

File created: 3-Nov-87 13:42:29 {QV}<LFG>PARSER>LYRIC>DECL.;2

changes to: (FNS *DECLMAC)

previous date: 23-Feb-87 13:22:27 {QV}<LFG>PARSER>LYRIC>DECL.;1

Read Table: INTERLISP

Package: INTERLISP

Format: XCCS

::
:: Copyright (c) 1983, 1984, 1985, 1987 by Xerox Corporation. All rights reserved.

(RPAQQ DECLCOMS

```
[( * DECLTYPE machinery, declaration translator, and declaration enforcer)
 (LOCALVARS . T)
 (GLOBALVARS FILEPKGFLG CLISPCHANGE CLISPARRAY DWIMESSGAG NOSPELLFLG MSDATABASELST DECLTYPESARRAY
 COMMENTFLG CLISPCHARS DECLATOMS LCASEFLG DECLMESSAGES CLISPRETRANFLG)
 (E (RESETSAVE CLISPIFYPRETTYFLG NIL)
 (RESETSAVE PRETTYPRINTMACROS (APPEND '( (DECL . QUOTE)
 (DPROGN . QUOTE)
 (DLAMBDA . QUOTE)
 (DPROG . QUOTE))
 PRETTYPRINTMACROS)))

 (COMS (* Interface to file package)
 (FNS DECLTYPE DECLTYPES DUMPDECLTYPES GETDECLDEF)
 (FILEPKGCOMS DECLTYPES IGNOREDECL)
 (PROP ARGNAMES DECLTYPE))

 (* User functions)
 (FNS COVERS GETDECLTYPEPROP SETDECLTYPEPROP SUBTYPES SUPERTYPES)
 (MACROS SELCOVERSQ SELTYPEQ)
 (ALISTS (PRETTYEQUIVLST SELCOVERSQ SELTYPEQ)
 (DWIMEQUIVLST SELCOVERSQ SELTYPEQ))
 [P (SETSYNONYM '(THE TYPE)
 '(AS A TYPE))

 (* Internal machinery)
 (DECLARE%: DONTCOPY (RECORDS TYPEBLOCK TYPEDEF)
 (ALISTS (PRETTYPRINTYPEMACROS TYPEBLOCK)))
 (INITRECORDS TYPEBLOCK)
 (P (DEFPRINT 'TYPEBLOCK 'TBDEFPRINT))
 (FNS CHECKTYPEXP COLLECTTYPES COVERSTYPE COVERSTB COVERSTE CREATEFNPROP CREATEFNVAL DECLERROR DELETETB
 FINDDECLTYPE FINDPROP FINDTYPEXP GETCTYPE GETDECLTYPE GETDECLTYPE.NOERROR GETTBPROP INHERITPROP
 INITDECLTYPES LCCTYPE LCC2 MAKECTYPE MAKEDECLTYPE MAKEBINDFN MAKESETFN MAPTYPEUSERS NOTICETB
 PPDTYPE RECDTYPE DECLCHANGERECORD RECDEFTYPE REPROPTB SETTBPROP TBDEFPRINT TETYPE TYPEMSANAL
 TYPEMSANAL1 UNCOMPLETE UNSAVETYPE USERDECLTYPE USESTYPE)
 (BLOCKS (LCCTYPE LCCTYPE LCC2)
 (TYPEMSANAL TYPEMSANAL TYPEMSANAL1))

 (* Test fn creation block)
 (FNS MAKETESTFN MAKETESTFNBLOCK COMBINE.TESTS FUNIFY MKNTHCAR MKNTHCDR OF.TESTFN TUPLE.TESTFN
 WHOSE.TESTFN)
 (BLOCKS (MAKETESTFNBLOCK MAKETESTFNBLOCK COMBINE.TESTS FUNIFY MKNTHCAR MKNTHCDR OF.TESTFN TUPLE.TESTFN
 WHOSE.TESTFN))

 (* Machinery to compile recursive testfns)
 (FILES (SYSLOAD FROM VALUEOF LISPUSERSDIRECTORIES)
 LABEL)

 (* Idioms. Expressed as macros for now)
 (DECLARE%: DONTCOPY EVAL@COMPILE (VARS DefaultBindFn DefaultSetFn)
 (ADDVARS (NLAMA MAKEDECLTYPEQ))
 (MACROS ANYC DECLVARERROR DTYPENAME foreachTB GETCGETD KWOTEBOX LAMBIND LAMVAL MAKEDECLTYPEQ
 NONEC TESTFORM)
 (FNS TESTFORM)
 (ADDVARS (DONTCOMPILEFNS TESTFORM))
 (TEMPLATES foreachTB MAKEDECLTYPEQ))

 (* Runtime utility functions)
 (FNS EVERYCHAR LARGE DECLRECURSING SMASHCAR)
 (DECLARE%: EVAL@COMPILE (MACROS LARGE))
 (DECLARE%: DONTCOPY EVAL@COMPILE (MACROS SMASHCAR))
 (* translator of dprogs and dlambdas)
 (FNS ASSERT ASSERTFAULT ASSERTMAC \*DECL \*DECLMAC \CHKINIT CHKINITMAC DECLCONSTANTP DD DECLCLISPTRAN
 DECLMSG DECLDWIMERROR DECLDWIMTESTFN DECLSET DECLSETQ DECLSETQQ DECLTRAN DECLVAR DLAMARGLIST
 DTYPE?TRAN EDITNEWSATLIST FORMUSETB IGNOREDECL MAKETESTFORM PPDECL PVARLIST SETQMAC THETRAN
 VALUEERROR \VARASRT VARASRT1 VARSETFN)
 (BLOCKS (DECLTRAN DECLTRAN DECLVAR)
 (PPDECL PPDECL PVARLIST)
 (\VARASRT \VARASRT VARASRT1))

 (* Declaration database fns)
 (FNS DECLOF DECLOF1 TBOF TYPEBLOCKOF VARDECL)
 (BLOCKS (DECLOFBLK DECLOF DECLOF1 TBOF TYPEBLOCKOF VARDECL (ENTRIES DECLOF TYPEBLOCKOF)))

 (* Enabling and disabling fns)
 (DECLARE%: EVAL@COMPILE DONTCOPY (RECORDS FNEQUIVS)
 (MACROS MOVEPROP PUTIFPROP))
 (FNS STARTDECLS DODECLS)
 (FILES (SYSLOAD FROM VALUEOF LISPUSERSDIRECTORIES)
 LAMBDATRAN)
```


(DEFINEQ

(DECLTYPE

[NLAMBDA X
 (USERDECLTYPE (CAR X)
 (CADR X)
 (CDDR X])

(* bas%: " 7-NOV-79 16:22")

(DECLTYPES

[NLAMBDA DTS
 (for D in DTS collect (USERDECLTYPE (CAR D)
 (CADR D)
 (CDDR D])

(* bas%: " 7-NOV-79 16:24")
(* Defines a list of decltypes)

(DUMPDECLTYPES

[LAMBDA (TL)
 (WITH [[TWOF LG (OR (NLISTP TL)
 (LISTP (CDR TL)
 (FFLG (NEQ T (OUTPUT]

(* rmk%: " 7-SEP-81 04:50")

(* Don't do the plural and extra parens if only one, and don't do the EVAL@COMPILE stuff if going to T=SHOWDEF)

(if FFLG
 then (printout NIL T "(DECLARE: EVAL@COMPILE" T T))
(printout NIL **(if TWOF LG**
 then "(DECLTYPES"
 else "(DECLTYPE ")")
(for D in TL do (if TWOF LG
 then (printout NIL 11 "("))
 [if (LISTP D)
 then (printout NIL .P2 (CAR D)
 %, .P2 (CADR D)
 %, .P2 (CADR D)
 %, .PPV (**GETDECLTYPEPROP** (CAR D)
 (CADR D)))
 else [SETQ D (CDR (**GETDECLDEF** D NIL 'NOCOPY))
 (printout NIL .P2 (CAR D)
 %,)
 (for TAIL (POS _ (POSITION)) on (CDDR D) by (CDDR TAIL)
 first (PRINTDEF (CADR D)
 POS)
 do (printout NIL .TAB POS .P2 (CAR TAIL)
 %, .PPF (CADR TAIL])
 (if TWOF LG
 then (printout NIL ")"))))
(printout NIL ") " T)
(if FFLG
 then (printout NIL ") " T])

(GETDECLDEF

[LAMBDA (NAME FPTYPE OPTIONS)

(* bas%: " 9-OCT-79 23:04")

(* This is the GETDEF function for DECLTYPE. FPTYPE is the file-package-type argument, which we ignore.)

(WITH ((TB (**FINDDECLTYPE** NAME))
 (NOCOPYP (EQMEMB 'NOCOPY OPTIONS)))
(if TB
 then [CONS 'DECLTYPE (CONS NAME (CONS (**WITH** ((TE (**fetch** TYPEXP of TB))
 (if NOCOPYP
 then TE
 else (COPY TE)))
 (**WITH** ((TP (**fetch** PROPS of TB))
 (if NOCOPYP
 then TP
 else (COPY TP))
 elseif (EQMEMB 'NOERROR OPTIONS)
 then NIL
 else (**DECLERROR** NAME "is not a DECLTYPE")])
)
)

[PUTDEF 'DECLTYPES 'FILEPKGCOMS '([COM MACRO (X (E (DUMPDECLTYPES 'X)
 (TYPE DESCRIPTION "type declarations" GETDEF GETDECLDEF DELDEF
 (LAMBDA (NAME)
 (DELETE(TB (OR (FINDDECLTYPE NAME)
 (DECLERROR "Can't delete non-existent type:" NAME])

[PUTDEF 'IGNOREDECL 'FILEPKGCOMS '((COM MACRO (X (DECLARE%: DOEVAL@COMPILE DONTEVAL@LOAD DONTCOPY
 (P (RESETSAVE COMPILEIGNOREDECL 'X)

(PUTPROPS **DECLTYPE ARGNAMES** (NIL (NAME TYPE PROP1 VAL1 |...|) . X))

(* * User functions)

(DEFINEQ

(COVERS

[LAMBDA (HI LO)
(AND (COVERSTB (GETDECLTYPE HI)
(GETDECLTYPE LO))
T])

(* bas%: "16-OCT-79 11:22")

(GETDECLTYPEPROP

[LAMBDA (TYPE PROP)
(GETTBPROP (GETDECLTYPE TYPE)
PROP)]

(* bas%: " 9-OCT-79 22:56")

(SETDECLTYPEPROP

[LAMBDA (NAME PROP VAL)
(OR (LITATOM NAME)
(DECLERROR "Can't set property of non-atomic type:" NAME))
(REPROPTB (OR (FINDDECLTYPE NAME)
(DECLERROR "Can't set property of non-existent type:" NAME))
(LIST PROP VAL))
(MARKASCHANGED (LIST NAME PROP)
'DECLTYPES)
VAL)]

(* rmk%: " 2-AUG-81 08:41")

(SUBTYPES

[LAMBDA (NAME)
(PROG (TYPES CT (BT (GETDECLTYPE NAME)))
(DECLARE (SPECVARS TYPES CT))
(SETQ CT (GETCTYPE BT))
(if (NONEQ CT)
elseif (EQ (CAR (fetch TYPEXP of BT))
'ONEOF)
then [RETURN (APPEND (CDR (fetch TYPEXP of BT)
else [foreachTB S (AND (LITATOM (fetch NAME of S))
(FMEMB CT (GETCTYPE S))
(push TYPES (fetch NAME of S)
(RETURN (OR TYPES (LIST 'NONE))

(* bas%: "16-OCT-79 18:59")

(SUPERTYPES

[LAMBDA (NAME)
(PROG (TYPES (CN (GETCGETD NAME)))
(DECLARE (SPECVARS TYPES CN))
[if (ANYC CN)
then NIL
else (foreachTB TB (AND (LITATOM (fetch NAME of TB))
(if (NONEQ CN)
then
(NULL (SUBTYPES (fetch NAME of TB)))
else
(FMEMB (fetch CTYPE of (fetch DEF of TB))
CN))
(push TYPES (fetch NAME of TB)
(RETURN TYPES)]

(* bas%: "16-OCT-79 18:20")

)

(DECLARE%: EVAL@COMPILE

(PUTPROPS SELCOVERSQ MACRO [F (LIST [LIST 'LAMBDA '(\$\$TMP)
(CONS 'COND (MAPLIST (CDR F)
(FUNCTION (LAMBDA (I)
(COND
((CDR I)
(CONS (LIST 'COVERS
(KWOTE (CAAR I))
'\$\$TMP)
(CDAR I)))
(T (LIST T (CAR I)
(LIST 'DECLOF (CAR F])

(PUTPROPS SELTYPEQ MACRO (F (APPLYFORM [LIST 'LAMBDA '(\$\$TMP)
(CONS 'COND (MAPLIST (CDR F)
(FUNCTION (LAMBDA (I)
(COND
((CDR I)
(CONS (LIST 'TYPE?
(CAAR I)
'\$\$TMP)
(CDAR I)))
(T (LIST T (CAR I)


```

(DOWN (COVERSTB (CAR SCR)
              J))
(SHOULDNT)))
then (RPLACD SCR VAL)
      (SETQ VAL SCR))]
(RETURN VAL])

```

(COVERSCTYPE

```

[LAMBDA (H L)
  (PROG NIL
    (* bas%: "11-OCT-79 11:35")
    (* COVERS for CTYPEs)

```

(* We use a PROG so we can chase singleton supertypes which are the common case by looping rather than recursion.)

```

LP (if (EQ H L)
      then (RETURN T)
      elseif (NLISTP L)
      then (RETURN (NONEC L))
      elseif (CDR L)
      then (RETURN (for I in L thereis (COVERSCTYPE H I)))
      else (SETQ L (CAR L))
          (GO LP])
(* Either we had NONE to start or we have arrived at ANY)
(* Single supertype)

```

(COVERSTB

```

[LAMBDA (H L)
  (OR (EQ H L)
      (COVERSCTYPE (GETCTYPE H)
                   (GETCTYPE L))
      (COVERSTE (fetch TYPEXP of H)
                (fetch TYPEXP of L]))
(* bas%: "19-OCT-79 17:40")
(* COVERS for type blocks. COVERSTE gets some cases that
are difficult from the lattice.)

```

(COVERSTE

```

[LAMBDA (H L)
  (* COVERS for type expressions. We pick off MEMQ and ONEOFs here because they cannot be efficiently linked into the
  type lattice.)

```

```

(SELECTQ (TETYPE H)
  (ONEOF (SELECTQ (TETYPE L)
                 (ONEOF (for I in (CDR L) always (for J in (CDR H) thereis (COVERS J I))))
          (for I in (CDR H) thereis (COVERS I L))))
  (MEMQ (SELECTQ (TETYPE L)
                (MEMQ (for I in (CDR L) always (MEMBER I (CDR H))))
          NIL))
NIL])

```

(CREATEFNPROP

```

[LAMBDA (PL PN)
  (* bas%: " 7-NOV-79 16:51")

```

(* If a value for prop PN appears on PL, CREATEFNVAL it. NIL will indicate that no specification has yet been made.)

```

(WITH ((PE (FINDPROP PL PN)))
  (AND PE (CREATEFNVAL (CADR PE)
                      PN))

```

(CREATEFNVAL

```

[LAMBDA (FVAL FNAME)
  (* bas%: " 7-NOV-79 16:53")

```

(* Gets given a purported FNVAL. If that value is NIL, use the default. Dwimify a list value.)

```

(DECLARE (USEDFREE DWIMFLG))
(if FVAL
  then (AND DWIMFLG (LISTP FVAL)
            (DWIMIFY FVAL T))
  FVAL
  else (SELECTQ FNAME
              (BINDFN (CONSTANT DefaultBindFn))
              (SETFN (CONSTANT DefaultSetFn))
              NIL])

```

(DECLERROR

```

[LAMBDA (MSG1 MSG2)
  (* bas%: "25-NOV-78 18:25")

```

```

(if (BOUNDP 'DECLERROR)
  then (SETQ DECLERROR T)
      (ERROR!))
  else (ERROR MSG1 MSG2])

```

(DELETETB

[LAMBDA (TB)

(* rmk%: "19-AUG-81 00:15")
(* Dissociates TB from its name and undoes any dependencies on it)

```
(WITH ((NAME (fetch NAME of TB)))
      (SELECTQ NAME
        ((ANY NONE)
         (DECLERROR "(Futile) attempt to delete" NAME))
        NIL)
      (UNSAVETYPE TB)
      (UNCOMPLETE TB)
      (NOTICETB NIL NAME)
      (replace NAME of TB with (PACK* 'Deleted NAME)))
```

(* Unsave dependent code)
(* Undo the cached values and dependent types)
(* Snap name association)

(FINDDECLTYPE

[LAMBDA (TE)

(* bas%: "10-OCT-79 01:46")
(* Finds the existing typeblock for a type expression if any)

```
(COND
  ((LISTP TE)
   (AND (GETHASH TE CLISPARRAY)
        (GETHASH TE DECLTYPESARRAY)))
  (T (OR (GETHASH TE DECLTYPESARRAY)
         (RECDDTYPE TE))))
```

(* TE must be in CLISPARRAY to detect edits of the type expression)

(FINDPROP

[LAMBDA (L P)

(* rmk%: "12-Mar-85 08:56")

```
(for TAIL on L by (CDR (LISTP (CDR TAIL))) thereis (EQ P (CAR TAIL]))
```

(FINDTYPEXP

[LAMBDA (TYPE)

(* bas%: "16-OCT-79 14:17")
(* Tries to find an equivalent TYPEBLOCK for the expression TYPE)

```
(DECLARE (SPECVARS TYPE))
(foreachTB TB (if (AND (LISTP (fetch NAME of TB))
                      (EQUAL TYPE (fetch TYPEXP of TB)))
                  then (OR (EQUAL TYPE (fetch NAME of TB))
                          (replace NAME of TB with TYPE))
                      (NOTICETB TB TYPE)
                      (RETFROM 'FINDTYPEXP TB)))
NIL])
```

(* NAME has been edited)
(* Remember this path)

(GETCTYPE

[LAMBDA (TB)

(* rmk%: "29-NOV-81 14:33")

```
(OR (fetch CTYPE of (fetch DEF of TB))
    (if (DECLRECURSING 'GETCTYPE TB)
        then (DECLERROR "Invalid recursive type definition" (fetch TYPEXP of TB))
        (replace CTYPE of (fetch DEF of TB) with (MAKECTYPE (fetch TYPEXP of TB))))
```

(GETDECLTYPE

[LAMBDA (TE VARNAME)

(* bas%: "18-OCT-79 15:38")

(* Either finds a typeblock with TE as its type expression or creates one.
We smuggle the name thru in the PROPS field as anyone who specifies a VARNAME is unnamed so neither has nor can acquire any properties.)

```
(OR (FINDDECLTYPE TE)
    (AND (LISTP TE)
         (OR (FINDTYPEXP TE)
             (MAKEDECLTYPE TE TE VARNAME))))
(DECLERROR TE "is not a DECLTYPE"])
```

(GETDECLTYPE.NOERROR

[LAMBDA (TE VAR)

(* bas%: "19-OCT-79 16:05")
(* Makes and completes a typeblock for TE suppressing any DECLERRORs)

```
(WITH ((DECLERROR))
      (DECLARE (SPECVARS DECLERROR))
      (OR (CAR (ERSETQ (WITH ((TB (GETDECLTYPE TE VAR)))
                          (GETCTYPE TB)
                          (fetch TESTFN of TB)
                          TB))))
          (COND
            (DECLERROR NIL)
            (T (ERROR!)))))
```

(* Force completion so any errors will happen now under the ERSETQ)

(GETTBPROP

[LAMBDA (TB P)

(* bas%: "15-AUG-79 23:49")

```
(SELECTQ P
```

```

(BINDFN (fetch BINDFN of TB))
(SETFN (fetch SETFN of TB))
(TESTFN (fetch TESTFN of TB))
(WITH ((PL (FINDPROP (fetch PROPS of TB)
                    P)))
      (if PL
          then (CADR PL)
          else (INHERITPROP TB P]))

```

(INHERITPROP

[LAMBDA (TB PROP)

(* bas%: "19-OCT-79 16:45")

(* Determines how types inherit their properties on the basis of the way they were formed from other types)

```

(WITH ((TE (fetch TYPEXP of TB))
      (AND (LISTP TE)
           (GETDECLTYPEPEPROP (SELECTQ (TETYPE TE)
                                       ((ALLOF ONEOF)
                                        (WITH ((V (GETDECLTYPEPEPROP (CADR TE)
                                                                    PROP))
                                              (ANYVAL (GETDECLTYPEPEPROP 'ANY PROP)))
                                              (RETFROM 'INHERITPROP
                                                    (if [OR (EQ V ANYVAL)
                                                        (for I in (CDDR TE)
                                                            always (EQ V (GETDECLTYPEPEPROP I PROP))
                                                            then V
                                                            else ANYVAL))))
                                              ((OF SATISFIES WHOSE)
                                               (CAR TE))
                                              (MEMQ (CONS 'ONEOF (for I in (CDR TE) collect (DTYPENAME I))))
                                              (SHARED (if (EQ PROP 'BINDFN)
                                                         then (RETFROM 'INHERITPROP (CONSTANT DefaultBindFn))
                                                         else (CADR TE))))
                                              ((SUBTYPE SYNONYM)
                                               (CADR TE))
                                              (TUPLE 'LISTP)
                                              'ANY)
                                           PROP]))

```

(INITDECLTYPES

[LAMBDA NIL

(* rmk%: "14-SEP-82 22:17")

(* Initializes DECLTYPES hash array)

```

[COND
  ((BOUNDP 'DECLTYPESARRAY)
   (CLRHASH DECLTYPESARRAY))
  (T (SETQ DECLTYPESARRAY (CONS (HARRAY 128)
                                128])

```

(* Make FILEPKG forget about any types it may have noticed.)

```

(FILEPKGCHANGES 'DECLTYPES NIL)
(RESETVARS (FILEPKGFLG)
  (for I in '(ANY NONE) do (create TYPEBLOCK
                                  NAME _ I
                                  DEF _ (create TYPEDEF
                                                TEXP _ I
                                                CTYPE _ I)
                                  BINDFN _ (CONSTANT DefaultBindFn)
                                  SETFN _ (CONSTANT DefaultSetFn)
                                  TESTFN _ (LAMVAL (EQ I 'ANY))
                                  (* ANY and NONE are created complete)

```

```

(MAKEDECLTYPEQ ARRAYP (SUBTYPE ANY)
  (TESTFN ARRAYP))
(MAKEDECLTYPEQ HARRAYP (SUBTYPE ARRAYP)
  (TESTFN HARRAYP))
(MAKEDECLTYPEQ LISTP (SUBTYPE ANY)
  (TESTFN LISTP EVERYFN EVERY))
(MAKEDECLTYPEQ HASHARRAY (ONEOF HARRAYP (LISTP (WHOSE (CAR HARRAYP)
                                                         (TESTFN READTABLEP))
                                                         (SUBTYPE ARRAYP)
                                                         (TESTFN READTABLEP)))
  (TESTFN READTABLEP))
(MAKEDECLTYPEQ ATOM (SUBTYPE ANY)
  (TESTFN ATOM))
(MAKEDECLTYPEQ LITATOM (SUBTYPE ATOM)
  (TESTFN LITATOM))
(MAKEDECLTYPEQ BOOL (MEMQ NIL T))
(MAKEDECLTYPEQ NUMBERP (SUBTYPE ATOM)
  (TESTFN NUMBERP))
(MAKEDECLTYPEQ FIXP (SUBTYPE NUMBERP)
  (TESTFN FIXP))
(MAKEDECLTYPEQ CARDINAL (FIXP (SATISFIES (IGEQL VALUE 0)))
  (TESTFN SMALLP))
(MAKEDECLTYPEQ SMALLP (SUBTYPE FIXP)
  (TESTFN SMALLP))
(MAKEDECLTYPEQ LARGE (SUBTYPE FIXP)
  (TESTFN LARGE))
(MAKEDECLTYPEQ FLOATP (SUBTYPE NUMBERP)
  (TESTFN FLOATP))
(MAKEDECLTYPEQ FUNCTION (SUBTYPE ANY)
  (TESTFN FNTYP))

```



```
(MAKEDECLTYPEQ NIL (MEMQ NIL)
  (TESTFN NULL))
(MAKEDECLTYPEQ LST (ONEOF LISTP NIL)
  (EVERYFN EVERY))
(MAKEDECLTYPEQ ALIST (LST OF LISTP))
(MAKEDECLTYPEQ STACKP (SUBTYPE ANY)
  (TESTFN STACKP))
(MAKEDECLTYPEQ STRINGP (SUBTYPE ANY)
  (TESTFN STRINGP EVERYFN EVERYCHAR))
```

(LCCTYPE

```
[LAMBDA (TL)
  (WITH [(C1 (GETCGETD (CAR TL)
    (if (CDR TL)
      then (LCC2 C1 (LCCTYPE (CDR TL)))
      else C1)])
```

(* bas%: "18-SEP-79 17:24")
(* Returns the lowest common ctype for the type names in TL)

(LCC2

```
[LAMBDA (A B)
  (if (COVERSCTYPE A B)
    then A
    elseif (COVERSCTYPE B A)
    then B
    else (for I C in A do (WITH ((D (LCC2 I B)))
      (if (OR (NULL C)
        (COVERSCTYPE C D))
        then (SETQ C D)))
    finally (RETURN C]))
```

(* bas%: "10-OCT-79 19:12")
(* Returns the lcd of A and B)

(MAKECTYPE

```
[LAMBDA (TE)
  (SELECTQ (TETYPE TE)
    (ALLOF [WITH [(S (COLLECTTYPES (CDR TE)
      'DOWN]
      (if (CDR S)
        then (SMASHCAR S (FUNCTION GETCTYPE))
        else (GETCTYPE (CAR S))
      (ONEOF [WITH [(S (COLLECTTYPES (CDR TE)
        'UP]
```

(* bas%: "31-OCT-79 16:44")
(* Computes the real sup types of TE)

(* Rather than having the subtypes point to this new ctype, we pick that case up in COVERS to avoid making the supertype structure bushy.)

```
(if (CDR S)
  then (LIST (LCCTYPE (CDR TE)))
  else (GETCTYPE (CAR S)))
((SHARED SYNONYM)
 (GETCGETD (CADR TE)))
(LIST (SELECTQ (TETYPE TE)
  (MEMQ (LCCTYPE (for I in (CDR TE)
    scratchcollect
    (DTYPENAME I))))
  (GETCGETD (SELECTQ (TETYPE TE)
    ((OF SATISFIES WHOSE)
     (CAR TE))
    (SUBTYPE (CADR TE))
    (TUPLE (if (CDR TE)
      then 'LISTP
      else 'NIL))
    (SHOULDNT]))
```

(* They are all on the same path)

(* All on the same path)

(MAKEDECLTYPE

```
[LAMBDA (NAME DECL PROPS)
  (CHECKTYPEEXP DECL)
  (WITH [(TB (create TYPEBLOCK
    NAME _ NAME
    TYPEXP _ DECL
    PROPS _ (COPY PROPS)
    (if (LISTP PROPS)
      then (replace BINDFN of TB with (CREATEFNPROP PROPS 'BINDFN))
      (replace SETFN of TB with (CREATEFNPROP PROPS 'SETFN))
      (replace TESTFN of TB with (CREATEFNPROP PROPS 'TESTFN))
      (CREATEFNPROP PROPS 'EVERYFN))
    TB])
```

(* bas%: " 7-NOV-79 16:33")
(* Defines the type specified by the type expression DECL)
(* Provides an early check on well formedness)

(MAKEBINDFN

```
[LAMBDA (TB)
  (replace BINDFN of TB with (INHERITPROP TB 'BINDFN))
```

(* bas%: "18-OCT-79 18:17")
(* Finds a BINDFN for TB)

(MAKESETFN

```
[LAMBDA (TB)
  (replace SETFN of TB with (INHERITPROP TB 'SETFN))
```

(* bas%: "18-OCT-79 21:17")
(* Finds a SETFN for TB)

(MAPTYPEUSERS

```
[LAMBDA (NAME FN)
  (DECLARE (SPECVARS . T))
  (foreachTB TB (AND (USESTYPE NAME (fetch TYPEXP of TB))
                    (APPLY* FN TB))
```

(* bas%: "28-AUG-79 22:18")

(NOTICETB

```
[LAMBDA (TBLOCK TEXP)
  (if (LISTP TEXP)
      then (PUTHASH TEXP TEXP CLISPARRAY)
      (PUTHASH TEXP TBLOCK DECLTYPESARRAY])
```

(* rmk%: " 7-SEP-81 03:26")
(* Enters hash links so TBLOCK can be found given type expression TEXP)
(* Access name is also in CLISPARRAY to detect changes)

(PPDTYPE

```
[LAMBDA (TYPE)
  (WITH [(LM (IPLUS 4 (POSITION)))
        (TB (if (type? TYPEBLOCK TYPE)
                then TYPE
                else (GETDECLTYPE TYPE)
                (printout NIL "DECLTYPE: " (fetch NAME of TB)
                           " = "
                           (OR (fetch TYPEXP of TB)
                               "No type expression"))
                (printout NIL .TAB LM "Suptypes: ")
                (if (fetch CTYPE of (fetch DEF of TB))
                    then (for I in (GETCTYPE TB) declare (SPECVARS I)
                          do (printout NIL .TAB0 (IPLUS LM 10))
                             (foreachTB S (AND (EQ I (fetch CTYPE of (fetch DEF of S)))
                                                (printout NIL (fetch NAME of S)
                                                             %)))
                          (* Start each new suptype list on a new line)
                          (* Dont force a completion to get the CTYPE)
                    )
                    else (printout NIL "... not completed..."))
        (if (fetch BF of TB)
            then (printout NIL .TAB LM "Bindfn: " .PPF (fetch BF of TB)))
        (if (fetch SF of TB)
            then (printout NIL .TAB LM "Setfn: " .PPF (fetch SF of TB)))
        (if (fetch TF of TB)
            then (printout NIL .TAB LM "Testfn: " .PPF (fetch TF of TB)))
        (if (fetch PROPS of TB)
            then (printout NIL .TAB LM "Property: ")
                 (for P on (fetch PROPS of TB) by (CDDR P) do (printout NIL .TAB0 (IPLUS LM 10)
                                                                              (CAR P)
                                                                              " = " .P2 (CADR P)
                                                                              )
                 )
        (TERPRI)
        TB])
```

(* bas%: "18-OCT-79 17:57")
(* PPs typeblock, completing unless NOCOMPFLG)

(RECDTYPE

```
[LAMBDA (R)
  (WITH [RDECL TB (TST (LIST 'type? R (CONS 'NIL]))
        (COND
          ((RESETVARS (CLISPCHANGE (DWIMESSGAG T))
                       (* CLISPCHANGE bound cause RECORDTRAN sets it)
          (* If the record package translation bombs, simply return NIL to GETDECLTYPE, which might then print an error message.)
          (RETURN (NLSETQ (RECORDTRAN TST 'DTYPE?TRAN)
                        (SETQ RDECL (RECLOOK R))
                        [SETQ TB (create TYPEBLOCK
                                         NAME _ R
                                         TYPEXP _ (LIST 'SUBTYPE (RECDTYPE RDECL)
                                         (* Use SETTBPROP to store TESTFN rather than doing it in the create, so that it also shows up on the property list. Then the decltype will print with all its info.)
          [SETTBPROP TB 'TESTFN (LAMVAL (LIST COMMENTFLG 'ASSERT%: (LIST 'RECORD R)
                                     (SUBST 'VALUE (CADDR TST)
                                     (PROG1 (GETHASH TST CLISPARRAY)
                                     (PUTHASH TST NIL CLISPARRAY))
```

(* rmk%: " 6-SEP-81 04:29")

(* The record package stores the DECL form in 9th car of the translation)

```
(for X on (CDAR (FNTH (GETHASH RDECL CLISPARRAY)
9))
  by (CDDR X) do (SETTBPROP TB (CAR X)
(CADR X)))
TB])
```

(DECLCHANGEREcord

[LAMBDA (RNAME RFIELDS OLDFLG)

(* rmk%: " 7-SEP-81 04:17")

(* CHANGEREcord is the default value of RECORDCHANGEFN, which is applied by RECREDECLARE. This makes sure that a record change wipes out a dependent decltype)

```
(REALCHANGEREcord RNAME RFIELDS OLDFLG)
(AND OLDFLG (WITH (TEMP (TB (GETHASH RNAME DECLTYPESARRAY))))
```

(* This is a marginal guess at the dependency%: we would be wrong if the user had, e.g., dumped a record-derived decltype and loaded it into a system without the record.)

```
(if (AND TB (SETQ TEMP (fetch TESTFN of TB))
[EQ COMMENTFLG (CAR (SETQ TEMP (CADDR TEMP)
(EQ (CADR TEMP)
'ASSERT%:))
(EQ (CAR (SETQ TEMP (CADDR TEMP)))
'RECORD)
(EQ RNAME (CADR TEMP)))
then (DELETETB TB])
```

(RECDEFTYPE

[LAMBDA (RD)

(* bas%: "21-SEP-79 14:53")

(* Computes the DECLOF type corresponding to a record package type expression)

```
(SELECTQ (CAR RD)
(AccessFNS (WITH ((CRF (FASSOC 'CREATE RD)))
(if CRF
then (DECLOF (CADR CRF))
else 'ANY)))
```

```
(ARRAYRECORD 'ARRAYP)
(ASSOCRECORD 'ALIST)
(ATOMRECORD 'LITATOM)
(DATATYPE (if (LISTP (CADR RD))
then (CADADR RD)
else 'ANY))
```

```
(HASHLINK 'HARRAYP)
(PROPRECORD 'LST)
(RECORD (WITH ((FLDS (CADDR RD)))
(if (LISTP FLDS)
then 'LST
elseif [AND FLDS (EQ FLDS (CADR (FASSOC 'SUBRECORD RD))
then
```

(* The declaration has a top-level field equal to the subrecord name)

```
FLDS
else 'ANY)))
(TYPERECORD 'LISTP)
'ANY])
```

(REPROPTB

[LAMBDA (TB PROPS INHERITING)

(* bas%: " 7-NOV-79 15:46")

(* Propgates changes in properties)

```
(PROG [(NEWP (for old PROPS by (CDDR PROPS) while PROPS
unless [if INHERITING
then (FINDPROP (fetch PROPS of TB)
(CAR PROPS))
else (EQUAL (CADR PROPS)
(LISTGET (fetch PROPS of TB)
(CAR PROPS)
join (SETTBPROP TB (CAR PROPS)
(COPY (CADR PROPS))
INHERITING)
(LIST (CAR PROPS)
(CADR PROPS)
(DECLARE (SPECVARS NEWP))
[if NEWP
then (UNSAVETYPE TB)
(MAPTYPEUSERS (fetch NAME of TB)
(FUNCTION (LAMBDA (X)
(REPROPTB X NEWP T])
```

(* Probably not necessary, but we cant tell)

(* Any recursions bottom out b/c the change will have been made the first time the type is reached)

(RETURN NEWP)

(* Indicate if any changes)

])

(SETTBPROP

```
[LAMBDA (TB P V BLKONLY)
  (SELECTQ P
    (BINDFN (replace BINDFN of TB with (CREATEFNVAL V 'BINDFN)))
    (EVERYFN (CREATEFNVAL V 'EVERYFN))
    (SETFN (replace SETFN of TB with (CREATEFNVAL V 'SETFN)))
    (TESTFN [SELECTQ (fetch NAME of TB)
              ((ANY NONE)
               (DECLERROR "(Futile) attempt to change TESTFN of" (fetch NAME of TB)))
              (replace TESTFN of TB with (CREATEFNVAL V 'TESTFN))]
    NIL)
  (if BLKONLY
    elseif (fetch PROPS of TB)
    then (LISTPUT (fetch PROPS of TB)
                 P V)
    else (replace PROPS of TB with (LIST P V]))
  (* bas%: " 7-NOV-79 16:55"
   * Unless BLKONLY, must also put on property list so it is known)
```

(TBDEFPRINT

```
[LAMBDA (TB)
  (CBOX (CONCAT "{DECLTYPE: " (fetch NAME of TB)
               "}")
        (PACK])
  (* bas%: "22-NOV-78 14:32"
   * DEFPRINTer for TYPEBLOCKs.
   Made a function to allow supression of constant cons)
```

(TETYPE

```
[LAMBDA (TE)
  (if (LITATOM TE)
    then 'PRIMITIVE
    elseif (LISTP TE)
    then (SELECTQ (CAR TE)
                 ((ALLOF MEMQ ONEOF SHARED SUBTYPE SYNONYM TUPLE)
                  (CAR TE))
                 (AND (LISTP (CDR TE))
                      (SELECTQ (CADR TE)
                               (OF 'OF)
                               (SELECTQ (CAR (LISTP (CADR TE)))
                                         ((SATISFIES WHOSE)
                                          (CAADR TE)))
                               NIL]))
  (* rmk%: "18-Feb-85 18:07"
   * returns the type of a type expression)
```

(TYPEMSANAL

```
[NLAMBDA (KIND)
  (DECLARE (USEDFREE EXPR FNNAME))
  (SELECTQ KIND
    (COVERS (SCRATCHLIST (CBOX)
                       (TYPEMSANAL1 EXPR)))
    ((type? the)
     [LBOX KIND (SCRATCHLIST (CBOX)
                            (TYPEMSANAL1 (CADR EXPR)))
      (OR (GETHASH EXPR CLISPARRAY)
          (RESETVARS (FILEPKGFLG (NOSPELLFLG T)
                                   (DWIMESSGAG T))
                    (PROG (LISPXHIST)
                          (DECLARE (SPECVARS LISPXHIST))
                          (DWIMIFY0? EXPR EXPR NIL NIL NIL FNNAME))
                    (RETURN (GETHASH EXPR CLISPARRAY]))
    (\*DECL
     (* We assume that the \*DECL came from a previous dwimification which also got the testfn.
      The typeblock should already exist, but sometimes it isn't found cause the clisparray gets cleared.
      The MAKEAPPLYFORM means that bogus VALUE's are most likely eliminated)
     (LBOX [SCRATCHLIST (CBOX)
                (TYPEMSANAL1 (fetch DECL of (fetch VARDECL of EXPR)
                               (APPLYFORM [fetch TESTFN of (GETDECLTYPE (fetch DECL of (fetch VARDECL of EXPR)
                                                                    (fetch VARNAME of EXPR))]))
                (SHOULDNT]))
  (* rmk%: " 9-NOV-83 09:24"
   * Returns the information that the various templates expect.)
```

(TYPEMSANAL1

```
[LAMBDA (TYPEXP)
  (* Collects from a type expression the names of all the named types that it uses)
  (if (LITATOM TYPEXP)
    then (ADDTOSCRATCHLIST TYPEXP)
    elseif (LISTP TYPEXP)
    then [SELECTQ (CAR TYPEXP)
                ((ALLOF ONEOF SHARED SUBTYPE TUPLE)
  (* bas%: "16-AUG-79 11:55")
```

```

      (for X in (CDR TYPEXP) do (TYPEMSANAL1 X))
      (MEMQ NIL)
      (PROGN
        (TYPEMSANAL1 (CAR TYPEXP))
        (if (EQ (CADR TYPEXP)
                'OF)
            then [TYPEMSANAL1 (CAR (LISTP (CDDR TYPEXP)
                else (SELECTQ (CAR (LISTP (CADR TYPEXP)))
                    (SATISFIES NIL)
                    (WHOSE (for I in (CDADR TYPEXP) do (TYPEMSANAL1 (CADR I))))
                    (SHOULDNT])
            else (SHOULDNT])

```

(* Infix operator so CAR is a type)
(* CDR TYPEXP must also be a listp)

(UNCOMPLETE

[LAMBDA (TB)

(* bas%: " 7-NOV-79 16:08")
(* Reinitializes the TYPEBLOCK for NAME, recursing if necessary)

```

      (replace BINDFN of TB with (CREATEFNPROP (fetch PROPS of TB)
        'BINDFN))
      (replace SETFN of TB with (CREATEFNPROP (fetch PROPS of TB)
        'SETFN))
      (replace TESTFN of TB with (CREATEFNPROP (fetch PROPS of TB)
        'TESTFN))
      (if (fetch CTYPE of (fetch DEF of TB))
          then (replace CTYPE of (fetch DEF of TB) with NIL)
          (MAPTYPEUSERS (fetch NAME of TB)
            (FUNCTION UNCOMPLETE]))

```

(UNSAVETYPE

[LAMBDA (TYPE)

(* rmk%: " 7-SEP-81 03:44")

```

      (DECLARE (SPECVARS TYPE))
      [MAPHASH CLISPARRAY (FUNCTION (LAMBDA (TRAN ORIG)
        (if (FORMUSETB ORIG TRAN TYPE)
            then (PUTHASH ORIG NIL CLISPARRAY)
            (* Clear translations that depend on this type)
            (AND MSDATABASELST (MSNEEDUNSAVE (GETRELATION (fetch NAME of TYPE)
              ' (USE TYPE)
              T)
              "type declarations" T])

```

(USERDECLTYPE

[LAMBDA (NAME DECL PROPS)

(* rmk%: " 2-AUG-81 08:42")
(* User entry to MAKEDECLTYPE)

```

      (if (LITATOM NAME)
          then (WITH ((TB (GETHASH NAME DECLTYPESARRAY)))
            (if [OR (EQ DECL NAME)
                (AND TB (EQUAL DECL (fetch TYPEXP of TB)
                  then (AND (REPROPTB (GETDECLTYPE NAME)
                    PROPS)
                    (MARKASCHANGED NAME 'DECLTYPES)) (* Adding properties to existing type)
                else (SELECTQ NAME
                    ((ANY NONE)
                    (DECLERROR "(Futile) attempt to redefine" NAME))
                    NIL)
                [MARKASCHANGED NAME 'DECLTYPES (COND
                    (TB 'CHANGED)
                    (T 'DEFINED)
                (if TB
                    then (DELETETB TB))
                    (* Forget it if it exists then remake it)
                    (MAKEDECLTYPE NAME (OR (LISTP DECL)
                    (LIST 'SYNONYM DECL)
                    PROPS)))
            else (DECLERROR "Non-atomic DECLTYPE name" NAME])

```

(USESTYPE

[LAMBDA (NAME TE)

(* rmk%: "18-Feb-85 18:14")
(* Computes whether NAME appears in TE)

```

      (OR (EQ NAME TE)
          (SELECTQ (TETYPE TE)
            ((ALLOF ONEOF SHARED SUBTYPE SYNONYM)
            (for I in (CDR TE) thereis (USESTYPE NAME I)))
            (MEMQ (for I in (CDR TE) thereis (EQ I (DTYPENAME I))))
            (OF [OR (USESTYPE NAME (CAR TE))
                (AND [LISTP (CDR (LISTP (CDR TE)
                (USESTYPE NAME (CADDR TE))
                (PRIMITIVE NIL)
                (SATISFIES (USESTYPE (CAR TE)))
                (TUPLE [OR (EQ NAME (if (CDR TE)
                    then 'LISTP
                    else NIL))
                (USESTYPE NAME (CONS 'ALLOF (CDR TE))

```

(WHOSE [OR (USESTYPE NAME (CAR TE))
(for I in (CADR TE) when (LISTP (CDR (LISTP I))) thereis (USESTYPE NAME (CADR I])
(SHOULDNT])

)

(DECLARE%: DONTEVAL@LOAD DOEVAL@COMPILE DONTCOPY

(BLOCK%: LCCTYPE LCCTYPE LCC2)

(BLOCK%: TYPEMSANAL TYPEMSANAL TYPEMSANAL1)

)

(* * Test fn creation block)

(DEFINEQ

(MAKETESTFN

[LAMBDA (TB)

(* rmk%: "29-NOV-81 22:41")

(* Computes the test fn for a type block. Called from TESTFN fetch function.
This is not a part of the MAKETESTFNBLOCK, so that the name MAKETESTFN is a reliable indicator for checking
recursion (DECLRECURSING))

(MAKETESTFNBLOCK TB)]

(MAKETESTFNBLOCK

[LAMBDA (TB)

(* rmk%: " 6-FEB-82 14:25")

(* Computes the test fn for a type block)

(WITH [(TE (fetch TYPEXP of TB))
(BINDINGNAME (OR (AND (LITATOM (fetch PROPS of TB))
(fetch PROPS of TB))
'VALUE]

(DECLARE (SPECVARS BINDINGNAME))

(COND

[(DECLRECURSING 'MAKETESTFNBLOCK TB) (* Name will be returned)

(replace TESTFN of TB with (PACK* (fetch NAME of TB)

'TestFn]

(T (WITH [(DEF (SELECTQ (TETYPE TE)

(ALLOF (COMBINE.TESTS (SMASHCAR (COLLECTTYPES (CDR TE)

'DOWN)

(FUNCTION TESTFORM))

'AND))

(MEMQ [LAMBIND (COND

[(COVERSTB (GETDECLTYPE ' (ONEOF LITATOM SMALLP))
TB)

(COND

((CDDR TE)

(LIST 'SELECTQ BINDINGNAME (LIST (CDR TE)

T)

NIL))

(T (LIST 'EQ BINDINGNAME (KWOTE (CADR TE)

(T (COND

[(CDDR TE)

(LIST 'MEMBER BINDINGNAME (KWOTE (CDR TE)

(T (LIST 'EQUAL BINDINGNAME (KWOTE (CADR TE))

(OF [OF.TESTFN (GETDECLTYPE (CAR TE))

(GETDECLTYPE (COND

((CDDR TE)

(CDDR TE))

(T (CADDR TE])

(ONEOF (COMBINE.TESTS (SMASHCAR (COLLECTTYPES (CDR TE)

'UP)

(FUNCTION TESTFORM))

'OR))

(SATISFIES (COMBINE.TESTS [LIST (TESTFORM (GETDECLTYPE (CAR TE)))

(COND

((CDDR (CADR TE))

(* There might be multiple forms or disconnected CLISP)

(CONS 'AND (CDADR TE)))

(T (CADR (CADR TE]

'AND))

((SHARED SUBTYPE SYNONYM

(fetch TESTFN of (GETDECLTYPE (CADR TE))))

(TUPLE (TUPLE.TESTFN (CDR TE)))

(WHOSE (WHOSE.TESTFN TB (CAR TE)

(CDADR TE)))

(SHOULDNT]

(WITH ((TF (fetch TF of TB)))

(replace TESTFN of TB with (COND

[TF

(* Must be recursive with TF being the atom name. TestFn and DEF being a lambda expression.
Convert to a LABEL expression, then translate it using DOLABEL from LABEL package.)

(DOLABEL (CONS 'LABEL (CONS TF (CDR DEF]
(T DEF]))

(COMBINE.TESTS

[LAMBDA (TESTS ANDOR)

(* bas%: "28-AUG-79 13:29")

(* Composes TESTS under either AND or OR composition)

(FUNIFY [for TST in TESTS join (COND

((EQ (CAR (LISTP TST))
ANDOR)

(APPEND (CDR TST)))

((EQ TST (EQ ANDOR 'AND))
NIL)

(* AND T or OR NIL)

((EQ TST (EQ ANDOR 'OR))

(* AND NIL or OR T)

(RETURN (LIST TST)))

(T (LIST TST]

ANDOR])

(FUNIFY

[LAMBDA (TEST ANDOR)

(* bas%: "11-OCT-79 18:05")

(* Provides LAMBDA abstraction for COMBINE.TESTS)

(LAMBIND (COND

((NLISTP TEST)

(* No tests)

(EQ ANDOR 'AND))

((CDR TEST)

(* More than one clause)

(CONS ANDOR TEST))

(T (CAR TEST])

(MKNTHCAR

[LAMBDA (L N)

(* bas%: " 8-MAR-79 17:55")

(* Constructs an expression for getting the Nth car of L)

(PROG [(F (MKNTHCDR L (SUB1 N)

(RETURN (SELECTQ (CAR F)

(CDR (CONS 'CADR (CDR F)))

(CDDR (CONS 'CADDR (CDR F)))

(CDDDR (CONS 'CADDR (CDR F)))

(LIST 'CAR F])

(MKNTHCDR

[LAMBDA (L N)

(* bas%: " 9-MAR-79 14:50")

(* Constructs an expression for getting the Nth cdr of L)

(if (ZEROP N)

then L

elseif (ILESSP N 5)

then (LIST (SELECTQ N

(1 'CDR)

(2 'CDDR)

(3 'CDDDR)

(4 'CDDDDR)

(SHOULDNT))

L)

elseif (ILESSP N 9)

then (MKNTHCDR (LIST 'CDDDDR L)

(IDIFFERENCE N 4))

else (LIST 'FNTH L (ADD1 N])

(OF.TESTFN

[LAMBDA (AGG ELT)

(* rmk%: "19-AUG-81 00:08")

(COMBINE.TESTS [LIST (TESTFORM AGG)

(LIST (OR (GETTBPROP AGG 'EVERYFN)

(DECLERROR "OF construction used with non-aggregate type"))

BINDINGNAME

(LIST 'FUNCTION (fetch TESTFN of ELT]

'AND])

(TUPLE.TESTFN

[LAMBDA (TYPES)

(* rmk%: "19-AUG-81 00:16")

(* Constructs the test function for TUPLES)

(COND

(TYPES (COMBINE.TESTS [CONS (LIST 'EQLLENGTH BINDINGNAME (LENGTH TYPES))

(for I in TYPES as J from 1 collect (APPLYFORM (fetch TESTFN of (GETDECLTYPE

I))

(MKNTHCAR BINDINGNAME J]

'AND))

(T 'NULL])

(WHOSE.TESTFN

[LAMBDA (TB SNAM TAIL)

(* bas%: " 6-NOV-79 16:56")

(* Constructs TESTFN for WHOSE expressions)

(COMBINE.TESTS [CONS (TESTFORM (GETDECLTYPE SNAM))

(for I in TAIL collect (APPLYFORM [fetch TESTFN of (GETDECLTYPE (COND

((EQLLENGTH I 2)
(CADR I))
(T (CDR I))

(COND
 [(EQ SNAM 'LISTP)
 (WITH ((V (CAR I)))
 (SELECTQ V
 ((CAR CDR CADR CDDR CAAR CDAR)
 (LIST V BINDINGNAME))
 (COND
 ((AND (FIXP V)
 (NOT (MINUSP V)))
 (MKNTHCAR BINDINGNAME V)
 (FMEMB (CAR I)
 (RECORDFIELDNAMES SNAM))
 (LIST 'FETCH (LIST SNAM (CAR I))
 'OF BINDINGNAME))
 (T (DECLERROR (CAR I)
 " is not a valid fieldname"])]

'AND])

)

(DECLARE%: DONTEVAL@LOAD DOEVAL@COMPILE DONTCOPY

(BLOCK%: MAKETESTFNBLOCK MAKETESTFNBLOCK COMBINE.TESTS FUNIFY MKNTHCAR MKNTHCDR OF.TESTFN TUPLE.TESTFN
 WHOSE.TESTFN)

)

(* * Machinery to compile recursive testfns)

(FILESLOAD (SYSLOAD FROM VALUEOF LISPUSERSDIRECTORIES)
 LABEL)

(* * Idioms. Expressed as macros for now)

(DECLARE%: DONTCOPY EVAL@COMPILE

(RPAQQ **DefaultBindFn** PROGN)

(RPAQQ **DefaultSetFn** REALSETQ)

(ADDTOVAR **NLAMA** MAKEDECLTYPEQ)

(DECLARE%: EVAL@COMPILE

(PUTPROPS **ANYC MACRO** ((C)
 (EQ C 'ANY)))

(PUTPROPS **DECLVARERROR MACRO** [ARGS (LSUBST ARGS 'ARGS '(DECLDWIMERROR ARGS T " inside " VARD)])

(PUTPROPS **DTYPENAME MACRO** [(X)
 (COND
 ((LARGE P X)
 'LARGE P)
 (T (TYPENAME X))

(PUTPROPS **foreachTB MACRO** [ARGS (LIST 'MAPHASH 'DECLTYPESARRAY (LIST 'FUNCTION
 (CONS 'LAMBDA (CONS (LIST (CAR ARGS))
 (CDR ARGS))

(PUTPROPS **GETCGETD MACRO** ((X)
 (GETCTYPE (GETDECLTYPE X))))

(PUTPROPS **KWOTEBBOX MACRO** [(V)
 ([LAMBDA (\$\$8)
 (DECLARE (LOCALVARS \$\$8))
 (FRPLACA (CDR \$\$8)
 V)
 \$\$8]
 'Q])

(PUTPROPS **LAMBIND MACRO** (ARGS (APPEND '(LIST 'LAMBDA (LIST BINDINGNAME))
 ARGS)))

(PUTPROPS **LAMVAL MACRO** (ARGS (APPEND '(LIST 'LAMBDA '(VALUE))
 ARGS)))

(PUTPROPS **MAKEDECLTYPEQ MACRO** ((NAME DEF PROPS)
 (MAKEDECLTYPE 'NAME 'DEF 'PROPS)))

(PUTPROPS **NONEC MACRO** ((C)
 (EQ C 'NONE)))

(PUTPROPS **TESTFORM MACRO** ((TB)

(APPLYFORM (fetch TESTFN of TB)
BINDINGNAME))

(DEFINEQ

(TESTFORM

[LAMBDA (TB)

(* rmk%: "24-NOV-81 22:17")

(* Doesn't get compiled, cause it is macroed out. Symbolic definition exists because it get's APPLY*, not EVALed)

(APPLYFORM (fetch TESTFN of TB)
BINDINGNAME])

(ADDTOVAR DONTCOMPILEFNS TESTFORM)

(SETTEMPLATE 'foreachTB '(CALL BIND |..| EFFECT))

(SETTEMPLATE 'MAKEDECLTYPEQ '(CALL NIL NIL NIL . PPE))

(* * Runtime utility functions)

(DEFINEQ

(EVERYCHAR

[LAMBDA (STRNG FN)

(* bas%: "6-MAR-79 17:58")

(* The EVERY function for strings)

(for I to (NCHARS STRNG) always (APPLY* FN (NTHCHAR STRNG I]))

(LARGE

[LAMBDA (X)

(* rmk%: "24-MAY-79 09:10")

(* For LARGE type-tests)

(AND (FIXP X)
(NOT (SMALLP X]))

(DECLRECURSING

[LAMBDA (NAME ARG)

(* jtm%: "19-Feb-87 11:31")

(* NAME is the name of a potentially looping function in our call chain.
ARG is the first arg in that lowest call to NAME. Determines whether the function NAME exists higher on the stack with ARG
as its first argument. Used to check for recursive loops.)

(bind (S _ (STKPOS NAME -1)) while (STKPOS NAME -2 S S) when (EQ ARG (STKARG 1 S)) do

(* At each step we back off one from the last frame we checked b/c it would otherwise be found by STKPOS, and search for
the next one. S is reused by both stack fns and released if the loop terminates with it pointing to anything.)

(RELSTK S)
(RETURN T])

(SMASHCAR

[LAMBDA (L FN)

(* bas%: "31-OCT-79 17:11")

(* Maps over L smashing the result of applying FN to each car into that car)

[MAP L (FUNCTION (LAMBDA (X)
(FRPLACA X (APPLY* FN (CAR X)
L]))

(DECLARE%: EVAL@COMPILE

(DECLARE%: EVAL@COMPILE

(PUTPROPS LARGE MACRO [(X)
(AND (FIXP X)
(NOT (SMALLP X]))

(DECLARE%: DONTCOPY EVAL@COMPILE

(DECLARE%: EVAL@COMPILE

(PUTPROPS SMASHCAR MACRO [ARGS (SUBST [SELECTQ (CAADR ARGS)
((FUNCTION QUOTE)
(APPLYFORM (CADADR ARGS)
'(CAR I)))
(LIST 'APPLY* (CADR ARGS)

```

      ' (CAR I]
      'NEWVAL
      (LIST ' [LAMBDA (L)
      (DECLARE (LOCALVARS L))
      [MAP L (FUNCTION (LAMBDA (I)
      (DECLARE (LOCALVARS I))
      (FRPLACA I NEWVAL)
      L]
      (CAR ARGS])
)
)

```

(* * translator of dprogs and dlambdas)

(DEFINEQ

(ASSERT

[NLAMBDA ARGS

(* rmk%: "11-NOV-83 08:00")

(* ARGS is a mixed list of variable names and forms. Forms must be true, and the test function for variables must be true too.)

```

(DECLARE (LOCALVARS . T))
(for v in ARGS do (if (LITATOM V)
  then (VARASRT V)
  elseif (LISTP V)
  then (OR (EVAL V 'INTERNAL)
  (ASSERTFAULT V NIL))
  else (ERRORX (LIST 27 V))

```

(ASSERTFAULT

[LAMBDA (DECL VARNAME)

; Edited 23-Feb-87 08:35 by jtm:
(* Prints out the assertion error messages.)

```

(LET [(FN (STKNAME (REALSTKNTH -1 'ASSERTFAULT)
[COND
  ((LISTP FN)
  (SETQ FN (STKNAME (REALSTKNTH -4 'ASSERTFAULT)
(LISPXPRI1 (if VARNAME
  then "DECLARATION"
  else "ASSERTION")
  T)
(LISPXPRI1 " NOT SATISFIED IN " T)
(LISPXPRI2 FN T)
(LISPXPRI1 (CONCAT ": " (if VARNAME
  then (LIST VARNAME DECL)
  else DECL))
  T)
(APPLY* (FUNCTION BREAK1)
  NIL T FN))

```

(ASSERTMAC

[LAMBDA (ARGS)

(* rmk%: " 2-AUG-79 23:21")
(* Compiler for ASSERT forms.)

```

(if (IGNOREDECL)
  then (CBOX COMMENTFLG (LBOX (CBOX 'ASSERT ARGS)))
  else (for v in ARGS collect (if (LISTP V)
  then (LIST 'OR V (LIST 'ASSERTFAULT (KWOTE V)))
  elseif (LITATOM V)
  then (MAKETESTFORM V (TYPEBLOCKOF V))
  else (ERRORX (LIST 27 V)))
  finally (RETURN (if (CDR $$VAL)
  then (CONS 'PROGN $$VAL)
  else (CAR $$VAL))

```

(*DECL

[NLAMBDA ARGS

(* DECLARATIONS%: (RECORD ARGRECORD
(SL . FORMS))
(* rmk%: "11-NOV-83 07:59")

(* This maintains the proper bindings of SATISFIESLIST. It is wrapped around function bodies by dprog's and dlambdas. Compiles open, depending on COMPILEIGNOREDECL.)

```

(PROG [(SATISFIESLIST (if [OR (NULL (fetch SL of ARGS))
  (LISTP (CAAR (fetch SL of ARGS))
  then

```

(* If NIL, then this is the top binding for a declarative without any bindings. If LISTP, then this is the first binding in this lexical scope.)

```

  (fetch SL of ARGS)
  else (CONS (fetch SL of ARGS)
  SATISFIESLIST)
(DECLARE (SPECVARS SATISFIESLIST))

```

(* Use \DECLPROGN instead of PROGN so BAKTRACELST can recognize us)

```
(RETURN (APPLY (FUNCTION \DECLPROGN)
              (fetch FORMS of ARGS)
              'INTERNAL]))
```

(*DECLMAC

```
[LAMBDA (ARGS)
```

(* DECLARATIONS%: (RECORD ARGRECORD (SL . FORMS)))
(* rmk%: "15-Sep-87 10:16")

```
(DECLARE (USEDFREE CSATISFIESLIST FREEVARS))
(PROG [FIRSTSL (FV FREEVARS)
      (SL (fetch SL of ARGS))
      (FORM (if (CDR (fetch FORMS of ARGS))
                then (CONS 'PROGN (fetch FORMS of ARGS))
                else (CAR (fetch FORMS of ARGS))
              )
      [SETQ FIRSTSL (OR (NULL SL)
                      (LISTP (CAAR SL))
                      (* The first declaration in this function)
```

(* Should maintain list of free variables for the benefit of clisp words arising in macros, but FREEVARS in compiling context has different meaning from FREEVARS in dwimify context. Interlisp-D byte compiler gets confused.)

```
(for v in (if FIRSTSL
             then (CAR SL)
             else SL)
  when (EQ (fetch PROGFLAG of (fetch VARDECL of V))
          'FREE)
  do (push FV (fetch VARNAME of V)))
[SETQ SL (LIST 'CSATISFIESLIST (KWOTE (if FIRSTSL
                                         then SL
                                         else (CONS SL CSATISFIESLIST))
```

(* Assumes that *DECLMAC is executed in the same compiletime context as CBIND. If this is the first declaration, we bind COMPILEIGNOREDECL for the benefit of compiler-generated sub-functions)

```
(RETURN (LIST '.CBIND. [CONS SL (NCONC (PROG1 NIL
                                         (if FIRSTSL
                                             then (LIST (LIST 'COMPILEIGNOREDECL (IGNOREDECL)
                                                             FORM]))
                                         (* (if (NEQ FV FREEVARS) then (LIST (LIST (QUOTE FREEVARS) (KWOTE FV))))
                                         )
```

(\CHKINIT

```
[NLAMBDA ARGS
```

(* bas%: " 9-OCT-79 23:15")

(* ARGS is a list of variable names whose nearest assertions are to be checked. Calls to \CHKINIT are generated by DLAMTRAN just for variables that have initial values and test-forms in the nearest SATISFIESLIST entry.)

```
(DECLARE (LOCALVARS . T))
(for v d in ARGS unless (APPLY* (fetch TESTFN of (GETDECLTYPE [SETQ D (fetch DECL
                                                                of (fetch VARDECL
                                                                of (ASSOC V (CAR SATISFIESLIST)
                                                                (EVALV V))
                                                                V))
                                do (ASSERTFAULT D V])
```

(CHKINITMAC

```
[LAMBDA (ARGS)
```

(* rmk%: " 9-NOV-83 09:20")
(* Compiler for \CHKINIT forms.)

```
(DECLARE (USEDFREE COMMENTFLG CSATISFIESLIST))
(if (IGNOREDECL)
  then (CBOX COMMENTFLG (CBOX '\CHKINIT ARGS))
  else (for v d TEMP in ARGS collect (LIST 'OR (APPLYFORM (fetch TESTFN
                                                         of (GETDECLTYPE
                                                         [SETQ D (fetch DECL
                                                         of (fetch VARDECL
                                                         of (ASSOC V (CAR CSATISFIESLIST)
                                                         V))
                                                         (LIST 'ASSERTFAULT (if (LISTP D)
                                                             then (CONS 'DECLMSGMAC D)
                                                             else (KWOTE D))
                                                         (KWOTE V))))
                                         finally (RETURN (if (CDR $$VAL)
                                                             then (CONS 'PROGN $$VAL)
                                                             else (CAR $$VAL]))
```

(DECLCONSTANTP

```
[LAMBDA (X)
```

(* bas%: " 9-OCT-79 21:32")

```
(OR (NULL X)
     (EQ X T)
     (NUMBERP X))
```

```
(STRINGP X)
(AND (LISTP X)
      (SELECTQ (CAR X)
                ('CONSTANT
                 T)
                (WITH ((TEMP (if (GETP (CAR X)
                                     'MACRO)
                                then (EXPANDMACRO X T)
                                else X)))
```

(* If we did a DECLOF and got a MEMQ, we'd have a constant. Thus, this code wouldn't have to duplicate what goes on in DECLOF, and we would get the funny PROG and SELECTQ cases for free.)

```
(if (AND (NEQ TEMP X)
         (NEQ TEMP 'IGNOREMACRO))
    then (DECLCONSTANTP TEMP)
    elseif (SELECTQ (CAR X)
                  ((SELECTQ CLOSER GO PROG COND)
```

(* CLOSER has side-effects. The others have CTYPE properties but their arguments can't be simply checked)

```
        NIL)
        (GETP (CAR X)
              'CTYPE))
    then
```

(* The test we really want is that the function doesn't reference freevariables or cause side-effects.)

```
(EVERY (CDR X)
       (FUNCTION DECLCONSTANTP])
```

DD

```
[NLAMBDA X
```

(* DECLARATIONS%: (RECORD ARGRECORD (NAME . DEF) (RECORD DEF (ARGS . BODY)))) (* rmk%: "24-JUL-78 08:13")

(* For Defining DLambda functions. NAME is the function name and DEF the rest of its definition.)

```
(DEFINE [LIST (LIST (fetch NAME of X)
                   (CONS 'DLAMBDA (fetch DEF of X)
                        T])
```

DECLCLISPTRAN

```
[LAMBDA (X TRAN)
  [PROG [DECL DFORM DPROGFLAG RETURNS (DECLARETAGS ' (LOCALVARS SPECVARS ADDTOVAR DEFLIST PUTPROPS CONSTANTS SETQQ USEDFFREE TYPE]
```

(* rmk%: "2-Nov-84 15:30")

```
(if [AND (LISTP TRAN)
         (EQ 'FORWARD (CAR (GETPROP (CAR (LISTP X))
                                     'CLISPWORD))
         (if (EQ 'PROG (CAR TRAN))
             then (SETQ DPROGFLAG T)
                 (SETQ DFORM TRAN)
             elseif (AND [EQ 'FUNCTION (CAR (SETQ DFORM (CAR (LISTP (CDR (LISTP (CDR TRAN))
                                                                    (EQ 'LAMBDA (CAR (SETQ DFORM (CAR (LISTP (CDR DFORM)
                                                                    (OR (NULL NEWSATLIST)
                                                                    (for D in (CDR (ASSOC 'DECLARE DFORM)) thereis (AND (LISTP D)
                                                                    (NOT (FMEMB (CAR D)
                                                                    DECLARETAGS]
```

```
then
  (FRPLACA DFORM (if DPROGFLAG
                    then 'DPROG
                    else 'DLAMBDA))
  [for F (PROGVARS _ (AND DPROGFLAG (CADR DFORM))) in (CDDR DFORM) when (EQ (CAR F) 'DECLARE)
    do (for D V DCLARE in (CDR F)
        do (if (OR (NLISTP D)
                  (FMEMB (CAR D)
                        DECLARETAGS))
              then (push DCLARE D)
              elseif DPROGFLAG
              then
```

(* Distribute declarations of local variables in the DPROG bindings. This means that initial values will be taken into account)

```
(for L on PROGVARS
  do (if (EQ (CAR D)
            (CAR L))
        then [FRPLACA L (CONS (CAR L)
                              (CONS NIL (CDR D)
                              (RETURN)
          elseif (AND (LISTP (CAR L))
                    (EQ (CAR D)
                        (CAAR L)))
```

```

                                then [if (NLISTP (CDAR L))
                                        then (FRPLACD (CAR L)
                                                (LIST (CDAR L)
              (* In case it's a list with no CADR)
              (NCONC (CAR L)
              (CDR D))
              (RETURN))
              finally (push DECL D))
                                elseif (EQ (CAR D)
              'RETURNS)
                                then (push RETURNS D)
                                else (push DECL D))
                                finally (FRPLACD F (DREVERSE DCLARE]
[if DECL
  then (push (CDDR DFORM)
            (CONS 'DECL (DREVERSE DECL]
(RESETVARS (CLISPRETRANFLG)
            (* Resetting this flag avoids redundancies in a IDW)
            (if RETURNS
              then (SETQ TRAN (LIST 'DPROGN (DREVERSE RETURNS)
              TRAN))
              (DWIMIFY0? TRAN TRAN NIL NIL NIL FAULTFN)
              (* Only happens for a MAPC/AR etc that has a RETURNS)
              (SETQ TRAN (PROG1 (CAR (CDDDDR (GETHASH TRAN CLISPARRAY)))
              (PUTHASH TRAN NIL CLISPARRAY)))
              (* Skip down to the CHECKVALUE)

              else (DWIMIFY0? DFORM DFORM NIL NIL NIL FAULTFN))
            (if (PROG1 (SETQ DECL (GETHASH DFORM CLISPARRAY))
              (PUTHASH DFORM NIL CLISPARRAY))
              then
              (* Don't clobber DFORM with an empty translation, which
              probably comes from a lower-level error)

              (FRPLNODE2 DFORM DECL)
              else (SETQ TRAN NIL]
(REALCLISPTRAN X TRAN])

```

(DECLMSG

```

[NLAMBDA DECLMSG
(* rmk%: "16-AUG-81 23:17")

```

(* Purely for saving storage. For list declarations, the DECL argument of ASSERTFAULT and VALUEERROR is compiled as a call to DECLMSGMAC which has a macro that calls DECLMSG as a compiletime or loadtime constant. We attempt to find an already existing copy of that list-structure, and if we do, we return a pointer to that instead)

```

(DECLARE (SPECVARS DECLMSG)
(GLOBALVARS DECLTYPESARRAY DECLMESSAGES) )
(if (GETHASH DECLMSG DECLTYPESARRAY)
  then

```

(* This never works when we're loading from a file, but always works when we are storing the compiled code directly into core.)

```

DECLMSG
else [foreachTB TB (if (EQUAL DECLMSG (fetch NAME of TB))
  then (RETFROM 'DECLMSG (fetch NAME of TB]

```

(* Fall through if didn't locate it. Look it up on our special message database list.)

```

(CAR (OR (MEMBER DECLMSG DECLMESSAGES)
(push DECLMESSAGES DECLMSG])

```

(DECLDWIMERROR

```

[LAMBDA ARGS
(* bas%: "10-OCT-79 18:24")

```

```

(DECLARE (USEDFREE FAULTFN)
(LISPXTERPRI T)
(LISPXPRI "in " T)
(LISPXPRI FAULTFN T)
(LISPXPRI " } " T)
(for I to ARGS do (if (EQ T (ARG ARGS I))
  then (LISPXTERPRI T)
  else (LISPXPRI (ARG ARGS I)
  T)))
(LISPXTERPRI T)
(ERROR!])

```

(DECLDWIMTESTFN

```

[LAMBDA (TB)
(* rmk%: " 6-FEB-82 14:26")
(* Returns the dwimified TESTFN of TB)

```

```

(DECLARE (USEDFREE FAULTFN)
(PROG ((FN (fetch TESTFN of TB)))
(if [AND (LISTP FN)
  (OR CLISPRETRANFLG (NOT (GETHASH FN CLISPARRAY))
  then (DWIMIFY0? FN FN NIL NIL NIL FAULTFN)

```

(* We hash the FN to itself to avoid repetitive dwimification unless CLISPRETRANFLG is on. But we're careful to avoid circularity if FN begins with a CLISPWORD.)

```

      (OR (GETHASH FN CLISPARRAY)
          (PUTHASH FN FN CLISPARRAY)))
  (RETURN FN])

```

(DECLSET

```

[LAMBDA (VAR VAL) (* rmk%: "11-NOV-83 08:00")

```

(* Version of SET that does ASSERT checks. This is moved to SET when DECLTRAN is loaded.
 The old definition of SET is available through the name REALSET.
 Uses VARSETFN to find the run-time type-dependent SETFN, which will be that for the lowest declaration on the
 satisfieslist for a DPROGN)

```

(DECLARE (LOCALVARS . T))
(PROG1 (APPLY (VARSETFN VAR)
             (LBOX VAR (KWOTEBOX VAL))))
  (\VARASRT VAR])

```

(DECLSETQ

```

[NLAMBDA U (* rmk%: "11-NOV-83 08:00")

```

(* Version of SETQ that does ASSERT checks. The old definition of SETQ is available through the name REALSETQ.
 The contortions are so DWIM gets to see the value forms in the environment of the running function.)

```

(DECLARE (LOCALVARS . T))
(WITH [(V (APPLY (FUNCTION PROG1)
                (CDR U)
                'INTERNAL]
      (PROG1 (APPLY (VARSETFN (CAR U))
                  (LBOX (CAR U)
                        (KWOTEBOX V))
                  'INTERNAL)
            (\VARASRT (CAR U))))])
(* Bind the value so no recursion thru the LBOX)

```

(DECLSETQQ

```

[NLAMBDA (XSET YSET) (* bas%: " 1-NOV-79 17:54")
  (APPLY* (FUNCTION DECLSETQ)
          XSET
          (KWOTEBOX YSET))

```

(DECLTRAN

```

[LAMBDA (FORM) (* DECLARATIONS%: FAST (RECORD FORM

```

(ATOM DCLS . FORMS)))
 (* rmk%: " 2-Nov-84 15:24")
 (* Translator for declarative statements)
 (* Used for DPROGN variable names)

```

(DECLARE (USEDFFREE VARS CLISPCHANGE))
(SETQ CLISPCHANGE T)
(PROG (TEMP CLISP%: DECLARE TOP BS PROGDCLS SPECVARS SAT INITVARS VARBINDFORMS RETURNS LOCALVARS
      (ATOM (fetch ATOM of FORM))
      (FORMS (fetch FORMS of FORM))
      (VARS VARS))
  (DECLARE (SPECVARS VARS DECLARE PROGDCLS SPECVARS SAT INITVARS RETURNS LOCALVARS VARBINDFORMS))
  (if (LISTP (SETQ TEMP (fetch DCLS of FORM)))
      then [for V in old TEMP do (if (AND (EQ ATOM 'DPROG)
                                           (EQ V 'THEN))
                                     then [SETQ FORMS (LIST (LIST 'RETURN (CONS 'DPROG (CONS (CDR TEMP)
                                                                                               FORMS))
                                                             (RETURN))
                                                           (DECLVAR V (EQ ATOM 'DPROG)
                                                             (NEQ ATOM 'DPROGN]
                                     else (if (AND TEMP (LITATOM TEMP)
                                                  (EQ ATOM 'DLAMBDA))
                                             then (DECLVAR (LIST TEMP 'CARDINAL)
                                                           NIL T)
                                             (SETQ INITVARS NIL))
                                             (SETQ PROGDCLS TEMP))
      (if [AND (EQ ATOM 'DLAMBDA)
              (OR (EQ [CAR (SETQ TEMP (LISTP (CAR FORMS))
                    'CLISP%:]
                  (AND (EQ (CAR TEMP)
                          COMMENTFLG)
                      (EQ (CADR TEMP)
                          'DECLARATIONS%:])]
          then (SETQ CLISP%: TEMP)
              (SETQ FORMS (CDR FORMS)))
      (if (NEQ ATOM 'DPROGN)
          then (for F DECL in old FORMS do (if (NLISTP F)
                                               then (GO $$OUT)
                                               elseif (EQ (CAR F)
                                                           COMMENTFLG)
                                               elseif (EQ (CAR F)
                                                           'DECLARE)

```

(* Handles no-spread case; not necessary to do \CHKINIT)


```

      (SETQ NAME VALUE))
      NIL)
    (SETQ TAIL (CDR VARD))
    (if DPROGFLAG
      then (RESETVARS ((NOSPPELLFLG T)
                      (DWIMESSGAG T))
             (DWIMIFY0? TAIL VARD TAIL NIL NIL FAULTFN))

```

(* This will glue all the components of the initial value together.
 It will also walk through the declarations, but no spelling corrections will be done.
 Corrections in the SATISFIES will happen when the whole translation is dwimified in DECLTRAN.)

```

      (SETQ INITV (pop TAIL)))
    else (SETQ NAME VARD))
  (if (NOT (AND NAME (LITATOM NAME)))
    then (DECLVARERROR "Illegal variable name"))
  (for V in TAIL do
    (RETRY
     (if (if BINDFLAG
            then [SELECTQ V
                  (SPECIAL (if (FMEMB NAME LOCALVARS)
                              then (DECLVARERROR "Variable can't be both LOCAL and
                                                SPECIAL: " NAME)
                              else (push SPECVARS NAME)))
                  (LOCAL (if (FMEMB NAME SPECVARS)
                              then (DECLVARERROR "Variable can't be both LOCAL and
                                                SPECIAL: " NAME)
                              else (push LOCALVARS NAME)))
                  (if (EQ (CAR (LISTP V))
                        'USEDIN)
                    then (if (FMEMB NAME LOCALVARS)
                              then (DECLVARERROR "Variable can't be both LOCAL and
                                                USEDIN: " NAME)
                              else (push SPECVARS NAME)
                    elseif (EQ V 'GLOBAL)
                      then (pushnew GLOBALVARS NAME)
                    elseif (OR (EQ V 'FREE)
                               (EQ (CAR (LISTP V))
                                   'BOUNDIN))
                      then (SETQ PROGFLAG 'FREE))
                    elseif (EQ (CAR (LISTP V))
                              'SATISFIES)
                      then (if SATFORM
                            then (DECLVARERROR "Multiple SATISFIES"))
                            (SETQ SATFORM V)
                    elseif (EQ (CAR (LISTP V))
                              COMMENTFLG)
                      then (SETQ TEMP (GETDECLTYPE.NOERROR V NAME))
                            then (if TYPEBLOCK
                                  then (DECLVARERROR "more than one type declaration: " V))
                                  (SETQ TYPEBLOCK TEMP)
                                  (SETQ DECL V)
                    elseif (AND (LISTP V)
                                (FIXSPELL (CAR V)
                                           80
                                           '(SATISFIES BOUNDIN USEDIN)
                                           T V))
                      then (AND FAULTFN (NEQ FAULTFN 'TYPE-IN)
                            (MARKASCHANGED FAULTFN 'FNS))
                            (GO RETRY)
                    else (DECLVARERROR "invalid declaration: " V)))
    (if (NULL TYPEBLOCK)
      then (SETQ DECL ANY))
    (if SATFORM
      then (SETQ DECL (LIST DECL SATFORM))
            (if (NULL (SETQ TYPEBLOCK (GETDECLTYPE.NOERROR DECL NAME)))
              then (DECLVARERROR "invalid declaration: " DECL)))
    (if (EQ NAME 'VALUE)
      then (SETQ RETURNS DECL) (* This gets reprocessed by THETRAN)
      (RETURN))
    (if BINDFLAG
      then (for D in PROGDCLS when [OR (EQ NAME D)
                                       (EQ NAME (CAR (LISTP D))
                                       do (DECLVARERROR "more than one binding for " NAME)))
            (* TYPEBLOCK=NIL if default ANY with no SATISFIES)
    (if TYPEBLOCK
      then (if (SETQ TEMP (GETTBPROP TYPEBLOCK 'DECLARESPEC))
              then (push DECLARE (SUBST NAME 'VAR TEMP)))
            (if (EQ (SETQ TEMP (fetch BINDFN of TYPEBLOCK))
                  (CONSTANT DefaultBindFn))
              elseif DPROGFLAG
                then [SETQ INITV (CONS TEMP (if INITV
                                                then (LIST INITV)
                                                else (* Indicate that the initialization is not to be checked)
                                                (SETQ DPROGFLAG NIL)
                else (push VARBINDFORMS (LIST 'REALSETQ NAME (LIST TEMP NAME]
    (if (NEQ DECL 'ANY)

```



```

then
  stick one in.)
  (push SAT (create SLISTENTRY
                   VARNAME _ NAME
                   VARDECL _ (create VARDECL
                                     DECL _ DECL
                                     PROGFLAG _ PROGFLAG)))
  (* A missing VARDECL is interpreted as ANY, so don't bother to
  checked)

  (if (if INITV
        then DPROGFLAG
        elseif (NULL DPROGFLAG)
        then (push INITVARS NAME))
    elseif BINDFLAG
    then
      (* The empty VARDECL conceals type information for higher
      declarations)
      (push SAT (create SLISTENTRY
                    VARNAME _ NAME
                    VARDECL _ NIL)))
  (if BINDFLAG
    then (push PROGDCLS (if INITV
                          then (LIST NAME INITV)
                          else NAME)))
  (push VARS NAME])

```

(DLAMARGLIST

```

[LAMBDA (DEF)
  (if (LISTP (CADR DEF))
    then (for A in (CADR DEF) unless (EQ (CAR (LISTP A))
                                         'RETURNS)
      collect (if (LISTP A)
                  then (CAR A)
                  else A))
    else (CADR DEF])
  (* rmk%: " 6-APR-78 10:13")

```

(DTYPE?TRAN

```

[LAMBDA (FORM)
  (SETQ CLISPCHANGE T)
  (if LCASEFLG
    then (/RPLACA FORM 'type?))
  [PROG (TESTFORM (TYPEBLOCK (GETDECLTYPE.NOERROR (CADR FORM)))
        (FORMS (CDDR FORM)))
  (if (NULL TYPEBLOCK)
    then (DECLDWIMERROR "invalid type declaration: " (CADR FORM)))
  (DWIMIFY0? FORMS FORM NIL NIL NIL FAULTFN)
  (* The forms are dwimified first so that we can decide whether the testform should be set-up for a bound VALUE.)

  (SETQ FORMS (if (CDR FORMS)
                  then (CONS 'PROGN FORMS)
                  else (CAR FORMS)))
  (SETQ TESTFORM (APPLYFORM (DECLDWIMTESTFN TYPEBLOCK)
                            FORMS))
  (REALCLISPTRAN FORM (if (NEQ TESTFORM T)
                          then TESTFORM
                          elseif (LISTP FORMS)
                          then (LIST 'PROGN FORMS T)
                          else
                            (* Cause PPT prints a non-list translation funny)
                            ' (PROGN T]
  FORM])

```

(EDITNEWSATLIST

```

[LAMBDA NIL
  (* Called from DW edit macro. True if there is no higher declarative on the current edit chain.)

  (DECLARE (USEDFREE L))
  (NOTANY (CDR L)
    (FUNCTION (LAMBDA (X)
              (AND (LISTP X)
                   [OR (LITATOM (SETQ X (CAR X)))
                       (LITATOM (SETQ X (CAR X))
                                (OR (FMEMB X DECLATOMS)
                                    (EQ (CAR (GETPROP X 'CLISPPWORD))
                                        'FORWARD])

```

(FORMUSESTB

```

[LAMBDA (FORM TRANS TB)
  (* Decides if FORM or its TRANSLation made use of the definition of the typeblock TB
  (Currently, T for any decl expression regardless of typeblock))

  (OR [AND (LISTP FORM)

```

```
(FMEMB (CAR FORM)
      ' (type? TYPE? the THE DLAMBDA DPROG DPROGN)
(AND (LISTP TRAN)
      (OR (EQ (CAR TRAN)
              '\*DECL)
          (AND (EQ [CAR (LISTP (GETP (CAR (LISTP FORM))
                                     'CLISPPWORD]
                               'FORWARD)
                (EQ [CAR (LISTP (SETQ TRAN (CAR (LAST TRAN]
                                     'RETURN)
                (EQ [CAR (LISTP (CAR (LISTP (CDR TRAN]
                                     '\*DECL))
```

(IGNOREDECL

[LAMBDA NIL

(* rmk%: " 4-APR-79 00:04")

(* Should be called only in macros; T if the function currently being compiled should have debug information suppressed)

(* FN is bound by COMPILE1 during ordinary compile, XXX during block compile.
The LISTP check inhibits the EVALV, and is necessary when called from CHECKVALUEMAC inside masterscope.)

```
(DECLARE (USEDFREE COMPILEIGNOREDECL)
(OR (EQ COMPILEIGNOREDECL T)
    (AND (LISTP COMPILEIGNOREDECL)
         (MEMB (EVALV 'FN 'COMPILE1)
               COMPILEIGNOREDECL)
        T))
```

(MAKETESTFORM

[LAMBDA (VAR TYPE)

(* rmk%: "16-AUG-81 23:12")

(* Makes a form that tests VAR to be of type TYPE and reports errors if test fails)

```
(WITH ((TEST (APPLYFORM (fetch TESTFN of TYPE)
                        VAR)))
      (if (EQ TEST T)
          then (CBOX COMMENTFLG (LBOX (LBOX 'ASSERT VAR)))
          else (LIST 'OR TEST (LIST 'ASSERTFAULT (WITH ((TN (fetch NAME of TYPE)))
                                                       (if (LISTP TN)
                                                           then (CONS 'DECLMSGMAC TN)
                                                           else (KWOTE TN))))
              (KWOTE VAR]))
```

(PPDECL

[LAMBDA (FORM)

(* rmk%: "28-JUN-82 12:44" posted%: "17-MAY-77 22:06")
(* Special prettyprinter for DLAMBDA's and DPROG's.
Called from PRETTYPRINTMACROS)

```
(DECLARE (GLOBALVARS %RPARS CLISPARRAY PRETTYTRANFLG COMMENTFLG)
(COND
  ((OR (NLISTP (CDR FORM))
        (AND PRETTYTRANFLG (GETHASH FORM CLISPARRAY)))
   FORM)
  (T (SELECTQ (CAR FORM)
              (DLAMBDA [PROG [(FORMPOS (IPLUS 2 (POSITION)
                                         (PRIN1 (COND
                                                  (%RPARS " [")
                                                  (T " (")
                                                  (PRIN1 "DLAMBDA ")
                                                  (PPVARLIST (CADR FORM))
                                                  (COND
                                                    ((AND (LISTP (SETQ FORM (CDDR FORM)))
                                                           (NEQ (CAR FORM)
                                                                COMMENTFLG))
                                                     (printout NIL .TAB0 FORMPOS)))
                                                  (PRINTDEF FORM FORMPOS T T FNSLST)
                                                  (PRIN1 (COND
                                                          (%RPARS "]")
                                                          (T " ")
                                                  (DPROG (PROG [FORMPOS (LABELPOS (ADD1 (POSITION) (* For DPROG's. Highlights the THEN's in the argument list and
                                                                                                     formats initial values)
                                                           (SETQ FORMPOS (IPLUS LABELPOS 4))
                                                           (PRIN1 "(DPROG ")
                                                           [COND
                                                             ((LISTP (CADR FORM))
                                                              (PRIN1 " (")
                                                             [for V VTAIL (LASTLIST _ T)
                                                               (VARPOS _ (IPLUS LABELPOS 7)) in (CADR FORM)
                                                             do (COND
                                                                 ((LISTP V)
                                                                  (printout NIL .TAB0 VARPOS " (" .P2 (CAR V))
                                                                 [COND
                                                                 ((SETQ VTAIL (CDR V))
                                                                  (SPACES 1)
                                                                 (for X in old VTAIL do (PRINTDEF X (POSITION)
```

```

                                T NIL FNSLST)
repeatwhile (FMEMB (COND
              ((AND (LISTP X)
                    (NLISTP (CADR VTAIL)))
              (NTHCHAR (CADR VTAIL)
                       1))
              ((AND (NLISTP X)
                    (LISTP (CADR VTAIL)))
              (NTHCHAR X -1)))
              CLISPCHARS)
            finally (SETQ VTAIL (CDR VTAIL))
                   (* Supress spaces in clisp initial values)
(for x in VTAIL do (SPACES 1)
                  (PRINTDEF X (POSITION)
                             T NIL FNSLST]

(COND
  ((ILESSP (POSITION)
            VARPOS)
   (TAB VARPOS)
   (PRIN1 " ")
   (T (PRIN3 " ")))
  (SETQ LASTLIST T)
  (EQ V 'THEN)
  (printout NIL .TAB0 (IPLUS LABELPOS 2)
             'THEN))
(T (COND
   (LASTLIST (TAB VARPOS 0))
   (T (SPACES 1)))
  (SETQ LASTLIST NIL)
  (PRIN2 V)

  (PRIN3 " ")))
(T (PRIN2 (CADR FORM]
[for F in (CDDR FORM) do (COND
  ((LITATOM F)
   (printout NIL .TAB LABELPOS .P2 F))
  (T (COND
     ((NEQ (CAR (LISTP F))
            COMMENTFLG)
      (printout NIL .TAB0 FORMPOS)))
     (PRINTDEF F (POSITION)
                T NIL FNSLST]

  (PRIN1 " ")))
(DECL (PRIN1 " (DECL "
      (PPVARLIST (CDR FORM)
                 T)
      (PRIN3 " ")))
(DPROGN (PROG [(FORMPOS (IPLUS 3 (POSITION)
                          (PRIN1 " (DPROGN "
                          (PPVARLIST (CADR FORM))
                          (COND
                            ((AND (LISTP (SETQ FORM (CDDR FORM)))
                                   (NEQ (CAR FORM)
                                       COMMENTFLG))
                              (printout NIL .TAB0 FORMPOS)))
                            (PRINTDEF FORM FORMPOS T T FNSLST)
                            (PRIN1 " "))))
NIL)
NIL])

```

(PPVARLIST

[LAMBDA (VLIST TAILFLG)

(* rmk%: "12-JUN-78 16:07")

(* Pretty-prints the variable declarations for DLAMBDA, DPROGN, DECL.
 The list begins at the current line position; unless TAILFLG, enclosing parens are printed)

```

(if (LISTP VLIST)
  then (OR TAILFLG (PRIN1 "("))
  (for V (VARPOS _ (POSITION))
    (LASTLIST _ T) in VLIST do (if (LISTP V)
      then (printout NIL .TAB0 VARPOS "(" .P2 (CAR V))
           (for X in (CDR V) do (SPACES 1)
                                (PRINTDEF X (POSITION)
                                           T NIL FNSLST))

           (if (ILESSP (POSITION)
                    VARPOS)
             then (TAB VARPOS)
                  (PRIN1 " ")
             else (PRIN3 " ")))
      (SETQ LASTLIST T)
    else (if LASTLIST
      then (TAB VARPOS 0)
           else (SPACES 1))
      (SETQ LASTLIST NIL)
      (PRIN2 V))

  finally (if $$$LST1
    then (PRIN1 " . ")

```

```

                (PRIN2 $$LST1))
      (OR TAILFLG (PRIN3 " "))
  else (PRIN2 VLIST])

```

(SETQMAC

[LAMBDA (ARGS)

(* bas%: "18-OCT-79 18:22")
(* Compiler macro for SETQ. Enforces declarations.)

```

(PROG [SETFORM (TB (TYPEBLOCKOF (CAR ARGS)
  (SETQ SETFORM (CONS (fetch SETFN of TB)
    ARGS))

```

(* We can suppress the run time test if either IGNOREDECLS, type is ANY, the value is a constant which passes the test fn now, or TB covers the possible set of values. Can't do constant evaluation if there's a setfn, cause a setfn clearly must have side-effects, and it may be doing coercions.)

```

(RETURN (if [OR (IGNOREDECL)
  (EQ (fetch TYPEXP of TB)
    'ANY)
  [AND (EQ (fetch SETFN of TB)
    (CONSTANT DefaultSetFn))
    (DECLCONSTANTP (CADR ARGS))
    (PROG (TEMP HELPFLAG (TST (fetch TESTFN of TB)))
      (DECLARE (SPECVARS HELPFLAG))
      (RETURN (AND (OR (SUBRP TST)
        (NOT (FREEVARS TST)))
          [NLSETQ (OR [SETQ TEMP (APPLY* TST (EVAL (CADR ARGS)
            (COMPEM " Warning: Probable type fault in"
              (CONS 'SETQ ARGS]
                TEMP]
      (COVERSTB TB (TYPEBLOCKOF (if (EQ (fetch SETFN of TB)
        (CONSTANT DefaultSetFn))
          then SETFORM
        else (CADR ARGS]
          then
            SETFORM
          else
            (* The variable's type includes the value's, so we're OK.)

```

(* PROG1 is used rather than embedding the SETFORM in the test to give MAKEAPPLYFORM a better chance of simplifying)

```

(LIST 'PROG1 SETFORM (MAKETESTFORM (CAR ARGS)
  TB])

```

(THETRAN

[LAMBDA (FORM)

(* rmk%: "9-NOV-83 09:17")

```

(DECLARE (USEDFREE LCASEFLG CLISPCHANGE))
(SETQ CLISPCHANGE T)
(if LCASEFLG
  then (/RPLACA FORM 'the))
[WITH [(TYPEBLOCK (GETDECLTYPE.NOERROR (CADR FORM)
  (if (NULL TYPEBLOCK)
    then (DECLDWIMERROR "invalid type declaration: " (CADR FORM)))
  (DWIMIFY0? (CDDR FORM)
    FORM
    (CDDR FORM)
    NIL NIL FAULTFN)
  (WITH [(TESTFORM (APPLYFORM (DECLDWIMTESTFN TYPEBLOCK)
    'VALUE))
    (VALFORM (if (CDDDR FORM)
      then (CONS 'PROGN (CDDR FORM))
      else (CADDR FORM])
    (REALCLISPTRAN
      FORM
      (if (EQ TESTFORM T)
        then VALFORM
        else (LIST '\CHKVAL (APPLYFORM [LAMVAL (LIST 'COND (LIST TESTFORM 'VALUE)
          (LIST T (LIST 'VALUEERROR 'VALUE
            (if (LISTP (CADR FORM))
              then (CONS 'DECLMSGMAC
                (CADR FORM))
              else (KWOTE (CADR FORM]
                VALFORM])

```

(VALUEERROR

[LAMBDA (VALUE DECL)

(* rmk%: "16-AUG-81 15:48")

```

(DECLARE (SPECVARS VALUE))
(LISPXPRI1 "
  VALUE ASSERTION NOT SATISFIED IN " T)
(bind POS when [LITATOM (STKNAME (SETQ POS (REALSTKNTH -1 (OR POS 'VALUEERROR)
  NIL POS]
  do (LISPXPRI2 (STKNAME POS)
    T)
    (RELSTK POS)

```

(RETURN)

(* VALUE is the break expression so that an OK will simply return it. Also, typing the command VALUE in the break will cause VALUE to be printed out, given the EVAL command that sets it up. There are some paradoxes though: If the user sets VALUE, he will not see the change in the break unless he does another EVAL. Instead, he must work with !VALUE.)

(APPLY* (FUNCTION BREAK1)
'VALUE T (LIST 'VALUE DECL)
'(EVAL))

(\VARASRT

[LAMBDA (VARNAME)

(* rmk%: " 2-DEC-78 14:47")

(* Checks all the declaration predicates for VARNAME in the run-time context.)

(DECLARE (LOCALVARS . T)
(USEDFREE SATISFIESLIST))
(VARASRT1 VARNAME SATISFIESLIST))

(\VARASRT1

[LAMBDA (VARNAME SLIST)

(* bas%: " 9-OCT-79 23:24")

(* Checks all run-time assertions for VARNAME. Evaluates the highest predicate in the current scope first for DPROGN variables.)

(DECLARE (LOCALVARS . T))
(for S D in old SLIST when (SETQ D (ASSOC VARNAME S))
do (if (NULL (SETQ D (fetch VARDECL of D)))
then (RETURN))
(if (fetch PROGNFLAG of D)
then (VARASRT1 VARNAME (CDR SLIST)))
(if (APPLY* (fetch TESTFN of (GETDECLTYPE (fetch DECL of D)
VARNAME))
(EVALV VARNAME))
then (RETURN))
(ASSERTFAULT (fetch DECL of D)
VARNAME]))

(\VARSETFN

[LAMBDA (VARNAME)

(* rmk%: " 2-Nov-84 15:05")

(* Called by DECLSET and returns the setfn for VARNAME, or NIL if there isn't one. The setfn is the lowest one found on a DPROGN chain. Should be equivalent to (fetch SETFN of (VARDECL VARNAME T))%, but is opencoded to avoid consing up the type each time.)

(DECLARE (USEDFREE SATISFIESLIST))
(for S TEMP D in SATISFIESLIST when (SETQ D (ASSOC VARNAME S))
do (RETURN (fetch SETFN of (GETDECLTYPE (if (NULL (SETQ D (fetch VARDECL of D)))
then 'ANY
else (fetch DECL of D)
VARNAME))))
finally (RETURN (CONSTANT DefaultSetFn))

(DECLARE%: DONTEVAL@LOAD DOEVAL@COMPILE DONTCOPY

(BLOCK%: DECLTRAN DECLTRAN DECLVAR)

(BLOCK%: PPDECL PPDECL PPVARLIST)

(BLOCK%: \VARASRT \VARASRT VARASRT1)

(* * Declaration database fns)

(DEFINEQ

(\DECLOF

[LAMBDA (FORM DECLCONTEXT)

(* bas%: "31-JUL-79 13:40")

(* Returns a declaration for FORM in the context maintained by the code reading system DECLCONTEXT)

(DECLARE (USEDFREE CSATISFIESLIST SATISFIESLIST DECLVARSLST))
(fetch NAME of (TBOF FORM (SELECTQ DECLCONTEXT
(COMPILER CSATISFIESLIST)
(INTERPRETER SATISFIESLIST)
(NIL (if (BOUNDP DECLVARSLST)
then DECLVARSLST
else CSATISFIESLIST))
(ERRORX (LIST 27 DECLCONTEXT]))

(DECLOF1

[LAMBDA (FORM)

(* rmk%: " 9-NOV-83 09:24")

(* Computes a declaration form for FORM. May be redundant as it will be checked in DECLOF.)

```

(if (LITATOM FORM)
  then (SELECTQ FORM
        (NIL NIL)
        (T '(MEMQ T))
        (VARDECL FORM))
  elseif (LISTP FORM)
  then
    [PROG (TEMP)
      (RETURN
        (if (LITATOM (CAR FORM))
          then
            [OR
              (if (AND (EQ [CAR (LISTP (SETQ TEMP (GETP (CAR FORM)
                'DECLOF]
                'FUNCTION)
                (NEQ (CAR (LISTP (CDR TEMP)))
                'SATISFIES))
                then (APPLY* (CADR TEMP)
                  FORM)
                else TEMP)
              (SELECTQ (CAR FORM)
                ((SETQ SETQQ)
                  [PROG [VSF (VD (VARDECL (CADR FORM)
                    (SETQ VSF (fetch SETFN of (GETDECLTYPE VD)))
                    (RETURN (if (EQ VSF (CONSTANT DefaultSetFn))
                      then [LIST 'ALLOF VD (if (EQ (CAR FORM)
                        'SETQQ)
                        then (LIST 'MEMQ (CADDR FORM))
                        else (DECLOF1 (CADDR FORM)]
                      else (DECLOF1 (CONS VSF (CDR FORM)]
                    (PROG

```

(* Declaration is known only if the first and only executable statement in the prog is a RETURN)

```

    (for TAIL TEMP on (CDDR FORM) suchthat (SELECTQ (SETQ TEMP (CAAR TAIL))
      ((ASSERT DECLARE)
      NIL)
      (NEQ TEMP COMMENTFLG))
    finally (RETURN (if (AND (EQ TEMP 'RETURN)
      (NULL (CDR TAIL)))
      then (DECLOF1 (CADAR TAIL))
      else 'ANY))
    (PROGN (DECLOF1 (CAR (LAST FORM))))
    (COND [for CL D TFLAG in (CDR FORM)
      unless (if (EQ [SETQ D (DECLOF1 (CAR (LAST CL]
        'ANY)
        then (RETURN 'ANY)
        else (if (EQ (CAR CL)
          T)
          then (SETQ TFLAG T))
          (MEMBER D $$VAL))
        collect D finally (if (NOT (OR TFLAG (FMEMB NIL $$VAL)))
          then (SETQ $$VAL (NCONC1 $$VAL NIL)))
          (RETURN (if (CDR $$VAL)
            then (CONS 'ONEOF $$VAL)
            else (CAR $$VAL]))
      (SELECTQ [for TAIL D on (CDDR FORM)
        unless (if (EQ [SETQ D (DECLOF1 (if (CDR TAIL)
          then (CAR (LAST (CDAR TAIL)))
          else (CAR TAIL]
          'ANY)
          then (RETURN 'ANY)
          else (MEMBER D $$VAL))
        collect D finally (RETURN (if (CDR $$VAL)
          then (CONS 'ONEOF $$VAL)
          else (CAR $$VAL]))
      ((REPLACEFIELD FREPLACEFIELD /REPLACEFIELD)
      (DECLOF1 (CADDR FORM)))
      (REALSETQ (DECLOF1 (CADDR FORM)))
      ((FETCHFIELD FFETCHFIELD)
      (if (FIXP (CADR FORM))
      then (SELECTQ (LRSH (LOGAND (CADR FORM)
        12582912)
        22)
        (1 'FIXP)
        (2 'FLOATP)
        (3 (* FLAG)
          ' (MEMQ NIL T))
          (PROGN (* 0=pointer)
            'ANY))
      else 'ANY))
    (REPLACEFIELDVAL

```

```

      (DECLOF1 (CADDR FORM))
    (PROG1 (DECLOF1 (CADR FORM)))
    (\*DECL [PROG [(DECLVARSLST (if [OR (NULL (CADR FORM))
                                     (LISTP (CAR (CADDR FORM))
                                     then (CADR FORM)
                                     else (CONS (CADR FORM)
                                               DECLVARSLST]
                                               (* Maintain proper DECLVARSLST for recursion)
      (DECLARE (SPECVARS DECLVARSLST))
      (RETURN (DECLOF1 (CAR (LAST (CDDR FORM))

((the THE)
  (CADR FORM))
((create CREATE)
  (CADR FORM))
(QUOTE
  (* Could be done in the constant eval, but here for efficiency
  cause very common)
  (LIST 'MEMQ (CADR FORM)))
(if (AND (NEQ FORM (SETQ TEMP (EXPANDMACRO FORM T)))
        (NEQ TEMP 'IGNOREMACRO))
    then (DECLOF1 TEMP)
    else (if [SETQ TEMP (OR (GETHASH FORM CLISPARRAY)
                          (AND (GETP (CAR FORM)
                                   'CLISPPWORD)
                              (RESETVARS (FILEPKGFLG (NOSPELLFLG T)
                                                    (DWIMESSGAG T))
                                           (DWIMIFY0? FORM FORM)
                                           (RETURN (GETHASH FORM CLISPARRAY]

      then (DECLOF1 TEMP)
    elseif (DECLCONSTANTP FORM)
      then (LIST 'MEMQ (EVAL FORM))
    else 'ANY]
elseif [AND (LISTP (CAR FORM))
            (SETQ TEMP (SELECTQ (CAAR FORM)
                              ([LAMBDA NLAMBDA]
                               (CAR (LAST (CDDAR FORM))))
                              (PROGN
                               (* Hope it's a translated LAMBDWORD)
                               (GETHASH (CAR FORM)
                                       CLISPARRAY]

      then (DECLOF1 TEMP)
    else 'ANY]
else (LIST 'MEMQ FORM])

```

(TBOF

```

[LAMBDA (FORM DECLVARSLST)
  (DECLARE (SPECVARS DECLVARSLST))
  (GETDECLTYPE (DECLOF1 FORM])
  (* bas%: "9-OCT-79 23:27")
  (* Returns a type block for the value of form)
  (* DECLVARSLST is SPECIAL for an eventual call on
  VARDECL on an atom.)

```

(TYPEBLOCKOF

```

[LAMBDA (FORM)
  (DECLARE (USEDFREE CSATISFIESLIST))
  (TBOF FORM CSATISFIESLIST])
  (* bas%: "31-JUL-79 13:40")
  (* Gets type block for compiler declaration of FORM)

```

(VARDECL

```

[LAMBDA (VARNAME)
  (* Returns the declaration for VARNAME. The declaration will include all inherited attributes for DPROGN variables.)
  (DECLARE (USEDFREE DECLVARSLST))
  (for S ONE DECLS D in DECLVARSLST when (SETQ D (fetch VARDECL of (ASSOC VARNAME S)))
    do (if ONE
        then (SETQ DECLS (LIST (fetch DECL of D)
                               ONE))
            (* ONE is to avoid the cons in the common single-test case)
        (SETQ ONE NIL)
        elseif DECLS
          then (push DECLS (fetch DECL of D))
          else (SETQ ONE (fetch DECL of D)))
      (if (NOT (fetch PROGNFLAG of D))
          then (GO $$OUT))
      finally (RETURN (if DECLS
                          then (CONS 'ALLOF (DREVERSE DECLS))
                          elseif ONE
                          else 'ANY]))

```

```

)
(DECLARE%: DONTEVAL@LOAD DOEVAL@COMPILE DONTCOPY
(BLOCK%: DECLOFBLK DECLOF DECLOF1 TBOF TYPEBLOCKOF VARDECL (ENTRIES DECLOF TYPEBLOCKOF))
)

```

(* * Enabling and disabling fns)

(DECLARE%: EVAL@COMPILE DONTCOPY

(DECLARE%: EVAL@COMPILE

[ACCESSFNS FNEQUIVS ((DECLFN (PACK* 'DECL DATUM))
(REALFN (PACK* 'REAL DATUM))
)

(DECLARE%: EVAL@COMPILE

(PUTPROPS MOVEPROP MACRO ((PROP FROM TO)
(PUTIFPROP TO PROP (GETPROP FROM PROP))))

(PUTPROPS PUTIFPROP MACRO [(ATM PROP VAL)
(WITH ((V VAL))
(COND
(V (PUTPROP ATM PROP V))
(T (REMPROP ATM PROP)
NIL])
)

(DEFINEQ

(STARTDECLS

[LAMBDA NIL

(* rmk%: "12-Mar-85 09:15")

(* Repository of various code that sets up dummy function defns and other things that would require P commands in the file
coms. Distinct from DODECLS which actually activates DECLS.)

(for I in '(DECL WHOSE) do (MOVD? 'QUOTE I))
(for I in '(\CHKVAL \DECLPROGN) do (MOVD? 'PROGN I))
[for I in '(CHANGERECD CLISPTRAN SETQ SET SETQ) do (AND (MOVD? I (fetch REALFN of I))
(BOUNDP 'SYSLINKEDFNS)
(BOUNDP 'LINKEDFNS)
(FMEMB I SYSLINKEDFNS)
(push LINKEDFNS (fetch REALFN of I))

(for P in MACROPROPS do (MOVEPROP P 'SETQ 'REALSETQ))
(for P in MACROPROPS do (MOVEPROP P 'SET 'REALSET))
(if (AND (BOUNDP 'DECLTYPESARRAY)
(EQ (ASKUSER DWIMWAIT 'N "Reinitialize DECLTYPE lattice? ")
'N))

else (INITDECLTYPES))

(for I in '((COVERS CALL (IF (EQ (CAR EXPR)
'QUOTE)
[NIL (@ (TYPEMSANAL COVERS)
'(|..| TYPE]
EVAL)
(IF (EQ (CAR EXPR)
'QUOTE)
[NIL (@ (TYPEMSANAL COVERS)
'(|..| TYPE]
EVAL) . PPE)
(SELCOVERSQ . MACRO)
(SELTYPEQ . MACRO)
(*DECL NIL [IF NULL NIL (IF (LISTP (CAAR EXPR))
[(|..| (@ (TYPEMSANAL *DECL)
'(|..| TYPE)
TEST]
(|..| (@ (TYPEMSANAL *DECL)
'(|..| TYPE)
TEST]
|..| EFFECT RETURN)
(\CHKINIT NIL)
(\CHKVAL NIL EVAL)
(TH @ (TYPEMSANAL the)
'(CLISP (|..| TYPE)
RETURN))
(TYPE? @ (TYPEMSANAL type?)
'(CLISP (|..| TYPE)
RETURN))
(the @ (TYPEMSANAL the)
'(CLISP (|..| TYPE)
RETURN))
(type? @ (TYPEMSANAL type?)
'(CLISP (|..| TYPE)
RETURN))
(VALUEERROR NIL))
do (PUTHASH (CAR I)
(CDR I)
MSTEMPLATES))

(DODECLS T])

(DODECLS

(MOVD? 'CONS 'CBOX)

(DECLARE%: EVAL@COMPILE

[BLOCKRECORD FBOX ((F FLOATING))
(CREATE (SELECTQ (SYSTEMTYPE)
((TENEX TOPS-20)
(FPLUS 0.0))
(D (\CREATECELL (CONSTANT \FLOATP)))
(HELP "FBOX CREATE NOT DEFINED FOR SYSTEMTYPE " (SYSTEMTYPE])

[BLOCKRECORD IBOX ((I INTEGER))
(CREATE (SELECTQ (SYSTEMTYPE)
((TENEX TOPS-20)
(IPLUS 100000))
(D (\CREATECELL (CONSTANT \FIXP)))
(HELP "IBOX CREATE NOT DEFINED FOR SYSTEMTYPE " (SYSTEMTYPE])

(DECLARE%: EVAL@COMPILE

(PUTPROPS IBOX DMACRO [ARGS (COND
(ARGS (APPEND ' (create IBOX smashing (LOADTIMECONSTANT (\CREATECELL (CONSTANT \FIXP)))
I _)
ARGS))
(T ' (LOADTIMECONSTANT (\CREATECELL (CONSTANT \FIXP))

(PUTPROPS FBOX DMACRO [ARGS (COND
(ARGS (APPEND ' (create FBOX smashing (LOADTIMECONSTANT (\CREATECELL (CONSTANT \FLOATP)))
F _)
ARGS))
(T ' (LOADTIMECONSTANT (\CREATECELL (CONSTANT \FLOATP))

(PUTPROPS NBOX DMACRO [OPENLAMBDA (NVAL)
(COND
((FLOATP NVAL)
(FBOX NVAL))
(T (IBOX NVAL])

(DECLARE%: EVAL@COMPILE

(PROGN (PUTPROPS CBOX MACRO ((X Y)
(FRPLNODE (CONSTANT (CONS)
X Y)))
(PUTPROPS CBOX DMACRO (= . CONS)))

(PROGN (PUTPROPS LBOX MACRO [ARGLIST (PROG (NILIST (FORM '\$X\$))
[MAP ARGLIST (FUNCTION (LAMBDA (ARG)
(SETQ NILIST (CONS NIL NILIST))
(SETQ FORM (LIST 'FRPLACA FORM
(CAR ARG)))
(AND (CDR ARG)
(SETQ FORM (LIST 'CDR FORM]
(RETURN (LIST (LIST 'LAMBDA '(\$X\$)
'(DECLARE (LOCALVARS \$X\$))
FORM
'\$X\$)
(KWOTE NILIST])
(PUTPROPS LBOX DMACRO (= . LIST)))

(DECLARE%: EVAL@COMPILE

[I.S.OPR 'scratchcollect '(SETQ \$\$\$SCPTR (FRPLACA [OR (CDR \$\$\$SCPTR)
(CDR (FRPLACD \$\$\$SCPTR (CAR (FRPLACA \$\$\$SCCONS (CONS]
BODY))
'(BIND \$\$\$SCPTR \$\$\$SCCONS _ (CONSTANT (CONS)) FIRST (SETQ \$\$\$SCPTR \$\$\$SCCONS)
FINALLY (SETQ \$\$VAL (AND (NEQ \$\$\$SCPTR \$\$\$SCCONS)
(PROG1 (CDR \$\$\$SCCONS)
[COND
((CDR \$\$\$SCPTR)
(FRPLACD \$\$\$SCCONS (PROG1 (CDR \$\$\$SCPTR)
(FRPLACD \$\$\$SCPTR NIL)
(FRPLACD (PROG1 (CAR \$\$\$SCCONS)
(FRPLACA \$\$\$SCCONS \$\$\$SCPTR))
(CDR \$\$\$SCCONS))))])

(ADDTOVAR SYSLOCALVARS \$\$\$SCCONS \$\$\$SCPTR)

(ADDTOVAR INVISIBLEVARS \$\$\$SCCONS \$\$\$SCPTR)

(DECLARE%: EVAL@COMPILE

```

(PUTPROPS WITH MACRO [ARGS (CONS (CONS 'LAMBDA (CONS [for I in (CAR ARGS) collect (COND
                                                                    ((LITATOM I)
                                                                     I)
                                                                    ((LISTP I)
                                                                     (CAR I))
                                                                    (T (ERROR "Invalid WITH form
                                                                    binding" I)
                                                                     (CDR ARGS)))
                                                                    (for I in (CAR ARGS) collect (CADR (LISTP I))
                                                                    )
                                                                    )
(SETTEMPLATE 'WITH ' ((BOTH (|..| (IF LISTP (NIL EVAL |..| EFFECT)
                                             NIL))
                             (|..| (IF LISTP (BIND EVAL |..| EFFECT) BIND)))
              |..| EFFECT RETURN))
(REMPROP 'WITH 'CLISPCWORD)
(ADDTOVAR DWIMEQUIVLST (WITH . PROG))
(ADDTOVAR PRETTYEQUIVLST (WITH . PROG))
)
(DECLARE%: DOCOPY
(DECLARE%: EVAL@LOADWHEN
(NEQ (SYSTEMTYPE)
      'D)
[OR (GETPROP 'LOADTIMECONSTANT 'FILEDATES)
     (PROG ((X (FINDFILE (PACKFILENAME 'NAME 'LOADTIMECONSTANT 'EXTENSION COMPILE.EXT)
                        T LISPUSERSDIRECTORIES)))
            (COND
              (X (LOAD X 'SYSLOAD))
              ((NOT (GETPROP 'LOADTIMECONSTANT 'MACRO))
               (PUTPROP 'LOADTIMECONSTANT 'MACRO '( (FORM)
                                                       (CONSTANT FORM]
              )
            )
)
(ADDTOVAR OPENFNS \DECLPROGN \CHKVAL \CHKINIT ASSERT \*DECL \VARASRT)
(PUTPROPS DPROG CLISPCWORD (DECLTRAN . DPROG))
(PUTPROPS DPROGN CLISPCWORD (DECLTRAN . DPROGN))
(PUTPROPS THE CLISPCWORD (THETRAN . the))
(PUTPROPS the CLISPCWORD (THETRAN . the))
(PUTPROPS DLAMBDA INFO BINDS)
(PUTPROPS DPROG INFO (BINDS LABELS))
(PUTPROPS DPROGN INFO EVAL)
(RPAQQ SATISFIESLIST NIL)
(RPAQQ CSATISFIESLIST NIL)
(RPAQQ NEWSATLIST T)
(RPAQ? DECLMESSAGES )
(RPAQ? COMPILEIGNOREDECL )
(ADDTOVAR DECLATOMS DLAMBDA DPROG DPROGN)
(ADDTOVAR LAMBDA SPLST DLAMBDA)
(ADDTOVAR SYSLOCALVARS VALUE)
(ADDTOVAR DESCRIBELST ["types: " (GETRELATION FN ' (USE TYPE))
(ADDTOVAR BAKTRACELST (\DECLPROGN (DPROGN APPLY *PROG*LAM \*DECL *ENV*)
                                (NIL APPLY *PROG*LAM \*DECL))
                    (PROG (DPROG \DECLPROGN APPLY *PROG*LAM \*DECL)))
(DECLARE%: EVAL@COMPILE DONTCOPY
(DECLARE%: EVAL@COMPILE
(RECORD SLISTENTRY (VARNAME . VARDECL))
(RECORD VARDECL (DECL . PROGFLAG))

```

```

{MEDLEY}<lispusers>DECL.;1
)
)
(ADDTOVAR LAMB DATRANFNS (DLAMBDA DECLTRAN EXPR DLAMARGLIST))
(DECLARE%: DONTEVAL@LOAD
(ADDTOVAR PRETTYPRINTMACROS (DPROGN . PPDECL)
                                (DECL . PPDECL)
                                (DLAMBDA . PPDECL)
                                (DPROG . PPDECL))
)
(PUTPROPS ASSERT INFO EVAL)
(DECLARE%: EVAL@COMPILE
(PUTPROPS ASSERT MACRO (ARGS (ASSERTMAC ARGS)))
[PROGN (PUTPROPS .CBIND. BYTEMACRO [APPLY (LAMBDA (PV BODY)
                                           (APPLY* 'PROG PV '(RETURN (COMP.EXP1 BODY)
                                                                    (PUTPROPS .CBIND. MACRO (X (HELP "Compiler dependent macro must be supplied for .CBIND."))))])
(PUTPROPS CHKINIT MACRO (ARGS (CHKINITMAC ARGS)))
(PUTPROPS CHKVAL MACRO [ARGS (COND
                               [(IGNOREDECL)
                                (COND
                                 ((EQ (CAAR ARGS)
                                       'COND)
                                  (CADADR (CAR ARGS)))
                                 (T (CADAR ARGS)
                                    (T (CAR ARGS)))]
(PUTPROPS *DECL MACRO (ARGS (*DECLMAC ARGS)))
(PUTPROPS DECL MACRO (X (COMPEM "DECL in illegal location" (CONS 'DECL X))))
[PROGN (PUTPROPS DECLMSGMAC DMACRO ((X . Y)
                                       (CONSTANT (DECLMSG X . Y))))
        (PUTPROPS DECLMSGMAC MACRO ((X . Y)
                                       (LOADTIMECONSTANT (DECLMSG X . Y))))]
[PROGN (DEFMACRO REALSETQ (X &REST CL:REST)
        (CONS 'CL:SETQ (CONS X CL:REST)))
        (PUTPROPS REALSETQ BYTEMACRO COMP.SETQ))
)

(** MACROS REALSET)

(AND (GETD 'STARTDECLS)
      (STARTDECLS))

[PROG [(COM (CDR (ASSOC 'DW EDITMACROS)
                      (AND COM (RPLACD COM (CONS (APPEND ' (RESETVAR NEWSATLIST (EDITNEWSATLIST))
                                                    (CDR COM)]

(** Builtin DECLOF properties)

(PUTPROPS APPEND DECLOF LST)
(PUTPROPS CONS DECLOF LISTP)
(PUTPROPS EQ DECLOF (MEMQ T NIL))
(PUTPROPS LIST DECLOF [FUNCTION (LAMBDA (FORM)
                                   (AND (CDR FORM)
                                        'LISTP])
(PUTPROPS LISTP DECLOF LST)
(PUTPROPS NCONC DECLOF LST)
(DECLARE%: EVAL@COMPILE DONTCOPY
(RESETSAVE DWIMIFYCOMPFLG NIL)
[AND (GETD 'DODECLS)
      (RESETSAVE (DODECLS)
                  '(DODECLS T]
)
(DECLARE%: DONTEVAL@LOAD DOEVAL@COMPILE DONTCOPY COMPILERVARS
(ADDTOVAR NLAMA DECLSETQ DECLMSG DD \CHKINIT \*DECL ASSERT DECLTYPES DECLTYPE)

```

{MEDLEY}<lispusers>DECL.;1

Page 37

(ADDTOVAR **NLAML** DECLSETQQ TYPEMSANAL)

(ADDTOVAR **LAMA** DECLDWIMERROR)
)

(PUTPROPS **DECL COPYRIGHT** ("Xerox Corporation" 1983 1984 1985 1987))

FUNCTION INDEX

*DECLMAC 19 DECLSETQQ 22 INITDECLTYPES 8 STARTDECLS 32
ASSERT 18 DECLTRAN 22 LARGE 17 SUBTYPES 4
ASSERTFAULT 18 DECLTYPE 3 LCC2 9 SUPERTYPES 4
ASSERTMAC 18 DECLTYPES 3 LCCTYPE 9 TBDEFPRINT 12
CHECKTYPEXP 5 DECLVAR 23 MAKEBINDFN 9 TBOF 31
CHKINITMAC 19 DELETETB 7 MAKECTYPE 9 TESTFORM 17
COLLECTTYPES 5 DLAMARGLIST 25 MAKEDECLTYPE 9 TETYPE 12
COMBINE.TESTS 15 DODECLS 32 MAKESETFN 10 THETRAN 28
COVERS 4 DTYPE?TRAN 25 MAKETESTFN 14 TUPLE.TESTFN 15
COVERSCTYPE 6 DUMPDECLTYPES 3 MAKETESTFNBLOCK 14 TYPEBLOCKOF 31
COVERSTB 6 EDITNEWSATLIST 25 MAKETESTFORM 26 TYPESANAL 12
COVERSTE 6 EVERYCHAR 17 MAPTYPEUSERS 10 TYPESANAL1 12
CREATEFNPROP 6 FBOX 33 MKNTHCAR 15 UNCOMPLETE 13
CREATEFNVAL 6 FINDDECLTYPE 7 MKNTHCDR 15 UNSAVETYPE 13
DD 20 FINDPROP 7 NBOX 33 USERDECLTYPE 13
DECLCHANGERECD 11 FINDTYPEXP 7 NOTICETB 10 USESTYPE 13
DECLCLISPTRAN 20 FORMUSESTB 25 OF.TESTFN 15 VALUEERROR 28
DECLCONSTANTP 19 FUNIFY 15 PPDECL 26 VARASRT1 29
DECLDWIMERROR 21 GETCTYPE 7 PPDTYPE 10 VARDECL 31
DECLDWIMTESTFN 21 GETDECLDEF 3 PPVARLIST 27 VARSETFN 29
DECLERROR 6 GETDECLTYPE 7 RECDEFTYPE 11 WHOSE.TESTFN 15
DECLMSG 21 GETDECLTYPE.NOERROR 7 REDTYPE 10 *DECL 18
DECLOF 29 GETDECLTYPEPEPROP 4 REPROPTB 11 \CHKINIT 19
DECLOF1 30 GETTBPROP 7 SETDECLTYPEPEPROP 4 \VARASRT 29
DECLRECURSING 17 IBOX 33 SETQMAC 28
DECLSET 22 IGNOREDECL 26 SETTBPROP 12
DECLSETQ 22 INHERITPROP 8 SMASHCAR 17

MACRO INDEX

ANYC 16 FBOX 34 LAMBIND 16 NBOX 34 SMASHCAR 17 \CHKVAL 36
ASSERT 36 foreachTB 16 LAMVAL 16 NONE 16 TESTFORM 16
DECL 36 GETCGETD 16 LARGE 17 PUTIFPROP 32 WITH 35
DECLVARERROR 16 IBOX 34 MAKEDECLTYPEEQ 16 SELCOVERSQ 4 *DECL 36
DTYPENAME 16 KWOTEBOX 16 MOVEPROP 32 SELTYPEQ 4 \CHKINIT 36

VARIABLE INDEX

BAKTRACELST 35 DefaultBindFn 16 INVISIBLEVARS 34 PRETTYEQUIVLST 5,35
COMPILEIGNOREDECL 35 DefaultSetFn 16 LAMBASPLST 35 PRETTYPRINTMACROS 36
CSATISFIESLIST 35 DESCRIBELST 35 LAMBATRANFNS 36 PRETTYPRINTYPEMACROS 5
DECLATOMS 35 DONTCOMPILEFNS 17 NEWSATLIST 35 SATISFIESLIST 35
DECLMESSAGES 35 DWIMEQUIVLST 5,35 OPENFNS 35 SYSLOCALVARS 34,35

PROPERTY INDEX

APPEND 36 CONS 36 DLAMBDA 35 DPROGN 35 LIST 36 NCONC 36 the 35
ASSERT 36 DECLTYPE 3 DPROG 35 EQ 36 LISTP 36 THE 35

RECORD INDEX

FBOX 34 FNEQUIVS 32 IBOX 34 SLISTENTRY 35 TYPEBLOCK 5 TYPEDEF 5 VARDECL 35

TEMPLATE INDEX

foreachTB 17 MAKEDECLTYPEQ 17 WITH 35

I.S.OPR INDEX

scratchcollect 34