

CLASS 987, ORGANIC COMPOUNDS CONTAINING A Bi, Sb, As, OR P ATOM OR CONTAINING A METAL ATOM OF THE 6TH TO 8TH GROUP OF THE PERIODIC SYSTEM

SECTION I - CLASS DEFINITION

CROSS-REFERENCE ART COLLECTIONS

Class 987 provides an ANCILLARY and totally OPTIONAL search for subject matter relating to certain types of ORGANIC COMPOUNDS found under official Class 532. This class has been developed and relates to the subject matter in Class C07F, subgroups 9/00-19/00 of the International Patent Classification System (IPC).

The subject matter of this class encompasses acyclic, carbocyclic, or heterocyclic compounds containing elements other than carbon, hydrogen, nitrogen, sulfur, selenium, tellurium, halogen, and elements of Groups I-IV of the Periodic System.

This Class Does NOT Provide for Organic Compounds Relating to:

- (1) Peptides, proteins, or enzymes ; (2) Sugars or derivatives thereof, nucleosides, nucleotides, nucleic acids, saccharides, or polysaccharides or derivatives thereof;
- (3) Steroids; (4) Macromolecular compounds; (5) Dyes.

The Technical Subject Matter of This Class Relates to:

- (1) Organic compounds containing a heavy metal of the 6th to 8th Group of the Periodic System
- (2) Organic compounds containing Bismuth, Antimony, or Arsenic
- (3) Organic compounds containing Phosphorus

See Subclass References to the Current Class, below, for a map to these subclasses.

SECTION II - LINES WITH OTHER CLASSES AND WITHIN THIS CLASS

The general hierarchy of the Class 532 series has not been followed and the above compounds include heterocyclic rings when present together with the required elements of this class. As can readily be seen, this class provides an opportunity for searching certain types of heterocyclic compounds as well as certain phosphorus

organic compounds in an alternative manner from that of Class 532.

Class 987 is a prototypical searching area developed under the auspices of the Office of International Patent Classification. In the past, search areas in the U.S. classification system (Classes 976, 968, 984, and 930) have been created utilizing the European Patent Office's (EPO) classification of U.S. patents into their search and retrieval system. Class 987 is significantly different from those other classification areas in that a substantial number of patents have been reviewed, a large number of subclasses have been rearranged or merged, and definitions have been written to describe the contents of each and every subclass. In addition, the entire schedule has been presented in a format which utilizes the first place rule of classification which is the standard practice within the U.S. Patent Classification System (USPCS).

The European Patent Classification System (EPCS) utilizes, for the most part, the skeletal outline of the International Patent Classification System (IPCS). To the broad IPCS, the EPO has added additional classification areas and thereby has created the EPCS. These are equatable to alpha subclasses in the USPC. Both the IPCS and the EPCS utilize a last place classification rule in C07F, which is the area of classification equatable to new Class 987. The last place rule requires locating the last subgroup in the classification schedule which provides for the subject matter to be classified. The U.S. classification system requires placement in the first subclass for the subject matter to be classified. As can readily be seen, these are substantially different philosophies in the placement of documents. The Class 987 schedule has been presented in a format which negates this difference and therefor does not place any undue burden upon the user to learn a new and different philosophy of search.

Class 987 was created with the intention that Group 1200 of the United States Patent and Office (USPTO) would soon have the capability of searching patents utilizing all of the enhanced aspects of the Automated Patent System; in particular, the aspect relating to image searching. It is the belief of Classification that the addition of Class 987 to the searchable database can be of assistance at various times in the examination process.

Although we believe that Class 987 will be of use to the examination process, we are fully aware that the addition of new search areas can create problems. One of the most obvious questions that we have is the question of how examiners in the EPO place documents. In the USPTO, we know that certain rules exist between

classes, that rules of superiority apply between diverse types of subject matter (compound, method of making, and method of using), that rules of comprehensiveness apply between classes, and that all claims are classified, and unclaimed subject matter is cross-referenced to subclasses when it is determined to be useful.

In Class 987, we are relying on the placement techniques of examiners in the EPO to locate U.S. patents. Although we believe that EPO examiners follow our general rules in the compound classes, we will not be completely certain until Class 987 is tested and evaluated by the Corps. We hope to conduct tests in concert with the Corps and will evaluate fully the effectiveness of Class 987. If, at the end of the evaluation period, we find that Class 987 does not meet the requirements of the Corps, we will rethink whether we want to retain the class.

The IPC and the EPC do not contain the types of definitions associated with U.S. classes. This, in itself, does not in any manner flaw their system. The titles and attendant notes in the IPC are the full extent of the content of any subgroup. When those tools are used together with the Guide to the IPC (Volume 9), all of the tools to access and retrieval are available. In the creation of this class, definitions and notes have been written. Many of the definitions are no more than the repeating of a subclass title, while in other areas the definitions are much more meaningful. The advantage, of course, to any definition is that it hopefully conveys information that the creator of the subclass thought might be useful to a user of the system and that information is available even if the creator is no longer available. We believe that the use of definitions leads to consistency of patent placement.

Class 987 is available on the Automated Patent System (APS). It is to be treated as any other class, with the proviso that it cannot accept any original classifications and that any search in the class is **OPTIONAL**. Patents can be added through the use of the blue slip on allowance or by miscellaneous transfer. Patents can be deleted from the files in the manner currently in use.

Subject Matter Relating to Subclasses 300-304

The subject matter in subclasses 300-304 relates to EPCS 9/02A-9/02E. This is an ancillary search to subclasses 30-234 which include the subject matter of this search area, but where no specific subclass has been identified in that array.

Subject Matter Relating to Subclasses 350-368

The subject matter in subclasses 350-368 which encompasses phosphorus containing a hetero ring containing at least one nitrogen atom and no other hetero atom is equivalent in scope to EPCS 9/65-9/65D3B. The aforementioned area in the EPCS does not accept new patents and will be abolished in the future. It has been replaced by subgroups 9/547 and 9/553-9/6533 which equate to new subclass 49 and subclasses 67-108. Although the scope of subject matter is the same, it has been presented in a different classification scheme and therefore movement of patents from one area to the other is not easily done without reading the documents. The EPO is in the process of reclassifying those patents into their new reclassification scheme.

It is apparently the policy of the EPO to maintain two searching areas as patents are being reclassified from an abolished to a newly created subgroup. Since the abolished area is not equivalent to the newly established areas, it has been determined by the U.S. IPC group to concurrently present the two classification systems. When the EPO has reclassified all of the patents in the abolished area, the U.S. IPC group will obtain that information and add those patents to subclasses 49 and 67-108. At the same time, subclasses 350-368 will be abolished.

SECTION III - SUBCLASS REFERENCES TO THE CURRENT CLASS

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 1, -21, for organic compounds containing a heavy metal of the 6th to 8th Group of the Periodic System.
- 22, -29, for organic compounds containing Bismuth, Antimony, or Arsenic.
- 30, -368, for organic compounds containing Phosphorus

SECTION IV - GLOSSARY

The following terms are used throughout the schedule.

ARYL

Denotes an independent benzene ring or a benzene ring which is part of a fused or bridged ring system.

CHALCOGEN

Limited to oxygen (O), sulfur (S), selenium (Se), or tellurium (Te).

CYANO

Denotes a triple bond between an adjacent carbon and nitrogen atom. As used in this class, cyano is always bonded directly to a phosphorus atom through the carbon atom.

CYCLOALIPHATIC

Denotes a ring composed solely of a carbon atom and includes aryl.

ETHYLENIC

Denotes a double bond or triple between adjacent acyclic carbon atoms.

HALOGEN

Limited to fluorine (F), chlorine (Cl), bromine (Br), iodine (I), and astatine (At).

SUBCLASSES

1 COMPOUND CONTAINS TWO OR MORE HEAVY METAL ATOMS WHICH ARE IN DIFFERENT GROUPS OF THE PERIODIC SYSTEM (19/00; 19/00B):

This subclass is indented under the class definition. Subject matter wherein the compound contains at least two different heavy metal atoms which are in different groups of the Periodic System.

- (1) Note. For purposes of this subclass, the lanthanides (atomic numbers 57-71) are to be considered as a whole to be in one group and the actinides (atomic numbers 89 and above) are to be considered as a whole to be in a separate group. Examples of appropriate placement in this subclass would be a compound that contained both Fe (Group 8) and As (Group 5) or a compound containing both Fe (Group 7) and any actinide or lanthanide atom.

- (2) Note. A heavy metal is defined as a metal having a specific gravity greater than four.

- (3) Note. Excluded as heavy metals are the Group 1A and Group 2A metals, with the exception of Ra. Also, excluded are Al and Sc. Arsenic is considered to be a heavy metal atom in Group 5.

- (4) Note. See the Class 502 schedule (Catalyst, Solid Sorbent, or Support Therefor: Product or Process of Making) for a grouping of metal atoms into the appropriate groups of the Periodic System.

2 HEAVY METAL COMPOUNDS WHEREIN THE METAL IS BONDED DIRECTLY TO AT LEAST TWO RING SYSTEMS (METALLOCENES) (17/00):

This subclass is indented under the class definition. Subject matter drawn to organic compounds wherein at least one heavy metal atom is bonded directly to at least two carbocyclic ring systems or at least two ring systems containing carbon and at least one atom of nitrogen, oxygen, sulfur, selenium, or tellurium as the only atoms in the ring or a combination of the above ring systems.

- (1) Note. A heavy metal atom is defined as a metal having a specific gravity greater than four.

3 Group 8 metal atom (Fe, Co, Ni, Pt, Rh, Pd, Ru, Ir, Os) (17/02):

This subclass is indented under subclass 2. Subject matter wherein the heavy metal is a Group 8 metal atom of the Periodic System (Fe, Co, Ni, Pt, Rh, Pd, Ru, Ir, or Os).

4 COBALT COMPOUNDS (15/06):

This subclass is indented under the class definition. Subject matter drawn to carbon compounds wherein cobalt is bonded directly to a carbon atom or is indirectly bonded to a carbon atom only through non-ionic bonding.

5 Devoid of any cobalt atom directly bonded to carbon (15/06B):

This subclass is indented under subclass 4. Subject matter wherein the compound is devoid of any carbon atom directly bonded to a cobalt atom.

- 6 NICKEL COMPOUNDS (15/04):**
This subclass is indented under the class definition. Subject matter drawn to carbon compounds wherein nickel is bonded directly to a carbon atom or is indirectly bonded to a carbon atom only through non-ionic bonding.
- 7 Devoid of any nickel atom directly bonded to carbon (15/04B):**
This subclass is indented under subclass 6. Subject matter wherein the compound is devoid of any carbon atom directly bonded to the nickel atom.
- 8 IRON COMPOUNDS (15/02; 15/03):**
This subclass is indented under the class definition. Subject matter drawn to carbon compounds wherein iron is bonded directly to a carbon atom or is indirectly bonded to a carbon atom only through non-ionic bonding.
- 9 Devoid of any iron atom directly bonded to carbon (15/02B):**
This subclass is indented under subclass 8. Subject matter wherein the compound is devoid of any carbon atom directly bonded to the iron atom.
- 10 PLATINUM COMPOUNDS (15/00N7):**
This subclass is indented under the class definition. Subject matter drawn to carbon compounds wherein platinum is bonded directly to a carbon atom or is indirectly bonded to a carbon atom only through non-ionic bonding.
- 11 Devoid of any platinum atom directly bonded to carbon (15/00N7B):**
This subclass is indented under subclass 10. Subject matter wherein the compound is devoid of any carbon atom directly bonded to the platinum atom.
- 12 RHODIUM COMPOUNDS (15/00N6):**
This subclass is indented under the class definition. Subject matter drawn to carbon compounds wherein rhodium is bonded directly to a carbon atom or is indirectly bonded to a carbon atom only through non-ionic bonding.
- 13 Devoid of any rhodium atom directly bonded to carbon (15/00N6B):**
This subclass is indented under subclass 12. Subject matter wherein the compound is devoid of any carbon atom directly bonded to the rhodium atom.
- 14 PALLADIUM COMPOUNDS (15/00N5):**
This subclass is indented under the class definition. Subject matter drawn to carbon compounds wherein palladium is bonded directly to a carbon atom or is indirectly bonded to a carbon atom only through non-ionic bonding.
- 15 Devoid of any palladium atom directly bonded to carbon (15/00N5B):**
This subclass is indented under subclass 14. Subject matter wherein the compound is devoid of any carbon atom directly bonded to the palladium atom.
- 16 RUTHENIUM COMPOUNDS (15/00N4; 15/00N4B):**
This subclass is indented under the class definition. Subject matter drawn to carbon compounds wherein ruthenium is bonded directly to a carbon atom or is indirectly bonded to a carbon atom only through non-ionic bonding.
- 17 IRIIDIUM COMPOUNDS (15/00N3; 15/00N3B):**
This subclass is indented under the class definition. Subject matter drawn to carbon compounds wherein iridium is bonded directly to a carbon atom or is indirectly bonded to a carbon atom only through non-ionic bonding.
- 18 OSMIUM COMPOUNDS (15/00N2; 15/00N2B):**
This subclass is indented under the class definition. Subject matter drawn to carbon compounds wherein osmium is bonded directly to a carbon atom or is indirectly bonded to a carbon atom only through non-ionic bonding.
- 19 COMPOUNDS CONTAINING ELEMENTS OF THE 7TH GROUP OF THE PERIODIC SYSTEM (Mn, Tc, Re) (13/00):**
This subclass is indented under the class definition. Subject matter drawn to organic compounds wherein a Group 7 metal of the Periodic System (Mn, Tc, or Re) is bonded directly

- to a carbon atom or is indirectly bonded to a carbon atom only through non-ionic bonding.
- 20 Devoid of any group 7 atom directly bonded to carbon (13/00B):**
This subclass is indented under subclass 19. Subject matter wherein the compound is devoid of any carbon atom directly bonded to the group 7 metal atom.
- 21 COMPOUNDS CONTAINING ELEMENTS OF THE 6TH GROUP OF THE PERIODIC SYSTEM (Cr, Mo, W, Po) (11/00):**
This subclass is indented under the class definition. Subject matter drawn to organic compounds wherein a Group 6 metal of the Periodic System (Cr, Mo, W, or Po) is bonded either directly to a carbon atom or is indirectly bonded to a carbon atom only through non-ionic bonding.
- 22 Devoid of any group 6 atom directly bonded to carbon (11/00B):**
This subclass is indented under subclass 21. Subject matter wherein the compound is devoid of any carbon atom directly bonded to the group 6 metal atom.
- 23 BISMUTH COMPOUNDS (9/94):**
This subclass is indented under the class definition. Subject matter drawn to organic compounds wherein bismuth is bonded either directly to a carbon atom or is indirectly bonded to a carbon atom only through non-ionic bonding.
- 24 ANTIMONY COMPOUNDS (9/90; 9/90B; 9/90C; 9/90D; 9/90E):**
This subclass is indented under the class definition. Subject matter drawn to organic compounds wherein antimony is bonded either directly to a carbon atom or is indirectly bonded to a carbon atom only through non-ionic bonding.
- 25 Contains aryl group (9/92):**
This subclass is indented under subclass 24. Subject matter wherein the compound contains at least one aryl ring.
- (1) Note. See the glossary of the Class Definition for a definition of the term "aryl".
- 26 ARSENIC COMPOUNDS (9/70C):**
This subclass is indented under the class definition. Subject matter drawn to organic compounds wherein arsenic is bonded either directly to a carbon atom or is indirectly bonded to a carbon atom only through non-ionic bonding.
- 27 Arsenic compounds devoid of any arsenic as ring atom in a ring system (9/66; 9/68; 9/70; 9/70B; 9/72; 9/72B; 9/72C):**
This subclass is indented under subclass 26. Subject matter wherein a compound contains at least one atom of arsenic and wherein the arsenic present is not part of a ring system.
- 28 Ring system containing at least one atom other than metal or carbon as ring atoms (9/80; 9/80B; 9/80C; 9/82; 9/84; 9/86; 9/88):**
This subclass is indented under subclass 27. Subject matter wherein the arsenic compound contains a ring system having at least one atom other than metal or carbon as ring atoms.
- 29 Contains aryl group (9/74; 9/74B; 9/74C; 9/76; 9/78):**
This subclass is indented under subclass 27. Subject matter wherein the arsenic compound contains an aryl group.
- 30 PHOSPHORUS CONTAINING COMPOUNDS (9/02; 9/06):**
This subclass is indented under the class definition. Subject matter drawn to organic compounds wherein phosphorus is bonded either directly to a carbon or is indirectly bonded to carbon only through non-ionic bonding.
- (1) Note. In those subclasses which do not recite a valence requirement, the P atom can be in any valence state.
- (2) Note. Many of the subclasses are presented in a structural formula recited format. The requirement for this and the indented subclasses and in the absence to the contrary is that a single moiety must exist in the compound having the required structure. It is permissible that the compound contain multiple moieties of the structure, although in most instances this does not occur or special provision has been made for those con-

cepts by the creation of subclasses requiring that feature.

- (3) Note. The following rules apply to the use of structural formulas or symbols in the schedule or definitions. A structure such as:

(a)Hal-P-N or (Hal)-P-(N) indicates a direct bond between the Hal and the P atom and a direct bond between the N atom and the P atom. Other atoms may be bonded to the P and N atoms. Atoms represented as being adjacent atoms to each other by a hyphen indicates a direct bond between those atoms. A hyphen may represent a single, double, or triple bond.

(b)P=N or P(=N) indicates a direct double bond between the P atom and the N atom. Other atoms may be bonded to the P and N atoms.

(c)C=X or (C=X) represents a double bond between a carbon atom and a chalcogen atom and where presented in a structure indicates a direct bond between the C and the P atom, i.e., P-(C=X) indicates that a direct bond exists between the C atom of the (C=X) group and the P atom.

(d)A single atom between parentheses (any atom) indicates a direct, e.g., single, double, etc., bond between that atom and a phosphorus atom, e.g., P-(O) indicates that the bond between the P and the oxygen atom is direct and not through another atom, and can be a single or double bond, and P-(C) indicates a direct bond between P and C and the C can be of any valence, etc.

(e)A single atom between parentheses (=any atom) indicates a direct double bond between that atom and a phosphorus atom, i.e., P-(=O) indicates that the bond between the P atom and the oxygen atom is direct and must be a double bond.

(f)A moiety between parentheses indicates a direct bond between the moiety

and the P. If the moiety is (X-and any other atom) where S is chalcogen, the direct bond is always between the chalcogen and the P atom, unless there exists a double bond between the X atom and the other required atom, i.e., C=X in which case the direct bond is between the C and the P atom.

(g)Chemical moieties shown without parenthesis with the exception of moieties shown between quotation marks "--" (see (h) below) cannot be bonded directly to the required P atom. Furthermore, they may or may not be directly bonded to the adjacent indicated atom.

(h)Chemical moieties shown between quotation marks "--" indicates that an atom of the group, e.g., "ethylenic group," indicates that a carbon of the ethylenic group can be directly or indirectly bonded to a P atom and "carbocyclic ring" indicates that a carbon atom of the carbocyclic ring can be directly or indirectly bonded to the P atom, etc.

(i)The term "Q" indicates a moiety containing an atom other than C or H. The particular atom that is other than C or H may or may not be bonded directly to the adjacent atom shown. The bonding to the adjacent atom shown cannot be through a phosphorus atom and requires a bond other than ionic.

(j)X used throughout the schedule and definitions is limited to chalcogen, i.e., Oxygen (O), Sulfur (S), Selenium (Se), and Tellurium (Te). For ease of readability, in many instances, the chemical symbols for these elements have been used.

(k)Phosphorus and its chemical symbol (P), carbon and its chemical symbol (C), nitrogen and its chemical symbol (N), and hydrogen and its chemical symbol (H) have been used interchangeably throughout the schedule and definitions.

(l)Halogen or its abbreviated form (Hal) has been used throughout the schedule or definitions to indicate the presence of

fluorine, chlorine, bromine, iodine, or astatine atoms.

(m)The term “Z” indicates an atom other than C or H and requires a direct non-ionic bond between the particular atom that qualifies as Z and the adjacent atom indicated. The term is meant to exclude classification on the inorganic portion of an organic phosphorus containing compound. See (q) below.

(n)Chemical moieties shown within parentheses and an asterisk (*). (1) (Aryl*) indicates that a carbon of the aryl ring is bonded to the adjacent indicated atom shown. (2) (Carbocyclic*) indicates a ring atom of the carbocyclic is directly bonded to the adjacent indicated atom shown. (3) (Ethylenic*) indicates a carbon of the unsaturated group (double or triple bond) is directly bonded to the adjacent atom shown. (4) (Cyano*) indicates a direct bond between the carbon of the cyano group and the adjacent atom shown. (5) (Acyl*) indicates a direct bond between the carbon of the acyl group and the adjacent group shown.

(o)A moiety interposed between quotation marks “-” indicates that it is alternative as to whether the named group is directly or indirectly bonded to the P atom.

(p)Bonded directly or directly bonded indicates a non-ionic bond between the two adjacent required atoms or moieties.

(q)Indirectly bonded or bonded indirectly indicates a nondirect, non-ionic, linkage between nonadjacent atoms or moieties. The terms are used to exclude classification on the inorganic portion of a salt. When a compound is composed of both an organic cation and an organic anion, then classification on both of the organic moieties is appropriate.

- (4) Note. Organic acid salts, alcoholates, phenates, chelates, or mercaptides are classified on the basis of the organic portion of the compound that contains the

phosphorus atom. If both the anion and cation are organic, the entire molecule is classified.

- 31 Compound contains a ring which is devoid of a metal atom as ring member and wherein the ring contains at least one atom other than C, N, O, S, P, Se, or Te as a ring atom; e.g., boron, etc. (9/6596):**

This subclass is indented under subclass 30. Subject matter wherein a ring contains at least one atom other than C, N, O, S, P, Se, or Te as ring members.

- 32 Compound contains at least one atom of silicon or boron (9/02G):**

This subclass is indented under subclass 30. Subject matter wherein the phosphorus containing compound contains at least one atom of silicon or boron.

- 33 Compound contains a ring which is devoid of a metal atom and contains at least one P atom as ring member (9/6564; 9/6564V; 9/6568; 9/6568B; 9/6568C; 9/6568D; 9/6568E; 9/6568F):**

This subclass is indented under subclass 30. Subject matter wherein a phosphorus atom is part of a ring.

- (1) Note. When phosphorus is a ring member, the traditional definition of “heterocyclic” atom, as used throughout the Class 532 series, is not met. Furthermore, the definition of “heterocyclic,” in the 532 series, requires the presence of a carbon atom as a ring member, this is not the situation in the EPC.

- (2) Note. Whenever a ring atom is used throughout this and its indented subclasses, it is meant to include only those additional atoms that are in the same ring as is phosphorus. An example of this is subclass 46, the oxygen ring atom must be in the same ring with the P atom.

- (3) Note. Extracyclic, as used in this and its indented subclasses, is meant to include atoms not in the same ring as phosphorus. A non-ring atom would include a heterocyclic ring containing that atom in a ring devoid of phosphorus and other

ring atoms required by the title of the subclass.

- 34 Ring contains N and P only, or may include in addition to the required N and P, only C, S, or O (9/6581; 9/6584; 9/6584A):**

This subclass is indented under subclass 33. Subject matter wherein a ring contains (a) N and P atoms only or (b) N and P and additional atoms only of C, S, or O.

- (1) Note. All of the additional possible atoms need not be present.

- 35 Ring contains at least two P atoms (9/6581D; 9/6587; 9/659; 9/6593):**

This subclass is indented under subclass 34. Subject matter wherein the ring contains at least two phosphorus atoms.

- 36 Ring contains S and P only, or may include in addition to the required S and P, only C or O (9/6578; 9/6578D):**

This subclass is indented under subclass 33. Subject matter wherein a ring contains (a) S and P atoms or (b) S and P and additional atoms of C or O only.

- (1) Note. All of the additional possible atoms need not be present.

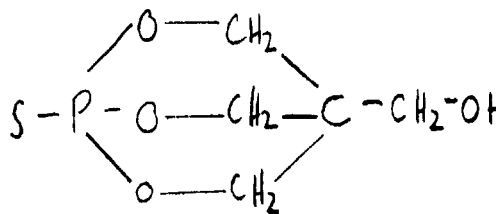
- 37 Ring contains O and P only, or may include in addition to the required O and P, only C (9/6571):**

This subclass is indented under subclass 33. Subject matter wherein the ring contains only phosphorus and oxygen atoms or phosphorus and oxygen and additional atoms only of carbon.

- 38 P in ring is directly bonded to at least two O atoms which are in separate rings (9/6571A8; 9/6574A8):**

This subclass is indented under subclass 37. Subject matter wherein a phosphorus atom is bonded directly to at least two oxygen atoms and wherein the phosphorus atom is shared by two separate rings and the two oxygen atoms are in different ring systems or are shared by two ring systems.

- (1) Note. An example of a compound classified herein is:



- 39 Ring contains a P(O) group as atoms within the ring and wherein all atoms bonded to the P atom within the ring, or extracyclic to the ring, are oxygen (9/6574; 9/6574A1):**

This subclass is indented under subclass 37. Subject matter wherein the phosphorus in the ring is bonded solely to oxygen atoms in the ring and solely to oxygen atoms extracyclic to the ring.

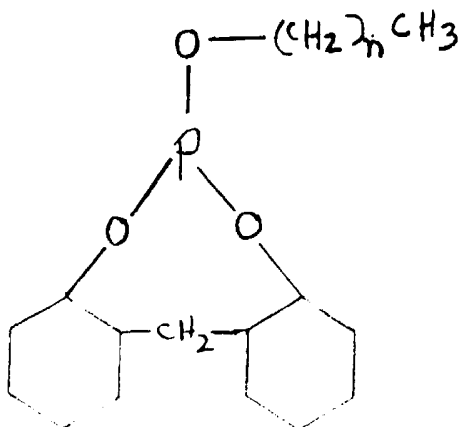
- 40 Two or more rings contain at least one P(O) group and wherein at least two P atoms in the two rings are bonded solely to O, or wherein the compound contains two P atoms in a single ring and all bonds of the P atoms are to O (includes spiro rings) (9/6574A6):**

This subclass is indented under subclass 39. Subject matter wherein (a) the compound contains at least two phosphorus atoms in different rings and the two phosphorus atoms are bonded solely to oxygen or (b) wherein a single ring contains at least two phosphorus atoms and all bonds to at least two of the phosphorus atoms are solely to oxygen.

- 41 P(O) group containing ring is part of a condensed or bridged carbocyclic ring system (9/6574A4):**

This subclass is indented under subclass 39. Subject matter wherein the phosphorus containing ring shares at least two carbon atoms of a carbocyclic ring or taken together with two or more carbocyclic rings forms a ring therewith.

- (1) Note. An example of a compound appropriate for this subclass is:



- 42** Contains P(O) group as atoms in the ring and wherein the P atom is directly bonded to N (9/6571B):

This subclass is indented under subclass 37. Subject matter wherein the ring phosphorus atom is bonded directly to at least one oxygen atom in the ring and is also bonded to at least one nitrogen atom which may be in the ring or extracyclic to the ring.

- 43** Contains P and O as ring atoms and wherein the P atom is directly bonded to a C atom (9/6571L):

This subclass is indented under subclass 37. Subject matter wherein the ring phosphorus atom is bonded to a carbon which may be part of the ring or extracyclic to the ring.

- 44** P atom bonded to C is also bonded directly to two O atoms which are in the same ring as P (9/6571L4):

This subclass is indented under subclass 43. Subject matter wherein the ring phosphorus atom is bonded directly to two ring oxygen atoms.

- 45** P atom bonded to C is bonded to an O atom which is in the same ring as P (9/6571L2; 9/6571L6):

This subclass is indented under subclass 43. Subject matter wherein the ring phosphorus atom is bonded directly to a single ring oxygen atom.

- 46** Contains P(O) group as ring atoms and wherein the P atom is directly bonded to extracyclic S (9/6571A; 9/6571A1):

This subclass is indented under subclass 37. Subject matter wherein the ring phosphorus atom is bonded directly to a sulfur atom, the sulfur being extracyclic to the phosphorus containing ring.

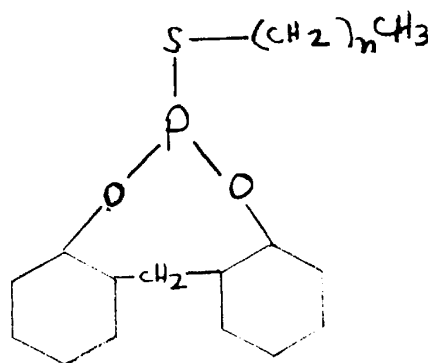
- 47** Two or more rings contain at least one P-O bond and wherein at least two P atoms in the two rings are bonded to S (includes spiro) (9/6571A6):

This subclass is indented under subclass 46. Subject matter wherein (a) the compound contains at least two phosphorus atoms in different rings and the two phosphorus atoms are bonded directly to ring oxygen and extracyclic sulfur or (b) wherein a single ring contains at least two phosphorus atoms and each of the phosphorus atoms is bonded directly to ring oxygen and extracyclic sulfur.

- 48** P(O) containing ring is part of a condensed or bridged ring carbocyclic system (9/6571A4):

This subclass is indented under subclass 46. Subject matter wherein the phosphorus containing ring shares at least two carbon atoms of a carbocyclic ring or taken together with two or more carbocyclic rings forms a ring therewith.

(1) Note. An example of a compound appropriate for this subclass is:



- 49** Ring is devoid of a P or a metal atom and contains at least one hetero atom (O, S, N,

Se, or Te) and may or may not contain C (9/547; 9/6524):

This subclass is indented under subclass 30. Subject matter wherein the phosphorus compound contains at least one hetero atom (i.e., oxygen, sulfur, nitrogen, selenium or tellurium) as a ring member, and wherein the ring may or may not contain carbon.

- (1) Note. Compounds herein are not required to have carbon atoms as ring atoms. Compounds which are devoid of a carbon atom as a ring member are not in fact "heterocyclic compounds" as used throughout the Class 532 series. In those instances where the ring does contain at least one atom of carbon the term is identical in usage to the Class 532 series. When the term "heterocyclic ring" is used in this class, it does in fact conform to the Class 532 definition.
- (2) Note. Included specifically in this subclass are rings containing four or more nitrogen atoms.
- (3) Note. The rule to be followed in those compounds containing multiple rings having an atom other than carbon as ring members is that classification is made on the ring nearest to the phosphorus atom. It is desirable, however, if classifications are assigned for each of the rings.

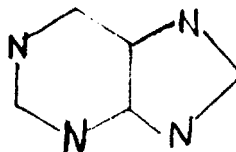
50 At least two rings, each ring containing at least one hetero atom, and wherein the rings are condensed directly to each other or condensed together through a common carbocyclic ring system (9/6561):

This subclass is indented under subclass 49. Subject matter wherein the P compound (a) contains two or more ring systems, each of which contains an atom other than C as a ring member, and wherein at least two of the rings share two or more of their ring atoms together, or (b) where a common carbocyclic ring or ring system shares two or more of its carbon atoms with each of the required rings.

51 Six-membered ring containing exactly two N atoms as sole hetero atoms shares two of its adjacent c atoms with a five-membered ring containing exactly two N atoms as sole het-

ero shares; e.g., purine and analogs, etc. (9/6561E):

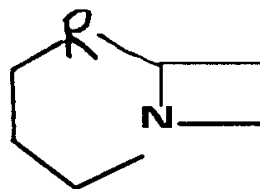
This subclass is indented under subclass 50. Subject matter wherein the P compound contains the following ring system.



- (1) Note. The degree of saturation between ring atoms is not pertinent for this subclass.

52 Six-membered ring shares a N and C atom with a four-membered ring wherein the six-membered ring contains a C or hetero atom in position 5 and no other hetero atom, the four-membered ring contains the single N as hetero atom; e.g., cephalosporins and analogs, etc. (9/6561B):

This subclass is indented under subclass 50. Subject matter wherein the P compound contains the following ring system.

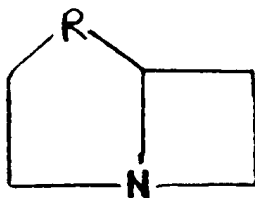


R is C, N, O, S, Se, or Te

- (1) Note. The degree of saturation between ring atoms is not pertinent for this subclass.

53 Five-membered ring shares a N and C atom with a four-membered ring wherein the five-membered ring contains a C or hetero atom in position 4 and no other hetero atom, the four-membered ring contains the single N as hetero atom; e.g., penicillins and analogs, etc. (9/6561A):

This subclass is indented under subclass 50. Subject matter wherein the P compound contains the following ring system.



R is C, N, O, S, Se, or Te

- (1) Note. The degree of saturation between ring atoms is not pertinent for this subclass.
- 54 At least two different rings containing hetero atoms or wherein, if the rings are the same, the substituents on at least two of the rings are different (9/6558; 9/6558B):**
This subclass is indented under subclass 49. Subject matter wherein the P compound (a) contains at least two different ring systems, each of which contains at least one atom other than carbon, or (b) where a compound contains a plurality of identical rings, each of which contains at least one atom other than carbon and wherein the substituents on at least two of the identical ring systems are different.
- 55 At least one of the rings is devoid of N as ring atom (9/6558C):**
This subclass is indented under subclass 54. Subject matter wherein the phosphorus compound contains at least one heterocyclic ring which is devoid of a nitrogen atom as a ring member.
- 56 Ring contains S only, or may include in addition to the required S, only C, Se, or Te (9/6553):**
This subclass is indented under subclass 49. Subject matter wherein the phosphorus compound (a) contains at least one ring having only sulfur, per se, as a ring member or (b) contains a ring having at least one atom of sulfur and additional ring atoms of only carbon, selenium, or tellurium.
- 57 Ring is condensed or bridged to a carbocyclic ring system (9/6553V):**
This subclass is indented under subclass 56. Subject matter wherein a ring containing both sulfur and carbon atoms shares at least two of its carbon atoms with a ring system containing only carbon atoms.
- 58 Ring contains O only, or may include in addition to the required O, only C, S, Se, or Te (9/655):**
This subclass is indented under subclass 49. Subject matter wherein the phosphorus compound contains at least one ring which contains only oxygen and carbon atoms, or oxygen and carbon and additional atoms of only sulfur, selenium, or tellurium.
- 59 Three-membered ring containing one O and two C's (9/655J; 9/655J38):**
This subclass is indented under subclass 58. Subject matter wherein the ring is three membered and contains a single oxygen and two carbon atoms.
- 60 Ring is condensed or bridged to a carbocyclic ring system (9/655V):**
This subclass is indented under subclass 58. Subject matter wherein the ring containing the oxygen atom shares at least two of its carbon atoms with a ring system containing only carbon atoms.
- 61 Ring contains N and S only, or may include in addition to the required N and S, only C, O, Se, or Te (9/6536):**
This subclass is indented under subclass 49. Subject matter wherein the ring contains (a) only atoms of sulfur and nitrogen or (b) only atoms of sulfur, nitrogen, and carbon or (c) oxygen, selenium, or tellurium as the sole additional atoms in a ring of (a) or (b) above.
- 62 Ring contains exactly six atoms (9/6544; 9/6547):**
This subclass is indented under subclass 61. Subject matter wherein the ring containing nitrogen and sulfur atoms is composed of exactly six atoms.
- 63 Ring contains exactly five atoms (9/6539):**
This subclass is indented under subclass 61. Subject matter wherein the ring containing nitrogen and sulfur atoms is composed of exactly five atoms.

- 64 Five-membered ring is condensed or bridged to a carbocyclic ring system (9/6541):**
This subclass is indented under subclass 63. Subject matter wherein a ring containing the nitrogen, sulfur and carbon atoms shares at least two of its carbon atoms with a ring system containing only carbon atoms.
- 65 Ring contains N and O only, or may include in addition to the required N and O, only C (9/6527; 9/653; 9/653V):**
This subclass is indented under subclass 49. Subject matter wherein the ring contains (a) only atoms of nitrogen and oxygen or (b) only atoms of nitrogen, oxygen, and carbon.
- 66 Ring contains exactly six atoms (9/6533; 9/6533V):**
This subclass is indented under subclass 65. Subject matter wherein the ring contains exactly six atoms.
- 67 Exactly three N atoms as only hetero atoms in ring (9/6515):**
This subclass is indented under subclass 49. Subject matter wherein a ring contains three nitrogen atoms as the only ring hetero atoms.
- 68 Six-membered ring containing three N and three C atoms (9/6521; 9/6521E; 9/6521G; 9/6521R):**
This subclass is indented under subclass 67. Subject matter wherein the ring is six membered and contains three carbons and three nitrogen atoms.
- 69 Six-membered ring is condensed or bridged to a carbocyclic ring system (9/6521V):**
This subclass is indented under subclass 68. Subject matter wherein the six-membered ring shares at least two of its ring carbon atoms with a ring system containing only carbon atoms.
- 70 C atom of ring is bonded directly to a P atom, or is bonded directly to a hetero atom other than N and the hetero atom is directly bonded to a P atom (9/6521K):**
This subclass is indented under subclass 68. Subject matter wherein at least one of the carbon atoms of the six-membered ring is (a) bonded directly to an extracyclic phosphorus atom or (b) is bonded directly to an extracyclic hetero atom other than nitrogen, and which hetero atom is directly bonded to an extracyclic phosphorus atom.
- 71 Five-membered ring containing three N and two C atoms (9/6518; 9/6518G; 9/6518R):**
This subclass is indented under subclass 67. Subject matter wherein the ring is five membered and contains two carbons and three nitrogen atoms.
- 72 Five-membered ring is condensed or bridged to a carbocyclic ring system (9/6518V):**
This subclass is indented under subclass 71. Subject matter wherein the five-membered ring shares at least two of its ring carbons with a ring system containing only carbon atoms.
- 73 C atom of ring is bonded directly to a P atom or is bonded directly to a hetero atom other than N and which hetero atom is directly bonded to a P atom (9/6518K):**
This subclass is indented under subclass 71. Subject matter wherein at least one of the carbon atoms of the five-membered ring is (a) bonded directly to an extracyclic phosphorus atom or (b) is bonded directly to an extracyclic hetero atom, other than nitrogen, and which hetero atom is directly bonded to an extracyclic phosphorus atom.
- 74 N atom of ring is bonded directly to a P atom or is bonded indirectly to a P atom other than through a ring atom of the five-membered ring (9/6518E):**
This subclass is indented under subclass 71. Subject matter wherein at least one of the nitrogen atoms of the five-membered ring is (a) bonded directly to an extracyclic phosphorus atom or (b) is bonded indirectly through any atom or atoms other than ring atoms of the five-membered ring to a phosphorus atom.
- 75 Exactly two N's as only hetero atom in ring (9/645):**
This subclass is indented under subclass 49. Subject matter wherein a ring contains only carbon and exactly two nitrogen atoms.

- 76 Six-membered ring containing two N and four C atoms (9/6509; 9/6509B2; 9/6509B2E; 9/6509B2G; 9/6509B2K; 9/6509B2R):**
This subclass is indented under subclass 75. Subject matter wherein the ring is six membered and contains four carbons and two nitrogen atoms.
- (1) Note. Included herein are rings wherein the nitrogens are in 1 and 2 ring positions.
- 77 N in 1 and 3 ring positions (9/6512; 9/6512E; 9/6512G; 9/6512R):**
This subclass is indented under subclass 76. Subject matter wherein the two nitrogen atoms in the six-membered ring are in 1 and 3 positions.
- 78 Ring is condensed or bridged to a carbocyclic ring system (9/6512V):**
This subclass is indented under subclass 77. Subject matter wherein the six-membered ring shares at least two of its ring carbon atoms with a ring system containing only carbon atoms.
- 79 C atom of ring is directly bonded to a P atom (9/6512K; 9/6512K4):**
This subclass is indented under subclass 77. Subject matter wherein at least one of the carbon atoms of the six-membered ring is bonded directly to an extracyclic phosphorus atom.
- 80 C atom of ring is bonded directly to a hetero atom other than N and which hetero atom is bonded directly to a P atom (9/6512K2):**
This subclass is indented under subclass 77. Subject matter wherein at least one of the carbon atoms of the six-membered ring is bonded directly to an extracyclic hetero atom other than nitrogen and which hetero atom is directly bonded to an extracyclic phosphorus atom.
- 81 N in 1 and 4 ring positions (9/6509B4; 9/6509B4G; 9/6509B4K; 9/6509B4R; 9/6509B4V):**
This subclass is indented under subclass 76. Subject matter wherein the two nitrogen atoms in the six-membered ring are in 1 and 4 positions.
- 82 N atom of ring is bonded directly to a P atom or is indirectly bonded to a P atom other than through a ring atom of the six-membered ring (9/6509B4E):**
This subclass is indented under subclass 81. Subject matter wherein an extracyclic phosphorus atom is directly or indirectly bonded to a nitrogen atom of the ring.
- (1) Note. Indirectly as used in this subclass is meant to exclude compounds wherein a phosphorus atom is first bonded to a ring carbon, either directly or indirectly, and which ring carbon is eventually bonded to a nitrogen atom of the same ring.
- 83 N in 1 and 2 ring positions and wherein the ring is condensed or bridged to a carbocyclic ring system (9/6509B2V):**
This subclass is indented under subclass 76. Subject matter wherein the two nitrogen atoms in the six-membered ring are in 1 and 2 position and wherein the six-membered ring shares at least two of its ring carbon atoms with a ring system containing only carbon atoms.
- 84 Five-membered ring containing two N's (9/6503; 9/6503B2; 9/6503B2G; 9/6503B2K; 9/6503B2R):**
This subclass is indented under subclass 75. Subject matter wherein the ring is five membered and contains three carbons and two nitrogen atoms.
- (1) Note. Included herein are rings wherein the nitrogens are in 1 and 2 ring positions.
- 85 N in 1 and 3 ring positions (9/6506; 9/6506G; 9/6506K; 9/6506R):**
This subclass is indented under subclass 84. Subject matter wherein the two nitrogen atoms in the five-membered ring are in 1 and 3 ring positions.
- 86 Five-membered ring is condensed or bridged to a carbocyclic ring system (9/6506V):**
This subclass is indented under subclass 85. Subject matter wherein the five-membered ring shares at least two of its ring carbon atoms with a ring system containing only carbon atoms.
- 87 N atom of ring is bonded directly to a P atom or is indirectly bonded to a P atom**

other than through a ring atom of the five-membered ring (9/6506E):

This subclass is indented under subclass 85. Subject matter wherein an extracyclic phosphorus atom is directly or indirectly bonded to a nitrogen atom of the ring.

- (1) Note. Indirectly as used in this subclass is meant to exclude compounds wherein a phosphorus atom is first bonded to a ring carbon, either directly or indirectly, and which ring carbon is eventually bonded to a nitrogen atom of the same ring.

88 N in 1 and 2 ring positions and wherein the ring is condensed or bridged to a carbocyclic ring system (9/6503B2V):

This subclass is indented under subclass 84. Subject matter wherein the two nitrogen atoms in the five-membered ring are in 1 and 2 positions and wherein the five-membered ring shares at least two of its ring carbons with a ring system containing only carbon atoms.

89 At least one N in 1 and 2 ring positions is bonded directly or indirectly to a P atom (9/6503B2E):

This subclass is indented under subclass 84. Subject matter wherein the two nitrogen atoms in the five-membered ring are in 1 and 2 positions and wherein an extracyclic phosphorus atom is directly or indirectly bonded to a nitrogen atom of the ring.

- (1) Note. Indirectly as used in this subclass is meant to exclude compounds wherein a phosphorus atom is first bonded to a ring carbon, either directly or indirectly, and which ring carbon is eventually bonded to a nitrogen atom of the same ring.

90 Single N as only hetero atom in ring (9/553; 9/568):

This subclass is indented under subclass 49. Subject matter wherein a ring contains carbon and a single nitrogen atom.

- (1) Note. Included herein are those rings that contain three carbon atoms and a single nitrogen atom.

91 Seven or more atoms in ring containing the single N atom (9/553A7):

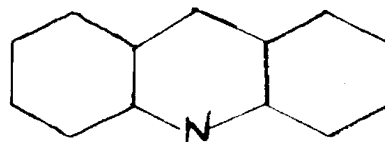
This subclass is indented under subclass 90. Subject matter wherein a ring contains at least six carbon atoms and a single nitrogen atom.

92 Six atoms in ring containing the single N atom (9/576):

This subclass is indented under subclass 90. Subject matter wherein a ring contains five carbon atoms and a single nitrogen atom.

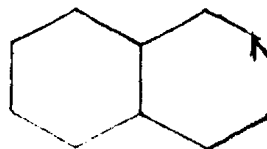
93 Acridine or hydrogenated acridine ring (9/64):

This subclass is indented under subclass 92. Subject matter wherein the ring system has the following basic structure, which may contain double bonds between ring members:



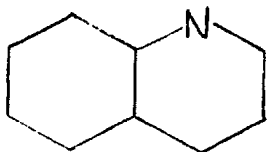
94 Isoquinoline or hydrogenated isoquinoline ring (9/62):

This subclass is indented under subclass 92. Subject matter wherein the ring system has the following basic structure, which may contain double bonds between ring members:



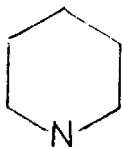
95 Quinoline or hydrogenated quinoline ring (9/60):

This subclass is indented under subclass 92. Subject matter wherein the ring system has the following basic structure, which may contain double bonds between ring members:



96 Hydrogenated pyridine ring (9/59; 9/59G; 9/59K; 9/59K2; 9/59K4; 9/59R):

This subclass is indented under subclass 92. Subject matter wherein the ring system has the following basic structure, and must contain less than three double bonds between ring members:



SEE OR SEARCH THIS CLASS, SUBCLASS:

99, for ring structures which contain three double bonds between ring members.

97 Ring is condensed or bridged to a carbocyclic ring system (9/576V):

This subclass is indented under subclass 96. Subject matter wherein the six-membered ring shares at least two of its ring carbons with a ring system containing only carbon atoms.

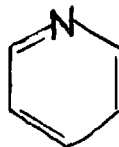
98 N of ring is bonded directly to a P atom or is indirectly bonded to a P atom other than through a ring atom of the hydrogenated pyridine ring (9/59E):

This subclass is indented under subclass 96. Subject matter wherein an extracyclic phosphorus atom is directly or indirectly bonded to the nitrogen atom of the ring.

- (1) Note. Indirectly as used in this subclass is meant to exclude compounds wherein a phosphorus atom is first bonded to a ring carbon, either directly or indirectly, and which ring carbon is eventually bonded to a nitrogen atom of the same ring.

99 Pyridine ring (9/58; 9/58G; 9/58R):

This subclass is indented under subclass 92. Subject matter wherein the six-membered ring is pyridine.



100 C atom of ring is bonded directly to a P atom (9/58K; 9/58K4):

This subclass is indented under subclass 99. Subject matter wherein the nitrogen atom of the pyridine ring is bonded directly to an extracyclic phosphorus atom.

101 C atom of ring is bonded directly to a hetero atom other than N and which hetero atom is bonded directly to a P atom (9/58K2):

This subclass is indented under subclass 99. Subject matter wherein the nitrogen atom of the pyridine ring is bonded directly to an extracyclic hetero atom other than nitrogen and which hetero atom is directly bonded to an extracyclic phosphorus atom.

102 N atom of ring is bonded directly to a P atom or indirectly to a P atom other than through a ring atom of the pyridine ring (9/58E):

This subclass is indented under subclass 99. Subject matter wherein an extracyclic phosphorus atom is directly or indirectly bonded to the nitrogen atom of the pyridine ring.

- (1) Note. Indirectly as used in this subclass is meant to exclude compounds wherein a phosphorus atom is first bonded to a carbon of the pyridine ring, either directly or indirectly, and which carbon is eventually bonded to the pyridine ring nitrogen atom.

103 Five-membered ring containing a single N atom (9/572; 9/572G; 9/572K; 9/572K2; 9/572K4; 9/572R):

This subclass is indented under subclass 90. Subject matter wherein a ring contains four carbon atoms and a single nitrogen atom.

- 104 Ring is condensed or bridged to a carbocyclic ring system (9/572V):**
This subclass is indented under subclass 103. Subject matter wherein the five-membered ring shares at least two of its carbon atoms with a ring system containing only carbon atoms.
- 105 N atom of ring is bonded directly to a P atom or indirectly to a P atom other than through a ring atom of the five-membered ring (9/572E):**
This subclass is indented under subclass 103. Subject matter wherein an extracyclic phosphorus atom is directly or indirectly bonded to the nitrogen atom of the ring.
- (1) Note. Indirectly as used in this subclass is meant to exclude compounds wherein a phosphorus atom is first bonded to a ring carbon, either directly or indirectly, and which ring carbon is eventually bonded to a nitrogen atom of the same ring.
- 106 Four-membered ring containing a single N atom is condensed or bridged to a carbocyclic ring system (9/568V):**
This subclass is indented under subclass 90. Subject matter wherein the ring which contains three carbons and a single nitrogen atom shares at least two of its ring carbons with a ring system containing only carbon atoms.
- 107 N atom of four-membered ring containing a single N atom is bonded directly to a P atom or indirectly to a P atom other than through a ring atom of the four-membered ring (9/568E):**
This subclass is indented under subclass 90. Subject matter wherein the nitrogen atom of a ring containing a single nitrogen atom and three carbons is bonded directly or indirectly to an extracyclic phosphorus atom.
- (1) Note. Indirectly as used in this subclass is meant to exclude compounds wherein a phosphorus atom is first bonded to a ring carbon, either directly or indirectly, and which ring carbon is eventually bonded to a nitrogen atom of the same ring.
- 108 Three-membered ring containing a single N atom (9/564):**
This subclass is indented under subclass 90. Subject matter wherein the phosphorus compound contains at least one three membered hetero ring containing a single nitrogen and two carbon atoms, e.g., ethyleneimine ring system, etc.
- 109 Quaternary compounds containing the structure (C)^a-P-(Z)^b where a+b=4, a=1-3, b=1-3, and Z is an atom other than C or H (9/54K):**
This subclass is indented under subclass 30. Subject matter wherein the P compound contains the structure: (C)^a-P-(Z)^b where a+b=4, a=1-3, b=1-3, and Z is an atom other than C or H.
- 110 Quaternary phosphonium compounds (C)^a-P-(H)^b where a+b=4, a=1-4, b=1-3 (9/54; 9/54A1; 9/54A1+W; 9/54A1+W2):**
This subclass is indented under subclass 30. Subject matter wherein the P compound contains the structure: (C)^a-P-(H)^b where a+b=4, a=1-3, b=1-3, i.e., phosphonium.
- 111 Contains the structure aryl-(C)ⁿ-P where n is at least one (9/54A7):**
This subclass is indented under subclass 110. Subject matter wherein the P compound contains the structure: aryl-(C)ⁿ-P wherein n is at least one and the aryl group is bonded indirectly to the P atom through a chain of only C atoms.
- 112 Contains two or more phosphonium P atoms (9/54A6):**
This subclass is indented under subclass 110. Subject matter wherein the P compound contains two or more phosphonium P atoms.
- 113 Contains the structure (aryl group*)-P where * indicates a direct bond between a carbon of the aryl ring and the P atom (9/54A4):**
This subclass is indented under subclass 110. Subject matter wherein one of the C atoms of an aryl ring is directly bonded to the P atom.
- 114 Contains the structure "carbocyclic ring"-P where "- " indicates that a ring carbon of**

- the carbocyclic ring may or may not be bonded directly to the P atom (9/54A3):**
This subclass is indented under subclass 110. Subject matter wherein at least one of the C atoms of a ring composed solely of carbon atoms is bonded directly or indirectly to the P atom.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
113, for a compound wherein a carbon of an aryl ring is directly bonded to the P atom.
- 115 Contains the structure “ethylenic group”-P where “-” indicates that a carbon of the ethylenic group may or may not be bonded directly to the P atom (9/54A2):**
This subclass is indented under subclass 110. Subject matter wherein at least one of the C atoms of an ethylenic group or is bonded directly or indirectly to a P atom.
- (1) Note. An ethylenic group is defined as a double or triple bond between adjacent acyclic carbon atoms.
- (1) Note. This subclass allows for those phosphorus compounds which may contain a single atom of phosphorus bonded directly to carbon and to another element distinct from carbon. It also provides for phosphorus compounds wherein plural phosphorus atoms are present and one of the phosphorus atoms present is bonded directly to carbon while a different phosphorus atom is bonded to a non-carbon atom.
- 116 Contains at least one (C)-P bond (9/28):**
This subclass is indented under subclass 30. Subject matter wherein the P compound contains at least one carbon atom directly bonded to a phosphorus atom (C)-P.
- 117 Pentavalent P compound containing a P(=N) bond and wherein the P atom is bonded directly to three carbon atoms (9/535D; 9/535D2):**
This subclass is indented under subclass 116. Subject matter wherein the P compound contains a pentavalent P atom, which atom forms a P=N bond with nitrogen, and wherein the other three valences of the P atom are filled by bonds to three separate carbon atoms.
- 118 Pentavalent P compound containing a P(=C) bond and wherein the P atom is not bonded directly to chalcogen (9/535B):**
This subclass is indented under subclass 116. Subject matter wherein the P compound contains a pentavalent P atom, which atom forms a P=C bond with carbon, with the proviso that none of the bonds of the pentavalent P can be directly to a chalcogen atom.
- 119 Pentavalent P compound containing at least one bond to carbon and wherein the other four valences are bonded directly to four separate atoms, none of which are chalcogen (9/535):**
This subclass is indented under subclass 116. Subject matter wherein the P compound contains a pentavalent P atom, which atom is bonded to at least one carbon and wherein the other four available valences are filled by bonds to four separate atoms, all or some of which may be carbon, with the proviso that none of the bonds of the pentavalent P can be directly to a chalcogen atom.
- 120 Pentavalent P compound having the structure (X=C*)-P(=X) or (cyano*)-P(=X) where X is chalcogen, * indicates a direct bond of the C of the C=X group or of the C of the cyano group directly to the P atom, and the other atoms bonded directly to the P atom are either carbon or hydrogen (9/53A9; 9/53P; 9/53Y):**
This subclass is indented under subclass 116. Subject matter wherein the P compound contains the structure (B)-P(=X) (C)(C); (B)-P(=X) (C)(H); (B)-P(=X) (H)(H) where B is the group X=C or N#C, the carbon atom of the B group is directly bonded to the P atom and X is chalcogen and N#C indicates a triple bond between the N and C atoms.
- 121 Pentavalent P compound having the structure (C)-P(=X)(C or H) (C or H) where X is chalcogen (9/53):**
This subclass is indented under subclass 116. Subject matter wherein the P compound contains the structure (C)-P(=X)(C or H)(C or H), X is chalcogen, and the carbon or hydrogen atoms are directly bonded to the P atom.

- 122 At least one of the carbon atoms bonded to the P atom is not part of an aryl ring and is bonded directly to an aryl ring or is bonded to an aryl ring through a chain of acyclic carbon atoms (9/53A7):**
This subclass is indented under subclass 121. Subject matter wherein at least one of the carbon atoms bonded to the P atom is directly bonded to a carbon atom of an aryl ring or is bonded to an aryl ring through an acyclic chain containing only carbon atoms.
- 123 Compound having two or more (C)-P(=X) groups or at least one (X=)-P-(C)-P(=X) group (9/53A6):**
This subclass is indented under subclass 121. Subject matter wherein the P compound contains two or more (C)-P(=X)(C or H) groups or at least one (C or H)(X=)-P-(C)-P(=X)(C or H) group where X is chalcogen.
- (1) Note. The P compound can contain two or more separate required groups or two or more P atoms may share a common carbon atom, e.g., (C or H)-(X=)P(=X)(C)(C or H).
- 124 Compound contains a ring composed solely of carbon atoms or contains an ethylenic group (9/53A3; 9/53A4):**
This subclass is indented under subclass 121. Subject matter wherein the P compound contains at least one ring containing only carbon atoms or a double or triple bond between adjacent carbon atoms.
- 125 Compound contains a nitrogen or halogen atom or contains a chalcogen atom other than bonded to the P atom (9/53A1; 9/53A2):**
This subclass is indented under subclass 121. Subject matter wherein the P compound contains at least one nitrogen atom, or at least one halogen atom, or at least one chalcogen atom which is other than the chalcogen atom bonded to the P atom.
- 126 Trivalent compounds having the structure (Hal)-P-(C)(C or H), or (Hal)2-P(C), or pentavalent compounds having the structure (Hal)-P(=X)(C)(C or H) or (Hal)2-P(=X)(C) where X is chalcogen (9/52):**
This subclass is indented under subclass 116. Subject matter wherein the P compound is trivalent and contains the structure (Hal)-P-(C)(C), (Hal)-P-(Hal)(C), or is pentavalent and contains the structure (Hal)-P(=X)(C) or (Hal)-P(=X)(Hal)(C), wherein X is chalcogen and Hal is a halogen atom.
- 127 Trivalent P compound having the structure (C or H)(C)-P-P-(C)(C or H) (9/50P):**
This subclass is indented under subclass 116. Subject matter wherein the P compound is trivalent and contains the structure (C or H)(C)-P-P(C)(C or H).
- 128 Trivalent P compound containing a metal atom and having the structure (C)-P(C or H or Metal)(C or H or Metal) (9/50Y; 9/50Z; 9/50Z2; 9/50Z4; 9/50Z6; 9/50Z8):**
This subclass is indented under subclass 116. Subject matter wherein the trivalent the P compound contains at least one metal atom or metal compound as part of a complex or in chelated form, and wherein the structure of the compound is (C or H or Metal)(C)-P-(C or H or Metal).
- 129 Trivalent P compound having the structure (C)-P-(C or H)(C or H) (9/50):**
This subclass is indented under subclass 116. Subject matter wherein the P compound is trivalent and contains the structure C-P(C or H)(C or H).
- 130 Contains the structure (X=C*)-P or (cyano*) where X is chalcogen, and where * indicates a direct bond of the C of the C=X group or of the C of the cyano group to the P atom (9/50A9):**
This subclass is indented under subclass 129. Subject matter wherein the P compound contains the structure (X=C)-P(C or H)(C or H) where X is a chalcogen atom or (N#C)-P(C or H)(C or H) and N#C indicates a triple bond between the N and C atoms.
- 131 At least one of the carbon atoms bonded to the P is not part of an aryl ring and is bonded directly to an aryl ring, or is bonded**

- to an aryl ring through a chain of carbon atoms only (9/50A7):**
 This subclass is indented under subclass 129. Subject matter wherein at least one of the carbon atoms directly bound to the P atom is not part of an aryl ring and is directly bonded to a carbon atom of an aryl ring, or is bonded to an aryl ring through a non-cyclic chain of carbon atoms.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
 133, for a compound containing an aryl ring wherein the C atom directly bound to the P atom is bound to the aryl ring through a non-aryl carbocyclic ring system or wherein the C atom directly bound to the P atom is part of an aryl ring system.
- 132 Compound has two or more (C)-P(C or H) (C or H) groups or at least one (C or H)-P-(C)-P-(C or H) group (9/50A6):**
 This subclass is indented under subclass 129. Subject matter wherein the P compound contains two or more C-P(C)(C) groups.
- (1) Note. The P compound can contain two or more separate required groups or two or more P atoms may share a common carbon atom, e.g., (C)(C)-P-C-P(C)(C), etc.
- 133 Contains ring solely composed of carbon atoms or at least one ethylenic group (9/50A2; 9/50A3; 9/50A4):**
 This subclass is indented under subclass 129. Subject matter wherein the P compound contains at least one ring containing only carbon atoms or an acyclic group containing a double or triple bond between adjacent carbon atoms.
- 134 Contains an atom other than C, P, or H (9/50A1):**
 This subclass is indented under subclass 129. Subject matter wherein the P compound contains at least one nitrogen atom or at least one halogen atom or at least one chalcogen atom or at least one metal atom.
- 135 Trivalent P compound having the structure (C)-P-(N) or (C)-P-(Hal) (9/48F; 9/48H):**
 This subclass is indented under subclass 116. Subject matter wherein the compound contains a trivalent P atom containing the structure (C)-P-(N) or (C)-P-(Hal)
- 136 Trivalent P having the structure (C)2-P(XH or X-Salt) or pentavalent P having the structure (C)2-P(=X)(XH or X-Salt) where X is chalcogen (9/46):**
 This subclass is indented under subclass 116. Subject matter wherein the compound contains a trivalent P containing the structure (C)2-P-(XH or X-Salt), or pentavalent P containing the structure (C)2-P(=X)(XH or X-Salt), wherein at least one X is a chalcogen atom single bonded to the P atom.
- 137 Trivalent P having the structure (C)-P-(XH or X-Salt) (XH or X-Salt or H) or pentavalent P having the structure (C)-P(=X)(XH or X-Salt)(XH or X-Salt or H) where X is chalcogen (9/48):**
 This subclass is indented under subclass 116. Subject matter wherein the compound contains a trivalent or pentavalent P atom bonded in the following manner: (a) (C)-P(=X)(XH or X-Salt)(C); (b) (C)-P(=X)(XH or X-Salt)(H); (c) (C)-P(=X)(XH or X-Salt)(X-Salt); (d) (C)-P(XH or X-Salt)(C); (e) (C)-P(XH or X-Salt)(H); (f) (C)-P(XH or X-Salt)(X-Salt)
- 138 Contains ring solely composed of carbon atoms or contains an ethylenic group (9/48A2; 9/48A3; 9/48A4):**
 This subclass is indented under subclass 137. Subject matter wherein the compound contains at least one ring containing only carbon atoms or a double or triple bond between adjacent acyclic carbon atoms.
- 139 Contains two or more P atoms or contains an atom other than C, H, or the required chalcogen atom (9/48A1; 9/48A6):**
 This subclass is indented under subclass 137. Subject matter wherein the compound contains (a) at least one nitrogen atom or (b) at least one halogen atom or (c) at least one chalcogen atom which is other than in a structure as required by this subclass or (d) at least one metal atom or (e) two or more P atoms.

- 140 Pentavalent P having the structure (C)-P(=X)(X)(N) or (C)-P(=X)(N)₂ where X is chalcogen (9/44; 9/44A; 9/44A1; 9/44A6; 9/44A9; 9/44B; 9/44B1; 9/44B9):**
This subclass is indented under subclass 116. Subject matter wherein the P atom is pentavalent and the compound contains the structure (C)-P(=X)(X)(N) or (C)-P(=X)(N)₂ and wherein X is chalcogen.
- 141 Contains the structure (C)-P(=X)(X)(N)(N-*acyl), (C)-P(=X)(X)(N-Z) or (C)-P(=X)(X)(N-*cyano) where Z is an atom other than C or H and * indicates a direct bond to the adjacent N atom (9/44C9; 9/44C9+Q; 9/449+U):**
This subclass is indented under subclass 140. Subject matter wherein the P compound contains the structure (C)-P(=X)(X)(N-acyl); (C)-P(=X)(X)(N-Z) or (C)-P(=X)(X)(N-cyano) wherein Z is an atom other than C or H and X is chalcogen.
- (1) Note. The C of the acyl group, the atom other than C or H, and the C of the cyano radical are all bonded directly to the nitrogen atom.
- 142 Contains the structure (C)-P(=X)(X)(N-Q) where Q is a radical containing an atom other than C or H, or contains a ring composed solely of carbon atoms or contains an ethylenic group (9/44C; 9/44C1; 9/44C2; 9/44C3; 9/44C4; 9/44C7):**
This subclass is indented under subclass 140. Subject matter wherein the P compound contains the structure (C)-P(=X)(X)(N-Q) wherein Q is a radical which contains (a) an atom other than C or H or (b) at least one ring containing only C atoms or (c) contains a double or triple bond between adjacent acyclic carbon atoms.
- (1) Note. The required Q group may be directly or indirectly bonded to the N atom. The requirement for this subclass is that the Q group is bonded to the nitrogen atom which in turn is directly bonded to the P atom. It is not necessary for the atom that is other than C or H to be directly bonded to the N atom, although it can be.
- 143 Compound contains a ring composed solely of carbon atoms or contains an ethylenic group (9/44A2; 9/44A3; 9/44A4; 9/44A7; 9/44B2; 9/44B3; 9/44B4; 9/44B7):**
This subclass is indented under subclass 140. Subject matter wherein the P compound contains at least one ring containing only carbon atoms or contains a double or triple bond between acyclic adjacent carbon atoms.
- 144 Pentavalent P having the structure (C)-P(=X)(X)(Hal) or (C)-P(=X)(Hal)₂ wherein X is chalcogen (9/42):**
This subclass is indented under subclass 116. Subject matter wherein the P atom is pentavalent and contains the structure (C)-P(=X)(Hal)₂ or (C)-(C)-P(=X)(X)(Hal) wherein X is chalcogen.
- 145 Contains the structure (C)-P(=X)(X*Y)(Hal) where Y is carbon or hydrogen and * indicates a direct bond to the adjacent X atom (9/42H):**
This subclass is indented under subclass 144. Subject matter wherein the compound contains the structure (C)-P(=X)(XY)(Hal) wherein X is chalcogen and Y is H or C.
- 146 Pentavalent P having the structure (C)-P(=X)(X)(X) where X is chalcogen (9/38):**
This subclass is indented under subclass 116. Subject matter wherein the P atom is pentavalent and the compound contains the structure (C)-P(=X)(X)(X) wherein X is chalcogen.
- 147 Pentavalent P having the structure (C)-P(=X)(X)(X-*C) and * indicates a direct bond to the adjacent X atom (9/40):**
This subclass is indented under subclass 146. Subject matter wherein the P compound contains the structure (C)-P(=X)(X)(X-C) and wherein X is a chalcogen atom.
- 148 Contains the structure (C)-P(=X)(X)(X-*acyl), (C)-P(=X)(X-C)(X-*Z), or (C)-P(=X)(X)(X-*cyano) where Z is an atom other than C or H and * indicates a direct bond to the adjacent X atom (9/40C9; 9/40C9+Q; 9/40C9+U):**
This subclass is indented under subclass 147. Subject matter wherein the P compound contains the structure (C)-P(=X)(X)(X-acyl)(C)-

- P(=X) (X) (C-Z), or (C)-P(=X) (X) (X-cyano) wherein Z is an atom other than C or H.
- (1) Note. The C of the acyl group, the atom other than C or H, and the C of the cyano group are all directly bonded to the X (chalcogen atom).
- 149 Contains the structure (C)-P(=X)(X)(X-aryl) (9/40C4):**
This subclass is indented under subclass 147. Subject matter wherein the P compound contains the structure (C)-P(=X)(X)(X-aryl moiety) and wherein the C of the aryl group can be directly bonded to the X atom or can be indirectly bonded to the X atom through other atoms.
- 150 Carbon of aryl ring is bonded directly to the X atom (9/40C7):**
This subclass is indented under subclass 149. Subject matter wherein a C of the aryl ring is directly bonded to the X atom.
- 151 Contains the structure (C)-P(=X)(X)(X-carbocyclic ring) (9/40C3):**
This subclass is indented under subclass 147. Subject matter wherein the P compound contains the structure (C)-P(=X) (X)(X-carbon only in ring) and wherein a C of the ring can be directly bonded to the X atom or can be indirectly bonded to the X atom through other atoms.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
157, wherein the compound contains a carbocyclic ring bonded indirectly or directly to the C atom of the C-P moiety.
- 152 Contains the structure (C)-P(=X)(X)(X-ethylenic group) (9/40C2):**
This subclass is indented under subclass 147. Subject matter wherein the P compound contains the structure (C)-P(=X) (X)(X-ethylenic moiety) wherein the C of the ethylenic group can be directly bonded to the X atom or can be indirectly bonded to the X atom through other atoms.
- (1) Note. An ethylenic group is defined as a double or triple bond between adjacent acyclic carbon atoms.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
158, wherein the compound contains an ethylenic group bonded directly or indirectly to the C atom of the C-P moiety.
- 153 Contains the structure (X=C*)-P(=X)(X)(X-C) or (cyano*)-P(=X)(X)(X-C) where * indicates a direct bond of the C of the C=X group or of the C atom of the cyano group directly to the P atom (9/40A9; 9/40A9+Q):**
This subclass is indented under subclass 147. Subject matter wherein the P compound contains the structure (X=C)-P(=X) (X) (X-C) or (N#C)-P(=X) (X) (X-C) where X is a chalcogen atom and N#C indicates a triple bond between the N and C atoms.
- 154 Contains the structure aryl-(C)n-P(=X)(X)(X-C) where n is at least one (9/40A7; 9/40A7+P):**
This subclass is indented under subclass 147. Subject matter wherein the P compound contains the structure aryl-(C)n-P(=X)(X)(X-C) wherein n is at least one and the aryl group is bonded indirectly to the P group through a chain of only C atoms.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
156, wherein a carbon of the aryl ring is bonded directly to the P atom.
157, for an aryl group bonded indirectly to the C atom of the (C)-P moiety through a chain containing an atom of carbon or any other atom.
- 155 Contains two or more (C)-P(=X)(X) (X-C) groups or at least one (C-X) (X) (X=)-P(=X) (X) (X-C) group (9/40A6; 9/40A6+J; 9/40A6+U):**
This subclass is indented under subclass 147. Subject matter wherein the P compound contains two or more separate (C)-P(=X)(X)(X-C) groups or at least one (C-X)(X)(X=)-P(=X)(X)(X-C) group.
- 156 Contains the structure (aryl*)-P(=X)(X)(X-C) * indicates a direct bond between a car-**

- bon of the aryl ring and the P atom (9/40A4):**
This subclass is indented under subclass 147. Subject matter wherein the P compound contains the structure aryl-P(=X) (X)(X-C) wherein one of the C atoms of the aryl ring is bonded directly to the P atom.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
157, for an aryl containing moiety bonded indirectly to the carbon of the C-P group and wherein the indirect linkage to the C atom is not through the P atom.
- 157 Contains the structure “carbocyclic ring” - P(=X)(X)(X-C) where “- -” indicates that a ring carbon of the carbocyclic ring may or may not be directly bonded to the P atom (9/40A3):**
This subclass is indented under subclass 147. Subject matter wherein the C atom bonded directly to the P atom is part of a ring composed solely of carbon atoms or is bonded directly or indirectly to a ring containing only carbon atoms, and wherein the indirect linkage to the C atom is not through the P atom.
- 158 Contains the structure “ethylenic group” - P(=X)(X)(X-C) where “- -” indicates that a C of the ethylenic group may or may not be bonded directly to the P atom (9/40A2):**
This subclass is indented under subclass 147. Subject matter wherein the C atom bonded directly to the P atom is part of an ethylenic group or is bonded indirectly or directly to an ethylenic group and wherein the indirect linkage is not through the P atom.
- (1) Note. An ethylenic group is defined as a double or triple bond between adjacent acyclic carbon atoms.
- 159 Contains the structure (C)-P(=X)(X)(X-C-Q) where Q is a moiety containing an atom other than C or H (9/40C; 9/40C1):**
This subclass is indented under subclass 147. Subject matter wherein the P compound contains the structure (C)-P(=X) (X) (X-C-Q) and wherein the moiety Q contains an atom other than C or H.
- (1) Note. The atom which is other than C or H may or may not be directly bonded to the C atom of the P-(X-C) group and the linkage to the C atom is not through the P atom.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
30, for rules pertaining to the classification of an inorganic salt.
- 160 Contains the structure Q-(C)-P(=X)(X)(X-C) where Q is a moiety containing an atom other than C or H (9/40A; 9/40A1; 9/40A1+U9; 9/40B):**
This subclass is indented under subclass 147. Subject matter wherein the P compound contains the structure (Q-C)-P(=X) (X)(X-C) and wherein Q contains an atom other than C or H.
- (1) Note. The atom which is other than C or H may or may not be directly bonded to the C atom of the (Q-C)-P group and the linkage to the C atom is not through the P atom.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
30, for rules pertaining to the classification of an inorganic salt.
- 161 Contains the structure (X=C*)-P(=X)(X)(X) or (cyano*)-P(=X)(X)(X) where * indicates a direct bond of the C of the C=X group or of the C atom of the cyano group to the P atom (9/38A9):**
This subclass is indented under subclass 146. Subject matter wherein the P compound contains the structure (X=C) -P (=X) (X)(X) or (N#C)-P(=X) (X)(X) where X is a chalcogen atom and N#C indicates a triple bond between the N and C atoms.
- 162 Contains the structure aryl-(C)n-P(=X)(X)(X) where n is at least one (9/38A7):**
This subclass is indented under subclass 146. Subject matter wherein the P compound contains the structure Aryl-(C)n-P(=X)(X)(X) wherein n is at least one and the aryl group is bonded indirectly to the P atom through a chain of only C atoms.

- SEE OR SEARCH THIS CLASS, SUBCLASS:
 165, wherein an aryl C is bonded directly to the P atom.
 166, for an aryl group bonded indirectly to the C atom of the C-P moiety through a chain containing an atom other than C and wherein the linkage is other than through the P atom.
- 163 Contains two or more P atoms (9/38B):**
 This subclass is indented under subclass 146. Subject matter wherein the P compound contains two or more P atoms.
- 164 Two or more (C)-P(=X)(X)(X) or at least one (X)(X)(X)=P-(C)-P-(=X)(X)(X) group (9/38A6; 9/30A6+J; 9/38A6+U):**
 This subclass is indented under subclass 163. Subject matter wherein the P compound contains two or more separate(C)-P(=X)(X)(X) groups or at least one (X)(X)(X)=P-(C)-P(=X)(X)(X) group.
- 165 Contains the structure (aryl group*)-P-(=X)(X)(X) where * indicates a direct bond of one of the carbon atoms of the aryl group to the P atom (9/38A4):**
 This subclass is indented under subclass 146. Subject matter wherein the P compound contains the structure (Aryl)-P(=X)(X)(X) wherein one of the C atoms of the aryl ring is bonded directly to the P atom.

 SEE OR SEARCH THIS CLASS, SUBCLASS:
 166, for an aryl containing moiety indirectly bonded to the P atom.
- 166 Contains the structure “carbocyclic ring” - P-(=X)(X)(X) where “-” indicates that a ring carbon of the carbocyclic ring may or may not be directly bonded to the P atom (9/38A3):**
 This subclass is indented under subclass 146. Subject matter wherein the C atom bonded directly to the P atom is part of a ring composed solely of carbon atoms, or is bonded directly or indirectly to a ring containing only C atoms, and wherein the linkage to the C atom is not through the P atom.
- (1) Note. The ring composed solely of carbon atoms can be aryl, or any ring containing only carbon atoms. In the instance where the ring is aryl a carbon of that ring cannot be directly bonded to the P atom. See subclass 162 wherein the linkage of an aryl group to the P is solely through carbon. When the ring is other than aryl a carbon of that ring may or may not be bonded directly to the P atom.
- 167 Contains the structure “ethylenic group” - P(=X)(X)(X) where “-” indicates that a carbon atom of the ethylenic group may or may not be directly bonded to the P atom (9/38A2):**
 This subclass is indented under subclass 146. Subject matter wherein the C atom bonded directly to the P atom is part of an ethylenic group, or is bonded directly or indirectly to an ethylenic group and wherein the linkage is not through the P atom.

 (1) Note. An ethylenic group is defined as a double or triple bond between adjacent acyclic carbon atoms.
- 168 Contains the structure Q-(C)-P(=X)(X)(X) where Q is a moiety containing an atom other than C or H (9/38A1; 9/38A1+U6; 9/38A1+U9):**
 This subclass is indented under subclass 146. Subject matter wherein the P compound contains the structure (Q-C)-P(=X)(X)(X) and wherein Q contains an atom other than C or H.

 SEE OR SEARCH THIS CLASS, SUBCLASS:
 30, for rules pertaining to the classification of an inorganic salt.
- 169 Pentavalent P having the structure (C)2-P(=X)(N) where X is chalcogen (9/36):**
 This subclass is indented under subclass 116. Subject matter wherein the P atom is pentavalent and contains the structure (C)2-P(=X)(N).

- 170 Pentavalent P having the structure (C)2-P(=X)(Hal) where X is chalcogen (9/34):**
This subclass is indented under subclass 116. Subject matter wherein the P atom is pentavalent and contains the structure (C)2-P(=X)(Hal), where Hal is halogen.
- 171 Pentavalent P having the structure (C)2-P(=X)(X-C) where X is chalcogen (9/32):**
This subclass is indented under subclass 116. Subject matter wherein the P atom is pentavalent and contains the structure (C)-P(=X)(C)(X-C), wherein X is a chalcogen atom.
- 172 Contains the structure (C)2-P(X)(X-*acyl), (C)2-P(=X)(X-*Z) or (C)2-P(=X)(X-*cyano) where Z is an atom other than C or H and * indicates a direct bond to the adjacent X atom (9/32C9):**
This subclass is indented under subclass 171. Subject matter wherein the P compound contains the structure (C) -P(=X)(C)(X-acyl), (C) -P(=X)(C)(X-Z) or (C)-P(=X)(C)(X-cyano) wherein Z is an atom other than C or H.
- (1) Note. The C of the acyl group, the atom other than C or H or the C atom of the cyano group are all directly bonded to the X (chalcogen atom).
- 173 Contains the structure (C)2-P(=X)(X-carbocyclic ring) (9/32C3; 9/32C4; 9/32C7):**
This subclass is indented under subclass 171. Subject matter wherein the P compound contains the structure (C) -P(=X) (C)(X-carbon only in ring) and wherein a C of the ring can be directly bonded to the X atom or can be indirectly bonded to the X atom through other atoms.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
177, for a ring system attached to the P carbon atom of the atom through the carbon atom of the C-P moiety and wherein the indirect linkage to the C atom is not through the P atom.
- 174 Contains the structure (C)2-P(=X)(X-ethylenic group)(9/32C2):**
This subclass is indented under subclass 171. Subject matter wherein the P compound contains the structure (C) -P(=X) (C)(X-ethylenic moiety) wherein a C of the ethylenic group can be directly bonded to the X atom or can be indirectly bonded to the X atom through other atoms.
- (1) Note. An ethylenic group is defined as a double or triple bond between adjacent acyclic carbon atoms.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
178, wherein the compound contains an ethylenic group bonded directly or indirectly to the C atom of the C-P moiety and wherein the indirect linkage to the C atom is not through the P atom.
- 175 Contains the structure (X=C*)-P(=X)(C)(X-C) or (cyano*)-P(=X)(C)(X-C) where * indicates a direct bond of the C of the C=X group or of the C atom of the cyano group to the P atom (9/32A9; 9/32A9+Q):**
This subclass is indented under subclass 171. Subject matter wherein the P compound contains the structure (X=C) -P(=X) (C)(X-C) or (N#C) -P(=X) (C)(X-C) where X is a chalcogen atom and N#C indicates a triple bond between the N and C atoms.
- 176 Contains two or more (C)-P(=X)(C) (X-C) groups or at least one (X-C)(C) (X=P)-P(=X)(C)(X-C) group (9/32A6):**
This subclass is indented under subclass 171. Subject matter wherein the P compound contains two or more (C)-P(=X) (C)(X-C) groups or at least one (X-C) (C) (X=P)-P(=X)(C) (X-C) group.
- 177 Contains the structure "carbocyclic ring" -P(=X) (C) (X-C) where "--" indicates that a ring carbon of the carbocyclic ring may or may not be directly bonded to the P atom (9/32A3; 9/32A4; 9/32A7):**
This subclass is indented under subclass 171. Subject matter wherein a C atom bonded directly to the P atom is part of a ring system composed solely of carbon atoms or is bonded

- directly or indirectly to a ring containing only carbon atoms and wherein the indirect linkage to the C atom is not through the P atom.
- (1) Note. The ring composed solely of carbon atoms can be aryl or any ring system containing only carbon atoms.
- 178 Contains the structure “ethylenic group” - $P(=X)(C)(X-C)$ where “-” indicates that a carbon atom of the ethylenic group may or may not be bonded directly to the P atom (9/32A2):**
This subclass is indented under subclass 171. Subject matter wherein one of the C atoms bonded directly to the P atom is part of an ethylenic group or is bonded directly or indirectly to an ethylenic group and wherein the indirect linkage to the C atom is not through the P atom.
- (1) Note. An ethylenic group is defined as a double or triple bond between adjacent acyclic carbon atoms.
- 179 Contains the structure $(C)-P(=X)(C)(X-C-Q)$ where Q is a moiety containing an atom other than C or H (9/32C; 9/32C1):**
This subclass is indented under subclass 171. Subject matter wherein the P compound contains the structure $(C)-P(=X)(C)(X-C-Q)$ wherein Q represents a moiety containing an atom other than C or H.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
30, for rules pertaining to the classification of an inorganic salt.
- 180 Contains the structure $Q-(C)-P(=X)(C)(X-C)$ where Q is a moiety containing an atom other than C or H (9/32A; 9/32A1):**
This subclass is indented under subclass 171. Subject matter wherein the P compound contains the structure $(Q-C)P(=X)(C)(X-C)$ wherein Q represents a moiety containing an atom other than C or H.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
30, for rules pertaining to the classification of an inorganic salt.
- 181 Pentavalent P having the structure $(C)2-P(=X)(X-B)$ where X is chalcogen and B represents an atom other than C (9/30; 9/30B):**
This subclass is indented under subclass 116. Subject matter wherein the P compound is pentavalent and contains the structure $(C)-P(=X)(C)(X-B)$ wherein X is chalcogen and B represents an atom other than carbon and is directly bonded to the X atom.
- (1) Note. B as represented in most of the patents in this subclass is hydrogen (H).
- 182 Contains the structure $(X=C^*)-P(=X)(C)(X-B)$ or (cyano*)- $P(=X)(C)(X-B)$ where * indicates a bond of the C of the $C=X$ group or of the C of the cyano group directly to the P atom (9/30A9):**
This subclass is indented under subclass 181. Subject matter wherein the P compound contains the structure $(X-C)-P(=X)(C)(X-B)$ or $(N\#C)-P(=X)(C)(X-B)$ where X is a chalcogen atom and $N\#C$ represents a triple bond between the N and C atoms.
- 183 Contains two or more $(C)-P(=X)(C)(X-B)$ groups or at least one $(B-X)(C)(X=)-P(=X)(C)(X-B)$ group (9/30A6):**
This subclass is indented under subclass 181. Subject matter wherein the P compound contains two or more $(C)-P(=X)(C)(X-B)$ groups or at least one $(B-X)(C)(X=)-P(=X)(C)(X-B)$ group.
- 184 Contains the structure “carbocyclic ring” - $P(=X)(C)(X-B)$ where “-” indicates that a ring carbon of the carbocyclic ring may or may not be directly bonded to the P atom (9/30A3; 9/30A4; 9/30A7):**
This subclass is indented under subclass 181. Subject matter wherein a C atom bonded directly to the P atom is part of a ring system composed solely of carbon atoms or is bonded directly or indirectly to a ring containing only carbon atoms and wherein the indirect linkage to the C atom is not through the P atom.
- 185 Contains the structure “ethylenic group” - $P(=X)(C)(X-B)$ where “-” indicates that a carbon atom of the ethylenic group may or**

- may not be directly bonded to the P atom (9/30A2):**
 This subclass is indented under subclass 181. Subject matter wherein a C atom bonded directly to the P atom is part of an ethylenic group or is bonded directly or indirectly to an ethylenic group and wherein the indirect linkage to the C atom is not through the P atom.
- (1) Note. An ethylenic group is defined as a double or triple bond between adjacent acyclic carbon atoms.
- 186 Contains a Q-(C)-P(=X) (C)(X-B) group wherein Q is a moiety containing an atom other than C or H (9/30A1; 9/30A1+U6):**
 This subclass is indented under subclass 181. Subject matter wherein the P compound contains the structure Q-(C) -P(=X)(C) (X-B) wherein Q represents a moiety containing an atom other than C or H.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
 30, for rules pertaining to the classification of an organic salt.
- 187 Phosphorus directly bonded to N, i.e., P(N) (9/22; 9/22A):**
 This subclass is indented under subclass 30. Subject matter wherein a phosphorus atom is directly bonded to at least one nitrogen atom.
- 188 P(=N) group containing (9/06B; 9/06B2; 9/06B2D):**
 This subclass is indented under subclass 187. Subject matter wherein the phosphorus atom is directly bonded to at least one nitrogen atom by a double bond, i.e., P=N.
- 189 (Hal)-P-(N) group containing (9/26):**
 This subclass is indented under subclass 187. Subject matter wherein the phosphorus atom directly bonded to at least one nitrogen atom is also directly bonded to at least one halogen atom, i.e., Hal-P=N.
- 190 P(N)(N)(N) group containing (9/22C):**
 This subclass is indented under subclass 187. Subject matter wherein the phosphorus atom is directly bonded to exactly three nitrogen atoms, i.e., P(N) (N) (N).
- 191 P-(N=C=X) where X is chalcogen or P-(N-N) (9/22D; 9/22E):**
 This subclass is indented under subclass 187. Subject matter wherein the compound contains at least one P-(N=C=X) group where N is directly bonded to the P atom and X is chalcogen or at least one P-(N-N) group where an N of the N-N group is directly bonded to the P atom.
- 192 Contains the structure (N)-P-(X-*acyl), (N)-P-(X-*Z) or (N)-P-(X-*cyano) where Z is an atom other than C or H, X is a chalcogen atom, and * indicates a direct bond to the adjacent X atom (9/24A9; 9/24A9+M; 9/24A9+Q; 9/24A9+U; 9/24A9+W):**
 This subclass is indented under subclass 187. Subject matter wherein the P compound contains the structure: (a) (N)-P-(X-acyl), or (b) (N)-P-(X-Z) where Z is an atom other than C or H, or (c) (N)-P-X-(C#N) X is a chalcogen atom and is bonded directly to the P atom and wherein the C of the acyl group, the atom other than C or H, and the C of the cyano group are all directly bonded to the X atom, and N#C represents a triple bond between the C and N atoms.
- 193 Contains the structure P-(N-*acyl), P-(N-*Z) or (N-*cyano) where Z is an atom other than C or H and * indicates a direct bond to the adjacent N atom (9/24C9; 9/24C9+M; 9/24C9+Q; 9/24C9+U; 9/24C9+W):**
 This subclass is indented under subclass 187. Subject matter wherein the phosphorus compound contains the structure: (a) P-(N-acyl) where a carbon of the acyl group is directly bonded to the N atom, or (b) P-(N-Z) where Z is an atom other than C or H and is directly bonded by a covalent bond to the N atom, or (c) P-(N-C#N) where the N atom is directly bonded to the P atom and C#N indicates a triple bond between the C and N atoms.
- 194 Contains the structure (N)-P-(X-C) wherein X is a chalcogen atom, i.e., esteramides (9/24):**
 This subclass is indented under subclass 187. Subject matter wherein the phosphorus compound contains the structure (N)-P-(X-C) where at least one N atom and chalcogen atom are directly bonded to the P atom and a C atom

- is directly bonded to the X atom, X is chalcogen.
- 195 (C-X)-P-(N-carbocyclic ring) (9/24C3; 9/24C4; 9/24C7):**
This subclass is indented under subclass 194. Subject matter wherein the N atom which is directly bonded to the P atom is also bonded directly to a ring carbon of a carbocyclic ring or is indirectly bonded to a carbocyclic ring through other atoms and wherein the bonding is not through the X atom.
- 196 (C-X)-P-(N-ethylenic group) (9/24C2):**
This subclass is indented under subclass 194. Subject matter wherein the N atom which is directly bonded to the P atom is also bonded directly to a carbon of an ethylenic group or is indirectly bonded to an ethylenic group through other atoms and wherein the bonding is not through the X atom.
- 197 Aryl ring-(X)-P-(N) (9/24A4):**
This subclass is indented under subclass 194. Subject matter wherein the C atom which is directly bonded to the X atom is either a ring atom of an aryl ring or is indirectly bonded to a ring atom of an aryl group and wherein the bonding is not through the X atom.
- 198 Aryl-(C)_n-(X)-P-(N) wherein n is at least one (9/24A7):**
This subclass is indented under subclass 197. Subject matter wherein the C atom is indirectly bonded to the aryl group through a chain consisting solely of one or more carbon atoms.
- 199 Carbocyclic ring -(X)-P-(N) (9/24A3):**
This subclass is indented under subclass 194. Subject matter wherein the C atom which is directly bonded to the X atom is either a ring atom of a carbocyclic ring or is indirectly bonded to a ring atom of a carbocyclic group and wherein the bonding is not through the X atom.
- 200 Ethylenic group -(X)-P-(N) (9/24A2):**
This subclass is indented under subclass 194. Subject matter wherein the C atom which is directly bonded to the X atom is either a carbon atom of an ethylenic group or is indirectly bonded to a carbon atom of an ethylenic group and wherein the bonding is not through the X atom.
- 201 C-(X)-P-(N)-C-Q wherein Q contains an atom other than C or H (9/24C; 9/24C1):**
This subclass is indented under subclass 194. Subject matter wherein a C atom is directly bonded to the N atom and where said carbon is part of an organic moiety containing at least one atom other than carbon or hydrogen.
- (1) Note. Included herein would be compounds where the organic moiety contained a P atom.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
30, for rules pertaining to the classification of an inorganic salt.
- 202 Q-C-(X)-P-(N) or compound contains two or more P atoms and wherein Q contains an atom other than C or H (9/24A; 9/24A1; 9/24A6):**
This subclass is indented under subclass 194. Subject matter wherein a C atom is directly bonded to the X atom and where said carbon is part of an organic moiety containing at least one atom other than oxygen or hydrogen.
- (1) Note. Included herein are compounds where the organic moiety contains a P atom.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
30, for rules pertaining to the classification of an inorganic salt.
- 203 Pentavalent P containing the structure (Hal)-P(X-C) wherein X is a chalcogen atom (9/14):**
This subclass is indented under subclass 30. Subject matter wherein the P atom in the compound is pentavalent and where the compound has the structure (Hal)-P(X-C) where at least one halogen atom and at least one X atom (X is chalcogen) are directly bonded to the P atom and a carbon atom is directly bonded to the X atom.
- 204 S, Se, or Te is bonded directly to the P atom (9/20; 9/20B2; 9/20B4):**
This subclass is indented under subclass 203. Subject matter wherein the X atom of the X-C group is sulfur, selenium, or tellurium.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:
205, where the X atom of the X-C group is oxygen.
- 205 Containing the structure (Hal)-P-(O-ethylenic) or (Hal)-P-(O-aryl) (9/14B2; 9/14B4):**
This subclass is indented under subclass 203. Subject matter wherein the C atom is bonded directly to the oxygen atom (the carbon atom is either of an ethylenic group or an aryl group) or is indirectly bonded to a carbon atom of an ethylenic group or aryl group and wherein the indirect bonding is not through the oxygen atom.
- 206 Trivalent P containing the structure (Hal)-P-(X-C) wherein X is a chalcogen atom (9/146; 9/206):**
This subclass is indented under subclass 30. Subject matter wherein the P atom is trivalent and the compound has the structure (Hal)-P-(X-C) where at least one halogen atom and at least one X atom (X is chalcogen) are directly bonded to the P atom and a carbon atom is directly bonded to the X atom.
- 207 Trivalent P containing the structure P-(X-C) wherein a S, Se, or Te atom is directly bonded to the P atom and wherein X is chalcogen (X may qualify as the required S, Se, or Te atom) (9/201; 9/201A1; 9/202; 9/203):**
This subclass is indented under subclass 30. Subject matter wherein the P atom in the compound is trivalent and where the compound has any of the following structures: P-(S-C), P-(Se-C), P-(Te-C), S-P-(O-C), Se-P-(O-C), Te-P-(O-C) where (a) P is bonded directly to a sulfur, selenium, or tellurium atom and a carbon atom is bonded directly to the sulfur, selenium, or tellurium atom or (b) where an atom of sulfur, selenium, or tellurium is directly bonded to the P atom and a O-C group is also directly bonded to the P atom through the O atom and the carbon atom is directly bonded to the O atom.
- (1) Note. It is permissible for the S, Se, or Te atom to be double bonded to the P atom.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
217, for a compound devoid of a sulfur, selenium, or tellurium atom directly bonded to the P atom.
- 208 Containing the structure P-(X-carbocyclic ring) (9/204; 9/205):**
This subclass is indented under subclass 207. Subject matter wherein the C atom which is bonded directly to the oxygen, sulfur, selenium, or tellurium atom is either a ring atom of a carbocyclic ring or is indirectly bonded to a ring atom of a carbocyclic group and wherein the bonding is not through the oxygen, sulfur, selenium, or tellurium atom.
- 209 Pentavalent P containing the structure P-(X-C) wherein a S, Se, or Te is directly bonded to the P atom and wherein X is chalcogen (X may qualify as the required S, Se, or Te atom) (9/16; 9/165; 9/165A1):**
This subclass is indented under subclass 30. Subject matter wherein the P atom in the compound is pentavalent and where the compound has any of the following structures: P-(S-C), P-(Se-C), P-(Te-C), S-P-(O-C), Se-P-(O-C), Te-P-(O-C) where (a) P is bonded directly to a sulfur, selenium, or tellurium atom and a carbon atom is bonded directly to the sulfur, selenium, or tellurium atom or (b) where an atom of sulfur, selenium, or tellurium atom is bonded directly to the P atom and a O-C group is also bonded directly to the P atom through the O atom and the carbon atom is directly bonded to the O atom.
- (1) Note. It is permissible for the S, Se, or Te atom to be double bonded to the P atom.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
216, when all of the carbon atoms are directly bonded to the chalcogen atoms which are bonded directly to P, the carbon atoms are substituted by only hydrogen or hydrogen and carbon atoms.
- 210 Two or more P atoms (9/165A6; 9/165B):**
This subclass is indented under subclass 209. Subject matter wherein the compound contains at least two phosphorus atoms.

- 211 Containing the structure P-(X-*acyl), P-(X-*Z) or P-(X-*cyano) wherein Z is other than C, H, or a salt forming moiety and * indicates a direct bond to the adjacent X atom (9/165A9; 9/165A9+M; 9/165A9+Q; 9/165A9+U):**
This subclass is indented under subclass 209. Subject matter wherein the P compound contains the structure: (a) P-(X-acyl) or (b) P-X-(C#N) X is a chalcogen atom and is bonded directly to the P atom and wherein the C of the acyl group and the C of the cyano group are all directly bonded to the X atom and C#N indicates a triple bond between the C and N atoms.
- 212 Containing the structure P-(X-aryl ring) (9/18):**
This subclass is indented under subclass 209. Subject matter wherein the C atom which is bonded directly to the X atom (X is chalcogen) is either a carbon atom of an aryl group or is indirectly bonded to a carbon atom of an aryl group and wherein the indirect bonding is not through the X atom.
- 213 Containing the structure P-(X)-[C]n-Aryl wherein n is at least one and the aryl ring is bonded to the X atom by a chain of only acyclic carbon atoms (9/165A7):**
This subclass is indented under subclass 212. Subject matter wherein the aryl group is bonded to the X atom indirectly and the bonding is through a single acyclic carbon atom or through a chain solely composed of acyclic carbon atoms.
- 214 Containing the structure P-(X-carbocyclic ring) (9/177):**
This subclass is indented under subclass 209. Subject matter wherein the carbon atom which is directly bonded to the X atom is either a ring atom of a carbocyclic ring or is indirectly bonded to a carbocyclic ring through other atoms and wherein the indirect bonding is not through the X atom.
- 215 Containing the structure P-(X-ethylenic group) (9/173):**
This subclass is indented under subclass 209. Subject matter wherein the carbon atom which is directly bonded to the X atom is either a carbon of an ethylenic group or is directly bonded to an ethylenic group through other atoms and
- wherein the indirect bonding is not through the X atom.
- 216 Containing the structure P-(X-unsubstituted alkyl) wherein all of the X atoms in the molecule which are single bonded to the P atom are bound directly to carbon radicals containing only carbon and hydrogen atoms (9/17):**
This subclass is indented under subclass 209. Subject matter wherein all of the carbon atoms which are directly bonded to the X atoms (X is chalcogen) which are directly bonded to the P atom are either substituted solely by hydrogen atoms or are part of a moiety containing only carbon and hydrogen atoms.
- (1) Note. This subclass differs from all other subclasses under subclass 209 in that it is proper for those subclasses to have a single one of the required entities. This subclass on the other hand requires that ALL of the groups be presented in the required format.
- 217 P is trivalent and contains the structure P-(O-C) or P-(O-Z) where Z is an atom other than H (9/141; 9/141A1):**
This subclass is indented under subclass 30. Subject matter wherein the P is trivalent and contains the structure P-(O-C) or P-(O-Z) where P is bonded directly to the oxygen atom and a carbon atom is bonded directly to the oxygen atom or an atom other than hydrogen is directly bonded to the oxygen atom.
- 218 Containing the structure P-(O-*acyl), P-(O-*Z) wherein Z is an atom other than C, H, or a salt former, or P-(O-*cyano) where * indicates a direct bond to the adjacent oxygen atom (9/141A9; 9/09A9+Q; 9/09A9+U):**
This subclass is indented under subclass 217. Subject matter wherein the P compound contains the structure: (a) P-(O-acyl), or (b) P-(O-Z) where Z is an atom other than C or H, or (c) P-O-(C#N) the oxygen atom is bonded directly to the P atom and wherein the C of the acyl group, the atom other than C or H, and the C of the cyano group are all directly bonded to the oxygen atom and C#N indicates a triple bond between the C and N atoms.

- 219 Containing the structure P-(O-carbocyclic ring) (9/145):**
This subclass is indented under subclass 217. Subject matter wherein the C atom which is bonded directly to the oxygen atom is either a ring atom of a carbocyclic ring or is indirectly bonded to a ring atom of a carbocyclic group and wherein the indirect bonding is not through the oxygen atom.
- 220 Ring is other than aryl (9/144):**
This subclass is indented under subclass 219. Subject matter wherein the carbocyclic ring is other than aryl.
- 221 Contains the structure P-(O)-[C]*n*-aryl wherein *n* is at least one and the aryl ring is bonded to the O atom through a chain of only carbon atoms (9/141A7):**
This subclass is indented under subclass 219. Subject matter wherein an aryl group is bonded to the oxygen atom indirectly and the indirect bonding is through a single acyclic carbon atom or through a chain solely composed of acyclic carbon atoms.
- 222 Containing the structure P-(O-ethylenic group) (9/143):**
This subclass is indented under subclass 217. Subject matter wherein the carbon atom which is bonded directly to the oxygen atom is a carbon atom of an ethylenic group or is indirectly bonded to a carbon atom of an ethylenic group and wherein the indirect bonding is not through the oxygen atom.
- 223 Containing the structure P-(O-unsubstituted alkyl) wherein all of the O atoms in the molecule which are single bonded to the P atom are bound directly to carbon radicals containing only carbon and hydrogen atoms (9/142):**
This subclass is indented under subclass 217. Subject matter wherein all of the carbon atoms which are directly bonded to the oxygen atoms which are directly bonded to the P atom are either substituted solely by hydrogen atoms or are part of a moiety containing only carbon and hydrogen atoms.
- (1) Note. This subclass differs from all other subclasses under 217 in that it is proper for those subclasses to have a single one of the required entities. This subclass on the other hand requires that ALL of the groups be presented in the required format.
- 224 P is pentavalent and contains the structure P-(O-C) or P-(O-Z) where Z indicates an atom other than H (9/09; 9/09A1):**
This subclass is indented under subclass 30. Subject matter wherein the P is pentavalent and contains the structure P-(O-C) or P-(O-Z) where Z is an atom other than H where P is bonded directly to the oxygen atom and a carbon atom is bonded directly to the oxygen atom, or an atom other than hydrogen is directly bonded to the oxygen atom.
- 225 Containing the structure P-(O-*acyl), P-(O-*Z) wherein Z is an atom other than C or H, or P-(O-*cyano) where * indicates a direct bond to the adjacent oxygen atom (9/09A9; 9/09A9+Q; 9/09A9+U):**
This subclass is indented under subclass 224. Subject matter wherein the P compound contains the structure: (a) P-(O-acyl), or (b) P-(O-Z) where Z is an atom other than C or H, or (c) P-O-(C#N) the oxygen atom is bonded directly to the P atom and wherein the C of the acyl group, the atom other than C or H, and the C of the cyano group are all directly bonded to the oxygen atom and C#N indicates a triple bond between the C and N atoms.
- 226 Contains two or more P atoms (9/09B):**
This subclass is indented under subclass 224. Subject matter wherein the compound contains at least two phosphorus atoms.
- 227 Containing the structure P-(O) -C-[K] -C-(O)-P wherein K is an organic residue (9/09A6):**
This subclass is indented under subclass 226. Subject matter wherein the compound containing at least two phosphorus atoms has the structure P-(O-C)-organic residue -(C-O)-P.
- 228 Containing the structure P-(O-carbocyclic ring) (9/12):**
This subclass is indented under subclass 224. Subject matter wherein the C atom which is bonded directly to the oxygen atom is either a ring atom of a carbocyclic ring or is indirectly bonded to a ring atom of a carbocyclic group

- and wherein the indirect bonding is not through the oxygen atom.
- 229 Ring is other than aryl (9/117):**
This subclass is indented under subclass 228. Subject matter wherein the carbocyclic ring is other than aryl.
- 230 Contains the structure P-(O)-[C]_n-aryl wherein n is at least one and the aryl ring is bonded to the O atom through a chain of only carbon atoms (9/09A7):**
This subclass is indented under subclass 228. Subject matter wherein an aryl group is bonded to the oxygen atom indirectly and the bonding is through a single acyclic carbon atom or through a chain solely composed of acyclic carbon atoms.
- 231 Containing the structure P-(O-ethylenic group) (9/113):**
This subclass is indented under subclass 224. Subject matter wherein the carbon atom which is bonded to the oxygen atom is a carbon atom of an ethylenic group or is indirectly bonded to a carbon atom of an ethylenic group and wherein the indirect bonding is not through the oxygen atom.
- 232 Containing the structure P-(O-unsubstituted alkyl) wherein all of the O atoms in the molecule which are single bonded to the P atom are bound directly to carbon radicals containing only carbon and hydrogen atoms (9/11):**
This subclass is indented under subclass 224. Subject matter wherein all of the carbon atoms which are directly bonded to the oxygen atoms which are directly bonded to the P atom are either substituted solely by hydrogen atoms or are part of a moiety containing only carbon and hydrogen atoms.
- (1) Note. This subclass differs from all other subclasses under subclass 224 in that it is proper for those subclasses to have a single one of the required entities. This subclass on the other hand requires that ALL of the groups be presented in the required format.
- 233 Alcohol moiety of ester contains at least three hydroxyl functions or derivatives thereof and wherein the oxygen atoms of the derivative can be attributed to the hydroxyl functions; e.g., phosphatides, lecithin, etc. (9/10):**
This subclass is indented under subclass 224. Subject matter wherein the C atom bonded directly to the oxygen atom is part of an organic moiety containing three or more hydroxyl groups or derivative groups thereof, e.g., phosphatides, lecithin, etc.
- 234 Reaction products of at least one compound containing both P and S atoms with a hydrocarbon or the reaction product of a P and a S reactant with a hydrocarbon (reactant P and S can be in elemental or compound form) (9/04):**
This subclass is indented under subclass 30. Subject matter wherein the product is the result of (a) reacting sulfur in elemental form or compound form with phosphorus in elemental or compound form and with a hydrocarbon reactant or (b) reacting a compound containing both sulfur and phosphorus atoms with a hydrocarbon reactant.
- (1) Note. In (a) above, it is not necessary that all reactants be present at the same time. It is permissible to first react the hydrocarbon with either a phosphorus reactant and then in a subsequent step to react the product of that reaction with a sulfur containing reactant. Conversely, it is permissible to first react the hydrocarbon with a sulfur containing reactant and in a subsequent step react that product with a phosphorus containing reactant.
- (2) Note. The products of this subclass are generally of unknown structure. If the product structure is known and is of a type provided higher in this class, then classification in that higher subclass is proper.
- 300 COMPOUND CONTAINS BOTH A PHOSPHORUS AND A METAL ATOM (9/02A):**
This subclass is indented under the class definition. Subject matter wherein a compound contains both phosphorus and a metal atom.

- 301 Compound contains at least one atom of Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, W, Mn, Tc, or Re (9/02E):**
This subclass is indented under subclass 300. Subject matter wherein the metal compound contains at least one atom of Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, W, Mn, Tc, or Re.
- 302 Compound contains at least one atom of Al, Ga, In, Tl, Ge, Sn, or Pb (9/02D):**
This subclass is indented under subclass 300. Subject matter wherein the metal compound contains at least one atom of Al, Ga, In, Tl, Ge, Sn, or Pb.
- 303 Compound contains at least one atom of Cu, Zn, Ag, Cd, Au, or Hg (9/02C):**
This subclass is indented under subclass 300. Subject matter wherein the metal compound contains at least one atom of Cu, Zn, Ag, Cd, Au, or Hg.
- 304 Compound contains at least one atom of Fe, Co, Ni, Ru, Rh, Pd, Os, Ir, or Pt (9/02B):**
This subclass is indented under subclass 300. Subject matter wherein the metal compound contains at least one atom of Fe, Co, Ni, Ru, Rh, Pd, Os, Ir, or Pt.
- 350 PHOSPHORUS CONTAINING AT LEAST ONE NITROGEN ATOM AS SOLE HETERO ATOM (9/65):**
This subclass is indented under the class definition. Subject matter wherein a ring contains only carbon and nitrogen atoms.
- 351 Ring contains at least four nitrogen atoms (9/65D; 9/65D1; 9/65D2; 9/65D3; 9/65D3B):**
This subclass is indented under subclass 350. Subject matter wherein the ring contains at least four nitrogen atoms.
- 352 Ring contains three nitrogen atoms (9/65C):**
This subclass is indented under subclass 350. Subject matter wherein the ring contains three nitrogen atoms.
- 353 Six-membered ring contains the three N atoms (9/65C6; 9/65C6E; 9/65C6G; 9/65C6K; 9/65C6Q; 9/65C6R; 9/65C6V):**
This subclass is indented under subclass 352. Subject matter wherein the ring is six membered.
- 354 Five-membered ring contains the three N atoms (9/65C5; 9/65C5E; 9/65C5G; 9/65C5K; 9/65C5R; 9/65C5V):**
This subclass is indented under subclass 352. Subject matter wherein the ring is five membered.
- 355 Ring contains two nitrogen atoms (9/65B):**
This subclass is indented under subclass 350. Subject matter wherein the ring contains two nitrogen atoms.
- 356 Six-membered ring (9/65B6):**
This subclass is indented under subclass 355. Subject matter wherein the ring is six membered.
- 357 N in 1 and 4 positions (9/65B64; 9/65B64E; 9/65B64K; 9/65B64V):**
This subclass is indented under subclass 356. Subject matter wherein the nitrogen atoms in the ring are in 1 and 4 positions.
- 358 N in 1 and 3 positions (9/65B63; 9/65B63E; 9/65B63G; 9/65B63J; 9/65B63K; 9/65B63K2; 9/65B63K4; 9/65B63M; 9/65B63R; 9/65B63V):**
This subclass is indented under subclass 356. Subject matter wherein the nitrogen atoms in the ring are in 1 and 3 positions.
- 359 N in 1 and 2 positions (9/65B62; 9/65B62E; 9/65B62J; 9/65B62K; 9/65B62M; 9/65B62V):**
This subclass is indented under subclass 356. Subject matter wherein the nitrogen atoms in the ring are in 1 and 2 positions.
- 360 Five-membered ring (9/65B5):**
This subclass is indented under subclass 355. Subject matter wherein the ring is five membered.
- 361 N in 1 and 3 positions (9/65B53; 9/65B53E; 9/65B53G; 9/65B53J; 9/65B53K; 9/65B53M; 9/65B53R; 9/65B53V):**
This subclass is indented under subclass 360. Subject matter wherein the nitrogen atoms in the ring are in 1 and 3 positions.

362 N in 1 and 2 positions (9/65B52; 9/65B52E; 9/65B52J; 9/65B52K; 9/65B52M):

This subclass is indented under subclass 360. Subject matter wherein the nitrogen atoms in the ring are in 1 and 2 positions.

363 Ring contains a single N atom (9/65A):

This subclass is indented under subclass 350. Subject matter wherein the compound contains a single nitrogen atom.

364 (O=C)-N-C(=O) group where C-N-C is part of the ring (9/65A9):

This subclass is indented under subclass 363. Subject matter wherein the compound contains a (O=C)-N-C(=O) and wherein the C-N-C group are ring atoms.

365 Ring contains at least seven ring atoms (9/65A7):

This subclass is indented under subclass 363. Subject matter wherein the compound contains a ring having at least seven atoms.

366 Six-membered ring (9/65A6; 9/65A6E; 9/65A6G; 9/65A6J; 9/65A6K; 9/65A6K2; 9/65A6K4; 9/65A6M; 9/65A6R; 9/65A6V):

This subclass is indented under subclass 363. Subject matter wherein the compound contains a six-membered ring.

367 Five-membered ring (9/65A5; 9/65A5E; 9/65A5G; 9/65A5J; 9/65A5K; 9/65A5K2; 9/65A5K4; 9/65A5M; 9/65A5R; 9/65A5V):

This subclass is indented under subclass 363. Subject matter wherein the compound contains a five-membered ring.

368 Four-membered ring (9/65A4; 9/65A4E; 9/65A4V):

This subclass is indented under subclass 363. Subject matter wherein the compound contains a four-membered ring.

END