

2117 Markush Claims [R-07.2022]

I. MARKUSH CLAIM

A “Markush” claim recites a list of alternatively useable members. *In re Harnisch*, 631 F.2d 716, 719-20, 206 USPQ 300, 302-304 (CCPA 1980); *Ex parte Markush*, 1925 Dec. Comm’r Pat. 126, 127 (1924). The listing of specified alternatives within a Markush claim is referred to as a Markush group or Markush grouping. *Abbott Labs v. Baxter Pharmaceutical Products, Inc.*, 334 F.3d 1274, 1280-81, 67 USPQ2d 1191, 1196-97 (Fed. Cir. 2003) (citing to several sources that describe Markush groups). Claim language defined by a Markush grouping requires selection from a closed group “consisting of” the alternative members. *Id.* at 1280, 67 USPQ2d at 1196. See [MPEP § 2111.03 \(s2111.html#d0e200824\)](#), subsection II, for a discussion of the term “consisting of” in the context of Markush groupings.

Treatment of claims reciting alternatives is not governed by the particular format used (e.g., alternatives may be set forth as “a material selected from the group consisting of A, B, and C” or “wherein the material is A, B, or C”). See, e.g., the *Supplementary Examination Guidelines for Determining Compliance with 35 U.S.C. 112 and for Treatment of Related Issues in Patent Applications* (“*Supplementary Guidelines*”), 76 Fed. Reg. 7162 (February 9, 2011). Claims that set forth a list of alternatives from which a selection is to be made are typically referred to as Markush claims, after the appellant in *Ex parte Markush*, 1925 Dec. Comm’r Pat. 126, 127 (1924). Although the term “Markush claim” is used throughout the MPEP, any claim that recites alternatively usable members, regardless of format, should be treated as a Markush claim. Inventions in metallurgy, refractories, ceramics, chemistry, pharmacology and biology are most frequently claimed under the Markush formula, but purely mechanical features or process steps may also be claimed by using the Markush style of claiming. See, e.g., *Fresenius USA, Inc. v. Baxter Int’l, Inc.*, 582 F.3d 1288, 1297-98, 92 USPQ2d 1163, 1170-1172 (Fed. Cir. 2009)(claim to a hemodialysis apparatus required “at least one unit selected from the group consisting of (i) a dialysate-preparation unit, (ii) a dialysate-circulation unit, (iii) an ultrafiltrate-removal unit, and (iv) a dialysate-monitoring unit” and a user/machine interface operably connected thereto); *In re Harnisch*, 631 F.2d 716, 206 USPQ 300 (CCPA 1980)(defining alternative moieties of a chemical compound with Markush groupings).

A Markush grouping is proper if the members of a group share a single structural similarity and a common use. See subsections II - IV, below, for guidelines regarding the determination of whether a Markush grouping is improper.

See [MPEP § 2111.03 \(s2111.html#d0e200824\)](#) and [MPEP § 2173.05\(h\) \(s2173.html#d0e218467\)](#) for discussions of when a Markush grouping may be indefinite under [35 U.S.C. 112\(b\) \(mpep-9015-appx-I.html#al_d1d85b_2ae65_215\)](#) (e.g., if the list of alternatives is not a closed grouping, or if a Markush group is so expansive that persons skilled in the art cannot determine the metes and bounds of the claimed invention).

See [MPEP § 803.02 \(s803.html#d0e98237\)](#) for information pertaining to the election, search, and examination of claims that include at least one Markush grouping.

II. IMPROPER MARKUSH GROUPING

A Markush claim may be rejected under judicially approved “improper Markush grouping” principles when the claim contains an improper grouping of alternatively useable members. A Markush claim contains an “improper Markush grouping” if either: (1) the members of the Markush group do not share a “single structural similarity” or (2) the members do not share a common use. *Supplementary Guidelines* at 7166 (citing *In re Harnisch*, 631 F.2d 716, 721-22, 206 USPQ 300, 305 (CCPA 1980)).

Where a Markush grouping describes part of a combination or process, the members following “selected from the group consisting of” (or a similar introductory phrase) must be substitutable, one for the other, with the expectation that the same intended result would be achieved. *Multilayer Stretch Cling Film Holdings, Inc. v. Berry Plastics Corp.*, 831 F.3d 1350, 1357, 119 USPQ2d 1773, 1779 (Fed. Cir. 2016)(“It is generally understood that ... the members of the Markush group ... are alternatively usable for the purposes of the invention”)(citations omitted). Where a Markush grouping describes part of a chemical compound, regardless of whether the claim is limited to a compound per se or the compound is recited as part of a combination or process, the members following “selected from the group consisting of” (or similar introductory phrase) need not share a community of properties themselves; the propriety of the grouping is determined by a consideration of the compound as a whole. See *Harnisch*, 631 F.2d at 722, 206 USPQ at 305 (“in determining the propriety of a Markush grouping the compounds must be considered as wholes and not broken down into elements or other components”). See also *In re Jones*, 162 F.2d 479, 481, 74 USPQ 149, 151 (CCPA 1947) (“In determining the propriety of a Markush grouping, moreover, the compounds which are grouped must each be considered as a whole and should not be broken down into elements or other components”).

The alternatives defined by the Markush group are either alternative chemical compounds as a whole (e.g., if a claim includes a compound R-OH wherein R is selected from the group consisting of methyl, propyl, and butyl, then the alternatives are methanol, propanol, or butanol) or in the context of a combination or process, the alternatives from which a selection is to be made (e.g., the alternatives in a list following the phrase “selected from the group consisting of”). The alternatives (1) share a “single structural similarity” when they belong to the same recognized physical or chemical class or to the same art-recognized class, and (2) share a common function or use when they are disclosed in the specification or known in the art to be functionally equivalent in the context of the claimed invention. See *Supplementary Guidelines* at 7166 and subsection II.A, below.

Where a Markush grouping describes alternative chemical compounds, whether by words or chemical formulas, and the compounds do not appear to be members of a recognized physical or chemical class or members of an art-recognized class, the members are considered to share a “single structural similarity” and common use when the alternatively usable compounds share a substantial structural feature that is essential to a common use. *Ex parte Hozumi*, 3 USPQ2d 1059, 1060 (Bd. Pat. App. & Int. 1984). See also subsection II.B, below.

A. “Single Structural Similarity” - Members of a Physical, Chemical, or Art-Recognized Class

Members of a Markush group share a “single structural similarity” when they belong to the same recognized physical or chemical class or to the same art-recognized class. A recognized physical class, a recognized chemical class, or an art-recognized class is a class wherein there is an expectation from the knowledge in the art that members of the class will behave in the same way in the context of the claimed invention. In other words, each member could be substituted one for the other, with the expectation that the same intended result would be achieved. For example, in the context of a claim covering a disposable diaper, a limitation “the fastener selected from the group consisting of a pressure sensitive adhesive and complementary release material, a complementary hook and loop structure, a snap, and a buckle” would likely be considered an art recognized class because a review of the prior art would establish that it was well known that each member could be substituted for each other with the expectation that the intended result (repositionable and refastenable) would occur.

Note that where a Markush group includes only materials from a recognized scientific class of equivalent materials or from an art-recognized class, “the mere existence of such a group in an application tend[s] to prove the equivalence of its members and when

one of them [is] anticipated the group [is] therefore rendered unpatentable, in the absence of some convincing evidence of some degree of non-equivalency of one or more of the remaining members." *In re Ruff*, 256 F.2d 590, 598-99, 118 USPQ 340, 348 (CCPA 1958) ("[A]ctual equivalence is not enough to justify refusal of a patent on one member of a group when another member is in the prior art. The equivalence must be disclosed in the prior art or be obvious within the terms of Section 103." *Id.* at 599, 118 USPQ at 348).

Thus, a Markush grouping is ordinarily proper if all the members of the group belong to a recognized class (whether physical, chemical, or art recognized) and are disclosed in the specification to possess at least one property in common which is mainly responsible for their function in the claimed invention, and it is clear from their very nature or from the prior art that all members possess this property. See also [MPEP § 803.02 \(s803.html#d0e98237\)](#).

B. Common Use Flows From Substantial Structural Feature

Where a Markush grouping describes alternative chemical compounds, whether by words or chemical formulas, and the alternatives do not belong to a recognized class as explained in subsection II.A, above, the members of the Markush grouping may still be considered to be proper where the alternatives share a substantial structural feature that is essential to a common use.

For example, in *Harnisch*, the claims were directed to a Markush group of coumarin derivatives disclosed to be useful as dyes. The claimed coumarin derivatives were not members of a recognized chemical class, encompassing "polyfused N-heterocyclics, cyclic, acyclic and aromatic amines, aryloxyalkylamines, amides, sulfonamides, [and] phthalimides" among others. *Harnisch*, 631 F.2d at 718, 206 USPQ at 302. Furthermore, they were not members of an art-recognized class ("[n]owhere in the record has it been established or even alleged that the variety of compounds included within the explicit scope of the claims are recognized by the art as being functionally equivalent" (*Id.*)). However, the court found that the Markush grouping was proper because the claimed compounds, viewed as a whole, all share a coumarin group and the property of being a dye. See also *In re Jones*, 162 F.2d 479, 481, 74 USPQ 149, 151 (1947).

See also *Ex parte Hozumi*, 3 USPQ2d 1059, 1060 (Bd. Pat. App. & Int. 1984)). See subsection IV, below, for a discussion of the *Harnisch* and *Hozumi* decisions.

III. REJECTION BASED ON IMPROPER MARKUSH GROUPING

When an examiner determines that the species of a Markush group do not share a single structural similarity or do not share a common use, then a rejection on the basis that the claim contains an "improper Markush grouping" is appropriate (see subsection II). Note that this is a rejection on the merits and may be appealed to the Patent Trial and Appeal Board in accordance with [35 U.S.C. 134 \(mpep-9015-appx-l.html#d0e303218912313\)](#) and [37 CFR 41.31\(a\)\(1\) \(mpep-9020-appx-r.html#ar_d24d1f_19b20_1b6\)](#). Use Form Paragraph [8.40 \(#fp8.40\)](#) to reject a claim on the basis that it includes an improper Markush grouping.

¶ 8.40 Improper Markush Grouping Rejection

Claim [1] rejected on the basis that it contains an improper Markush grouping of alternatives. See *In re Harnisch*, 631 F.2d 716, 721-22 (CCPA 1980) and *Ex parte Hozumi*, 3 USPQ2d 1059, 1060 (Bd. Pat. App. & Int. 1984). A Markush grouping is proper if the alternatives defined by the Markush group (i.e., alternatives from which a selection is to be made in the context of a combination or process, or alternative chemical compounds as a whole) share a "single structural similarity" and a common use. A Markush grouping meets these requirements in two situations. First, a Markush grouping is proper if the alternatives are all members of the same recognized physical or chemical class or the same art-recognized class, and are disclosed in the specification or known in the art to be functionally equivalent and have a common use. Second, where a Markush grouping describes alternative chemical compounds, whether by words or chemical formulas, and the alternatives do not belong to a recognized class as set forth above, the members of the Markush grouping may be considered to share a "single structural similarity" and common use where the alternatives share both a substantial structural feature and a common use that flows from the substantial structural feature. See [MPEP § 2117 \(s2117.html#ch2100_d299b6_1ae8e_380\)](#).

The Markush grouping of [2] is improper because the alternatives defined by the Markush grouping do not share both a single structural similarity and a common use for the following reasons: [3].

To overcome this rejection, Applicant may set forth each alternative (or grouping of patentably indistinct alternatives) within an improper Markush grouping in a series of independent or dependent claims and/or present convincing arguments that the group members recited in the alternative within a single claim in fact share a single structural similarity as well as a common use.

Examiner Note:

- 1. In bracket 1, insert claim number(s) and "is" or "are" as appropriate.
- 2. In bracket 2, insert a description of the Markush group(s) that are improper.
- 3. In bracket 3, explain why these alternatives do not meet the requirements for a proper Markush grouping, i.e., why the alternatives are not all members of the same recognized physical or chemical class or the same art-recognized class; and/or why the members are not considered to be functionally equivalent and have a common use; and/or why (if the Markush grouping describes alternative chemical compounds), the alternatives do not share both a substantial structural feature and a common use that flows from the substantial structural feature. See [MPEP § 2117 \(s2117.html#ch2100_d299b6_1ae8e_380\)](#).
- 4. If an election of species requirement is appropriate, this form paragraph should only be used after applicant has made an election.

In accordance with the principles of compact prosecution, a rejection based on an improper Markush grouping should be made in the first action on the merits after presentation of the claim with the improper Markush grouping (e.g., first Office action on the merits or next Office action following presentation of the claim). In addition, if the examiner determines that one or more claims include an improper Markush grouping, the examiner should also require the applicant to elect an alternative or group of indistinct alternatives for search and examination (i.e., an election of species), if such an election requirement was not previously made. See [MPEP § 803.02 \(s803.html#d0e98237\)](#) for more information on election of species requirements in Markush claims. Note that if a written provisional election of species requirement must be made separate from the first Office action on the merits, it should not include a rejection on the basis of an improper Markush grouping. Any appropriate improper Markush grouping rejection should be made in an Office action on the merits.

The examiner should include suggestions for the applicant as to how to overcome the rejection, e.g., by suggesting a proper Markush grouping based on the specification as filed and/or by suggesting that applicant set forth each alternative (or grouping of patentably indistinct alternatives) within an improper Markush grouping in a series of independent or dependent claims. There may be more than one way to formulate a proper Markush grouping. The examiner should not suggest any grouping that clearly would not meet the requirements of [35 U.S.C. 112\(a\) \(mpep-9015-appx-l.html#al_d1d85b_2ae60_3d5\)](#). For example, the examiner should not suggest a grouping that meets the requirements for a proper Markush grouping, but would clearly lack adequate written description if presented in a separate claim.

In addition to a rejection based on an improper Markush grouping, the claim should also be rejected under [35 U.S.C. 112\(b\) \(mpep-9015-appx-l.html#al_d1d85b_2ae65_215\)](#) if one skilled in the art cannot determine the metes and bounds of the Markush claim due to an inability to envision all of the members of the Markush grouping. In other words, if a boundary cannot be drawn

separating embodiments encompassed by the claim from those that are not, the claim is indefinite and should be rejected under 35 U.S.C. 112(b) ([mpep-9015-appx-l.html#al_d1d85b_2ae65_215](#)). See also MPEP § 2173.05(h) ([s2173.html#d0e218467](#)).

The claim should be examined for patentability with respect to all other conditions of patentability (e.g., 35 U.S.C. 101 ([mpep-9015-appx-l.html#d0e302376](#)), 102 ([mpep-9015-appx-l.html#al_d1fbc1_234ed_52](#)), 103 ([mpep-9015-appx-l.html#al_d1fbc1_19797_b0](#)), 112 ([mpep-9015-appx-l.html#d0e302824912](#)), and nonstatutory double patenting). As explained with regard to election of species practice as set forth in detail in MPEP § 803.02 ([s803.html#d0e98237](#)), the search need not be extended to species that fall outside a proper Markush grouping.

The improper Markush grouping rejection of the claim should be maintained until (1) the claim is amended such that the Markush grouping includes only members that share a single structural similarity and a common use; or (2) the applicant presents convincing arguments why the members of the Markush grouping share a single structural similarity and common use (i.e., are members of a physical, chemical, or art-recognized class that share a common use, or are chemical compounds that share a substantial structural feature that is essential to the common use). In addition, even if the applicant does not take action sufficient to overcome the improper Markush grouping rejection, when all of the claims are otherwise in condition for allowance the examiner should reconsider the propriety of the improper Markush grouping rejection. If the examiner determines that in light of the prior art and the record as a whole the alternatives of the Markush grouping share a single structural similarity and a common use, then the rejection should be withdrawn. Note that no Markush claim can be allowed until any improper Markush grouping rejection has been overcome or withdrawn, and all other conditions of patentability have been satisfied.

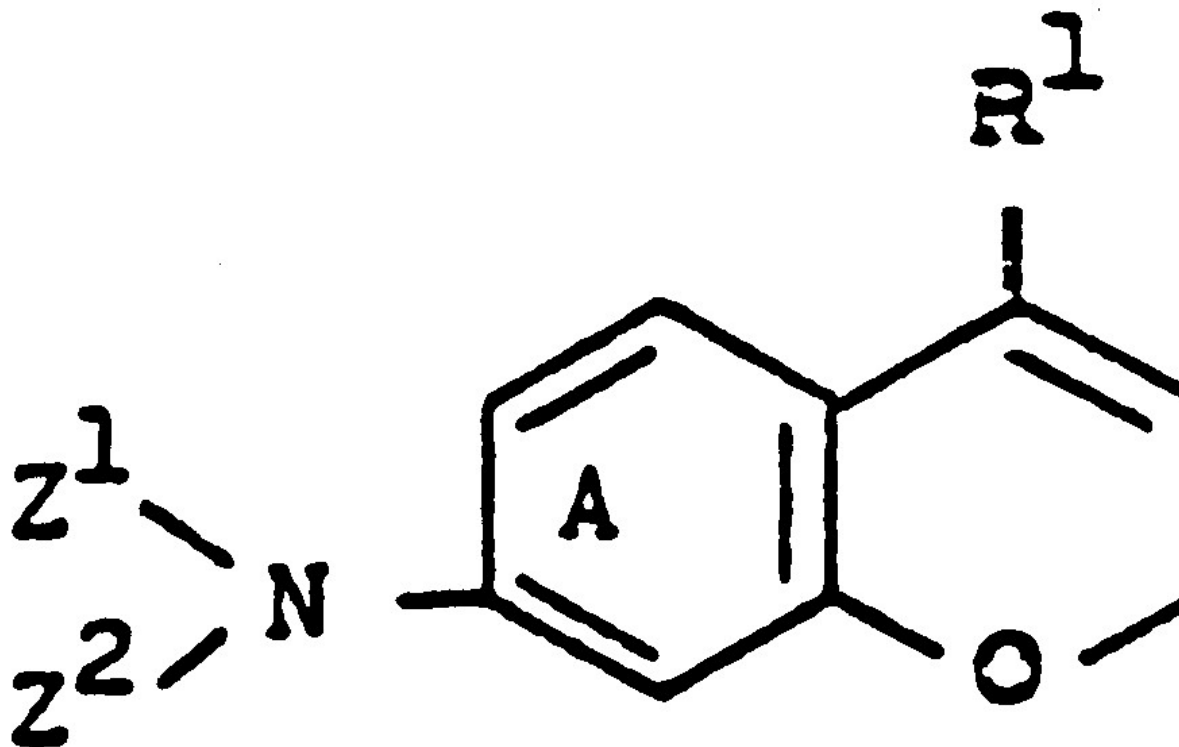
IV. MARKUSH GROUPING EXAMPLES

The propriety of Markush groupings must be decided on a case-by-case basis. The following examples illustrate Markush groupings that have been found to be proper and improper. Office personnel should note that the cases from which these examples are drawn have been selected for their treatment of Markush groupings. The cases may not necessarily reflect current practice as to other issues discussed therein.

A. *In re Harnisch*, 631 F.2d 716, 206 USPQ 300 (CCPA 1980)

Representative Claim:

1. Coumarin compounds which in one of their mesometric limiting structures correspond to the general formula



wherein

- X represents aldehyde, azomethine, or hydrazone,
- R¹ represents hydrogen or alkyl,
- Z¹ represents hydrogen, alkyl, cycloalkyl, aralkyl, aryl or a 2- or 3-membered alkylene radical connected to the 6-position of the coumarin ring and
- Z² represents hydrogen, alkyl, cycloalkyl, aralkyl or a 2- or 3-membered alkylene radical connected to the 8-position of the coumarin ring

and wherein

- Z¹ and Z² conjointly with the N atom by which they are bonded can represent the remaining members of an optionally benz-fused heterocyclic ring which, like the ring A and the alkyl, aralkyl, cycloalkyl and aryl radicals mentioned, can carry further radicals customary in dye-stuff chemistry.

Background: The Board had entered a rejection – later reversed by the CCPA – of claim 1 under 37 CFR 1.196(b) on the ground that it was drawn to an improper Markush group. The Board had focused on the wide variety of functional groups that could be present in the claimed compounds, and had stressed the different physical and chemical properties of the compounds in view of the functional groups. The Board had observed that “[n]owhere in the record has it been established or even alleged that the variety of compounds included within the explicit scope of the claims are recognized by the art as being functionally equivalent.” In the Board’s view, “the mere fact” that all of the compounds encompassed by claim 1 shared “a single structural similarity (i.e., the coumarin group),” and as a result were useful either as dyes or intermediates for the preparation of dyes, was insufficient to render the Markush grouping proper because the compounds could “be subject to different modes of application and use.”

Analysis/Conclusion: The CCPA reversed the Board's decision and held that the Markush grouping was proper. The court pointed out that all of the claimed compounds are dyes, even if some might also be seen as synthetic intermediates. The court noted the Board's admission, despite the significant variation in functional groups, that all of the compounds shared "a single structural similarity" which is the coumarin core. The court held that "the claimed compounds all belong to a subgenus, as defined by appellant [in the specification], which is not repugnant to scientific classification." Stating that "[u]nder these circumstances we consider the claimed compounds to be part of a single invention," the court concluded that the Markush grouping of claim 1 was proper. The CCPA also stressed that they decide cases involving the propriety of Markush groupings "on their facts on a case-by-case basis."

The *Harnisch* court also cited its earlier decision in *In re Jones*, 162 F.2d 479, 74 USPQ 149 (CCPA 1947) with approval as to the proper approach to evaluating claims containing Markush groups. According to the *Harnisch* court, "in determining the propriety of a Markush grouping the compounds must be considered as wholes and not broken down into elements or other components." In other words, when considering whether the members of a Markush group have sufficient structural similarity and common use to meet prongs 1 and 2 above, the proper focus should be on the commonality across all of the alternative embodiments of the invention within the scope of the claim. Note that in the *Harnisch* decision, the court looked to the common structure of the coumarin core and its associated common function as a dye, even though the coumarin core was not part of the variable Markush groups of substituents. A Markush grouping is not improper simply because the members of a list of alternative elements or substituents of the invention, as distinguished from a list of complete embodiments of the invention, lack "a single structural similarity" or a common use. When assessing whether a Markush grouping defining a chemical compound is proper, each claimed chemical compound as a whole must be compared and analyzed to determine whether the claimed compounds share both a substantial single structural similarity and a common use.

B. Ex parte Dams, Appeal No. 1997-2193, 07/986,648, decision mailed 9-13-2000 (unpublished); USP 6,201,122

Representative Claims:

1. A fluoroaliphatic radical-containing anionic sulfonamido compound which comprises a fluoroaliphatic radical-containing sulfonamido group and an ethylenecarbonyl group whose beta ethylene carbon atom is bonded to a sulfur or nitrogen atom which is bonded to a linking group bonded to the nitrogen atom of said sulfonamido group, and the carbonyl carbon atom of said carbonyl is bonded to an anionic hydrophilic polar group comprising at least one carbon, nitrogen, oxygen, or sulfur atom.

2. The fluoroaliphatic radical-containing sulfonamido compound of claim 1 wherein said compound has the formula



where Rf is a fluoroaliphatic radical; A is S or NR'''; W is siloxylene, silylene, alkylene, arylene, or combinations thereof; R, R', R'', and R''' are independently hydrogen, lower alkyl, aryl, or combinations thereof, and can contain functional groups, or R and R''' together with the nitrogen atoms to which they are bonded and W, form a ring; and Y is an anionic hydrophilic polar group comprising at least one carbon, nitrogen, oxygen, or sulfur atom.

6. The fluoroaliphatic radical-containing sulfonamido compound of claim 2 wherein said N(R)WA is selected from the group consisting of N(R)CH₂CH₂NH,



N(R)CH₂CH₂CH₂Si(CH₃)₂OSi(CH₃)₂CH₂CH₂CH₂NH, N(R)CH(CH₃)CH₂(CH₂CH₂O)_q(CH(CH₃)CH₂O)_zCH₂CH(CH₃)NH where q and z are from 1 to 20, and N(R)CH₂CH₂S, where R is H, CH₃ or CH₂CH₃.

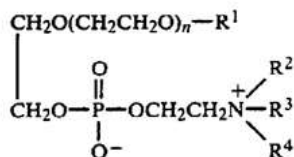
Background: The examiner had rejected the claims on a number of grounds, including the ground of improper Markush groupings. It had been the examiner's position that the Markush groups of the claims lacked a common structural feature. The examiner had also stated that in his view, the members of the Markush group were separately classifiable and separately patentable. This rejection was later reversed by the Board.

Analysis/Conclusion: The Board stated that the examiner erred by failing to treat the compounds of the claims as a whole. The examiner had improperly "focused on the individual moiety defined by the Markush terminology." Referring to claim 6 and relying on *In re Harnisch*, the Board explained that even though Markush terminology was used to define the substituent N(R)WA, the proper inquiry was "whether the compounds defined by the different moieties" have the necessary common structure and common use. The Board held that the compounds shared "a common structural feature disclosed as essential to the disclosed utility of being an anionic surfactant." Thus the compounds satisfied prongs 1 and 2 above, and the Markush grouping was proper.

C. Ex parte Hozumi, 3 USPQ2d 1059 (Bd. Pat. App. & Interf. 1984) Appeal No. 559-94, Application No. 06/257,771, decision mailed 06-26-1984 (USP 4,551,532)

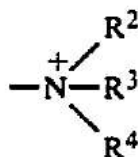
Representative Claim:

Claim 1. A compound of the formula:



• wherein

- n is an integer of 1 to 15;
- R₁ is C₆-26 alkyl, C₆-26 alkenyl or C₆-26 alkynyl, each of said groups being unsubstituted or substituted by hydroxyl, mercapto, amino, oxo, carbamoyl, carboxyl, halogen, C₃-7 cycloalkyl or phenyl; and
- R₂, R₃ and R₄ are independently hydrogen or C₁-5 alkyl, or



represents cyclic ammonio selected from the group consisting of pyridinio, oxazolio, thiazolio, pyridazinio, quinolinio, isoquinolinio, N-C1-4 alkylmorpholinio and N-C1-4 alkylpiperazinio, each of said groups being unsubstituted or substituted by C1-4 alkyl, hydroxyl, hydroxyethyl, aminoethyl, amino, carbamoyl or ureido,

or a pharmaceutically acceptable salt thereof.

Background: The examiner had rejected claim 1 on the ground that it included an improper Markush grouping.

Analysis/Conclusion: The Board reversed the examiner's improper Markush grouping rejection of claim 1, once again relying on the *Harnisch* decision. The Board summarized *Harnisch* by stating that the Markush grouping of coumarin compounds in that case was proper because there was "in common a functional utility related to a substantial structural feature disclosed as being essential to that utility." In this case, as in others already discussed, the Board emphasized the case-by-case nature of the inquiry.

Applying the *Harnisch* criteria to the facts of this case, the Board pointed out that structurally "the compounds claimed are phosphoric acid diesters in which one esterifying moiety is derived from a poly(ethylene glycol) monoether and the other is derived from a beta-aminoethanol." The Board acknowledged that as a result of the variable number of repeating oxyethylene units indicated by the "n" index, the molecular weight could "vary over a fairly broad range," and that further structural variation was seen in the etherifying groups and the substituents on the nitrogen atom. Despite the breadth of the claim, the Board focused on "the relatively large proportion of the structure of the compounds in the claimed class which is common to the entire class," and determined that the prong 1 requirement for structural similarity was met. As for the prong 2 common use requirement, the Board stated that all of the compounds shared antimycotic activity. Thus the Board found that in this case, as was also the case in *Harnisch*, there was "a substantial structural feature of the class of compounds claimed disclosed as being essential to at least one disclosed utility." Thus the Markush grouping was proper and the examiner's rejection was reversed.

D. Based On PCT International Search and Preliminary Examination Guidelines Example 33

Claim 1: A herbicidal composition consisting essentially of an effective amount of the mixture of (a) 2,4-D (2,4-dichloro-phenoxy acetic acid) and (b) a second herbicide selected from the group consisting of copper sulfate, sodium chlorate, ammonium sulfamate, sodium trichloroacetate, dichloropropionic acid, 3-amino-2,5-dichlorobenzoic acid, diphenamid (an amide), ioxynil (nitrile), dinoseb (phenol), trifluralin (dinitroaniline), EPTC (thiocarbamate), and simazine (triazine) along with an inert carrier or diluent.

Background/Prior Art: A review of the art demonstrates that the alternatives are not all members of the same recognized physical or chemical recognized class of compounds. The prior art explains that mixing herbicides can be risky and can result in physical or chemical incompatibilities, e.g., increasing or decreasing the effectiveness of each or all of the herbicides, increasing toxicity, or reacting to form a precipitate. The prior art also shows that the many of the herbicides set forth in component (b) are effective against one type of weed (e.g., algae, woody weeds, or grasses), but are not effective against other types of weeds. In addition, many of the herbicides listed in the Markush group are tolerated by one type of crop (e.g., legumes, tomato, or corn) or in one type of environment (e.g., ponds, golf courses, or orchards), but are not tolerated by other crops or in other environments.

Analysis: All members of the Markush grouping have a common disclosed use as herbicides. However, the alternatives set forth in the Markush grouping are not all members of the same physical or chemical recognized class of compounds. Furthermore, the members of the Markush group defining component (b) are not in an art recognized class because a person of ordinary skill in the art would not expect that members of the class will behave in the same way in the context of the claimed invention. Specifically, a person of ordinary skill in the art would not expect that any one herbicide of component (b) could be substituted with any other member of the Markush group with the expectation that the same intended result would be achieved because of the unpredictability of results when mixing herbicides, the different weeds that are controlled by one member of the Markush group as compared to another, the different crops that do (or do not) tolerate the alternatives within the Markush group, and the different environments in which the each second herbicide is suitable for use.

Although the members of the Markush grouping are not members of a recognized class (physical, chemical, or art-recognized) for the reasons set forth above, the Markush grouping describes alternative chemical compounds. Therefore the members of the Markush grouping may be considered to share a "single structural similarity" and common use if the alternatives share both a substantial structural feature and a common use that flows from the substantial structural feature.

In this case, the members of the Markush grouping do not share a substantial structural feature. Rather, the members of the Markush group defining component (b) represent a plurality of chemical classes with varying structures which may be identified as follows:

- (a) inorganic salts: copper sulfate, sodium chlorate, ammonium sulfamate (no ring structure)
- (b) organic salts and carboxylic acids: sodium trichloroacetate, dichloropropionic acid, 3-amino-2,5-dichlorobenzoic acid (only the third chemical has a ring structure, which is a benzoic acid)
- (c) amides: diphenamid (ring structure is diphenyl)
- (d) nitriles: ioxynil (ring structure is dinitrophenol)
- (e) phenols: dinoseb
- (f) amines: trifluralin, (ring structure is dinitroaniline), and
- (g) heterocyclic: simazine (ring structure is triazine).

Conclusion: The claim sets forth an improper Markush grouping because the alternatives are not all members of the same recognized physical or chemical class or the same art-recognized class, nor do the alternative chemical compounds share both a substantial structural feature and a common use that flows from the substantial structural feature.

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