of both the nozzle inlet area and the nozzle outlet area to obtain the specified actual weight flow rate and the specified cone angle,

ΔP is the actual pressure drop of the nozzle,

K_{ref} is the nozzle discharge coefficient at a reference pressure drop,

C_p is a correction factor to relate the nozzle discharge coefficient at the reference pressure drop (K_{ref}) to the discharge coefficient at a particular pressure drop,

$2\Psi_{ref}$ is the spray cone angle at the reference pressure drop and,

$C_{2\Psi}$ is a correction factor relating the nozzle spray cone angle at the reference pressure drop to any pressure drop.

Claim 1 relates to a spray nozzle when produced in accordance with the equations as set forth in claim 2.

The first determination is the scope and content of the prior art and what is considered as common knowledge.

The applicant stated in his disclosure that "spray nozzles of the type using a logarithmic or other spiral flow for the fluid, are known in the art." He then went on to discuss British Patent 760,972 which was applied by the examiner in the Final Action. This patent relates to a nozzle comprising a body formed with an inlet passage, a swirl chamber having a portion in the shape of an arc, a tangential inlet opening and an orifice having an outlet in communication with the swirl chamber. Claim 1 of this reference reads:

> a spray nozzle comprising a housing having a circulation chamber confined by end members at least one of which has an axial outlet, and by a peripheral wall having a quadrangular tangential inlet the height of which is substantially equal to the height of the peripheral wall, said inlet having in the region of the opening into the chamber a maximum width not larger than 2/9 of the largest radius of the circulation chamber, the height of said chamber increasing substantially from the region of the peripheral wall towards the rim of the axial outlet in such a way that the streamline angle remains substantially constant from the inlet to the outlet or outlets of the circulation chamber, i.e. the liquid flows in substantially logarithmic spiral streamlines from the inlet to the outlet.

The Tate reference (U.S. 2,904,263) relates to a spray nozzle which has an actual weight flow rate of fluid - a spray cone angle, a nozzle inlet area and a nozzle outlet area. The two former variables are related to the "area ratio X" of the two latter variables by the parameters recited in the instant claims.

Of interest in the determination of this case is the rationale of the court in the British case of Lips' Application 1959 R.P.C. 35 in which the only novelty found in a claim to an article (Ships' Screw Propellers) was the mental process, and not by particularizing physical steps, was considered not to be a manner of manufacture. At page 37 Lloyd-Jacob J. says: "It is not of course a circumstance fatal to the grant of a patent that a manufactured article cannot be physically

distinguished from previously made similar articles. Indeed it may well be that an article made by say a less costly process of manufacture may be so devised as to simulate as closely as possible a known similar article made by a more costly process. It is common for a specification to include such a claim as 'A ... made by the process according to claims ...' But in such a case the process must to be allowable particularise 'physical' steps which constitute a manner of manufacture, and there is thus a test for determining whether or not the 'article' claim is infringed. That test is -- was an allegedly infringed article (physically indistinguishable) made by the process of manufacture referred to in the hypothetical prior claim? No such test is applicable in the present case. Once it is decided that the propeller forming the subject of the Applicant's claim 1 is not distinguished (only dimensional distinctions are here involved) from other propellers, it seems that the only novelty allegeable in the claim is the mental process by which the propeller blade thicknesses at different radial positions are determined. This clearly cannot be said to be manufacture within the meaning of the Act. In my opinion, having regard to my finding that the propeller claimed in claim 1 is distinguished only by the process of calculation by which its profile is determined, the claim cannot be regarded as for an invention within the meaning of the Act."

It is observed, however, from reviewing the above case that the parameters used were known parameters, whereas in the present application the applicant has argued that he is using new parameters, or at least different ratios of parameters. We submit, however, that this is just a different route for calculating the same end.

Turning now to a consideration of the subject matter of the claims, as previously mentioned Claim 1 in effect relates to a nozzle where the parameters of the nozzle are selected by the equations of claim 2.

The applicant agrees that "both references appear to illustrate structures very similar to that of claim 1. However, claim 1 clearly specifies a spray nozzle which must be constructed within the limits imposed by the mathematical relationships defined within that claim." The applicant goes on to state that "these mathematical relationships obviously define the nozzle in more restricted terms than is disclosed in either of the references."

It is well known, however, to determine parameters of any device by experimentation with actual or model units, by measuring the variables in question, and then to ascertain the physical relationship from such data. Unless, however, inventive experimentation (some unexpected result) is involved it is not patentable subject matter. The steps of operating a plurality of nozzles having different physical parameters at different fluid inlet pressures is analogous to testing fans, pumps, etc. The step of measuring the actual flow rate and the spray cone angle is known, since the applicant admits that the "two criteria are usually specified by the purchaser for whom the design is being made." The step of formulating equations from experimental data is also well known and we consider it a "mental process" only.

It is not of course a circumstance fatal to the grant of a patent that a new manufactured article cannot be distinguished from previously made articles by physically defined characteristics, provided it can be distinguished in some manner, for in some instances an article could be claimed by the process of making, but in such a case the process must, to be allowable, particularise "novel physical" steps. In our view, however, the nozzle of claim 1 is distinguished only by the process of calculations by which its profile is determined. This may also be reconciled to the circumstances in which the advance in the art as claimed, is purely mental, as that considered in the British case of Lips' Application, supra.

Of interest and showing a similar approach in designing violins is "C.M. Hutchins, 'The Physics of Violins,' Scientific American, November, 1962, pp. 78-93," which indicates that the idea of formulating sets of physical empirical rules for making musical instruments was known at least in 1962, if not earlier. In consequence it would appear that the adoptation of that principle to nozzle making might well be obvious.

The examiner also raised an objection to claim 2 under Section 2 of the Patent Act "since the method does not treat a physical object to alter the object in any manner." Section 2 of the Patent Act reads in part:

> "Invention" means any new and useful art, process machine, manufacture or composition of matter, or any new and useful improvement in any art, process, machine, manufacture or composition of matter.

The question of whether a subject matter is an "art" or a "process" was considered in Tennessee Eastman v The Commissioner of Patents (1970) 62 C.P.R. 117 at 128. In that case "art", "process" and "method" were viewed as one and the same thing, and in any event it was settled that "art" may include a method or process, citing Refrigerating Equipment Limited v Waltham Systems Incorporated (1930) Ex.C.R. 154 at 166.

An "art", within the meaning of patent law, must accomplish some change in the character or condition of material objects. When the practice of the alleged art will not produce any physical effect, but merely involves the carrying out of a plan or theory of action without the production of any physical results proceeding directly from the operation of the theory or plan itself, it is not an art within the meaning of patent law. In short, it may be said that an "art" is the use of means to produce a result.

That the process under consideration "fails" within the meaning of "an art" is a matter of fact for the process merely consists of: operating a plurality of nozzles having different physical parameters, measuring the actual flow rate at different pressures, measuring the spray cone angle at different pressures, producing equations from the measurements made and then selecting from the equations the parameters of both the nozzle inlet area and the nozzle outlet area to obtain the specified actual weight flow rate and the specified cone angle. There is no "use of means" to produce a result.

The applicant argues "that the single inlet logarithmic spiral flow is governed by the area ratio, is unique, and constitutes a basic invention which cannot be derived from systematic experimentation." This, however, appears to be in the nature of a scientific principle,

which in itself is not patentable. On the other hand a practical application of "physical means" giving effect to a new principle might be patentable.

The Board is satisfied that the claims on file lack a patentable advance in the art, and therefore recommends that the decision of the examiner to refuse the claims be affirmed. Furthermore, the proposed amended claims do not overcome the objections made in the Final Action.

J.F. Hughes,
Assistant Chairman,
Patent Appeal Board.

I concur with the findings of the Patent Appeal Board and refuse to grant a patent on the claims on file or the proposed claims. The applicant has six months within which to appeal this decision under the provision of Section 44 of the Patent Act.

Decision accordingly,

A.M. Laidlaw,
Commissioner of Patents.

Signed and dated in
Hull, Quebec this 24th.
day of July, 1974.

Agent for Applicant

Alex. E. MacRae & Co.,
Ottawa, Ontario.