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(72) Inventors: KASSON, Richard ; 77 West Bare Hill Road, Harvard, MA 01451 (US). ANDERSON, Brian ; 5 Emery Lane, Box 616-L1, Weare, NH 03281 (US). SANGSTER, Barbara ; 9 Bellevue Road, Wellesley Hills, MA 02181 (US). PETERSON, Gerald ; 21230 Fondant Avenue, North, Forest Lake, MN 55025 (US). SHAPIRO, Charles ; 3130 Excelsior Boulevard, Minneapolis, MN 55416 (US).

(54) Title: IMPROVED RESEARCH APPARATUS

(57) Abstract

Research apparatus for performing research on books stored (119) either locally on magnetic (109) or optical (111) media or remotely in an on-line data base (117). A user of the research apparatus performs research in a project whose state is automatically saved on non-volatile storage, permitting a user to suspend and resume work on the project. The project state includes a list of the books being used by the project and for each book, the last location read and the last query executed on the book, and when the selection is made, the research apparatus automatically displays (105) text from the current book which contains the last location read. If there was a query active, the research apparatus automatically re-executes the query. If the current book is stored on an on-line data base, the research apparatus automatically establishes a connection with the on-line data base.

PRS HARDWARE

-1-

IMPROVED RESEARCH APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention disclosed in this application relates to
computerized systems for accessing information and more
particularly to computerized systems for performing
research on a body of literature.

2. Description of the Prior Art

The development of random-access mass storage devices for
use in computer systems was quickly followed by the
development of data base systems which permitted the
computer to quickly access information stored in the mass
storage devices by means of keys identifying the records
in which the information was stored. Query languages in
such systems permitted users to specify a subset of the
information contained in the data base by specifying one
or more keys and operators on the keys. In response to
such a specification, the data base system output all
records which satisfied the specification. As the cost of
mass storage and memory decreased and the power of

SUBSTITUTE SHEET

processors increased, full text retrieval systems were developed in which the data base consisted of text and every word of the text could serve potentially as a key. The query languages in such systems permitted users to specify queries by means of the words in the text and operators which included not only the operators of older data base systems, but also operators specifying information such as the proximity to each other in the text of the words used in the query.

The first full-text retrieval systems were difficult and expensive to use, and were consequently employed principally by specialists such as reference librarians. Moreover, the cost of mass storage was still high enough that individual researchers could not afford enough mass storage to store large text data bases. The full-text retrieval systems thus generally featured large central data bases to which users could gain access by means of telephone lines. As expensive and difficult to use as they were, the first full-text retrieval systems proved so valuable that improved full-text retrieval systems were developed which were designed specifically for use by professionals such as doctors and lawyers rather than librarians.

An example of such a full-text retrieval system is the WESTLAW(TM) system, developed by West Publishing Company, St. Paul Minnesota. WESTLAW is an interactive full-text

retrieval system for performing legal research on a large
on-line data base of legal documents such as cases and
statutes. Users of the system have terminals or personal
computers which are connected by telephone to the on-line
data base. The user performs research by inputting short
commands and queries from his terminal to Westlaw. By
means of commands, he specifies a part of the data base
such as a reporter for cases decided by a given group of
courts. Having done this, he composes a query to be run
on the reporter. The system runs the query and makes a
list of cases from the reporter which satisfy the query.
The list is ordered by the number of times the query is
satisfied in the case. The user may access the text of
the cases by moving from one location at which the query
term appears to the next or by selecting a case from the
list and reading that case. Once the user is reading the
text of a case, he may move forward or backward from one
page to the next. By running a query, reading cases which
satisfy the query, using what he learns to refine the
query, and running the refined query, the user can define
a subset of cases which are exactly "on point" for the
legal question he is researching. The user can command
WESTLAW to provide part of all of the text of particularly
interesting cases, and WESTLAW will send the cases via the
telephone line for print out at the user's printer.

While systems such as WESTLAW were successful, the need
for telephone-line access to a central data base and the

need to memorize commands limited their use. For example, WESTLAW was typically used by research paralegals in large law firms and not by lawyers themselves. These drawbacks were overcome by two developments: powerful personal computers became available at prices which any individual professional practitioner could afford, and CD-ROM optical disks enormously reduced the cost of read-only mass storage. The power of the personal computers permitted better user interfaces to the full text retrieval systems. The CD-ROM disks made text data bases cheaper than books. Every professional user could afford to acquire CD-ROM disks with the information necessary in his field, and the central data bases were now required only for information too recent to be published on a CD-ROM disk. CD-ROM based research systems for personal computers appeared which could be used in the same fashion as WESTLAW, and had such additional features as improved user interfaces employing menus or function keys, "following" a reference embedded in one text to its location in another, output from the optical disks to documents, spreadsheets, or "notepads", and commands permitting users to save the present "state" of a research project so that work could be continued at that point later on. Examples of such CD-ROM based research systems for personal computers include Silversmith, manufactured by Taunton Engineering, Inc., Billerica, MA, and Research Retrieval and Data Base System, manufactured by TMS, Inc., Stillwater, Oklahoma.

While the CD-ROM based research systems for personal
computers overcome many of the cost and ease-of-use
difficulties of the on-line research systems, problems
remain. Among them are the following: Professional
researchers typically do research on several projects at
once; present research systems do not accommodate that
mode of work. Professional researchers are also typically
able to define useful subsets of all of the information in
the data base before they begin researching; present
systems do not permit him such a definition. Different
kinds of research may be more convenient if the same
information can be presented in different orders; present
systems present the information in a single order.
Present systems permit the user to save what he perceives
as significant state, but users often fail to save what
turns out later to be important. Present systems further
cannot tailor the manner in which an embedded
cross-reference is followed to the user's environment and
cannot associate other information which might be valuable
to the user of a document with the document. Present
systems further do not permit a user to both locate
information and work on it within the research system.
Moreover, even with the improvements resulting from the
availability of personal computers and optical disks, the
user interface of present research systems often makes the
transition from book-oriented to electronic research more
difficult than necessary. It is an object of the
invention disclosed in this application to provide an

-6-

improved research system which solves these and other

problems of present research systems.

SUMMARY OF THE INVENTION

The present application discloses apparatus for performing

research upon books. The apparatus includes non-volatile

storage, a display, an input device, and a processor

coupled to the non-volatile storage, the display, and the

input device. The non-volatile storage includes readable

storage for storing the books and readable and writable

storage for storing project state for one or more research

state further includes desk top information for each of

the books currently being used in a project. Information

from the desk top information for a book includes the

book's title, the last location accessed in the book, the

last query executed for the book, and the number of

documents in the book which satisfied the query. The

research apparatus displays this information on the

display in response to an input from the input means. The

display further indicates which of the books selected for

the project is the current book. In response to another

projects being performed on the research apparatus. The

state for each project includes an indicator of a current

book and an indicator of a location in the text of the

current book. The display displays a visual

representation of a portion of the text of a stored book.

The input device receives inputs from a user of the research apparatus. The processor means responds to an input from the input device which indicates resumption of work on a given project and to an input from the input device which indicates the display of text on the display device by automatically displaying a visual representation of a portion of the text of the book specified by the current book indicator which contains the location specified by the location indicator.

In other aspects of the research apparatus, the process input from the input means, the user can select one of the books as the current book. Thereupon, the processing means causes the display to display a portion of the text of the new current book which includes the last location accessed.

The non-volatile storage may be either local storage which is directly accessible to the processor or remote storage which is accessible by means of a communications link. When a book in remote storage is selected by a project as the current book, the processor automatically accesses that book by means of the communication link.

The research apparatus further includes library information for each book presently accessible to the research apparatus. A user working on a project may select a book to be used in his project by means of an

-8-

input to which the processing means responds by using
information from the library information for the book to
make the desk top information for the book.

The book storage further includes an ordered document list
for each stored book which specifies documents in the
stored book. The processor responds to an input from the
input means by displaying a portion of the document list
for the current book. Moreover, when the processor is
displaying a portion of the current book, the processor
responds to inputs indicating movements in the current
book which are relative to the current location but which
are outside the document containing the current location
by moving to the relative location as determined by the
order of the documents in the document list. In some
cases, the book storage includes specifiers for one or
more alternate orders for the document list. The
processor responds to a user input selecting one of the
alternate orders by displaying the document list and
moving in the book as specified by the alternate order.

The book storage for some books further contains search
information for the book which can be used to run a query
on the book. When a user inputs a query to the research
apparatus, the processing means executes the query on the
search information and makes a subset document list of
documents which has the same order as the document list,
but contains only those documents which satisfy the

query. The subset document list may be displayed in the
same manner as the document list and governs relative
movement in the displayed text of the current book in the
same fashion.

Whenever a query is executed for a project, the processor
automatically adds the text of the executed query to the
project state. In response to an input from the user, the
processor causes the display to display the queries
executed thus far. If the user selects one of the
queries, the processor causes the display to display the
selected query and edit the query in response to further
user inputs. In response to another input, the processor
executes the edited query. Additionally, the book storage
may further include a published query list of queries for
a book. The published query list is provided by the
publisher of the book. The list may be displayed and a
query selected therefrom and edited as just described for
the queries belonging to project state.

Whenever the display is displaying text from a book and a
user provides an input which does not specify a location
in a book relative to the current location, the processor
automatically pushes state needed to restore the display
at the current location onto a stack in the project
state. In response to another input, the processor pops
the state on the top of the stack and uses the popped
state to restore the display.

-10-

The project state further includes a notebook which
contains information in an editable format. In response
to an input, the processor displays the notebook, and by
providing other inputs, the user can copy text from a book
to the notebook and edit the contents of the notebook.

In conclusion, a book may contain a reference to
information at another location in that book or another
book. Each reference includes one or more location
specifiers specifying a book and a location for the
information in the book. When the processor is displaying
the text of a book and an input specifies that references
are to be displayed, the processor indicates in the
display which text has references. In response to another
input, the processor displays the referenced information.
It does so by first determining whether any location
specifier indicates that the information is located in the
current book. If so, it displays that location in the
current book. If not, it determines whether any location
specifier indicates that the information is located in a
book for which there is desk top information. If it is,
the processor makes that book the current book and
displays the location. If not, the processor determines
whether any location specifier specifies that the
information is located in a book for which there is
library information. If there is, the processor makes
desk top information for the book, makes the book the
current book, and displays the location. Moreover, if the

-11-

processor has a choice between a location specifier
specifying a local book and one specifying a remote book,
the processor makes the local book the current book and
displays the text of that book.

It is thus an object of the invention to provide an
improved research apparatus.

It is another object of the invention to provide research
apparatus in which research may be easily performed for
different projects.

It is a further object of the present invention to
provide research apparatus which automatically maintains
certain state for each project.

It is another object of the present invention to provide
research apparatus which permits a user to perform
research on both local and remote books.

It is a still further object of the present invention to
provide research apparatus permitting viewing of documents
in different orders.

Other objects and advantages of the present invention will
be understood by those of ordinary skill in the art after
referring to the detailed description of a preferred
embodiment and the drawing, wherein:

-12-

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1   is an overview of the hardware of the present invention;

Fig. 2   is a state diagram which is a functional overview of the present invention;

Fig. 3   shows the function and navigation keys in the present invention;

Fig. 4   is the command bar and pull-down menu which appears in response to the MENU key;

Fig. 5   shows screens for the entry state;

Fig. 6   shows screens for the utility state;

Fig. 7   shows screens for the utility state;

Fig. 8   shows substates of the list managers state;

Fig. 9   shows screens for the project list manager state;

Fig. 10   shows screens for the desk top list manager state;

Fig. 11   shows the screen for the library list manager state;

-13-

Fig. 12   shows the screen for the document list manager
               state;

Fig. 13   shows screens in the bookview state;

Fig. 14   shows screens in the bookview state;

Fig. 15   shows screens in the bookview state;

Fig. 16   shows screens in the query manager state;

Fig. 17   shows screens in the query manager state;

Fig. 18   shows the screen for the notebook manager state;

Fig. 19   shows the top-level structure of the programs
               for the invention;

Fig. 20   shows the structure of list manager low-level
               routines;

Fig. 21   is an overview of the contents of an optical
               disk used in the invention;

Fig. 22   is a detail of view files in the optical disk;

Fig. 23   is an overview of the documents file in the
               optical disk;

SUBSTITUTE SHEET

-14-

Fig. 24   is a detail of the document text in the optical

           disk; and

Fig. 25   is a detail of the per-project CBAM lists in a

           preferred embodiment.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

The following Detailed Description of a Preferred

Embodiment will first describe the hardware environment in

which the preferred embodiment of the professional

research system operates, and will then provide a

functional overview of the professional research system, a

detailed description of the user interface to the

professional research system, and a detailed description

of the implementation of the professional research

system.

1. The Hardware Environment -- Fig. 1

The hardware environment in which a preferred embodiment

of the professional research system operates is shown in

Figure 1. The primary components of the environment are

personal computer (PC) 101, terminal (TERM) 103, magnetic

disk drive (MDD) 109, optical disk drive (ODD) 111, modem

113, communications link (COM LINK) 115, and on-line data

-15-

base (OLDB) 117. Personal computer 101 may be any

computer. In a preferred embodiment, personal computer

101 is one of the class of personal computers which are

adapted to execute the MSDOS operating system, for

example, the PC 240, 280, and 380 computers manufactured

by Wang Laboratories, Inc.

Personal computer 101 has two main components, memory

(MEM) 102, in which data and programs are stored, and

processing unit (PU) 100, which executes the programs and

operates on the data in accordance therewith. The user

interface to personal computer 101 is provided by terminal

103, which has a display (DISP) 105 and a keyboard (KB)

107. Display 105 operates under control of PU 100 to

display data output from memory 102. The user of personal

computer 101 may input data to personal computer 101 by

means of keyboard 107. In the preferred embodiment, the

user controls the professional research system by

responding to information on display 105 by inputting

keystrokes from KB 107 to indicate what the professional

research system is to do next. In other embodiments,

inputs may come from a pointing device such as a mouse in

addition to keyboard 107.

In the professional research system's environment,

personal computer 101 is equipped with data storage and

communications peripherals. Additionally, personal

computer 101 may be equipped with a printer and a floppy

SUBSTITUTE SHEET

-16-

disk drive (not shown). The data storage peripherals
include magnetic disk drive 109, on which data is stored
on a magnetic medium, and optical disk drive 111, on which
data is stored on an optical medium. Magnetic disk drive
109 is supplied as part of the Wang personal computers
employed in a preferred embodiment and optical disk drive
111 in a preferred embodiment is manufactured by Toshiba.
In both drives, the data is stored in files, and data is
accessed by accessing the file which contains it. The
data stored on magnetic disk drive 109 is readable and
writable, i.e., personal computer 101 may both read and
modify the data. The data stored on optical disk drive
111 is read only, i.e., personal computer 101 may read it
but not modify it.

The communications peripheral is modem 113, by means of
which personal computer 101 may exchange data over a
communications link such as a telephone line with another
computer system. In the preferred embodiment, the other
computer system has an on line data base 117, and personal
computer 101 may read items from on line data base 117 via
com link 115. In the presently preferred embodiment,
optical disk drive 111 and on line data base 117 together
make up book storage 119 and contain the read-only books
accessed by the professional research system. Book
storage 119 is further divided into local book storage
121, made up of optical disk drive 111, and remote book
storage 123, made up of on line data base 117 and the

SUBSTITUTE SHEET

-17-

communications equipment required to access it remotely.
Other embodiments may permit users to make their own
books, and these user books would be stored on writable
media such as magnetic disk drive 109. Magnetic disk
drive 109 further serves as user storage (US) 125. As
such, it contains the lists the user employs to select
documents from books and the user's notebook.

As will be apparent from the following discussion, user
storage 125 and book storage 119 may be implemented by any
combination of local and remote devices and read-write,
read only, or write once-read many media which provides
the functionality required by the professional research
system.

2.   Functional Overview of the Professional Research
        System: Fig. 2

Figure 2 presents a functional overview of the
professional research system. The professional research
system appears to its users as a set of <u>states</u>. The state
that the user is presently in determines what operations
he can perform. The performance of an operation has as a
state transition as its result. The state transition may
be to another state or to the same state. In Fig. 2,
states are represented by circles and transitions between
states by curved arrows. An arrow which returns to the

state it left indicates a transition to the same state.
In the professional research system, different types of
reference information and user information are associated
with different states. Reference information 233 is
represented by oblongs with curved ends; user information
235 is represented by squares. Straight arrows connecting
reference information 233 or user information 235 to a
state indicate the flow of data between the information
and the state. The direction of the arrow indicates
whether the state merely reads the information, merely
writes the information, or does both.

The functional overview of Fig. 2 is related to the
hardware environment of Fig. 1 as follows: there is
associated with each state one or more screens which are
displayed on DISP 105. By inputting keystrokes from KB
107 in response to the screen, the user causes personal
computer 101 to execute a program which carries out the
transition to the next state. Transitions may be brought
about by depressing program function keys as specified in
the screen, by selecting items from lists, by selecting
from pull down menus which appear in response to a MENU
key, or by filling in fields in the screen and striking an
EXECUTE key. In a preferred embodiment, reference
information 233 is read-only information which is provided
by a publisher to the user of the professional research
system. Reference information 233 resides on optical disk
drive 111 or is retrieved from on-line data base 117.

User information 235 is information such as document lists,
queries, and a notebook which the user employs to perform
research on the reference information. As is implied from
the above, user information 235 is writable and is stored
on magnetic disk drive 109. In other embodiments, users
may be able to define their own reference information 233.
Such user-defined reference information would be stored on
media which were at least write once and the professional
research system would include devices for reading and
writing such media.

In a presently-preferred embodiment, the following
reference information 235 may be obtained from reference
sources such as the optical disks used in optical disc
drive 111 or on-line data base 117:

> Reference Text (RT) 225, which is the text of
> the reference books available from the
> reference source.
>
> Reference library list (RLL) 233, which is a
> catalog of the reference books available from
> the source.
>
> Reference document list (RDL) 208, which is a
> catalog of the documents which make up the
> books in the source A document is a
> publisher-defined subdivision of a book such
> as an article, a chapter, or in the case of
> legal reporters, a case.
>
> Reference search information (RSI) 223, which
> is the information which the query portion of
> the professional research system uses to
> search the text in reference text 225.
>
> Reference query list (RQL) 227, which is a
> list of queries provided by the publisher of
> the reference source for use in researching
> the source. Not every reference source will

-20-

have a reference query list.

The user information includes information which the user

derives from the reference information, information which

is provided entirely by the user, and information which is

a combination of both:

Library list (LL) 205 is a list derived from
reference library lists 202 of reference
sources accessible to the professional
research system which has entries for all
books currently available to users of the
professional research system. An entry for a
book on the list contains all of the
information required by the professional
research system to access the book.

Project list (PROJL) 205 lists all of the
research projects currently in progress on the
professional research system. All research
done on the professional research system is
carried out within a project. Each project
has its own list of books, lists of documents,
list of queries, and notebook.

Desk top list (DTL) 211 for each project lists
the books from library list 205 which are
currently being used by the project.
Information for a project's DTL 211 comes from
library list 205. A user of the professional
research system selects a single book from
desk top list 211 as the current book.

Full document list (FDL) 213 for each project
is a list of all of the documents in the
current book. The information in FDL 213
comes from RDL 208 for the book.

Subset Document List (SDL) 217 for each
project is a list of documents which satisfy a
query run on the current book. The list is
made by omitting the documents from FDL 213
which do not satisfy the query but otherwise
keeping the documents in the same order as on
FDL 213.

Published query list (PUBQL) 220 for each
project is a list of queries provided by the
publisher for the current book. The queries
are obtained from reference query list 207.

SUBSTITUTE SHEET

If there are no published queries, this list
will not exist.

Project query list (PQL) 221 for each project
is a list of queries used thus far in the
project. The queries are made by the user,
but the user may run or modify a query from
published query list 220. The queries are run
using the information in reference search
information 223.

Notebook (NB) 229 for each project is a word
processing document in which a user can write
notes or to which the user can copy portions
of the text of a document. Notebook 229 can
further be edited or copied like any other
word processing document.

In the presently-preferred embodiment, library list 205

for books in local book storage 1210 project list 209,

desk top lists 211, and project query lists 221 all

contain information which is particular to a given

professional research system or project and is retained

from one use of the professional research system to the

next. In particular, the desk top list 211 and project

query list 221 for a project contain project state which

is automatically saved by the professional research system

when a user ceases work on a project and is automatically

restored by the professional research system when the user

resumes work on a project. A user of the professional

research system may thus cease work on a project and later

resume work at exactly the point at which he left off

work.

Since library list 205, project list 209, desk top lists

211, and project query lists 221 must be both non-volatile

and easily accessible, they are maintained in a preferred

-22-

embodiment in CBAM (compressed B-tree access method) files

on magnetic disk drive 109. Each entry in a list is a

record in the list's CBAM file, and mappings and inverted

lists in the file permit rapid accesses to the entries by

means of various keys.

Other lists are generated as needed and maintained in

buffers in memory 102. Included in these lists are

library lists 205 for books in remote book storage 123 and

full document list 213, subset document list 217, and

published query list 220 for the current book. Library

lists 205 for remote books are generated when the user

selects an on-line library from information in on-line

data base 117. Full document list 213 and subset document

list 217 are generated when needed for the current book

using reference document list 208 for the current book and

information in the current book's desk top list entry

which specifies the last query run on the book. Published

query list 220 is generated when needed from reference

document list 208. In other embodiments, these lists,

too, may be maintained in files in magnetic disk drive

109.

The states are the following:

      ENTRY 201 is the first state entered from
      MSDOS. From there, the user may transition to
      UTIL 203 or LMS 207.

      Utilities (UTIL) 203 is the state entered by a
      user who wishes to add a book to library list

-23-

205 or redefine the manner in which personal
computer 101 may be connected to on-line data
base 227.

List manager state (LMS) 201 is the state
entered by a user who wishes to use the user
lists to add or select a project from project
list 209, add a book from library list 205 to
desk top list 211, select a current book from
desk top list 211, or select a document from
full document list 213 for the current book.

Query manager (QM) state 215 is the state a
user enters who wishes to run a query on the
current book. The user may select a query
from project query list 221, modify a selected
query, or make a new query. When the
specified query is run, the documents which
satisfy the query are listed in subset
document list 217.

Bookview (BV) state 219 is the state a user
enters who wishes to read the text of a
current document selected from full document
list 213 or subset document list 217. The
user may move forward and backward in the
selected document at will, may move from one
location which satisfies a query to the next,
and may move from one appearance of a term to
the next. The user may also move forward to
the next document or backward to the preceding
document in the list from which the current
document was selected. Further, the user may
copy a portion of the current document to
notebook 229.

Notebook manager (NM) state 231 is the state a
user enters who wishes to work on notebook
229.

As may be seen from Fig. 2, transitions are possible

between ENTRY 201 and UTIL 203 or LMS 207, between LMS 207

and QM 215 or BV 219, and between QM 215 and BV 219.

Additionally, transitions are possible between LMS 207, QM

215, or BV 219 and NM 231 and from any state to MSDOS.

Two keys may be used for transitions in any state: the

professional research system responds to the CANCEL key by

going back to the state which preceded the present state

-24-

and to the EXIT key by returning to ENTRY state 201.

3.   Overview of Operation of the Professional Research
      System

The following example of how a user might operate the
professional research system presumes that the user has
already established a project and selected books for it.
When the user enters the ENTRY state from MSDOS, he can go
to utilities state 203 or list manager state 207.
Presuming the latter case, in list manager state 207, the
user is presented with a display on display 105 of the
list of projects presently stored in project list 209.
The user selects one of the projects, and in response to
that selection, the user is presented with a display of
current desk top list 211 for the project. The user
selects one of the books from current desk top list 211 as
the current book and in response to the selection, the
professional research system enters bookview state 219 and
displays the last location read in the book. If the user
wishes to select a different document, he specifies that
he wishes to view full document list 211 for the current
book. When he selects a document from that list, the
professional research system enters bookview state 219 and
displays the first page of the selected document. From
desk top list 211 or bookview state 219, the user can
enter query manager 215 and compose a query which query
manager 215 runs using reference search information 223

for the current book to produce subset document list 217
consisting of documents from the book which satisfy the
query. A document may be selected from subset document
list 217 as described for full document list 213, but in
this case, when bookview state 219 is entered, bookview
state 219 displays the first place in the selected
document at which the query is satisfied.

Once the user is in bookview state 219, he can use keys on
KB 107 to navigate in the displayed text. Kinds of
navigation include browsing by reading preceding or
following pages, going to pages which may be specified
either by a label such as a number or by position relative
to the current page, going to the next or previous place
in the document where the query is satisfied, or scanning
for a specified text string. The user can further select
either full document list 213 or subset document list 217
for navigation purposes. In the former case, when the
navigation goes beyond the bounds of the current document,
the next or previous document in full document list 217,
depending on the direction of navigation, becomes the
current document. In the latter case, the next or
previous document on subset document list 217 becomes the
current document. A publisher of reference material may
specify more than one way in which a book's documents are
ordered in the document list, and the user may select the
order which is most convenient for his purposes. A
publisher may thus use alternate orders to provide

-26-

different users with different paths through the material
,contained in the book. For example, a publisher of a
legal reporter may specify an order which presents the
cases contained in the reporter in the order in which they
appear in the printed recorder, may specify a
chronological order in which the oldest case appears
first, and may specify a reverse chronological order in
which the youngest case appears first.

As will be explained in more detail below, a document may
contain a reference to another document in the same or a
different book. While in bookview state 219, the user may
go to the referenced document. Additionally, a document
may have a "see also" section provided by the publisher.
The "see also" section indicates other documents that are
not referenced in the given document but may be of
interest to the reader of the given document. When a user
specifies "see also" in bookview state, a list of
references to the other documents appears and the user may
go to one of the references in the manner just described.
Besides permitting the user to read and navigate in a
document, bookview state 219 permits the user to print a
portion of a document on a printer accessible to the
professional research system and to copy a portion of a
document to notebook 229. In the course of the copy
operation, the professional research system performs a
transition to notebook manager state 231.

The user can further transition to notebook manager state

231 without performing a copy operation. Such transitions
are allowed from list manager state 207, query manager
state 215, or bookview state 219. Once in notebook
manager state 231, the user can write and edit his own
text or edit any material copied from documents to
notebook 229, can copy material from notebook 229 to other
documents or text files, and can print all or part of the
material in notebook 229. By striking the CANCEL key
while in notebook manager state 231, the user can return
to the state from which he entered notebook manager state
231.

The books on library list 205 and desk top list 237 may be
either local, i.e., stored on storage media such as
optical disks in optical disk drive 111 which are
immediately accessible to personal computer 101, or
remote, i.e., stored on a computer system accessible via
com link 115, as is on line data base 117. When a user
performs an action which requires information from on line
data base 117, such as adding a remote book to desk top
list 211, running a query on a remote book, or selecting a
remote book for viewing, personal computer 101
automatically connects itself to the computer system on
which on line data base 117 is stored and fetches the
necessary information from on line data base 117. There
is thus no distinction from the user's point of view
between information stored on locally-available optical

-28-

disks and information stored on on-line data base 117.

4.   Features of the User Interface to the Professional

       Research System which are Common to All States:

       Figs 3 and 4

Before entering into a detailed discussion of the states
of the professional research system, the Detailed
Description will present two aspects of the user interface
of the professional research system which are common to
all states: the function keys of keyboard 107 and the
command bar and menus which appear when the MENU function
key of keyboard 107 is struck.

4.a. Keyboard 107: Fig. 3

Keyboard 107 is a standard typewriter keyboard which has
in addition a number of function keys for specifying
transitions between states and operations within states
and navigation keys for navigating in documents, lists,
and the notebook. The function and navigation keys are
arranged around the standard keyboard. Fig. 3 shows these
function and navigation keys in a preferred embodiment.

Beginning with function keys 301, there are 16 such keys.
As with other keys on the keyboard, certain of the

SUBSTITUTE SHEET

-29-

function keys have one function when the shift key is not

depressed with the function key and another function when

the shift key is so depressed. In Fig. 3, such function

keys have two labels and the top label indicates the

function of the key when the shift key is depressed. In

overview, the function keys have the following functions:

A. Function Keys Which work in Any State:

   HELP 303: gives the user context-dependent help
   information.

   MENU 305: presents the user with a
   context-dependent command bar with pull-down menus.

   EXIT 339: permits the user to return to ENTRY state
   201 from any other state.

   CANCEL 341: The user employs CANCEL key 341 to
   abandon a given state and return to the state from
   which the given state was entered and within a
   state to abandon an action in the state.

B. Function Keys which Perform Transitions to New States

   EXEC 348 in navigation keys 343: When a transition
   to a new state requires a user to select from a
   list or enter information, the user initiates the
   transition by striking EXEC after he has made his
   selection or entered the information.

   SEARCH BOOK 311: permits a user who is in the
   desktop substate of LMS state 207 or bookview state
   219 to transition directly to query manager state
   215.

   GOTO DOCLIST 327: if the user is in the substate of
   list manager state 207 which manages desk top list
   211 or in bookview 219, the function key
   transitions the user to a substate of list manager
   state 207 which manages document list permits the
   user to immediately view either full document list
   213 or subset document list 217, depending on which
   was selected by full/subset key 313.

SUBSTITUTE SHEET

-30-

NTBK/MOVE 325: in states in which the user does not
edit text, NTBK/move 325 transitions the user to
notebook manager 231; in states in which he does,
the function key specifies the MOVE editing
operation.

C. Function Keys which work in the BOOKVIEW state:

GO BACK 307: restores the context of the BOOKVIEW
state which preceded the present context thereof.

GOTO REF 315: permits the user in bookview state
219 to choose a reference in the current document,
retrieves the document referred to in the reference
for the user, and places him at the location in the
retrieved document specified in the reference.

SEE ALSO 317: presents the current document's list
of see also references to the user. The user can
then select a reference from the see also
references as described above for GO TO REFERENCE
315.

FULL/SUBSET 313: toggles the user in bookview state
219 to toggle between full document list 213 and
subset document list 217 as the source of documents
to be viewed.

SCAN 321: if the user is in bookview state 219,
scan 321 permits the user to specify a text string
to be searched for in the text. Bookview state 219
then shows the user the next location of the text
string in the current book.

GOTO DOC 329: when the user is in bookview 219,
this key combined with navigation keys 343 permits
the user to go to the previous or following
document or to the beginning or end of the previous
document.

PREV TERM 331, NEXT TERM 333: when the user has run
a query on the book and is in bookview state 219,
these keys move the user to the previous or the
next location in the book which satisfies the
query.

D. Function Key employed in Query Manager State 215

RECALL 319: if the user is in query manager state
215, recall 319 permits the user to recall the last

SUBSTITUTE SHEET

-31-

query used in the project, the last query used in
the current book, or to select a query to be
recalled from a list of all of the queries used in
the project.

E. Other Function Keys

GOTO PAGE 337: when the user is viewing a document,
list, or notebook, he can specify a page and move
to it by striking this key.

GET BOOK 309: permits a user who is in query
manager state 215, bookview state 219, and a
substate of LMS state 207 which manages the desk
top list to specify a book by name and make that
book the current book without leaving the state in
which the function key is pressed. The
professional research system automatically takes
all actions required to make the new book the
current book.

COPY 323: if the user is in bookview state 219,
copy 323 permits the user to copy a portion of the
current document to notebook 229 or to a printer;
if the user is in notebook state 231, copy 323
permits him to copy material from one portion of
the notebook to the next.

PRINT 335: In bookview state 219, the key permits
the user to print a portion of the current document
on a printer connected to PC 101; in notebook
manager state 231, it permits the user to print a
portion of the notebook.

As can be seen from the above description, the function

keys permit the user to get from one state of the

professional research system to another and to operate

within a state easily and efficiently.

Continuing with navigation keys 343, these keys include

EXEC key 348, which is actually one of the function keys

and is described above. PREV 345, NEXT 347, and the

direction keys 349 are used to navigate when a document is

SUBSTITUTE SHEET

-32-

being read in bookview state 219 or in screens requiring

user input. In bookview state 219, PREV 345 and NEXT 347

get the previous and next pages of the current document

respectively. If there is not previous or next page, the

keys get the last page of the preceding document or the

first page of the following document respectively. Each

stroke of the up and down direction keys 349 cause the

screen to scroll up or down one line respectively; each

stroke of the the left and right direction keys 349 cause

the current line to scroll one character to the left or

right respectively, up to a maximum of 40 characters. In

notebook manager state 231 and when a list is being

viewed, PREV 345 and NEXT 347 cause the display to display

the next page of the notebook or list. When the user is

writing in notebook 229, writing a query, or filling in a

field, the direction keys move the cursor in the direction

indicated by the key.

4.b. The Command Bar and the Pull-Down Menus presented in

     response to MENU Key 305: Fig. 4

The top line of the screens for the states of the

professional research system are reserved for the command

bar. The command bar includes headers for a number of

menus. When the user presses MENU key 305 in any of the

states of the professional research system, the command

bar becomes active and the user may select an item from

any of the menus. Which set of menus are offered to the

user and what items appear on those menus depends on the
state the professional research system is in when the user
presses MENU key 305; however, the command bar and the
menus have the general form shown in Fig. 4 for all
states, and the same keys are used in all states to select
a menu and an item from the menu.

Fig. 4 shows the command bar for screens in bookview state
219. Contained in command bar 401 are menu headers 403,
which indicate which menus the user may select from. Once
the user has pressed MENU key 305, he can employ keys on
the keyboard to move to the left or right on the command
bar. When the user moves to a menu header 403, the menu
header 403 is highlighted and the menu 407 for that header
appears below the menu header. Only the menu for the
presently-selected header is displayed. In Fig. 4, the
menu associated with the Search menu header is displayed.
The menu contains a list of items 407, which in the case
of the Search menu, offer the user the choice of searching
the book using a query, scanning the book using a text
string, or clearing the query. By means of other keys on
the keyboard, the user can move a selection bar,
represented by italic type in Fig. 4, up and down the list
of items. The item presently selected has an arrow 411 to
the left of it. When the user has made his selection, he
strikes EXEC key 348, the professional research system
does the selected function, the menu disappears, and the
command bar becomes inactive. If the user decides he does

-34-

not want to make a selection from the menus, he strikes
cancel key 341, the menu disappears, and the command bar
becomes inactive.

In the presently preferred embodiment, the user may move
to the right among menu headers 403 by using the tab key
on the keyboard or the right direction key 347 and may
move to the left by using the backtab key on the keyboard
or left direction key 347. The distinction between the
keys is that movement in response to the right and left
direction keys stop at the last headers on the menu bar,
while movement in response to tab continues from the last
header to the first and movement in response to backtab
continues from the first to the last. The user may move
selection bar 409 up among menu items 407 by means of the
backspace key or the up direction key 347 and down by
means of the space bar or the down direction key 347.
Both sets of keys operate in a circular fashion when they
reach the end of the list. Additionally, a user may type
the first letter of a menu item 407 to cause selection bar
409 to move immediately to that item.

In a preferred embodiment, when a user enters a state and
strikes MENU key 305 for the first time in that state, the
leftmost menu header 403 is automatically selected and
that header 403's menu 407 displayed. From then on, as
long as the user stays in the state, header 403 is
selected when the user hits MENU key 305 which was last

-35-

selected by the user and with the menu 406 for that header
displayed. The use of MENU key 305 to activate command
bar 403 and the use of keyboard keys to navigate across
command bar 403 and within menus 405 gives users of the
professional research system the ease of use and
flexibility typical of menu systems used with pointing
devices, but without the need to permanently devote a part
of display 105 to menus and without the need to move the
hand from the keyboard to the pointing device in order to
make a menu selection. Moreover, as can be seen from Fig.
4, the user can generally perform the same actions using
menu picks and EXEC key 348 as he can with the function
keys. The combination of command bar 401 and menus 405
with the function keys thus offer the less skilled user
who has not yet learned the function keys an easy
interface to the professional research system without
interfering with the skilled user who no longer requires
menus.

5. Detailed Description of the States of the Professional
      Research System: Figs.

The following discussion of the states of the professional
research system will discuss the functions performed by
each state, the transitions from the state, and the user
interface for the state in detail.

5.a: ENTRY State 201: Fig. 5
As may be seen from Fig. 2, ENTRY state 201 is the first

-36-

state entered by the user of the professional research

system. Fig. 5 shows the screens which appear on display

105 in that state. When the user commands MSDOS to

execute the professional research system program, boot

screen 501 appears and remains while MSDOS is loading the

professional research system program and data from files

on magnetic disk drive 109 into memory 102 of personal

computer 101. When loading is complete, entry menu 503

appears. When the user selects either the first or second

entries in the menu and hits EXEC key 348, the

professional research system performs a transition to the

project list manager substate of list manager state 207;

when the user selects the third entry, the professional

research system performs a transition to utilities state

203. If the user hits CANCEL key 341, the professional

research system returns to MSDOS.

5.b. Utilities State 203: Figs. 6 and 7

When the user selects "Utilities" from entry menu 503 and

hits EXEC key 348, the menu shown in Fig. 6 appears. As

shown by the menu, the user can perform three actions in

utilities state 203: install an optical disk on ODD 111,

remove a book from library list 205, and modify the manner

in which personal computer 101 connects itself via com

link 115 to the system containing on line data base 117.

If the user selects "modify connections," he can interact

with a set of screens to modify a file in magnetic disk

drive 109 from which personal computer 101 determines how
it is to effect a connection to on line data base 117.

As shown in Fig. 7, if the user selects "Install a
CD-ROM", install screens 703 and 705 appear. Screen 705
indicates to the user that he must place an optical disk
in optical disk drive 111, and after the user has done so,
screen 701 provides him with an abstract 703 of the
installed disk which utilities 203 reads from the optical
disk. When the disk is installed, the information about
the disk's books in reference library list 233 on the disk
is automatically added to library list 205. The
information about the books on the disk remains in library
list 205 even after the optical disk is removed from
optical disk drive 111.

Once a book has been added to library list 205, it may be
removed only by selecting "remove a book" on main
utilities menu 601. When the user does so, remove book
screen 707 appears. That screen displays CD-ROM library
list 709, listing all of the books on optical disks which
are presently on library list 205. The user selects one
or more of the books from list 709, and these books are
removed from library list 205. To select more than one
book, the user employs INSERT key 351. When a user who is
in util state 203 performs the last action in that state,
or when he hits the cancel key, he is returned to entry
state 201.

-38-

5.c. List Manager State 207: Figs

The discussion of list manager state 207 will begin with

an overview of the substates of that state and will then

provide a detailed description of each of the substates.

5.c.a: Overview of the Substates of List Manager State

207: Fig. 8

List manager state 207 in a preferred embodiment consists

of four substates. Those substates and the user lists and

reference lists they are associated with are shown in

overview in Fig. 8:

Project list manager (PLM) 801 manages the list of
projects currently being done in the professional
research system, which is kept in project lists
209. The user may make transitions between project
list manager 801 and entry state 201 and desk top
list manager state 805.

Desk top list manager (DTLM) 805 manages each
project's desk top list 211, which contains the
list of books currently being used by the project.
Research in a book begins with the selection of the
book as the current book in desk top list manager
805, and thus there are transitions to and from
project list manager 801, to entry 201, to and from
library list manager 803, to and from document list
manager 807, and to and from query manager 215,
notebook manager 231, and bookview 219.

Library list manager (LLM) 803 manages library list
205, the list of all books presently available to
the professional research system. Transitions are
to and from notebook manager 231 and desk top list
manager 805.

Document list manager (DLM) 807 manages the
document lists for a project. It obtains

information from reference document list 208 for
the current book and generates s full document list
213 from that information. After a search, it
generates subset document list 217. Transitions
are to and from desk top list manager 807, bookview
219, and notebook manager 231.

As may be seen from the foregoing description, library
list manager substate 803, desktop list manager substate
805, and document list manager 807 are of fundamental
importance to a central feature of the user interface for
the professional research system: that it presents
electronically-accessible information in a manner similar
to that in which books are presented to a user in the
library. Library list 205 is analogous to the library's
catalog, desk top list 211 is analogous to the set of
books presently on the user's desk, and the document lists
are analogous to the tables of contents of those books.

5.c.b. Detailed Description of Project List Manager State
       801

As previously pointed out, users of the professional
research system perform all their research within
projects. Each project has its own desk top list 211, its
own project query list 221, and its own notebook 229.
When a user stops working on a project, the lists and
notebook for the project are saved on magnetic disk drive
109. Further, when a user references materials on on line
data base 117 in the preferred embodiment, the owner of on

-40-

line data base 117 identifies and bills the user by

project name. In project list manager state 801, the user

can select a project to work on, can select a project to

be deleted or archived, can edit information about the

project, and can restore an archived project.

Screens for project list manager state 801 are shown in

figure 9. As described in the discussion of entry state

201, a user enters project list manager state 501 by

selecting one of two items on entry memo 503. If he

selects "Existing Project," project list screen 901

appears unless there is only one project on the list. In

that case, the professional research system moves directly

to list managers state 207. Screen 901 displays a

project list 911 of presently-available projects. If the

user selects one of the projects from the list and strikes

EXEC key 348, a transition to desk top list manager 805 is

made and desk top list 211 for that project appears. If

the user wishes to perform some other operation on a

project, he strikes MENU key 305. The menus that appear

at action bar 401 offer the following possibilities:

Action menu:	Start new project Delete a project Edit project info Go to page
Misc menu:	Exit
Utility:	Archive a project Retrieve a project

Selection of "Go to page" and "Exit" from the menus has

the same effect as striking the function keys of the same
names. If "Delete a project" is selected, the project
which the user has selected from project list 911 is
deleted. When a project is deleted, its desk top list
211, project query list 221, and notebook 229 are also
deleted. Consequently, when a user specifies deletion,
delete project dialog box 915 appears to warn him of the
consequences of his act. In order to actually perform the
deletion, the user must strike EXEC key 348.

If "Edit project info" is selected, edit project
information screen 919 appears with the project name and
project description for the selected project and the user
can edit name and description. If "Archive a project" is
selected, a series of screens take the user through the
steps of using the floppy disk drive to make a copy of the
project information, desk top list 211, project query list
221, and notebook 229 for the selected project on one or
more magnetic diskettes. If "Retrieve a project" is
selected, the user specifies the disk drive which has the
diskette containing the project to be retrieved and the
project is retrieved. If a project of the same name
already exists, the user is asked whether the existing
project is to be overwritten before retrieval occurs. If
"Start new project" is selected, start new project screen
917 appears and the user enters the project name and
information. When he is finished, he strikes EXEC 348, an
empty desk top list 211, an empty notebook 229, and an

empty project query list 221 are created for the project,
and the project is added to project list 911.

Project list screen 901 is typical for the list screens
which are displayed by the substates of list manager state
207. As previously indicated, the top line of the screen
is action bar 401 with menu headers 403. On the next line
is found list name 905, which indicates which list is
being displayed. List size 903 indicates how many pages
and items there are to the list. Prompt 907 indicates how
the user is to interact with the screen. List header 909
provided titles for the columns of the list. List 911
follows the list header and is divided into columns 913.
In the case of the project list, the information for the
items on the list is provided by the user; in the cases of
library list 205, desk top list 211, full document list
213, and subset document list 217, the information is
provided by the publisher of the reference book. In the
latter cases, both form and content of the information is
determined by the publisher.

Which item in a list has been selected is indicated by a
selection bar and an arrow, as in a menu 405. The same
keys are used to move the selection bar as in menu 405.
In addition, PREV 345 moves the user back to the previous
screen of a list requiring more than one screen and NEXT
moves the user forward to the next screen of such a list,
and GOTO PAGE key 337 permits the user to move to a

specified screen of the list. In some lists, the user can employ INSERT key 351 to select more than one item from the list. Once the action to be taken and the list items it is to be taken on have been specified, the user executes the action by striking EXEC key 348.

5.c.c. Detailed description of Desktop List Manager State 805: Fig. 10

Desktop list manager state 805 is the state in which a user selects a book to be viewed from desk top list 211 for the project in which the user is currently working. The entry for each book in desk top list 211 includes the last document and last location therein which the user accessed in the book and the last query which the user ran on the book. In addition, desk top list manager state 805 keeps track of which book on desk top list 211 is the current book and saves that information when the user leaves the professional research system.

Figure 10 shows the screens which appear to the user in desk top list manager state 805. Desk top list screen 1001 is the screen which appears when the user enters desk top list manager state 805. As a list screen, screen 1001 generally resembles project list screen 401 and the same keys are used for navigation and selection. The following differences are noteworthy:

Project Name 1003 indicates the project to

which the desk top list belongs.

black ball 1005 preceding the second item on
the list indicates that the book is an on-line
book, i.e., is stored in on-line data base 117
instead of on optical disk drive 111.

Last Document column 1007 indicates the name
of the last document read in the book.

Last Query column 1009 indicates the last
query run on the book.

When desk top list screen 1001 appears on display 1005,

the selection bar indicates current book 1011. The first

book on the list in screen 1001, titled Training Book, is

a book supplied with the system which the user may use for

training purposes. If there are no books in desk top list

211, empty desktop list dialog box 1015 appears instead of

the list of books.

To select a book to view, the user moves the selection bar

to the desired entry on the desktop list and strikes EXEC

key 348. The professional research system then

establishes the selected book as the current book,

constructs full document list 213 from reference document

list 205 for the book, makes the transition to bookview

state 219, and there displays the last location read in

the current book. As will be explained in more detail

later, the professional research system saves subset

document list 217 for the current book and the immediately

preceding current book; if the new current book selected

by the user is neither of these, no subset list dialog box

1013 appears on desk top list screen 1001 before the

transition is made to bookview. The user may choose to
either restore the subset list or open the book
immediately. In response to the first choice, the
professional research system restores subset list 217 by
running the last query saved for the book in desk top list
211 on the book and proceeding to bookview state 219; in
response to the second, the professional research system
simply proceeds to bookview state 219 as described above.

If the user strikes MENU key 305, the following menus
appear on desktop list screen 1001:

Action:	Shelve Book
	Go to Page
	Get Book
Libraries:	CD-ROM
	CD-ROM UPDATE
	WESTLAW
Misc:	Connect/Disconnect
	Exit
	Open Notebook
	Change Project

When the user selects the "Action menu" and then "Shelve
book" and selects a book from desk top list screen 1001,
the selected book is removed from desk top list 211. By
using INSERT key 351, the user may select more than one
book to be removed. Go to Page and the corresponding
function key permit the user to move to a different page
of desk top list 211.

Get Book and the corresponding function key permit the
user to make any book on a library list 205 the current

-46-

book. In response to the function key or the menu pick,
the professional research system requests short title 1105
of the book. When the user then presses EXEC key 348, the
professional research system takes any action required to
make the specified book the current book. At a minimum,
the professional research system replaces the current full
document list 213 with a new full document list 213 for
the referenced book. If the book is not on the project's
desk top list, the professional research system adds the
book to the desk top list. Moreover, if the book is
listed on library list 205, but the optical disk
containing the book is not presently mounted on optical
disk drive 111, the professional research system requests
the user to mount the disk; similarly, if the book is a
remote book, a communication link is established with
on-line data base 117.

The "Libraries" menu permits the user to specify a library
from which he wishes to select a new book. In the
preferred embodiment, both CD-ROM Update and WESTLAW are
remote libraries stored on on line data base 117. CD-ROM
update contains current updates of the books in the user's
CD-ROM library and functions as an electronic equivalent
of the "pocket parts" found in legal reference materials.
When the user makes a selection and strikes EXEC key 348,
a transition to library list manager 803 occurs.

The "Misc" menu permits the user to specify that the

professional research system establish or disestablish a

connection to on line data base 117 or specify a

transition to Entry state 201 ("Exit"), to notebook

manager state 231 ("Open Notebook"), or to project list

manager state 801 ("Change Project"). A user may also

perform the former transitions by means of EXIT key 339 or

NTBK/MOVE key 325 respectively. Two other function keys

are active in desktop list manager state 805: SEARCH BOOK

key 311 and GOTO DOCLIST key 327. When the former key is

pressed, a transition to query manager state 315 occurs;

when the later key is pressed, a transition to document

list manager 807 occurs.

5.c.d. Detailed Description of Library List Manager State

       803: Fig. 11

In library list manager state 803, the user can select

books for a project desk top list 211 from one or more

library lists 205. Entry to list manager state 803 is by

means of a selection from the "Libraries" menu in desk top

list manager 805. As previously mentioned, in a preferred

embodiment, there are three library lists 205:

        the CD-ROM library list is a list of books
        stored on optical disks which are available to
        the given professional research system.

        the WESTLAW library list and the CD-ROM Update
        list are lists of books stored in on line data
        base 117.

As previously mentioned, the information on CD-ROM library
list 205 is copied from reference library list 202 on an
optical disk when an optical disk is installed for the
first time on the professional research system and remains
on CD-ROM library list 205 until a user removes it by
performing the remove book action in utility state 203.
The information on WESTLAW library list 205 and CD-ROM
update list 205 is obtained from on line data base 117
when a user selects either of those libraries.

On entry into library list manager state 803, library list
screen 1101 for the selected library, shown in Fig. 11,
appears. Library list screen 1101 is a standard list
screen, and differs from those previously disclosed in the
following respects: library title field 1103 indicates
which library list 205 is being displayed. The list
itself has four columns. Column 1105 gives a short name
for the book. Users may employ the short name together
with GET BOOK function key 309 or the equivalent function
key to get a book without selecting it from desk top list
211. Column 1107 gives the book's title; column 1109
gives the publisher; column 1111 gives the publisher's
number for the optical disk containing the book. This
column is left blank when the WESTLAW or CD-ROM Update
lists are being displayed. When the selection bar is
placed at an entry in the list and EXEC key 348 is struck,
the selected book is added to the project's desk top list
211.

-49-

Library list screen has menus accessible by MENU key 305
as follows:

Action:	Go To Page
Libraries:	CD-ROM
	CD-ROM Updates
	WESTLAW
Misc:	Open Notebook
	Exit

Selection of Go To Page, Open Notebook, and Exit are
equivalent to striking the GO TO PAGE, NTBK/MOVE, and EXIT
function keys; in the "Libraries" menu, selecting a
library list 205 other than the one presently being
displayed causes that list to be displayed.

5.c.e. Detailed Description of Document List Manager State
805: Fig. 12

In document list manager state 805, the user of the
professional research system selects a document from a
list of the documents in the current book. Transitions to
document list manager state 805 are from desk top list
manager state 805 and bookview state 219 and are
accomplished by striking GOTO DOCLIST key 327 in either of
those states or selecting "Go to doc list" from the
"Action" menu in bookview state 219.

Figure 12 shows the screen which appears when the user
enters document list manager state 807. Document list

-50-

screen 1201 is a standard list screen, but has the
following items of particular interest: book title 1203
identifies the book the documents on the list belong to;
as in desk top list 211, black ball 1205 indicates that
the book is an on-line book; list type 1207 indicates
whether the list being displayed is full document list 213
or subset document list 217; and query text 211 indicates
the last query run on the book. As previously explained,
when the list being displayed is subset document list 217,
only those document which contain locations satisfying the
query are on the list; when the list being displayed is
full document list 213, entries on screen 1201 for
documents satisfying the query are highlighted.

As previously mentioned, a publisher of a book may specify
more than one order for the documents in the document
list. Alternative orders are specified in reference
document list 208. Order indicator 1209 indicates which
of the orders is presently being used. The term
"published order" in the preferred embodiment indicates
that the document appear on the list in the same order as
in the equivalent hard-copy book. The column headings and
columns in the actual document list are determined by the
publisher of the book; in screen 1201, the first column
contains citation 1215, a short specification of the
document used to cite it in legal writings; the second
column contains title 1215 of the document; the third
column 1217 specifies the number of pages in the
document.

SUBSTITUTE SHEET

-51-

Selection of an item in the displayed list in document

list screen 1201 is the same as for list screens

generally; when the user selects the item and strikes EXEC

key 348, the professional research system makes the

transition to bookview state 219 and displays the first

page of the indicated document. When the user strikes

MENU key 305, the following menus become available:

                Action: Go to page
                                     Search book
                                     Reorder list
                                     Get book
                                     Switch to (SUBSET)
                                               (FULL)

                Misc: Go to Desktop
                                     Go to Bookview
                                     Open Notebook
                                     Exit

In the menus, "Go to page", "Search book", "Get Book",

"Open Notebook", and "Exit" have the same effects as GOTO

PAGE key 337, SEARCH BOOK key 322, GET BOOK key 309,

NTBK/MOVE key 325, and EXIT key 339 respectively, and each

of those keys may be used instead of the menu pick. "Go

to Desktop" and "Go to Bookview" take the user to desktop

list manager state 807 and bookview state 219

respectively. "Switch to (SUBSET)", like FULL/SUBSET key

313 permit the user to toggle back and forth between

subset document list 217 and full document list 213. When

the user toggles from one list to the other, the list

displayed on document list screen 1201 changes

accordingly. When the user selects "reorder list",

finally, a menu appears on document list screen 1201 which

SUBSTITUTE SHEET

-52-

shows the user what orders are available for the document

list and permits him to select one. If the user selects a

new order, the professional research system rebuilds full

document list 213 and subset document list 217 according

to the new order and changes the display on document list

screen 1201 accordingly.

5.d.   Detailed Description of Bookview State 219: Figs.
        13 - 15

The detailed description of bookview state 219 includes an

overview of the state and detailed descriptions of

bookview screens, of navigation within a screen, and of

the menus for the bookview screens.

5.d.a. Overview of Bookview State 219

Bookview state 219 is the state in which the text of a

document contained in the current book is displayed on

display 205. In the case of a document from a local book,

a preferred embodiment retrieves the text from an optical

disk in optical disk drive 111; in the case of a document

from a remote book, the preferred embodiment retrieves the

text via modem 113 and com link 115 from on line data base

117. Entry into bookview state 219 is from desk top list

manager state 805 or document list manager state 807. In

-53-

the former case, when the user selects a book from desk

top list 211 as the current book and strikes EXEC key 348,

bookview state 219 displays either the last location which

the project accessed in the selected book or the first

page of the first document in the selected book; in the

latter, when the user selects a document from document

list 213 or 217 and strikes EXEC key 348, bookview state

219 displays the first page of the selected document.

When the user is finished in bookview state 219, CANCEL

key 341 returns him to desk top list manager state 805.

Once in bookview state 219, the user can read documents in

the current book in the order in which the documents occur

in full document list 213 or if there is a subset document

list 217, in the order in which they occur on subset

document list 217. From a given point in a document, a

user can move forward and backward relative to his current

position. The relative movement may be within a document

or to documents adjacent to the document containing the

current position on whichever document list is selected.

There are three modes of relative movement: browse mode,

search mode, and scan mode. In browse mode, the user can

move to the top or bottom of the current page, to a page

which is specified relative to the current page, to the

beginning or end of the current document, to the beginning

or end of the preceding or following document, or to the

first or last document in the current list. After running

a query on a book, a user can use search mode, to move

SUBSTITUTE SHEET

forwards and backwards from one term which satisfies the
current query to another term which satisfies the query.
In scan mode, finally, a user can specify a string of
characters to be searched for and can move forwards and
backwords from one occurrence of the string of characters
to the next. In the preferred embodiment, some books
permit all three modes of relative movement; others permit
searching only, and still others do not permit searching.
No queries may be run on books of the last type, and
consequently, no subset document list 217 will exist.

The user may specify the following non-relative moves in
bookview state 219: to a named page within the present
book by means of GO TO PAGE key 337 or an equivalent menu
pick, to a different book by means of GET BOOK key 309 or
an equivalent menu pick, or to a location specified in an
embedded reference in the text currently being displayed
by means of GO TO REF key 315 or an equivalent menu pick.
An embedded reference is a reference to a location in
another document in the same book or a different book. In
bookview state 219, the user can specify a reference in
the text displayed on screen 105 and bookview state 219
will automatically go to the specified location if the
document is contained in a book on library list 205. The
book containing the referenced location becomes the
current book, and full document list 213 becomes the
current document list. If the book is on library list 205
but not on desk top list 211 for the project, the

-55-

professional research system will automatically add the

book to desk top list 211. Further, if the book is a

remote book and there is presently no connection to on

line data base 117, the professional research system will

automatically establish the connection. References also

appear in SEE ALSO pages provided by publishers for

certain documents. These references are of interest to

the reader but are not part of the text. By means of SEE

ALSO key 317 or an equivalent menu pick, the user can

command the professional research system to display the

SEE ALSO page for the document, and can then go to any of

the references on the page. Bookview state 219 also

provides a GOBACK function, activated by GOBACK key 307 or

an equivalent menu pick, which permits the user to return

to certain previously-displayed locations.

5.d.b. Bookview Screens: Fig. 13

When the user enters bookview state 219, a bookview screen

appears. Fig. 13 shows one such bookview screen, QUERY

screen 1301. This screen appears whenever a user has run

a query on the book being displayed. The following

features of QUERY screen 1301 are general to all bookview

screens which display text:

    Command bar 401 works the same way as it does
    in list screens.

    Title line 1302 contains book title 1303 of

SUBSTITUTE SHEET

-56-

the book from which text is being displayed
and document title 1311, which in this case is
the citation for the text being displayed. If
the book is an on-line book, title 1303 will
be preceded by a black ball and if the book is
search only or not searchable, book title 1303
is followed by SO and NS respectively.

Field 1305 gives the page of the book being
displayed.

Field 1313 gives the document page being
displayed and the total number of pages in the
document.

Screen 1301 is displaying the beginning of the document,

and consequently includes document header 1315, which

contains the document's full title.

In all bookview screens, the user can navigate within the

screen, from screen to screen, from document to document,

and from book to book. Additionally, the user can scan

from one occurrence of a text string to another. If the

current book is not a search only book, the user can

further navigate from page to page of the book, and if the

book is searchable, the user can navigate from one query

term 1317 to the next. In all cases but navigation by

book page name, the order in which documents are displayed

is determined by full document list 213 or subset document

list 217, depending on whether the user is in FULL or

SUBSET mode.

The following keys are used to navigate within a screen

and from screen to screen:

Direction keys 349 cause the displayed text to

scroll up, down, left, and right.

NEXT key 347 causes the next screen of text to
be displayed.

PREV key 345 causes the previous screen of
text to be displayed.

GO TO DOC key 329 and an equivalent menu pick are used to
navigate from document to document. When the user presses
the key, a prompt appears asking for a document
specification. The user provides the specification by
striking another key and hits EXEC key 348, and bookview
219 displays a screen of the specified document. The keys
which specify a document are NEXT key 347 and PREV key 349
and up and down direction keys 347. NEXT key 347 and PREV
key 349 respectively specify the beginning of the next or
previous document on the relevant document list. Up
direction key 347 specifies the first screen of the
current document and down direction key 347 displays the
last screen of the current document. GET BOOK key 309 and
an equivalent menu pick are used as previously described
to navigate from book to book. When GET BOOK is specified
in bookview state 219, the last location read in the book
is displayed.

SCAN key 321 and an equivalent menu pick are used to
navigate from one occurrence of a text string to the
next. When the user presses the key, a prompt appears
asking for the text string. The user supplies the text
string and presses EXEC key 348 or NEXT key 347, the
professional research system scans through the documents

-58-

on the current document list for the next occurrence of

the specified text string. When the next occurrence is

found, a screen bookview screen containing the occurrence

is displayed with the occurrence highlighted. To scan the

other direction, the user presses PREV key 345 instead of

NEXT key 347 or EXEC key 348. To stop scanning, the user

presses CANCEL key 341. In response, the prompt with the

text string appears and the user can either edit the text

string and resume the scan or again strike cancel key 341,

which ends the scan. When text is displayed during the

scan operation, only occurrences of the scan string are

highlighted. A particular advantage of SCAN mode is that

a user can scan a book for an item which interests him

without having to formulate a query.

GO TO PAGE key 337 and an equivalent menu pick are used to

navigate from page to page in books where that is

permitted. When the user presses the key, a prompt

requesting a page specification appears. The user

provides the specification and hits EXEC key 348, and the

specified page is displayed. The page specification can

specify the top or bottom of the current page, the

preceding or following page in the book, the first or last

page of the current document, a page within the current

document relative to the current page, and any page

within the current book. To specify the top or bottom of

the current page, the user employs up and down direction

keys 349 to specify the top and bottom lines of the

current page; to specify the previous or following page in

the book, the user employs PREV key 331 and NEXT key 333

respectively; to specify the first or last page of the

current document, the user employs the shift key together

with up and down direction keys 349; to specify a page

within the current document relative to the current page,

the user employs a number prefixed with + or - to indicate

the relative location;   To specify any page in the current

book, the user employs the book page name specified in

field 1305 and the desired page number. When bookview

state 219 is in subset mode and the next or previous page

is not in the current document, the new page is from the

next or previous document as determined by subset document

list 217; if the book page specified with the book page

name is not in one of the documents on subset document

list 217, bookview state 219 switches to full mode, and

field 1307 is changed accordingly.

5.d.c. Special Bookview Screens: Figs. 13-15

Aspects of QUERY screen 1301 specific to that type of

bookview screen include full/subset indicator 1307, which

indicates whether full document list 213 or subset

document list 217 is determining the sequence in which

bookview state 219 displays documents, query result

position indicator 1309, which indicates how many results

the query had in the book and which result of that number

-60-

is presently displayed, and query term 1317, which is a

term in the document which satisfies the query. As

suggested by the bold face type in Fig. 13, query term

1317 is highlighted in a preferred embodiment. The user

may navigate from one query term 1317 to the next by means

of PREV TERM key 331, NEXT TERM key 333, and equivalent

menu picks. PREV TERM key 331 takes the reader to

preceding occurrence of query term 1315 and NEXT TERM key

333 takes the reader to the following occurrence.

If no query has been run on the current book, the screen

shown in Fig. 14 is displayed on display 105. Header 1304

of no query screen 1403 has no full/subset indicator 1307

or result position indicator 1309. Moreover, no query

terms 1317 are highlighted. No query screen 1401 further

shows how document pages and the end of a document are

indicated in all bookview text screens. End of page

indicator 1403 indicates the end of a page of a document,

and end of document indicator 1405 indicates the end of

the document.

Figure 15, finally, shows the bookview screens which are

displayed in connection with the GOTO REF and SEE ALSO

functions. GO TO REF screen 1501 is displayed when the

user presses GO TO REF key 315 or makes an equivalent menu

pick. References 1505 to other documents which are

embedded in the text currently being displayed are

highlighted and the first of the references 1505 is

displayed in reverse video. Using direction keys 349 or

the space bar and the backspace key, the user can move the
reverse video backwards and forwards from one reference to
the next in the display. When the user has thus selected
the desired reference, he presses EXEC key 348 and the
professional research system displays the text in bookview
mode at the location specified in the reference. If the
reference is to another book, that book becomes the
current book.

The professional research system automatically performs
any actions necessary to make the book the current book in
the same fashion as described for GET BOOK key 309 and the
corresponding menu pick.

SEE ALSO screen 1507 is displayed when the user presses
SEE ALSO key 317 or makes an equivalent menu pick in
bookview state 219. The screen displays a see also page
which the book's publisher provides for the document and
which is visible only when see also key 317 is struck.
The page contains a list of see also references 1509 for
the document. The user selects one of these references in
the same fashion as he selects a reference on GOTO REF
screen 1501, the book specified in the reference becomes
the current book as described above, and the portion of
the reference relevant to the document to which the see
also page belongs is displayed.

5.d.e. Bookview Menus

As may be seen from Fig. 13, a user in bookview state 219

-62-

may select from Action, Search, Browse, Copy, and Misc

menus. The Action menu offers the following choices:

                    Action: Go to reference
                                     Display see also
                                     Scan book
                                     Go back
                                     Go to doc list
                                     Go to page
                                     Go to document
                                     Get book

With the exception of Go back and Go to doc list, these

menu selections correspond to function keys whose actions

have already been discussed in detail. The professional

research system responds to a selection of Go to doc list

and to the corresponding function key by performing a

transition to document list manager state 807.

When the user presses GO BACK function key 307 or selects

Go back from the Action menu, bookview state 219 displays

the previous bookview screen for which bookview

information was saved. Bookview information is simply the

information required by bookview state 219 to resume

displaying text at a specified location and to respond to

the function keys and menu picks in the same fashion as

when the text was originally displayed.

After bookview state 219 has restored a display in

response to GO BACK, but before it has made the restored

bookview information the current bookview information,

bookview state 219 provides a prompt which instructs the

user to press CANCEL key 341 if he wishes to undo the GO

BACK. If the user presses CANCEL key 341, he is returned

to the screen being displayed when he hit GO BACK; if he

presses any other key, bookview state 219 makes the

restored bookview information into the current bookview

information and continues displaying the restored screen.

In a preferred embodiment, bookview state 219 saves

bookview information each time the user performs a move

which is not relative to the location in the book

currently being displayed by bookview state 219. Such

non-relative moves in a preferred embodiment include

leaving bookview state 219, performing the GET BOOK

operation, or specifying a named page in the GO TO PAGE

operation. The professional research system maintains a

stack of records for up to 30 saves of bookview

information for a project, and by repeated use of GO BACK,

the user can work down the stack to restore any of the 30

displays.

The Search menu has the following selections:

      Search: Find WESTLAW doc
                        Clear query
                        Search book

When the user selects "Find WESTLAW doc", the
professional research system requests a short title
for a document in a book in the WESTLAW library of
remote books. When the user provides the title and
strikes EXEC key 348, the professional research
system responds in the same fashion as if the
specified document had been a reference selected by
the user after striking GOTO REF key 315.

When the user selects "Clear query", the professional
research system ceases highlighting query terms,
deletes subset document list 217, and returns to FULL
viewing mode. The selection of "Search book,

-64-

finally, causes a transition to query manager state
215. The Browse menu has the following selections:

       Browse: First document
                      Last document
                      Next page
                      Previous page
                      Top of page
                      Bottom of page
                      Next document
                      Previous document
                      Top of document
                      Bottom of document
                      Next query term
                      Previous query term

These selections have the same effect as the corresponding

function keys and navigation keys.

The Copy menu is the same as the one which appears when

COPY key 323 is struck. The user indicates by his

selection from the menu whether he wants to copy to a

printer connected to personal computer 101 or to notebook

229. The user employs the navigation techniques already

discussed to specify the portion of the current book he

wishes to copy. The specified portion is highlighted, and

when he strikes EXEC key 348, it is copied to the printer

or to notebook 229. When the copy is to notebook 229, the

professional research system includes a citation and a

copyright notice for the portion of text being copied and

gives the copied portion of text the same format as it has

when displayed in bookview state 219. On completion of the

copy, the professional research system performs a

transition to notebook manager state 231.

-65-

The Misc menu has the following selections:

Misc: Open notebook
                             Return to desktop
                             Exit
                             Switch to (SUBSET)(FULL)

Selection of one of these options has the same effect as
striking the corresponding function key or, in the case of
"Return to desktop", Cancel key 341.

As may be seen from the foregoing, a particular advantage
of bookview state 219 is the wide range of navigation
possibilities it offers the user. The user can view a
document without formulating a query, can read the
document sequentially, as he would in a book, can skip
from page to page, can move from document to document, can
move from one location which satisfies a query to the
next, can move from one occurrence of a text string to the
next, can immediately follow up on a reference, and can
immediately turn to another book. Moreover, it makes no
difference to the user whether the book is on optical disk
drive 111 or stored in on line data base 117. The user
thus has a flexibility which beyond what has heretofore
been available in document reading systems.

5.e. Detailed Description of Query Manager State 215:
       Figs. 16 and 17

Query manager state 215 is the state in which a user of

-66-

the professional research system formulates and executes a
query on the current book. When the query has been
executed, the query manager state constructs a subset
document list 217 containing the documents from the
current book which satisfy the terms of the query and
returns the user to bookview state 217. Bookview state
217 is in SUBSET mode and displays QUERY screen 1301 for
the first location in the first document of subset
document list 217 which satisfies the query.

Entry to query manager state 215 is by means of SEARCH
BOOK function key or the corresponding menu pick from desk
top list manager state 805 or bookview sate 219. As shown
in figure 16, on entry into query manager state 215, the
professional research system displays query formulating
screen 1601, upon which the user formulates a query. Like
other professional research system screens, screen 1601
has command bar 401. In the header, book name field 1603
displays the name of the current book; state identifier
field 1605 indicates that the user is searching a book,
and prompt field 1607 indicates that he is to enter the
query.

Using his keyboard, the user enters a query in query entry
window 1609. In the preferred embodiment, the user may
edit the entered query by moving the cursor to the desired
point in query entry window 1609 and performing editing
functions such as insertion, deletion, copying, or

overwriting. The query may be in any query language which
is interpretable by the professional research system. A
preferred embodiment employs the query language developed
by West Publishing Co. for its WESTLAW (TM) on-line legal
research system. That language and the manner in which it
is used in legal research are explained in detail in
<u>WESTLAW Reference Manual</u>, West Publishing Co., 1982, which
is hereby incorporated by reference into the present
application. When the user is satisfied with the query,
he strikes EXEC key 348 to execute the query and return to
bookview state 219. To return to the state from which he
entered query manager state 215 without executing the
query, the user strikes CANCEL key 341.

The menus from which the user may select on query
formulating screen 1601 are the following:

Action:	Show/remove assists Erase query Get book
Recall:	Last query in proj Last query in book All project queries
Misc:	Open Notebook Go to Desktop Go to Bookview Exit

When the user selects "Show/remove assists" in the
"Action" menu, assists window 1611 appears below query
entry window 1609. The window contains a short summary of
the WESTLAW query language. On selection of "Erase
query", the current contents of query entry window 1609

following the current cursor position are erased. "Get
book" and the function key of the same name, finally,
operate to make a book specified by the user the current
book while remaining in query manager state 215.

The "Recall" menu and RECALL key 319 permit the user to
retrieve a previously-used query and automatically insert
it at the current cursor position in query entry window
1609. On pressing RECALL key 319, a menu appears which
offers the same choices as the "Recall" menu. If the user
selects "last query in proj" and pushes EXEC 348, the last
query used in the project is recalled; if he selects "Last
query in book", the last query used in the book is
recalled.

If he selects "All project queries", the screen shown in
Fig. 17 appears. Query list screen 1701 is a list screen
like those previously described which lists all of the
queries executed for a project thus far. The columns in
the list include query text column 1703, containing text
for each query, book name column 1709, which indicates the
book's name and, by means of the black ball, whether it is
local or remote, and docs column 1705, which indicates the
number of documents in the book satisfying the query. The
user selects a query from the list as previously described
for list screens. In other embodiments, the "Recall" menu
may have a fourth entry permitting the user to select a
query from reference query list 227 provided by the

publisher in the same manner as from project query list

221. RECALL function key 319 and the "Recall" menu make

an important contribution to the ease of use of the

professional research system, since they permit the user

to formulate queries with a minimum of typing and to widen

or narrow a promising search by simply recalling the query

for the search and deleting terms from it or adding terms

to it.

The "Misc" menu, finally, provides for transitions to

other states. In response to "Open notebook", the

professional research system performs a transition to

notebook manager state 231; in response to "Go to

desktop", it performs a transition to desk top list

manager state 805; in response to "Go to Bookview", it

performs a transition to bookview state 219; in response

to "Exit" or EXIT key 339, it performs a transition to

entry state 201.

5f.   Detailed Description of Notebook Manager State 231:

        Fig. 18

Notebook manager state 231 manages notebooks 229. Each

project in the professional research system has a notebook

229, and users can read, write, edit, and print text from

notebook 229 in the same fashion as they can read, write,

edit, and print text using a word processing system. In

-70-

addition, as described in the discussion of bookview state
219, users can copy text from a document being displayed
in bookview 219 to notebook 229, and can edit the copied
text. In a preferred embodiment, notebook 229 is a word
processing document of the type used in the WP+ word
processing system manufactured by Wang Laboratories, Inc.
and notebook manager state 231 uses components of the WP+
word processing system to manipulate notebook 229. The
WP+ word processing system is described in U.S. Patent
4,633,430, Cooper, Control Structure for a Document
Processing System, issued 12/30/86, and incorporated
herein by reference.

Transition to notebook manager state 231 may occur from
any state other than entry state 201, utilities state 203,
project list manager state 801, and notebook manager state
231 itself. The transition is by means of NTBK/MOVE key
325 and equivalent menu selections and by means of a "Copy
to notebook" menu selection in bookview state 219. When
CANCEL key 341 terminates editing in notebook manager
state 231, the professional research system performs a
transition back to the state from which notebook manager
state 231 was entered.

Figure 18 shows notebook screen 1801 which is displayed
when a user enters notebook manager state 231. Like other
professional research system screens, notebook manager
screen 1801 has a command bar 401. Following the command

bar in the header are project name 1803, notebook manager
state indicator 1805, notebook position indicator 1807,
and format line 1809, indicating the display format of
that portion of the notebook. The remainder of the screen
is occupied by notebook text 1811. Page marker 1813
indicates where a page of notebook text 1811 ends. In a
preferred embodiment, the user may manipulate notebook
text 1811 by using the keyboard and function keys in the
same manner as described in WP Plus Release 2 Reference
Guide, 2nd edition, Wang Laboratories, Inc., 1986 which is
incorporated herein by reference.

The menus available in notebook manager state 231 are the
following:

        Copy   To printer
                        To WP document
                        To text file
                        To WITA

        Misc   Erase notebook
                        Exit

In the "Copy" menu, the text to be copied is selected as
described above for "Copy to notebook". "To printer" is
self-explanatory; "To WP Document" copies the selected
text to a WP+ document outside the professional research
system; "To text file" converts the selected text to the
form required for a MSDOS text file and copies the
converted text to such a file; "To WITA converts the
selected text to the form required for the Wang
Information Transfer Architecture, an intermediate
document structure used in Wang Laboratories, Inc.
systems.

SUBSTITUTE SHEET

-72-

In the Misc menu, the professional research system responds to the selection of "Exit" or the corresponding function key by performing a transition to entry state 201 and to selection of "Erase notebook" by deleting the entire contents of notebook 229. Before doing so, the professional research system presents the user with a dialog box warning him of the consequences and requesting confirmation.

As can be seen from the foregoing, notebook manager 231 is fully integrated into the professional management system and notebook 229 is accessible from any state the user enters after he has chosen a product. In addition, the user can do the same things with notebook 229 as he can with a word processing document. These facts taken together make the professional research system particularly useful for researchers whose job is to not only find material, but also to analyse it, to comment on it, and to use it to prepare new documents.

6.   Details of the Implementation of the Professional Research System in a Preferred Embodiment: Figs. 19-25

The detailed description of the preferred embodiment of the professional research system now turns to certain characteristic details of the implementation of the

preferred embodiment. The discussion will begin with the
overall structure of the professional research system
software, will continue with a discussion of the
information formats used in the optical disk, and will
conclude with a discussion of the implementation of lists
in a preferred embodiment.

6.a. Structure of Professional Research System Software:
        Figs. 19 and 20

The software for the professional research system is made
up of a large set of routines. One routine may invoke
another and may provide information to and receive
information from the invoked routine. The following will
first describe the high-level structure of the
professional research system software and its
correspondence to the system's states and will then
describe the structure of the list management software as
an example of the low-level structure of the professional
research system.

Figure 19 shows the top-level structure of the
professional research system. The circles in the figure
indicate routines, and an arrow pointing from one routine
to another indicates that the routine which is the source
of the arrow invokes the routine which is the destination
of the arrow. The top-level structure consists of a

switch routine (SW) 1901 and routines which correspond to
each of the states as follows:

Routine Name	State
Entry routine (ER) 1903	Entry 201
Utility routine (UR) 1905	Utility 203
Project list routine (PLR) 1907	Project List 801
Desk top list routine (DTLR) 1909	Desk Top List 805
Library list routine (LLR) 1911	Library List 803
Document list routine (DLR) 1913	Document list 807
Bookview routine (BVR) 1915	Bookview 219
Query routine (QR) 1917	Query 215
Notebook routine (NR) 1919	Notebook 231

Each of the routines which corresponds to a state further
invokes lower-level routines 1921.

Operation of the top level structure is as follows: when
a user enters the professional research system, he enters
switch routine 1901, which operates as an endless loop to
switch the professional research system from one state to
another until the user exits the system. Each time the
user specifies a state change, the routine corresponding
to the state he is presently in returns control to switch
1901 and at the same time provides switch 1901 with the
information it needs to invoke the routine corresponding
to the new state specified by the user. For example, on
entry from MSDOS, switch 1901 invokes entry routine 1903;

if the user selects utility state 203, entry routine 1903

provides switch 1901 with that information and returns to

switch 1901, which then invokes utility routine 1905.

When the user is finished in utility state 203, utility

routine 1905 returns information to switch 1901 which

causes switch 1901 to invoke entry routine 1905. If the

user then selects project list manager state 801, entry

routine 1905 returns that information to switch 1901,

which invokes project list routine 1907. Other state

transitions are managed in the same fashion.

The routines corresponding to the states also operate as

infinite loops: as long as the user input specifies an

action within the state, the state routine performs the

action and waits for the next input. However, if the user

input specifies a state transition, the state routine

returns to switch 1901. While operating, each state

routine invokes a large number of lower level routines

1921 to perform the functions of the state. Figure 20

provides an example of the structure of these lower level

routines. Shown in figure 20 is the structure of the

lower level routines 1921 for document list manager state

805. The same structure is employed for the other list

states PLM 801, LLM 803, and DLM 807 and in query manager

state 215 to manage the query lists. Structures for other

states will be generally similar to those for the list

states, but will differ as required for the functions of

the other states.

-76-

In figure 20, each circle represents one or more routines
at a given level of the structure. There are four
levels: specific list function level 2001 contains the
routines which carry out the specific functions of desk
top list manager 805; in order to carry out these
functions, the routines at level 2001 invoke routines at
generic list function level 2003. These routines, which
are used by routines at level 2001 for all of the list
states, fall into three groups: list display functions
2011 perform the functions necessary to display list
screens. List utilities functions 2013 are functions that
are used not only by list states, but also by states such
as query manager 215 which require information about a
list. For example, query manager 215 uses functions from
LUF 2013 to determine the current query for the current
book. List manager manager functions 2015 perform the
actual functions specified by a user in making a selection
from the list. In many cases, of course, the function
will involve a state transition, and consequently a return
to document table list routine 1909 and switch 1901.

List display functions 2011 and list utility functions
2013 invoke routines at the next level, system library
level 2005. These routines are routines which belong to
libraries of high-level system primitives provided by Wang
Laboratories, Inc. MENU functions (MENUF) 2017 is a set
of routines for displaying menus and returning user input
provided in response to the displays; system library
functions 2019 provide memory and high-level file

management functions. List manager functions 2015 invokes
routines at system primitive level 2007. The routines at
this level deal with the media upon which information is
stored: optical disk functions 2021 read reference
information employed on lists from the optical disk in
optical disk drive 111; remote functions 2025 do the same
with regard to reference information obtained from on-line
data base 117; file functions 2025 read and write the CBAM
files in which the lists are stored in magnetic disk drive
109.

6.b. Overview of Optical Disks for the Professional
     Research System: Fig. 21

The optical disks used in optical disk drive 111 are
standard CD-ROM disks employing the High Sierra format.
The layout of the information on the CD-ROM disks used in
the professional research system is shown in overview in
Figure 21. In that Figure, optical disk 2101 is
represented as a column of data, beginning ag the center
of optical disk 2101 and ending at the outer edge. The
column is logically divided into 328,500 logical blocks
(LB) 2103, each one of which contains 2048 bytes. In the
professional research system, the logical blocks are used
in a directory system permitting location of files on
optical disk 2101 and in the files themselves.

The components of the directory system are volume

-78-

descriptor 2105, path table 2107, alternate path table
2121, and directories 2109. Volume descriptor 2105
contains information about the volume of information
contained on optical disk 2101. Among other things, the
information uniquely identifies the volume by means of a
unique volume set number and a volume number specifying
the volumne's position in the set, the location and size
of path table 2107 and alternate path table 2121, the
location of the root directory in directories 2109, unique
identifiers for the volume set the volume belongs to, the
publisher, the data preparer for the volume, the
application the volume is intended for, time of volume
creation, and if required, the time at which the volume
was last modified, the time at which it expires, and the
time at which it becomes effective.

Each file on optical disk 2101 belongs to a named
directory. A given directory may contain files and/or
other directories. If a directory contains other
directories, that directory is the parent of the
directories it contains. Path table 2107 contains a table
entry for each directory on optical disk 2101. The
information in the entry includes the directory name and
permits location of the named directory in directories
2109 and location of the entry for the directory's parent
in path table 2107. Alternate path table 2121 is a copy
of path table 2107 which provides access to the
directories in case the portion of optical disk 2101
containing path table 2107 is damaged.

Directories 2109 contains a file for each directory on optical disk 2101. The file for a given directory contains a directory entry for each file or directory belonging to the given directory. The information in the directory entry for a file includes the location of the file on optical disk 2101, the time and date of creation of the file, the type of the file, the file's number in the set of files in the set of volumes to which optical disk 2101 belongs, and the name of the file.

Search files 2111 contain the information which query manager 215 uses to carry out queries on the books contained in optical disk 2101. Search files 2111 thus represent an embodiment of reference search information 223 in optical disks. As previously indicated, remote books or books stored on magnetic disk drive 109 may have other forms of reference search information 223. In a preferred embodiment, each book on optical disk 2101 has a set of search files. Search files for every book include a dictionary of the words in the book, an index specifying the locations of each word in the dictionary in the book, and a character control file which contains character translation tables for translating the character codes used in the book to the character codes used in the professional research system. Using the dictionary file and the index file, query manager 215 can determine the location in the book being searched of every occurrence of the set of query terms defined on query formulating screen

SUBSTITUTE SHEET

1601 for the query. Query manager 215 places the
locations in buffers in memory 102 of professional
computer 101 which are accessible to bookview 219.
Bookview 219 then uses the locations in the buffers to
locate and display the portions of the book's text which
contain the query terms.

The search files for a book may additionally include a
query field menu file and a query field definition file.
The query field menu file contains the list of query field
names which appears in the FIELDS portion of assists
window 1611 in query formulating screen 1601. The query
field definition file contains an entry for each of the
query field names. The entry for the name contains the
components of the actual query which is used to find the
information specified by the query field name.

View files 2113 contain the files used by bookview 219 to
display the text, those used by document list manager 807
to make document lists 213 and 217, and those used by
query manager 215 to make published query list 220. Each
book on the optical disk has its own set of view files
2113. View files 2113 thus represent the embodiment for
books on optical disks of reference text 225, reference
document list 208, and reference query list 227. A
detailed discussion of view files 2113 will follow the
present overview of optical disk 2101.

Abstract file 2115 contains the text for the abstract of

the contents of the volume which appears on screen 703 of

utilities 203 when the optical disk containing the volume

is installed on optical disk drive 111. Copyright file

2117 contains the copyright notice for the entire optical

disk 2101.

Install file 2119 is the embodiment on optical disk 2101

of reference library list 233. It contains the

information about the books contained in optical disk 2101

which is entered in library list 205 for the professional

research system and desk top list 211 for each project.

Install file 2119 is discussed in detail below.

6.c Install File 2119 Detail

Install file 2119 contains information about the volume

contained on optical disk 2101 and each of the books in

the volume. In a preferred embodiment of install file

2119, the following information is included for the

volume:

      The name used for the volume set in mount requests

      A description of the volume

      A count of the number of disks in the volume set

      A count of the number of books in the volume.

      An install message which appears on display 105
      when installation of the volume is complete.

The remainder of install file 2119 is a set of records for

-82-

each book in the volume. The record for a book includes

the following information:

The type of the book, for example, whether it
is a new or replacement book

The volume set id and volume id for the
book. This information is used by GET BOOK
to request the user to mount the disk
containing the book when the disk is not
presently in optical disk drive 111.

Identifiers for the book and its publisher.
When the book identifier is concatenated with
the volume and volume set identifier, the
result is a unique book identifier.

A short book name, used in GET BOOK and in
screens displaying document lists from the
book, and a long book name.

A description of the book

The name of the publisher and the date of
publication

Information needed by query manager 215 to
correctly interpret the book's search files
2111.

The names of search files 2111 and view files
2113 for the book.

The number of alternate orders in which the
book's document list may be displayed.

For each alternate order, the names of the
files in view files 2113 which specify the
alternate order.

When an optical disk is first used in a professional

research system, all of the information from the install

file regarding each book on the optical disk is copied

into the book's entry in library list 205. The

professional research system can then use the information

not only to produce a display in library list manager

state 803 showing the book's title, publisher,

description, and so on, but also to determine what disk a

book is on, to determine how to set up query manager 215

to perform queries on the book, and to determine the

locations of the files needed to search the book, display

it, and make the book's document list. When a user of the

professional research system adds a book to his project's

desk top list 211, desk top list manager 805 copies the

volume set name, the book name, the book description, the

publisher, and the book identifier into the desk top list

entry for the book.

6.d Detailed Description of View Files 2113: Fig. 22

As mentioned above, view files 2113 are the files used by

bookview 219 to display text and by query manager 213 and

document list manager 807 to make full document list 213,

subset document list 217, and published query list 220. .

View files 2213 thus correspond to reference query list

227, reference document list 208, and reference text 225.

Figure 22 shows the structure of view files 2113. Each

book on optical disk 2101 has a set of book view files

2201 in view files 2113. In overview, the set of book

view files consists of the following:

       View attribute file 2203 contains formatting
       information for document lists 213 and 217.

       Published query pointers 2205 and published
       query list 2207 together contain published

-84-

query information 2208, the information
required to construct PUBQL 220.

Page name file 2209 contains a three-level
index by page name to each page in the book.
The professional research system uses page
name file 2209 to locate pages when the user
presses GOTO PAGE key 337 or selects Go to
page in the BROWSE menu and specifies a page
name.

Prim-alt map 2211 and alternate order 2213
together contain alternate order information
2215 for one alternate order of full document
list 213 and subset document list 217. There
is a set of alternate order information 2215
for each of the possible alternate orders.

Primary order file 2217 indicates the order in
which the documents are to appear in the
document lists when no alternate order is
specified.

Document ID file 2219 permits access to the
data in a document's document list entry by
the document's ID number. The professional
research system uses the file to construct
subset document list 217.

Document list data 2221 contains the actual
data for the document list.

Documents file 2223 contains the text of the
documents in the book.

Published query files 2208 and alternate order files 2215

may not exist for every book. In the following, the files

used to generate full document list 213 ,i.e., document

list data file 2221, view attribute file 2203, the files

belonging to alternate order information 2215, and

documents file 2223 will be explored in more detail.

6.e. Files used to Generate Full Document List 213

In a preferred embodiment, the contents and display format

SUBSTITUTE SHEET

of the document list for a book are determined by the book's publisher. Document list data file 2221 contains the contents of the document list. The file is organized as a set of records, one record for each document. Each record contains a fixed number of fields of varying length. The only fields which must be in the record are a field which specifies the index of the record for the document text in documents file 2223 for the book, and fields which specify how the name of the document is to appear in the document list, on the bookview screen, and when text is copied from the document to notebook 229, and a field which specifies the location of the document's text in documents file 2223 and the length of the document. Some of the fields contain information which is always displayed in the document list entry for a document; others contain information which is displayed in an expanded document list entries. In some embodiments, users will be able to specify display of expanded document list entries by means of a selection from the menu provided with document list screen 1201. In others, a function key may be provided for this purpose.

The manner in which the records of document list data file 2221 are to be interpreted by document list manager 807 is determined by view attribute file 2203. The information in that file includes the following:

A count of the number of fields in the records
of document list data file file 2221.

SUBSTITUTE SHEET

A count of the number of documents in the book

The names of primary order file 2217 and any
alternate order files 2215.

Copyright notices for display when a book is
opened and for outputting when a portion of
the book is printed or copied to notebook 229
or some other location.

A count of how many fields in the record of
doc list data file 2221 are always to be
displayed.

A specification for each field which is always
displayed of how the field is to appear and
which field in the document list data file
record for the book contains the field's data.

A count of how many fields in the record are
to be additionally displayed when an expanded
display is specified.

A specification for each field which is to be
additionally displayed of how the field is to
appear and which field in the document list
data file record for the book contains the
field's data.

Specifications of which fields in the document
list data file record indicate the location
and length of the text in the documents file,
contain the index of the record containing the
document's text in documents file 2223, and
contain the forms of the document name
required for the document list, bookview
screens, and the non-page number part of the
citation which is provided when a portion of
the document is copied to notebook 229.

Primary order file 2217 is simply a list in the order in

which the document text is stored in documents file 2223

for the book of the locations of the records for the

entries in document list data file 2221. Alternate order

file 2213 for each alternate order is the same kind of

list, except that the list is in the alternate order.

Primary to alternate order map file 2211 for each

alternate order maps the primary order onto the alternate

order. The file consists of one record for each position

in the document list, the positions being taken in order
from first to last. The content of the record is a number
which specifies the position in the primary order and in
documents file 2223 of the document which occupies the
position represented by the record in the alternate
order. For example, if there are 50 documents in the book
and the alternate order is the reverse of the primary
order, the first record in primary to alternate order map
file 2211 would have the value 50, the next would have the
value 49, and so forth.

When a user selects a book to be the current book, either
by selecting it from desk top list 211 or by specifying it
using GET BOOK function key 309 or the equivalent menu
selection in document list manager state 807, query
manager state 215, or bookview state 219, the professional
research system employs the information in document list
data file 2221, view attribute file 2203, and primary
order file 2217 to construct full document list 213.
The contents of each entry in the document list comes from
document list data file 2221, the manner in which the
records are formatted is determined by view attribute file
2203, and the order of the entries in the file is
determined by primary order file 2217.

As previously explained, a user can reorder the document
list into one of the alternate orders by selecting
"reorder list" from the menu on document list screen

1201. At that point, a pop-up menu appears with a list of the alternate orders. When the user makes a selection from the menu and strikes EXEC key 348, document list manager 807 retrieves records from document data list file 2221 in the order specified by alternate order file 2213 for the given order and generates full document list 213 as previously described. In addition to making the proper document list, document list manager 807 makes a list of the indexes to the documents in the documents file which has the same order as the document list. When bookview 219 is operating in full mode, it uses the list to determine the sequence in which text is retrieved from the documents file for the book during sequential viewing operations.

Generation of subset document list 217 proceeds as follows: when query manager 215 executes a query, it produces a list of indexes into the documents file for the documents which satisfy the query terms. Query manager 215 then provides the list of indexes to document list manager 217, which uses it to generate subset document list 217. If the full document list is in primary order, document list manager 217 simply takes each index on the list of indexes, uses it to locate the record for the indexed document in primary order file 2217, uses that record to locate the record containing the data for the document in document list data file 2221, and uses view attribute file 2203 to generate the document list entry.

If the full document list is in an alternate order,
document list manager 217 uses primary-alternate map to
reorder the list of indexes in the alternate order and
then proceeds as just described.

6.f.   Detail of Documents File 2223: Figs. 23 and 24

Documents file 2223 for a book contains the text of all
the documents in the book. Figure 23 presents an overview
of that file. Documents file 2223 has one document entry
2301 for each document in the book. Each document entry
2301 has three major parts: target table 2303, page table
2313, and document text 2327.

Target table 2303 provides a means of establishing a
relationship between logical identifiers of locations in
the document text and the physical locations. By this
means, logical identifiers may remain constant through
various editions of the book and the portions of the
professional research system which use the logical
identifiers will work with any edition of the book. In a
preferred embodiment, a location identified by a logical
identifier is termed a target. Target count field 2307
gives the number of targets in the document; for each
target, there is a target entry 2305, which contains
target name 2309, the logical identifier for the target,
and word number 2311, which specifies the location
corresponding to the target identifier in the current

document. An example of target use is to specify
locations in the document referred to by embedded
references in other documents.

Page table 2313 establishes a relationship between the
actual pages of the document, the names of the pages, and
the word numbers for the words on the pages. Last word
number 2317 is the number of the last word in the
document; page name length 2319 is the length of the page
name, and page count 2321 is the number of pages in the
document. There is a page entry 2313 for each page of the
document and the index of page entry 2313 in the array of
page entries corresponds to the number of the page to
which it corresponds. Page entry 2323 has two fields:
first word on page field 2323, which is the number in the
document of the first word on the page, and page name
field 2325, which is the name of the page. Thus, if the
number of a page in a document is known, its page entry
2315 can be located and the name of the page and the
number of the first word on the page can be determined.
The number of the first word can in turn be used to
determine whether the target specified by a given target
entry is on a given page.

Document text 2327 is represented in a preferred
embodiment by the document structure shown in Fig. 24.
The document structure is closely related to the document
structure used in the WP+ document processing system

developed by Wang Laboratories, Inc. The document

structure is made up of blocks 2405, each one of which has

a number. The blocks form three classes of items in the

document: document header 2401, document indexes 2407,

and document components 2409. Document components 2409

are made up of chains of one or more text blocks 2425.

Blocks in a chain are connected by forward and backward

pointers, permitting movement along the chain in either

direction. Each text block 2425 has a text portion (T)

2419, containing character codes representing the text

characters, and an attribute portion (A) 2421 which

contains attributes which indicate how the text is to be

displayed or indicate a reference number for information

which applies at a given location in text portion 2419.

Document header 2401 contains index table 2403, which

includes a pointer to the first block 2405 in each of the

document indexes 2407. In document text 2327, there are

two such indexes: page index 2411, by means of which a

given page of the document may be located, and reference

index 2415, by means of which components of the document

referred to in the document text may be located.

Depending on the size of the index, the index may contain

more than one block and may have more than one level. A

leaf node in page index 2411 contains page index entries

2413. Each page index entry 2413 relates a page number in

the document to the number of the first block 2405 in the

page. A leaf node in reference index 2415 contains

-92-

reference index entries 2417, which relate reference
numbers to the number of the first text block 2425 in the
chain containing the information represented by the
reference number. The entire text of the document is
represented by a single text chain 2427. Each page of the
document begins with a new text block 2425, and page index
entry 2413 for that page contains the number of the first
text block 2425 in the page.

As previously pointed out, notebook 229 is a WP+ document,
and consequently has a structure like that of the document
text. When the user performs the COPY TO NOTEBOOK
operation, the text contained in the portion of text chain
2427 specified in the copy operation, together with a
citation and a copyright notice, are copied to a chain of
text blocks 2425 which are appended to the end of the
equivalent of text chain 2427 in notebook 229. Chains
referred to by references, such as ER INFO 2433 for an
embedded reference, or See Also page 2423, are not
copied. The user can then perform editing operations on
the text chain in notebook 229.

As previously pointed out, the text of a document may
contain embedded references. When a user of the
professional research system employs GOTO REF key 315 to
select a reference and then presses execute, the
professional research system displays the location
specified in the selected embedded reference. Embedded

references are implemented in a preferred embodiment as
follows: When a text block 2425 in text chain 2427
contains an embedded reference (ER) 2429 in text portion
2419, attribute portion 2421 contains a reference number
for embedded reference 2429 at a location in attribute
portion 2421 corresponding to the location of embedded
reference 2429 in text portion 2419. There is a reference
index entry 2417 for reference number 2431 in reference
index 2425, and reference index entry 2417 contains the
first text block 2425 of the chain containing embedded
reference information 2433. In a preferred embodiment, ER
INFO 2433 contains from one to four descriptions of
locations of the text referred to in embedded reference
2429. The use of multiple location descriptions permits
the professional reference system to deal with problems
arising from the fact that the same document may be
contained in several different books and will also be
available in on line data base 117.

There are three kinds of location information: local
location information, which is employed when the embedded
reference is to a location in another document in the same
book, other book location information, which is employed
when the embedded reference is to a location in a document
in another book, and on-line location information, which
is employed when the embedded reference is to a location
in on-line data base 117. Local location information
consists of the following:

The identification number of the document

The target name for the location.

In this case, the professional research system uses the
document identification number to locate document entry
2301 for the document in documents file 2223, uses the
target name to locate target entry 2305 for the target,
uses word number 2311 to determine the word location of
the reference, and uses page entry 2315 to locate the
document page containing the reference. The document
becomes the new current document and bookview 219 displays
the specified page.

When the location information specifies a document in
another book, the information further includes a unique
identifier for the book containing the document and the
publisher's identifier for the book. In this case, the
professional research system uses the book and publisher's
identifiers to look for the book. The search begins with
desk top list 211, and if the book is not there, continues
with library list 205. If the book is on library list 205
but not mounted, the professional research system asks the
user to mount the disk containing the book. If the book
is available, it becomes the current book. When the
location information is on-line location information, it
further includes an on-line identifier instead of the
publisher's ID and the book ID. In this case, the
professional research system establishes a connection via

com link 115 with on line data base 117 and retrieves the
text at the specified location. Again, the on-line book
becomes the current book.

If the embedded reference is to a document in the same
book as the document containing the embedded reference, ER
INFO 2433 will contain only the local reference
information; if the embedded reference is to a document in
another book, ER INFO 2433 will contain one to three other
book location descriptions for books containing the
referenced document, and an on-line location description,
for use when none of the books are on library list 205.
The professional research system always attempts to find
the reference in a book locally available to the
professional research system before retrieving it from
on-line data base 117. In some cases, of course, the
referenced material is available only in on line data base
117, and in that case, ER INFO 2433 will contain only
on-line location information.

In a preferred embodiment, the see also page is
implemented as information located by means of a reference
number and reference index 2415. The reference number for
the see also page is contained in attribute part 2421 of
the first text block 2425 in text chain 2427 for the
document. When a user presses see also key 317 or makes
the equivalent menu selection, the professional research
system uses the reference number to locate the chain of

text blocks 2423 for the see also page. These text blocks

2423 contain the text of the see also page and also

contain reference numbers for ER INFO chains 2433 for the

embedded references listed in see also page 2423. The

reference numbers and ER INFO chains (not shown) are

similar to those just described.

6.g. Detail of User Lists 235: Fig. 25

As previously mentioned, user lists 235 other than full

document list 213, subset document list 217, and published

query list 220 are stored in CBAM files. In a preferred

embodiment, CBAM files are made up of U elements, each of

which has two parts: a key, which is unique to the

element in the file, may contain from 1 to 127 bytes, and

is used by the CBAM file system to retrieve the U element,

and a data part, which may contain 0 to 255 bytes of

data. Each U element in a list has a field in the key

which identifies the list the element belongs to. The

lists in the preferred embodiment employ 3 kinds of U

elements: data elements, mapping elements, and inverted

elements. Another field in the key indicates which kind a

given U element is.

The data elements contain the data for a list. There is

one data element for each field of a list entry. The key

portion of each data element has a record serial number

which uniquely identifies the entry in the list to which

the data element belongs and a field identifier which
indicates the field in the entry which the data in the
data element belongs to. The list specifier, the element
type, the record serial number, and the field specifier
together make up the data element's key. The mapping
elements map entry sequence numbers to record serial
numbers. When a list manager displays a list, it displays
the list entries according to their order in the mapping
element. The mapping thus permits rearrangement of the
order in which the entries in a list are displayed by a
list manager without any change in the keys of the data
elements and also permits a list to be treated as a data
structure such as a stack. In a preferred embodiment,
when an entry is added to or deleted from a user list, the
mapping element is altered so that the display of the list
is reordered to take into account the addition or
deletion.

Each inverted element is an element in an inverted list,
i.e., a list which maps values of fields onto the record
serial number for the list entry which contains that
value. For example, in a preferred embodiment, one such
inverted list in library list 205 maps a book's short
title onto the record serial number for the book's entry
in library list 205. The key for the inverted element
contains the field identifier for the field and a value
for the field which may be up to 124 bytes long. The data
is the record serial number for the list entry containing
the field value in the key.

In a preferred embodiment, the system user lists, namely
library list 205, project list 209, and an internal volume
list, are each contained in a separate CBAM file. The
per-project user lists, namely desk top list 211 and
project query list 221, for each project are contained in
a single CBAM file for that project. Each list begins
with a special element having record serial number 0 which
contains internal data used by the relevant list manager
to manage the list. In the following, the information
contained in project list 209, library list 205, desk top
list 211, and project query list will be described in
detail. In each of these lists, some information is
always displayed, other information is displayed only if
the user requests an expanded list, and some information
is never displayed.

Each entry in project list 209 contains fields for the
project name and description provided by the user when the
project is created and fields for the project's creation
date and time, the date and time of last access to the
project, the project's author, the amount of time spent
working on the project using PRS, the name of the CBAM
file which contains the project's lists, and an identifier
for the project. Internal data for project list 209
includes the total number of entries on the list, the
project ID for the project presently being worked on, and
an ID for the next project to be created.

Each entry in library list 205 for a book on an optical

disk includes the information about the book from install file 2119 for the volume and the date and time at which the book was installed in the professional research system. Inverted lists permit location of entries in library list 205 by the book's unique ID and by the book's short name. The former inverted list is used to locate a book specified in embedded reference information 2433 for an embedded reference and the latter is used to locate a book specified in connection with the GET BOOK operation. The list's internal data specifies the number of items in the list. The entries in the internal volume list contain information from install file 2119 for each volume about the volumes to which the books in library list 205 belong. The information includes the volume set's unique identifier, a description of the volume set, the number of books in the set, and the number of disks in the set.

The per-project lists are shown in Figure 25. Desk top list 211 contains an entry (DTLE) 2511 for each book presently being used in a project. Each entry in a preferred embodiment includes the following information:

The book's name, unique ID, volume set name, date of publication, date of installation, and record serial numbers and field identifiers for the fields in the entry for the book in library list 205 which contain the description of the book and the publisher's name.

an identifier for the entry in the project query list which has the last query used for the book.

Whether the book is local or on-line, and if it is local, the kind of media.

-100-

Whether the book has a reference query list
227.

Information about the last document accessed
in the book including the identifier for the
document, whether it is being viewed in full
or subset mode, and the number of the first
word in the last screen viewed, and whether
there is a query active for the book.

Information for generating the document lists
including a value indicating which of the
possible orders is being used for generation
of the document lists and the total number of
entries in full document list 213 and subset
document list 217.

If the book is an on-line book and is the
current book, the current on line document ID
and information identifying the communications
session by which the book is being accessed,
any query result, and the number of results
for the query.

The internal data includes the total number of entries in

the list and the unique book ID for the current book.

Inverted lists (DTLILS) 2509 include a list permitting

location of entries by unique book ID and one permitting

location by short book title. These inverted lists are

used to resolve embedded references and to perform the GET

BOOK operation as described for library list 205. Desk

top list mapping element (DTLME) 2503 determines the order

in which DTLEs 2511 are displayed.

As can be seen from the above, DTLE 2511 for each book

contains the information required by bookview 219 to

restore the display, any active query, and the document

lists to the condition they were in the last time a user

working on the project used the book. Such restoration

occurs when the user resumes working on a project, selects

a different book from desk top list 211, performs a GET
BOOK operation, or performs a GO TO REFERENCE operation
where the embedded reference is to a location in a
different book. When the user resumes working on a
project, the professional research system uses the unique
book identifier for the current book to determine which
DTLE 2511 contains the information bookview 219 requires
to restore the display; in the GET BOOK operation, the
professional research system uses the short book name to
locate the proper DTLE; in the GO TO REF operation, the
professional research system uses the unique book ID
contained in embedded reference information 2433 to locate
the book.

Current information such as the identification for the
entry for the current query in the project query list, the
document currently being read and the current position in
the document, and the state of the document lists are
saved whenever a user ceases working on a project while
the book represented by DTLE 2511 is the current book or
the user performs an action which results in a different
book becoming the current book. Examples of such actions
are selection of a new book from DTL 211, execution of a
GET BOOK operation, and execution of a GO TO REF operation
in which the embedded reference refers to a different
book.

Project query list 211 is a list of entries 2515 for all

of the queries executed by query manager 215 for a

project. Each time query manager 215 executes a query, it

adds the query to project query list 211. Information in

an entry includes the text of the query, the number of

documents in which terms satisfying the query were found,

the name of the book, and the date the query was last

executed. The internal data includes the total number of

entries in the list, which is also the record serial

number for the last entry in the list. Mapping element

(PQLME) 2513 for the list organizes the list so that it is

displayed chronologically, with the most recent query

(MRPQLE 2517) first. As previously mentioned, the user

can display project query list 221 by selecting that

option when he strikes RECALL key 319 or selects the

Recall menu in query manager state 215.

6.h. Other Types of User Lists

Other embodiments of the professional research system may

employ additional user lists. One example of such a user

list is a bookmark list displayed by bookview 219. In the

professional research system, a bookmark is an association

between a user-defined name and a page in a book. Some

embodiments of the professional research system permit the

user to establish a list of bookmarks for any book on the

desk top list. Such a list appears in Fig. 25 as bookmark

list 2521. A bookmark list entry (BMLE) 2525 is made by

means of a menu in bookview state 219. When "Make

bookmark" is selected, a fill-in field appears for the

bookmark name. When the user fills in the field and

strikes EXEC key 348, an entry is established in the

bookmark list for the book which relates the name provided

by the user to the page being displayed by bookview state

219. Information in each entry for a bookmark list

includes the bookmark name, a description of the book, the

book's name, the book's author, the book's publisher, the

page referred to by the bookmark, the name and identifier

for the document, the identifier for the book, and the

creation date of the bookmark. Bookmark list mapping

element 2523 specifies an order such as alphabetically by

bookmark name for the display of bookmark list 2521.

If there is a bookmark list for a book, information in the

desk top list entry for a book will indicate whether there

is a bookmark list for the book, and the display of the

entry will also indicate whether there is such a list. By

selecting the entry for the book and selecting a "Display

bookmark list" option from the menu, a user can cause

desktop list manager 805 to display the bookmark list for

the book. A user may also be permitted to select "Display

bookmark list" from a menu in bookview and see the

bookmark list for the current book. In the display of the

bookmark list, each list entry includes the bookmark name,

the name of the document, and the page of the book. The

expanded display for the list might include a display for

each book of a description of the book, the book's author

and publisher, and the date of creation of the bookmark.

When the user selects an entry in the bookmark list and

strikes EXEC key 348, the book to which the bookmark list

belongs is located and the page specified in the bookmark

is displayed by bookview 219 in the manner described for

location and display of an embedded reference. When a

bookmark list is being displayed, menu choices permit

modification of a bookmark name and deletion of a bookmark

entry. Additionally, a user may employ the bookmark name

in the GET BOOK operation. In that case, the professional

research system responds to the GET BOOK function key or

menu selection by making the book the bookmark is for the

current book and displaying the location in the book

specified in the bookmark.

Other embodiments may further include a project saved

query list, (not shown) consisting of query texts which a

user of the professional research system has specifically

named and saved while working on the project. Contents of

a saved query list entry include the query name, the query

text, the name of the book it is to be used on, a

description of the query, the query's author, the project

name, the date it was saved, and the date it was last

used. Users can retrieve a saved query text by name from

the saved query list and use it in the same manner in

which they employ texts from published query list 220 or

project query list 221.

6.i. Implementation of GOBACK: Fig. 25

As mentioned in the discussion of bookview state 219, when

the professional research system is in bookview state 219,

a user may return to the last position in a document from

which he made a move which was not relative to his present

position in the book by striking GO BACK key 307 or

making a corresponding selection from the menu displayed

in bookview state 219. In a preferred embodiment, GO BACK

is implemented by means of go back list 2527 in the CBAM

file containing the project lists. The GO BACK list is a

stack 2531 (LIFO) of bookview information saved for each

of the last 30 non-relative moves in bookview state 219.

Each time a non-relative move occurs, a GO BACK list entry

is pushed onto the GO BACK list. In a preferred

embodiment, non-relative moves include the following:

> Exiting from bookview state 219 to another
> state.
>
> Performing a GO TO PAGE operation which
> specifies a named page.
>
> Successfully performing a GO TO REF operation.
>
> Successfully performing a GET BOOK operation.

In the preferred embodiment, all other movements in

bookview state 219, including a GO TO PAGE operation which

specifies a page by means of a relative page number, a GO

TO DOC operation, and a NEXT or PREV TERM operation are

relative movements and do not result in a saving of

bookview information.

The kind of bookview information saved in a GO BACK list

entry (GBLE) 2533 depends on whether bookview 219 was

displaying a portion of a book stored on an optical disk

or a portion of an on-line book. In the first case, the

information is the following:

> the unique identifier for the book being
> displayed
>
> the identifier for the document being
> displayed
>
> the number of the first word in the display
>
> the entry number for any query being performed
> in project query list 221
>
> whether the book was being viewed in full or
> subset mode
>
> what order was being used for the document
> lists.

In the second case, the unique book ID and the document ID

are stored as above, but the remainder of the information

is the following:

> the position of the line in the document at
> which the display begins
>
> an identifier for the on-line session which
> referenced the document
>
> an identifier for the action which caused the
> GO BACK state to be saved
>
> A description of any action which has to be
> performed to return to the GO BACK state.

An example for a description is the text of the query

whose results were being displayed when the non-relative

move occurred.

In a preferred embodiment, the stack is implemented by
means of data elements for 30 GO BACK list entries and a
mapping element (GBLME) 2529 which maps entry sequence
numbers for the 30 stack entries onto the record serial
numbers for the entries. Bookview 219 keeps track of top
and bottom of stack pointers containing the entry sequence
numbers for the GO BACK list entries which are currently
at the top and bottom of the stack and the usual stack
operations are performed. If the stack overflows, the GO
BACK information for the new top entry is stored in the
previous bottom entry and the top and bottom pointers are
adjusted accordingly; if it underflows, an error message
is returned to bookview state 219.

When a user of the professional research system performs a
GO BACK operation, either by means of GO BACK key 307 or
by means of a menu selection, bookview 219 saves the
current bookview information, compares the saved current
information with the bookview information in the top entry
of the GO BACK list, and performs whatever operations are
necessary to cause bookview 219 to display the location
specified by the top entry's bookview information. For
example, if the current bookview information differs from
the bookview information in the top entry only with regard
to document ID and/or word number, bookview 219 simply
displays the specified document beginning at the specified
word; if it differs with regard to document order,
bookview 219 also has document list manager 807

reconstruct the document lists; if it differs with regard to view mode, bookview further shifts from one mode to the other and has document list manager 807 reconstruct the subset document list as necessary; if it differs with regard to the query, bookview 219 additionally has query manager 215 reexecute the query and thereupon has document list manager 807 reconstruct the subset query list; if it differs with regard to the book ID, bookview 219 still further performs the operations described for GET BOOK, including establishing a connection to on-line data base 227 if the restored state specifies an on-line book.

Once bookview 219 has displayed the location specified in the top entry's bookview information, it waits for the user to strike a key. If the user strikes anything other than CANCEL key 341, the top entry is popped from the GO BACK list and becomes the current bookview state; if the user strikes CANCEL key 341, the top entry is not popped and the saved current state is restored as the current state. The user can continue to perform the GO BACK operation until there are no entries remaining in the GO BACK list; at that point, bookview 219 provides the user with a "GO BACK list empty" error message.

7. Conclusion

The foregoing Description of a Preferred Embodiment has

disclosed to one of ordinary skill in the art how to make
and use an improved research apparatus. The improved
research apparatus disclosed herein has many advantages.
It has capabilities which permit a user to easily resume
work on a project, and thereby permit the user to easily
work on several different projects over a period of time.
When a user resumes work on a project, the research
apparatus displays the last location accessed in the last
book used in the project and behaves with regard to
queries and operations involving movement in the book as
if there had been no interruption of work.

The user can select books as required for each project
from a library of books available to all users of the
improved research apparatus. The books may be stored
locally or may be accessible by means of a communications
link. A user of the research apparatus can work with
equal ease on locally or remotely stored books. When the
user selects a remotely stored book, the research
apparatus automatically establishes the communications
link necessary to access the remotely-stored book.

Another advantage of the research apparatus is that the
order in which a user views documents in the book is
determined by a document list which is published with the
book. When the user executes a query on a book, the
result is a subset list which lists documents which
satisfy the query in the same order as they appear in the

document list for the book. A publisher may provide more
than one order for a book's document list and a user may
select among the document orders.

The research apparatus makes query formulation easier by
retaining for each project the last query run on each book
being used in the project and a list in chronological
order of all of the queries run in the project. A user
can select one of these queries and can edit it to produce
a new query, and can thus easily narrow his search. Users
can employ published queries accompanying some of the
books in the same fashion as the saved queries.

In order to permit a user to go back to a previous display
of a book, the research system automatically saves display
state each time the user makes a movement in a book which
is not relative to the user's current position in the
book. By striking a key, the user can restore the display
previous to the present one, the one previous to the
restored display, and so forth.

The research apparatus improves the following of embedded
references by specifying more than one book and location
containing the information referred to where that is
possible. When the user requests the research apparatus
to go to a reference, the research apparatus looks to
determine the "closest" location of the information
specified in the reference. Thus, if the information is

in the same book, it goes to that book. If the
information is available in a book in the library, the
research apparatus automatically does all that is required
to display the location in the book that contains the
information. Where there is a choice between displaying
an on-line book and a book which is locally available, the
research apparatus automatically chooses the local book.

Users of the research apparatus can mark locations in
books which they wish to refer back to by means of named
bookmarks. When the user specifies the bookmark, the
research apparatus automatically displays the location
specified in the bookmark.

The research apparatus also includes a notebook for each
project. The notebook is fully integrated into the
research apparatus. It is accessible whenever the user is
working on the project and can be edited in the same
manner as a word processing document. When the research
apparatus is displaying text of a book, the user can copy
a portion of the displayed text to the notebook and edit
the copied portion in the same manner as a word processing
document.

A particularly significant advantage of the improved
research apparatus is the use of lists to make
selections. A user selects the project he wishes to work
on from a list of projects; the selection of the project

-112-

automatically places him in the desk top list for the
project, which lists all of the books being used in the
project. A selection of a book from the desk top list
automatically results in the display of the last location
read in the selected book. If the user wishes to add a
book to his project, he selects a book from a library
list; the selection places him in the desk top list for
his project. If the user wishes to select a specific
document in a book, he can select from a list of all of
the documents in the book, in the order selected by the
user, or from a list of the subset of the documents which
satisfy a query. Upon selection, the research apparatus
automatically displays the selected document. The user
may further can select a query from lists of queries used
by the project or published queries, and can select a
bookmark from a list of bookmarks.

While the foregoing disclosure has disclosed a
presently-preferred embodiment of the research apparatus,
many other embodiments are possible. The preferred
embodiment is thus exemplary and not restrictive and the
scope of the appended claims is not limited to the
embodiment of the invention disclosed herein, but includes
any embodiment equivalent thereto.

What is claimed is:

1) Apparatus for performing research upon books comprising:

portable media containing a structure for representing one or more of the books, the structure including

a directory file permitting location of other files on the portable media by the research apparatus and

for each book, a plurality of book view files which are associated with the book and are locatable from the directory file, the book view files including at least

first book view files representing an ordered document list of the documents contained in the book and

a second book view file contining the text of each document;

reading means for reading the portable media;

display means for displaying a visual representation of a portion of the text of one of the books;

input means for receiving inputs from the user; and

processor means coupled to the reading means, the display means, and the input means for responding to an input from the input means indicating one of a set of navigation operations by selecting a portions of the text of a given document for display, reading the selected

-114-

portion from the second book view file, and displaying the
selected portion on the display means, the result of
certain of the navigation operations being determined by
the order of the documents on the document list.

2) The apparatus for performing research set forth in
claim 1 and wherein:

the structure further includes for each book, a
plurality of search files which are associated with the
book and are locatable from the directory file, the search
files containing information permitting location of query
terms in the text of the documents in the second book view
file associated with the book and

the processor means responds to an input from the
input means indicating a query containing query terms by
using the search files to locate portions of the text of
the documents in the second book view file associated with
the book which contain the query terms as specified in the
query and thereby satisfy the query and by defining a
subset document list which is a subset of the document
list, whose elements have the same order relative to each
other as they have in the document list, and which
specifies documents containing text which satisfies the
query, and thereupon using the subset document list to
determine the result of the certain navigation operations
from the order for the subset document list.

3) The apparatus for performing research set forth in
claim 1 and wherein:

the structure for representing books further
comprises an install file locatable from the directory
file, the install file containing information describing
each book represented on the portable media;

the apparatus for performing research further
includes readable and writable non-volatile storage means;
and

the processor means is coupled to the readable and
writable storage means and responds to an input from the
input means specifying installation of a portable media by
employing the reading means to read the install file and
entering information from the install file in a desk top
list in the non-volatile storage means which specifies
books presently available to the apparatus for performing
research.

4) The apparatus for performing research set forth in
claim 1 and wherein:
the first book view files include
a document list data file which contains data
describing each document in the associated book and
a view attribute file which contains data
describing how the data in the document list data file is
to be displayed by the research apparatus and
the processor means responds to an input received on the

input means specifying display of a document list for a

book by employing the reading means to read the the

document list file and the view attribute file and using

information contained therein to display a selected

portion of the document list on the display means.

5) The apparatus for performing research set forth in

claim 4 and wherein:

the first book view files further include

        a primary order file specifying an order of the

documents on the document list and

        the processor means reads the primary order file to

determine the result of the certain navigation

operations.

6) The apparatus for performing research set forth in

claim 5 and wherein:

the first book view files for certain of the books further

include

        an alternate order file specifying an additional

order of the documents in the document list and

        the processor means responds to an input received

from the input means which specifies the additional order

by reading the alternate order file to determine the

result of the certain navigation operations.

7) The apparatus for performing research set forth in
claim 6 and wherein:

the processor means displays the selected portion
of the document list in the order specified by the
alternate order file if the processing means has received
an input specifying that the additional order is selected
and otherwise in the order specified by the primary order
file.

8) The apparatus for performing research set forth in
claim 3 and wherein:

the second book view file includes a document entry
for each document in the book;

each document entry includes

a target table relating one or more target
names specifying logical locations in the document to
which the entry belongs to the number of the first word
belonging to that logical location in that document,

a page table relating the number of each page
in the document to the number in the document of the first
word on that page and to the page's name, and

a document structure representing the text of
the document, the document structure; and

the processor means responds to an input from the
input means indicating navigation to a given page by using
the document structure to produce displays of document

-118-

text, the page table to navigate in the book by word

number, page name, and page number, and the target table

and the page table to navigate in the book in response to

a target name and to the word number specified for the

target name in the target table.

9) The apparatus for performing research set forth in

claim 8 and wherein:

the install file includes a unique identifier for

each book on the portable media;

the processor means creates a desk-top list of

presently-used books in the non-volatile storage and

copies the install list's unique identifier into the desk

top list;

the book view files include a document ID file

containing for each document in the book a document

identifier which is unique in the book and the location of

the information about the book in the document list data

file;

the document list data file includes for each

document data specifying the location of the document's

document entry in the second book view file;

the document structure includes an embedded

reference to a location in a document accessible to the

research apparatus, the embedded reference including the

target name for the location, the document identifier for

the document containing the location, and if the document

is contained in a book different from the book in which

the document containing the embedded reference is

contained, the unique identifier for the book; and

the processor means responds to an input from the

input means indicating navigation to a location specified

in a given embedded reference by using the unique

identifier to locate the book in the desk top list if the

book is different, and using the target name in the target

table and the word number from the target table in the

page table to find the location specified by the embedded

reference.

10) A structure for representing one or more books in

files on portable media readable by a research apparatus

which displays portions of the text of the books, the

structure comprising:

a directory file permitting location of other files

on the portable media by the research apparatus;

for each book, a plurality of book view files which

are associated with the book and are locatable from the

directory file, the book view files including at least

a document list data file which contains data

describing each document in the associated book,

a view attribute file which contains data

describing how the data in the document list data file is

to be displayed by the research apparatus,

-120-

a primary order file specifying an order of
the documents on the document list, and

a documents file including a document entry
for each document in the book, each document entry
including

a target table relating one or more
target names specifying logical locations in the document
to which the entry belongs to the number of the first word
in the logical location in that document,

a page table relating the number of the
page in the document to the number of the first word on
the page and to the name of the page, and

a document structure representing the
text of the document,

the research apparatus employing the document list
data file, the view attribute file, and the primary order
file to perform a display operation displaying a portion
of the document list for a given book in the order
specified in the primary order file and in the fashion
specified in the view attribute file, employing the
document structure to perform navigation operations
selecting and displaying portions of the text of the given
book, employing the primary order file to determine the
result of first certain of the navigation operations, and
employing the target table and page table to determine the
result of second certain of the navigation operations
wherein navigation is done by word number, page number,
page name, or target name.

1/19
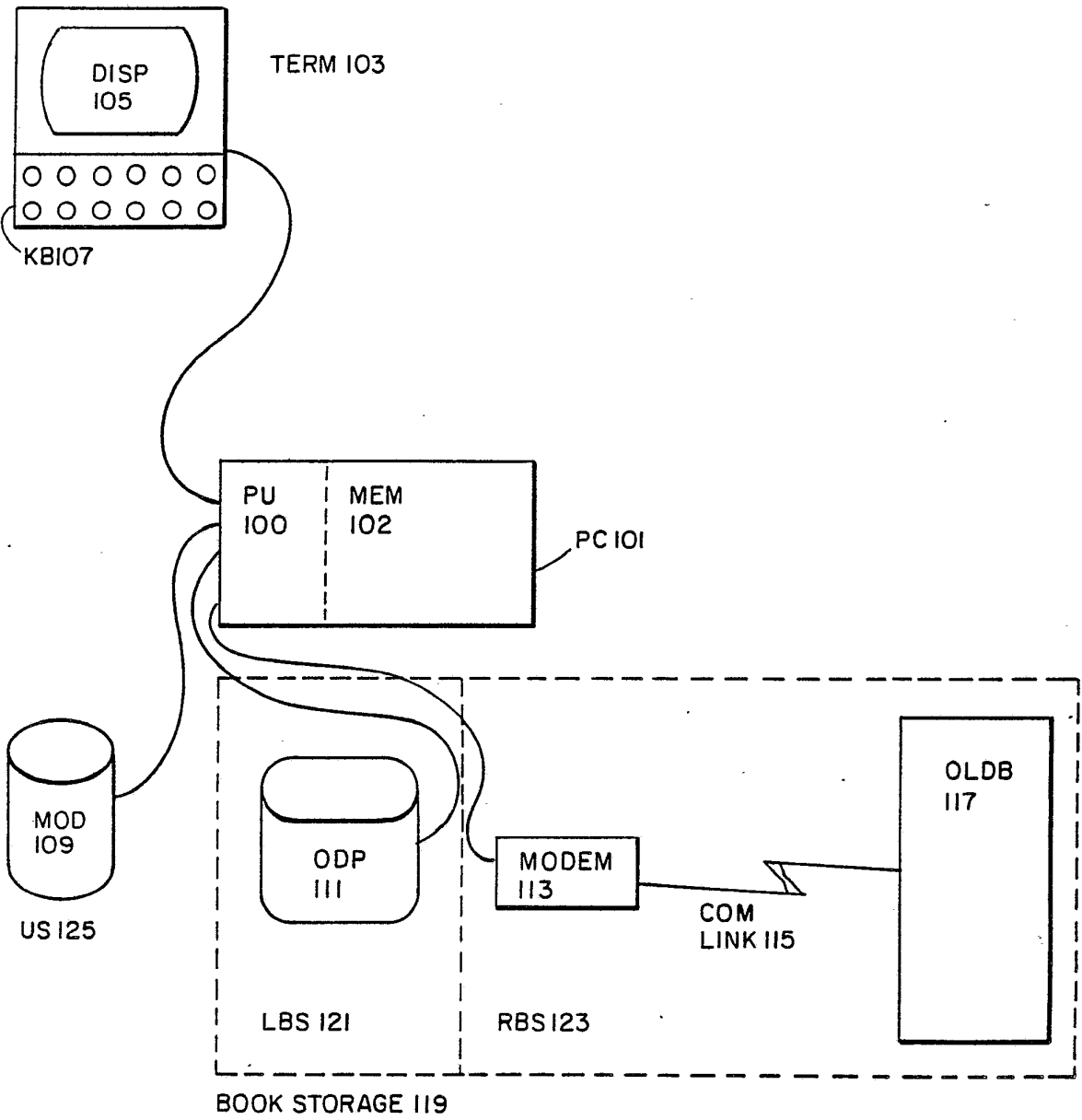
FIG. 1: PRS HARDWARE

2/19
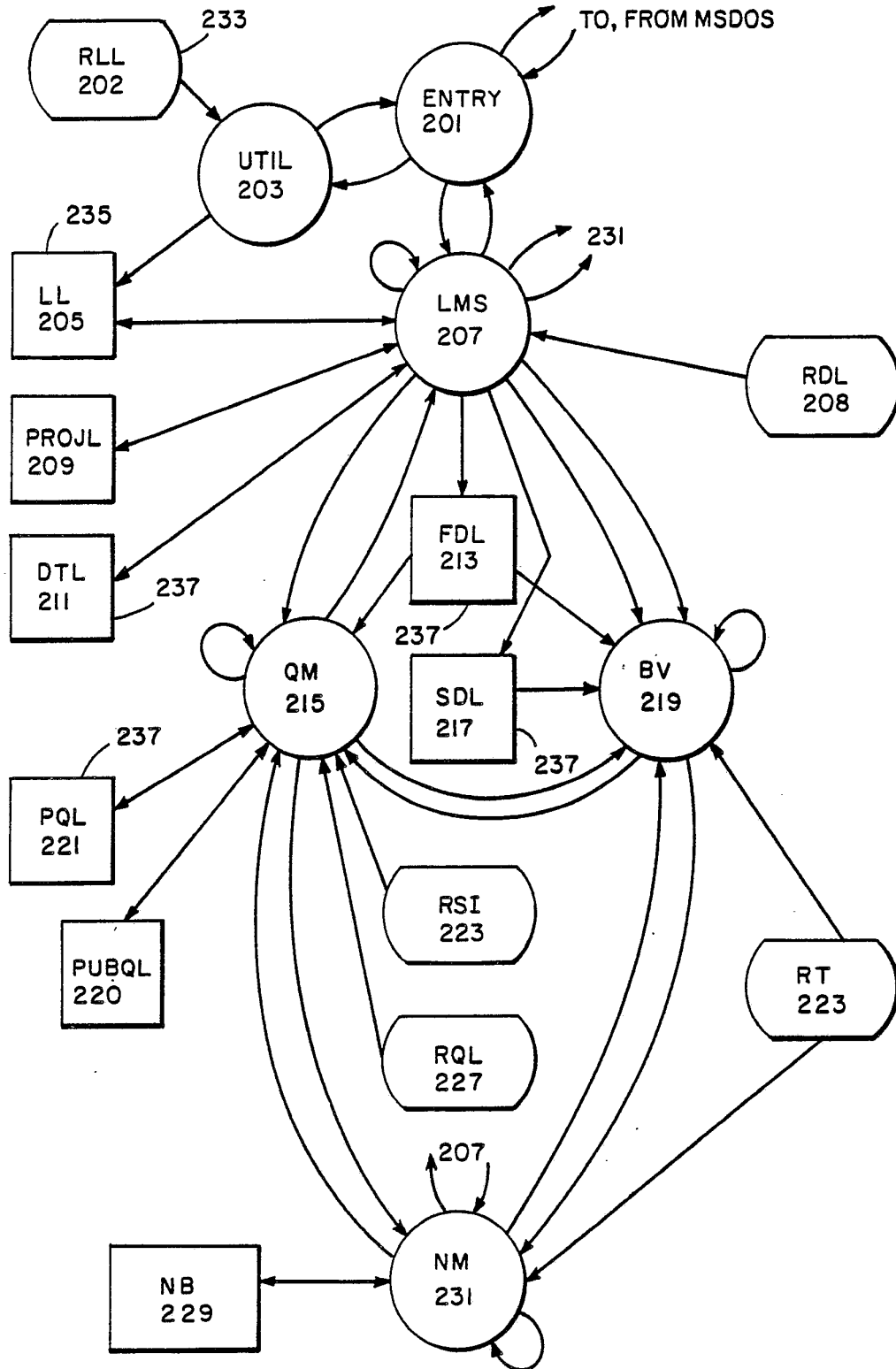
FIG. 2: PRS FUNCTIONAL OVERVIEW

3/9

F1	F2	F3	F4	F5	F6	F7	F8
HELP / MENU	GO BACK	GET BOOK		SEARCH BOOK	FULL/ SUBSET	GO TO REF	SEE ALSO	RECALL

303 307 311 315 319
305 309 323 313 317 339

F9	F10	F11	F12	F13	F14	F15	F16	
SCAN		COPY	NTBK/ MOVE	GOTODOCLIST GOTO DOC	PREV TERM NEXT TERM	PRINT	GO TO PAGE	EXIT CANCEL

321 325 327 329 331 333 335 337 341

FUNCTION KEYS 301

351

INSERT	HELP	PREV
DELETE	EXEC	NEXT

345
347
348

NAVIGATION KEYS 343

	↑	
←	↓	→

DIRECTION KEYS 349
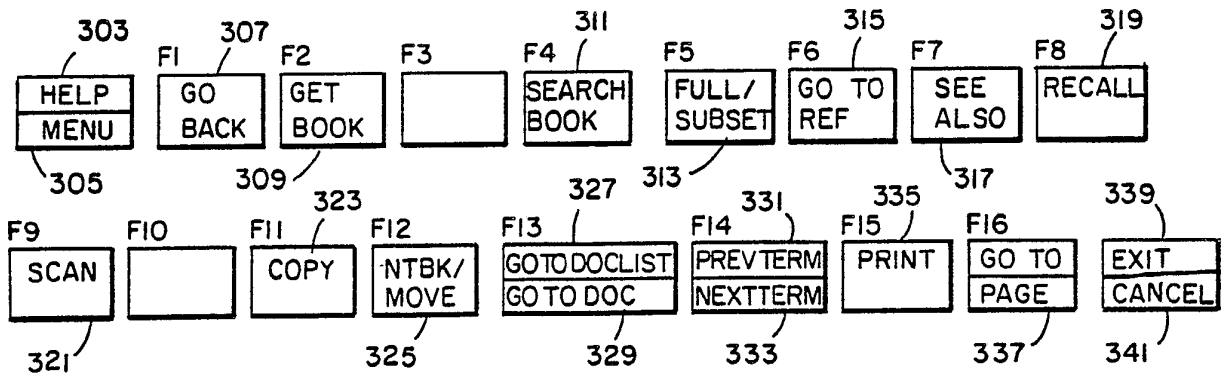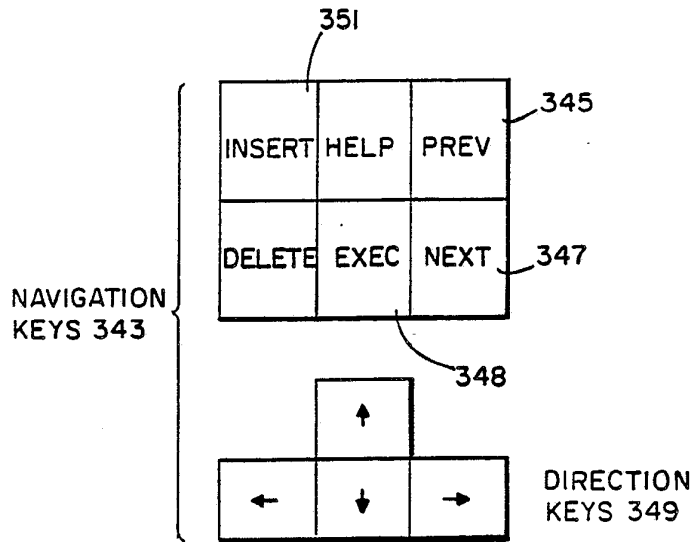
FIG. 3: KB 107 FUNCTION AND NAVIGATION KEYS

403   401

ACTION	SEARCH	BROWSE	OUTPUT	MISC

SEARCH BOOK
407——SCAN   405
CLEAR QUERY

411   409
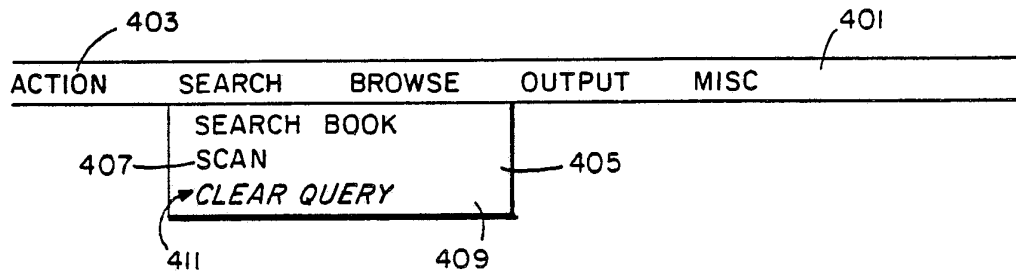
FIG. 4: MENU KEY COMMAND BAR AND PULL-DOWN MENU

4/19

```
┌──────────────────────────────┐
│          Premise             │
│     The Professional         │
│         Research             │
│         System               │
│                              │
│  ©1988                       │
│    Wang Labs, Inc            │
│    West Publishing Co.       │
└──────────────────────────────┘
```

BOOT SCREEN 501

```
┌────────────────────────────────────────────────────┐
│                                                    │
├────────────────────────────────────────────────────┤
│            Premise    Release 1.00                 │
├────────────────────────────────────────────────────┤
│        ©1988  Wang Labs, West Pub. Co.             │
├────────────────────────────────────────────────────┤
│                                Select an item.     │
│                                                    │
│        ─ Existing Project                          │
│          New  Project                              │
│          Utilities                                 │
│                                                    │
│                                                    │
└────────────────────────────────────────────────────┘
```
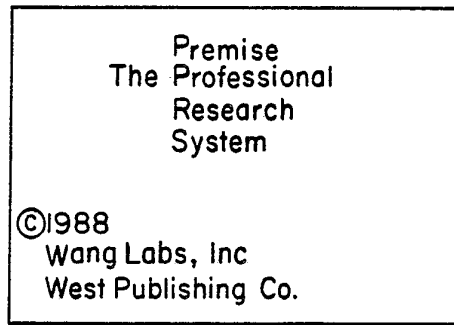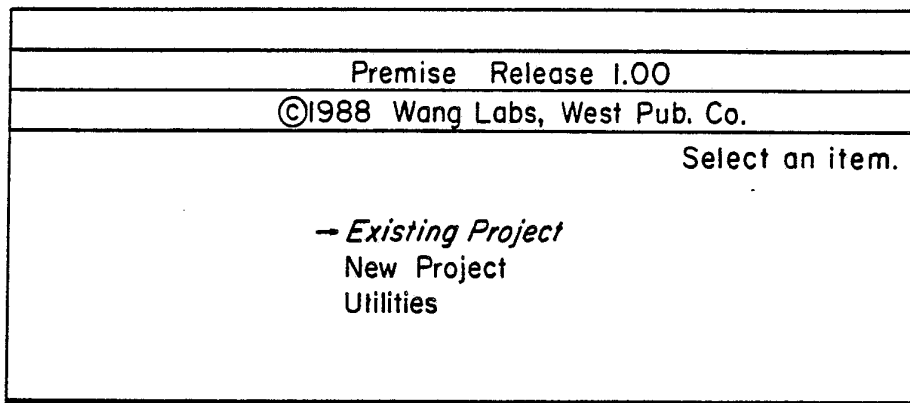
ENTRY MENU 503

FIG. 5: Screens for Entry State 201

```
┌──────────────────────────┐
│ Install a CD-ROM         │
│ Remove a book            │
│ Modify connections       │
└──────────────────────────┘
```
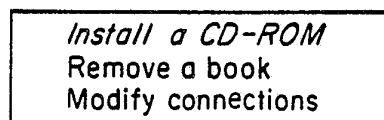
MAIN UTILITIES MENU 601

─ FIG. 6: Screens for Utility State 203

5/19

```
┌─────────────────────────────────────────────────────────────┐
│ Misc                                                          │
├─────────────────────────────────────────────────────────────┤
│                    Install Disc Utility                       │
├─────────────────────────────────────────────────────────────┤
│                                                        705    │
│     ┌──────────────────────────────────────────┐             │
│     │ Please place the CD-ROM disc in drive x   │             │
│     │ Then Press EXEC.                          │             │
│     │ To discontinue, press CANCEL.             │             │
│     └──────────────────────────────────────────┘             │
└─────────────────────────────────────────────────────────────┘
```

```
┌─────────────────────────────────────────────────────────────┐
│ Misc                                                          │
├─────────────────────────────────────────────────────────────┤
│                    Install Disc Utility                       │
├─────────────────────────────────────────────────────────────┤
│     ┌──────────────────────────────────┐                      │
│     │ This is the second disc of the   │        703           │
│     │ Bankruptcy Law Library. Three    │                      │
│     │ books are included on the disc   │                      │
│     │ which contain relevent bankruptcy│                      │
│     │ cases, statutes, rules, forms,   │                      │
│     │ and treatise material.           │                      │
│     └──────────────────────────────────┘                      │
│                                                               │
│                                                               │
└─────────────────────────────────────────────────────────────┘
```

INSTALL DISC SCREENS 701

```
┌─────────────────────────────────────────────────────────────┐
│ Misc                                                          │
├─────────────────────────────────────────────────────────────┤
│                    CD-ROM Book Removal                        │
├─────────────────────────────────────────────────────────────┤
│ Page I of 3 (53 items)                                        │
├─────────────────────────────────────────────────────────────┤
│              CD-ROM LIBRARY LIST 709          Select a book.  │
│  Name                          Publisher            Disc #    │
│  Default startup book          Wang Labs/West Publishing  WPC0001│
│ ─U.S. Supreme Court Decisions, 1961-1975   West Publishing Co.  WPC0002│
│  U.S. Ct. of Appeals, 2nd Circuit   West Publishing Co.   WPC0002│
│  USC Title II, Bankruptcy Rules, Bankrup...  West Publishing Co.  WPC0101│
│                                                               │
│  Black's Law Dictionary, fifth edition   West Publishing Co.   WPC1001│
└─────────────────────────────────────────────────────────────┘
```

REMOVE BOOK SCREEN 707

FIG. 7: SCREENS FOR UTILITY STATE 203

6/19
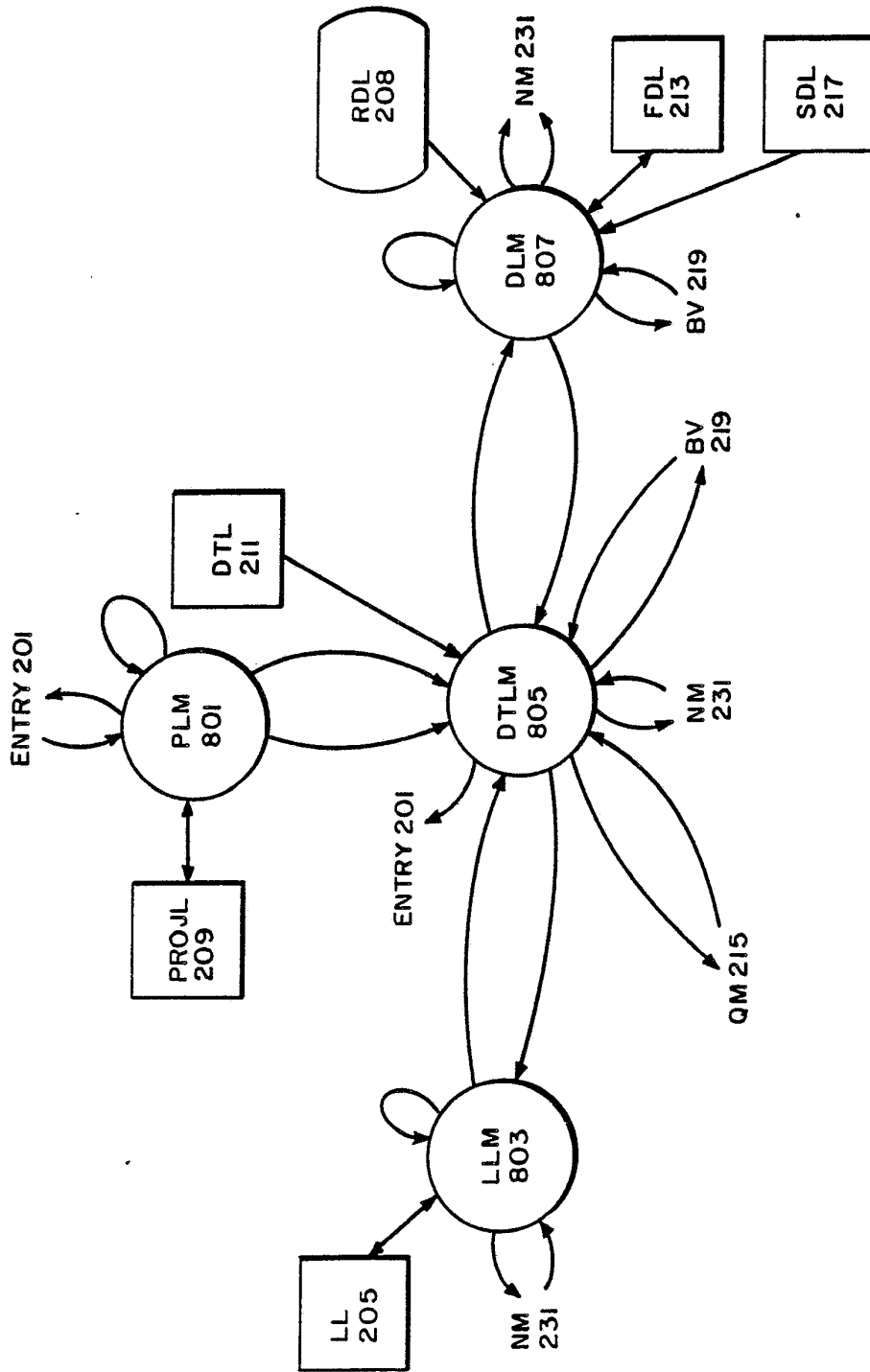
FIG. 8: SUBSTATES OF LMS 207

7/19

```
                            ┌403              ┌401
 ┌─────────────────────────────────────────────────────────────────┐
 │ Action    Misc    Utility                                        │
 ├─────────────────────────────────────────────────────────────────┤
 │                                              905___Projects       │
 ├─────────────────────────────────────────────────────────────────┤
 │ Page 1 of 1  (15 items)                                          │
 ├─────────────────────────────────────────────────────────────────┤
 │        ╲903          ┌909                    Select a project     │
 │   Project Name     Description              907─┘                 │
 ├─────────────────────────────────────────────────────────────────┤
 │   Training         Default project, introductory information     │
 │  ─FineyTax         Finey's tax liability                          │
 │   Smith vs. Jones  Smith assault case                            │
 │   Venn Will        Contested will w/bankruptcy                   │
 │   Martin vs. Walton  State limitations on lawyer's practice in other states │
 │        913                                                       │
 │   Caleth vs. Minnesota  Bankruptcy proceedings against Caleth farm │
 └─────────────────────────────────────────────────────────────────┘
```
911

PROJECT LIST SCREEN 901

```
 ┌─────────────────────────────────────────────────────────────────┐
 │ Deleting this project will remove all Books from the Desktop,     │
 │ all Project Queries and the Notebook. Do you really want to       │
 │ delete this project? To delete the project, press EXEC.           │
 │ To discontinue, press CANCEL.                                     │
 └─────────────────────────────────────────────────────────────────┘
```

DELETE PROJECT DIALOG BOX 915

```
 ┌─────────────────────────────────────────────────────────────────┐
 │ Misc                                                             │
 ├─────────────────────────────────────────────────────────────────┤
 │                     Start new project                             │
 ├─────────────────────────────────────────────────────────────────┤
 │                                              Enter information.    │
 │                                                                   │
 │ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─    │
 │       Project:  Enter project name here. (21 characters)          │
 │   Description:  Enter project description here. (56 characters)    │
 └─────────────────────────────────────────────────────────────────┘
```

START NEW PROJECT SCREEN 917

```
 ┌─────────────────────────────────────────────────────────────────┐
 │ Misc                                                             │
 ├─────────────────────────────────────────────────────────────────┤
 │                   Edit Project Information                        │
 ├─────────────────────────────────────────────────────────────────┤
 │                                              Enter changes.        │
 │                                                                   │
 │ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─    │
 │       Project:  Finey Tax                                         │
 │   Discription:  Finey's tax liability                             │
 └─────────────────────────────────────────────────────────────────┘
```

EDIT PROJECT INFORMATION SCREEN 919

FIG. 9: PROJECT LIST MANAGER STATE SCREENS

8/19

Action / Libraries Misc	
Project: Finey Tax	Books on Desk
Page 1 of 3 (56 items)	

Title	Last Document	Last Query Select a book
Training Book	[NS] Welcome	research & query
•U. S. Supreme Court Decision	82 S. Ct. 22	title (johnson) &
		Kansas
⌐ U.S. Ct. of Appeals, 2nd Ci	5427	drank/p car auto autom

1003 401
1005
1007 1009
1011

DESK TOP LIST SCREEN 1001

```
This desk contains no books.  To view
the library lists, select the library
pull-down menu.
```

EMPTY DESK TOP LIST DIALOG BOX 1015

```
The last SUBSET list for this book was  not
saved.  Please select:
  → Restore SUBSET LIST, then open Book
    Open Book Immediately
```

NO SUBSET LIST DIALOG BOX 1013

FIG. 10: DESKTOP LIST MANAGER STATE SCREENS

1103

Action Libraries Misc			
Project: Finey Tax			CDROM Library
Page 1 of 3 (53 items)			

ID	Title	Publisher	Select a book Disc #
Training	How to use the system	West Publishing Co	WPC0001
→SCT	U. S. Supreme Court Dec...	West Publishing Co	WPC0172
CA-2	U. S. Ct of Appeals, 2nd Cir	West Publishing Co	WPC0102
BKR-CODE	U.S. Code Title II, Bankruptcy	West Publishing Co	WPC0010
: 1105	1107	1109	1111
Blacks	Black's Law Dictionary	West Publishing Co	WPC0195

LIBRARY LIST SCREEN 1101

FIG. 11: LIBRARY LIST MANAGR STATE SCREEN

4/19

Action Misc				•
Federal Bankruptcy Reporter, 1961				Documents
List Page 3 of 159 (2703 items)		SUBSET		Published Order

Query: corporation partnership "joint venture" s/ eligib! /s Select a Document.

Citation	Title	Pages
–85 S. Ct. 24	Ace Trucking vs. Teamster Union	I

1203   1207   1209   1205   1211   1213   1215   1217

Document List Screen 1201

FIG. 12: Screen for Document List Manager State 807

Auction	Search	Browse	Copy	Misc	
U.S. Supreme Court Decision				82 S. CT. 23, Martin v. Walton	1304
Book pg 82 sct 23	: SUBSET :Result 12 of 234 :		Document pg 1 of 13		1313

1302   1303   401   1307   1309   1311   1305

Keith MARTIN, Appellant,

v.

Herbert WALTON, as Probate Judge of Johnson County, Kansas.

No. 30.

Argued Oct. 17, 1961.

Decided Nov. 6, 1961.

Rehearing Denied Dec. 11, 1961.

See 368 U.S. 945, 82 S. CT. 376.

1317

An attorney who was a member of the Kansas Bar, and who practiced law in both Kansas and Missouri, brought action against the Probate Judge of Johnson County, Kansas, to compel the Probate Judge to permit the attorney to appear in court without being associated with local counsel. The Johnson District Court, Division No. 1, rendered a judgement adverse to the attorney, and the attorney appealed. The Kansas Supreme Court, 187 Kan. 473, 357 P. 2d 782 affirmed the judgement, and the attorney appealed to the United States Supreme Court. The United States Supreme Court held that the appeal should be dismissed for want of a substantial federal question, and that the Kansas statute and Kansas Supreme Court Rules providing in effect that a Kansas Attorney, who regularly practices law in another state, must be associated with local counsel before he

1315

QUERY Screen 1301

FIG. 13: Screens in Bookview State 219

10/19

Action Search Browse Copy Misc	
Bankruptcy Code, Rules and	Chapter 13 - Adj. of Depts of an individual
Book pg BCRF330	Document pg 8 of 9

⟩1304

hearing, the court may convert a case under this chapter to a case under
chapter II of this title.

(e) The court may not convert a case under this chapter to a case under

1403

═ ══ ═══ ═════════ ═══

chapter 7 or II of this title if the debtor is a farmer, unless the debtor
requests such conversion.

(f) Notwithstanding any other provision of this section, a case may not be
converted to a case under another chapter of this title unless the debtor may be
a debtor under such chapter.

Pub. L. 95=598, Nov. 6, 1987, 92 Stat. 2647. Paragraph (c)(4) added by Sec. 315;
Paragraphs (c)(5), (7) and (8) amended by Sec. 527 o Pub. L. 98-353, July 10,
1984, 98 Stat. 333.

End of Document

No Query Screen 1401

1405

FIG. 14: Screens in Bookview State 219

11/19

Action	Search	Browse	Copy		
U. S. Supreme Court Decision, 1961-1975				82 S. Ct. 23, Martin v. Walton	
Book pg 82sct23		:Subset :Result 12 of 234:		Document pg 1 of 13	

Select a reference.

Keith MARTIN, Appellant   1503

v.

Herbert WALTON, as Probate Judge of Johnson County, Kansas.

No. 30.

Argued Oct. 17, 1961.

Decided Nov. 6, 1961.

Rehearing Denied Dec. 11, 1961.

See *368 U.S. 945, 82 S.Ct. 376.*

1505

An attorney who was a member of the Kansas Bar, and who practiced law in both Kansas and Missouri, brought action against the Probate Judge of Johnson County, Kansas, to compel the Probate Judge to permit the attorney to appear in court without being associated with local counsel. The Johnson District Court, Division No. 1, rendered a judgement adverse to the attorney, and the attorney appealed. The Kansas Supreme Court, 187 Kan. 473, 357 P. 2d 782, affirmed the judgement, and the attorney appealed to the United States Supreme Court. The United States Supreme Court held that the appeal should be dismissed for want of a substantial federal question, and that the Kansas statute and Kansas Supreme Court Rules providing in effect that a Kansas Attorney, who regularly

GO TO REF Screen 1501

Action	Search	Browse	Copy	Misc	
U. S. Supreme Court Decision...				82 S. Ct. 23, Martin v. Walton	
Book pg 82sct23		:Subset :Result 12 of 234:		Document pg 1 of 13	

Select a reference.

The potential See Also reference for the above document are:

Shepard's Citations

Insta-Cite
Cowan's Bankuptcy Law   } 1509

SEE ALSO Screen 1507

FIG. 15: Screens in Bookview State 219

12/19

```
┌──────────────────────────────────────────────────────────────────┐
│  Action    Recall    Misc                              │          │
├──────────────────────────────────────────────────────────────────┤
│  Bankruptcy Code, Rules and...                          Search     │
│                                                       Enter query, │
│                          401                                       │
│        ┌──────────────────────────────────────────────┐           │
│        │ .................................. ....... .. │           │
│        │ -  . . . . . . . . . . . . . . . . . . . . .  │           │
│        │ . . . . . . . . . . . . . . . . . . . . . . . │           │
│        │ . . . . . . . . . . . . . . . . . . . . . . . │           │
│        └──────────────────────────────────────────────┘           │
│                                          1609                      │
│                                                                    │
└──────────────────────────────────────────────────────────────────┘
```

1603 · 1605 · 1607

Query Formulating Screen 1601

__FIELDS__	CONTEXT & PROXIMITY	BOOLEAN, OTHER SYMBOLS
Citation	Within: Slash (/)	Boolean: AND, OR, NOT
Title	/n in 'n' words of	& both terms in doc
Date	/s in same sent.	either term in doc
Topic	/p in same para.	% term not in doc
Court		
Digest	Precedes: Plus (+)	Symbols
Synopsis	+n precedes by 'n' words	# no equivalent terms
Opinion	+s precedes in sent	★ single-char subs
Headnote	+p precedes in para.	! multi-char sub/expand
Settlement		" " phrase delimiter

Assists Window 1611

FIG. 16: Screens for Query Manager State 215

```
┌──────────────────────────────────────────────────────────────────┐
│  Action      Misc                                                  │
├──────────────────────────────────────────────────────────────────┤
│  Project:   Finey Tax                              Project Queries │
├──────────────────────────────────────────────────────────────────┤
│  Page 1 of 17 (347 items)                                          │
├──────────────────────────────────────────────────────────────────┤
│                                                  Select a query.   │
│  Query Text                                  Docs  Book Name       │
│  bankruptcy /2 judge /s "article iii"          3  Federal Bankrupt...│
│ ►trustee /s fail*** declin *** /s bring prosecute /s s...  2  Federal Bankrupt...│
│  corporation partnership "joint venture" s/ eligib! /...  12  U.S. Ct. of Appe...│
│                      1703                    1705      1709        │
│  trustee /s requir! duty /s clos*** /s estate /s quickly  33  U.S. Supreme Cou...│
│  mosser +3 darrow                              1  Federal Bankrupt...│
└──────────────────────────────────────────────────────────────────┘
```

Query List Screen 1701

FIG. 17: Screens for Query Manager State 215

13/19

Copy	Misc	
Project: Johnson & Kansas		Notebook
Pos. I Line 23 Page 67		1809

>....>....>..<

An attorney who was a member of the Kansas Bar, and who practiced law in both Kansas and Missouri, brought action against the Probate Judge of Johnson County, Kansas, to compel the Probate Judge to permit the attorney to appear in court without being associated with local counsel. The Johnson District Court, Division No. I, rendered a judgement adverse to the attorney, and the attorney appealed. The Kansas Supreme Court, 187 Kan. 473, 357 P. 2d 782, affirmed the judgement, and the attorney appealed to the United States Supreme Court. The United States Supreme Court held that the appeal should be dismissed for want of a substantial federal question, and that the Kansas statute and Kansas Supreme Court Rules providing in effect that a Kansas Attorney, who regularly practices law in another state, must be associated with local council before he can appear in Kansas, both on their face and as applied to the attorney, were not beyond allowable range of state action under Fourteenth Amendment to Kansas and Missouri, brought action against the Probate Judge of Johnson County, Kansas, to compel the Probate Judge to permit the attorney to appear in court. By state law, any attorney must be associated with local council before he can appear in Kansas, both on their face and as applied to attorney, who was member of Kansas Bar and who practiced law in both Kansas and Missouri, were

Notebook Screen 1801

FIG. 18: Screen for Notebook Manager State 231

14/19
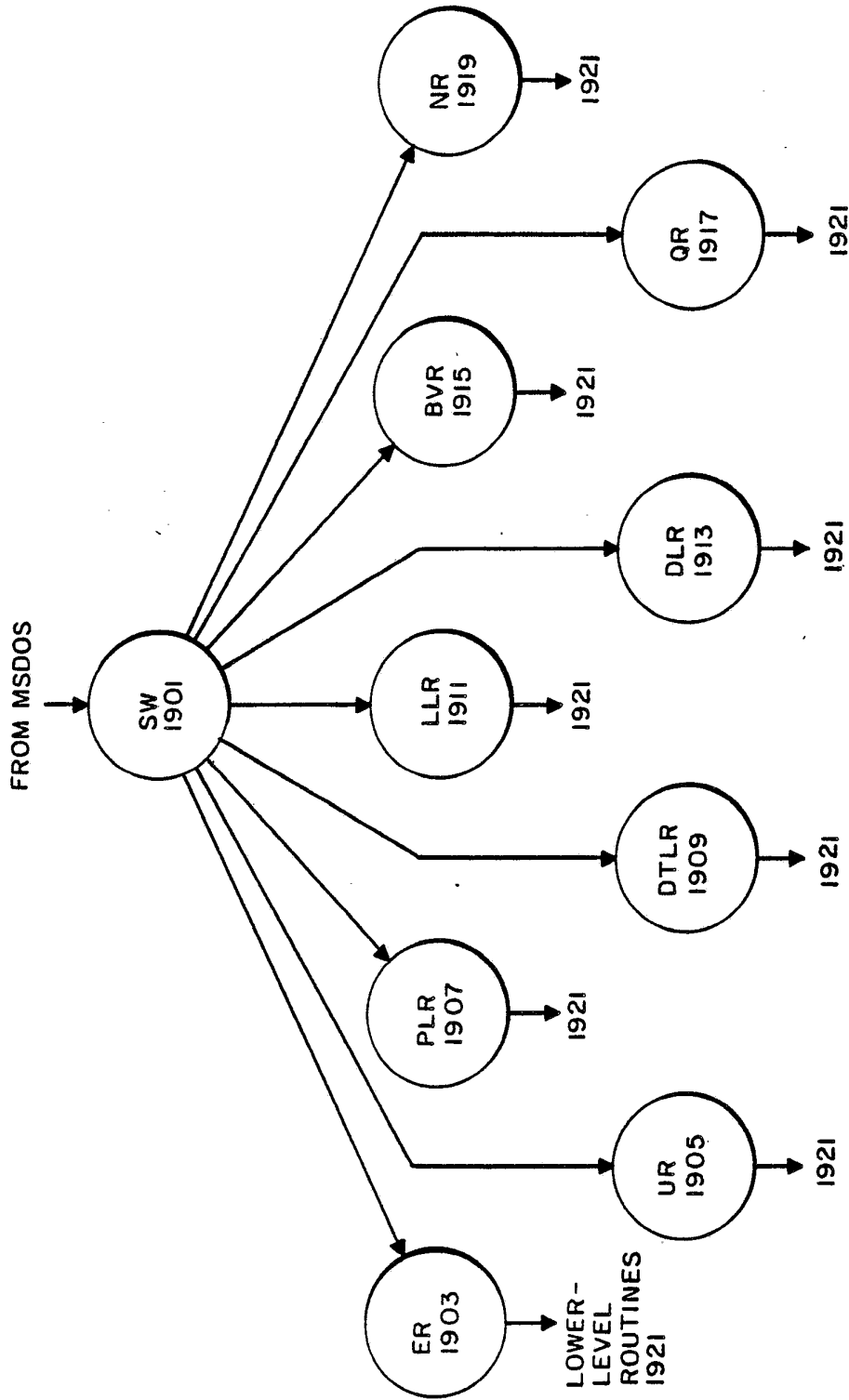

FIG. 19: PRS TOP-LEVEL STRUCTURE

15/19
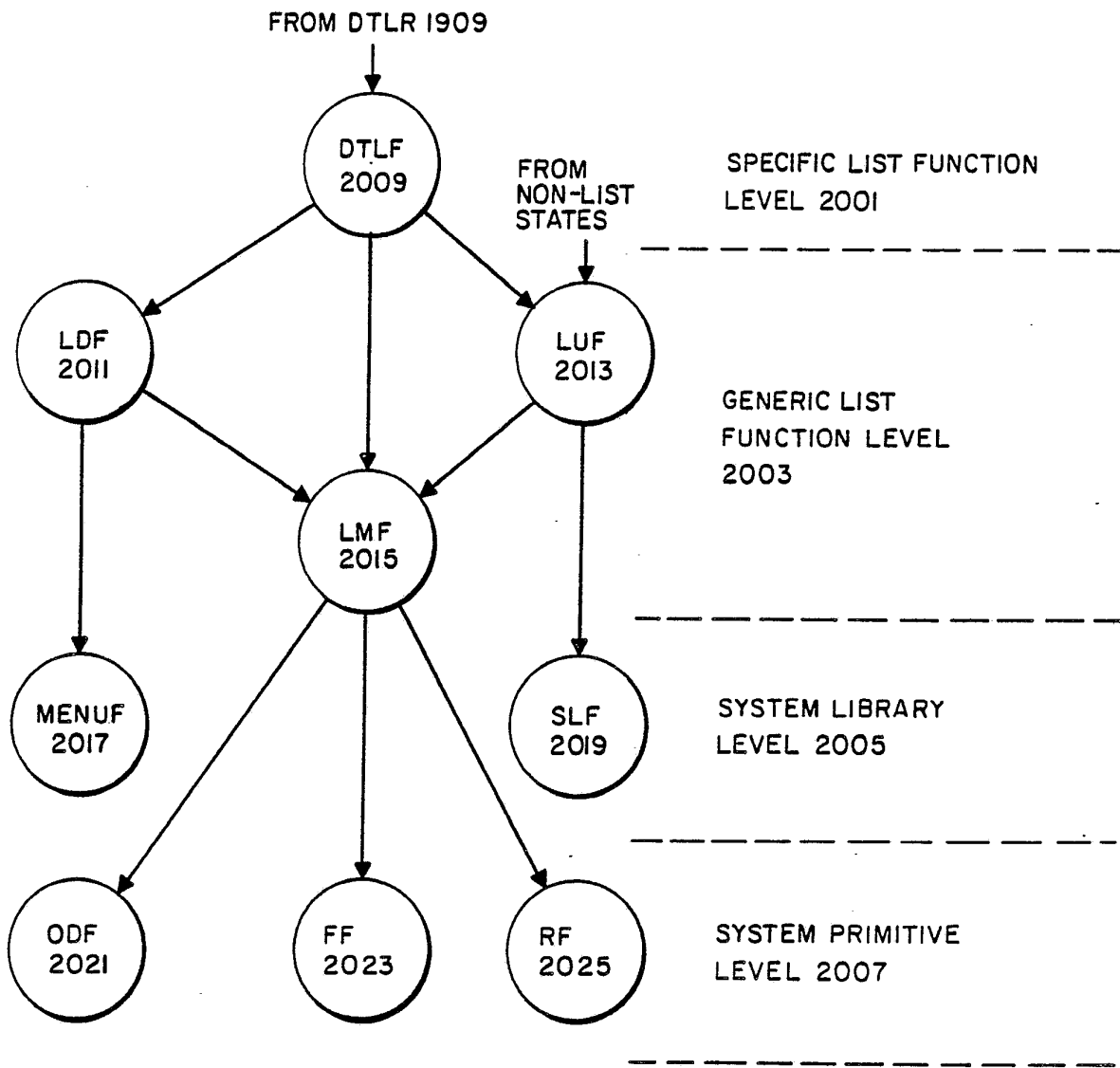
FIG. 20: STRUCTURE OF LIST MANAGER LOW-LEVEL ROUTINE 1921

14/19

CD-ROM CENTER	LOGICAL BLOCKS	PRS STRUCTURES

```
                          ┌─────────────┐
                          │  RESERVED   │        ┌──────────────┬─────┐
OPTICAL                   ├─────────────┤        │ VOLUME DESCR │─2105│
DISK          LB          │   LBN 16    │        │  PATH TABLE  │─2107│
2101          2103        ├─────────────┤        │ DIRECTORIES  │─2109│
                          │   LBN 17    │        ├──────────────┤     │
                          ├─────────────┤        │              │     │
                          │   LBN 18    │        │ SEARCH FILES │ 2111│
                          ├─────────────┤        │              │     │
                          │             │        ├──────────────┤     │
                          │      ─      │        │              │     │
                          │      ─      │        │  VIEW FILES  │ 2113│
                          │      ─      │        │              │     │
                          │             │        ├──────────────┼─────┤
                          │             │        │ ABSTRACT FILE│─2115│
                          │             │        │ COPYRIGHT FILE│─2117│
                          │             │        │ INSTALL FILE │─2119│
                          │ LBN 328,499 │        │ ALT PATH TABLE│─2121│
                          └─────────────┘        └──────────────┴─────┘
```

CD-ROM OUTER EDGE
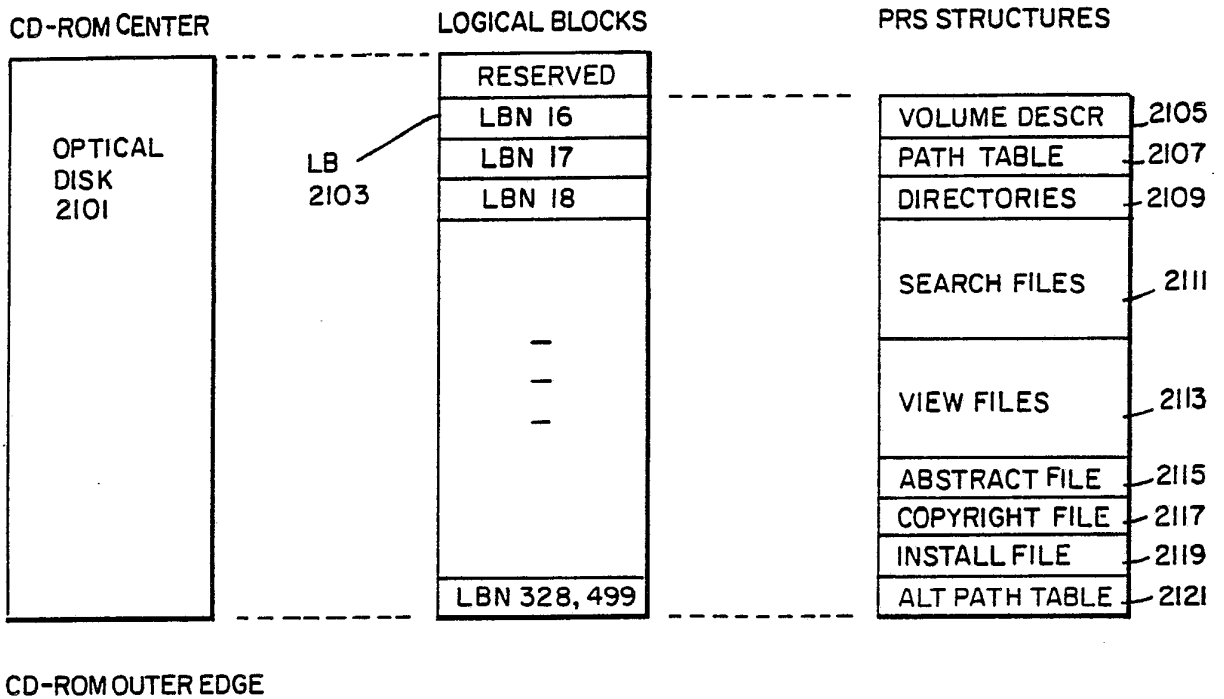
FIG. 21: OPTICAL DISK OVERVIEW

```
        2201                                    2203
      ┌────────────┐            ┌──────────────────┐
      │            │     /.     │  VIEW ATTR FILE  │
      │  BOOK 1    │    /...    │  PUB QUERY PTRS  │ 2205 } 2208
      │ VIEW FILES │   /.....   │                  │ 2207 }
      │            │  /.......  │  PUB QUERY LIST  │
      ├────────────┤ /........  │  PAGE NAME FILE  │─2209
      │            │ .........  │   PRIM-ALT MAP   │─2211 } 2215
      │  BOOK 2    │ .........  │ ALTERNATE ORDER  │─2213 }
2113{ │ VIEW FILES │ ........   │  PRIMARY ORDER   │─2217
      │            │ \.......   │ DOCUMENT ID FILE │─2219
      ├────────────┤  \......   │   DOC LIST DATA  │─2221
      │  BOOK n    │  \.....    │                  │
      │ VIEW FILES │   \....    │  DOCUMENTS FILE  │─2223
      │            │    \..     │                  │
      └────────────┘     \      └──────────────────┘
```

FIG. 22: DETAIL OF VIEWFILES 2113

17/19

FIG. 23: OVERVIEW OF DOCUMENTS FILE 2223
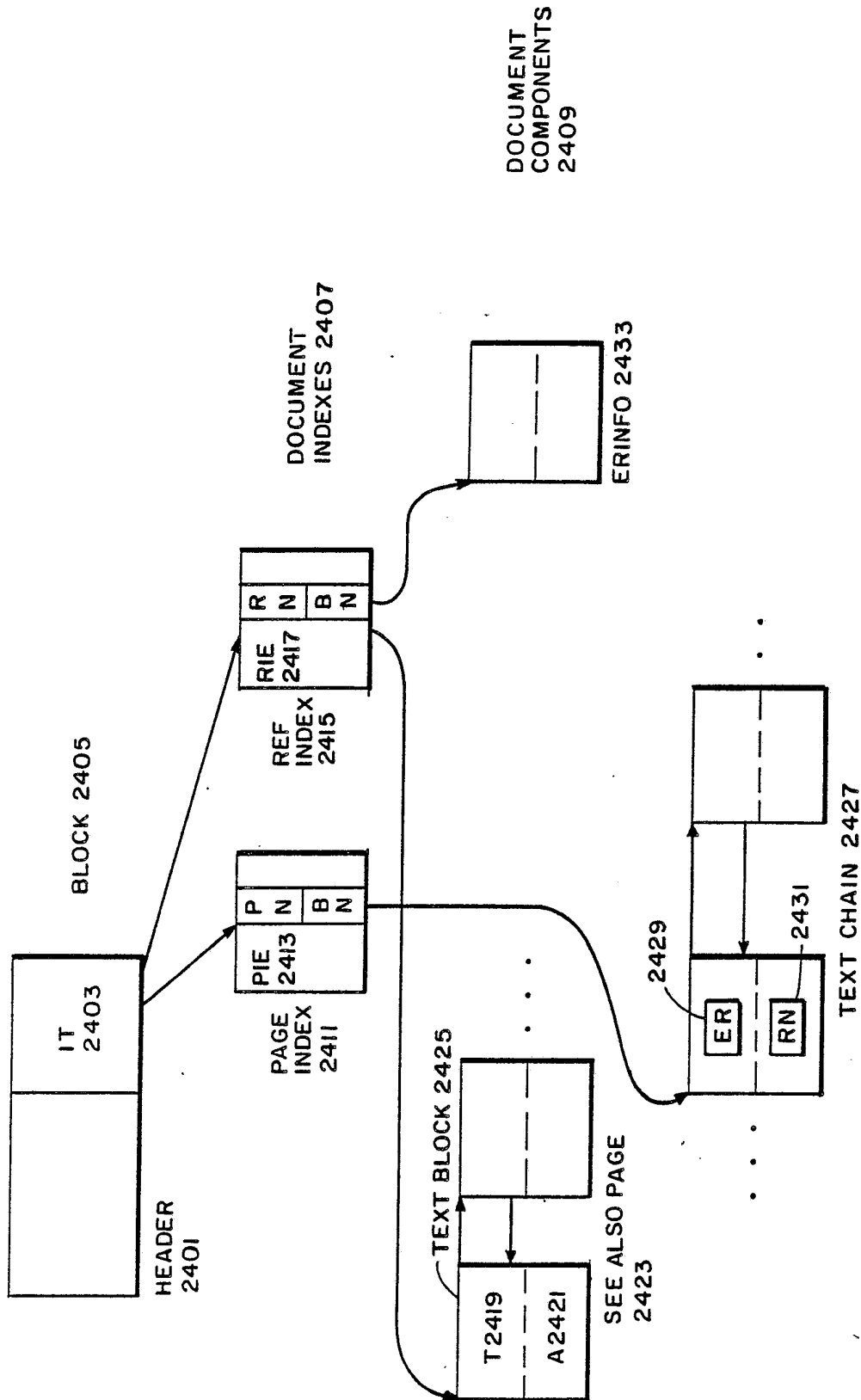
FIG. 24: DETAIL OF DOCUMENT TEXT 2327

19/19

```
┌─────────────────────────────┐
│       DTLME 2503            │
├─────────────────────────────┤
│      DTLIE 2507            │ ┐
├─────────────────────────────┤ │
│            •               │ ├ DTL ILS 2509
│            •               │ │
├─────────────────────────────┤ ┘
│       DTLE 2511            │
├─────────────────────────────┤
│            •               │
│            •               │
├─────────────────────────────┤
│         2511               │
└─────────────────────────────┘
           DTL 211
```
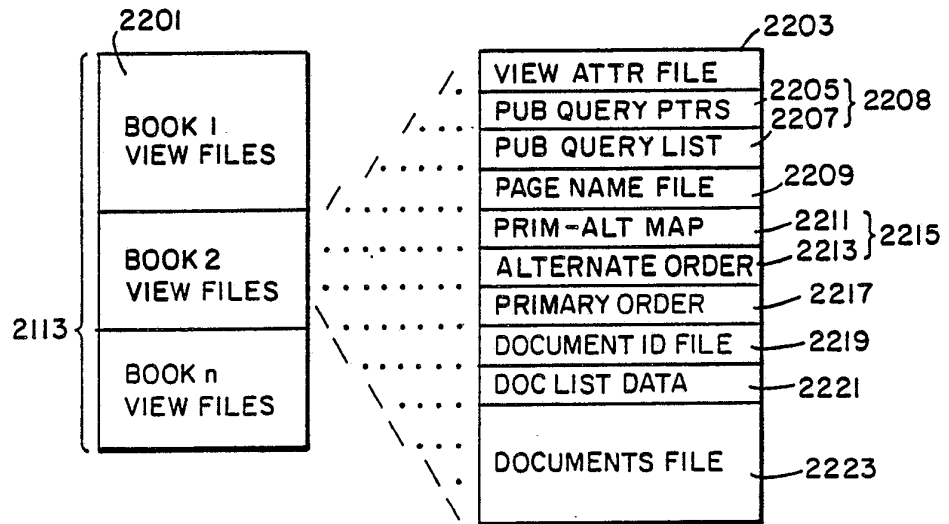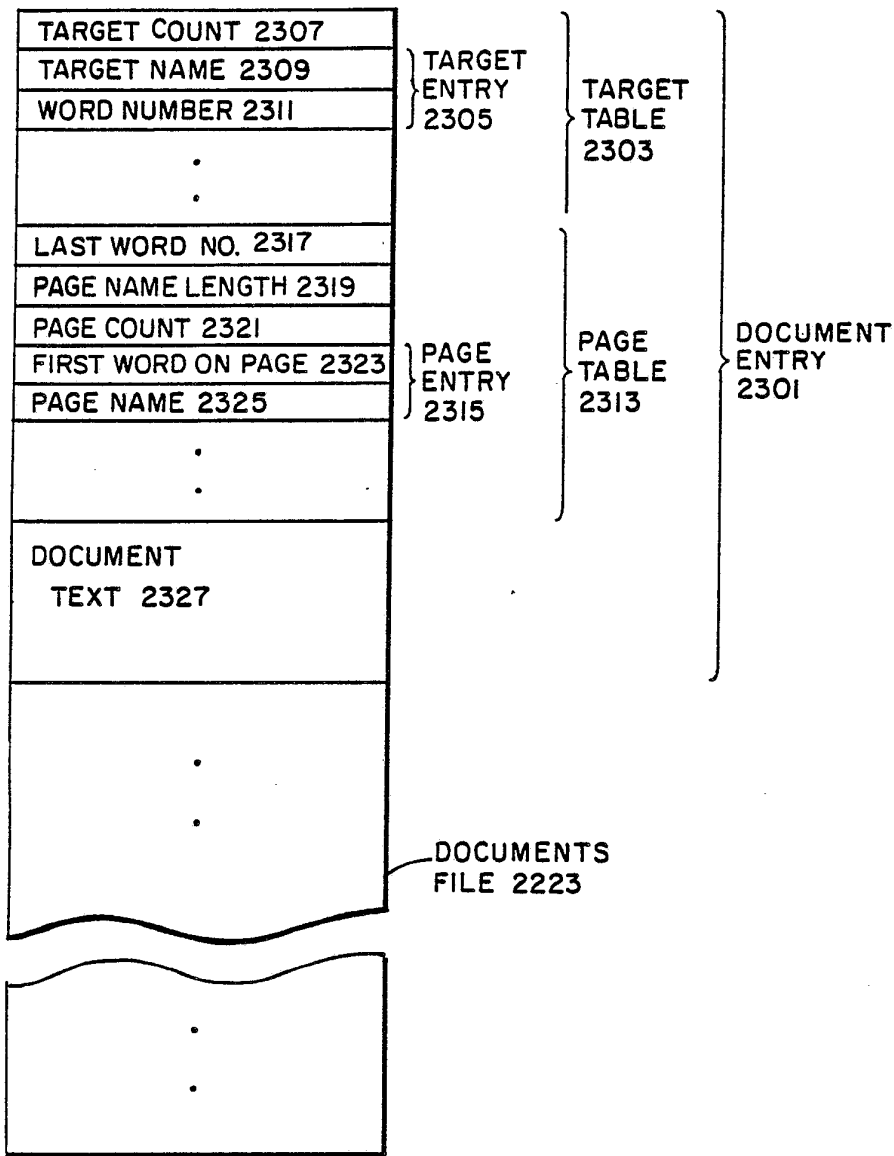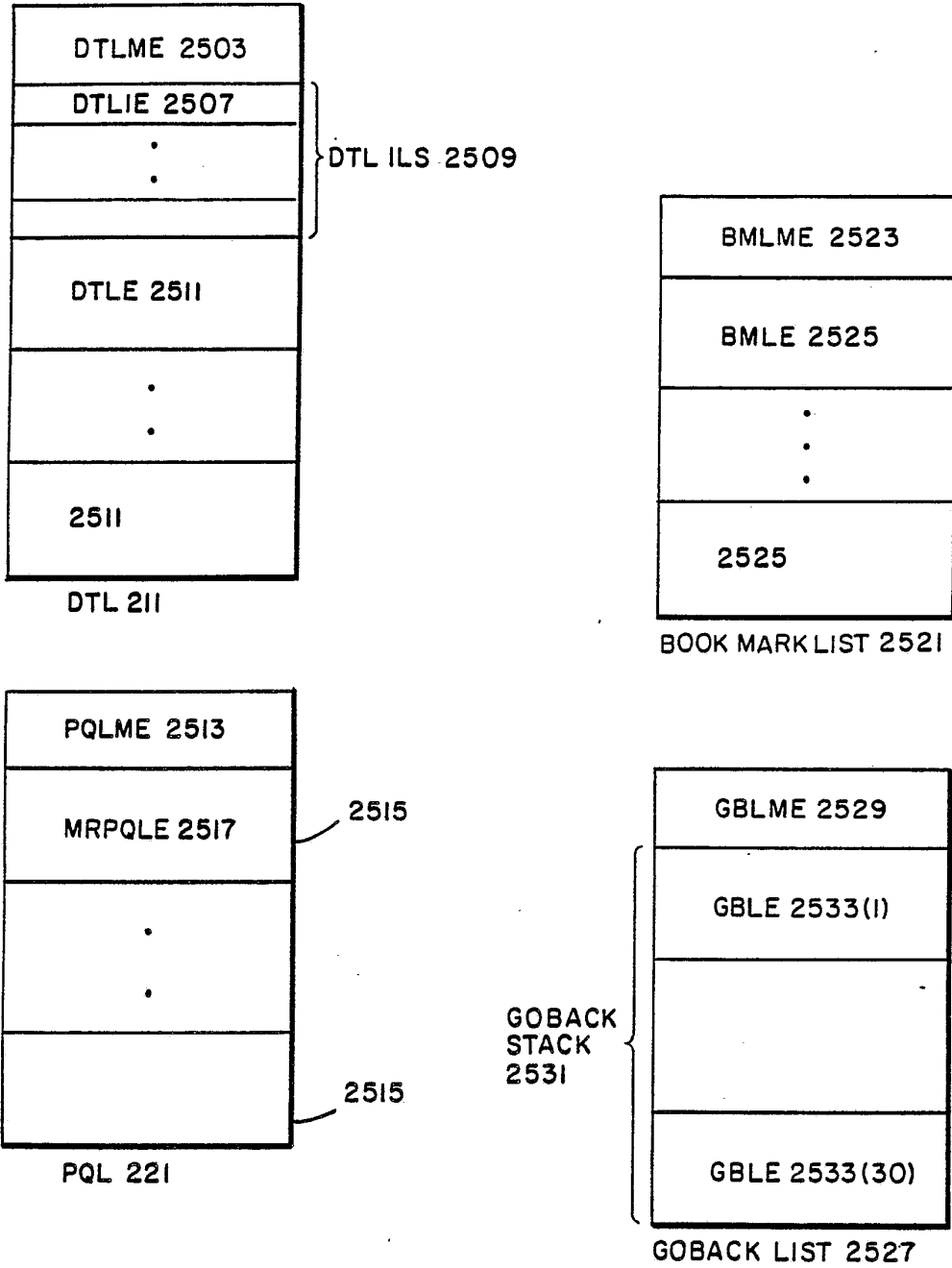
```
┌─────────────────────────────┐
│       BMLME 2523           │
├─────────────────────────────┤
│       BMLE 2525            │
├─────────────────────────────┤
│            •               │
│            •               │
│            •               │
├─────────────────────────────┤
│         2525               │
└─────────────────────────────┘
       BOOK MARK LIST 2521
```

```
┌─────────────────────────────┐
│       PQLME 2513           │
├─────────────────────────────┤
│      MRPQLE 2517          │ ─── 2515
├─────────────────────────────┤
│            •               │
│            •               │
├─────────────────────────────┤
│                            │ ─── 2515
└─────────────────────────────┘
           PQL 221
```

```
┌─────────────────────────────┐
│       GBLME 2529           │
├─────────────────────────────┤
│      GBLE 2533(I)         │ ┐
├─────────────────────────────┤ │
│            •               │ ├ GOBACK STACK 2531
│                            │ │
├─────────────────────────────┤ │
│      GBLE 2533(30)        │ ┘
└─────────────────────────────┘
       GOBACK LIST 2527
```
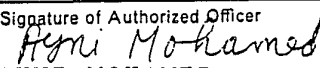
FIG. 25: PER-PROJECT CBAM LISTS 2501

INTERNATIONAL SEARCH REPORT

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) 6

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC(4): G06F 15/40

U.S. Cl. 364/900

II. FIELDS SEARCHED

Minimum Documentation Searched 7

Classification System	Classification Symbols
U.S.	364/200, 900 "MSFILE"

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched 8

III. DOCUMENTS CONSIDERED TO BE RELEVANT 9

Category *	Citation of Document, 11 with indication, where appropriate, of the relevant passages 12	Relevant to Claim No. 13
Y	EP, A, 0,121,072 (IBM CORPORATION) 10 October 1984, see page 4, lines 1-8, page 8, lines 14-31, page 10, lines 6-10, page 13, lines 16-33.	1-10
Y	US, A, 4,713,754 (AGARWAL ET AL.) December 15 1987, see col. 10, lines 1-29, col. 16, lines 50-55.	1-10
A	US, A, 4,495,566 (DICKINSON ET AL.) January 22 1985, see the entire document.	1-10
A	US, A, 4,422,158 (GALIE) December 20 1983, see the abstract.	1-10
A, P	US, A, 4,774,661 (KUMPATI) September 27 1988, see the entire document.	1-10

* Special categories of cited documents: 10

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
21 APRIL 1989	17 MAY 1989
International Searching Authority	Signature of Authorized Officer
ISA/US	AYNI MOHAMED

Form PCT/ISA/210 (second sheet) (Rev.11-87)