

Part I

EXPERIMENTS IN THE USE OF SYNTACTIC
INFORMATION IN AUTOMATIC EXTRACTING
AND INDEXING

Section 1

THE SYNTACTIC ANALYZER "PHRASE"

1.1 BACKGROUND: PREVIOUS EXPERIMENTS IN THE USE OF SYNTACTIC ANALYSIS IN AUTOMATIC INDEXING AND EXTRACTING

In 1969, as a natural outgrowth of some experiments in the compilation of a "sentence dictionary" of syntactic word types, a specialized parsing program was developed. It was designed both for a further "sentence dictionary" experiment and for more generalized indexing and extracting experiments. This limited parsing program was to identify all noun phrases, verb phrases, and infinitives within a sentence, resolving all ambiguities so that a sentence could be represented by one structure, consisting of a string of noun and verb phrases, infinitives, and gerunds, connected by the part-of-speech strings of the function words. An example of the mapping of a sentence into this kind of structure is shown in Fig. 1. This parsing program is described in the 1969 Annual Report (Ref. 1). It was used in three experiments, in extracting by a "sentence dictionary" method, and in both extracting and indexing by combining syntactic and frequency criteria in the choice of representative sentences or phrases. These experiments can only be briefly summarized here, but they are described in detail in the 1970 Annual Report (Ref. 2) and also in "Experiments in Automatic Extracting and Indexing" in Information Storage and Retrieval (Ref. 3).

In the "sentence dictionary" experiment in extracting, it was postulated that a dictionary of syntactic sentence types could be constructed in which extract-worthy sentences would be distinguished from other sentences by their syntactic form. This did not turn out to be a valid conjecture, though there were indications that sentence typing might be used in a screening process in conjunction with other extracting techniques. In the second experiment in extracting, each sentence in the text was analyzed.

Accordingly	→	ajective-adverb
,	→	punctuation
with	→	preposition
Jefferson	→	<u>noun phrase</u>
,	→	punctuation
they	→	<u>noun phrase</u>
feel	→	<u>verb phrase</u>
that	→	<u>noun phrase (conjunction)</u>
the	}	<u>noun phrase</u>
maintenance		
of	→	preposition
a	}	<u>noun phrase</u>
competitive		
free		
enterprise		
system	}	<u>noun phrase</u>
is		
a	}	<u>noun phrase</u>
basic		
requirement		
for	→	preposition
continuing	→	present participle
a	}	<u>noun phrase</u>
democratic		
government	}	<u>noun phrase</u>

Fig. 1 Sample of Limited Parsing

Syntactic criteria were used to reduce the text, then frequency criteria were used to choose words, which were in turn used in choosing the extract sentences. The method used in the automatic indexing experiment was similar, with the same syntactic criteria used to reduce the text, but with different frequency criteria used to choose the words which defined the index phrases. Thus, in these experiments the noun phrases identified were extracted from the text as potential index items. Frequency counts on the individual words of the noun phrases were then used in an algorithm to determine which noun phrases were to be chosen as index items, or which sentences were to make up an extract. Thus, the analysis was able to provide two important contributions to the indexing system:

- The size of the text subject to frequency counts was efficiently and effectively reduced to the concept-words in the text
- The index produced was one not of words but of phrases, which carry more particularized meaning, e.g., if intelligence was a high frequency word, actual phrases in the text such as artificial intelligence laboratory were included in the automatic index

These contributions are surely significant; it became very tempting to expand the parsing program in order to make it possible to apply still more sophisticated syntactic criteria within the indexing and extracting algorithms. At first it was planned simply to expand the parsing program to include the identification of prepositional, participial, and infinitive phrases. Gradually a plan for a complete, but four level parser, was evolved and is described in the next section.

1.2 THEORY AND METHODOLOGY

1.2.1 Overview

Most methods of syntactic analysis, like the predictive analysis system of Oettinger and Kuno (Ref. 4), produce dozens of possible interpretations for many, if not most, English sentences. This is not very useful for information handling. Obviously, one of the possible sentence structures must be chosen, hopefully the correct one. Whether this is done by producing one structure initially or by eliminating anomalous structures is unimportant, except that from the standpoint of efficiency and time, the first alternative seems more attractive. Obviously, syntactic analyzers may deliver differing amounts of information, and may express this information in differing ways; thus both the information to be provided and also the form in which it is to be provided are best dictated by the use to which the analysis is put. The syntactic analyzer to be described here, called the PHRASE parser, was developed for use in indexing and extracting experiments. It was decided that it was advantageous to develop the parser in levels, with each succeeding level providing more information about the sentence. This was because the simpler the grammar, the easier it would be to obtain an unambiguous structure; while the more sophisticated the grammar, the more information would be available for use in indexing or extracting. By developing the grammar in levels, the most efficient level for a given purpose can be sought by experimentation. At each level, only one structure was to be defined for the sentence, and those ambiguities in which structural or government information was insufficient for resolution were to be resolved by selecting the most probable structure. (Most often a speaker has intuitive knowledge of the most probable structure, but sometimes the structure probabilities must be determined statistically.)

As is true with most automatic parsers, the rules of the PHRASE grammar use the part-of-speech strings of the words in the sentence as their basic data, and occasionally also the words themselves, because some function words contain structural information which cannot be coded as traditional parts of speech. Rather than use an

extensive dictionary for parts of speech, with its demands in search time and storage space, a part-of-speech algorithm was developed and programed to assign parts of speech to words on the basis of the part-of-speech implications of the affixes and the length of the remaining kernel (Ref. 5). The parts of speech of function and exception words, however, were provided by a dictionary of about 800 words, and the most costly errors in the algorithm have been eliminated by adding another exception dictionary of perhaps 200 words. The part-of-speech string so assigned is an inclusive one, designed to contain at least all the parts of speech attributed to the word by the dictionary, but which may also contain one or two more parts of speech. Thus, the natural ambiguity of English words is compounded somewhat by use of the part-of-speech algorithm. There are 15 parts of speech assigned: noun, article, adjective, verb, past verb, adverb, preposition, conjunction, pronoun, interjection, present participle, past participle, auxiliary verb, pronoun, and plural noun. Of course, since a word is most often assigned more than one part of speech, the number of word classes, or part-of-speech strings, actually used is much higher than 15. Noun-verb or noun-plural-verb is a very common word class, and resolving this ambiguity is a major concern of the parsing program. Other common ambiguities include the adjective-adverb class, the preposition-conjunction, preposition-adverb, noun-adjective-conjunction, adverb-noun, adverb-conjunction, and past verb-past participle classes. Function words often have as many as four or five parts of speech assigned to them.

As illustrated in Fig. 2, there are four levels of analysis in the PHRASE system, with each level of the analysis providing a more complete description of the sentence structure. The information provided by levels 1, 2, and 3 is designed to be useful in its own right, and also suitable for input to the analysis at the next higher level. The first level defines the simple or basic word groups which form the building blocks of language. The second level defines how these basic groups are relationally linked with other words and groups to form complex word groups. The third level defines how basic or complex word groups are joined by conjunctions. The fourth level defines how basic and complex word groups combine functionally to form clauses. Each of these levels can now be further explicated.

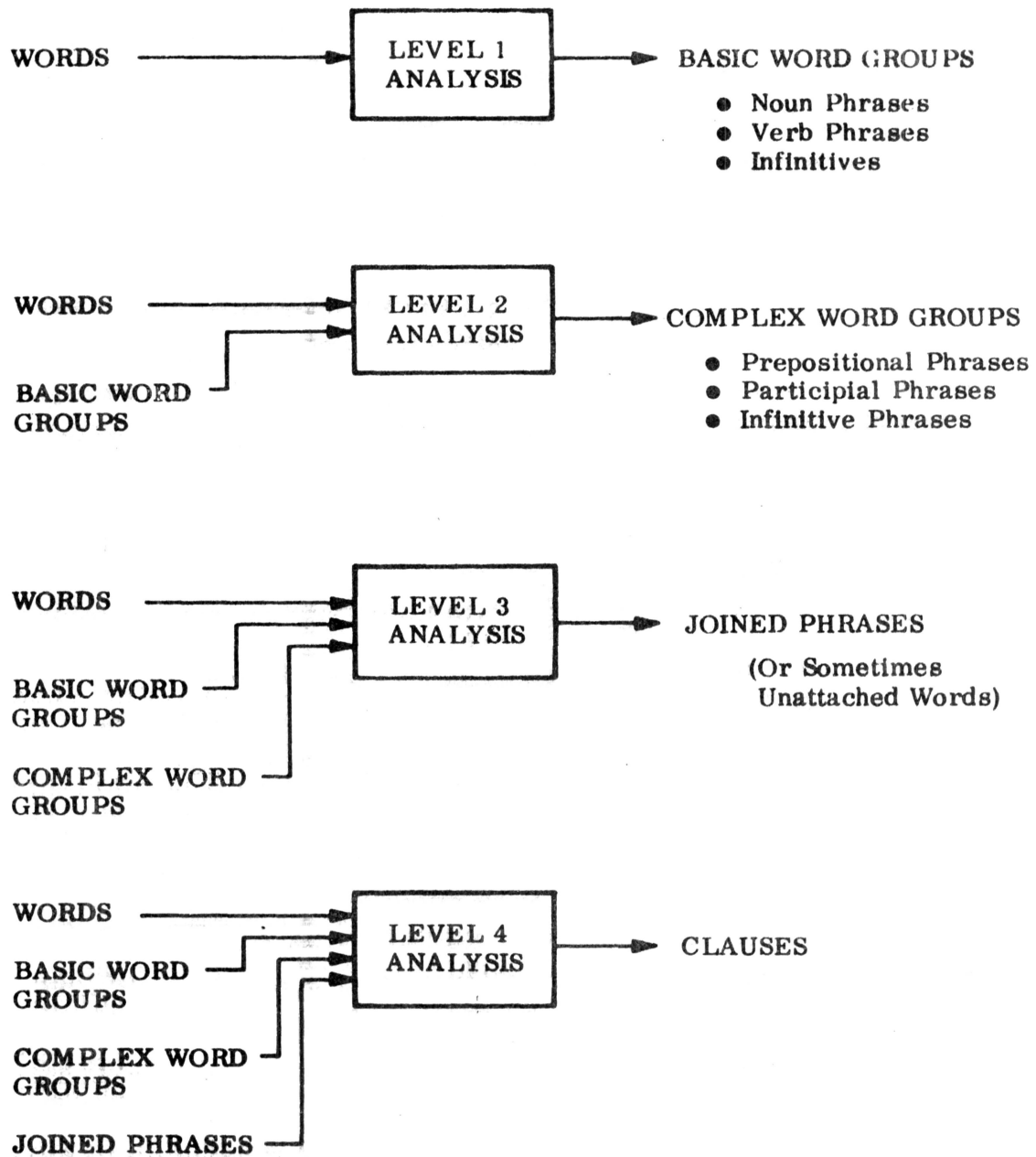


Fig. 2 Four Levels of Analysis

1.2.2 Summary of the Four Levels

The first level of analysis defines the noun groups and the verb groups, which are the basic building blocks of the language, and also defines infinitives, for reasons which will become evident. These word groups identified at level 1 will be abbreviated as follows:

Noun phrase – NAP

Verb phrase – VBP

Infinitive – NF

The PHRASE grammar defines all these word groups by structural rules of combination, but they can be conceptually defined as follows:

NAP – a main noun, together with its immediately preceding delimiters and modifiers.

VBP – a main verb, together with its auxiliaries and contiguous adverb modifiers.

NF – an infinitive, most easily defined by its form, the word to plus the base form of a verb, to express existence or action apart from any specific actor.

These three groups are defined on the first level because they are basic, because they constitute potential entries in an index, and because their definition resolves the most basic and pervading ambiguity, the noun-verb ambiguity.

In English, the lines between substantives and verbs, between things and actions, are not clearly drawn by word form. The word "part," for example, can refer equally well to a portion of a whole or to the act of separating a portion from a whole. Only the context distinguishes the thing from the act, according to our custom of speech. We see that it is necessary to distinguish four syntactic usages of part: as a noun (a part), as an adjective (a part interest), as a verb (he parts), as an infinitive (to part). One other more complex ambiguity must be partially dealt with at this level, for those participles which are in verb phrases must be distinguished from those in noun phrases. The resolution of participial ambiguity will extend also to levels 2 and 3, and sometimes to level 4.

The relationship between the basic word group notation and the often used binary tree representation is shown by example in Fig. 3. Note that when a basic word group consists of two words, as in NAP_1 , NAP_2 , and VBP_2 , the basic word group corresponds to the lowest level bracket in the binary tree representation. Note also that a binary tree parse implicitly shows a modification structure, as in NAP_4 . In this system, the modification structure within a noun or verb phrase will not be established at this first level, indeed not until level 4 of the analysis.

The second level of analysis defines complex word groups of three types, the prepositional, infinitive, and participial phrases. These phrases are composed of two elements, an initial preposition, infinitive or participial, and the following phrase which acts as the object or modifier of the initial element. Such complex word groups usually act as modifiers of noun or verb groups, and infinitive and participial phrases may also substitute for noun groups.

For convenience, the complex word groups will be abbreviated thus:

Prepositional phrase:	PRP (e.g., for my sister)
Infinitive phrase:	NFP (e.g., to find my sister)
Participial phrase:	PTP (e.g., finding my sister)
	(built by my sister)

In these phrases, the preposition always defines the relationship between the object phrase and the word or phrase it modifies. This is sometimes true for infinitives and participles also, but because these have both substantive and verbal characteristics, they may either indicate a verbal relationship or may assume the role of a noun phrase in the sentence. At this level in the analysis, the word, if any, which the preposition, infinitive, or participle modifies is not identified, and therefore the exact nature of the relationships cannot be defined at this level.

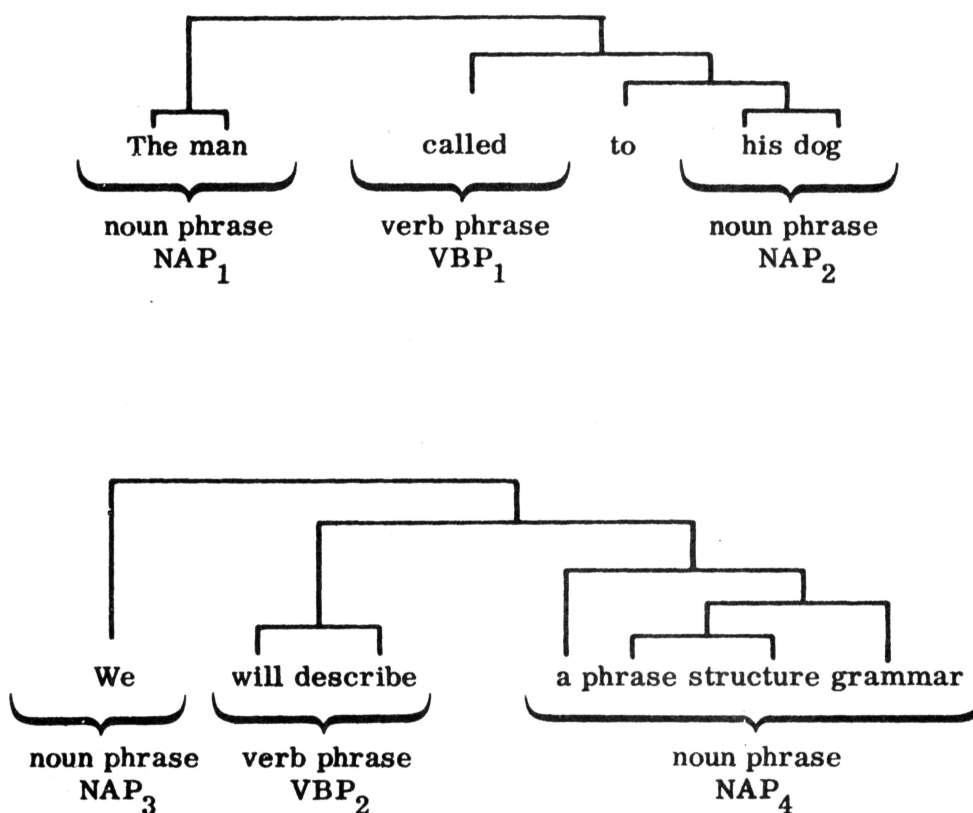
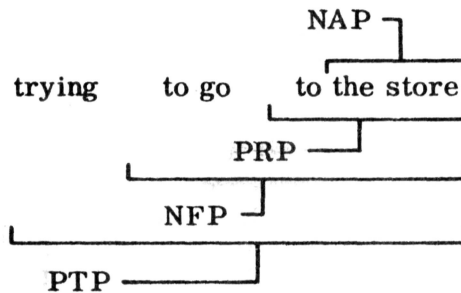


Fig. 3 Relationship of Basic Phrases to Binary Tree Representation

Because of the dual nature of infinitives and participles, nesting of second-level phrases is common, as in the phrase:



Here to go is the object of trying, while to the store is the object or modifier of to go. The many possible functions of these second-level phrases, especially the participles, are also best shown by example. In Fig. 4, the PTP recognizing in the first sentence is acting as an object of the preposition for; in the second sentence, the participle selecting is functioning as a verbal noun, itself a subject but with an object answers; in the third sentence, the participle rushing modifies the word he and shows the relationship between he and the object of the participle, to get the ball. At this second level in the analysis, only the extent, type, and nesting of these phrases is determined; the functions are not identified until the fourth level in the analysis.

The third level of the analysis is concerned with identifying phrases which are joined in a series to phrases of the same kind, wherein each of the joined elements is of equal importance. This level has not yet been implemented, but there is every reason to believe it can be done with sufficient accuracy independent of the fourth level. Occasionally, however, an error may be made which will have to be corrected at the fourth level, where examination of a larger context can aid in distinguishing and's and or's used as clause conjunctions from those used as phrase conjunctions. Figure 5 shows the structure of a simple sentence as defined by the first three levels of analysis. Phrases identified in level 1 are indicated by braces. Phrases identified in level 2 are indicated by squared brackets. The joining of phrases identified in level 3 is shown by dotted lines and arrows.

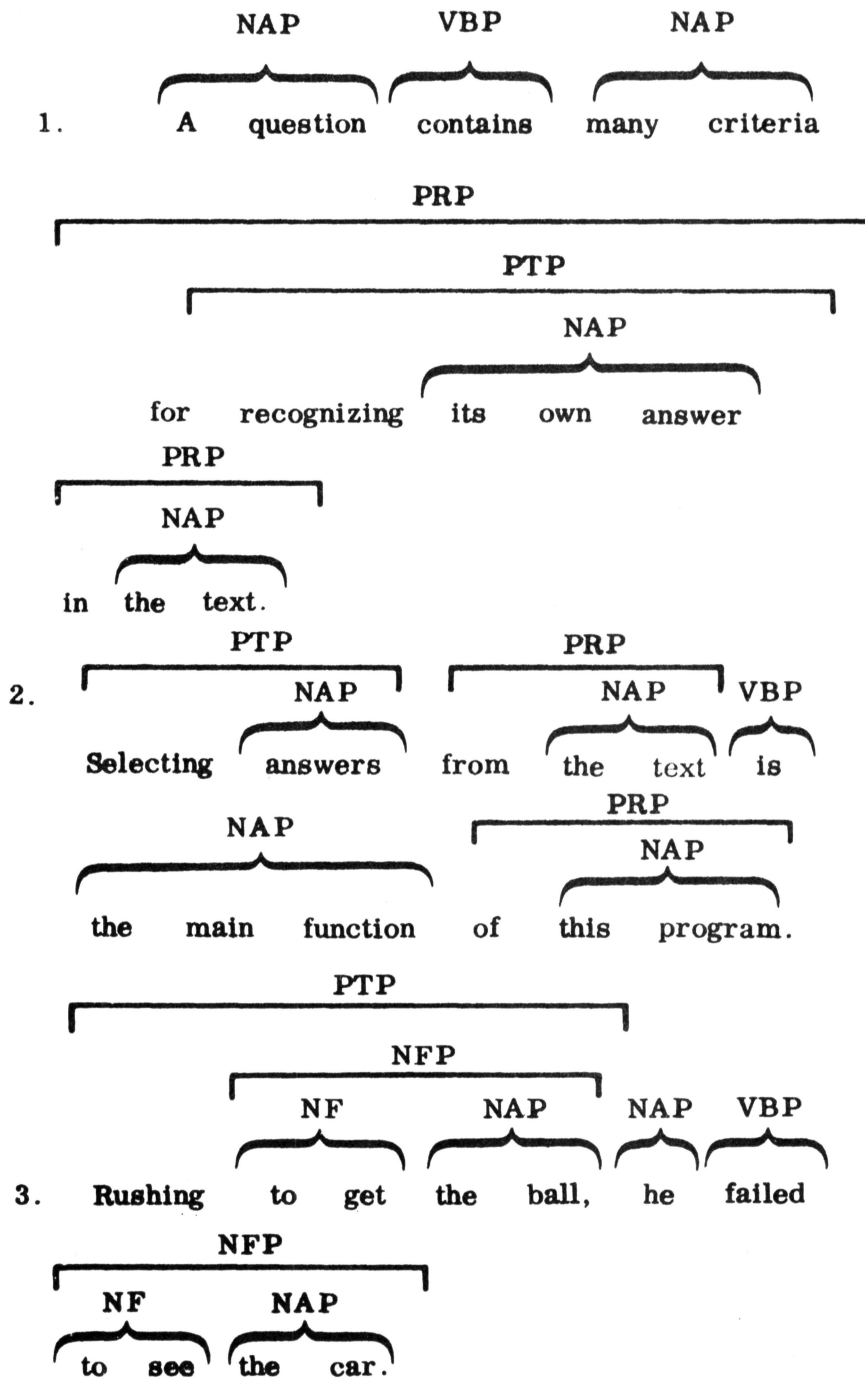


Fig. 4 Examples of Participle Usages

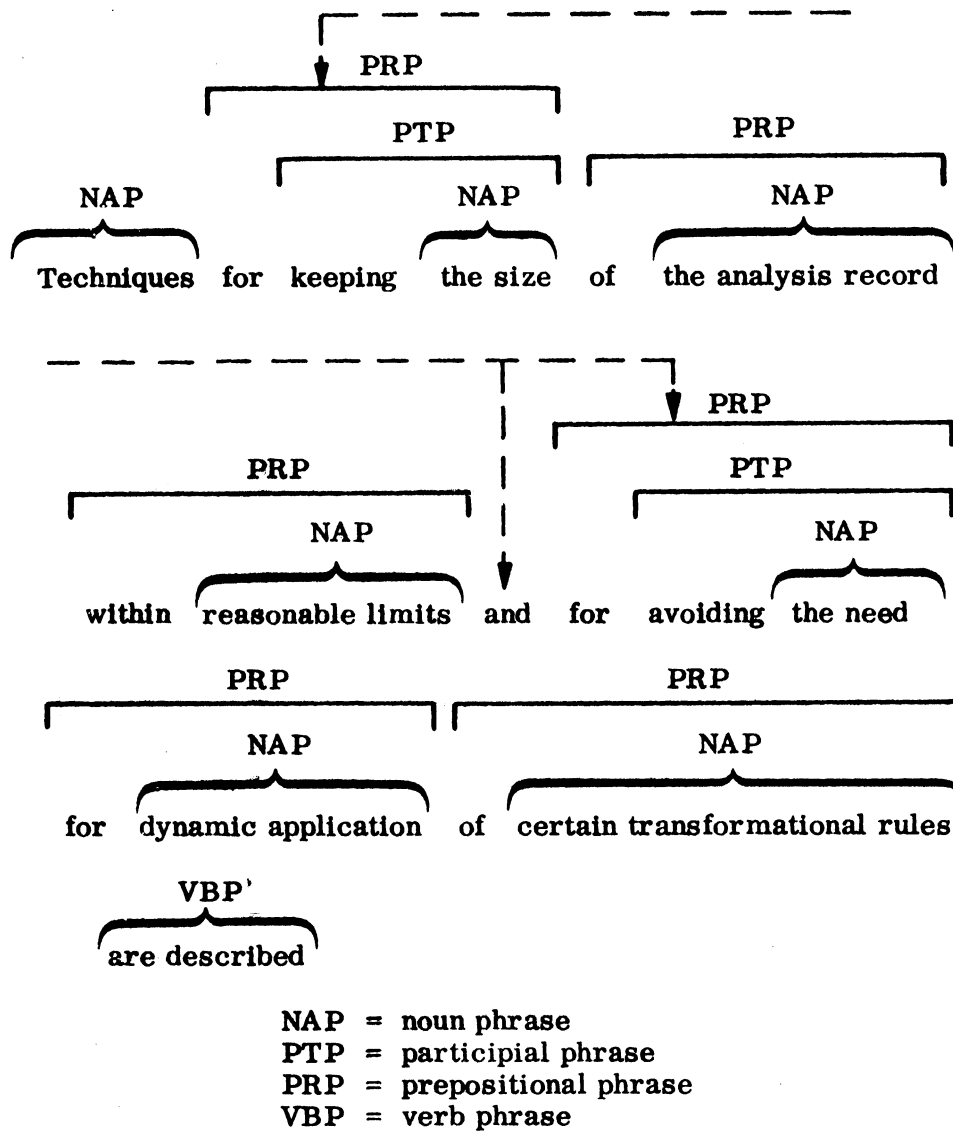


Fig. 5 Sample of Grammatical Structure After Level 3 Analysis

Level 4, which will complete the job of analysis, will draw upon the structure provided by the other three levels, and in some cases will also draw upon semantic information. Level 1, although it identified noun and verb phrases, did not spell out the function of each word within the phrase; this must be done at level 4. Level 2, though it identified the higher level prepositional, infinitive, and participial phrases, and thus implicitly identified the function of many of the noun phrases, did not identify the function of the higher level phrases themselves. This too must be done at level 4, and those noun phrases whose function was not identified in level 2 or level 3 must now be assigned a function. In addition, the clauses must be delineated and their relationships established. As each clause is delineated, its subject, verb, and object of the verb, if any, is defined. Thus levels 1 through 3 define structural units, while level 4 defines the functions of the units, completes the structure by defining the main elements of the sentence, and also acts as a check on the ambiguity resolutions of previous levels.

It is in the definition of clauses and their main parts that errors in the interpretation of preposition-conjunction (PR-CJ) ambiguities (at level 2) or phrase CJ-clause CJ ambiguities (at level 3) can now be detected and corrected. An example of a PR-CJ ambiguity will make this clearer, as is illustrated in Fig. 6. The NAP and VBP in sentence 1 of Fig. 5 are defined in a straightforward manner. In sentence 2, needs and processing are ambiguous, but both ambiguities are resolved in level 1, with needs being defined as a VBP, and more processing as a NAP. In level 2 analysis, both as an example in sentence 1 and as the sentence in sentence 2 meet the requirements of a prepositional phrase and both will be so defined. In level 4 analysis, however, the presence of needs as a VBP will indicate the need for an unattached NAP preceding it to act as subject. Since as is a conjunction possibility, the PRP will be dissolved, leaving the NAP the sentence free to act as subject. If no conjunctive possibility had occurred, the program would have to assume that the ambiguity of needs had been incorrectly resolved and add it to the NAP the sentence.

1.2.3 Methods of Ambiguity Resolution at Each Level

In discussing the methods by which the PHRASE parser determines structure, we can now enlarge on the previous discussion of the levels of analysis, which has already

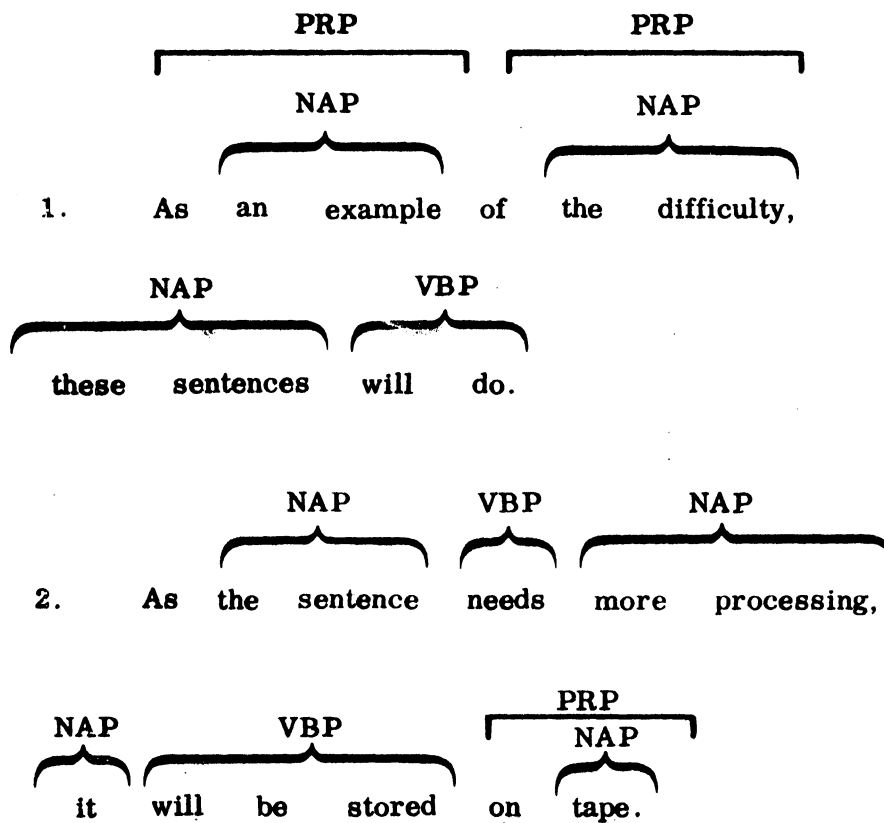


Fig. 6 Resolution of Preposition-Conjunction Ambiguity

shown in a general way how the parser determines structure by taking advantage of speech customs. The actual algorithms used in the level 1 and level 2 analysis are completely documented in sections 3.1 and 3.2, respectively, in the form of flow diagrams. These flow diagrams have evolved from those documented in sections 3.1 and 3.2 of last year's report (Ref. 6). To aid in the interpretation of the flow diagrams, it will be helpful to discuss the methods used at each level and to give some examples to illustrate the nature and application of the parsing rules.

Level 1, which defines the noun and verb phrases and the infinitives, is not only the most basic, laying the groundwork for subsequent levels, it is also probably the most complex and difficult. Level 1 deals with noun-verb and participle-verb ambiguities. Four main steps can be distinguished:

- (1) Elimination of some part-of-speech ambiguities
- (2) Identification of possible noun and verb phrases
- (3) Resolution of noun and verb phrase conflicts
- (4) Resolution of verb-participle ambiguities

An initial scan through the sentence takes advantage of certain impossibilities in the juxtaposition of parts of speech to narrow down part-of-speech possibilities or functional possibilities of certain words. For example, if a participle not an auxiliary is preceded by an article or an adjective possibility which is not an adverb possibility, then it is functioning as a noun or adjective and cannot be a verb or part of verb, nor is it likely that it is followed by a verb. Similarly, an ambiguous noun-verb in the same position as described above for the participle can be identified as a noun, and its verbal possibility could be eliminated. This rule is shown in flow diagram notation in Fig. 7.

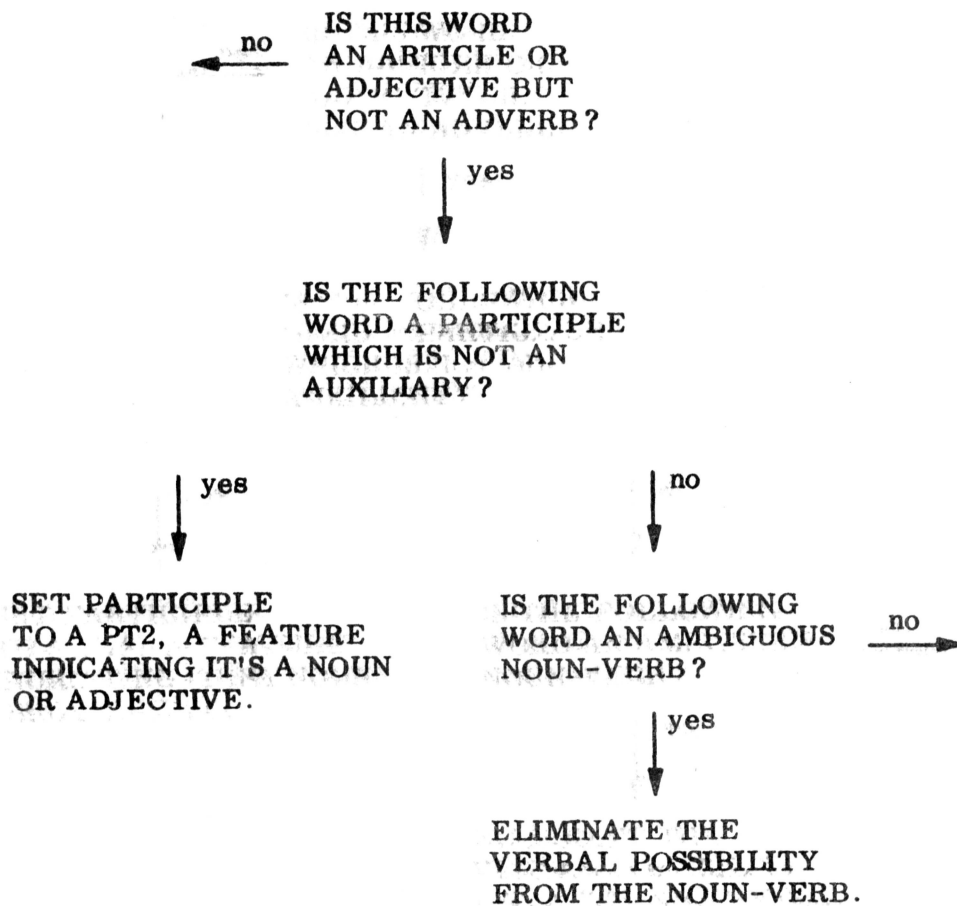


Fig. 7 Example of Operation of Juxtaposition Rules

In the following sentence, all ambiguities but one could be resolved in this first step.

She was demonstrating the zigzag stitch

PN	AX	NA PT	AR	NA	NA
	VB	VB PT		VB	VB

on the sewing machine.

PR	AR	NA PT	NA
	AJ	VB PT	VB

Presence of the auxiliary (AX) was eliminates the noun or adjective function (NA) from the participle (PT) demonstrating, showing that it functions as a verb (VB).

Presence of the article (AR) the eliminates the verbal possibility for zigzag, showing that it functions as a noun or adjective. Presence of the article (AR) the eliminates the verbal possibility for sewing and the combination of adjective followed by participle eliminates the verbal possibility for machine.

Some may object that these combining rules may result in error, as indeed they may, but the probability is so low as to be negligible, and if an error does occur, it can probably be detected and corrected at a later stage in analysis. For example, an auxiliary may be actually followed by an adjectival participle, contrary to the combination rules, as in

Those are flying saucers.

In scientific literature, such a possibility is rare enough to be ignored. Note that a rule could be formulated, however, to reduce this ambiguity problem even further, because the presence of those is a key to the semantics of the sentence. One could, but would not ordinarily, answer, "They are flying saucers" to the question, "What are those things?" or even "What are they?" On the other hand, one would have to answer the question, "What are they doing" with they and not those as in

They are flying planes (or knitting sweaters or whatever)

In level 4, therefore, presence of an animate plural subject will indicate a progressive verb like are flying; presence of these or those as subject will indicate an adjectival participle as in flying saucers.

In the second step of level 1, all possible noun and verb phrases are identified. Legal noun phrase strings are identified by a variety of rules which state what can be included in a phrase, what can begin or end a phrase, and what can be in a phrase under limited conditions only. After noun phrases, all possible verb phrases are identified by a similar set of rules. Possible noun phrases and verb phrases may overlap and often do, since there are always many noun-verb ambiguities in the sentence. Figure 8 shows all the possible noun and verb phrases in a sample sentence. Noun phrases are bracketed above the sentence and verb phrases below it. (Note that "mediates" is included in a noun phrase because the part-of-speech algorithm puts it in the noun plural-verb class, and "Galen" and "life" are included in verb phrases because the part-of-speech algorithm puts them in the noun-verb class.)

After all noun and verb phrases are defined, resolution of noun-verb ambiguity can begin. In this step, the rules, though involved, are based largely on the concept that each clause of a declarative sentence can contain but one verb, which is preceded by a subject, although both subject and verb may consist of two or more joined elements. Another of the characteristics of English declarative sentences which is used in resolving ambiguities is that two noun phrases cannot be contiguous unless the first is the object of a preposition, participle, or infinitive. In the resolution logic, each possible verb phrase is subjected to tests with respect to its immediate context, the availability of a noun phrase to act as its subject, presence of auxiliaries in the phrase, existence of other verb phrases in the sentence, and existence of clause or coordinating conjunctions, and so on. Each possible verb phrase is then accepted or rejected as a result of these tests, and changes are made in noun phrase boundaries to accommodate this choice.

Perhaps the easiest way to illustrate the kinds of rules used is to look at a portion of the noun-verb ambiguity routine, taken from the flow diagram and shown in Fig. 9.

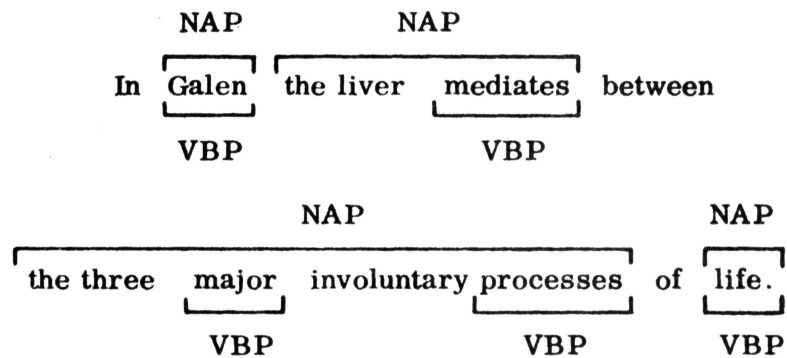


Fig. 8 Example of All Possible Noun Phrases
and Verb Phrases

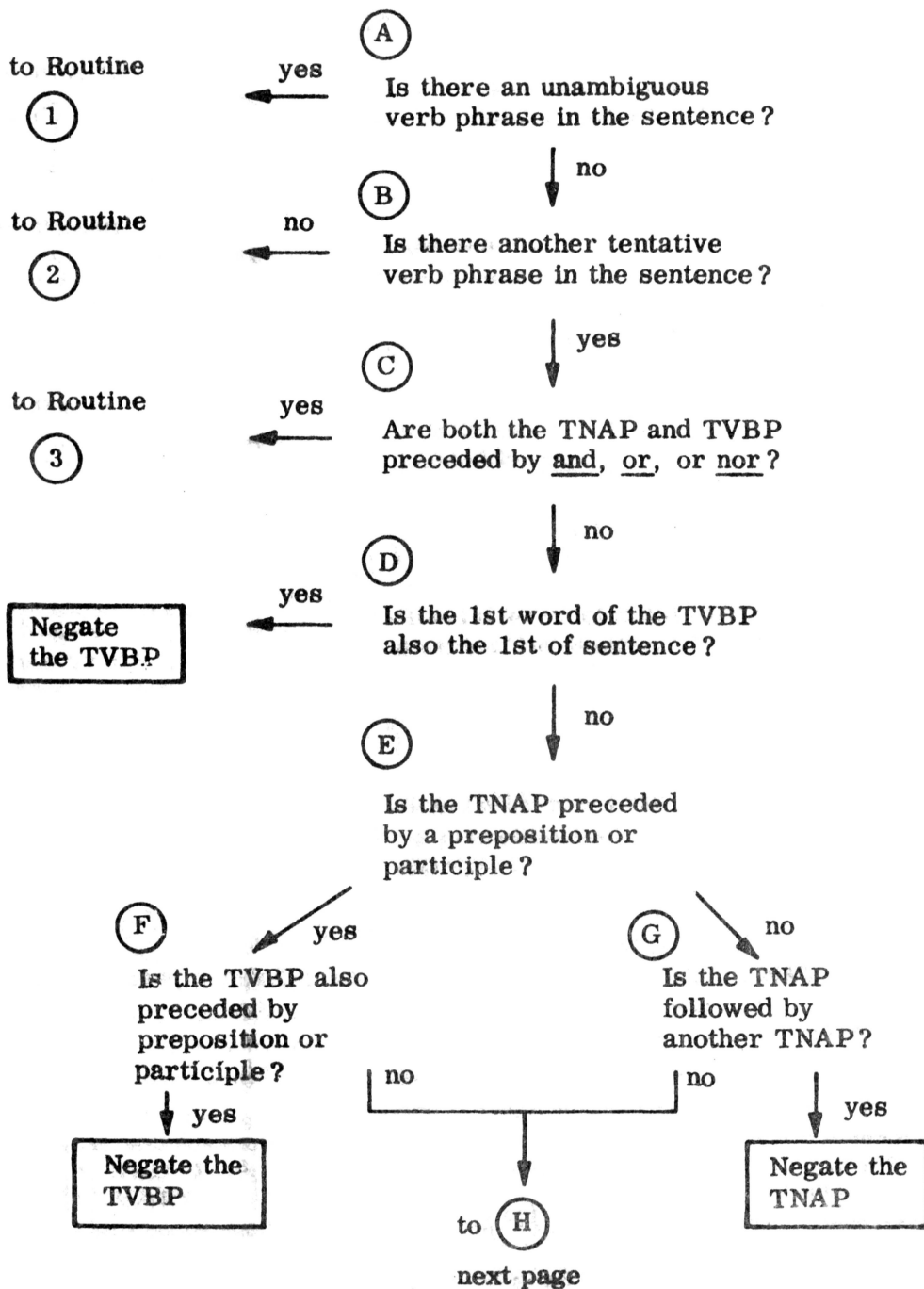


Fig. 9 Portion of Noun-Verb Ambiguity Logic

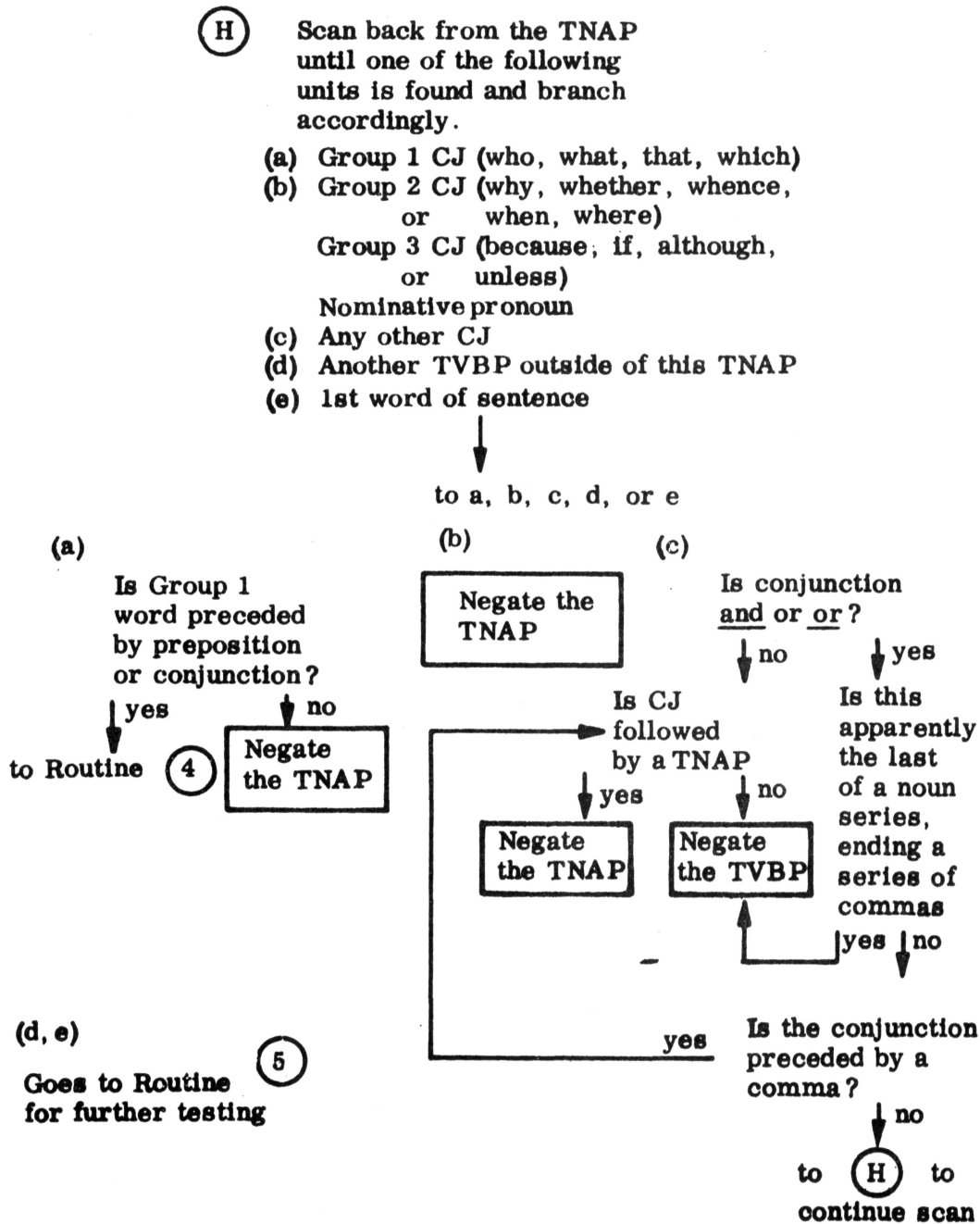


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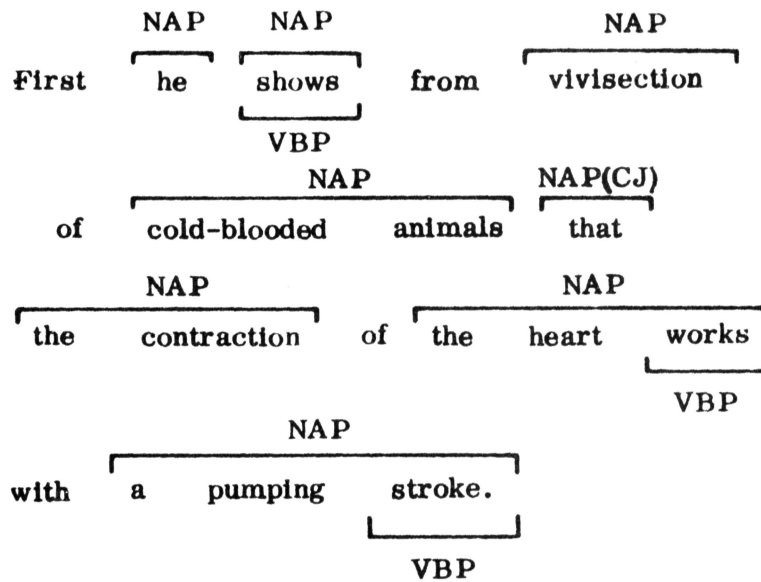
It shows part of the logic for resolving ambiguities when all the verb possibilities in the sentence are ambiguous. (Routine 1 referred to from box A has a different logic for resolving ambiguities when one or more unambiguous verb phrases occur in the sentence.) Every ambiguous word considered by this routine belongs within both a tentative noun phrase (referred to as the or this TNA P) and a tentative verb phrase (referred to as the or this TVBP). Other tentative phrases in the sentence are designated a or another TNA P and a or another TVBP. Figure 10 shows a sentence with three noun-verb ambiguities, indicates the path in Fig. 9 which the logic follows in resolving these ambiguities, and finally shows the sentence with remaining noun and verb phrases.

In the last step of level 1, an effort is made to identify infinitives. Any verb phrase possibility which directly follows the word to is called an infinitive. This is one of the weaknesses in the grammar rules. Though right much more than wrong, it is hard to get an intuitive feeling for how often it is wrong, and counts have not been taken. Fortunately, this is a problem which can be ameliorated with the use of word government, as will be explained later.

At this point, an attempt is also made to distinguish verbal present participles from adjectival or gerundal present participles. Rules dealing with this type of ambiguity can be compared to those dealing with noun-verb ambiguities, but differ as the characteristics of participles and nouns differ. Most present participle ambiguities are handled at level 2, but at this level the NAP designation is removed from present participles which are (1) the first word of the sentence, (2) are preceded by punctuation, or (3) are followed by past participles, as in the following examples:

- (1) Believing himself unobserved, he snatched the diamonds.
- (2) She left the room quietly, hoping that no one noticed.
- (3) He enjoys being praised by his parents.

These participles are then free to form participial phrases at level 2. Level 4 will have to identify the function of the participial phrases, and also of the free-floating



shows - A, B, C, D, E, G, Hb to set VBP
 works - A, B, C, D, E, F, Ha to set VBP
 stroke - A, B, C, D, E, F, Hd and to routine (5)
 where other tests set NAP

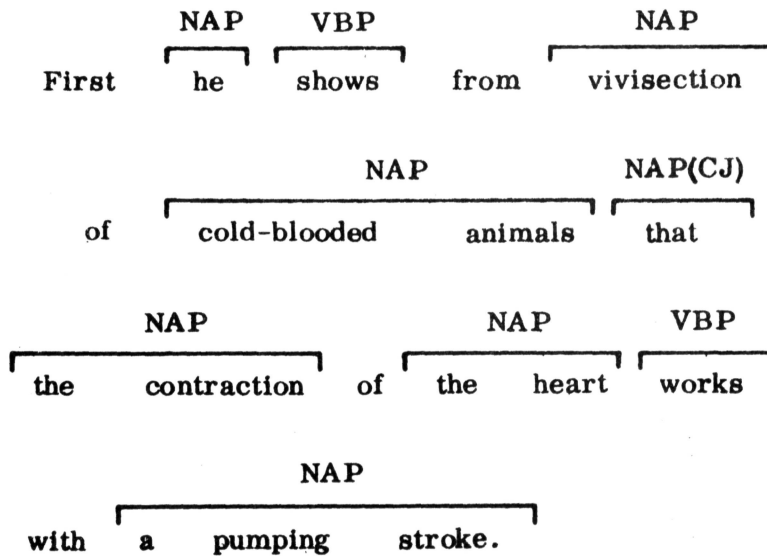
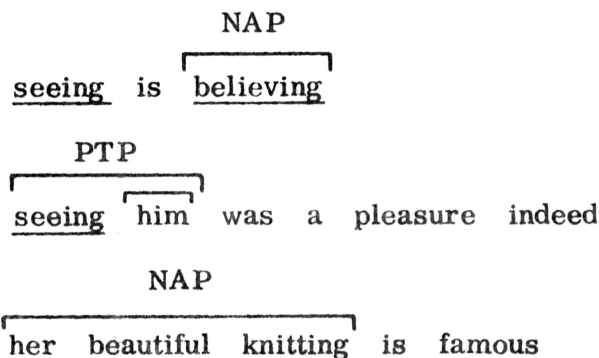


Fig. 10 Example of Noun-Verb Ambiguity Resolution

or noun phrase participles. Thus, all the underlined participles below should be designated as subject or predicate complement, assuming the role of a nominal, although some are in noun phrases, some in participial phrases, some floating.



The past participle-verb phrase ambiguities are handled by scans that search for free noun phrases, clause or coordinating conjunction, etc., much as in the noun-verb ambiguities, and with many of the same possibilities for error. Here again a "best guess" is being made at this point which will be checked at level 4, when the various functions in the sentence are identified.

At the second level of the analysis, the PHRASE program uses as data the basic word groups from the first level as well as the parts of speech of the words as assigned by the part-of-speech program. This section of the program defines phrases which may link together in a nesting fashion, with one phrase being identified in another phrase which may in turn be included in a larger phrase. It is convenient to think of these phrases in levels (not to be confused with analysis levels) with each higher level defined from the previous level, until no more phrases can be formed. Thus, in the first pass through the sentence, all noun phrases are examined to see if they belong within a second-level phrase. Noun phrases are examined from the back of the sentence, working toward the front because this makes it easier to resolve participial ambiguities. In the second pass through the sentence, all second-level phrases are examined to see if they belong within a third-level phrase. In the third pass, third-level phrases are examined to see if they belong within a fourth-level phrase.

(Nesting above the fourth level is not common, but the program has been recently expanded to handle fifth-level phrases.) High-level phrases are examined from the beginning of the sentence, working toward the end, because this makes it easier to keep the levels separate. The two examples given in Fig. 11 may help clarify the nesting concept. Noun phrases are regarded as on the lowest or first level. The second level phrases are labeled L2PH; the third level phrases are labeled L3PH.

In both examples, it is assumed that the past participle has already been identified as the verb phrase, which indeed would be the case. In the first example, the participle "allowing" is identified as the beginning of a participial phrase rather than the single noun object of the preposition "despite." The same thing is true of "fighting" in the second example; however, the function of "purchasing" had been tentatively resolved as adjectival in the first level analysis of PHRASE. Some additional checks are made at this level, but the adjective identification is allowed to stand. (The differentiation between an adjectival participle and one beginning a participial phrase is often very difficult, and will be discussed in the sections on "disambiguation," particularly in disambiguation from structural clues.)

Level 3 of the PHRASE program operates again on the output of the previous levels as well as on the parts of speech of the words. It identifies the role of those conjunctions in the sentence which are capable of linking either words or phrases or clauses, to determine just which are the actual linked entities; and, or, and but are conjunctions of this type. Development of these rules is still in progress, and it is possible that level 3 should be integrated with level 4, at which time the functions of the phrases are determined and the clause boundaries defined. Obviously, at the end of level 2 the phrases which could be linked are identified, but not the clauses. According to the present philosophy, level 3 will tentatively link words and phrases, and level 4 will correct the linkage to a clause linkage when necessary. The rules are based on the fact that the entity immediately following the conjunction is one of the pair of joined entities; therefore, a backward scan to the first encountered entity of the same type will generally find the other of the pair. Also, a comma before a

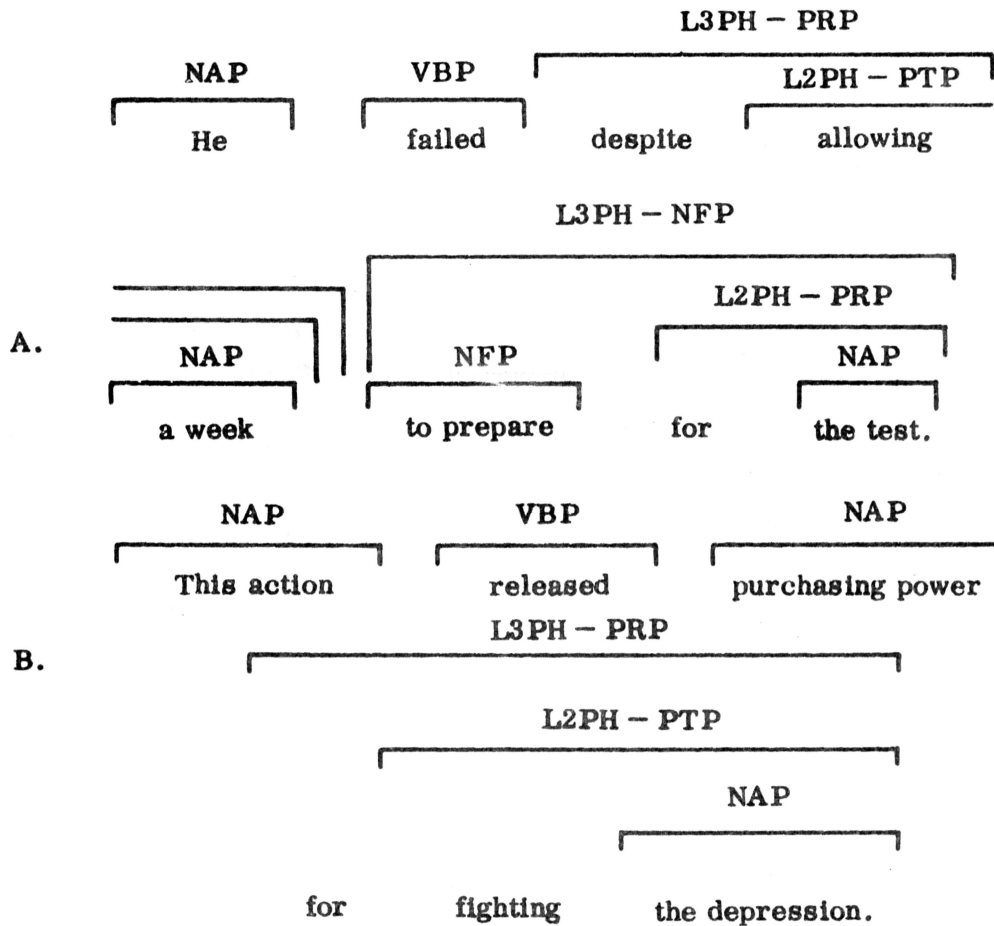
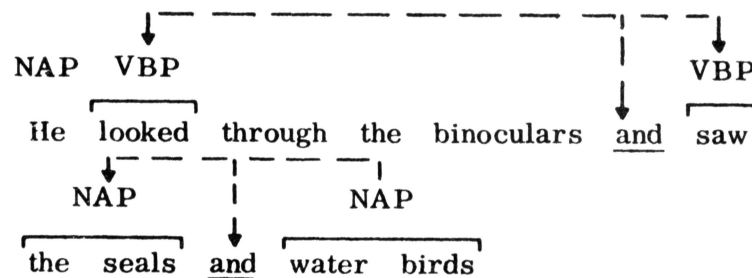
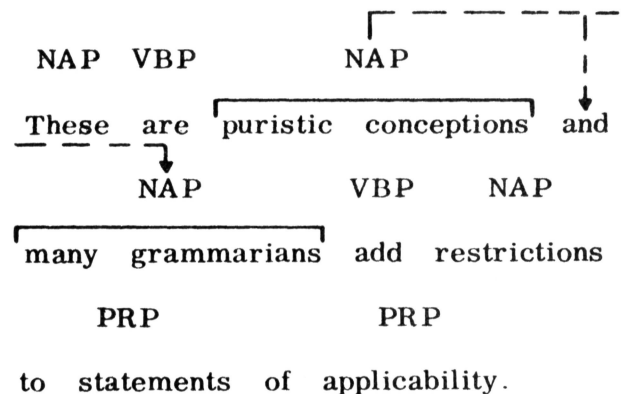


Fig. 11 Examples of Higher Level Phrases

conjunction indicates that it is a clause conjunction unless there is a whole series of entities joined by commas. Several examples will clarify.

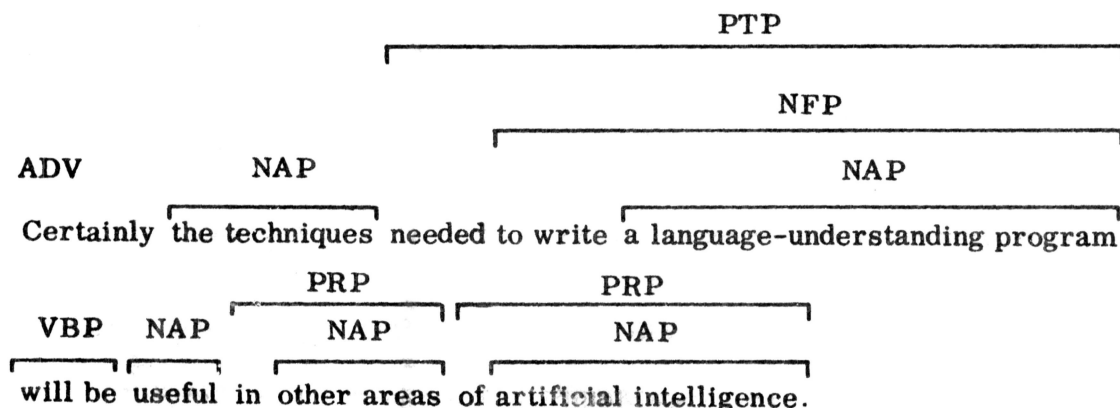


In this example, the first and is followed by a VBP. A scan back from the and finds looked as the first available VBP and links the two VBP. Similarly, the second and is followed by a NAP and a scan back immediately encounters the NAP the seals and links it to water birds. The next example shows a case in which two noun phrases would be joined at level 3 but dissolved at level 4 when it becomes clear that there are two complete clauses joined by the and.



Since the PHRASE program deals only with declarative sentences, it must be obvious that if all the analyses of levels 1, 2, and 3 have been correct, the level 4 analysis program has a very easy task in identifying subjects, verbs, and objects. The first "free" NAP (i.e., one not already in a complex word group), if any, will be the subject of the clause, and it should be followed by a VBP, which may or may not be followed by another "free" NAP, which if present is the object or predicate complement of the clause. This is, of course, a simplification of the rules which will be

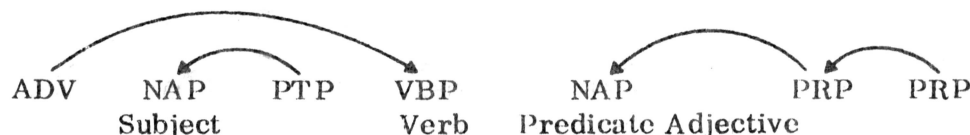
formulated, because some complex word groups can substitute for NAP, and because subject, verb, and object can all consist of more than one joined element. Let us look at an example:



Selecting always the highest level designations available, this sentence can be represented as a string of words and phrases thus:

ADV NAP PTP VBP NAP PRP PRP

There is only free NAP and VBP to act as the subject and predicate, and the predicate complement and modification patterns are also easily deduced as that shown below.



The logic of revision in case of error will be much more complex, but still relatively straightforward. However, it is also the task of level 4 to discover the modifying relationships within the sentence, both inter- and intra-phrase, and this is an area in which structural rules of syntax are very weak. As the section on word government will show, word government tables are an effective way to encode semantic information for the identification of inter-phrase modifying relationships.

1.3 PROGRESS AND RESULTS

1.3.1 Levels 1 and 2 of PHRASE

In the previous sections on the form and methods of the PHRASE program, much has been said about the resolution of ambiguity. Now that the coding of the first and second levels of PHRASE has been completed, testing of the efficacy of the resolution logic has been undertaken. Because of the method of implementation, the length of the sentence has relatively little effect on running time. Sentences average a little over a second for reading, processing, and printing the results. Thus, not run time, but analysis time is the limiting factor.

Testing of the parsing complex is an iterative and heuristic process in which some sentences of text are parsed, the results are perused, any indicated changes or corrections are made, and the whole process is repeated, until it seems that the results cannot be improved upon. Then more sentences are added to the test base, and the iterative testing and correction process is resumed. It is best to retain all of the previously tested sentences when new test sentences are added, because a change in the program to correct one problem may adversely affect the operation of the rules on some other construction, thus producing another problem. Keeping all the sentences in the test base makes such an adverse effect show up immediately while its cause is still very evident.

Testing was initiated with a group of about 48 sentences from a text on the philosophy of science; this number has been gradually increased to 320. As the number of sentences increases, the time it takes to check over printout of the parsed structures also increases, so that the time per iteration is always increasing. At some point soon, the sentence group will become too unwieldy, and it will be necessary to work with a fresh group, then merge the two groups for final tests.

Test runs on the 320 sentence test are beginning to look reasonable. Figure 12 shows the structure of two parsed sentences as printed by the OUTPUT program. The sentence is printed first. The next five lines give information about the first 13 words,

A DISCUSSION OF THE HOLY SPIRIT IN THE TRINITY LED HIM TO WRITE OF THE THREE SPIRITS OF THE BLOOD, WHICH CONVEYS SOUL THROUGHOUT THE BODY

L1	NAP	1	PR-	2	NAP	3	NAP	4	NAP	5	AV-PR-	6	NAP	7	NAP	8	VRP	9	NAP	10	NAP	11	NAP	12	NAP
L2	PRP		PRP		PRP		PRP		PRP		PRP		PRP		PRP		PRP		PRP		PRP		PRP		PRP
L3	NFPP		NFPP		NFPP		NFPP		NFPP		NFPP		NFPP		NFPP		NFPP		NFPP		NFPP		NFPP		NFPP
L4	PU-		PU-		PU-		PU-		PU-		PU-		PU-		PU-		PU-		PU-		PU-		PU-		PU-

IT WAS NOT THAT SIMPLE - VESALIUS CERTAINLY LOOKED WITH HIS OWN - BUT IT IS EASIER TO LOOK THAN TO SEE DIFFERENTLY, AND THERE WAS NO ALTERNATIVE TO THE ILLUSION OF UNDERSTANDING CREATED BY EXPLANATIONS LIKE THAT WHICH MAKES THE HUMBLE HFEEL AS PERFECTLY ADAPTE D FOR ITS ROLE IN THE HUMAN BODY AS IS THE SUN FOR GIVING LIFE TO THE BODY OF THE WORLD.

L1	NAP	1	VRP	2	NAP	3	NAP	4	PU-	5	NAP	6	VRP	7	NAP	8	VRP	9	PR-	10	NAP	11	NAP	12	PU-
L2	PRP		PRP		PRP		PRP		PRP		PRP		PRP		PRP		PRP		PRP		PRP		PRP		PRP
L3	NFPP		NFPP		NFPP		NFPP		NFPP		NFPP		NFPP		NFPP		NFPP		NFPP		NFPP		NFPP		NFPP
L4	PU-		PU-		PU-		PU-		PU-		PU-		PU-		PU-		PU-		PU-		PU-		PU-		PU-

Fig. 12 Sample of Parsing Output

the next five lines give information about the next 13 words, etc., for as many five-line groupings as necessary. The first line of each five-line group is labeled WD, and it contains the word numbers which act as column headings for the next four lines. The second line of each five-line group is labeled L1, and it shows the first-level phrase membership (noun phrase, verb phrase, or infinitive) of each word, if any, or if not, gives the codes for the parts of speech assigned to that word. The third line of each five-line group is labeled L2, and it shows the second-level phrase membership of each word, if any; i.e., all prepositional, participial, or infinitive phrases which have noun phrases as objects. The fourth line of each five-line group is labeled L3, and it shows the third-level phrase membership for each word; i.e., all prepositional, participial, or infinitive phrases which have second-level phrases as objects. Similarly, the fifth line, labeled L4, shows all prepositional, participial, or infinitive phrases which have third level phrases as objects.

First level phrases are abbreviated as follows:

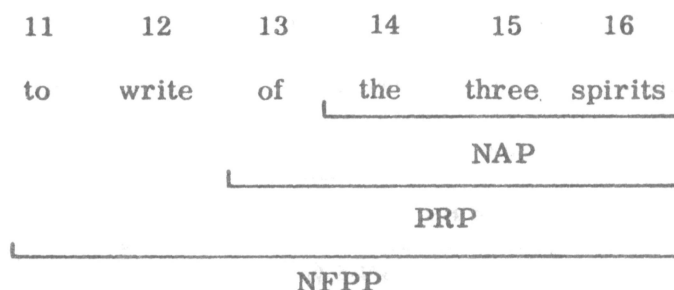
NAP	noun phrase
VBP	verb phrase
NFP	infinitive

Higher level phrases are abbreviated:

PRP	prepositional phrase
PTP	participial phrase
NFPP	infinitive phrase
APTPP	ambiguous participial phrase

In the first sentence in Fig. 12, to facilitate illustration, the word numbers have been written in above the words and lines enclose the word-number columns. The word numbers appear to the far right of the 10-character columns, while the phrase notations appear to the far left. Consider words 11 through 16, "to write of the three spirits." Words 11 and 12 are labeled as an infinitive on the L1 line, line L2 is blank, and line L3 shows that this infinitive is the initial word of a third-level phrase. Checking word 13 shows that the object of the infinitive is the second level prepositional

phrase beginning with this word. Word 13 is labeled as a preposition on the L1 line, the beginning of a prepositional phrase on the L2 line, and part of an infinitive phrase on the L3 line. Words 14 through 16 are labeled a noun phrase on the L1 line, part of a prepositional phrase on the L2 line, and part of an infinitive phrase on the L3 line. Thus, the structure,



is represented as

WD	11	12	13	14	15	16
L1				NAP	NAP	NAP
L2			PRP	PRP	PRP	PRP
L3	NFPP	NFPP	NFPP	NFPP	NFPP	NFPP

and so the phrase structure is shown graphically without actually drawing a graph.

The second sentence in Fig. 12 is included because it is an especially interesting one. For one thing, it is a five-clause sentence with all five verbs correctly identified. For another, though nesting of phrases above level 3 is quite rare, this sentence has a construction with a fifth level of nesting, only four levels of which were identified, originally, because this was the limit of the program. This limit has been expanded to five. For another, this sentence contains one of the ambiguous participial phrases which present such an interesting and difficult problem in automatic analysis.

Present participles can be considered as words which name an action by adding ing to the verb stem. They are used in four difficult capacities, and can be named according to function, thus:

PT1 — with the verb "to be" for a special tense,
I am planning to leave tomorrow

PT2 – as an adjective within a noun phrase,

He is a member of the planning commission.

PT3 – to act as a noun in the capacity of subject or object,

Planning ahead is a good idea.

PT4 – to modify a noun or verb phrase,

Planning to leave, they put down no roots.

PT1 is of course part of the verb. PT3 and PT4, though not part of the verb, can take an object like a verb, and for this reason are difficult to distinguish from PT2. When a noun group follows a participle, it is sometimes difficult to tell if the noun is an object of a PT3 or PT4 or is the word a PT2 modifies. If either the participle or the noun group are preceded by a noun identifier such as a, the, this, my, etc., there is no trouble. An identifier preceding the participle identifies the participle as PT2; an identifier preceding the noun group identifies the participle as a PT3 or PT4.

For example:

PT2 – the planning commission

PT3 or PT4 – planning the party

If identifiers are not used, then strings of the type NG NAP are structurally ambiguous, as for example:

PT2 – the law of falling bodies

PT3 – criticism for omitting line demonstrations

Since it was difficult even to predict which construction was the more common, it was decided to mark these cases as PT3, but ambiguous, and collect statistics on them.

In the first 256 sentences, there were 13 ambiguous participles, four of which were actually PT2, the remaining nine being PT3. The number of the noun turns out to be a good if not infallible guide for differentiation and will be used as criteria in the algorithm unless a better one is found. Of the four PT2, only one was followed by a singular noun; of the nine PT3, only two were followed by a plural noun. Actually, the rule that if the noun is singular the participle is PT3 is more consistently true than is the rule that if it is plural the participle is PT2. For now, these participles will be

left as ambiguous so that further studies can be made. Some PT2-PT3 ambiguities can be resolved by word government, to be discussed in the next section.

In the example in Fig. 12, the 59th word is a PT3, not a PT2, so the PTP should be allowed to form as shown, and the participle removed from the NAP, to give a different prepositional phrase and a structure as follows:

WD	58	59	60
L1	PR	NG	NAP
L2		PTP	PTP
L3	PRP	PRP	PRP

Although only ambiguous participial phrases were so marked by the program, this is by no means the only difficulty that comes up so far in the PHRASE program. It is simply a particularly common and intransigent difficulty for which statistics were desired. As was noted in the introduction, the philosophy used in forming the parsing algorithm called for the selection of the one most probable structure for the sentence. Tests to date show that there are still a number of constructions for which the algorithm fails to pick the correct structure. Since the number of constructions per sentence is quite high, the error rate will look to be low if the percentage of incorrect constructions is considered and will look to be high if the percentage of sentences with one or more errors is considered. Of the first 256 sentences tested, 45 sentences contain an error for which a "fix" cannot be devised at this time. Some of these errors result from unexpected uses of punctuation or misconstruing a sentence fragment as a sentence because it ends with a period. Some of the errors are dubious, where the traditional grammar we are trying to follow is not too precise. Some are very minor, as when an adverb between two verb phrases or between a noun and verb phrase is attached to the wrong phrase. Other errors, particularly the choice of the wrong verb phrase for a clause, or no verb phrase for a dependent clause, cannot be easily dismissed. Using a dictionary with precise part-of-speech information rather than a part-of-speech algorithm would help in some cases. In other cases, the level 4 analysis will point out the error, particularly in the case of a missing verb phrase, of an incorrect noun phrase boundary, or of an incorrect joining of words or phrases. It might be interesting to look at one of the errors in the present level 1 and 2 analysis which will be resolved

by the level 4 analysis. Figure 13 shows the 58th sentence in the 256 sentence test group. Note that words 4 and 5, gravity and Newton, are included in one noun phrase which is then included within a prepositional phrase. At the level 4 analysis, a free noun phrase will be sought preceding the verb phrase could unite (words 6 and 7), to act as the subject for that verb. When none is found, the preceding noun phrases will be examined for noun phrases containing more than one noun, which can be broken up to yield a free noun phrase. In this case, Newton can be detached from the prepositional phrase of gravity to provide a subject for the verb.

The other error in this sentence leads naturally to the discussion in Section 2 on word government tables, which encode several kinds of semantic clues, among them the transitivity of verbs. Note that word 24, all, has been called an adverb and part of the verb phrase encompassed. If encompassed had been coded as a transitive verb only, then the level 4 analysis would look for a free noun phrase to act as its object. Finding none, it could scan for noun possibilities following the verb and will immediately find the pronoun-adverb-adjective all which can be detached from the verb phrase to form the required object noun phrase.

Having spoken of error, it is time to show the considerable capabilities of the first and second levels of the PHRASE system. Figure 14 shows a group of consecutive sentences from text with their structure as assigned after the level 2 analysis. The structure of all eight sentences is substantially correct, although a grammarian might argue with my convention of calling here and there noun phrases in constructions of the there are type, as in the last sentence.

1.3.2 Level 3 of PHRASE

Formulation of an algorithm for level 3, which identifies joined words and phrases, has now been undertaken. As indicated in section 1.2, the aim of the level 3 analysis is first to distinguish clause conjunctions from phrase or word conjunctions, and then, for all nonclause conjunctions, to identify which words or phrases are joined. In formulating the algorithm, the following approach was used. First, tentative

IN THE THEORY OF GRAVITY NEWTON COULD UNITE KEPLER'S PLANETARY LAWS WITH GALILEO'S MECHANICS IN A MATHEMATICAL SCIENCE OF MATTER I
N MOTION THAT ENCOMPASSED ALL OF PHYSICS .

W0	0	1	2	3	4	5	6	7	8	9	10	11	12
L1AV-PR-	NAP	NAP	PR-	NAP	NAP	VBP	VBP	NAP	NAP	NAP	PR-	PR-	NAP
L2FRP	PRP	PRP	PRP	PRP	PRP	PRP	PRP	PRP	PRP	PRP	PRP	PRP	PRP
L3													
L4													
W0	13	14	15	16	17	18	19	20	21	22	23	24	25
L1NAP	AV-PR-	NAP	NAP	NAP	PR-	NAP	AV-PR-	NAP	NAP	NAP	VRP	VRP	PR-
L2PRP	PRP	PRP	PRP	PRP	PRP	PRP	PRP	PRP	PRP	PRP	PRP	PRP	PRP
L3													
L4													
W0	26	27											
L1NAP	PU-												
L2PRP													
L3													
L4													

Fig. 13 Example of Error Correction at Level 4 (Sentence 58)

DE FABRICA , FINALLY , IS A HIGHLY SYSTEMATIC WORK IN WHICH THE SYSTEM IS NO ARBITRARY SCHEME BUT THE VESALIAN ANALYSIS OF THE ROD Y ITSELF .

WD	0	NAP	1	PU-	2	AJ-AV-	3	PU-	4	VBP	5	NAP	6	NAP	7	NAP	8	NAP	9	AV-PR-	10	NAP	11	NAP	12
L1NAP																									
L2																									
L3																									
L4																									
WD	13	VBP	14	NAP	15	NAP	16	NAP	17	AV-PR-CJ-	18	NAP	19	NAP	20	NAP	21	PR-	22	NAP	23	NAP	24	NAP	25
L1NAP																									
L2																									
L3																									
L4																									
WD	26																								
L1PU-																									
L2																									
L3																									
L4																									

THE STRUCTURE OF THE OBJECT GIVES STRUCTURE TO THE STUDY .

WD	0	NAP	1	PR-	2	NAP	3	NAP	4	VBP	5	NAP	6	PR-	7	NAP	8	NAP	9	PU-	10
L1NAP																					
L2																					
L3																					
L4																					

SKIN AND MUSCLE ARE PLAYED AWAY LAYER AFTER LAYER TO REVEAL EACH LEVEL OF ORGANIZATION : THE MUSCULAR SYSTEM ITSELF , THE VASCULAR SYSTEM , THE NERVOUS SYSTEM , THE RESPIRATORY ORGANS , THE ABDOMINAL TRACT , THE ARCHITECTURE OF THE SKELETON , AND THE ARTICULATION OF THE JOINTS .

WD	0	CJ-	1	NAP	2	VBP	3	VBP	4	VBP	5	NAP	6	AJ-AV-PR-CJ-	7	PR-	8	NFP	9	NFP	10	NAP	11	NAP	12
L1NAP																									
L2																									
L3																									
L4																									
WD	13	NAP	14	PU-	15	NAP	16	NAP	17	NAP	18	NAP	19	PU-	20	NAP	21	NAP	22	NAP	23	PU-	24	NAP	25
L1PR-																									
L2PRP																									
L3																									
L4																									
WD	26	NAP	27	PU-	28	NAP	29	NAP	30	NAP	31	PU-	32	NAP	33	NAP	34	NAP	35	PU-	36	NAP	37	NAP	38
L1NAP																									
L2																									
L3																									
L4																									
WD	39	NAP	40	NAP	41	PU-	42	CJ-	43	NAP	44	NAP	45	PR-	46	NAP	47	NAP	48	PU-	49				
L1PR-																									
L2PRP																									
L3																									
L4																									

Fig. 14 Sample of Processed Text

PARTICULAR ORGANS, THE HEART AND LUNGS, THE BRAIN, THE GENITALIA, ARE DISMOUNTED AND DISMEMBERED AND DEPICTED, MISTAKENLY ON OCCASION (THE UTERUS LOOKS LIKE SOME FREUDIAN NIGHTMARE), BUT GENERALLY WITH AN ACCURACY AND PRECISION NEVER BEFORE SEEN. 12

WD	1	2	3	4	5	6	7	8	9	10	11	12
LINAP	NAP	PU-	NAP	NAP	CJ-	NAP	PU-	NAP	NAP	PU-	NAP	NAP
L2												
L3												
L4												
WD	13	14	15	16	17	18	19	20	21	22	23	24
LINAP	VBP	VBP	VBP	VBP	VBP	VBP	VBP	PU-	AJ-AV-	AV-PR-	NAP	PU-
L2												
L3												
L4												
WD	26	27	28	29	30	31	32	33	34	35	36	37
LINAP	VBP	VBP	VB-AV-PR-	NAP	NAP	NAP	PU-	PU-	AV-PR-CJ-	AJ-AV-	PR-	NAP
L2												
L3												
L4												
WD	39	40	41	42	43	44						
LINAP	NAP	AV-	AV-PR-CJ-	PR-	PU-							
L2												
L3												
L4												

THE PLATES COMBINE THE SCIENTIST'S EYE FOR DETAIL WITH THE ARTIST'S EYE FOR EFFECT. 12

WD	1	2	3	4	5	6	7	8	9	10	11	12
LINAP	NAP	VBP	NAP	NAP	NAP	PR-	NAP	PR-	NAP	NAP	NAP	PR-
L2												
L3												
L4												
WD	13	14										
LINAP	PU-											
L2												
L3												
L4												

Fig. 14 (Cont.)

THE IMPORTANCE OF THE WORK , THEREFORE , DERIVED FROM ITS INFLUENCE AS A WHOLE .

WD	0	NAP	1	PR-	2	NAP	3	NAP	4	PU-	5	AV-	6	PU-	7	VBP	8	PR-	9	NAP	10	NAP	11	AJ-AV-PR-C	12
L1NAP				PRP		PRP		PRP										PRP		PRP		PRP			
L2																									
L3																									
L4																									
WD	13	NAP	14	PU-	15																				
L1NAP		PRP																							
L2FRP																									
L3																									
L4																									

NOT ONLY IS IT A MODEL ANATOMICAL TREATISE , IT WAS THE FIRST TREATISE IN THE HISTORY OF ANY SCIENCE IN WHICH ALL THE RELEVANT FACTS WERE PUT DOWN IN ORDER AND FROM NATURE .

WD	0	AJ-AV-	1	VBP	2	NAP	3	NAP	4	NAP	5	NAP	6	NAP	7	PU-	8	NAP	9	VBP	10	NAP	11	NAP	12
L1AV-																									
L2																									
L3																									
L4																									
WD	13	AV-PR-	14	NAP	15	NAP	16	PR-	17	NAP	18	NAP	19	AV-PR-	20	NAP	21	NAP	22	NAP	23	NAP	24	NAP	25
L1NAP		PRP		PRP		PRP		PRP		PRP		PRP		PRP		PRP		PRP							
L2																									
L3																									
L4																									
WD	26	VBP	27	VBP	28	AV-PR-	29	NAP	30	CJ-	31	PR-	32	NAP	33	PU-	34								
L1VBP						PRP		PRP				PRP		PRP											
L2																									
L3																									
L4																									

THERE WERE NO NEW THEORIES , BUT HERE WERE ALL THE FACTS .

WD	0	VBP	1	NAP	2	NAP	3	NAP	4	PU-	5	AV-PR-CJ-	6	NAP	7	VBP	8	VBP	9	NAP	10	NAP	11	PU-	12
L1NAP																									
L2																									
L3																									
L4																									

Fig. 14 (Cont.)

conjunctive rules were formulated. Then a journal article was chosen and all sentences containing conjunctives were extracted. The rules were tested against these sentences and were modified or augmented as necessary. Finally, these rules were transformed into a form suitable for computer coding, as is shown in the documentation, section 3.4. This must be regarded as a preliminary or working flow diagram.

Before any actual coding can take place, considerably more analysis is necessary

- Already recognized deficiencies in the algorithm should be repaired
- The algorithm should be hand-checked for efficacy on still more text, and modified as necessary
- The method to be used to store and to display the results of the level 3 analysis must be carefully planned
- Careful consideration must be given to the advisability of merging the level 3 and level 4 analyses

One of the recognized deficiencies which should be repaired is a failure to take cognizance of all the common conjunctive pairs found in English, such as:

between X and Y
rather X than Y
either X or Y
both X and Y
not X but Y

Only the first two of these pairs, which occurred in the development text, are recognized by the present algorithm.

Some of the problems which have come up in formulating the conjunctive rules are of interest. First of all, to simplify the problem, only the basic conjunctives and, or, and but were considered, together with than as a special case. Others such as as, as well as, then, for, etc., which show a more complicated conjunctive relation,

were ignored for now. The guiding rule for the basic conjunctives is simple once perceived; the entity following the conjunction is being joined to a like entity mentioned previously in the sentence. The problem is that it is not always easy to identify either the extent of the entity following or to which of several preceding like-entities it is joined. For example, if the conjunctive is followed by a noun phrase, at least three things must be decided.

- (1) Is the noun phrase itself the joined entity or is it the beginning of a clause which is the real joined entity?
- (2) Is the noun phrase part of a whole series of joined entities, or just one of a pair?
- (3) Is the noun phrase being linked to a preceding object of a preposition, participle, or infinitive, or is it being linked directly to the subject or object of the clause?

(Sometimes the noun phrase may actually be a part of the noun phrase immediately preceding, or may have been incorrectly labeled as a noun phrase. These additional complications will not be considered at this time).

Some sentence pairs can be used to illustrate the three main problems. In each pair, although the second level structure in the near-context of the conjunctive is the same in each sentence, the third level structure is different. To show this, the entities which should be linked are underlined. Notice that in all six sentences, the conjunctive in question is both preceded and followed by a noun phrase.

● Problem (1) – Does CJ begin a clause?

- 1a They lived on a farm where fat cows and sheep meandered through the fields
- 1b The grass there grew lush with clover and sheep meandered through the fields.

● Problem (2) – Does CJ end a series?

- 2a They chose the valley site for its good transportation, a climate enjoyed by most, and an adequate power supply.

2b They enjoyed the site for its good view, and revelled in the clean air, unusual in this area, and the good soil.

● Problem (3) – Does CJ link to a noun phrase within a higher level phrase?

3a The existence of organized social institutions and beliefs is evidence of such a degree of development

3b The organization of social institutions and tool making are evidence of such a degree of development.

The present rules will handle 1a correctly but not 1b, 2a but not 2b, and 3a but not 3b, favoring what seems the most probable construction. Problems 1 and 3 will yield to an analysis of clauses, such as is planned for level 4 analysis. This means that the possible merging of levels 3 and 4, as discussed in section 1.2, remains very much a moot question.

Section 2 ENGLISH WORD GOVERNMENT

2.1 NATURE OF WORD GOVERNMENT

Before taking up the application of word government to resolution of ambiguity, some definitions must be given. A governing word is one which requires one or more of several constructions to complete its meaning. Thus, believe can be completed by a noun, or by the prepositional phrase beginning with in, or by a that clause, or by a clause with that understood, etc.

The relationship between believe and the elements it governs can be conveniently shown in the following tabular arrangement:

believe	vt	S
	vt	(that) + clause
	vt	what + clause
	vi	in S
	vi	in what + clause
	vt	S/(to be)S

where vt denotes a transitive verb, vi denotes an intransitive verb, S denotes a substantive, and parentheses indicate that the inclusion of that or to be is optional in that pattern.

Following the Ramo-Wooldridge nomenclature (Ref. 7), the governing word is called the primary. The elements governed by the primaries (S, that + clause, in S, etc.) are called secondaries or secondary patterns. Thus, the phenomenon of word government deals with two sets of English words, primaries and secondaries, and the relationship between them. Primaries are nouns, verbs, adjectives, occasionally

adverbs; secondaries are usually prepositional phrases, clauses, a particular form of verb, or certain case forms of nouns. Government tables in a format similar to that given above are being compiled at the Lockheed Palo Alto Research Laboratory. The tables are more than half complete, and it has been estimated that about 8000 primaries, or entries, will appear in the completed tables.

Government tables are of considerable potential value in automatic language processing because they encode syntactic and semantic relationships in a convenient and concise tabular form. They are useful in the resolution of three kinds of ambiguity.

- (1) Syntactic ambiguity, in the usage of both primaries and secondaries
- (2) Semantic ambiguity of the primaries
- (3) Semantic ambiguity of the prepositions which occur in the secondary patterns

Resolution of type (1) is possible because occurrence of a government pattern usually establishes the part of speech of the primary and of substantives in the secondary, and also establishes that the secondary does indeed modify the primary. This use of government will be discussed in the next section (2.2). Resolution of type (2) is possible because it often happens that different secondary patterns impart different meanings to the primary, in which case it is possible to distinguish the meanings of the primary by the presence of the secondary patterns. This use of government is fully discussed in Robison's Computer-Detectable Semantic Structures (Ref. 8). Resolution of type (3) is possible because occurrence of a preposition in a government pattern ties down its meaning to a specific, as the preposition in following believe (see pattern above) denotes an abstract relationship "residing in" rather than the more common spatial relationship "inside of." This use of government is also mentioned in Ref. 8, and will be discussed in this section.

Resolution of ambiguities of type (1) is possible from the tables in their original form, as illustrated by believe above. For resolution of ambiguities of type (2), a code for meaning must be added, and current government compilation includes this, as in the patterns for PEER below. (See section 3.5 for description of government table

format.) Thus, if PEER is unmodified or completed by "of" plus a substantive (S), it means either "an equal" or "a nobleman," as in "his peer," or "peer of the realm." If PEER is modified by "into" plus a substantive, it means "to look closely" as in "I peered into the window." If PEER is modified by "out from" it may mean either "to look closely" or "to appear," although the latter is most likely, since "from" is usually omitted for meaning (5), as in "I peered out the window" but "The sun peered out from the cloud."

PEER

Meanings

- (1) an equal
- (2) a nobleman
- (3) to make equal
- (4) to make a nobleman of
- (5) to look closely
- (6) to appear or appear partially

Patterns

1,2	n	(of S)
3	vt	S/with S
4	vt	S
5	vi	at S/(through S)
5	vi	into S/(from S)/(through S)
5	vi	out (from) S/(at S)
6	vi	above S
6	vi	through S
6	vi	out from S

Resolution of ambiguities of type (3) requires, in addition, a code attached to each preposition in the secondary patterns, to indicate which of that preposition's meaning-relationships is operative in the pattern. For example, the preposition through in the patterns for PEER above, has the meaning of "from one side or end to the other

side or end," out of perhaps seven other meanings, such as "by means of" or "as a result of." A meaning code should be attached to through to establish that its meaning in this context is "from one side or end to the other." Sometimes the use of meaning codes for prepositions will mean that extra secondary patterns must be created. For example, consider one of the government patterns for hire, which could be listed as

hire vt S/(for S)/ (at S)

However, for S may be used in two different ways in this pattern.

- (1) We hired him for farm work at three dollars an hour
- (2) We hired him for three dollars an hour.

In (1), for indicates a relationship of purpose; in (2) it indicates a relationship of price. Suppose we use superscripts to distinguish different prepositional relations. Then for and at are each capable of expressing a number of relationships, among them

for² = relationship of purpose
for⁷ = relationship of price
at⁵ = relationship of price

Now the above pattern for hire can be more precisely stated by two patterns.

hire vt S/(for² S)/(at⁵ S)
 vt S/(for⁷ S)

Note that patterns which appear to be identical for two different words will be shown to be distinct

Thus

hire vt S/(for S)
admire vt S/(for S)

would become instead

hire vt S/(for⁷ S)
admire vt S/(for³ S)

where for³ would be defined
for³ = relationship of cause
as in

We admire him for his bravery.

These meaning codes for prepositions have not yet been added to the government tables being compiled at Lockheed. In fact, the prerequisite study of prepositional meanings has not yet been undertaken. There have been some studies of prepositions. Newman (Ref. 9) has examined the common prepositions beginning with "a." He finds 15 meanings for the preposition at. It is not easy to discover all the usages of a preposition, or to decide how finely to draw the distinctions meaning. For at, the Webster's New World dictionary lists a general meaning and 12 particularized meanings. The Oxford English Dictionary admits that "... at is used to denote relations of so many kinds, and some of these so remote from its primary local sense, that a classification of its uses is very difficult. Only a general outline can be given...." They then list 38 meanings.

Often, as is the case with at, many of a preposition's meanings are interchangeable with those of other prepositions. For example, at in the patterns for PEER above is roughly equivalent to toward in its major meaning "in the direction of, " and "toward" could be used in those patterns, though it usually is not.

Since the meaning of the preposition is obviously so tied to the word it modifies (its primary in word government pariance), the best way to proceed would seem to be to tabulate all the possible relations which prepositions express, then tag all prepositions in secondary patterns with the appropriate relation-tag. If all possible meanings of a given preposition are desired, these could be obtained by sorting the government tables, as could the correlation of identical meanings of different prepositions. Or at least this is true for all prepositions and all meaning-relations which occur in word government; it is quite likely that there are prepositions and meaning-relationships which do not occur in the word government tables. Thus, though we must admit that

word government tables cannot be used to solve all problems of the semantic interpretation of prepositions, they could be used to make a very significant contribution in this very crucial area of semantic analysis.

Government tables with codes for meanings, but without specific meanings, have been completed through the letter o. Tables for the letters n and o have not been previously published and will be found here in Appendix A. Government tables which include specific meanings have been completed for the letter r. These will be found here in Appendix B. The r table is in the format decided upon last year, as described in section 3.5. Section 3.5 documents and explains some changes in syntactic code and secondary pattern notation, including the use of parentheses to designate optional secondary patterns. It is possible that further changes in notation should be considered, for two limitations of the government tables in their present form have been noted, as follows:

- Often secondary patterns are interchangeable, as they are for the primary reassurance; no effort has been made to show this.

I gave reassurance to her on that point

I gave reassurance on that point to the students

I gave the students reassurance on that point

- Sometimes it is difficult to tell whether or not a prepositional phrase used with a word is really completing the meaning or simply modifying the meaning of the primary word. This distinction may not be operationally important, however.

2.2 Utilization of Word Government in Syntactic Analysis

Word government's relation to syntactic analysis is twofold; they are interdependent, one upon the other. Syntactic analysis at level 2 of the parsing system is necessary for the automatic identification of government patterns in text. On the other hand, identification of government patterns is necessary for error detection and resolution of functional ambiguity at the fourth and last level of the analysis. Fortunately, the government tables can be utilized for this ambiguity resolution in their original form, without any attached meanings for either primary or secondary. This means that the information can be encoded in a convenient, concise table of about 8000 entries.

The general mechanism for the use of government tables for resolution of syntactic ambiguity can be summarized as a process consisting of scan, table-look-up, and a drawing of inference. The sentence is first scanned for presence of governing words, i.e., primaries. Then the government patterns, i.e., secondaries, associated with each governing word found are sought in the sentence structure as shown by the parsing system. Inferences can then be drawn according to the government patterns found. For example, if none of the patterns are found, an error in syntactic analysis is indicated and some analysis backtracking can be undertaken. Or, if only one of the patterns is found, then the functions of the words making up the pattern have been determined. Or, if the primary word is both a noun and verb, but the secondary government patterns for noun and verb differ, then identification of the government pattern in the sentence establishes the usage of the governing word. And so on. (Except, of course, that more than one government pattern may be found for a given governing word, or a given syntactic element may be an element in the pattern of more than one governing word. Then again we must resort to picking the most probable structure until still more discriminatory techniques are developed.)

Some examples will help to clarify the mechanism of use of the government tables and at the same time serve to demonstrate their value. In the examples which follow, the government tables are used in four capacities: (1) to determine when a noun phrase must be split into two phrases to provide an indirect object, (2) to determine

the word or phrase which a prepositional phrase modifies, (3) to detect an error in infinitive definition, and (4) to detect an error in resolution of noun-verb ambiguity.

As people work to reduce the number of alternative structures produced by automatic analysis, they are bound to introduce easily coded semantic information. In their parsing program, Thorne et al. (Ref. 10) mark verbs that can take a double object in their dictionary. This allows them to produce but one analysis for the sentence

(a) Fred lost (the dog biscuits)

because lost does not take a double object, whereas two analyses are necessary for double object verbs such as hand or give.

(b) Fred handed (the girl biscuits) or
gave (the dog biscuits)

(c) Fred handed (the girl) (biscuits) or
gave (the dog) (biscuits)

This could be regarded as a limited form of government wherein "hand" is recorded as governing two objects. The full government table for the verbal used of hand; as given in Table 2-1, is an even more powerful aid. In entries 3 through 7, the initial slash indicates that the prepositions, in, down, out, on, or over can either precede or follow the substantive.

He handed out pencils,
or
He handed pencils out.

Table 2-1
FULL GOVERNMENT TABLE FOR THE VERBAL
USES OF HAND

Word	Meaning	Part of Speech	Pattern
① hand	1	vt	S/S
② hand	1	vt	S/to S
③ hand	2	vt	/in S/(to S)
④ hand	3	vt	/down S/(to S)
⑤ hand	4	vt	/out S/(to S)
⑥ hand	5	vt	/on S/(to S)
⑦ hand	6	vt	/over S/(to S)

Note that Thorne would evidently be forced to produce two analyses (d) and (e) for the sentences below.

- (d) Fred handed (the windshield wipers) to me
and
Fred handed (the dog biscuits) to me
- (e) Fred handed (the windshield) (wipers) to me
and
Fred handed (the dog) (biscuits) to me

With the full government table available, only analysis (d) would be valid, because the pattern ① S/S does not include the prepositional phrase to S. Similarly, in the previous example only analysis (c) will be valid.

The government pattern for hand also provides an example of the use of government in the resolution of the modification of prepositional phrases, and in explication of the anomaly of two prepositions occurring together. For example, the sentence

The Supreme Court will soon hand down a judgment on the case to the lower court.

can be regarded as follows:

The Supreme Court will soon hand down S on S to S.

It is theoretically possible for the prepositional phrase on the case to modify either the verb hand or the noun judgment, and for the prepositional phrase to the lower court to modify either the verb hand, the noun case, or more rarely, the noun judgment. It is also possible for down to be an adverbial particle modifying or changing the meaning of hand, or the preposition in the prepositional phrase down a judgment. These three ambiguities give rise to twelve alternate structures, all of which would presumably be produced by most automatic analyzers.

All ambiguities can be resolved by referring to the government table. Although both patterns (4) and (6) appear to be applicable, since both (4) and (6) involve adverbial particles which must occur either after the verb or after the verb and a substantive, never after a prepositional phrase, pattern (6) can be eliminated. Down is thus identified as an adverbial particle modifying hand, and to as a preposition modifying hand. Since on is not a part of the hand pattern, it must modify the noun it follows, i.e., judgment. If the sentence had been written

The Supreme Court will soon hand a judgment down on the case to the lower court. down can be immediately recognized as a floating adverbial participle and linked with the verb hand or, if you prefer, hand S down can be transformed to hand down S. Then on the case can be set to modify judgment, the noun it follows after the transformation. As before, to is recognized as modifying the verb hand, not the noun case.

Of course, it must be admitted that government does not always do a complete job of determining the modification patterns of prepositional phrases. It may happen that there are no governing words among the ambiguous structures, or that there is more than one governing word with the same government pattern. Then, although the most probable structure is always the simplest one, with related phrases adjacent, another way must be found to define the structure with certainty.

For an example of the detection of errors in infinitive definition, we can look at actual occurrences of the error in the present test samples. One sentence in the sample reads in part as follows:

... when they were carried back to Paris

Because Paris was assigned the parts of speech "noun" and "verb," to Paris was called an infinitive. The government patterns for carry do not show any infinitives as secondaries, but one of the patterns reads as follows:

vt /back S/to S

In the passive the object S is lost, of course, and the pattern fits exactly, showing Paris to be a substantive. Another sentence reads in part as follows:

Anatomy necessarily moves from description to function,

Here, again, to function was defined as an infinitive. Both description and move are governing primaries. Description has no infinitives among its secondaries, but move has among its patterns

① (S)/from S/to S

② to-inf S

Here pattern ① fits the sentence exactly, while the S required in pattern ② is missing, and function is thus shown to be a substantive.

Incorrect resolution of noun-verb ambiguities can also be detected by use of the government table. Consider the sentence which reads in part:

... while the ignorant menial down below would grapple in the body and hold up the liver by way of illustration

Levels 1 and 3 of the present analysis will resolve the ambiguity of hold as a substantive and link the noun phrase the body with the noun phrase hold. However, if the government patterns of hold are consulted, 53 verbal patterns and 4 noun patterns will be found. Four of the verbal patterns include up:

- 1 vt /up S/until S
- 1 vt /up S/CJ + Cl
- 2 vt /up S
- 3 vt /up S/(to S)

None of the noun patterns include up:

- 4 n (of S)/on S
- 4 n (of S)/upon S
- 4 n (of S)/over S
- 5 n of S

The pattern for meaning ② of course fits exactly and incidentally determines not only that hold is a verb but also narrows down its possible meanings.

It is clear that word government is a device which is very valuable in the analysis not only of the highly inflected languages where it was first used, but also of our own English language.* It is limited in its scope, but it is also far easier to implement for the whole of a language than a semantic world-model, such as that used by PROGRAMMAR [11], or Schank [12], for example. Consider the sentence discussed on page 89 of Ref. 2.

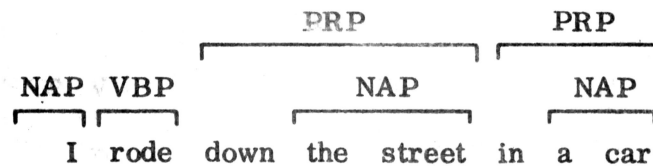
"I rode down the street in a car."

*The universal character of the government concept was brought to our attention by Serge Kassatkin, Lecturer in Russian at the University of California at Berkeley and consultant to Lockheed on an early machine translation project.

PROGRAMMAR will consult a world-model which includes both general knowledge (cars do not contain streets) and specific knowledge (Melvin owns a red car). Thus, it can deduce that in a car does not modify street. But a world-model of this quality is much more difficult both to compile and to consult than the government patterns of ride, which will of course include the entries

- 1 vt S/(down S)/(to S)
- 2 vi (down S)/(in S)/(to S)

along with many others, ride being a very common and therefore pattern-rich word. The sentence after analysis by PHRASE will show the structure:



or in government notation:

vi
S rode down S in S

The second pattern given above fits exactly, and both prepositional phrases will be assigned to modify the governing word rode.

Section 3 DOCUMENTATION

3.1 BPHRAS - LEVEL 1 OF PHRASE PARSER

The BPHRAS program analyzes the string of part-of-speech codes associated with a sentence and identifies noun, verb, and infinitive phrases within the sentence. It was documented in section 5.3 of the 1968 report, and an amended flow diagram was given in section 3.1 of the 1969 report. Since substantial changes in parsing logic have been made this year (see section 1.3), the complete revised flow diagram is given in Fig. 15. The description, input, and theory given in the 1968 report are still valid, augmented by the discussion in section 1.2 of the 1971 report and section 1.2 of this report.

BPHRAS BEGIN

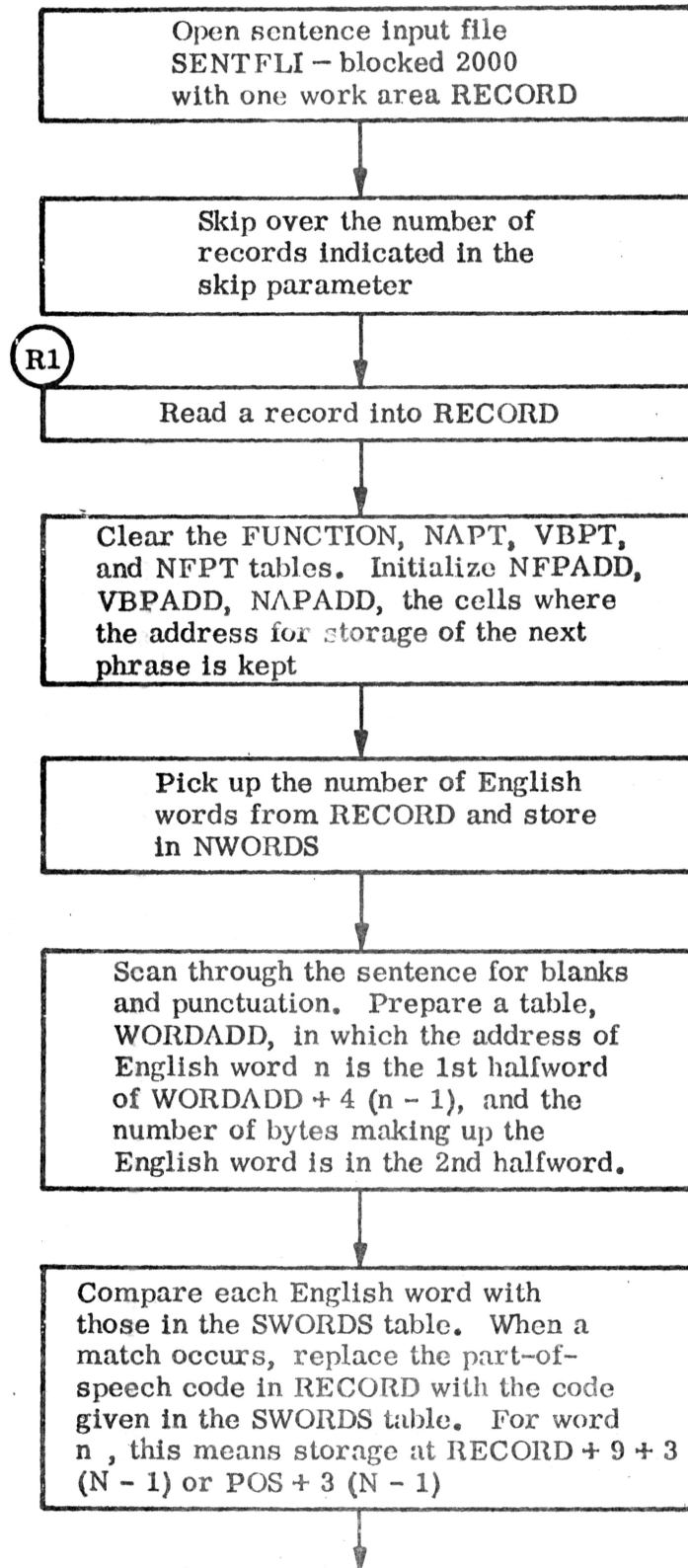


Fig. 15 BPHRAS Flow Diagram

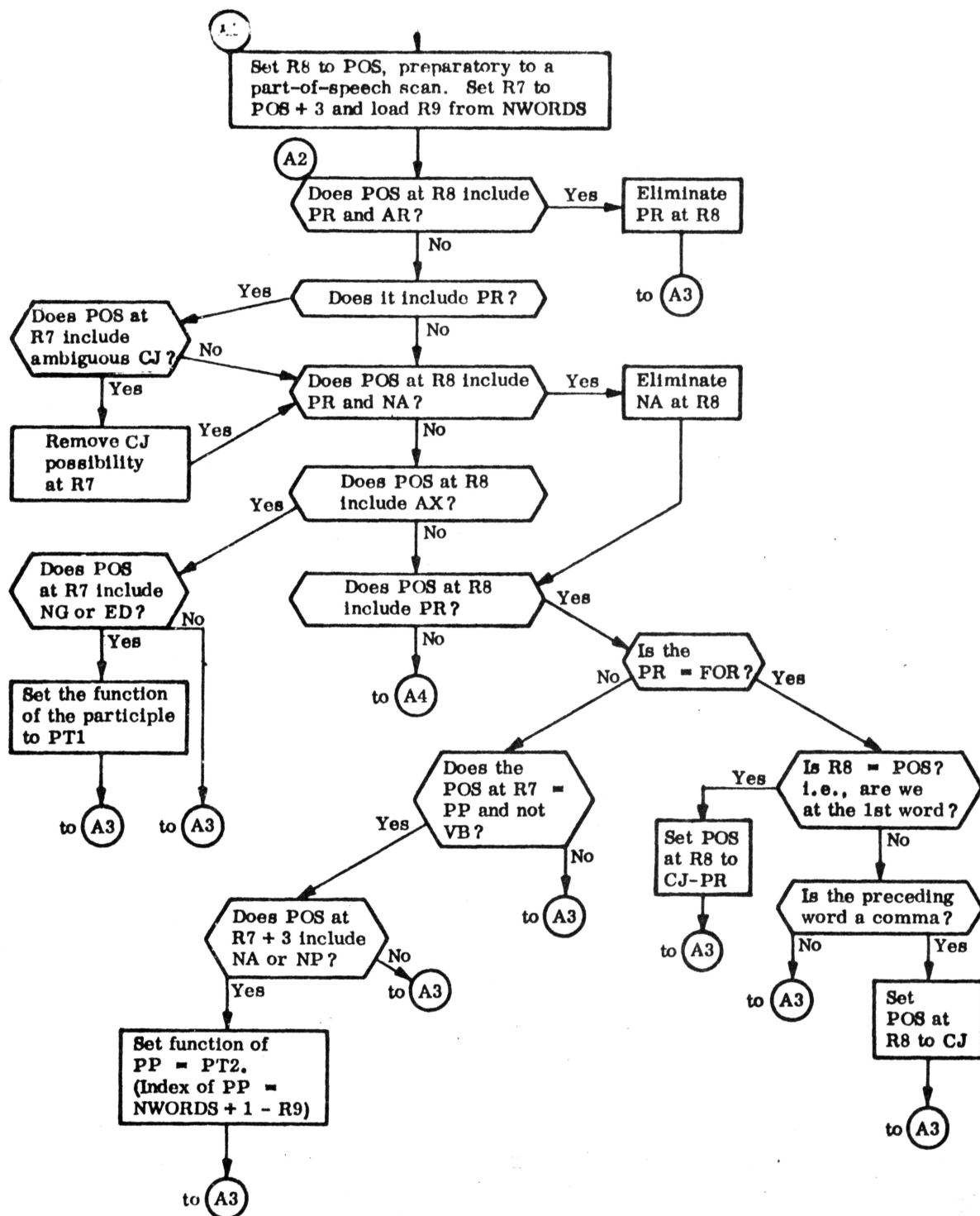


Fig. 15 BPHRAS Flow Diagram (Cont.)

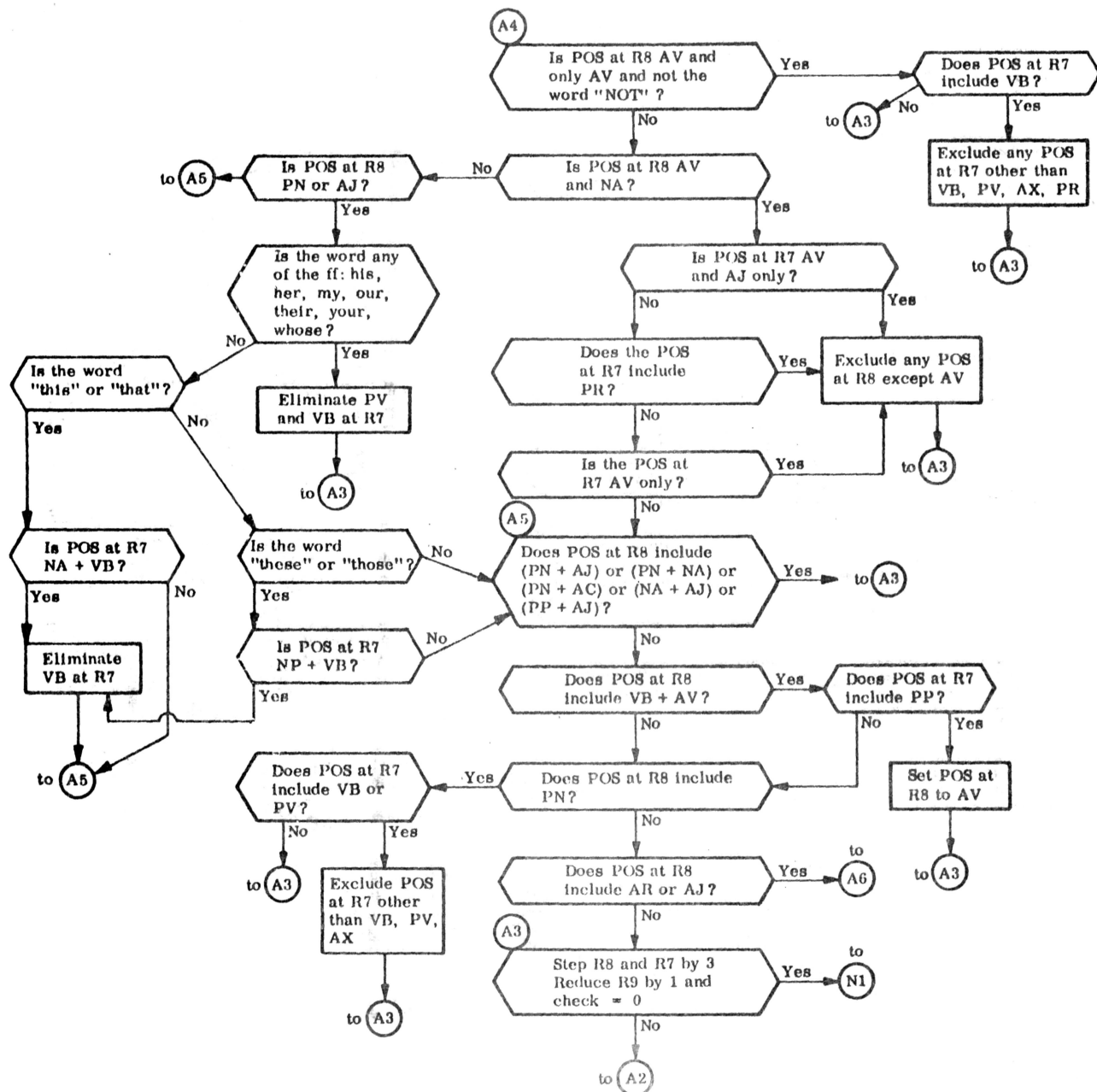


Fig. 15 BPHRAS Flow Diagram (Cont.)

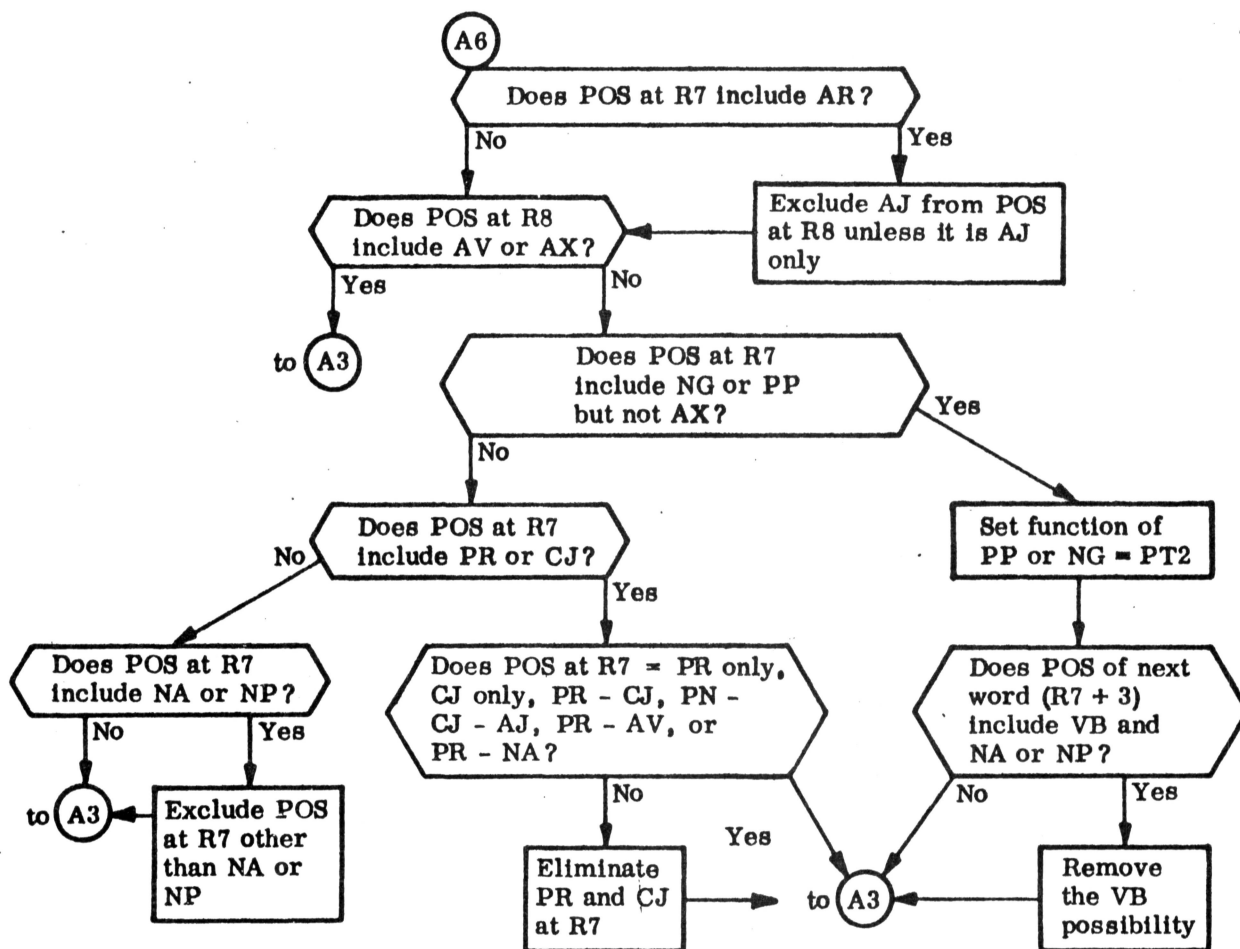


Fig. 15 BPHRAS Flow Diagram (Cont.)

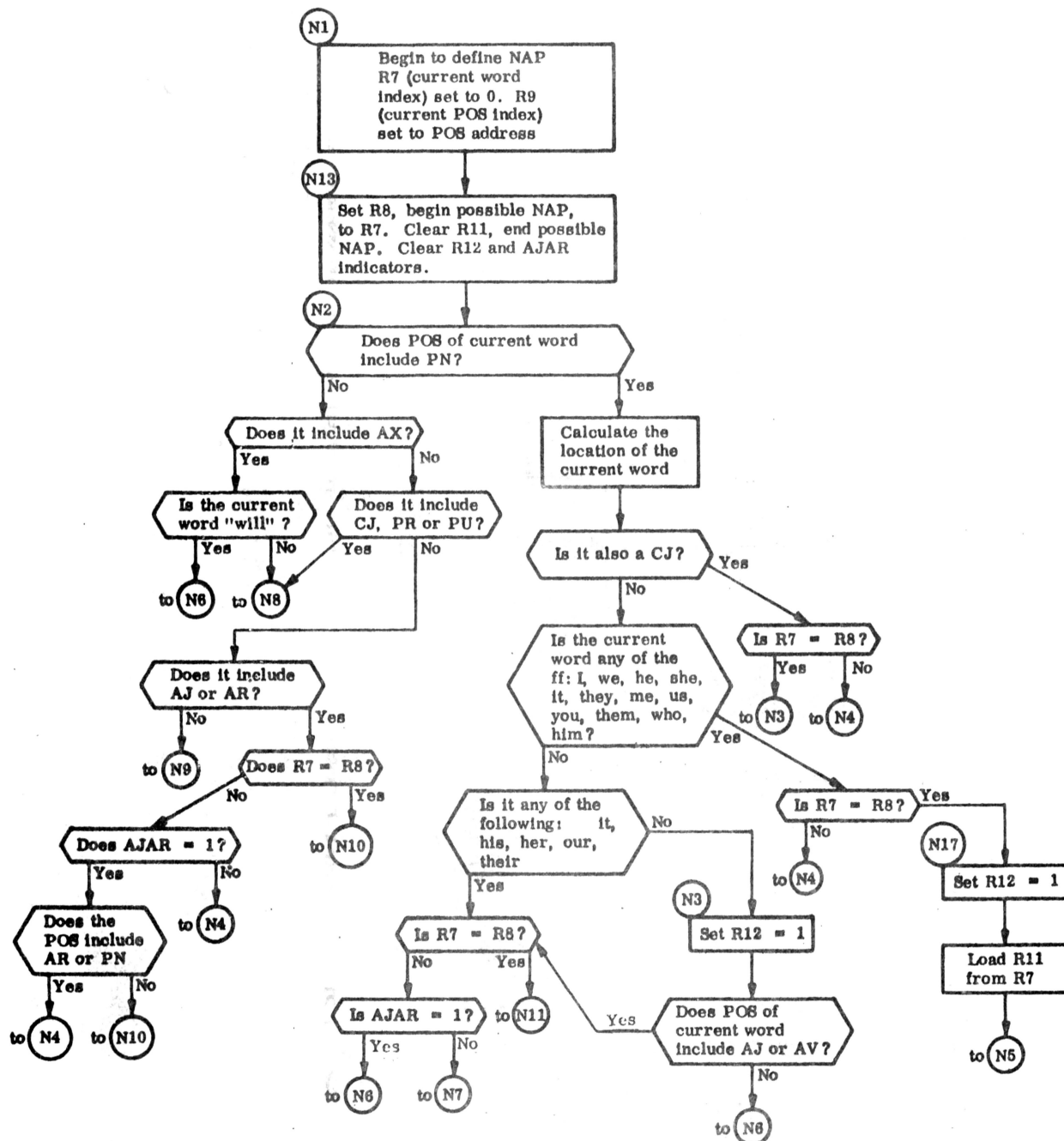


Fig. 15 BPHRAS Flow Diagram (Cont.)

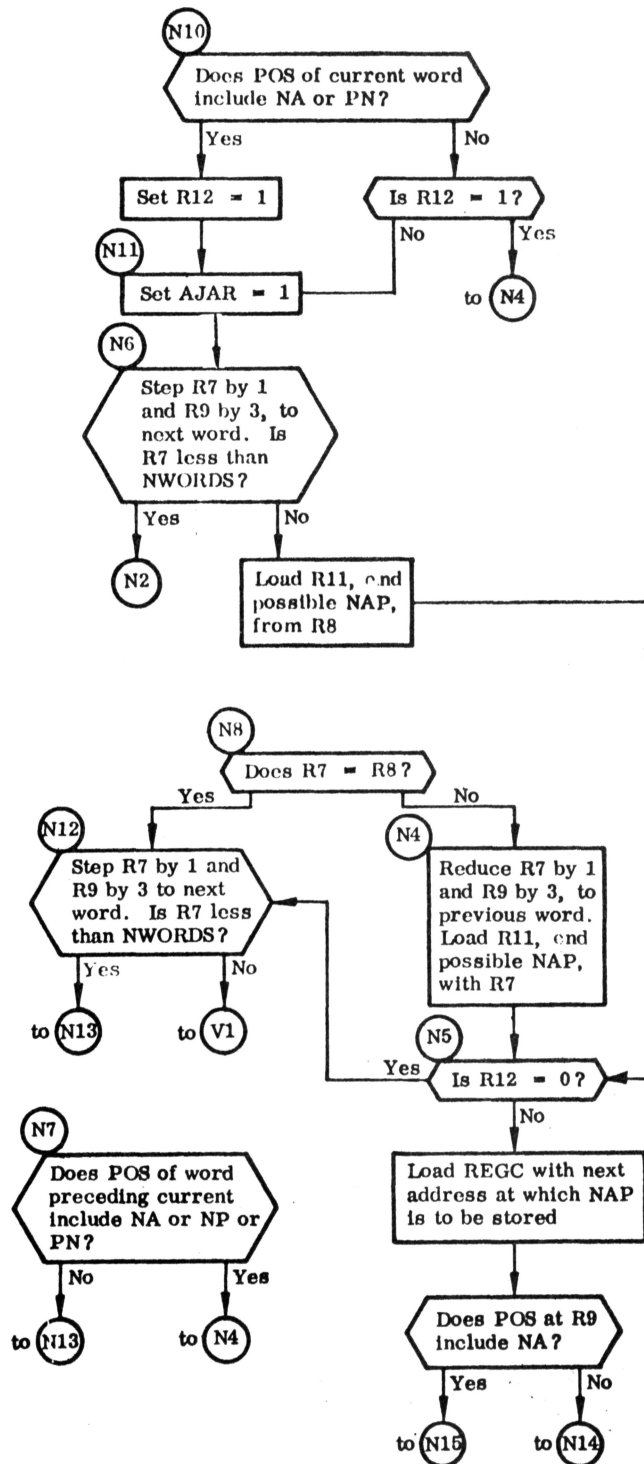


Fig. 15 BPHRAS Flow Diagram (Cont.)

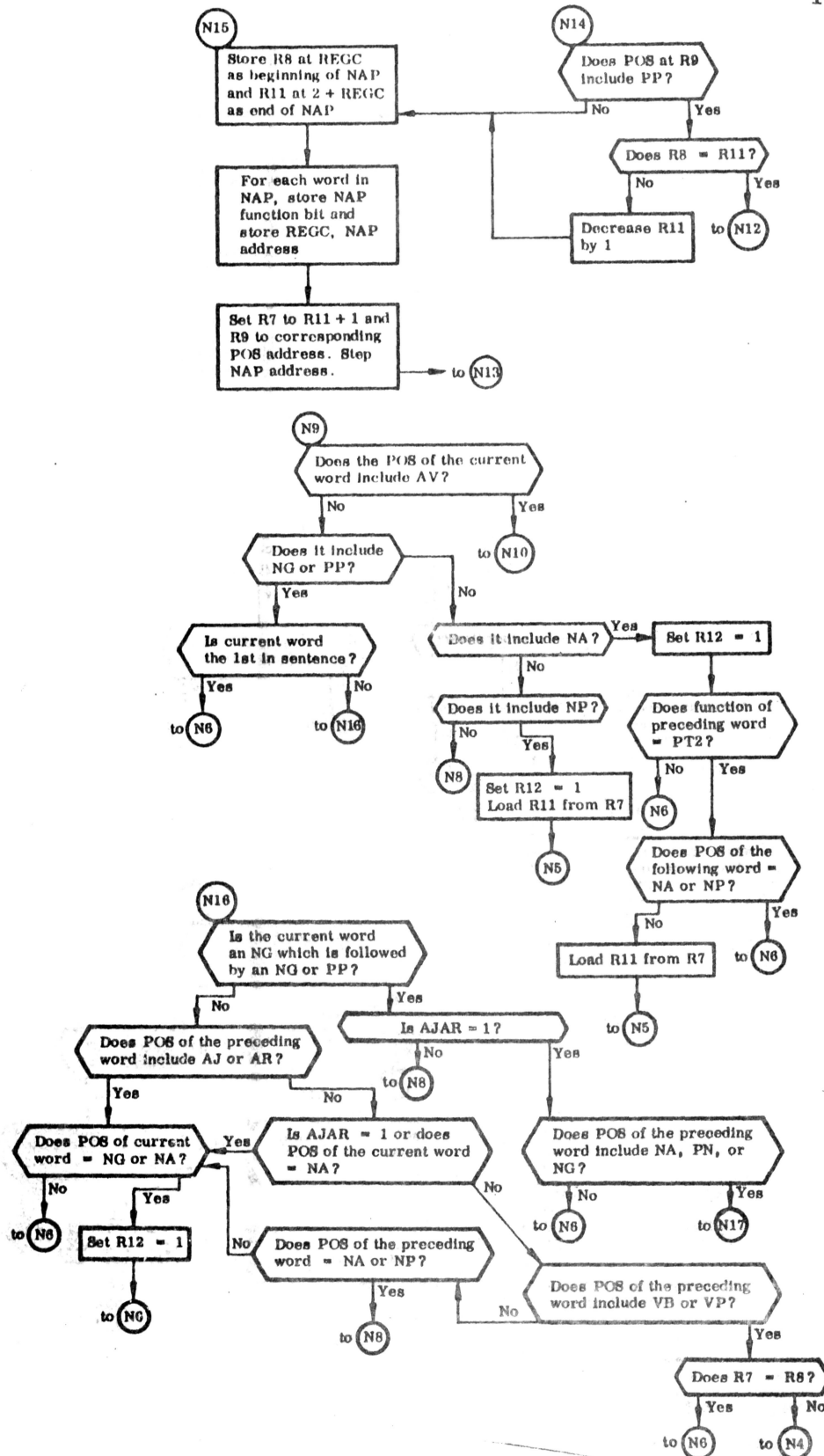


Fig. 15 BPHRAS Flow Diagram (Cont.)

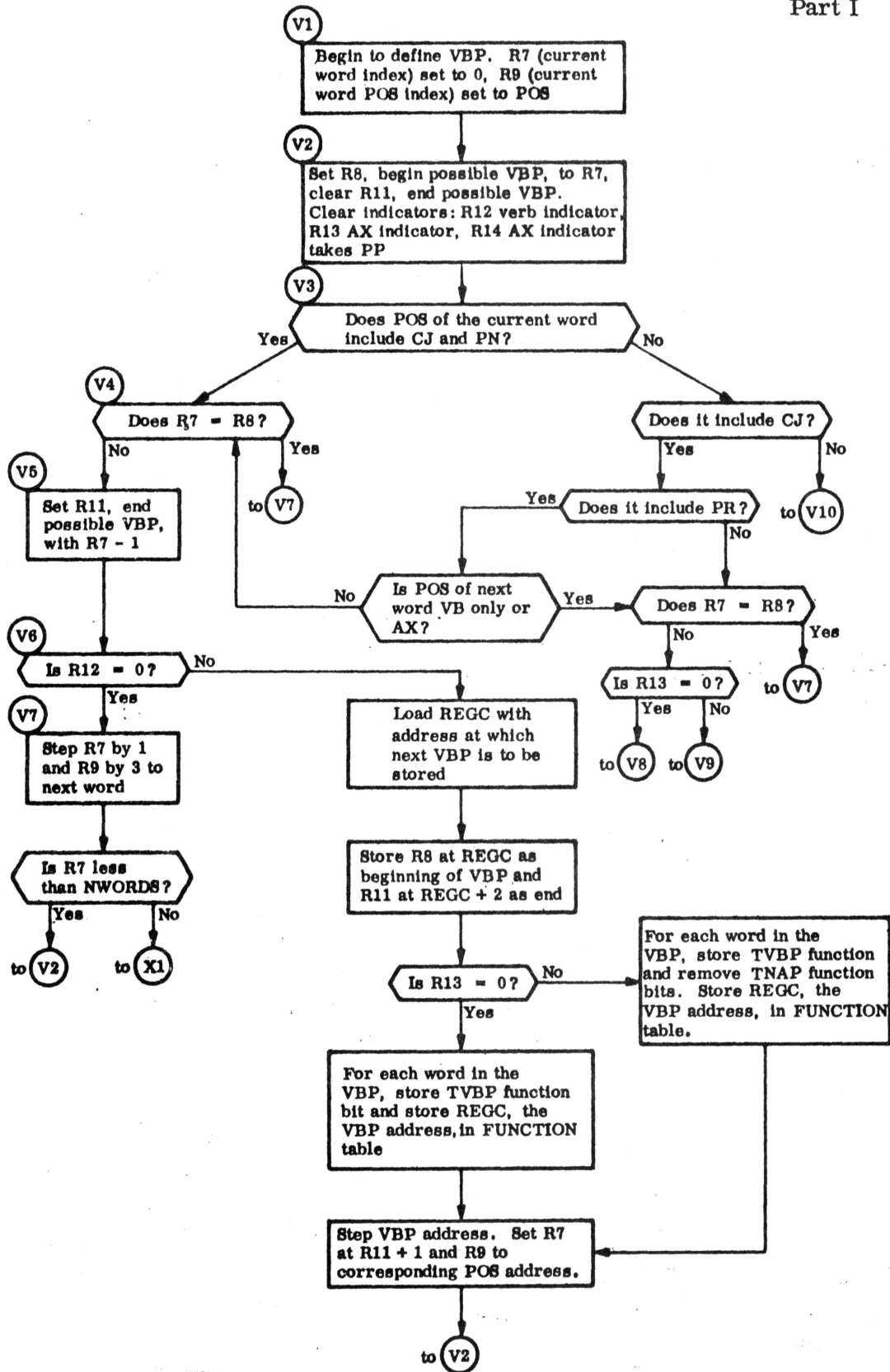


Fig. 15 BPHRAS Flow Diagram (Cont.)

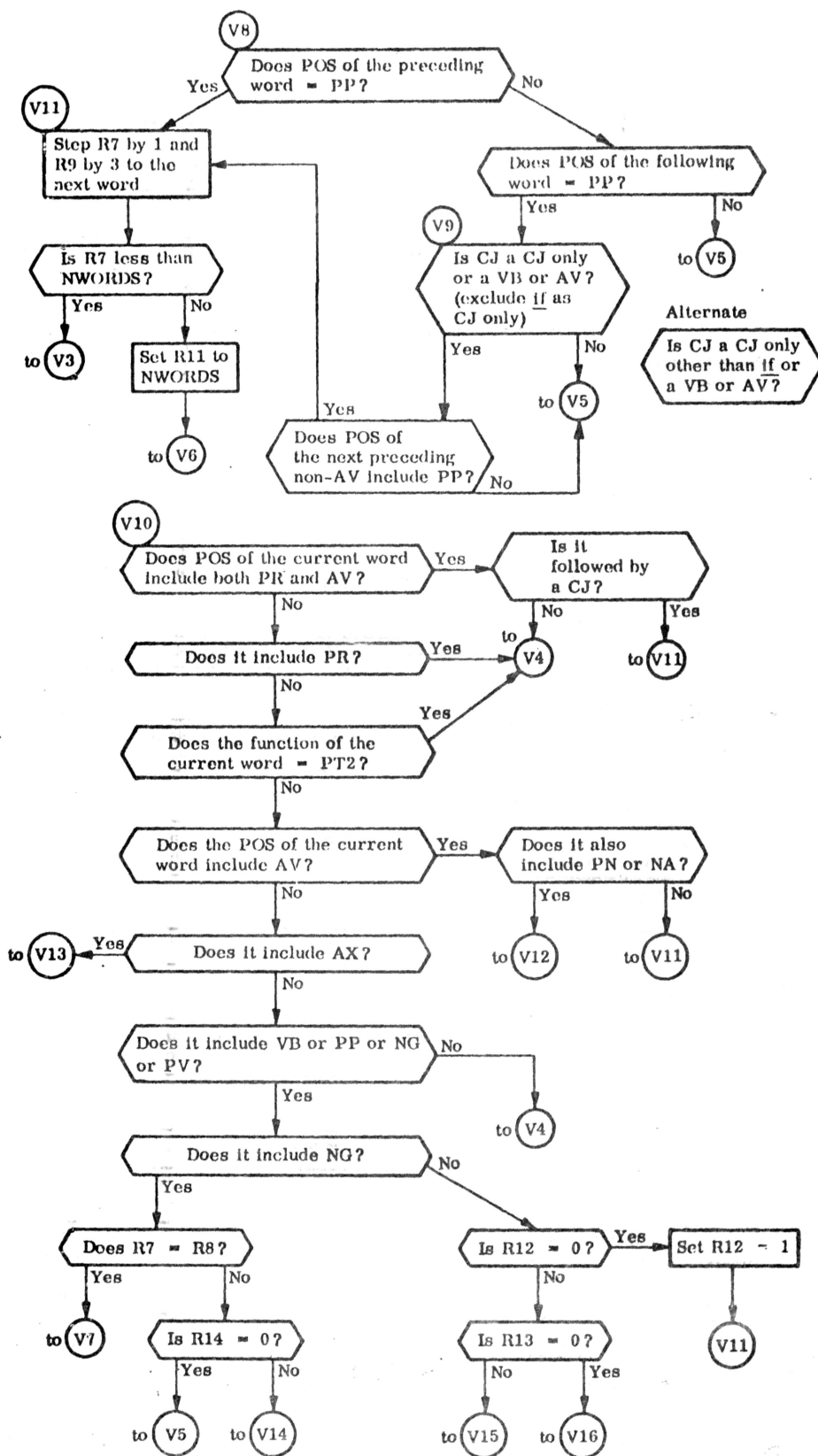


Fig. 15 BPHRAS Flow Diagram (Cont.)

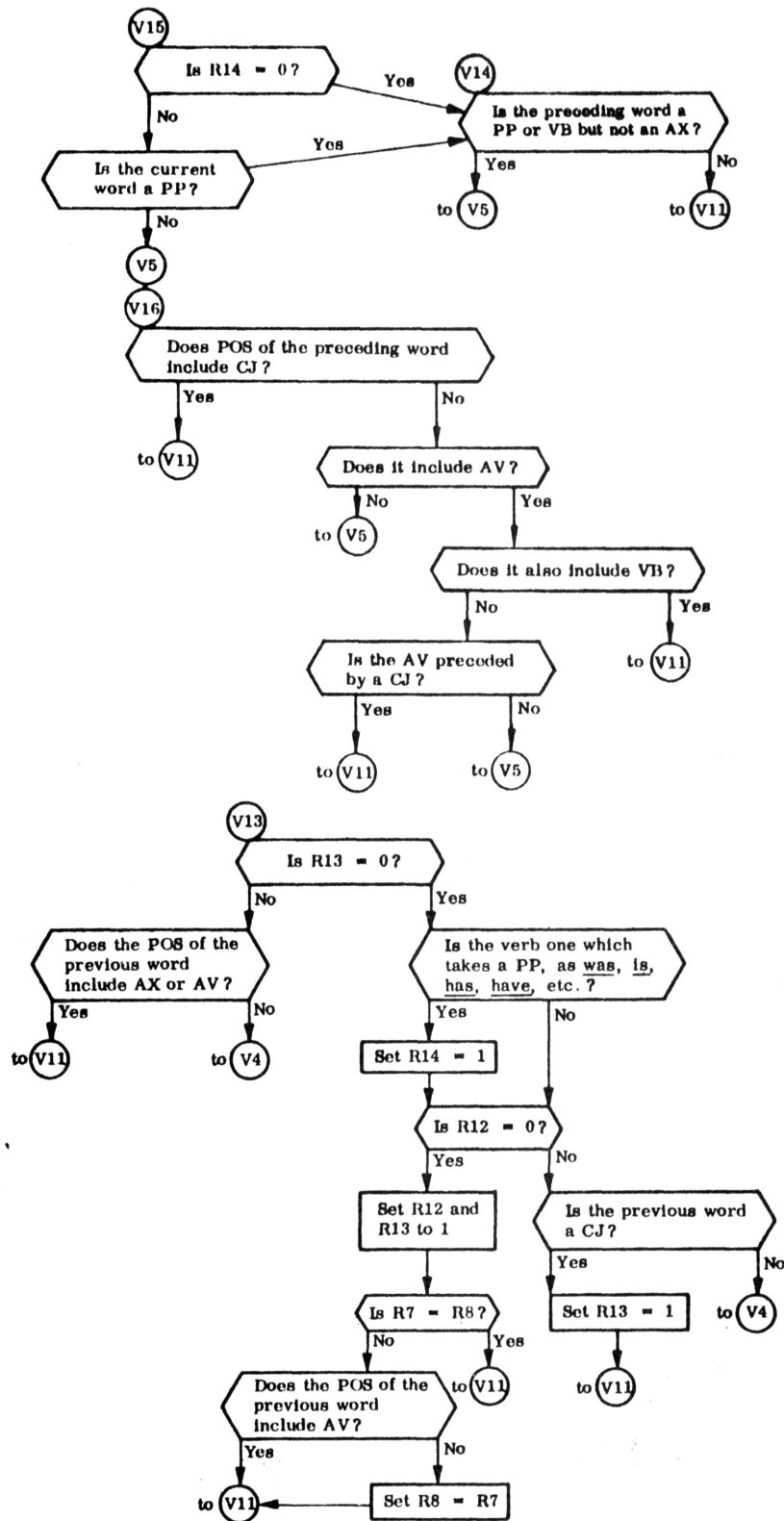


Fig. 15 BPHRAS Flow Diagram (Cont.)

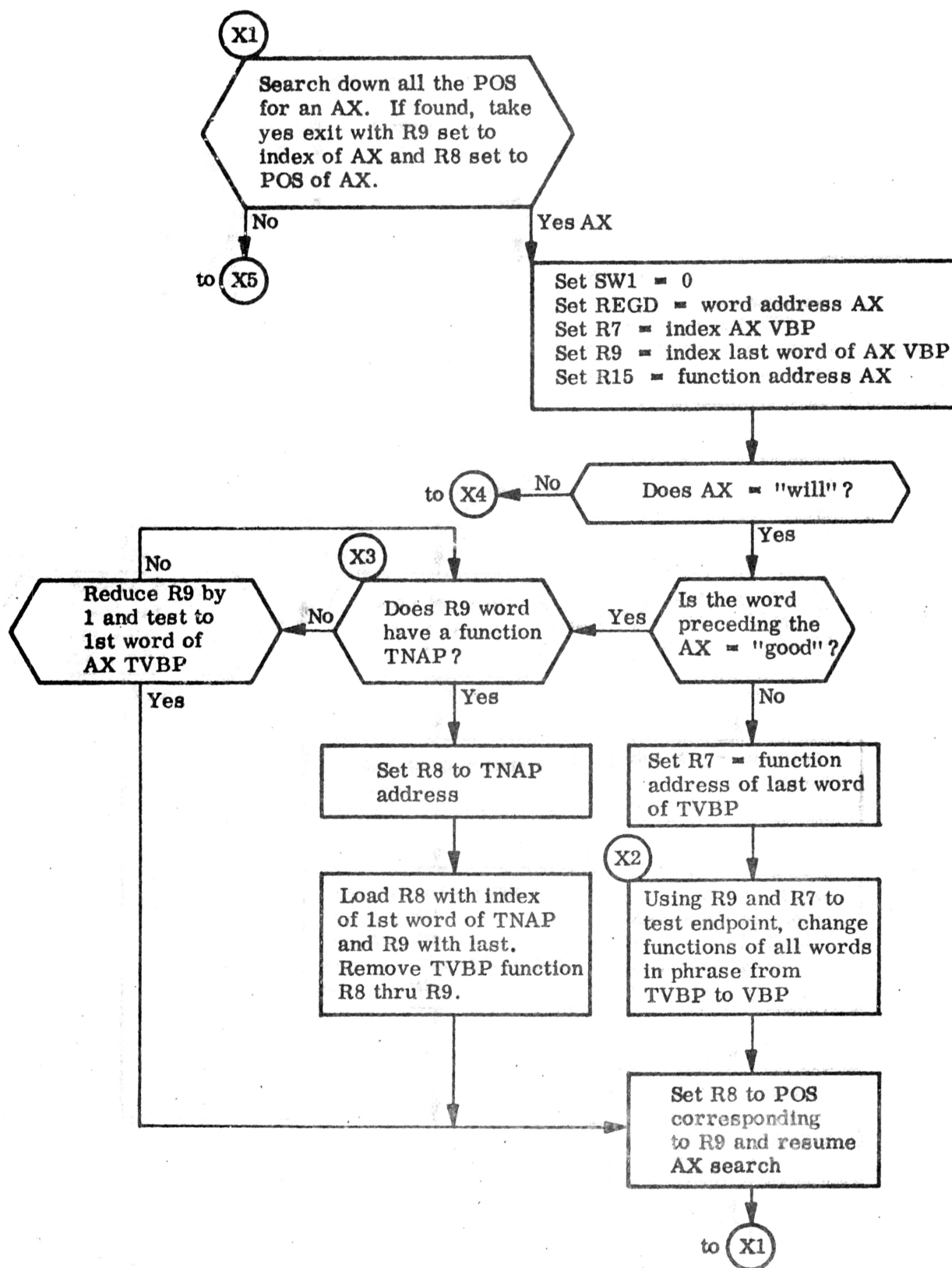


Fig. 15 BPHRAS Flow Diagram (Cont.)

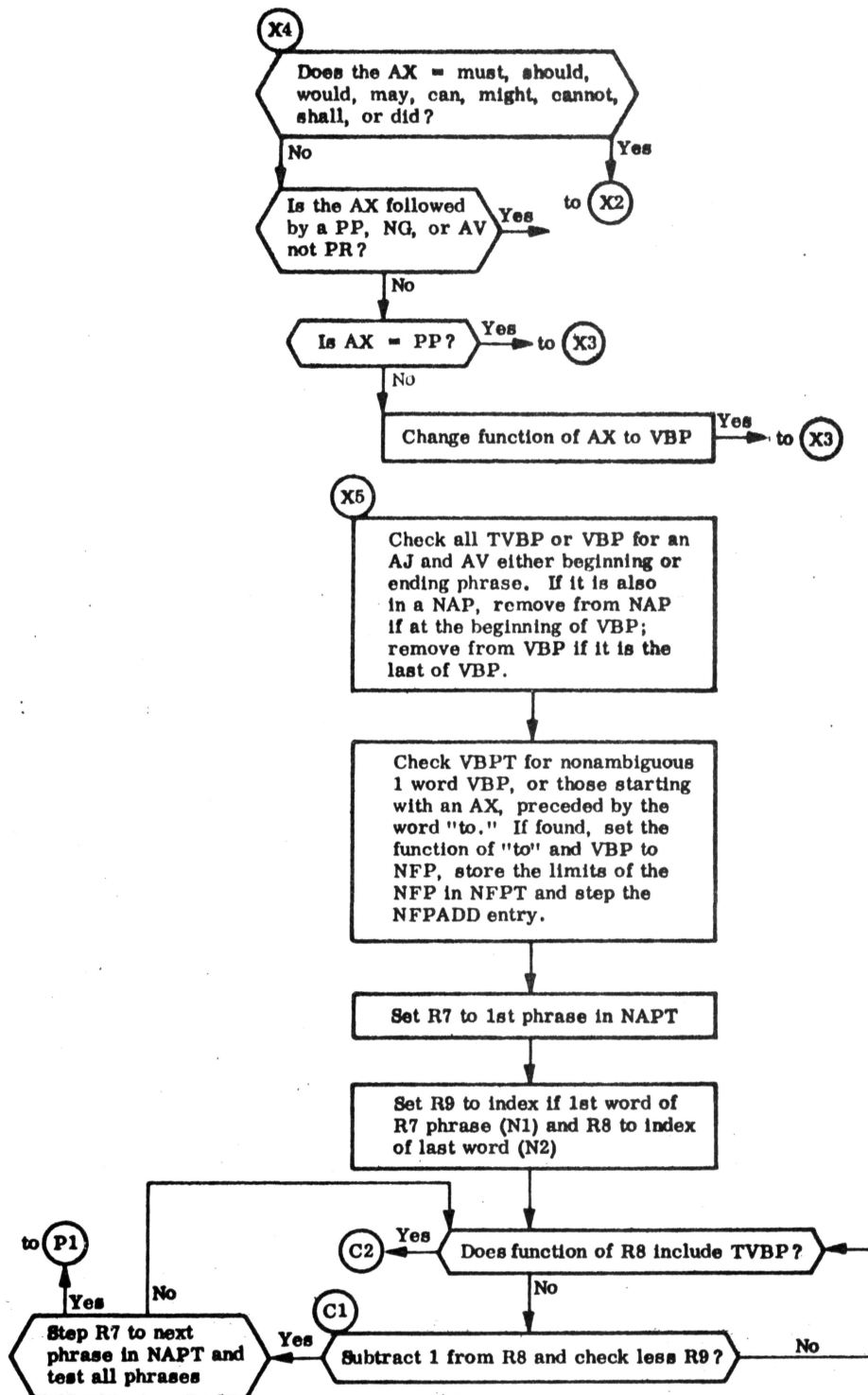


Fig. 15 BPHRAS Flow Diagram (Cont.)

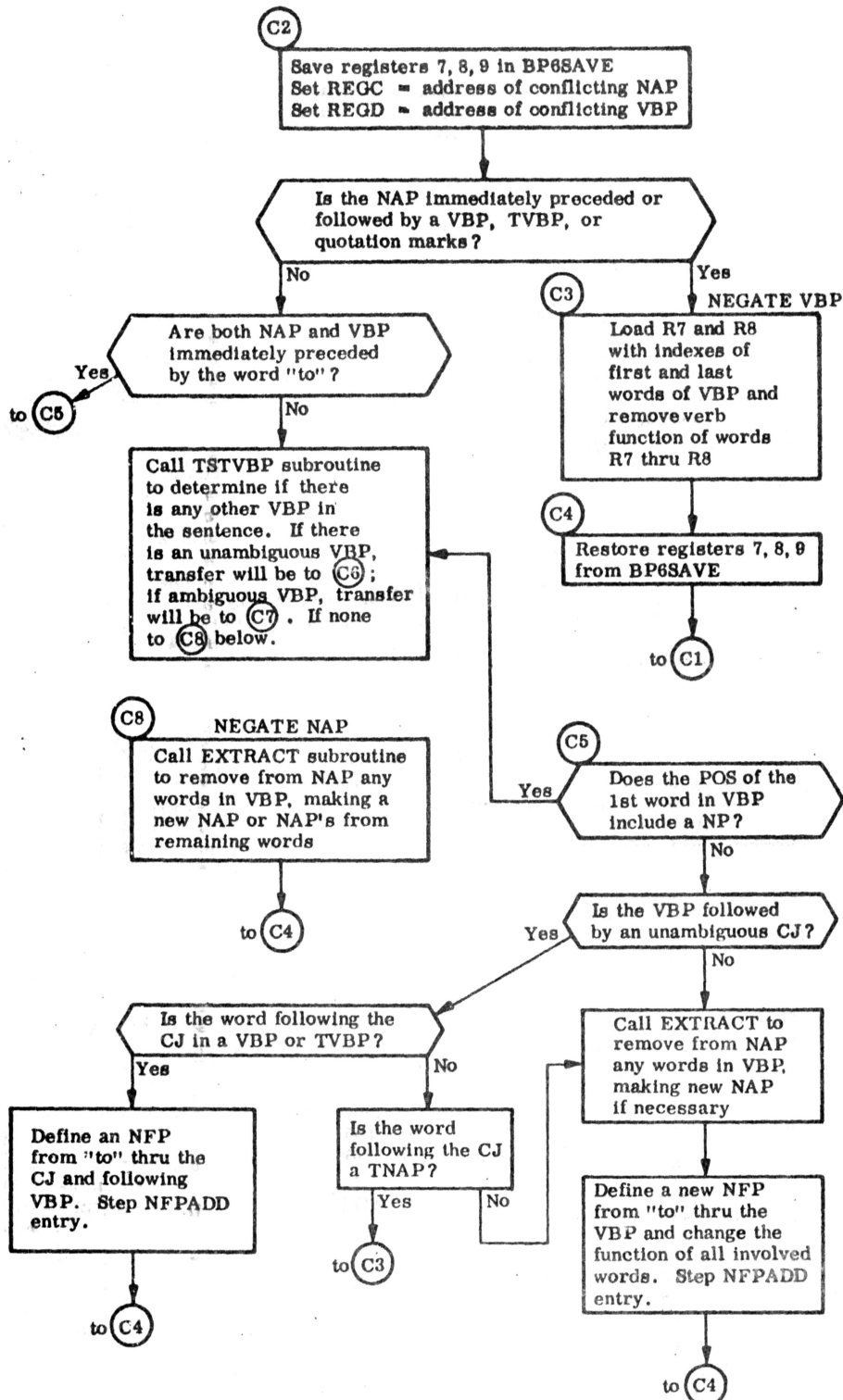


Fig. 15 BPHRAS Flow Diagram (Cont.)

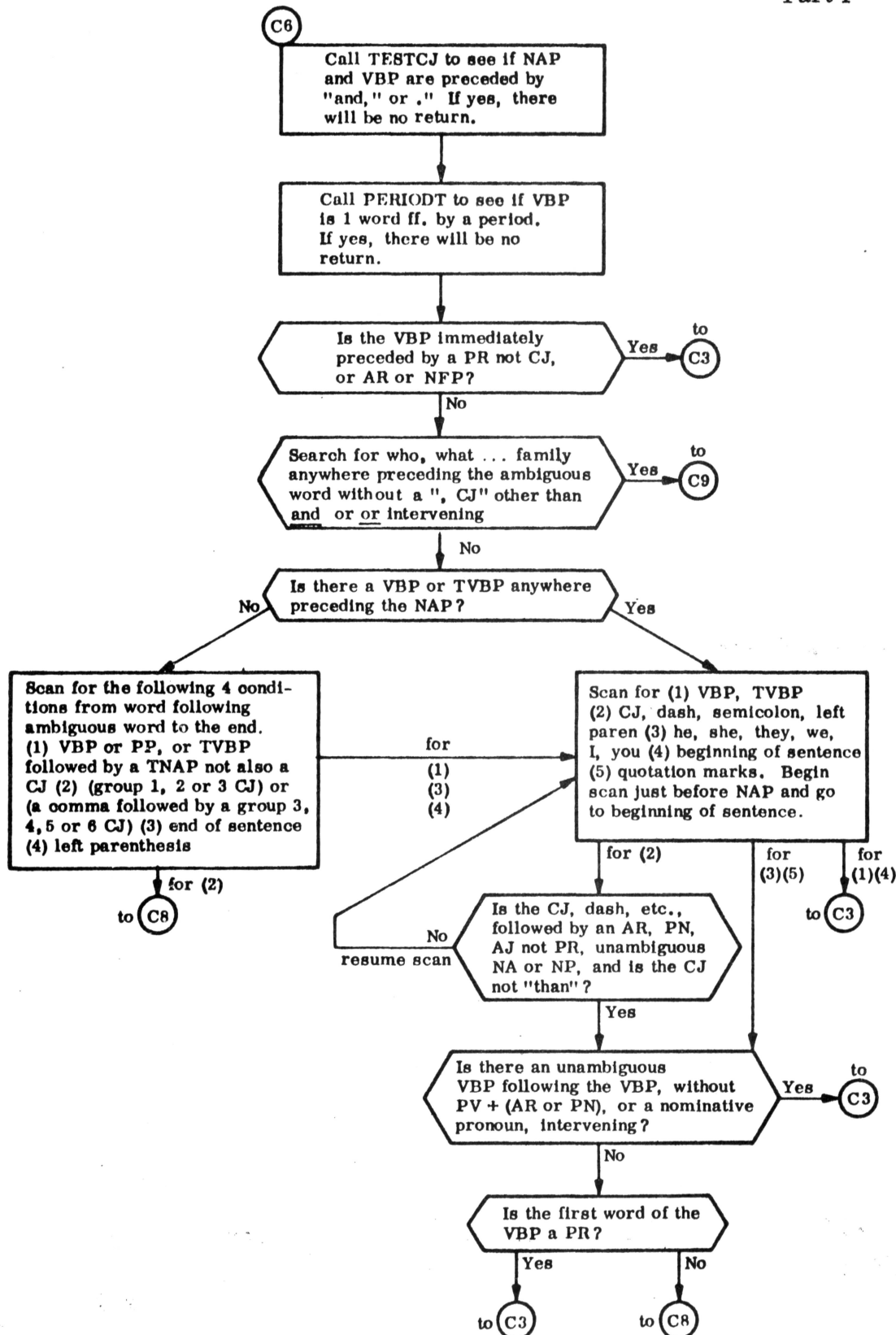


Fig. 15 BPHRAS Flow Diagram (Cont.)

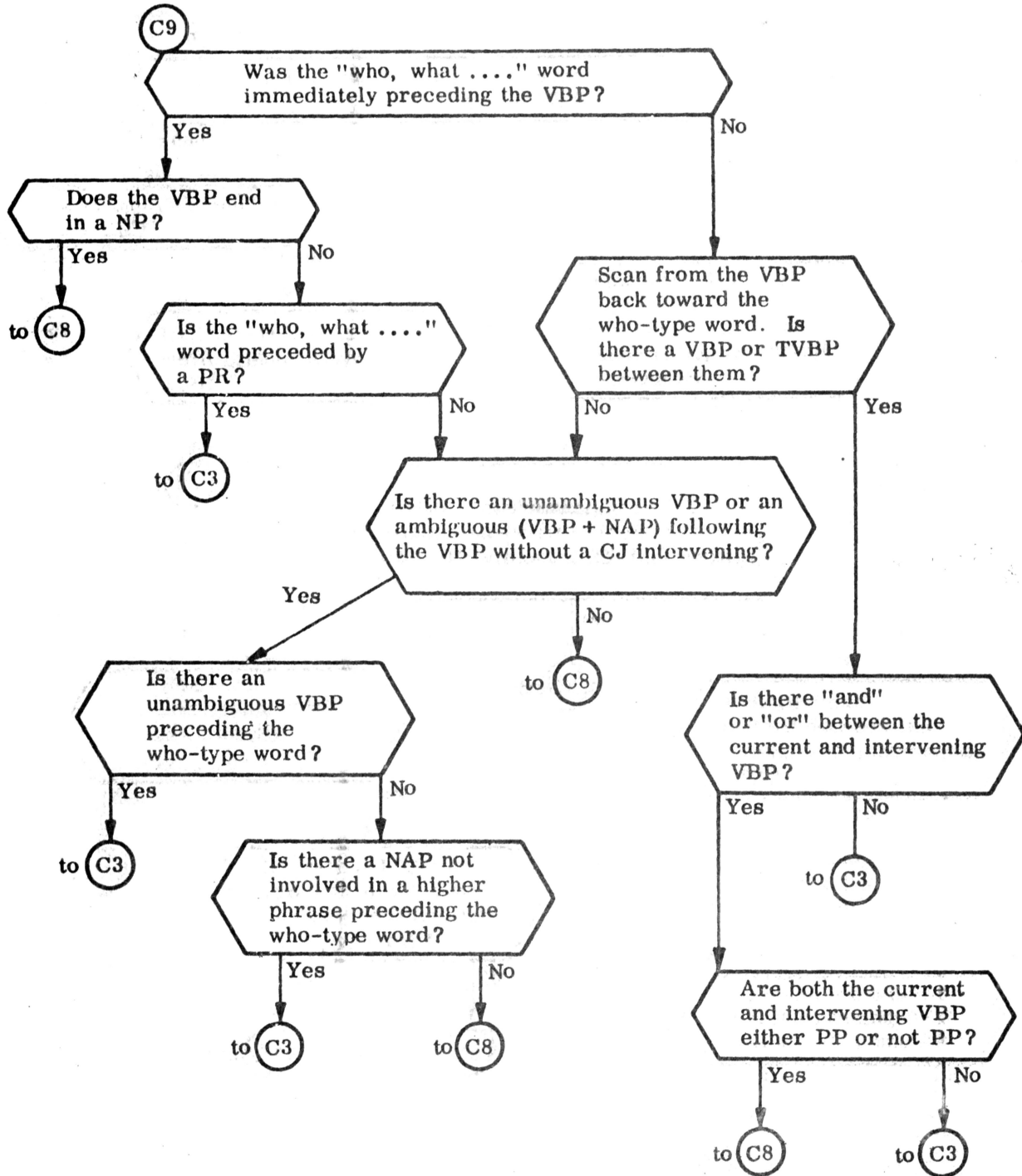


Fig. 15 BPHRAS Flow Diagram (Cont.)



Fig. 15 BPHRAS Flow Diagram (Cont.)

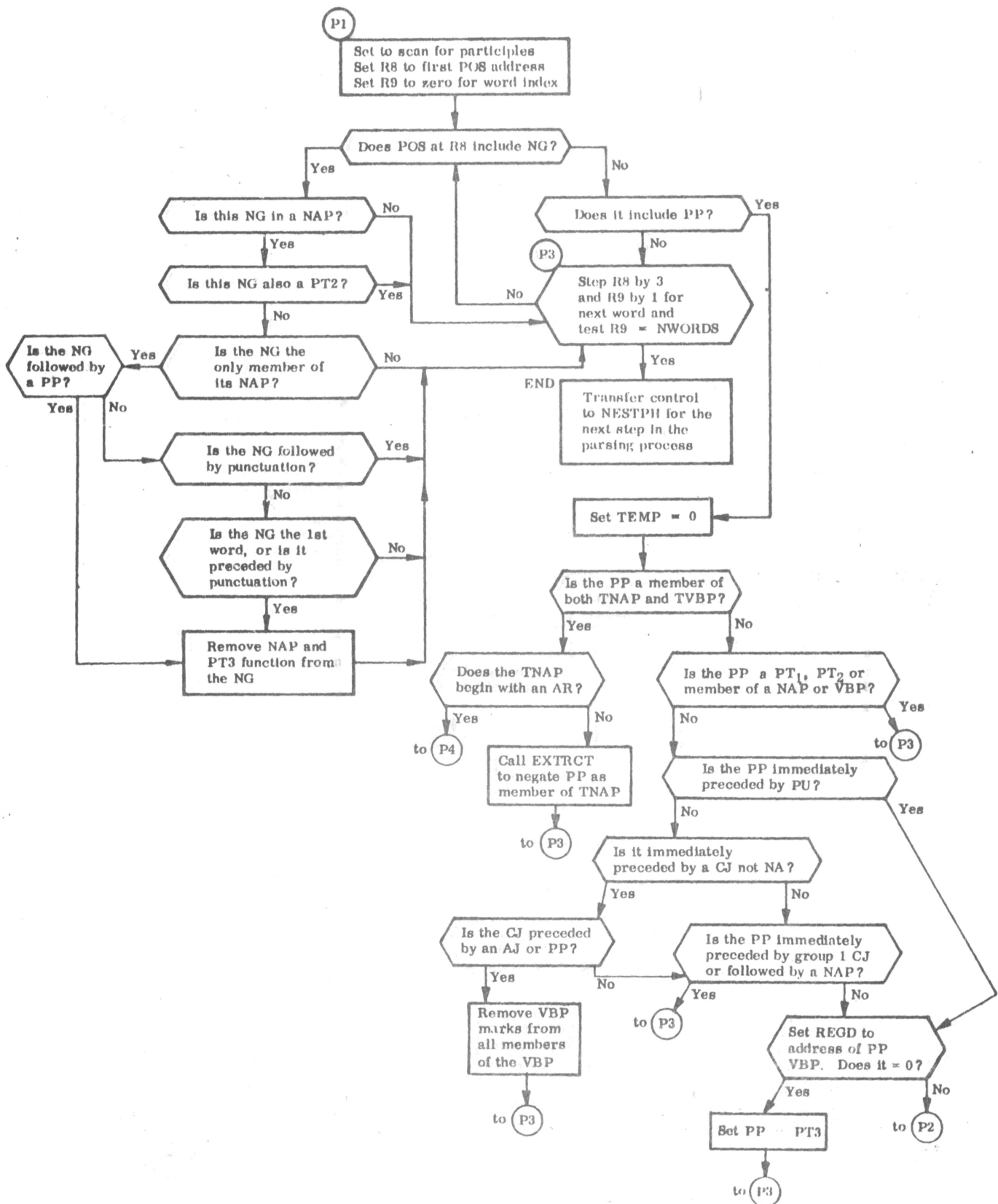


Fig. 15 BPHRAS Flow Diagram (Cont.)

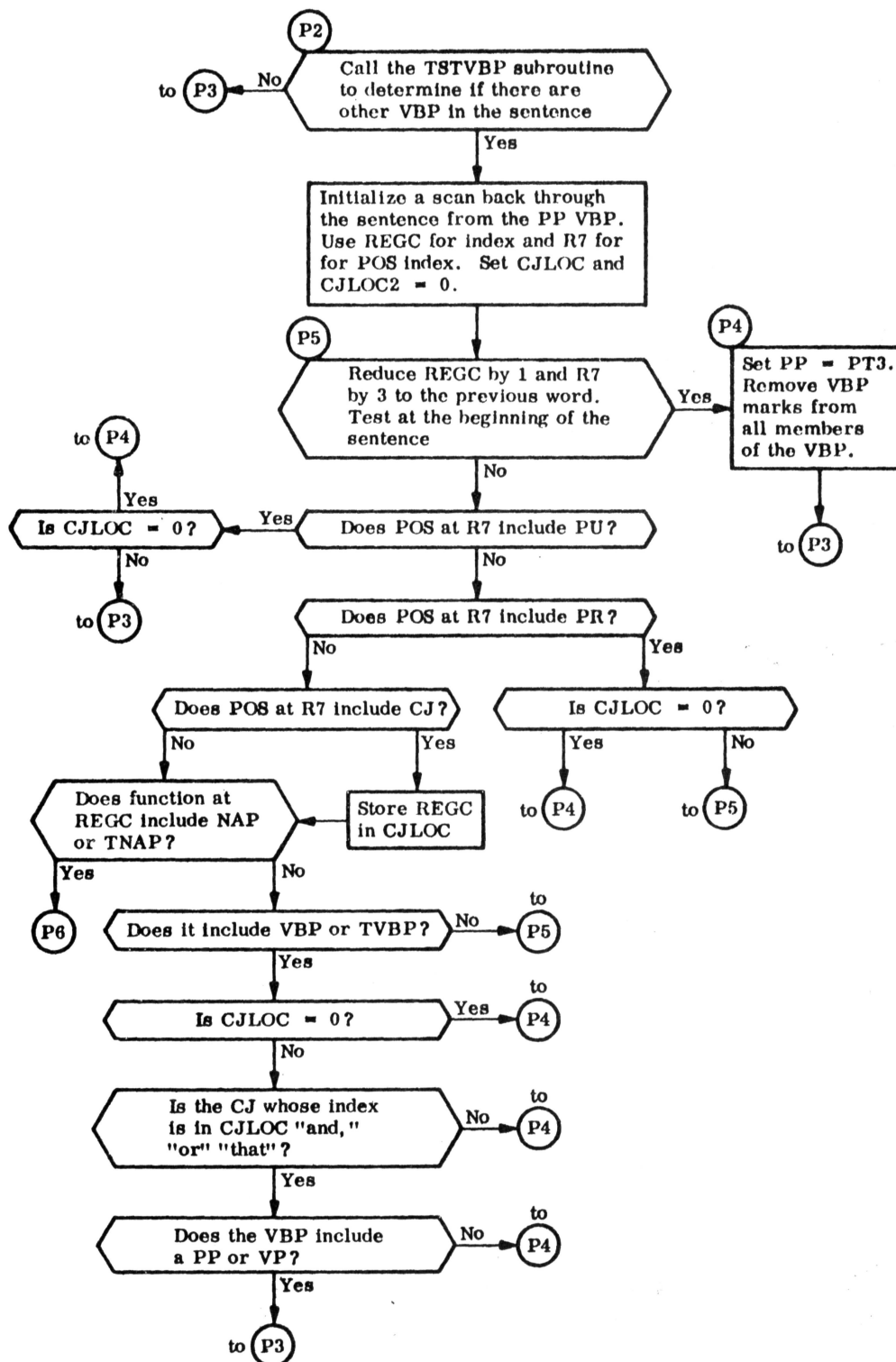


Fig. 15 BPHRAS Flow Diagram (Cont.)

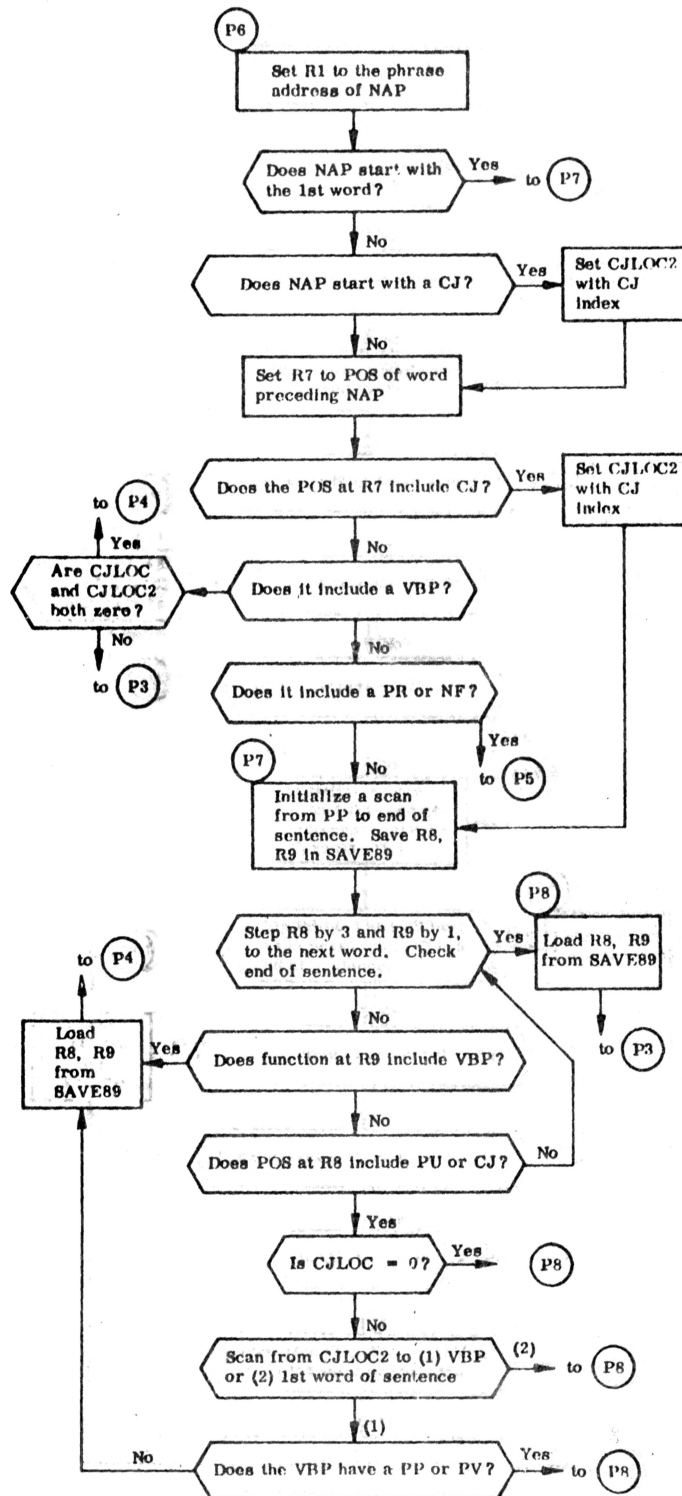
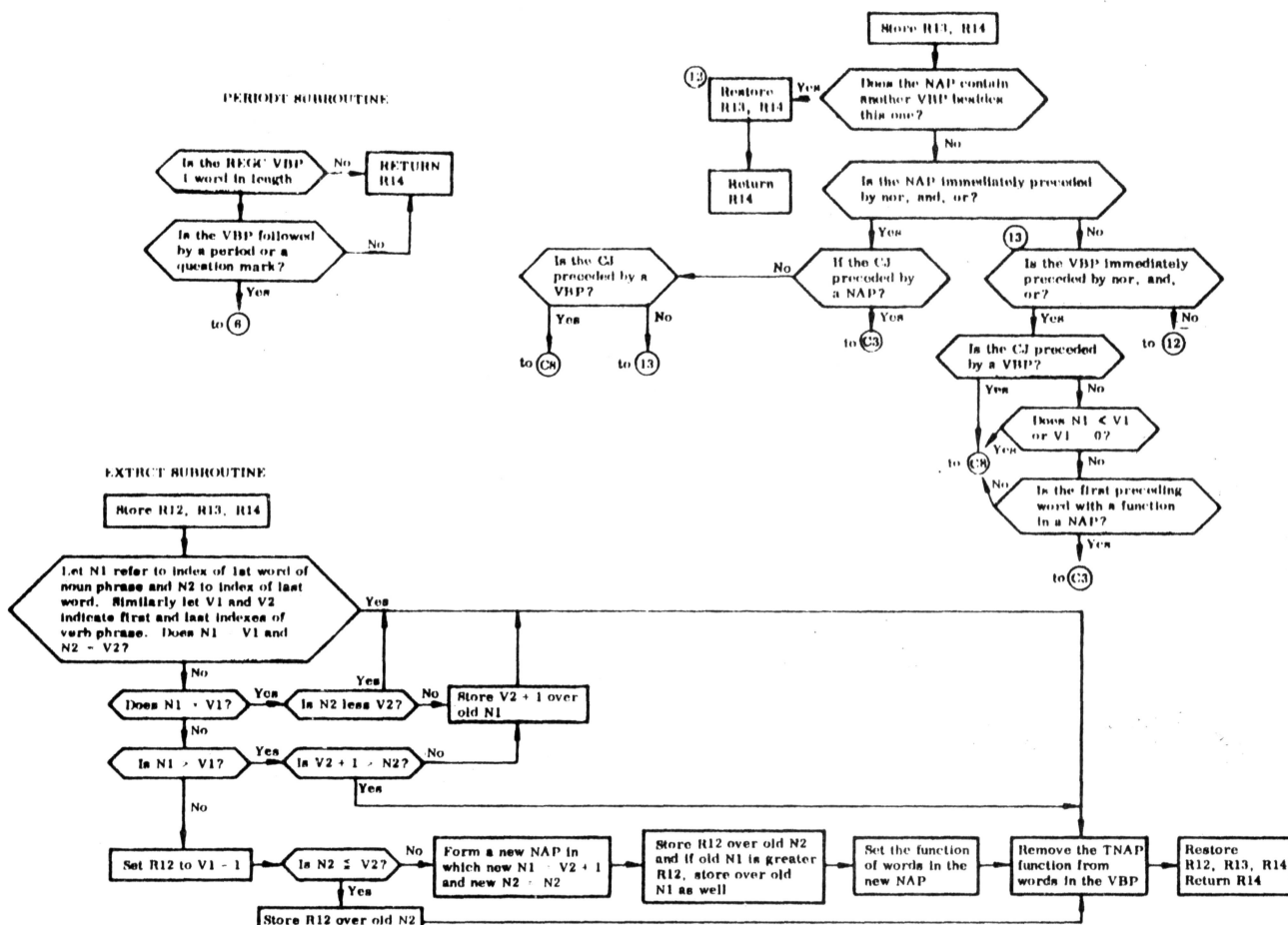


Fig. 15 BPHRAS Flow Diagram (Cont.)

TEST CJ SUBROUTINE

PERIOD SUBROUTINE



TSTVBP SUBROUTINE

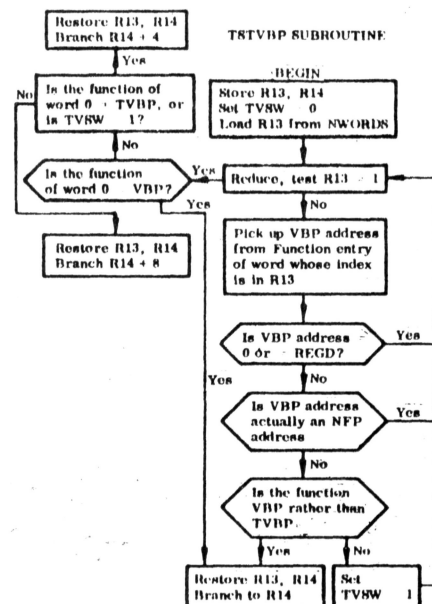
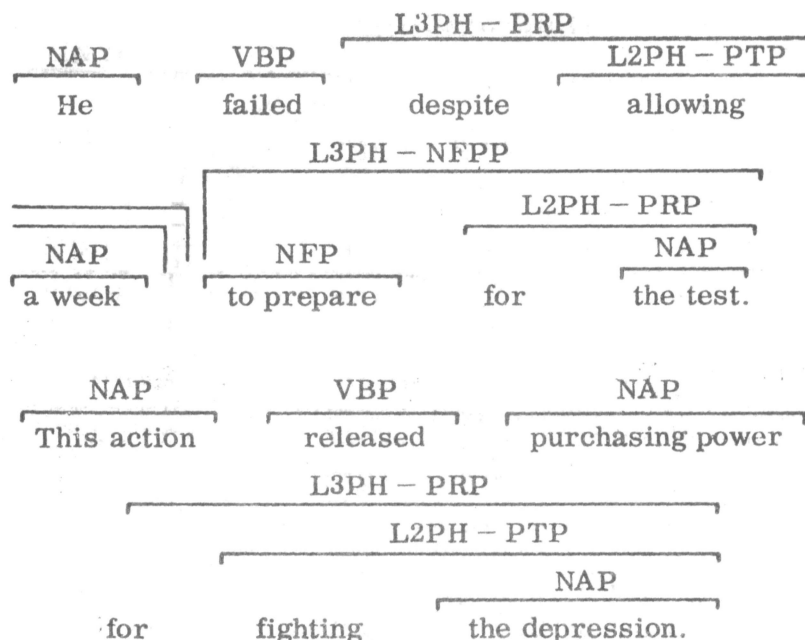


Fig. 15 BPHRAS Flow Diagram (Cont.)

3.2 NESTPH - LEVEL 2 OF PHRASE PARSER

NESTPH constitutes an addition to BPHRAS which defines high-level phrases, i. e., prepositional, participial, and infinitive phrases, which will be identified by the initials PRP, PTP, and NFPP, respectively. These phrases can be regarded as nesting because a high-level phrase always includes another phrase of the next lower level. (See section 1.2) NESTPH operates after the noun and verb phrases have been defined and the ambiguities resolved. NESTPH uses as data these definitions and the parts of speech of the remaining words. The high-level phrases are defined level by level until no more phrases are found. In the first pass through the sentence, all noun phrases are examined to see if they belong within a second-level phrase. Noun phrases are examined from the back of the sentence, working toward the front because this makes it easier to resolve participial ambiguities. In the second pass through the sentence, all second-level phrases are examined to see if they belong within a third-level phrase. In the third pass, third-level phrases are examined to see if they belong within a fourth-level phrase. (Nesting above the fourth level is not common, but the program is being expanded to handle fifth-level phrases.) High-level phrases are examined from the beginning of the sentence, working toward the end, because this makes it easier to keep the levels separate. Descriptions of second-level phrases are stored in the table L2PH, third-level phrases in L3PH, and fourth-level phrases in L4PH. Two examples follow:



In both examples, it is assumed that the past participle has already been identified as the verb phrase. In the first example, the participle "allowing" is identified as the beginning of a participial phrase rather than the single noun object of the preposition "despite." The same thing is true of "fighting" in the second example; however, the function of "purchasing" had previously been tentatively resolved as adjectival. In NESTPH, some additional checks were made, but the adjective identification was allowed to stand. The differentiation between an adjectival participle and one beginning a participial phrase is often very difficult. Fortunately, a participle usually gives a structural cue to function. For example, it may be followed by a noun phrase with a leading article (as with "allowing" and "fighting" in the examples), showing that it begins a participial phrase, or it may be preceded by a verb phrase (as with "purchasing" in the example) showing that it does not. If there is no structural cue, it is assumed to begin a phrase, which is designated as ambiguous. This would happen in both the following examples, with the assumption being correct only in the first case.

Are you interested in flying planes?

Do you believe in flying saucers?

When a higher level phrase is identified, it is recorded in the appropriate table L2PH, L3PH, L4PH, or L5Ph depending on the level. Space for 40 entries has been set aside for each table. In all these tables, a double word, or four half words, is used to record the phrase, as follows:

- 1st 2 bytes — index of first word of phrase ω_1 .
- 2nd 2 bytes — index of last word of phrase, i.e.,
of last word of lowest level phrase
in the nesting
- 3rd 2 bytes — address where description of the inner
level phrase is stored, i.e., the phrase
beginning at $\omega_1 + 1$.
- 4th 2 bytes — code giving the type of phrase. This is
the same code as is used in the second
byte of FUNCTION.

At the same time, the function of each word is recorded in the table FUNCTION. In the FUNCTION table there are 6 bytes for each word in the sentence. Byte 1 gives the functional information obtained by BPHRAS, with the bits interpreted from left to right as follows:

<u>Bit</u>	<u>Function</u>	<u>If present indicates</u>
1	TNAP	Word is in a tentative noun phrase
2	NAP	Word is in an unambiguous noun phrase
3	TVBP	Word is in a tentative verb phrase
4	VBP	Word is in an unambiguous verb phrase
5	NFP	Word is part of an infinitive
6	PT1	Word is a PT1 participle
7	PT2	Word is a PT2 participle
8	PT3	Word is a PT3 participle

Byte 2 gives the functional information obtained by NESTPH, with the bits from left to right as follows:

<u>Bit</u>	<u>Function</u>	<u>If present indicates</u>
1	PT4	Word is a PT4 participle
2	NFPP	Word starts an infinitive phrase
3	PTP	Word starts a participial phrase
4	PRP	Word starts a prepositional phrase
5	AFTP	Word starts an ambiguous participial phrase
6-8		Unused

Bytes 3 through 6 point to the addresses within other tables which store the limits of the phrases in which the word appears. Bytes 3 and 4 give the address of any noun (in NAPT) or participial phrase (in LnPH) in which the word appears. Bytes 5 and 6 give the address of any verb phrase (in VBPT), infinitive phrase (in NFPT), or prepositional phrase (in LnPH), in which the word appears. Although a word may be in many phrases,

there is no conflict in this storage scheme because only the lowest level phrase membership of a word is recorded. Thus, a noun in a noun phrase which is also in a prepositional phrase will have only its noun phrase address given (and its verb phrase address if it is ambiguous, because a verb phrase is also a first-level phrase).

The rules for the formation of the higher level phrases are most definitively described by the flow diagram (Figs. 16 and 17), but can be stated conceptually as follows:

- (1) If a NAP consists of a single present participle, it is not eligible for the object of a second level phrase if it is itself the initiator of a second level phrase. (It will be eligible as the object of a third level phrase.)
- (2) If a NAP is preceded by a PR or NF, a second-level phrase is defined from the PR or NF through the NAP.
- (3) If a NAP is preceded by an NG and the first word of the NAP is an AR or AJ, a second-level phrase is defined from the NG through the NAP. If the first word of the NAP is not an AR or AJ, the word preceding the NG is examined. If it is a VBP or a past participle, the NG is incorporated into the NAP. Otherwise, a second-level phrase is defined from the NG through the NAP.
- (4) If a second-level phrase is preceded by an NF, PR, or PP not in a NAP, then a third-level phrase is defined from the PR, NF, or PP through the second-level phrase (which will terminate at the end of the NAP terminating the second-level phrase).
- (5) If a second level phrase is preceded by a present participle, which is not a member of either a NAP or a VBP, or is in a NAP but is not preceded by a noun or pronoun in the same NAP, then a third-level phrase is defined from the NG through the second-level phrase. If the NG is in a NAP and does have a noun or pronoun preceding it, then the NG is first removed from its NAP and a tentative noun phrase is formed consisting of the NG only; then a third-level phrase is defined from the NG through the second-level phrase.
- (6) Fourth-level phrases are formed from third-level phrases exactly as third-level phrases are formed from second-level phrases, as in rules (4) and (5).

- (7) Additional second-level phrases may be formed from NG. There are two reasons for this. The first is that a second-level phrase may form from an NG followed by an infinitive (NF) as well as from an NG followed by a NAP, and infinitives were not included in rules (1) through (3). All NG not already beginning a PTP are checked to see if an NF follows. If so, and if the NG is not in a NAP, or is not preceded by a NA, PN, or NP, a second-level PTP is formed from NG through the NF. If NG is in a NAP, but is preceded by NA, PN, or NP, it is removed from the NAP before the PTP is formed.
- (8) The second way that a second level PTP may have been missed is if an NG has been included in a NAP which is really its object (e.g., He is interested in watching birds). An attempt is made to find such cases, whether clearcut or ambiguous. All NG not already beginning a PTP are examined. If the NG is preceded by a VBP, no PTP is formed. If NG is the first word in a NAP and has preceding it the first word of the sentence, punctuation, or a word in another NAP, the NG is removed from its NAP and a second-level PTP is formed from the NG through its former NAP. If the NG is the first word in a NAP and has a PR preceding it, an ambiguity is recognized. It is both left in its NAP and an APTP (ambiguous PTP) is formed from the NG through its NAP. In all other cases, no PTP is formed.

Part I - Form L2PH Phrases

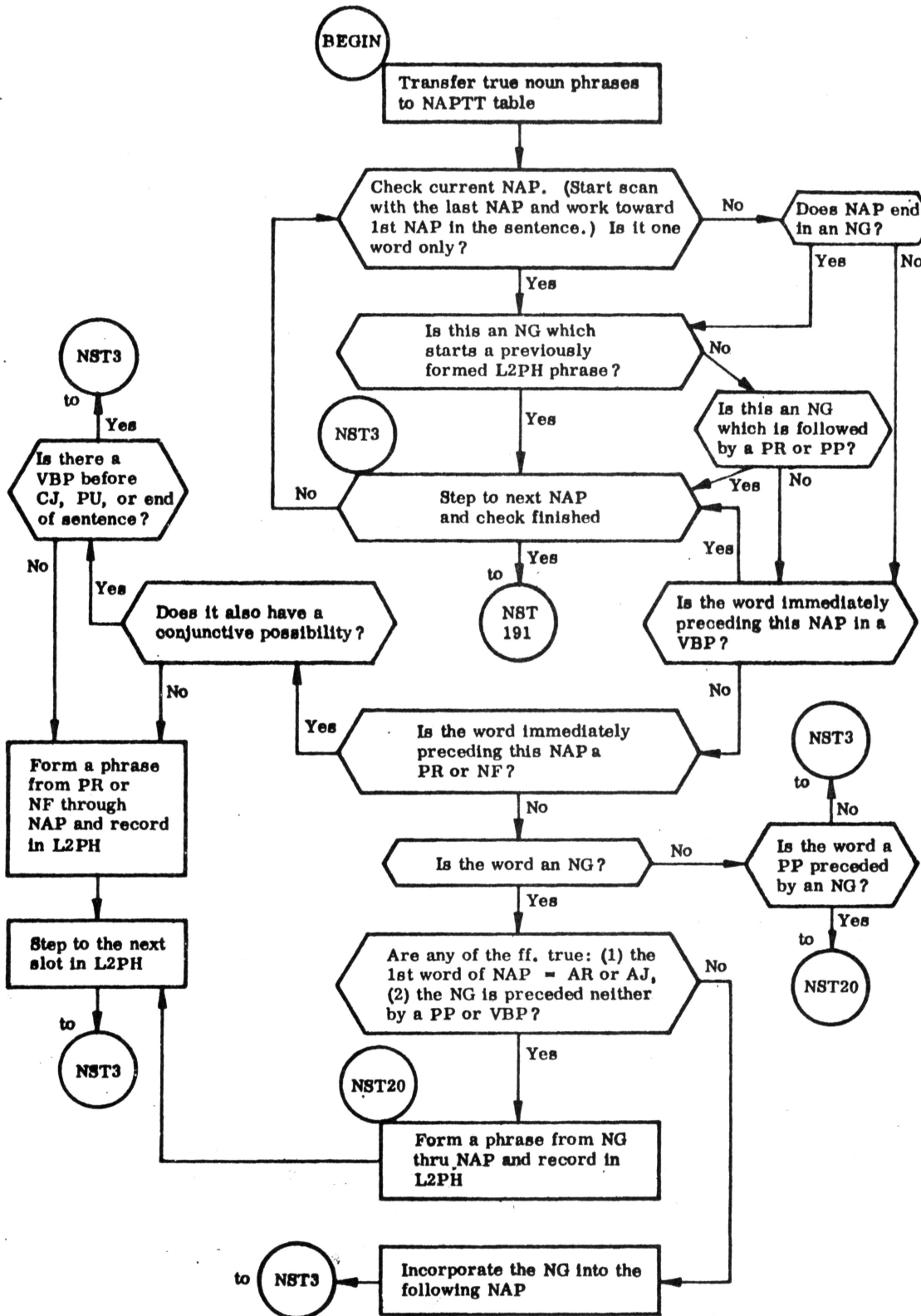


Fig. 16 NESTPH Flow Diagram – Conceptual

Part II - Form L3PH and L4PH phrases

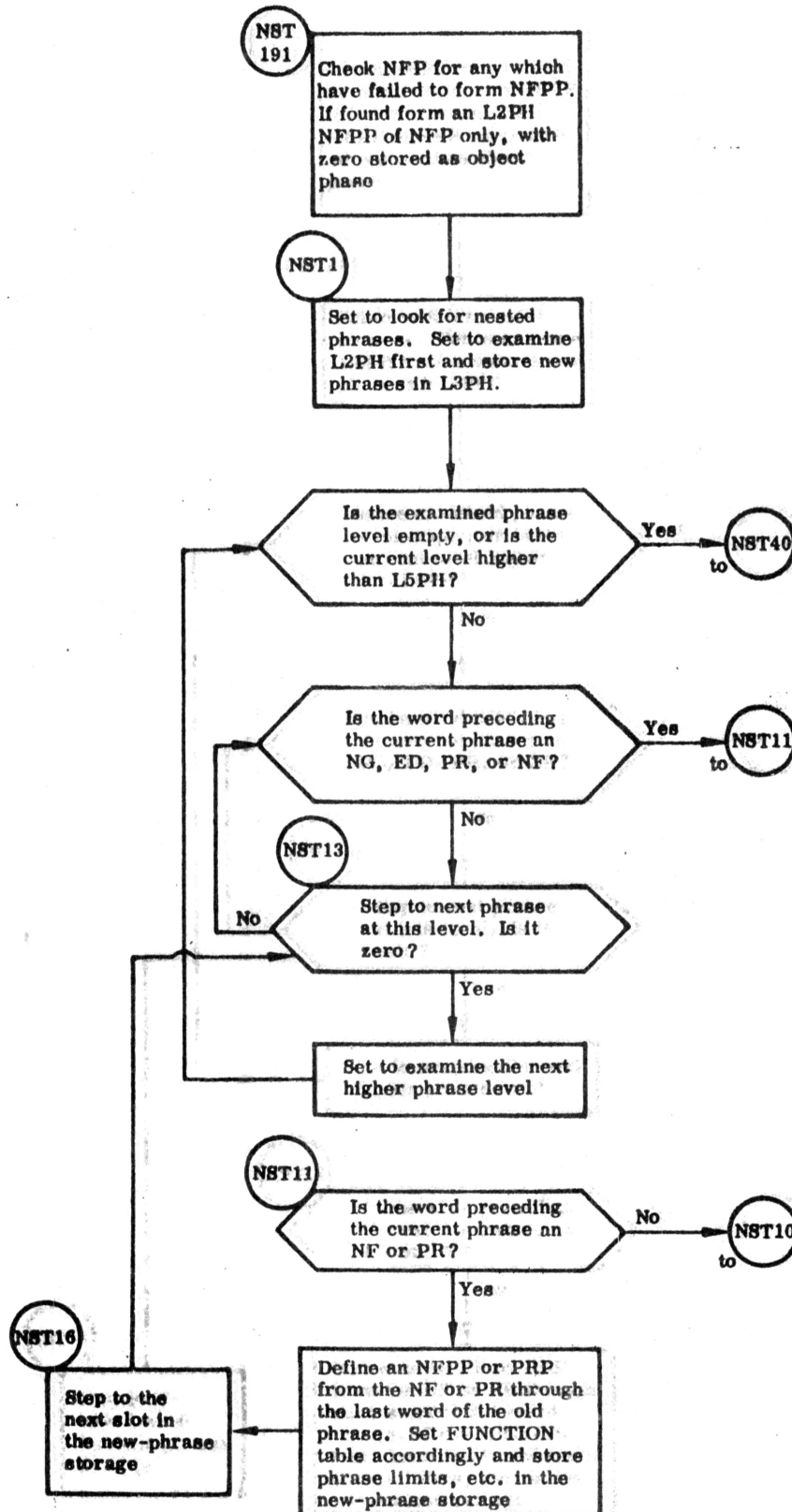


Fig. 16 NESTPH Flow Diagram - Conceptual (Cont.)

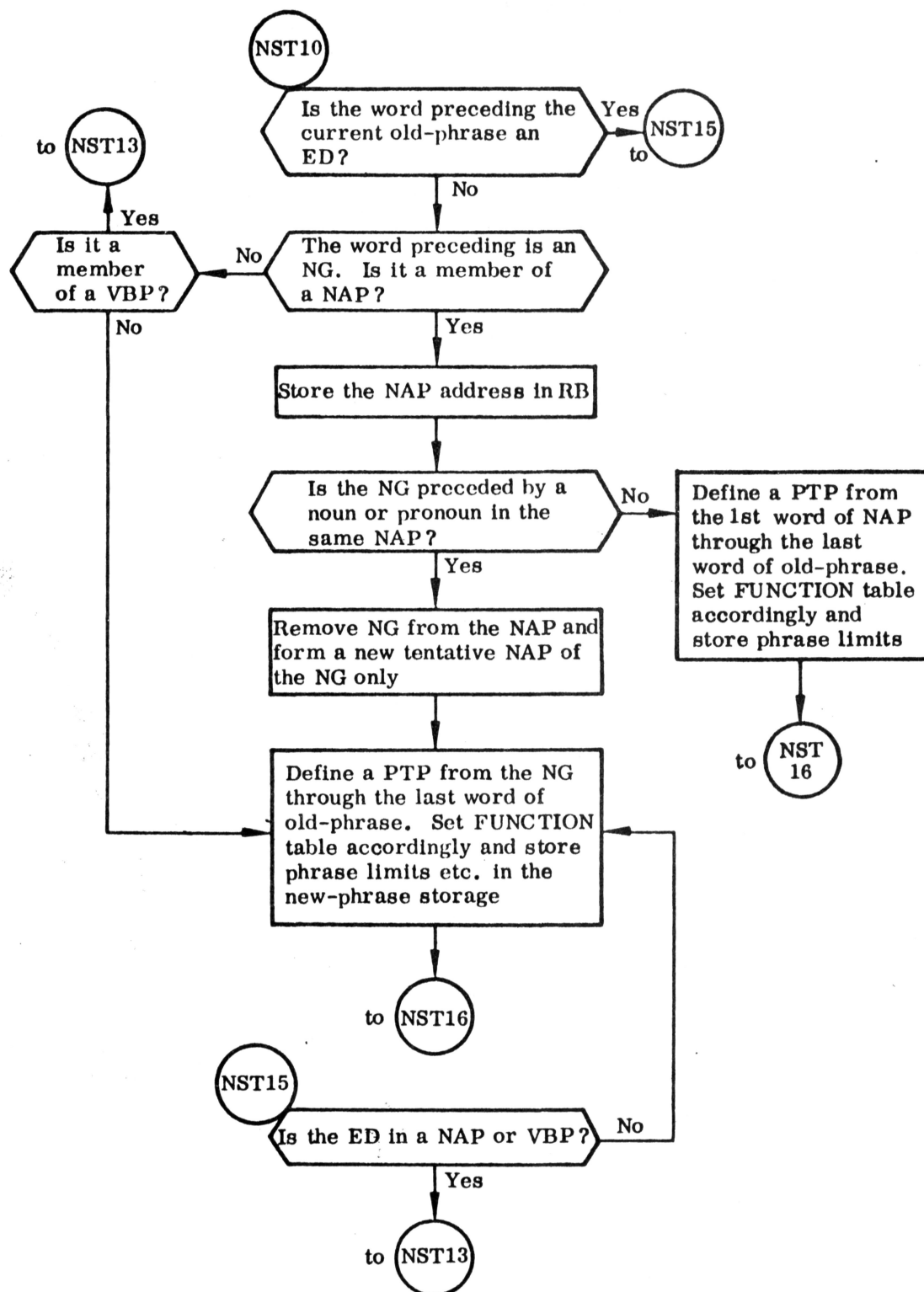


Fig. 16 NESTPH Flow Diagram – Conceptual (Cont.)

Part III - Check for NG in NAP which shouldn't be there

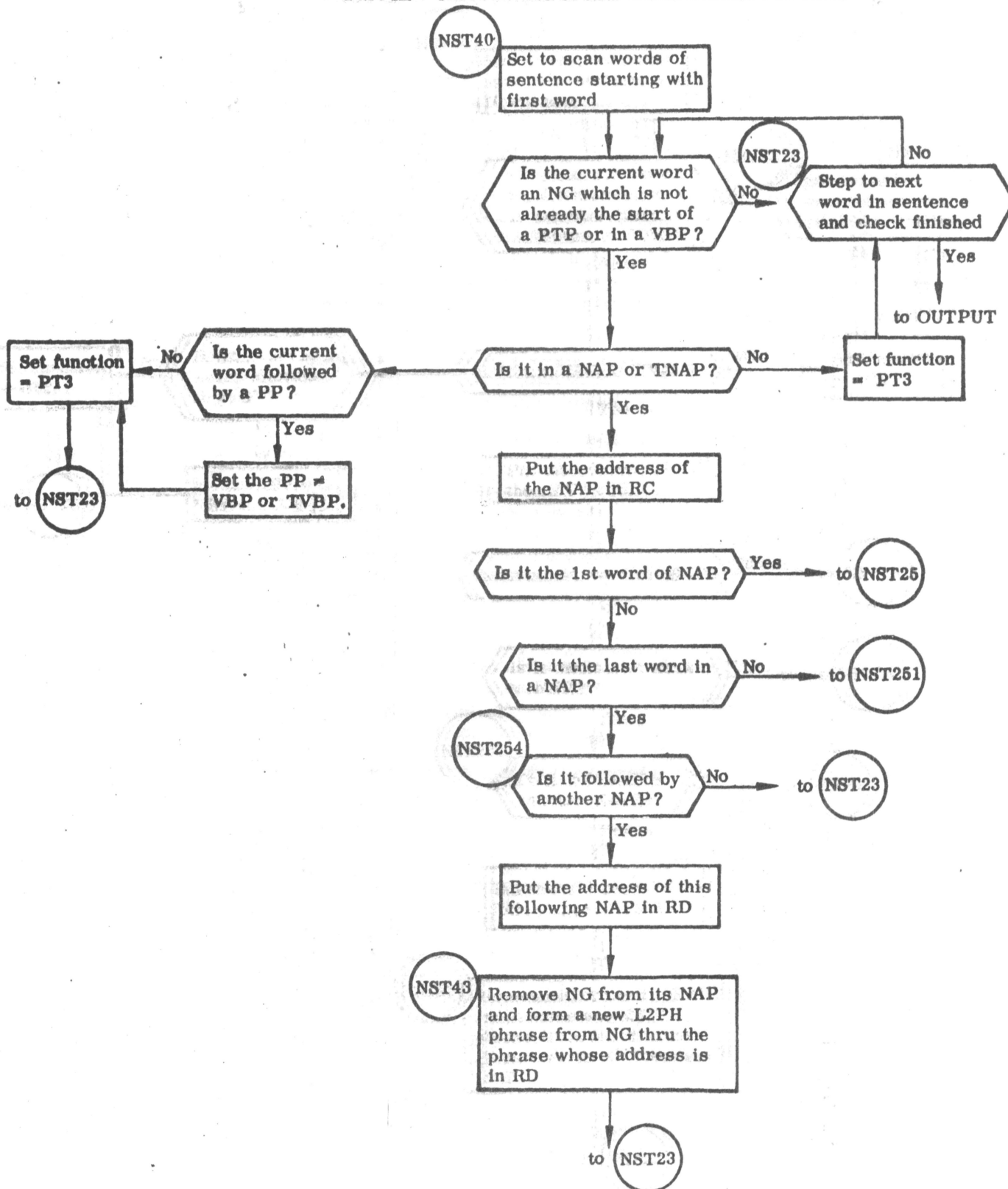


Fig. 16 NESTPH Flow Diagram - Conceptual (Cont.)

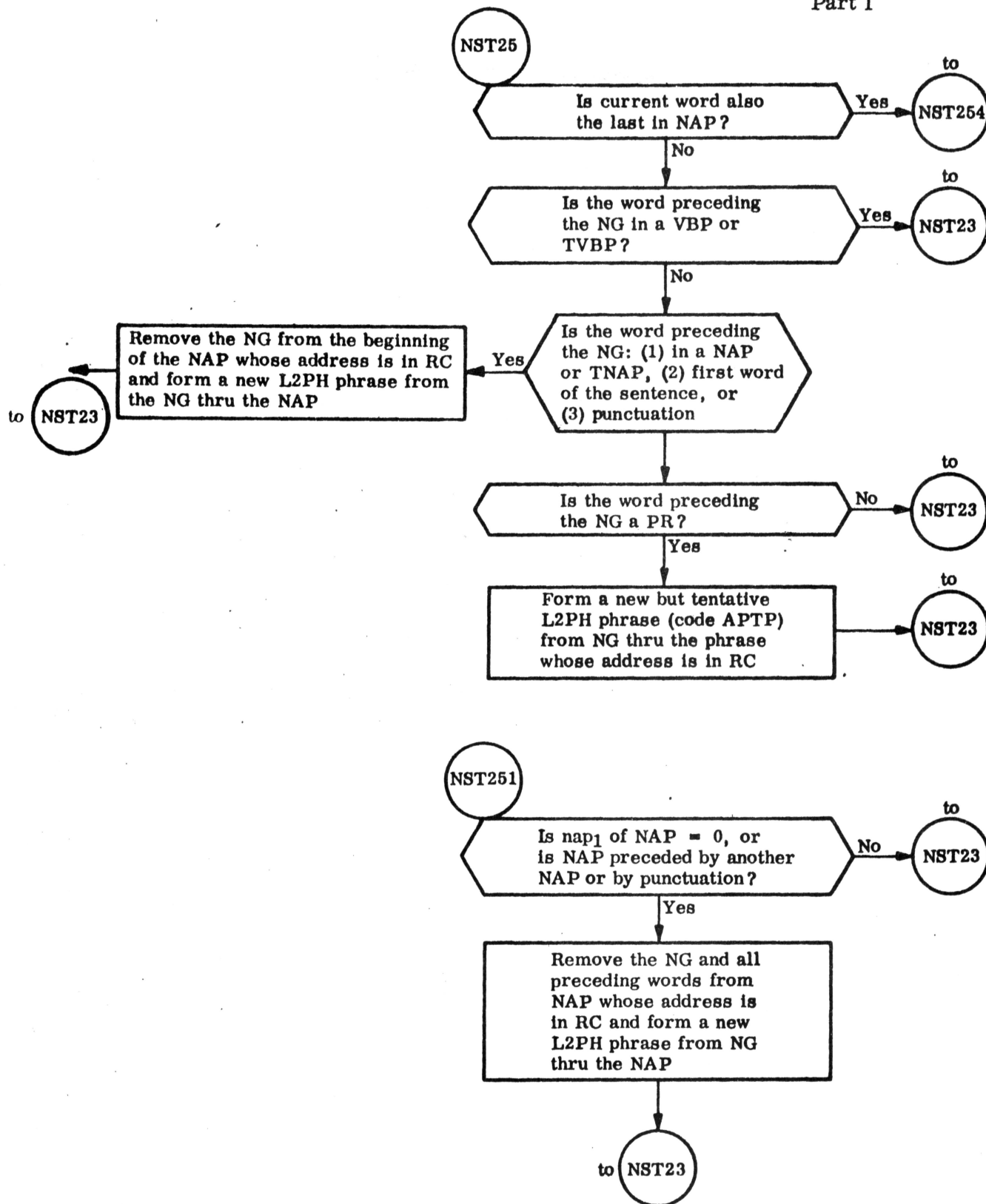


Fig. 16 NESTPH Flow Diagram - Conceptual (Cont.)

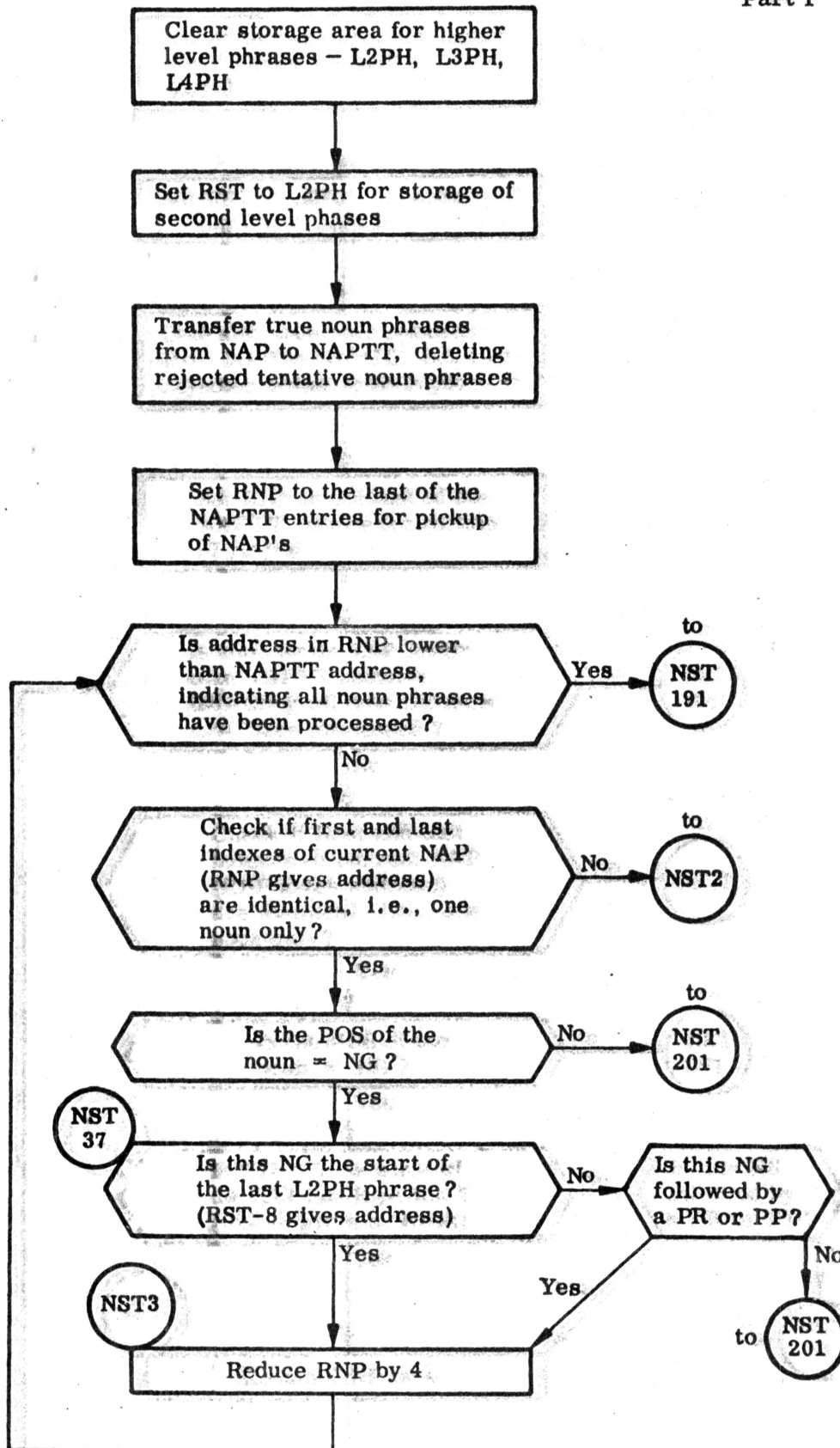


Fig. 17 NESTPH Flow Diagram - Detail

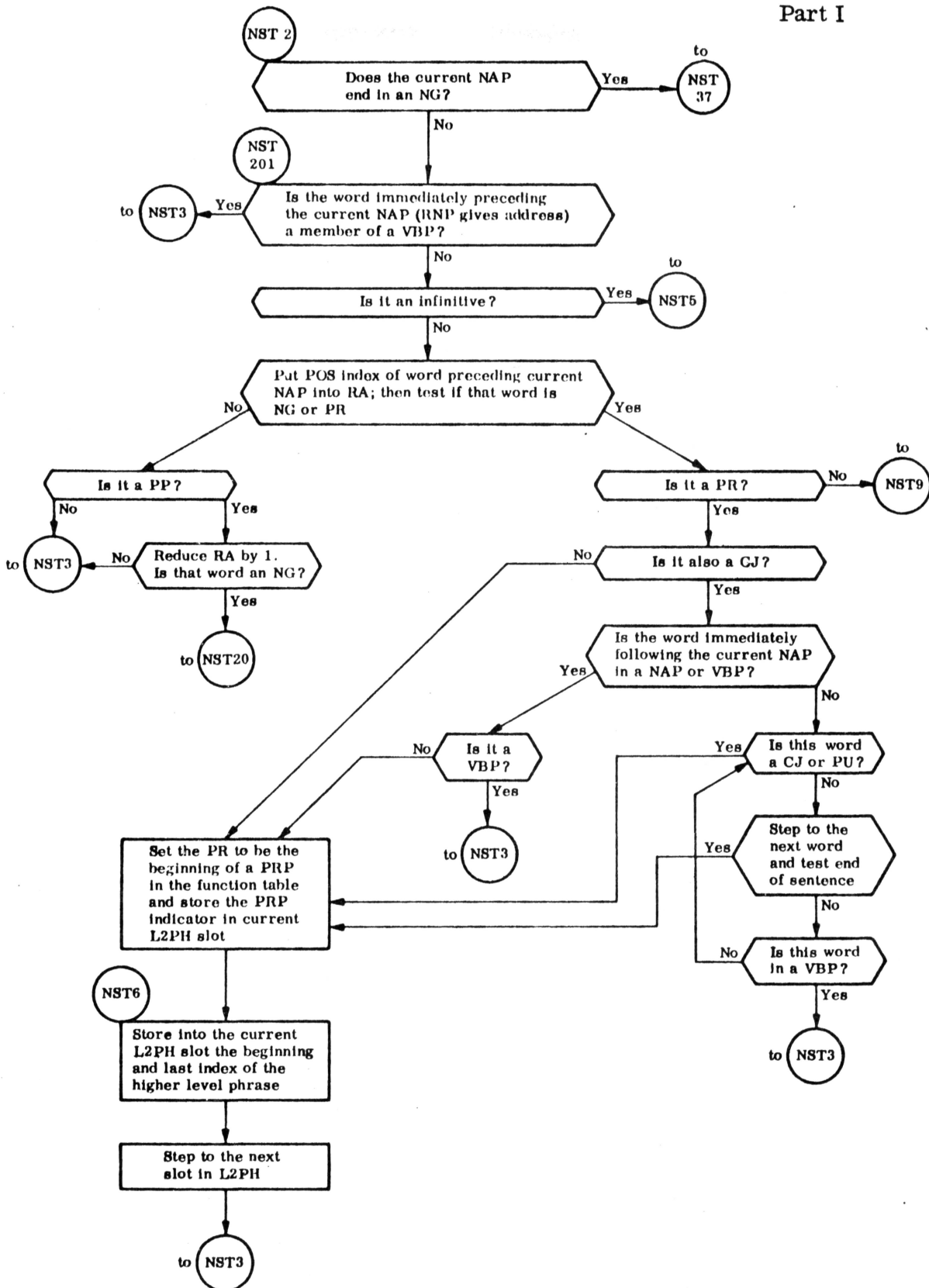


Fig. 17 NESTPH Flow Diagram – Detail (Cont.)

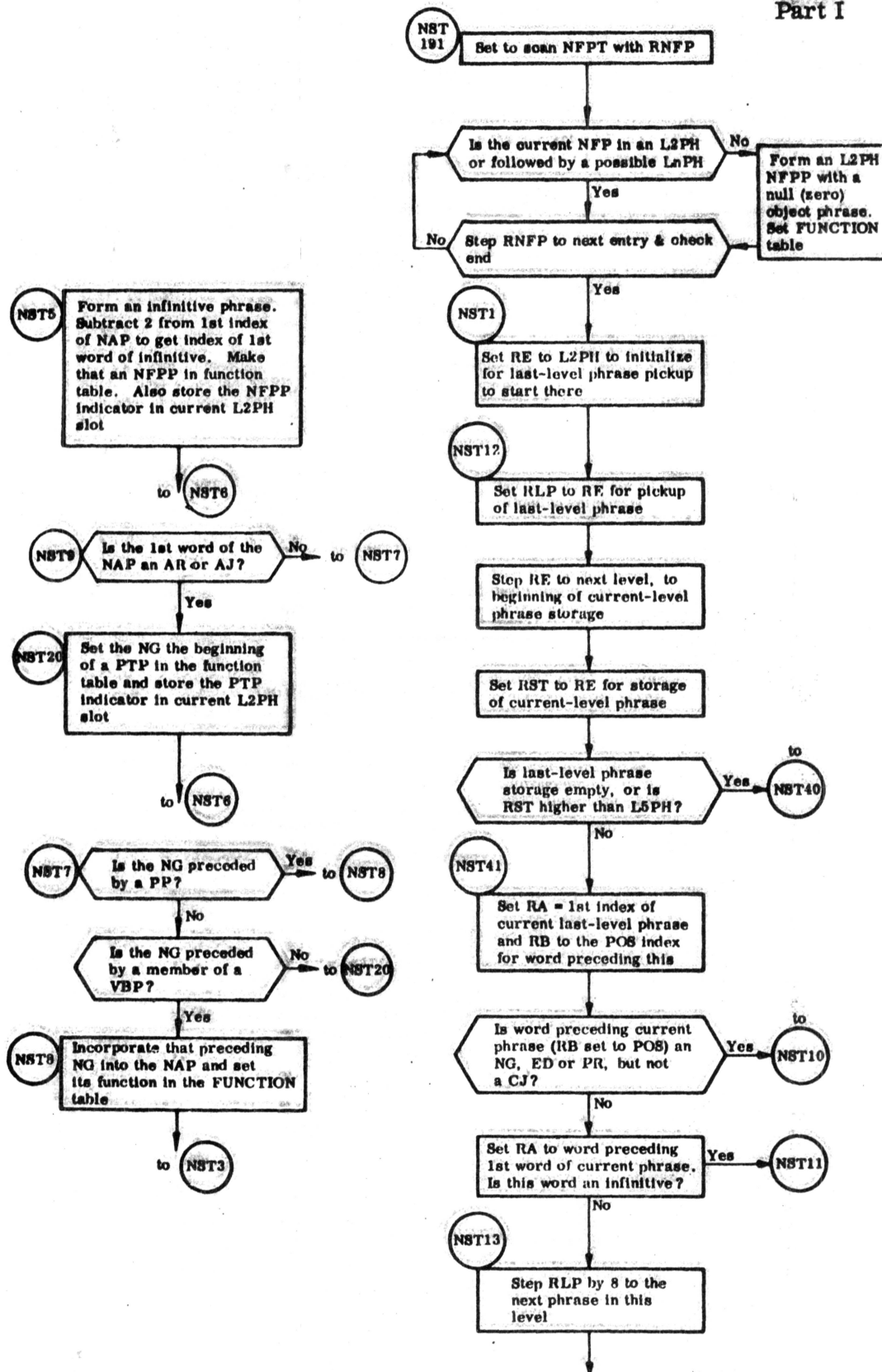


Fig. 17 NESTPH Flow Diagram - Detail (Cont.)

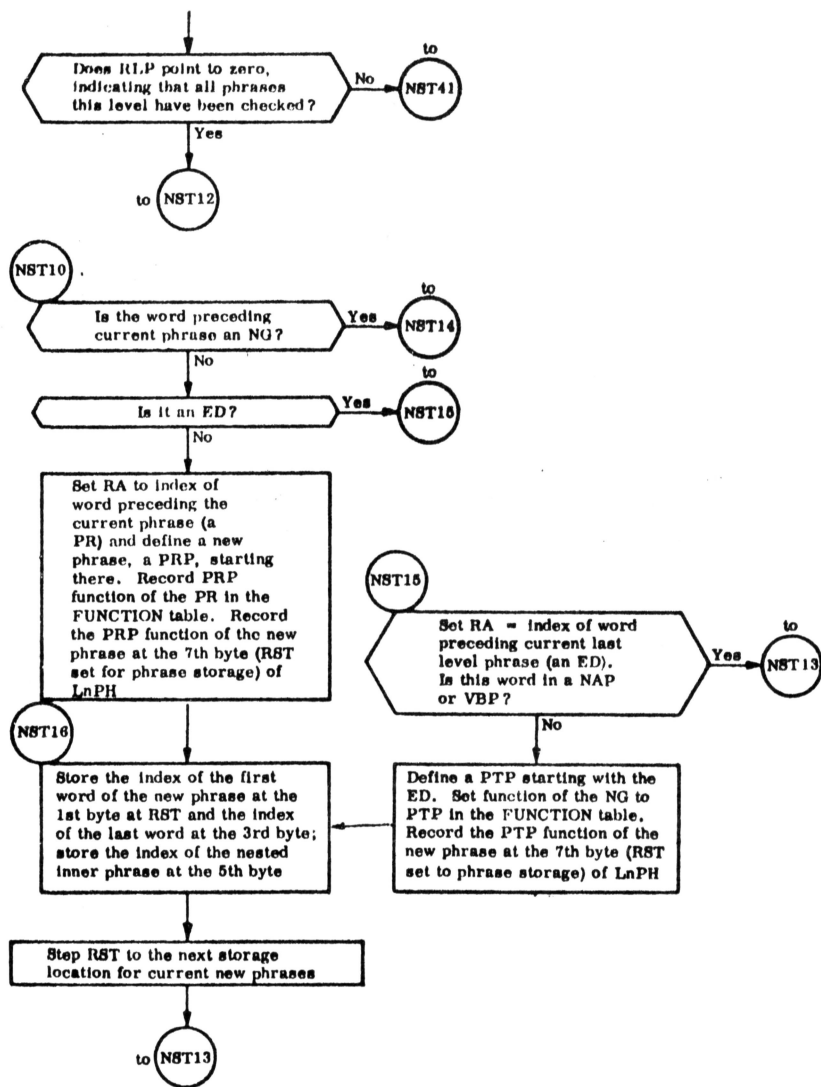


Fig. 17 NESTPH Flow Diagram - Detail (Cont.)

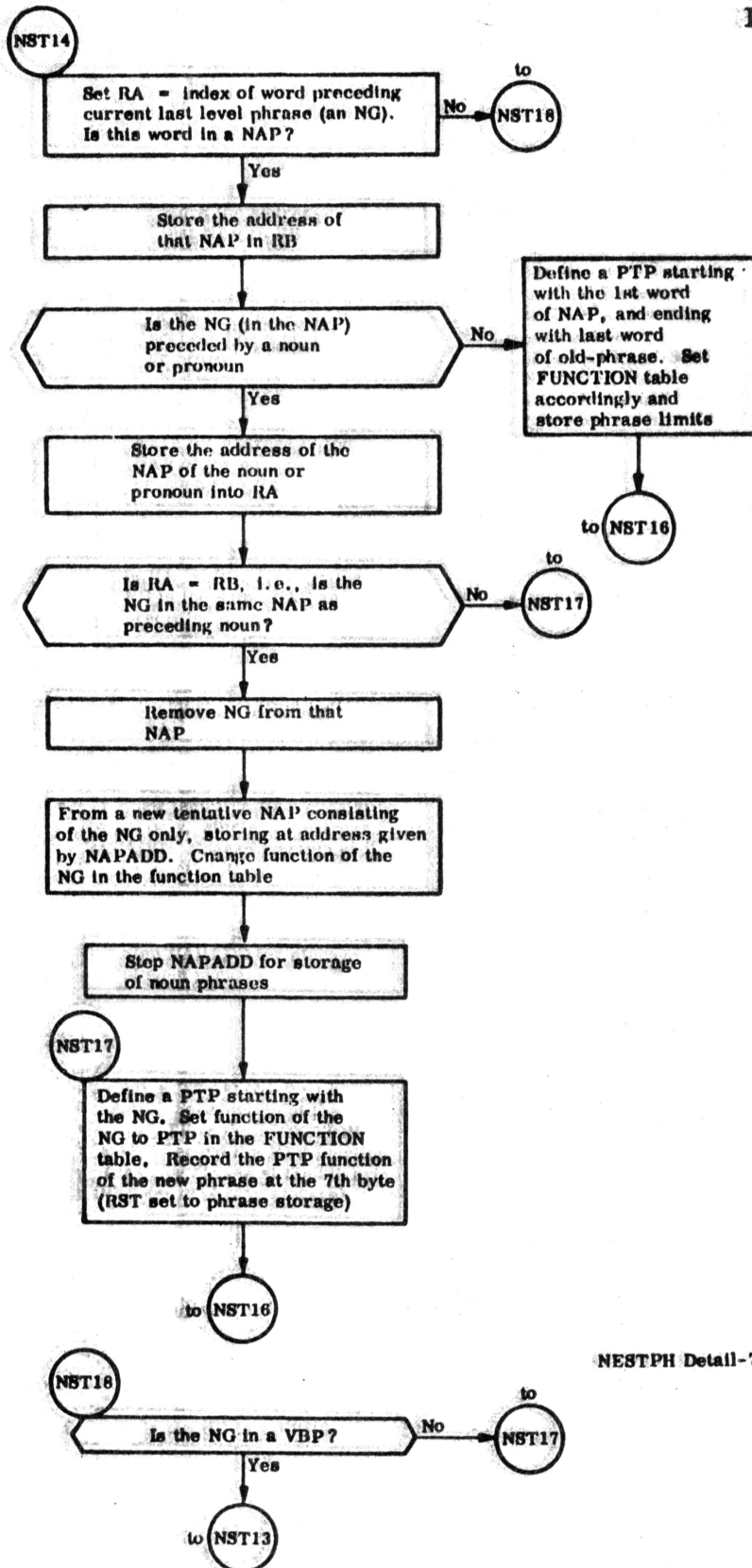


Fig. 17 NESTPH Flow Diagram - Detail (Cont.)

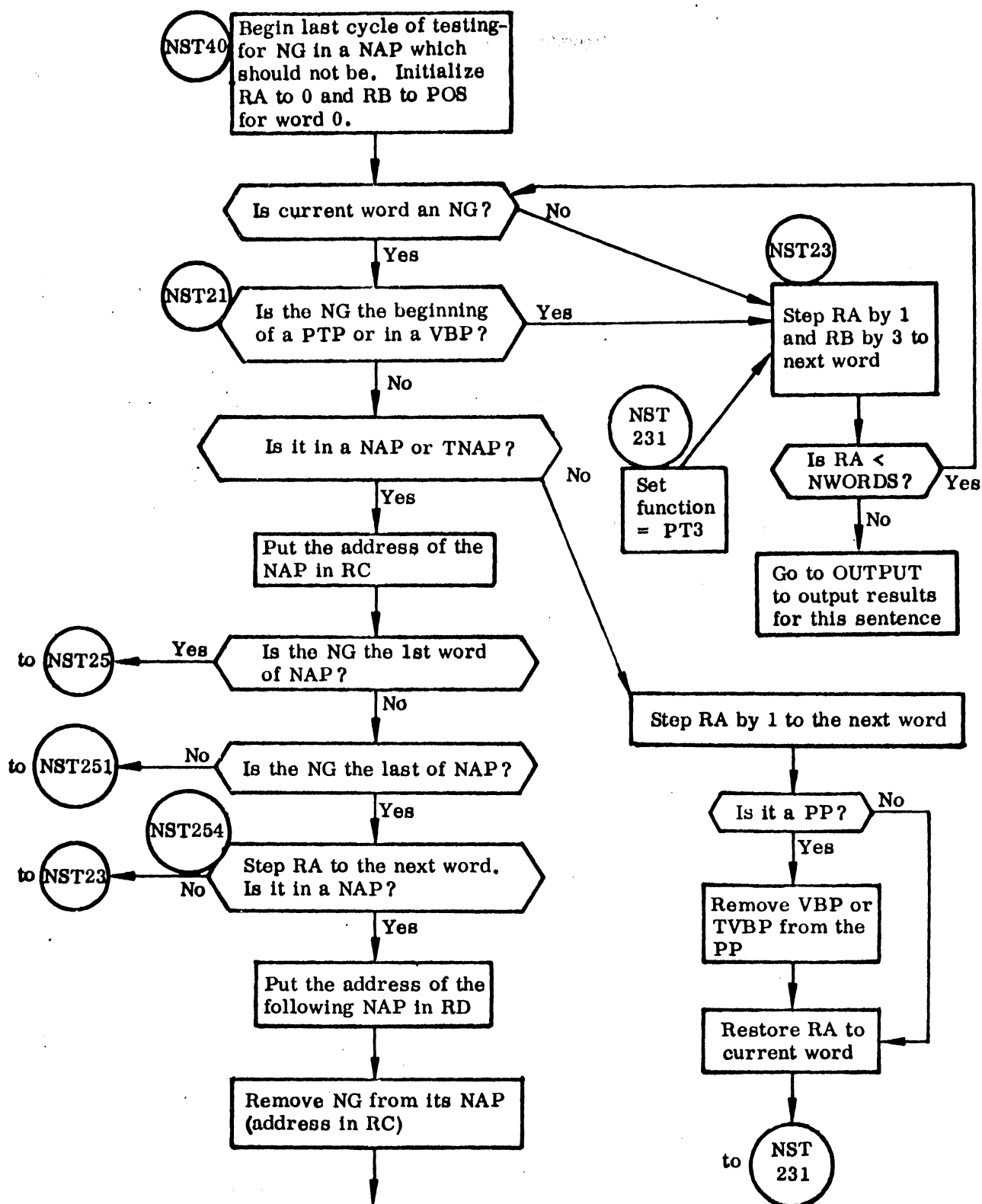


Fig. 17 NESTPH Flow Diagram - Detail (Cont.)

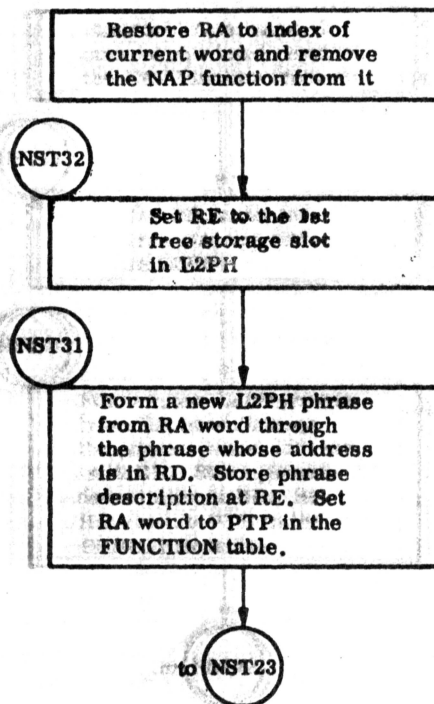


Fig. 17 NESTPH Flow Diagram - Detail (Cont.)

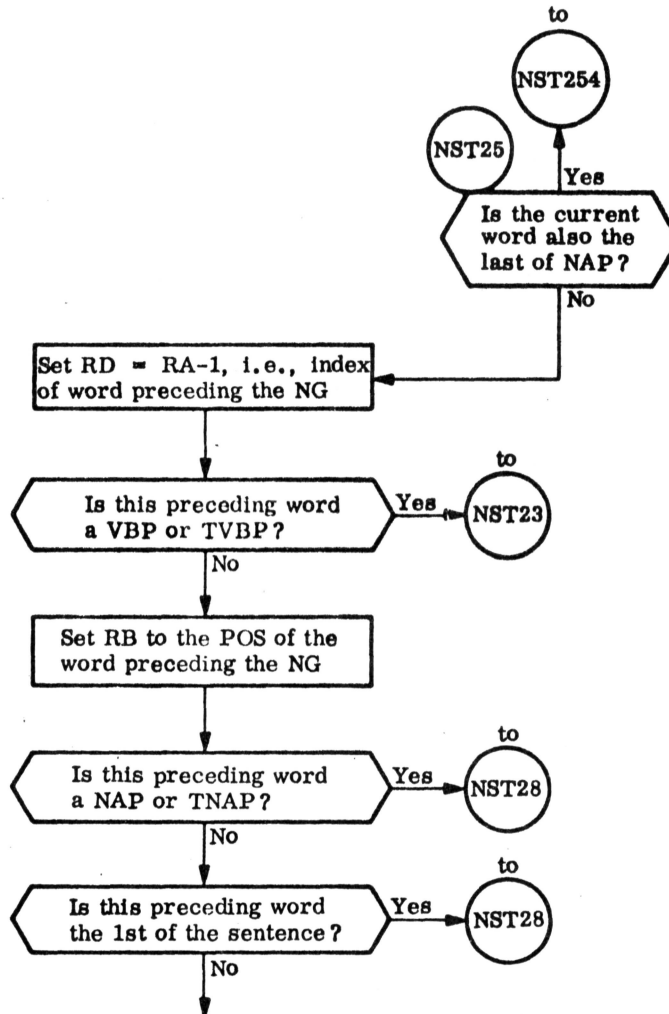


Fig. 17 NESTPH Flow Diagram - Detail (Cont.)

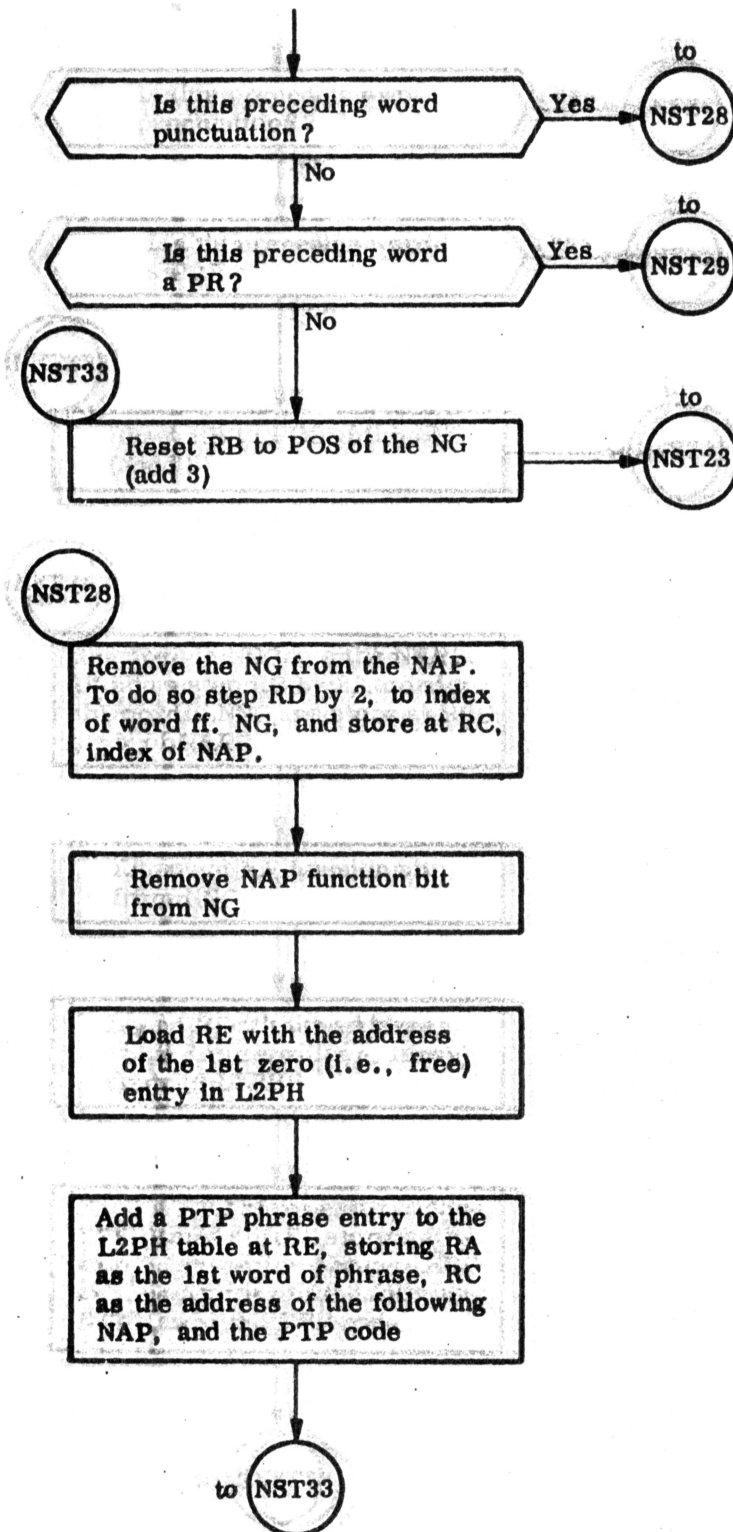


Fig. 17 NESTPH Flow Diagram - Detail (Cont.)

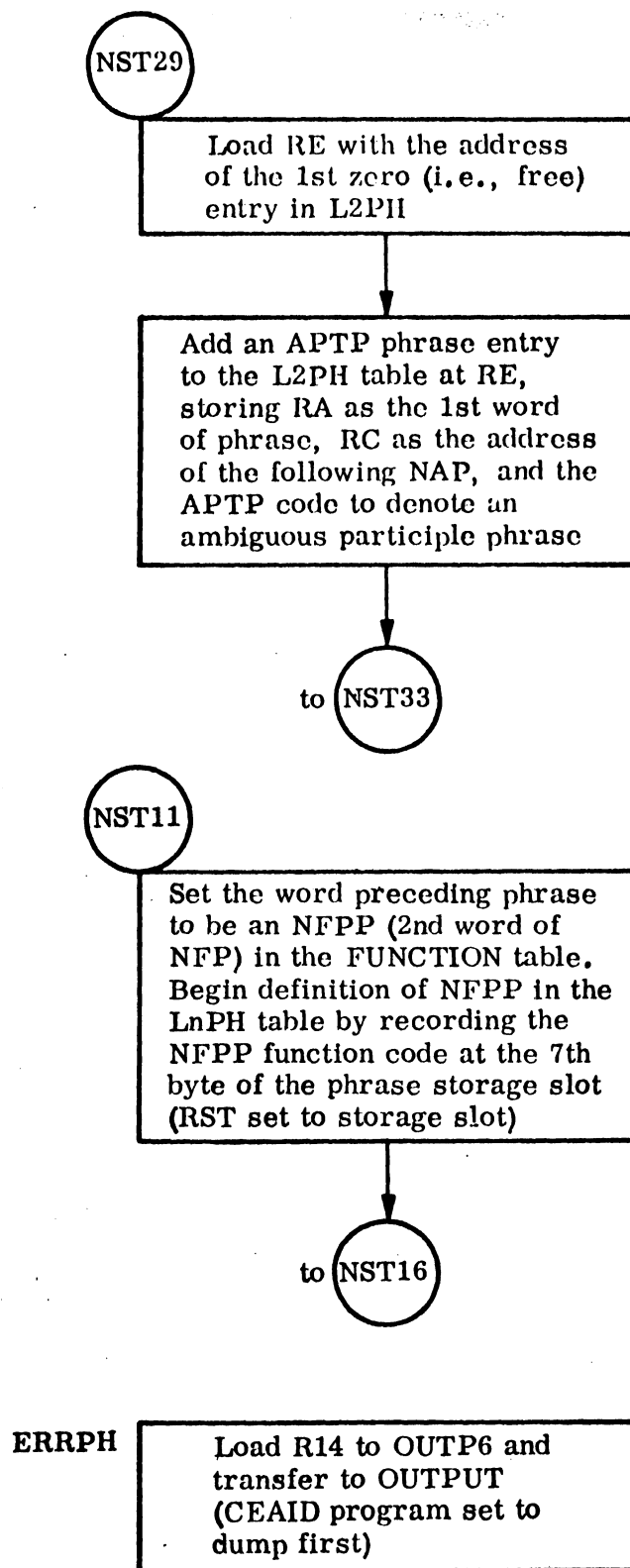


Fig. 17 NESTPH Flow Diagram – Detail (Cont.)

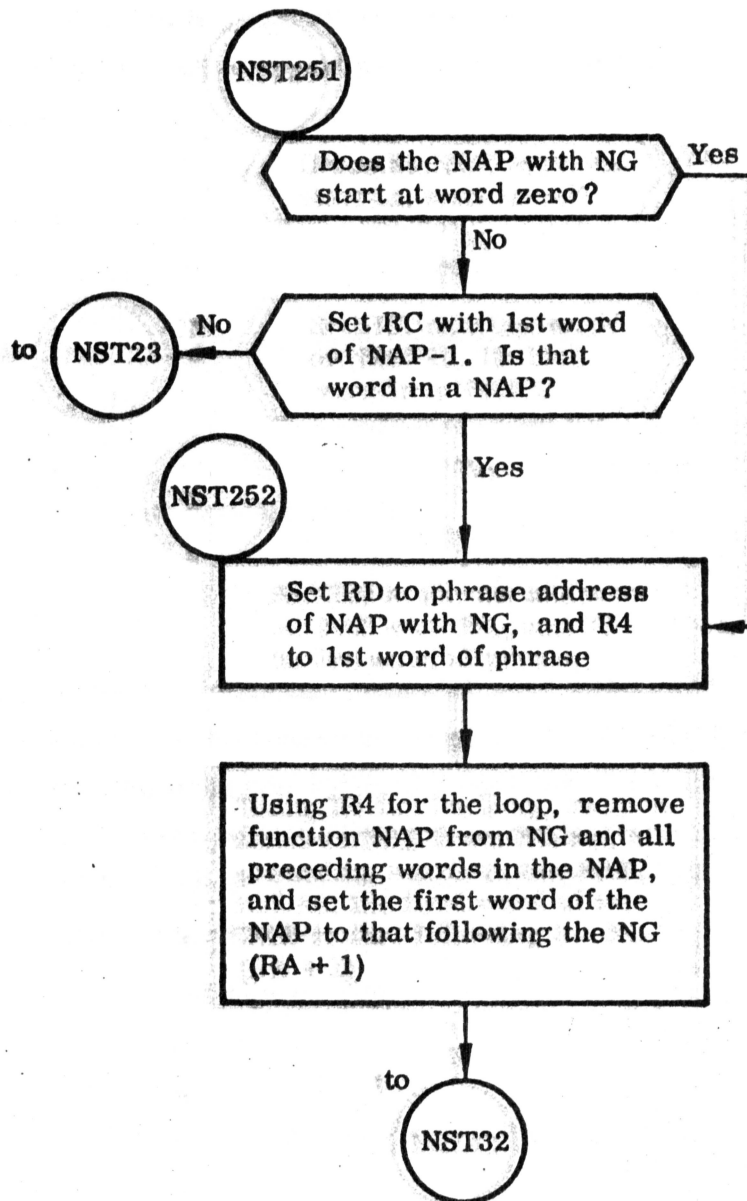


Fig. 17 NESTPH Flow Diagram - Detail (Cont.)

3.3 OUTPUT PROGRAM – FOR LEVEL 1 AND 2 OF PHRASE

After NESTPH was added to BPHRAS to identify higher level phrases, it was necessary to add output which would allow display, checking, and use of this new information. To provide display, a printout was planned, showing lower and higher level phrases, as follows:

- First n lines – Sentence
- Line n + 2 – Column headings giving word number
- Line n + 3 – First-level phrase or POS of each word, under its word number
- Line n + 4 – Second-level phrases of words having these, under the appropriate word number
- Line n + 5 – Third-level phrases of words having these, under the appropriate word number
- Line n + 6 – Fourth-level phrases of words having these

Since 10 spaces were allotted for each word, only 13 words can fit on each line, so the above 5 lines (n + 2 through n + 6) are repeated as many times as necessary to accommodate all the words in the sentence. Round 0 has words 0 – 12, round 1 words 13 – 25, round 2 words 26 – 38, etc. With 13 words per line and 10 spaces each, 130 spaces are used. The other 2 spaces are used for labeling. WD is put in column 1 – 2 of line n + 2, L1 in column 1 – 2 of line n + 3, L2 in line n + 4, etc. An example follows:

		0	1	2	3	4	5	6	7	8	9	10	11
		Francis Bacon, who is famous for his scientific philosophy, was											
		12	13	14	15	16	17						
		not an outstanding scientist himself.											
Round 0	WD												
	L1	NAP	NAP	PU	NAP	VBP	AJ	PR/AV	NAP	NAP	NAP	PU	VBP
	L2							PRP	PRP	PRP	PRP		
	L3												
	L4												
Round 1	WD	13	14	15	16	17							
	L1	NAP	NAP	NAP	NAP	PU							
	L2												
	L3												
	L4												

(This does not show that one NAP ends at 15 and another begins at 16, but this will be a fairly rare occurrence.) The program calculates rounds as follows. The rounds start at 0. The first word of the round n is $n(13)$. $(n + 1)(13)$ is subtracted from the total number of words. As long as the result is positive, 13 words are printed per line. When it is negative, the total number of words minus $13n$ gives the number of words to be printed.

For example, if $NW = 30$

$$\begin{array}{r} 30 \\ -13 \\ \hline 17 \end{array} + \text{start at } 0(13) \text{ print 13 words, } 0-12$$

$$\begin{array}{r} -13 \\ 4 \end{array} + \text{start at } 1(13) \text{ print 13 words, } 12-25$$

$$\begin{array}{r} -13 \\ 9 \end{array} - \text{start at } 2(13)$$

$$\begin{array}{r} +13 \\ +4 \end{array} \text{ print 4 words, } 26-30$$

To provide output suitable for further computer processing, a sentence description record was also planned, to be assembled in the buffer SENDES. As with all variable-length IOCS records, the first four bytes of a sentence description record are used for counts. The next five bytes contain the sentence description carried over from the input record (records put out by SENDIC, which assembled this information and the part-of-speech strings of the words). It includes:

- byte 1 - I or N indexability code
- byte 2 - 3 - page number
- byte 4 - sentence number
- byte 5 - number of words in sentence NW

There were then five bytes for each word in the sentence for a total of 5 NW bytes, as follows:

- byte 1 - 2 a phrase-type code for the word, for the lowest level phrase that the word is in. Because of nesting, it may also be in a higher level phrase, as a NAP may be included in PRP. Phrase codes are the same as in the FUNCTION table as described in section 3.2.

- byte 3 — index of the first word of phrase coded above
- byte 4 — index of the last word of phrase coded above
- byte 5 — blank

Following these 5-byte codes, the sentence was printed in EBCDIC.

Later the blank byte 5 of the word description may be used to show the main words of the sentence skeleton, and the full parts of speech may be output prior to the sentence. Contents of the present tape output record, assembled in the SENDES buffer, is shown below.

SENDES Buffer		
Field Number	Number of Bytes	Description
0	4	First half word gives the total record length in bytes, right justified, logical IOCS uses second half word
1	1	I or N for indexible or nonindexible
2	2	Page number in binary
3	1	Sentence number in binary
4	1	Number of English words, NW, in sentence right justified
5	5 NW	Word descriptions, 5 bytes to word giving lowest level phrase membership, phrase boundaries, and eventually role in phrase
6	Variable	Sentence in EBCDIC

Logical variable-length records are blocked into variable-length physical records.

The OUTPUT routine therefore currently gives two options, by UPSI card:

- (1) The old output, consisting of
 - (a) A sentence file, out on tape, with sentence ID, sentence description with simple phrases and POS interspersed (no indication of phrase length), and the sentence itself. LLESENO is used for output. Output is interpreted and printed by program PHRASP.

- (b) A file of index words, in the latest version with their page and sentence numbers, and the simple phrase of which they are part. Output, by LLEIPO, is onto disk, later sorted onto tape.
- (2) The new output, consisting of
 - (a) A printout, showing each word's membership in simple or higher nested phrases, showing the levels of nesting. PRINT is used for output.
 - (b) A sentence file, output by LLESENO on tape from the buffer SENDES. Each record gives sentence ID, sentence description word by word, showing each word's phrase membership (lowest level phrase), and the sentence itself.

The OUTPUT program is described by the flow diagrams in Figs. 18 and 19.

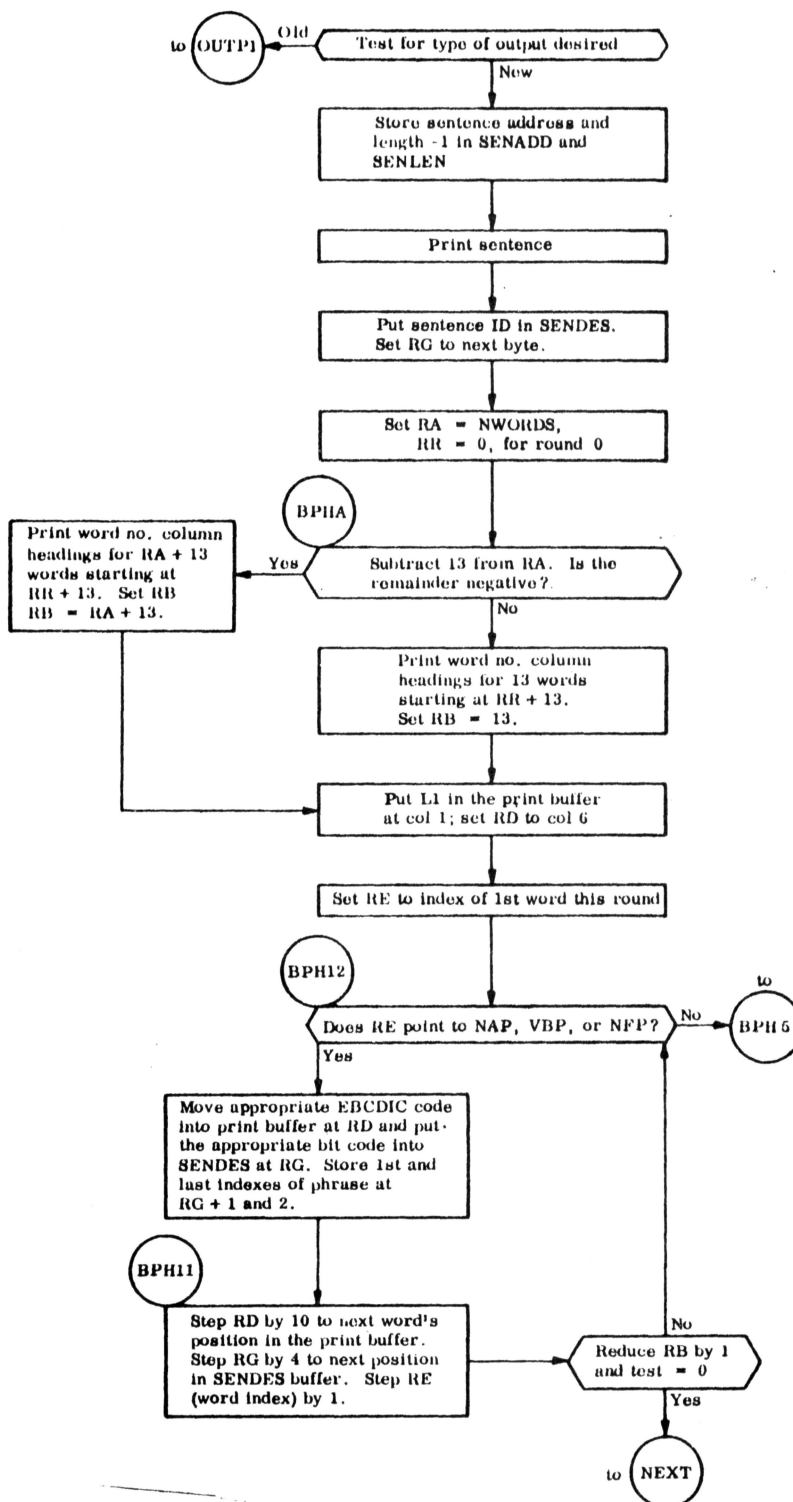


Fig. 18 OUTPUT Skeleton Flow Diagram

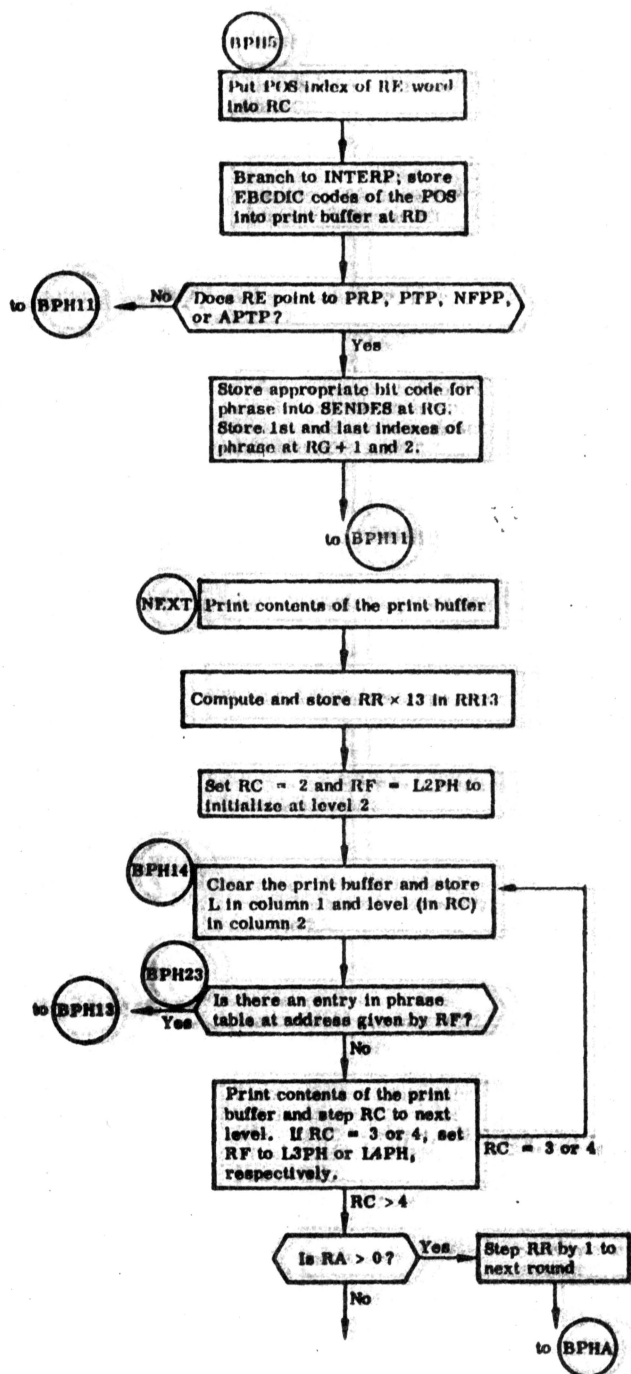


Fig. 18 OUTPUT Skeleton Flow Diagram (Cont.)

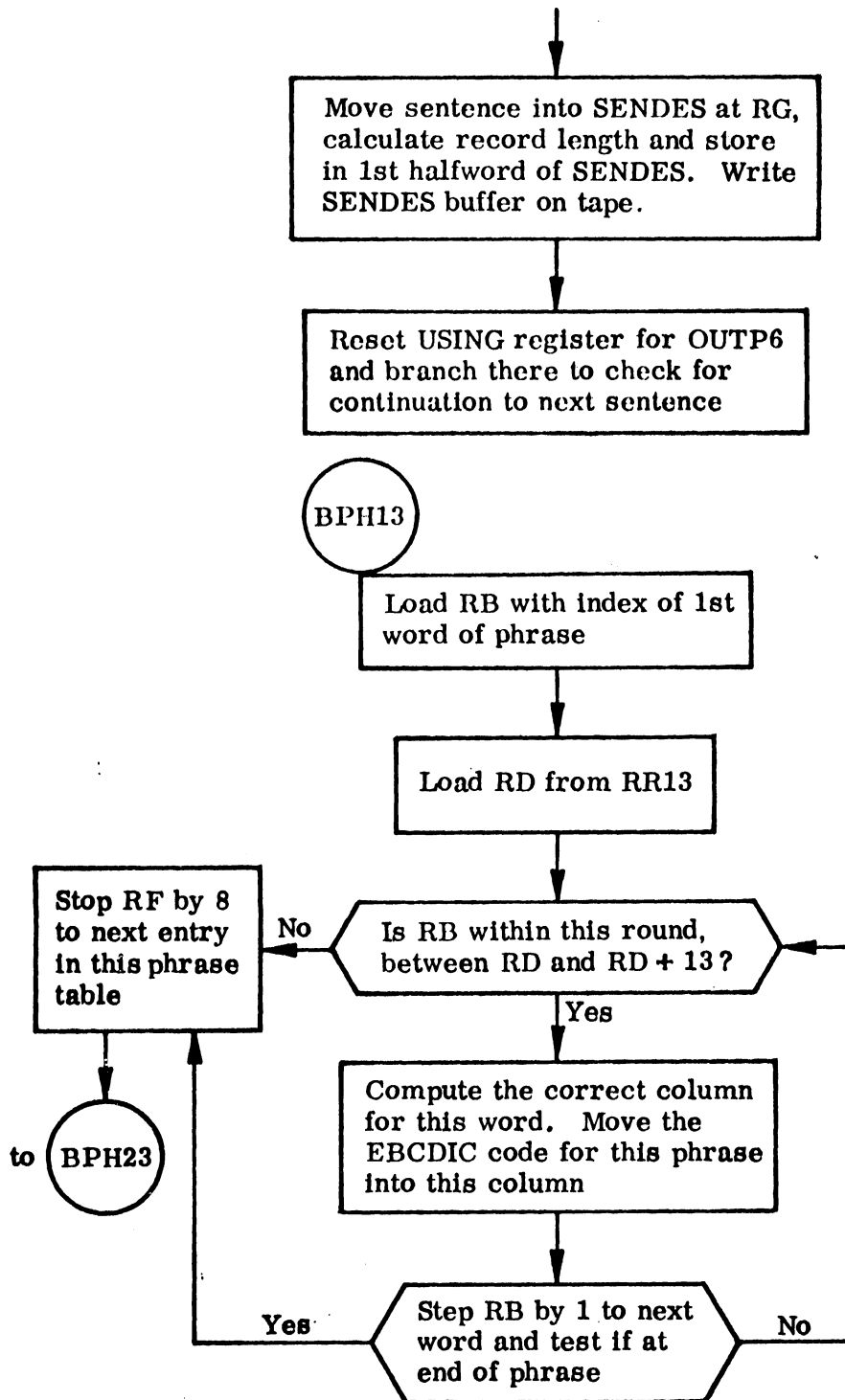


Fig. 18 OUTPUT Skeleton Flow Diagram (Cont.)

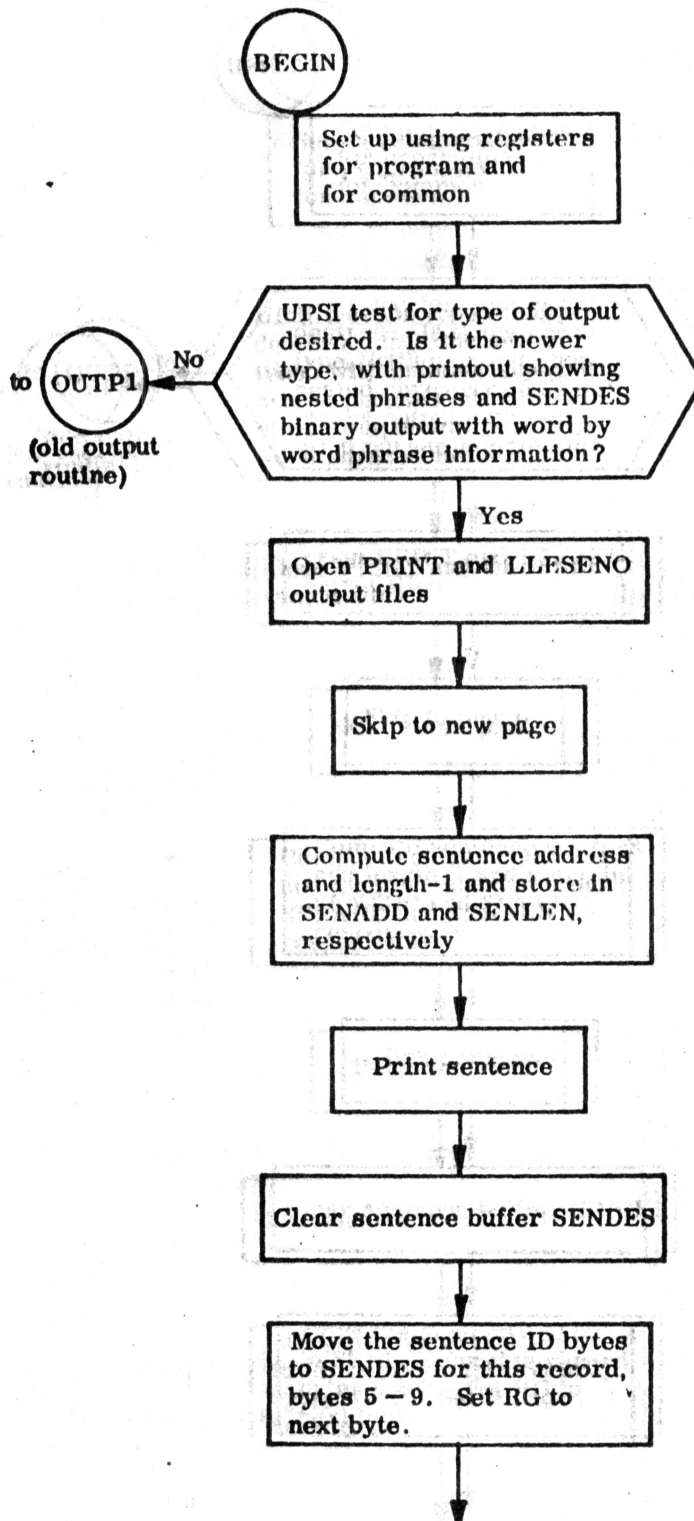


Fig. 19 OUTPUT Flow Diagram - Detail

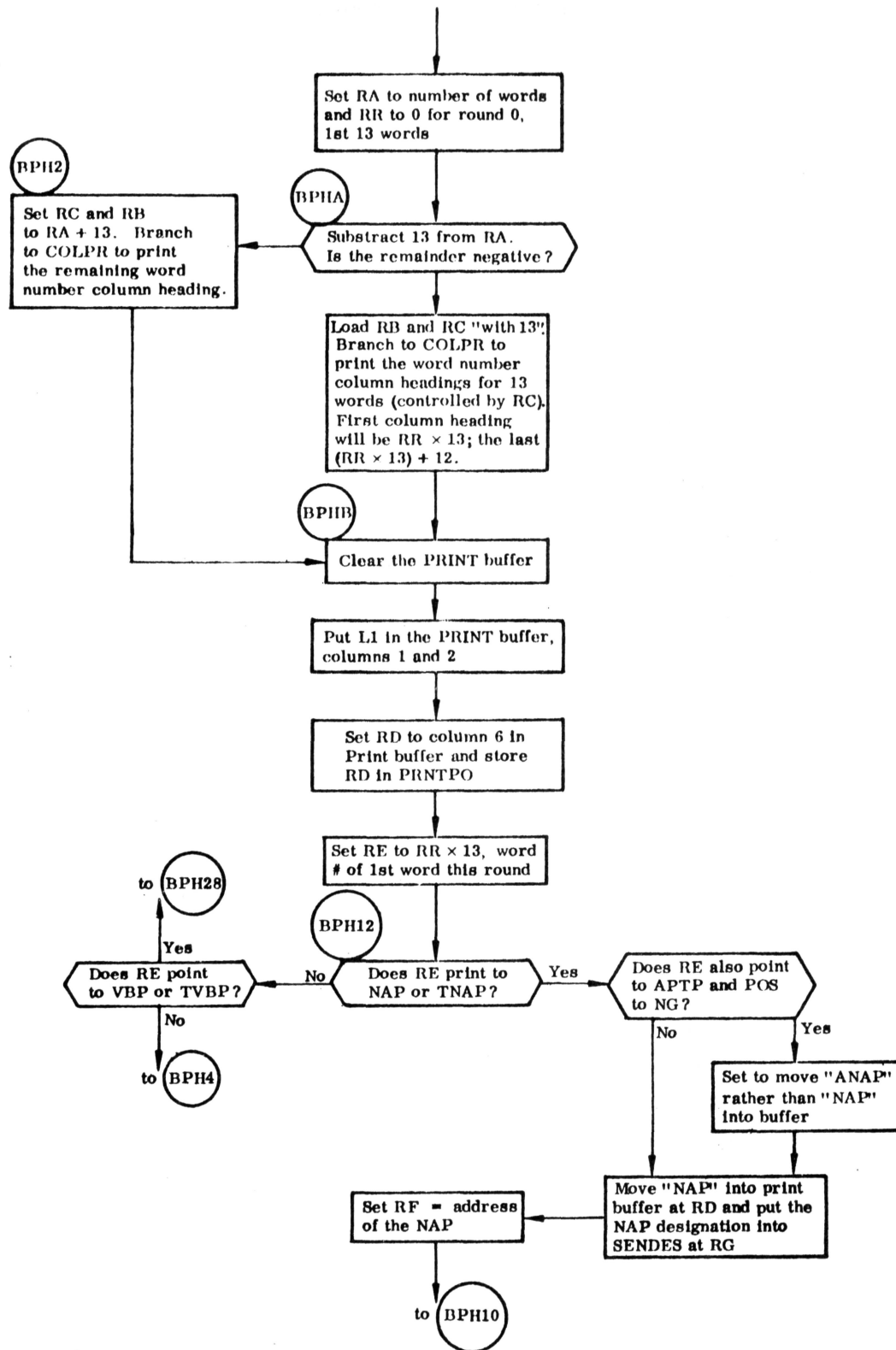


Fig. 19 OUTPUT Flow Diagram - Detail (Cont.)

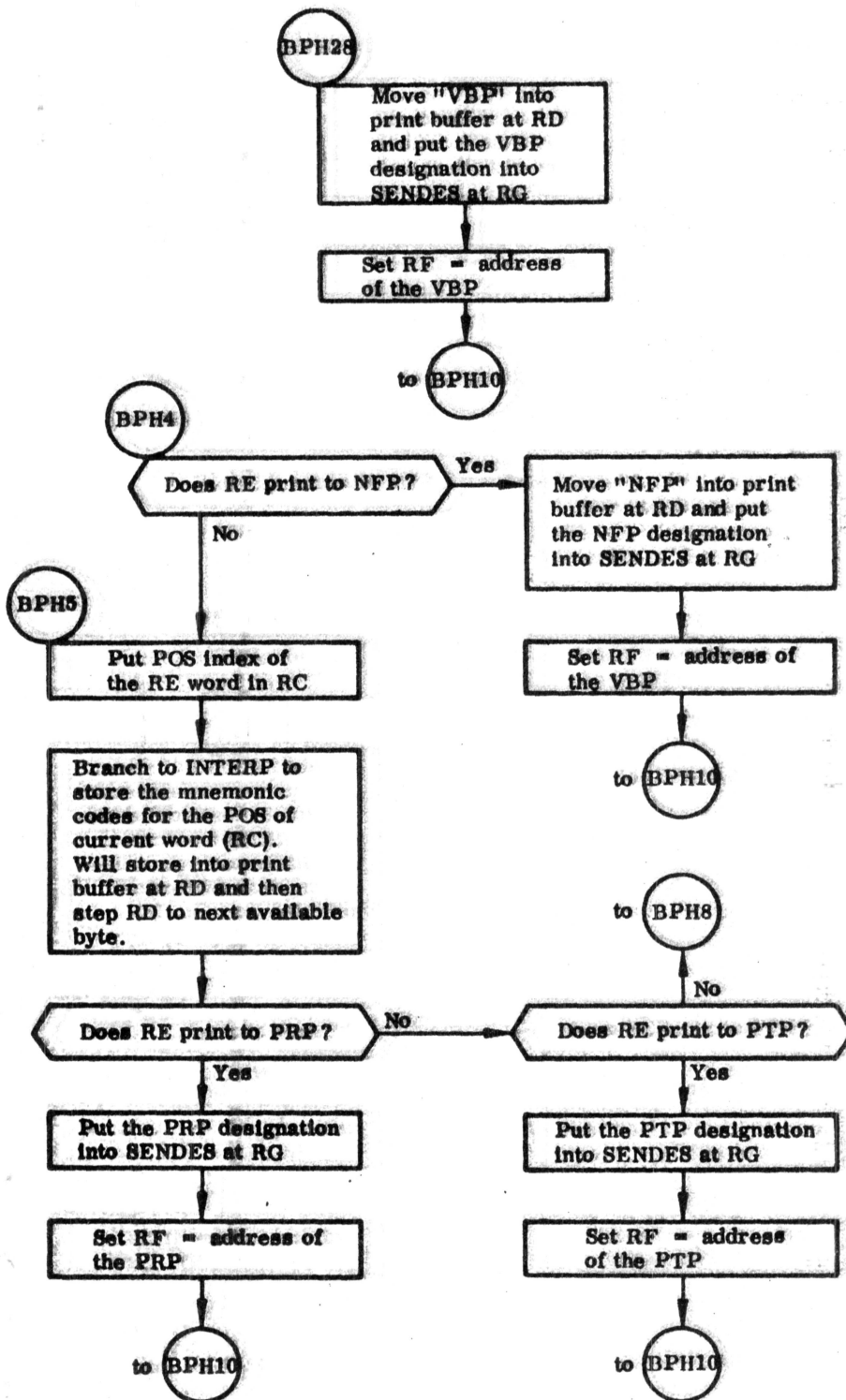


Fig. 19 OUTPUT Flow Diagram - Detail (Cont.)

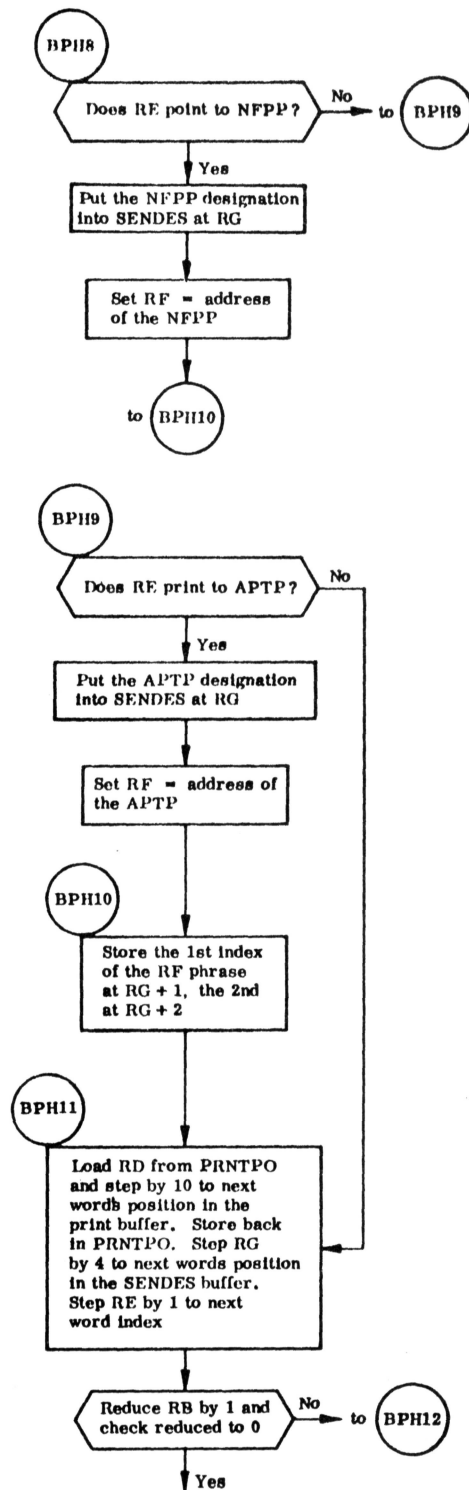


Fig. 19 OUTPUT Flow Diagram – Detail (Cont.)

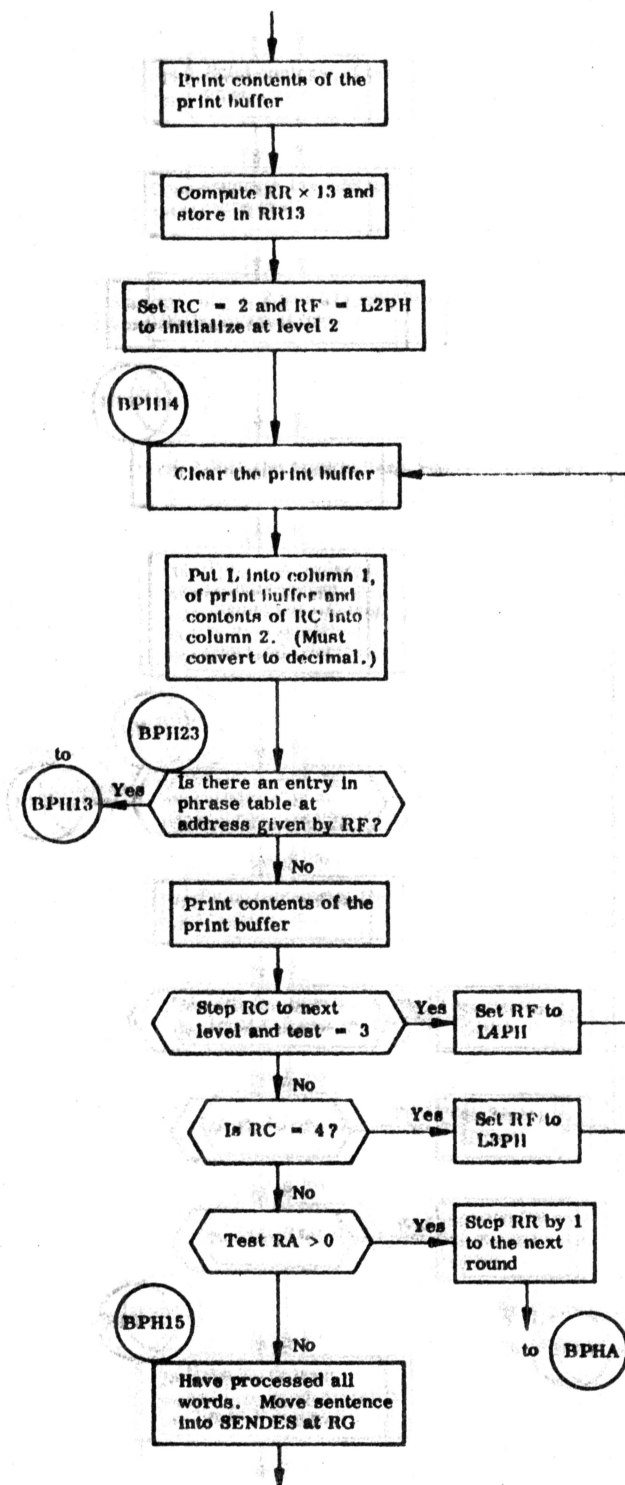


Fig. 19 OUTPUT Flow Diagram -- Detail (Cont.)

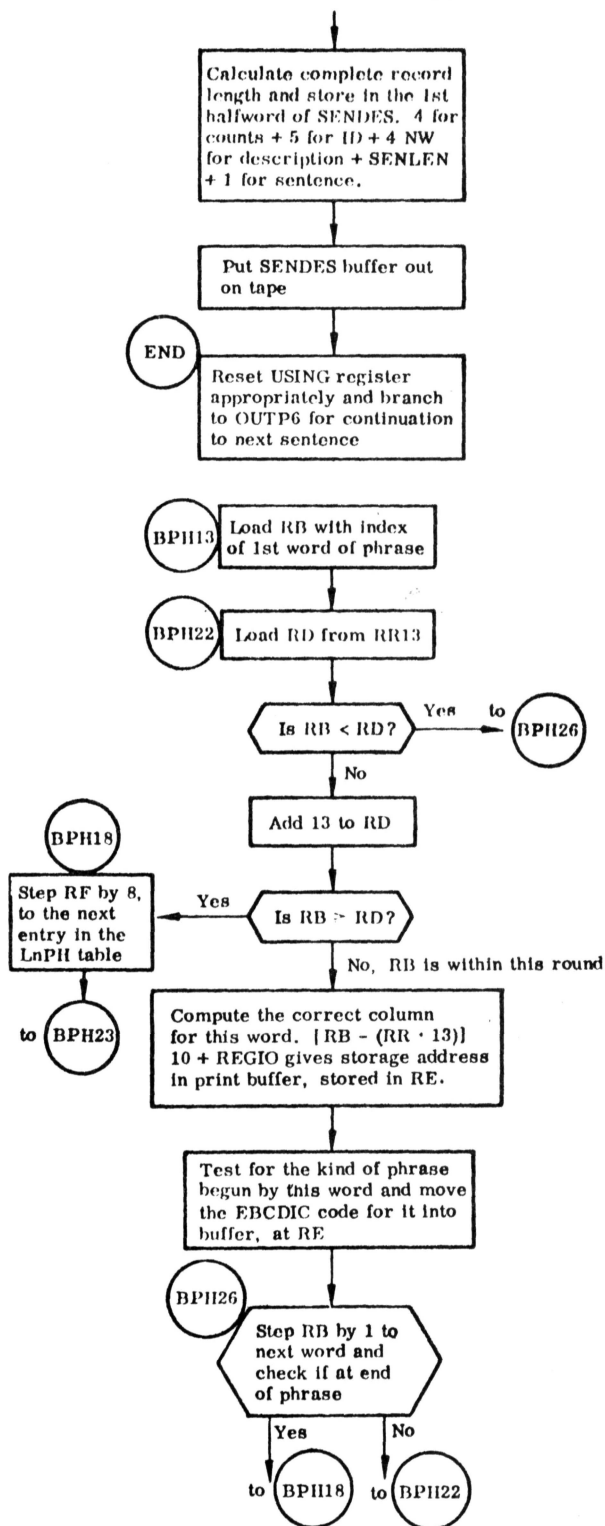


Fig. 19 OUTPUT Flow Diagram - Detail (Cont.)

COLPR Subroutine - RC must contain the # of column headings desired and RR must give the "round."
The "round" $\times 13$ gives the 1st column heading

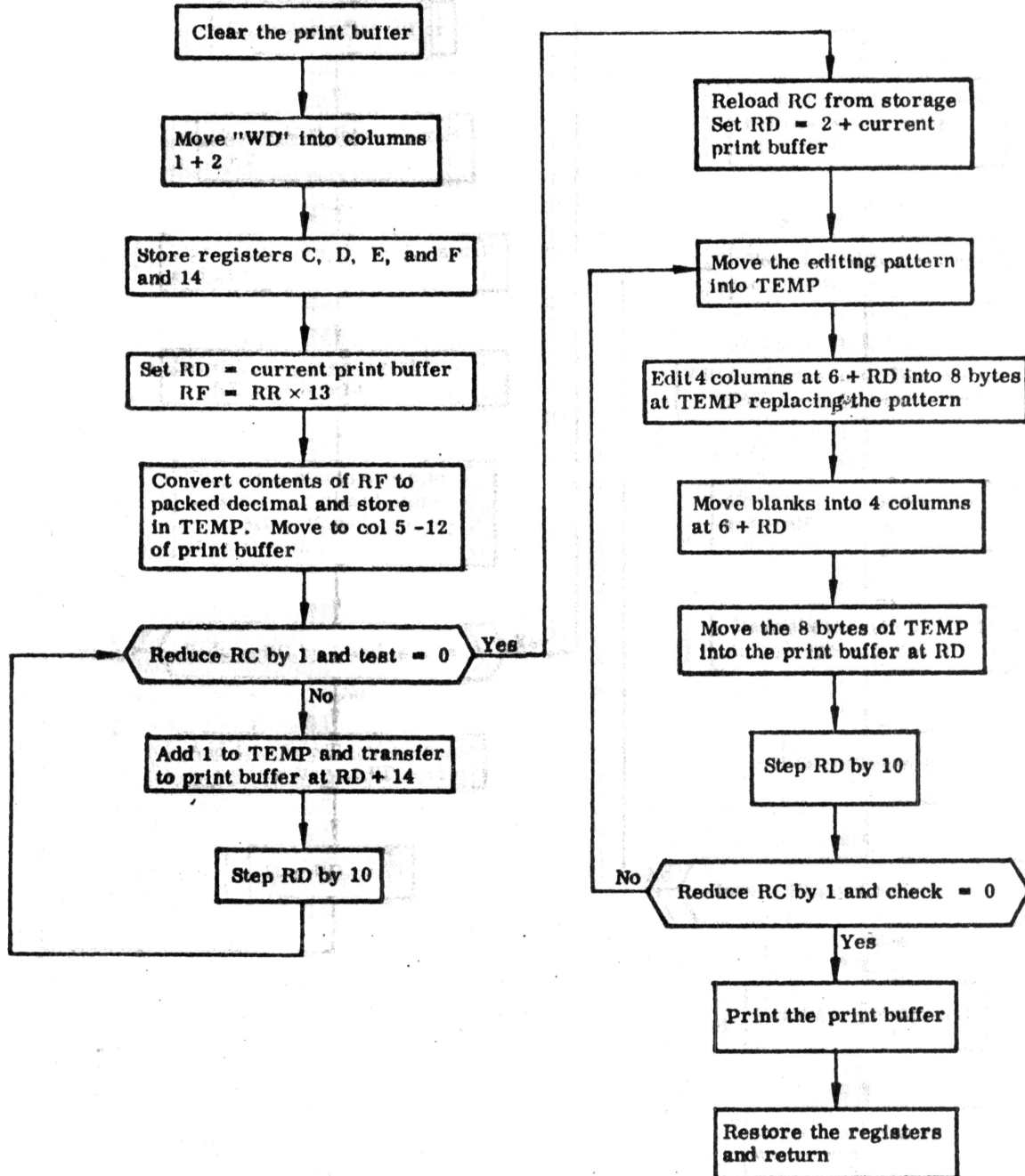
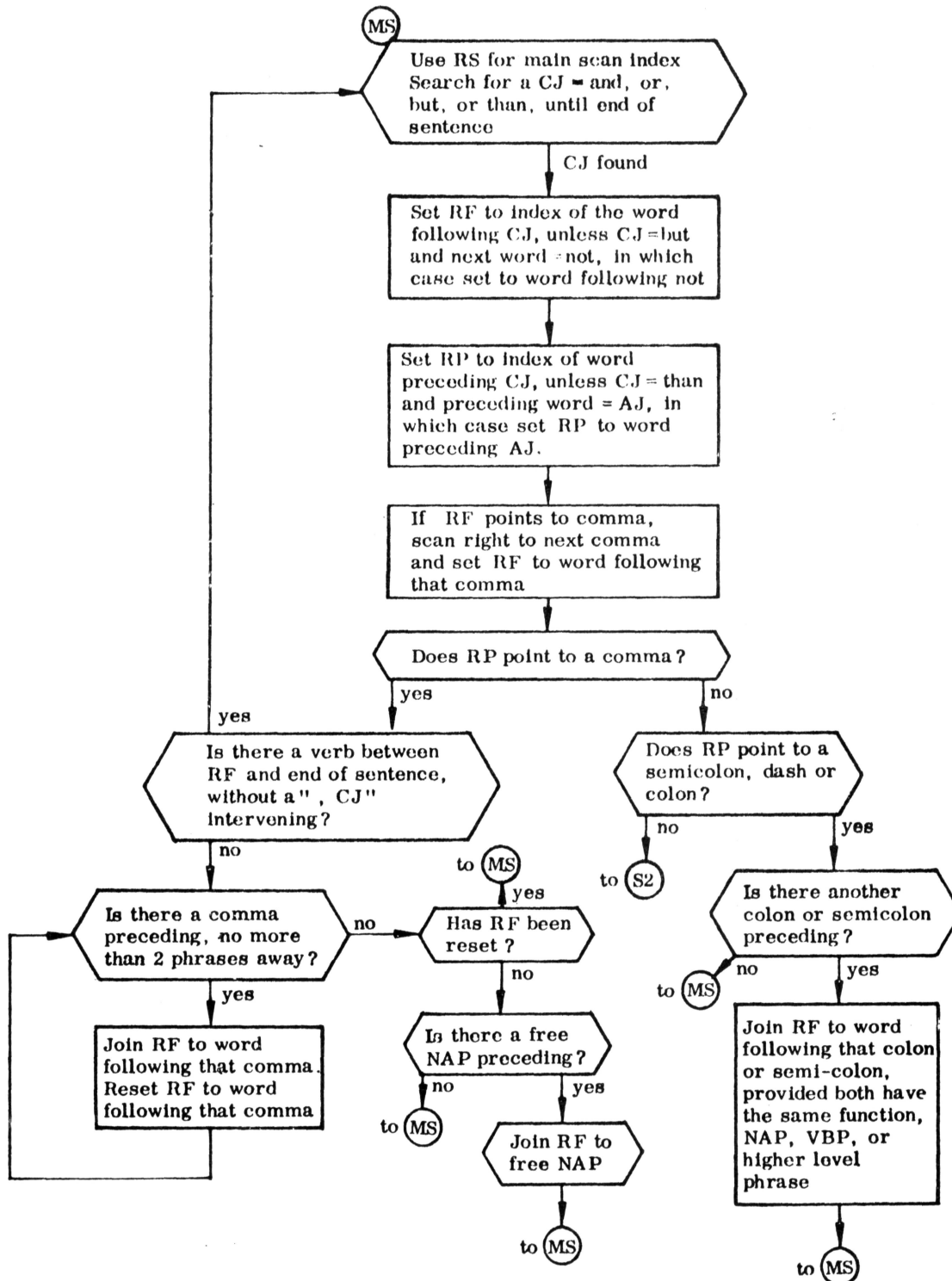
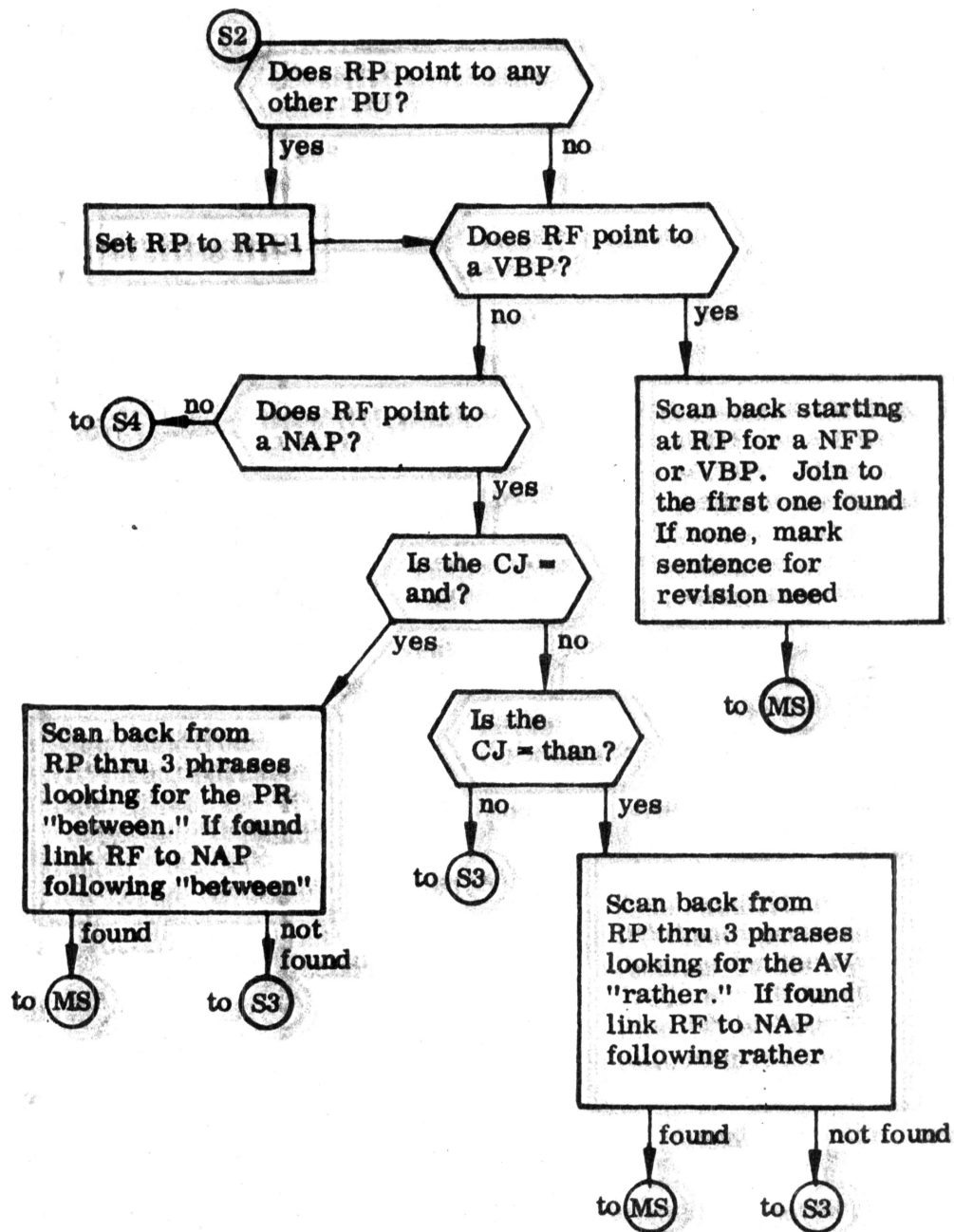
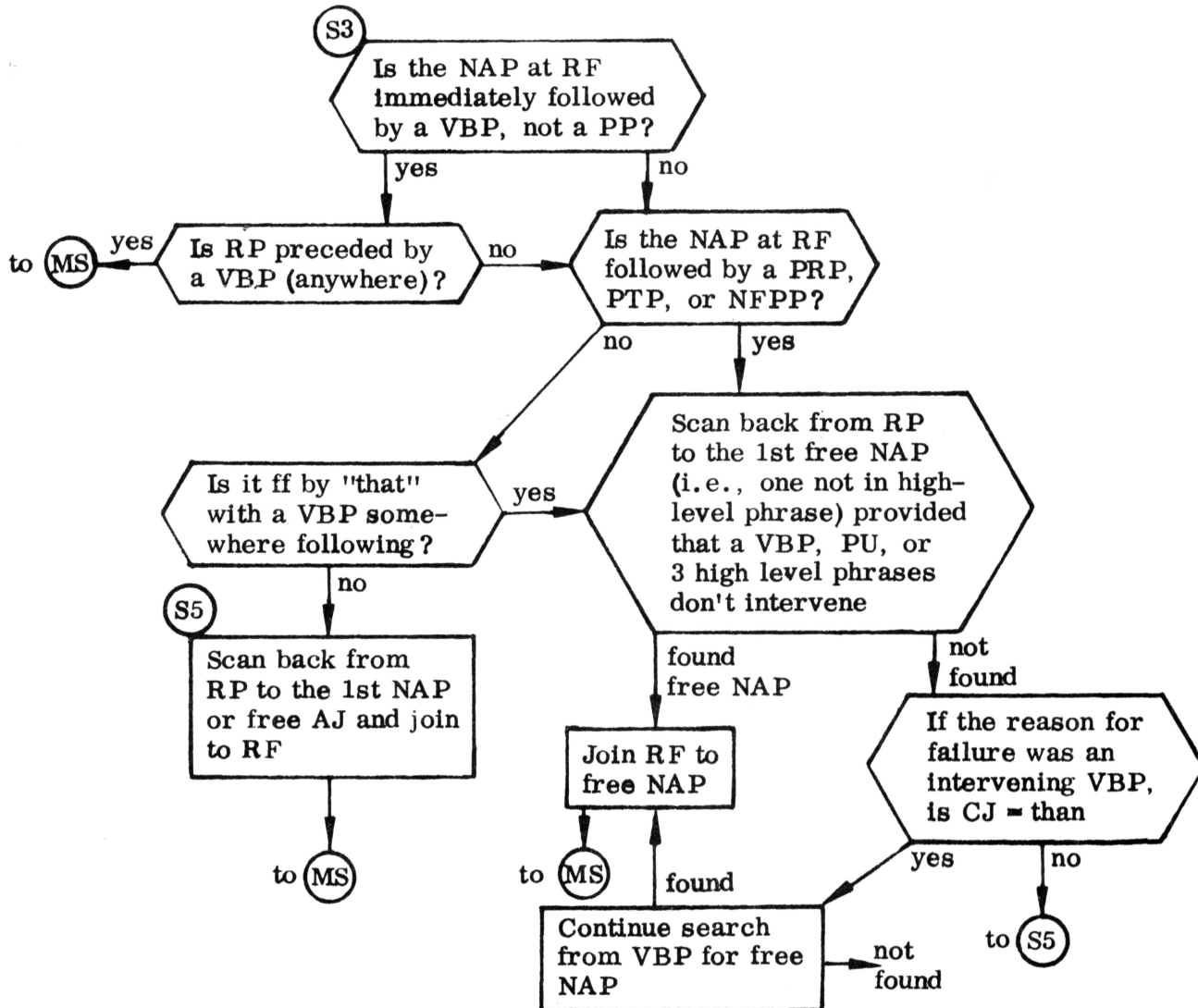


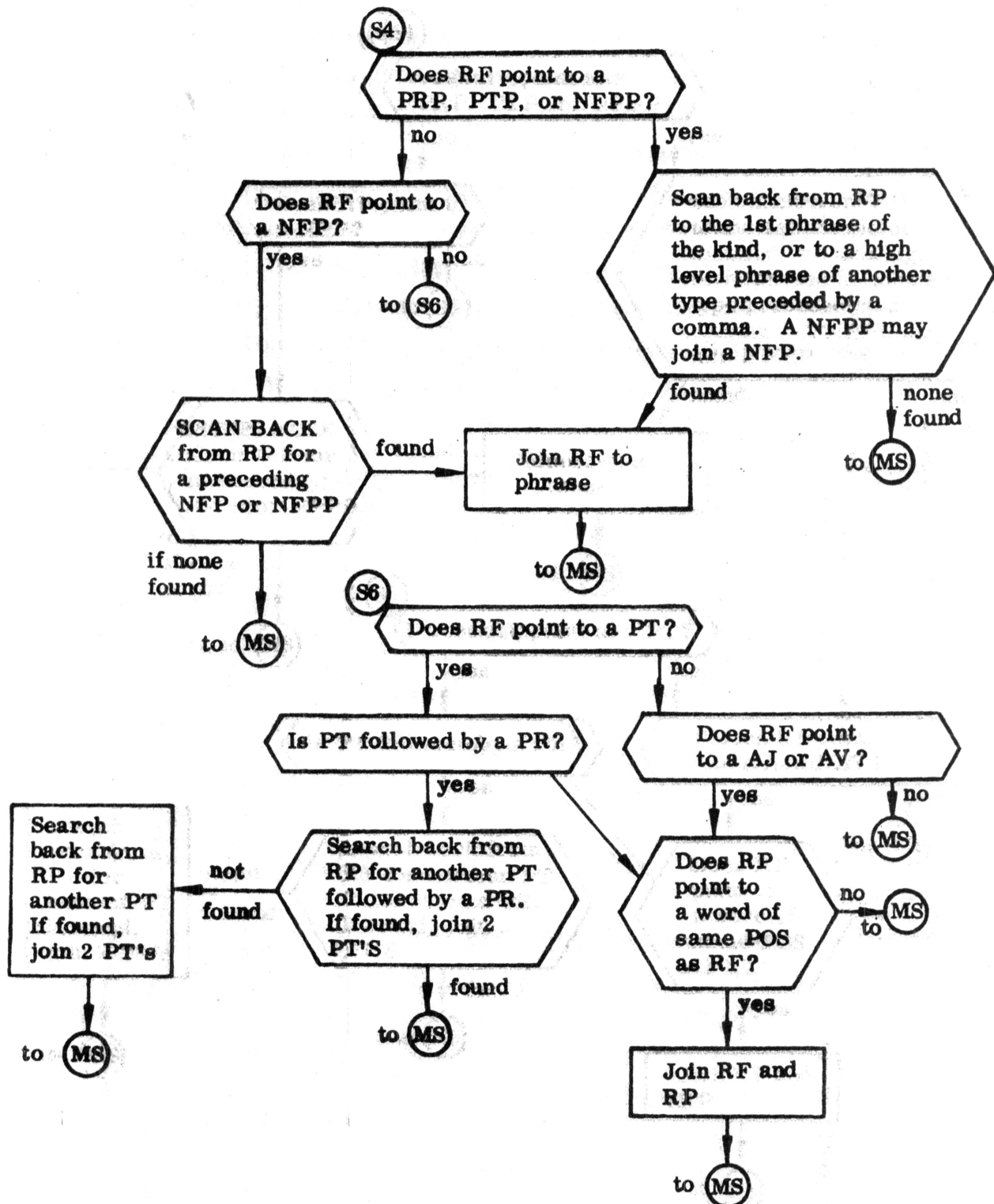
Fig. 19 OUTPUT Flow Diagram - Detail (Cont.)

3.4 CJPAS FLOW DIAGRAM – A PRELIMINARY OR WORKING DRAFT FOR LEVEL 3 OF PHRASE









3.5 WORD GOVERNMENT TABLES

As the concept of word government has evolved, the format of the word-government dictionary has also evolved. Since there has been a change in personnel of the dictionary compiler, a review of existent dictionary listings is given in the following table.

Published	Scope	Characteristics	Compiler
1968 Appendix, Ref. 13	<u>abandon</u> through <u>master</u>	meaning variations marked through the <u>c's</u>	H. R. Robison
1969 Appendix, Ref. 1	<u>abandon</u> through <u>lynch</u>	meaning variations marked throughout	H. R. Robison
1972 Appendix A, this report	<u>nab</u> through <u>peace</u>	meaning variations marked throughout	H. R. Robison
1972 Appendix B, this report	<u>rank</u> through <u>rusty</u>	new format; meaning variations listed as well as marked; optional secondary elements enclosed in parentheses	L. L. Earl

References 13 and 1 contain a description of the format used in the dictionaries published therein, and in Appendix A. The new format used in Appendix B is described below.

The governing primary heads each entry, appearing in capital letters. Under the primary those meanings which are distinguished by government patterns are given,

rather succinctly, and numbered. If no meanings are given, either there is but one meaning, or the government patterns are incapable of distinguishing among the meanings. Often this means that for words functioning as both nouns and verbs, only the verbal meanings will be given. When this occurs, it is noted following the word meanings. The patterns of the primary are then given in three columns, in a format as similar as possible to that in the previously published government tables. Column 1 is blank if there are no meanings listed, or gives the number of all meanings which can be associated with that particular government pattern. Column 2 gives an abbreviation for the part of speech of the primary when it is associated with that particular government pattern. Column 3 gives the secondaries in this government pattern, separated by slashes and with optional secondary elements enclosed in parentheses. An example will help to clarify.

ABIDE

meanings

- (1) to tolerate
- (2) to live up to, submit to
- (3) to reside or live in

patterns

1	vt	S
2	vi	by S
3	vi	in S or D/(for S)

First, three meanings are given for abide. Then the patterns listing shows that in this case each meaning is associated with a different pattern. In meaning 1, abide is a transitive verb (vt) and is followed by a substantive (S), as in "I cannot abide that color." In meaning 2, abide is an intransitive verb (vi) followed by a "by" prepositional phrase, as in "I cannot abide by that decision." In meaning 3, abide is an intransitive verb which is completed by an adverb or "in" prepositional phase, and sometimes a "for" prepositional phrase also, as in "Will you abide in Santa Clara (for the whole summer)?" or "Will you abide there (for the whole summer)?"

This notation for meaning (3) differs from the notation in Ref. 1, and Ref. 11 where it appears as:

3 vi in S/for S

Use of parentheses to show optional patterns not only clarifies their use, particularly in the distinction of meanings, but also takes care of the concept of "strong" and "weak" government as discussed in Ref. 13, where "for S" would have been considered weakly governed and dependent on the strongly governed "in S." With the use of the optional notation, the concept of strong and weak government should no longer be necessary.

Column 2 under patterns gives the parts of speech of the primary, by abbreviations which are given below:

n	noun
ns	noun singular
npl	noun plural
aj	adjective
ajp	predicative adjective
ajt	post adjective, which follows the noun
av	adverb
vt	verb transitive
vi	verb intransitive
vrf 1	verb reflexive
vrf 2	
vprp	verb, present perfective
vtx	verb transitive, does not undergo passive transformation
vax	verb auxiliary
vtn	verb transitive, negative
vin	verb intransitive, negative
vir	verb intransitive, interrogative
vip	verb in the passive
or	
vtp	

vit	verb with "it"
vim	verb imperative
pp	present participle
ps	past participle

The abbreviations are mostly self-explanatory. For verbs, usually the abbreviations vt and vi are used (verb transitive and verb intransitive), but occasionally a more precise part of speech is given, as in the following, which may need explication.

Verb Reflexive 1 (vrf 1). In this type of verb the reflexive element is optional (He behaved or He behaved himself)

Verb Reflexive 2 (vrf 2). In this type of verb the reflexive element is mandatory. (He absented himself from the house)

Verb Passive (vip) or (vtp). In this type of verb the government pattern given occurs only when verb is passive (He was chagrined at the crowd's behavior)

Verb with it (vit). In this type of verb "it" is used to stand for the following clause (I would appreciate it if you)

Abbreviations are also used in column 3 under patterns, which describe the actual government patterns. These abbreviations and special symbols are tabulated below.

<u>Abbreviation</u>	<u>Meaning</u>
S	substantive
N	noun
CN	noun plural
NM	noun animate
A	adjective
D	adverb
DT	adverbial time expression (e.g., daily, soon)

DJ	adverbial adjunct
P	pronoun
PX	pronoun reflective
PSS	pronoun possessive
G	gerund
PS	past participle
PR	present participle
VRB	verb
cl	clause
to-inf	"to" infinitive (to see, to go, etc.)
bare-inf	infinitive without "to"
NT	nominal time expression (e.g., 10 days, every week)
CNM	noun plural animate
NJ	nominal adjunct
ON	ordinal number
CJ	conjunctive; that is, one of the following, how, what when, where who, whom whose, why whether, if
phrs	phrase
to-be	the verb "to be," or inflected form thereof

Special Symbols

<u>Symbol</u>	<u>Definition</u>
()	Whatever is contained within the parentheses is optional in the government pattern.
n	"not"
+	The structure following the " + " requires analysis by parsing program (e.g., that + clause)
-	Substitute the primary for the " - "
--	Substitute an inflected form of the primary for " -- "

There are two other conventions in the writing of secondaries which should be noted.

(1) A slash preceding a pattern is used to indicate a floating adverbial particle, as away, for example, in the following phrases;

carry that sack away

carry away that sack

The pattern for carry will thus be written:

CARRY

meanings

(1) to transport from one place to another

(2) to handle with success

⋮

patterns

1 vt /away S/(from S)/(to S)

1 vt /off S/(to S)

1 vt S/(from S)/(to S)

2 vt /off S/(with S)

⋮ ⋮ ⋮
⋮ ⋮ ⋮
⋮ ⋮ ⋮

(2) In addition to prepositions, which are always written out in the secondary patterns, other words may be specifically written out, particularly in the case of idioms. For example, consider the last two meanings under peg.

PEG

meanings

(1) a short rod used to join pieces or plug a hole

⋮
⋮
⋮

(11) to lower the pride of (idiom)

(12) person in a position for which he is unqualified (idiom)

patterns

1, 2, 3	n	(for S)
1	n	(into S)
1, 2	n	in S
⋮		
11	n	to take down a -
12	n	round - in a square hole

Appendix A contains the government entries from nab through peace, in the old format. Appendix B contains the government entries rank through rusty, in the new format.

Section 4
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13. Lois L. Earl and H. R. Robison, Annual Report: Automatic Informative Abstracting and Extracting, M-21-68-1, Lockheed Palo Alto Research Laboratory, Mar 1968

Appendix A
OLD FORMAT GOVERNMENT TABLES
NAB - PEACE

Part I

nab		vt	S
		vt	S/for S
nadir		n	-of S
nag	1	vt	S
	2	vt	S/into S
	2	vt	S/to-inf
	2	vi	at S/to-inf
	1	vi	at S
	2	vt	S/for S
	1	vi	O
nail		vt	S/to S
		vt	S/against S
		vt	S/down to S
		vt	/down S
		vt	S/on
		vt	S/upon
		vt	/up S
		vt	S/up to S
		vt	S/up on S
naive		aj	It to-be -/of S/to -inf
		aj	How - of S/to -inf
name	1	vt	S
	1	vtx	S/S
	1	vtx	S/for S
	1	vtx	S/after S
	2	vt	S
	3	vt	S/as S
	3	vt	S/to S
	3	vt	S/S
	3	vt	S/to -inf
	1	n	of S
	2	n	by -
	3	n	for S/to-be S
	3	n	for CJ + cl
	4	n	to-have a -/for S
narrate		vt	S/to S
		vt	to S/CJ + cl
narration	1	n	O
	2	n	-of S/to S/by S
	2	n	of S/CJ + cl
	2	n	of CJ + cl by S
narrow	1	vi	O
	1	vi	from S/down (to) S
	2	vt	S/from S/(down) to S
nasty		aj	-
		ajp	It to-be - of S/to -inf
		ajp	How - of S/to -inf
native	1	aj	-S
	2	ajp	to S
		n	-of S
natural		aj	-S
		ajp	It to-be - for S/to -inf
		ajp	How - for S/to -inf
naturalize		vip	O
naughty	1	ajp	It to-be - of S/to -inf
	2	aj	-S

nauseate		vt	S
		vip	by S
		vip	at S
nausea		n	of S/at S
		n	by - at S
		n	with - at S
		n	with - by S
navigable		aj	- S
		ajp	from S/to S/by S
		ajp	by S
navigate		vt	S
		vt	S/around S
		vt	S/among S
		vt	S/down S
		vt	S/from S/to S
		vt	S/out of S
		vt	S/over S
		vt	S/through S
		vt	S/toward S
		vt	S/by S
		vt	S/with S
navigation	1	n	of S/around S
		n	of S/among S
		n	of S/down S
		n	of S/from S/to S
		n	of S/from S/to S
		n	of S/out of S
		n	of S/over S
		n	of S/through S
		n	of S/toward S
		n	of S/by S
		n	of S/with S
	2	n	O
near		vt	S
		vi	O
necessary		aj	- S
		ajp	It to-be - for S/to -inf
		ajp	It to-be - that + cl
necessitate		vt	S
		vt	G
		vt	PSS G
necessity		n	to -inf
		n	O
		n	of -
		n	by -
		n	out of -
		n	to-be a - that + cl
		n	there to-be no - for S/to -inf
need		n	of S/for S
		n	of S/to -inf
		n	a - for S/to -inf
		n	a - for S
		vt	S
		vt	G
		vt	to be A
		vt	to be S
		vt	to be PS
		vt	to -inf
neglect	1	vt	S
	2	vt	to -inf
	2	vt	G
	1	vt	S/for S
	1	vt	S/to -inf
		n	of S/of S
neglectful		aj	- S
		ajp	of S

Part I

negligence		n	of S/to S
		n	of S/toward S
negotiate	1-3	vt	S
	1	vt	S/with S
	1	vi	with S
	1	vi	to -inf
negotiation		n	of S/of S/with S
		npl	to-enter into -/with S/to-inf
		npl	to-inf
		npl	for S
		npl	over S
		npl	between S/and S
nerve		vtx	PX/for S
		vtx	PX/to -inf
		vtx	PX/against S
nervous	1	aj	- S
	2	ajp	at S
	2	ajp	about S
	2	ajp	over S
	2	ajp	among S
	2	ajp	with S
nest		vi	O
		vi	at S
		vi	among S
		vi	in S
		vi	on S
		vi	upon S
		vi	over S
nestle		vt	S/to S
		vt	S/against S
		vt	S/in S
		vt	S/on S
		vt	S/upon S
		vi	among S
		vi	against S
		vi	in S
		vi	on S
		vi	upon S
net	1	vt	NM
	2	vt	S
	3	vt	S/after S
	3	vt	S/from S
nettle		vt	S/with S
		vt	S/by S
		vip	at S
neutral		aj	- S
	1	n	to-be -/in S
	1	n	to-be - during S
	1	n	to-remain -/in S
	1	n	to-remain -/during S
	2	n	to-be -/about S
	3	n	to-be in -
	3	n	to-leave S/in -
neutralize		vt	S/by S
		vt	S/with S
new	1	aj	-S
	2	ajp	to S
news		npl	of S
		npl	from S
		npl	out of S
		npl	to-be - to S
		npl	to-be in the -
		npl	that + cl
		npl	of CJ + cl

nibble		vi	at S
		vi	against S
		vi	from S
		vi	into S
		vi	on S
		vi	upon S
		vi	through S
nice		aj	- S
		ajp	to S
		ajp	It to-be -/of S/to -inf
		ajp	How - of S/to -inf
		ajp	How - for S/(that) + cl
nip		vt	S
		vi	at S
nod		vi	at S
		vi	to S
		vt	S/at S
		vt	S/to S
		vi	O
nominate		vt	S
		vt	S/(to be) S
		vt	S/for S
		vt	S/to -inf
nomination		n	of S
		n	of S/to be S
		n	of S/for S
		n	of S/to -inf
nonchalant		aj	- S
		ajp	about S
		ajp	over S
normal		aj	- S
		aj	It to-be -/for S/to -inf
		ajp	O
nose	1	n	of S
	2	n	to-have a -/for S
	1	vt	S/into S
	1	vt	S/onto S
	1	vt	S/over S
	1	vt	S/out of S
	1	vt	S/toward S
	1	vt	S/through S
	2	vt	/out S
	3	vt	/about S
	3	vi	It about that + cl
	3	ps	It to-be - about that + cl
nostalgia		n	of S/for S
nostalgic		aj	- S
		ajp	about S
		ajp	for S
notable		aj	- S
		ajp	for S
		n	O
note	1	vt	S
	1	vt	(that) + cl
	1	vt	CJ + cl
	1	vt	whether + cl
	2	vt	/down S
noted		aj	- S
		ajp	for S
		ajp	as S

notice	1	n	of S
	2	n	to -inf
	2	n	to-give S/-/to -inf
	2	n	to-give S/-/that + cl
	3	n	to-take -/of S
	3	vt	S
	3	vt	S/bare -inf
	3	vt	S/PR
	3	vt	(that) + cl
notify	3	vt	CJ + cl
	3	vt	whether + cl
	3	vi	O
		vt	S
		vt	S/of S
		vt	S/(that) + cl
		vt	S/to -inf
notification		n	of S
		n	of S/of S/by S
		n	of S/that + cl
		n	of S/to -inf
notion		n	of S
		n	of S/of S
		n	of S/that + cl
		n	to-have a -/(that) + cl
		n	to-take a -/to -inf
notorious		aj	- S
		ajp	for S
		ajp	as S
novice		aj	- S
		n	to-be a -/at S
nowhere		av	to be/PS
		av	to -inf
number		n	of S/in S
		n	of S/among S
		n	in -
	1	vt	S/from S/to S
	1	vt	S/from S/through S
	2	vt	S
	3	vt	S/in S
	3	vt	S/among S
	4	vip	O
nutty	1, 2	aj	- S
	2	ajp	about S
	2	ajp	over S
nuzzle		vt	S
		vi	against S
obdurate		aj	- S
		ajp	about S
obedience		n	of S/to S
obedient		aj	- S
		aj	to S
obsequance		n	to-do -/to S
		n	to-pay -/to S
obey		vt	S
		vi	O
object	1	vi	to S
	1	vi	to G
	1	vi	O
	2	vt	that + cl

objection	1	n	of S/to S
	1	n	of S/to G
	2	n	of S/that + cl
	3	n	O
objective		n	of S/in S
obligate		vt	S/to S
		vt	S/to -inf
		vip	to S
		vip	to -inf
obligation		n	of S/to S
		n	of S/to -inf
		n	of S
		n	to-have an -/to S/to -inf to-be under an -/to S/to -inf
obligatory		aj	- S
		ajp	O
		ajp	for S
		ajp	It to-be -/for S/to -inf
		ajp	It to-be -/on S/to -inf
oblige	1	vt	S/to -inf
	2	vip	to-inf
	3	vtx	S/with S
	3	vtx	S/by S
	3	ps	to-be -/to S/for S
obliterate		vt	S
		vt	S/from S
oblivious		aj	- S
		ajp	to S
		ajp	to CJ + cl
		ajp	of S
		ajp	of CJ + cl
obsequious		aj	- S
		ajp	to S
observable		aj	- S
		ajp	It to-be -/that + cl
		ajp	It to-be -/CJ + cl
		ajp	by S/from S
observance		n	of S/of S
		n	of S/by S
observation	1	n	of S/on S
	1	n	of S/upon S
	1	n	of S/about S
	2	n	of S/of S
	2	n	of S/by S
observe	1-3	vt	S
	1	vt	S/to-be/AS
	1	vt	S/bare -inf
	1	vt	S/PR
	1,3	vt	that + cl
	1	vt	CJ + cl
	1	vt	why + cl
	1	vt	S/CJ + cl
	1	vi	O
observer		n	of S
		n	of S
obstacle		n	to S
obstinate		aj	- S
		ajp	about S
		ajp	in S

obtain	1	vt	S
	1	vt	S/from S/by S
	1	vt	S/from S/for S
	2	vi	O
obtrude		vt	S/on S
		vt	S/upon S
		vt	S/into S
		vi	on S
		vi	upon S
		vi	into S
obvious		aj	- S
		ajp	It to-be -/to S/that + cl
		ajp	It to-be -/to S/CJ + cl
		ajp	It to-be -/to S/why + cl
occasion		n	of S
		n	for S
		n	to-be A
		n	to -inf
occupation	1	n	of S/of S
	1	n	of S/by S
	2	n	of S
occupy	1	vt	S
	2	vt	S
	3	vi	in S
	3	vi	with S
	3	vtx	PX/in S
	3	vtx	PX/with S
occur	1	vi	O
	1	vi	at S
	1	vi	about S
	1	vi	around S
	2	vi	among S
	1	vi	before S
	2	vi	in S
	2	vi	on S
	2	vi	upon S
	3	vi	It -- to S/(that) + cl
	3	vi	It -- to S/CJ + cl
occurrence		n	of S
offend		vt	S
		vt	S/by S
		vt	S/with S
offensive	1	aj	- S
	2	ajp	It to-be - of S/to -inf
	2	ajp	It to-be - to S/to -inf
	2	ajp	It to-be - to S/that + cl
offer		vt	S
		vt	to -inf
		vt	S/to S
		vt	S/S
		vt	S/to S/for S
		vt	S/S/for S
		n	of S/of S
		n	of S/to -inf
		n	of S/of S/to S
officer		n	to-be an - in S
		n	to-be an - of S
officiate		vi	O
		vi	as S/at S
		vi	as S
offset	1	vt	S/by S
	1	vt	S/with S
	2	vip	from S/by S

Part I

offspring		n	to-be the - S/ and S
ogle		vt	S
omission	1	n	O
	1	n	of S
	2	n	of S/of S/from S
omit	1	vt	S
	1	vt	S/from S
	2	vt	to -inf
	2	vt	G
onset		n	at the - of S
		n	the - of S
onslaught		n	of S/against S
		n	of S/on S
		n	of S/upon S
ooze		vi	from S
		vi	out of S
		vi	through S
		vt	S/from S
		vt	S/out of S
		vt	S/through S
open	1	vt	S
	2	vt	/up S
	2	vt	/up S/to S
	3	vi	on S
	3	vi	upon S
	4	vi	with S
opening	1, 2	n	in S
	3	n	of S
operate	1	vt	S
	1	vi	O
	1	vi	to -inf
	2	vi	on S/for S
	2	vi	upon S/for S
operation	1	n	to-be in -
	2	n	on S/for S
	2	n	upon S/for S
	2	n	on S/to -inf
	2	n	upon S/to -inf
	3	n	of S/by S
operational		ajp	O
opinion		n	of S/of S
		n	of S/on S
		n	of S/about S
opportunity		n	for NG
		n	of NG
		n	to -inf
oppose	1	vt	S
	1	vip	to S
	2	vt	S/against S
	3	vt	S/with S
	3	vt	S/for S
opposition		n	of S/to S
		n	in - to S
oppression	1	n	of S
	2	n	of S/of S
	2	n	of S/by S
opt		vi	for S
		vi	out
		vi	out of S
optimistic		aj	- S
		ajp	about S

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Part I

option		n	of S/to -inf
		n	of S/on S
		n	of S/upon S
		n	of S
ordain	1	vt	S
	1	vt	S/S
	2	vt	S/to -inf
	2	vt	(that) + cl
order	1	vt	S
	1	vt	S/to -inf
	1	vt	S/D
	1	vt	that + cl
	1	vt	S/to S
	1	vt	S/against S
	1	vt	S/about S
	1	vt	S/about
	1	vt	S/around S
	1	vt	S/around
	1	vt	/back S
	1	vt	S/into S
	1	vt	S/off S
	1	vt	/off S
	1	vt	S/out of S
	1	vt	/down S/from S
	2	vt	S/for S/from S
	3	vt	S/D
	3	vt	S/according to S
	1, 2	n	in -
	1	n	in - of S
	2	n	to-be in -
	2	n	to-be out of -
	3	n	O
	4	n	to -inf
	4	n	by - of S
	5	n	for S
	5	n	to-place an -/for S
organization	1	n	O
	1	n	of S
	2	n	of S/by S
	2	n	of S/into S/by S
organize		vt	S
		vt	S/from S/into S
orient		vt	S
		vtx	PX/with respect to S
		vtx	PX/in S
originate	1	vt	S
	2	vi	from S
	2	vi	in S
	2	vi	with NM
	2	vi	from NM
ornament	1, 2	n	O
	3	n	to-be an -/to S
		vt	S
		vt	S/with S
orphan		vt	S
		vi	by S
oscillate	1	vi	O
	1	vi	between S/and S
	2	vt	S

Part I

ostracize		vt vip vip	S O from S/by S
oust		vt vt	S S/from S
outcry		n n n	O of S of S/against S
outdo		vt vt	S S/in S
outfit		vt vt vt	S/with S S/for S S/to -inf
outflow		n	of S/from S
outlay		n n n	of S/of S/on S of S/of S/to -inf of S/of S/for S
outlet		n n n	of S for S on S
outline		vt vt	S S/to S
outlive		vt	S/by S
outlook		n n	for S on S
outnumber		vt	S/by S
outrage		vt vip vip	S by S at S
outvote		vt	S/on S
overburden		vt	S/with S
overcharge		vt vt	S/for S S/on S
overcome	1 2 2	vt vip vip	S by S with S
overhear		vt vt vt	S S/PR S/to-inf
overjoyed		aj ajp ajp ajp ajp ajp	-S at S by S over S with S to-inf S
overlay		vt vt	S S/with S
overpower		vt vt vt	S S/by S S/with S
overrun		vt vip vip	S by S with S
overshoot		vt vt	S S/by S
overstock		vt vt	S S/with S
overtake	1 1,2 2	vt vip vip	S by S with S

ostracize		vt	S
		vip	O
		vip	from S/by S
oust		vt	S
		vt	S/from S
outcry		n	O
		n	of S
		n	of S/against S
outdo		vt	S
		vt	S/in S
outfit		vt	S/with S
		vt	S/for S
		vt	S/to -inf
outflow		n	of S/from S
outlay		n	of S/of S/for S
		n	of S/of S/on S
		n	of S/of S/to -inf
outlet		n	of S
		n	for S
		n	on S
outline		vt	S
		vt	S/to S
outlive		vt	S/by S
outlook		n	for S
		n	on S
outnumber		vt	S/by S
outrage		vt	S
		vip	by S
		vip	at S
outvote		vt	S/on S
overburden		vt	S/with S
overcharge		vt	S/for S
		vt	S/on S
overcome	1	vt	S
	2	vip	by S
	2	vip	with S
overhear		vt	S
		vt	S/PR
		vt	S/to -inf
overjoyed		aj	- S
		ajp	at S
		ajp	by S
		ajp	over S
		ajp	with S
		ajp	to -inf S
overlay		vt	S
		vt	S/with S
overpower		vt	S
		vt	S/by S
		vt	S/with S
overrun		vt	S
		vip	by S
		vip	with S
overshoot		vt	S
		vt	S/by S
overstock		vt	S
		vt	S/with S
overtake	1	vt	S
	1,2	vip	by S
	2	vip	with S

overture	1	n	of S/to S
	1	npl	to-make --to S
	2	n	of S
	2	n	to S
overwhelm		vt	S
		vt	S/by S
		vt	S/with S
owe	1	vt	S
	1	vt	S/to S
	1	vt	S/S
	1	vt	S/for S
	1	vt	S/on S
	1	vi	O
	2	vip	S/to S
pace	1,4	vt	S
	2	vi	O
	2	vi	DJ
	3	vi	/off S
pacification		n	of S/by S
pacify		vt	S
		vt	S/with S
		vt	S/by G
pack	1	vt	S
	1	vt	S/into S
	1	vt	/up S
	1	vi	up
	2	vi	/off S/to S
	3	vt	S/into S
	3	vip	into S
	4	vt	S/in S
	4	vt	S/with S
	5	vt	S/with S
pad	1,2	vt	S/with S
	1,2	vt	/out S/with S
page	1	vt	NM
	2	vi	through S
	2	vt	S/through S
pain		vtx	It -- S/to-inf
		vt	S
paint	1	vt	S
	1	vt	S/with S
	1	vt	S/A
	2	vt	S/in S
	2	vt	S/into S
	2	vt	S/over S
	2	vt	/in S
	2	vi	over S
	2	vt	/out S
	3	vt	S/as S
pair		n	of S
		vt	S/with S
		vt	/off S/with S
		vt	/off S/against S
palatable		aj	-S
		ajp	to S
pall		vi	O
		vi	on S
		vi	upon S
palm	1	vt	S
	2	vt	/off S/on S
	2	vt	/off S/upon S

Part I

pamper		vt	S
		vt	S/with S
		vt	S/by S
pander		vi	to S
panel		vt	S
		vt	S/with S
panic		vt	S
		vi	O
		vi	at S
		vi	by S
paper		vt	S/with S
par	1	n	to-be above -
	1	n	to-be below -
	1	n	to-be at -
	2	n	to-be on a-with S
parachute		vi	into S
parade		vi	O
		vt	S/before S
		vi	before S
parallel		aj	- S
		ajp	to S
		ajp	with S
paralyze		vt	S
		vt	S/with S
		vt	S/by S
paralysis		n	of S
		n	of S/by S
parcel		vt	/out S/to S
		vt	/out S/among S
pardon		vt	S
		vt	S/S
		vt	S/for NG
pare		vt	S
		vt	S/from S
		vt	/down S
parity		n	of S/and S
		n	between S/and S
parley		vi	with S
part		vt	S
		vi	with S
		vi	O
partake		vi	of S
partial	1	aj	- S
	2	ajp	to S
partiality		n	of S
		n	of S/for S
		n	of S/to S
		n	of S/toward S
participate	1	vi	in S
	2	vi	of S
participant		n	in S
particular		aj	- S
		ajp	about S
partition		vt	S/into S/and S
		vt	/off S/into S/ and S
	1	n	of S/into S/and S
	2	n	between S/and S
partitioning		n	of S/into S/and S
		n	off/of S/into S/and S
partner		n	of S
		n	of S/in S

Part I

pass	1	vi	among S
	1	vi	along S
	1	vi	by S
	1	vi	down S
	1	vi	through S
	1	vi	O
	1	vi	on/
	1	vi	through/
	2,3	vt	S
	4	vi	O
	4	vi	D
	5	vt	S
	6	vi	from S/into S
	6	vi	from S/to S
	6	vi	into S
	7	vt	S
	7	vt	S/to S
	7	vt	S/S
	7	vi	D
	8	vt	S
	9	vi	as S
	9	vi	under S
	9	vi	for S
	10	vi	O
	10	vi	D
	11	vi	on/
	12	vt	S
	12	vi	O
	13	vi	between S/and S
	14	vi	on S
	14	vi	upon S
	14	vt	S/on S
	14	vt	S/upon S
	15	vi	O
	15	vi	D
	16	vt	/down S/from S/to S
	17	vi	before S
	18	vi	into S
	18	vi	out of S/into S
	19	vt	/off S/as S
	20	vi	over S
	21	vi	over S/for S
	22	vip	over
passable	1	ajp	O
	2	aj	-S
passage	1	n	of S
	2	n	of S/through S
	2	n	of S/by S
	3	n	O
	4	n	in S

passion		n	of S/for S
		n	of S/to-inf
passport	1	n	A -
	2	n	to S
paste		vt	S
		vt	S/in S
		vt	S/into S
		vt	S/on S
		vt	S/onto S
		vt	S/over S
		vt	S/to S
		vt	S/upon S
		vt	S/up on S
		vt	/together S
pat		vt	S
		vt	S/on S
		vt	S/upon S
		vt	S/with S
patch	1, 2	vt	S/with S
	2	vt	/up S
path		n	O
		n	of S
		n	around S
		n	down S
		n	down to S
		n	from S
		n	in S
		n	into S
		n	out of S
		n	over S
		n	to S
		n	through S
		n	on S
		n	upon S
patience		n	of S
		n	to-have the -/to-inf
		n	to-have the -/for S
		n	to-have -/with S
patient		aj	- S
		ajp	with S
pattern		vt	S/on S
		vt	S/upon S
		vt	S/after S
pause		n	in S
		n	of S
		n	O
		vt	S
		vi	O
		vi	at S
		vi	before S
		vi	DJ
		vi	to-inf
		vi	in S
paw	1	vt	S
	1	vi	at S
	2	vi	about
pawn		vt	S/for S
		vt	S/to-inf.
pay	1	vt	S
	1	vt	S/for S
	1	vt	S/S for S
	1	vt	S/to-inf
	1	vt	S/to-inf
	1	vt	S/what + cl
	1	vt	S/to S/for S
	1	vt	S/to S/to-inf
	2	vt	/out S/to S/for S
	2	vt	/out S/to S/to-inf
	3, 4	vt	/off S

pay (Cont'd)

	4	vt	/up S
	1,5	vi	for S
	6	vi	It -- to-inf
	7	vi	/out S
payable		a)	- S
		ajp	to S
		ajp	at S
payment		n	of S/of S/to S/for S
		n	of S/of S/to S/to-inf
peace	1	n	of S
	2	n	among S
	2	n	between S/ and S
	2	n	to-be at -/with S
	2	n	to-make - /with S

Appendix B
NEW FORMAT GOVERNMENT TABLES
RANK - RUSTY

B-1

RANK

Meanings

- | | |
|---|--|
| 1 | to place in a rank or assign a rack |
| 2 | to have a higher rank, or take precedence |
| 3 | to hold a position in a rank |
| 4 | holding the highest position in a rank |
| 5 | luxuriant in growth |
| 6 | smelly |
| 7 | of a strongly marked or absolute type; extreme |

Note: Nouns, with no special government characteristics, have not been included here.

Patterns

- | | | |
|------|----|-------------------|
| 1 | vt | S/ according to S |
| 1 | vt | S/ by S |
| 1 | vt | S/ with S |
| 1 | vt | S/ above S |
| 1, 2 | vt | S |
| 3 | vi | in S/ (of S) |
| | | ON/ (in S) |
| | | ON/ (on S) |
| | | among S/ (of S) |
| 4 | pp | -ing S |
| 5-7 | aj | - S |

RANSACK

Pattern

- | | |
|----|------------|
| vt | S/ (for S) |
|----|------------|

RAP

Meanings

- | | |
|---|---------------------|
| 1 | blame or punishment |
| 2 | a sharp knock |
| 3 | to knock sharply |
| 4 | to say sharply |

Patterns

- | | | |
|------|----|------------|
| 1 | n | take the _ |
| 1 | n | beat the _ |
| 2 | n | (at S) |
| 3 | vt | (upon S) |
| | | (at S) |
| 3, 4 | vt | (upon S) |
| | | (out S) |

RAPPORT

Patterns

aj with S

RAPT

Meanings

- 1 to be carried away in body or spirit
- 2 to be inraptured
- 3 to be completely absorbed or engrossed
- 4 showing rapture

Patterns

- | | | |
|---|-----|---------|
| 1 | ajp | into S |
| | | to S |
| | | up to S |
| 2 | ajp | with S |
| 3 | ajp | in S |
| 4 | aj | _ S |

RATE

Meanings

- 1 to deserve
- 2 to rank, be in a class
- 3 to appraise
- 4 to have status
- 5 amount, degree, or ratio
- 6 value or price
- 7 rank
- 8 in any event (idiom)

Patterns

- | | | |
|------|-----|----------|
| 1, 3 | vt | S |
| 2 | vi | with S |
| 2 | vip | as S |
| 2 | vip | with S |
| 4 | vi | 0 |
| 5 | n | of S |
| 6 | n | (for S) |
| 7 | n | (of S) |
| 7 | aj | -S |
| 8 | n | at any _ |

RATTLE

Meanings

- 1 to make a series of sharp short sounds
- 2 to talk rapidly and incessantly
- 3 to cause to make a series of sharp sounds
- 4 to disconcert

Patterns

1	vi	{in S)
1	vi	(over S)
2	vi	on (about S)
3, 4	vt	S

RAVE

Meanings

1	to talk incoherently
2	to talk with excessive enthusiasm

Patterns

1	vi	0
2	vi	about S

REACH

Meanings

1	to try to make emotional contact
2	to make communication contact
3	to make physical contact or go as far as
4	to influence
5	to be extended into

Patterns

1	vi	out to S
5	vi	(into S)
2-4	vt	S/(by S)
2-4	vt	S/(with S)

REACT

Meanings

1	to act in return
2	to respond to stimulus
3	to act in opposition
4	to act chemically, as by combination, with another substance

Patterns

1	vi	upon S
2	vi	(to S)/(by S)
2	vi	(to S)/(with S)

Patterns

3	vi	against S
4	vi	with S/(to inf)
4	vi	with S/(PR)

READ

Meanings

Note: As always only meanings with specific government patterns are detailed. Meaning 1 covers most others

1	to interpret characters, to oneself or aloud
2	to learn by reading
3	to study
4	to be well written, readable
5	to interpret in a certain way
6	to peruse
7	to note the result of a calibrated instrument
8	to register (a calibrated instrument)
9	to dismiss or expel by public reading

Patterns

1, 7, 8	vt	S
2	vi	of S
2	vi	about S
3	vt	S/ for S
3	vi	(with S)/for S
4	vi	D
5	vt	S/ into S
5	vt	S/ as S
5	vt	S/ in S
6	vi	over S
6	vi	through S
7	vi	out S/(from S)
9	vi	out of S

READY

Meanings

1	prepared to act or to be used
2	prepared in mind
3	inclined to
4	prompt
5	convenient or accessible
6	with make – to prepare

Patterns

1, 2, 3	ajp	to inf
1, 2	ajp	for S
4, 5	aj	_ S
6	aj	make _

REALISTIC

Patterns

ajp	in S
ajp	about S
aj	_ S

REALIZATION

Patterns

n	that + cl
---	-----------

REALIZE

Meanings

1	to achieve
2	to fully apprehend, understand
3	to convert into money, or to gain

Patterns

1-3	vt	S
2	vt	that + cl

REAM

Patterns

vt	/out S
----	--------

REAR

Meanings

1	to grow, or breed, or bring to maturity
2	to rise or stand up on hind legs
3	to rise up (in anger), etc. or to rise high (as a mountain)

Patterns

1	vt	S
2, 3	vt	(up) S
2	vi	(up) (on S)
3	vi	(up)

REASON

Meanings

1	to think logically
2	to argue logically
3	to support with reasons
4	to persuade with reasoning
5	because of (idiom)
6	justifiably (idiom)
7	unreasonable (idiom)
8	to be logical (idiom)
9	an explanation or motive
10	mental power

Patterns

1 - 3	vt	that + cl
	vi	about S
	vi	upon S
	vi	0
4	vi	with S/ (about S)
9	n	(for S)
5	n	by _ of
6	n	in _
	n	with _
7	n	out of all
8	n	stand to _
10	n	0

REASSURANCE

Patterns

n	on S/(to S)
n	about S/(to S)
n	that + cl

REASSURE

Patterns

vt	S/about S
vt	S/on S
vt	S/that + cl

REBATE

Patterns

vt	S/(to S)
n	for S
n	on S

REBEL

Patterns

vi	at S
vi	against S

REBELLIOUS

Patterns

ajp	against S
ajp	at S
aj	_ S

REBORN

Patterns

ajp	(to S)
-----	--------

REBUKE

Patterns

vt	S/(for S)
n	(to S)/(for S)

RECAPITULATE

Patterns

vt (S)/(for S)

RECEDE

Patterns

vi (from S)

RECEIPT

Patterns

n (for S)

RECEIVE

Meanings

- | | |
|---|------------|
| 1 | to admit |
| 2 | all others |

Patterns

1, 2	vt	S
1	vt	S/into S

RECEPTACLE

Patterns

n (for S)

RECEPTIVE

Patterns

ajp (to S)

RECESS

Meanings

- | | |
|---|---------------------------------|
| 1 | a hollow place or niche |
| 2 | a secluded place |
| 3 | a halting of business or school |
| 4 | to place in a recess |
| 5 | to form a recess in |
| 6 | to set back or way |
| 7 | to halt business or school |

Patterns

- | | | |
|---|-----|----------------|
| 1 | n | (in S)/(for S) |
| 2 | n | of S |
| 3 | n | in _ |
| 3 | n | (for NT) |
| 4 | vt | S/in S |
| 5 | vip | (for NT) |
| 6 | vt | from S |
| 7 | vi | for NT |

RECHARGE

Patterns

- | | |
|----|------------|
| vt | S/(with S) |
|----|------------|

RECIPE

Patterns

- | | |
|---|---------|
| n | (for S) |
|---|---------|

RECIPROCITY

Patterns

- | | |
|---|-------------------|
| n | (between S and S) |
|---|-------------------|

RECOIL

Meanings

- | | |
|---|---------------------------------|
| 1 | to retreat, withdraw, fall back |
| 2 | to fly back when released |
| 3 | to return to source |

Patterns

1	vi	(from S)
2	vi	(upon or on S)
3	vi	(at S)

RECOMPENSE

Patterns

vt	S/(for S)
n	(for S)

RECONCILE

Meanings

1	to bring into harmony
2	to make content or submissive

Patterns

1	vt	CN
1	vt	S/with S
2	vip	to S
2	vt	PX/to S

RECONDITION

Patterns

vt	S/(for S)/(by S)/(with S)
----	---------------------------

RECORD

Meanings

1	preserve an account of
2	preserve pounds on flat surface
3	a preservation, often in writing
4	a surface on which sounds are preserved
5	the best performance to date
6	largest or best to date
7	to state ones opinions publicly (idiom)
8	not for publication (idiom)
9	to give (5) (idiom)

Patterns

1, 2	vt	S/(for S)/(with S)
1	vt	that or what + cl
3	n	of S
3, 5	n	for S
5	n	in S
6	aj	— S
4	n	(of S)/(with S)
7	n	(go) on —
8	n	off the —
9, 4	n	break a —

RECOURSE

Patterns

n	(to S)
---	--------

RECOVER

Meanings

1	to get back or compensate for
2	to get well or save oneself from something
3	to reclaim

Patterns

1	vt	S
2	vi	from S
3	vt	S/from S

RECOVERY

Patterns

n	(of S)/from S
n	(of S)/after S

RECTIFY

Patterns

vt	S/(by S)
	S/(with S)

RECUPERATE

Patterns

vi	(from S)
vt	S/(from S)

RECUPERATION

Patterns

n	(from S)
---	----------

RED

Meanings

- | | |
|---|---------------------------|
| 1 | color or pigment |
| 2 | member of communist party |
| 3 | in debt (idiom) |
| 4 | be angry (idiom) |

Patterns

1, 2	n	0
1	aj	S
1, 2	ajp	0
3	n	in the ____
4	n	see ____

REDEEM

Meanings

- | | |
|---|---|
| 1 | to buy back or recover |
| 2 | to fulfill |
| 3 | to free, liberate, rescue, reclaim (not common) |

Patterns

1 - 3	vt	S/(by S)
1	vt	S/(from S)/(for S)
1	vt	S/(out of S)/(for S)
1, 3	vt	S/(from S)
1, 3	vt	S/(with S)
1, 3	vt	S/(by S)
1, 3	vt	S/(out of S)

REDEEMABLE

Patterns

ajp (by S)/(for S)

REDEPLOY

Patterns – see DEPLOY

REDEPOSIT

Meanings

- | | |
|---|-------------------------------------|
| 1 | to place again |
| 2 | to entrust for safekeeping |
| 3 | to coat |
| 4 | something entrusted for safekeeping |

Patterns

- | | | |
|------|----|---------------|
| 1, 2 | vt | S/(in S) |
| 1-3 | vt | S/(with S) |
| 1-3 | vt | S/(at S) |
| 1, 3 | vt | S/(upon S) |
| 4 | n | (of S)/(in S) |
| 4 | n | (of S)/(at S) |

REDEVELOP

Meanings

- | | |
|---|--------------------------------|
| 1 | to reprocess (as film) |
| 2 | to strengthen something |
| 3 | to enlarge or detail something |
| 4 | to bring into activity |

Patterns

- | | | |
|---------|----|---|
| 1, 2, 3 | vt | S/(by S)/(in S) |
| 4 | vi | (among S)/(in S)/(at S)/(on S)/(after S)/(from S) |

REDIRECT

Meanings

- | | |
|---|---|
| 1 | to guide or regulate again as in a different manner |
| 2 | questioning by a lawyer of his witness after crossexamination |

Patterns

1	vt	S/(around S)
1	vt	S/(onto S)
1	vt	S/(into S)
1	vt	S/(to S)
1	vt	S/(toward S)
2	aj	- examination
2	n	on -

REDOLENT

Patterns

n	with S
n	of S

REDOUBLE

Patterns

vt	S/(to - inf)
vt	S/(for S)
vi	when + cl

REDOUND

Patterns

vi	(to S)
----	--------

REDUCE

Meanings

1	to be brought down to or forced into by circumstances
2	to be weakened
3	to lower or lessen
4	to analyze
5	to break up or melt
6	to decrease in positive valence (chem)
7	to change in form but not value (arithmetic)
8	to lose weight

Patterns

1, 2	vip	to S
1	vip	to G/(for S)
3	ut	S/(to S)/(for S)
3	vt	S/(by S)/(for S)
4	vt	S/(to S)/(by S)
5, 7	vt	S/to S
6	vt	S/(at S)
8	vi	(to S)

REDUCTION

Patterns

n	(of S)/(to S)
n	(of S)/(by S)

REDUNDANT

Patterns

ajp	(with S)
ajp	(in S)
aj	___ S

RE-EDUCATE

Patterns

vt	S/(for S)
vip	to - inf/(by G)
vt	PX/(for S)/(by S)
vt	PX/to - inf/(by G)

REEK

Patterns

vi	with S
vt	S

REEL

Meanings (verbal only)

1	to wind on a reel
2	to tell or write fluently

Patterns

1	vt	/in S
1	vt	/out S
2	vt	/off S

RE-ENTRY

Patterns

n	(to S)
---	--------

REFER

Meanings

1	to regard as caused by
2	to classify or regard as belonging to
3	to submit for settlement
4	to send (a person) for aid or information
5	to relate to or be concerned with
6	to direct attention to
7	to turn for information to

Patterns

1, 2, 3	vt	S/to S
4	vt	NM/to S
5, 6, 7	vi	to S

REFEREE

Patterns

n	(for S)
n	(in S)
n	(of S)

REFERENCE

Meanings

1	submission of a problem for settlement
2	relation, regard e. g. , "with reference to your letter"
3	a mention or allusion
4	a citing of another work, or such a citation
5	a person to give information or recommendation for another person, or the giving of such a person's name, or a written statement about a person
6	a research aid
7	to cite

Patterns

1-4	n	to S
5	n	(to - inf)
5	n	(for S)
5	n	(for NM)
6	n	0
6	aj	S
7	vt	\bar{S}

REFERRAL

Patterns

n	to S
---	------

REFIT

Patterns

vt	(S)/(for S)
vt	(S)/(to - inf)

REFLECT

Meanings

1	to hand or throw back energy waves or particle
2	to give back an image
3	to bring back as a consequence
4	to be bent or turned back
5	to contemplate
6	to cast blame or discredit

Patterns

1	vt	S/ off S/(to or toward S)
1	vt	S/ off of S/to or toward S)
1	vt	S/ off or off of S/(into S)
4	vip	(off or from S)/(to or into S or toward S)
2	vt	S
2	vip	in S
3	vt	S/ on or upon S
3, 6	vi	(back)/on or upon S
5	vi	on or upon S

REFLECTION

Meanings

- | | | |
|---|--|---|
| 1 | | the throwing back by a surface of energy waves or particles |
| 2 | | an image or likeness |
| 3 | | contemplation or the ideas which are the results of contemplation |
| 4 | | blame or discredit or a statement inputing or action bringing blame |
| 5 | | anything reflected |

Patterns

- | | | |
|---|---|--------------------------------|
| 1 | n | (of S)/from or off or off of S |
| 5 | n | of S/from or off or off of S |
| 2 | n | (in S) |
| 3 | n | (on or upon S) |
| 4 | n | on or upon S |

REFRACT

Meanings

- | | | |
|---|--|--|
| 1 | | to bend a ray of energy or particles |
| 2 | | to measure the degree of refraction of an eye or lense |

Patterns

- | | | |
|---|-----|-------------------------|
| 1 | vip | (by S)/(to or toward S) |
| 1 | vt | S/(to or toward S) |
| 2 | vt | S |

REFRACTION

Meanings

- | | | |
|---|--|--|
| 1 | | the bending of a ray as it passes through a medium |
| 2 | | the measuring of the degree of refraction of the eye |

Patterns

- | | | |
|---|---|--------------------------|
| 2 | n | 0 |
| 1 | n | (of S)/(by S)/(toward S) |

REFRAIN

Meanings

- | | | |
|---|--|---|
| 1 | | to hold back, keep oneself from |
| 2 | | a repeated verse or music to go with it |

Patterns

1	vi	from S
2	n	(of or from S)

REFRESH

Patterns

vt	S/(by S)
vt	S/(with S)
vi	(by S)

REFUGE

Patterns

n	(from S)
---	----------

REFUGEE

Patterns

n	(from S)
---	----------

REFUND

Patterns

vt	S/(for S)
vip	(by S)
n	(from S)/(for S)

REFUSE

Meanings

1	to reject
2	to decline to do something
3	to decline to grant something
4	anything thrown away

Patterns

1	vt	S
2	vi	to - inf
3	vt	S/S
4	n	(from S)

REGALE

Patterns

vt S/with S

REGARD

Meanings

- | | |
|----|--------------------------------|
| 1 | a firm look or gaze |
| 2 | attention |
| 3 | esteem, respect |
| 4 | reference |
| 5 | good wishes |
| 6 | to observe with a gaze |
| 7 | to take into account |
| 8 | to esteem or respect |
| 9 | to consider in a certain light |
| 10 | concerning (idiom) |

Patterns

- | | | |
|-----|----|------------|
| 1 | n | 0 |
| 2 | n | to S |
| 2,3 | n | for S |
| 4,5 | n | to S |
| 6 | vt | S/(with S) |
| 7,8 | vt | S |
| 9 | vt | S/ as S |
| 10 | n | as _ S |

REGIONAL

Patterns

ajp to S

REGISTER

Meanings

- | | |
|---|---|
| 1 | to enter in a list or record |
| 2 | to indicate on a scale |
| 3 | to show, as by facial expression |
| 4 | to safeguard mail |
| 5 | , to enter ones name in a list, as a hotel or to vote |

Note: Noun meanings are not involved in government.

Patterns

1, 2, 3, 4	vt	S
3	vt	S/(at S)
5	vi	in S
5	vi	for S

REGISTRATION

Patterns

n	(for S)
---	---------

REGRESS

Patterns

vi	(to S)
----	--------

REGRESSION

Patterns

n	(to S)
---	--------

REGRET

Patterns

vt	that + cl
vt	S
vt	to inf
n	that + cl
n	for S

REGRETABLE

Patterns

ajp	that + cl
-----	-----------

REGROUP

Patterns

vi or vt	(S)/(for S)
vi or vt	(S)/to inf

REHEARSE

Meanings

- | | |
|---|---|
| 1 | to recite or tell in detail |
| 2 | to perform for practice |
| 3 | to drill a person by practice in what he is to do |

Patterns

- | | | |
|---|----|-------------------------|
| 1 | vt | S |
| 2 | vt | S/(for S)/(on S)/(in S) |
| 3 | vt | NM/(in S)/(for S) |
| 2 | vi | (for S)/(on S)/(in S) |

REHEAT

Patterns

- | | |
|----|--------|
| vt | S/to S |
|----|--------|

REHIRE

Patterns – see hire, meanings 1 & 2

RELAY

Patterns

- | | |
|----|-------------------|
| vt | S/(from S)/(to S) |
|----|-------------------|

RELEASE

Meanings

- | | |
|---|--|
| 1 | to set free |
| 2 | to grant freedom from |
| 3 | to permit to be issued, shown, published |
| 4 | to surrender to someone else |
| 5 | a setting free or liberation from |
| 6 | a permission for publication |
| 7 | a device for switching or releasing |
| 8 | a transfer of right, claim, etc. |
| 9 | something which has been published |

Patterns

1, 2	vt	NM/from S
3	vt	S/for S
4	vt	S/to S/(for S)
5, 9	n	(from S)
6	n	(for S)/(from S)
8	n	from S/to S
7	n	(for S)

RELEGATE

Patterns

vt	S/to S
----	--------

RELEVANT

Patterns

ajp	to S
-----	------

RELIEF

Meanings

1	an easing, setting free, lightening
2	something which offers a change
3	aid
4	release from work or duty or the person who takes over so such release is possible
5	projection of forms from a flat surface
6	differences in elevation or the depiction of such differences on a map

Patterns

1, 2	n	from S
2	n	after S
3	n	to S
4	n	for S
5	n	in _
6	n	_ map

RELIEVE

Meanings

- | | |
|---|--|
| 1 | to ease, reduce, lighten |
| 2 | to fire from a position |
| 3 | to give aid to |
| 4 | to set free from work or send someone to do so |
| 5 | to make less tedious or set off by contrast |
| 6 | to ease (oneself) by passing bodily waste |

Patterns

- | | | |
|------|----|---------------------|
| 1, 3 | vt | S |
| 2, 4 | vt | NM/(from S)/(for S) |
| | vt | NM/(of S) |
| 5 | vt | S/with S |
| | vt | S/by S |
| 6 | vt | PX |

RELINQUISH

Patterns

- | | |
|----|----------|
| vt | S/(to S) |
|----|----------|

RELISH

Meanings

- | | |
|---|-----------------------|
| 1 | flavor |
| 2 | trace |
| 3 | pleasure |
| 4 | side dish for flavor |
| 5 | to give flavor to |
| 6 | to enjoy |
| 7 | to have the flavor of |

Patterns

- | | | |
|---------|----|--------|
| 1, 2, 4 | n | (of S) |
| 3 | n | in S |
| 5, 6 | vt | S |
| 7 | vi | of S |

RELOAD

Patterns – see LOAD

RELOCATE – see LOCATE

RELUCTANCE

Patterns

n	(to inf)
n	(to PR)

RELUCTANT

Patterns

ajp	(to inf)
-----	----------

RELY

Patterns

vi	on S/(for S)
vi	upon S/(for S)

REMADE – see MADE

REMAP – see MAP

REMARK

Meanings

1	to make an observation or comment
2	a noticing or observing (e. g. , person worthy of remark)
3	brief comment or casual observation

Patterns

1	vi	on S
1	vi	upon S
1	vi	(about S)/(that + cl)
3	n	(about S)
3	n	(on S)
2	n	0

REMARKABLE

Patterns

ajp	that + cl
ajp	of S/to inf

REMARRIAGE – see MARRIAGE

REMARRY – see MARRY

REMEDY

Patterns

n	(for S)
vt	S/(with S)
vt	S/(by S)

REMELT – see MELT

REMERGE – see MERGE

REMIGRATE – see MIGRATE

REMINISCE

Patterns

vi	(about S)
----	-----------

REMINISCENCE

Patterns

n	(about S)
---	-----------

REMINISCENT

Meanings

- | | |
|---|--|
| 1 | given to dwelling on the past or characterize by remembering |
| 2 | bringing to mind something else |

Patterns

1	aj	0
2	ajp	of S

REMISS

Patterns

ajp	in S
-----	------

REMODIFY – see MODIFY

REMONSTRATE

Patterns

vi	(with NM)/(about S)
vi	(with NM)/(on S)
vi	(with NM)/against S

REMORSE

Patterns

n	(at S)
n	(for S)
n	(about S)

REMORSEFUL

Patterns

ajp	(for S)
ajp	(about S)
aj	— S

REMOTE

Patterns

ajp	(from S)	
aj	– control	control from a distance

REMOVE

Meanings

- | | |
|---|----------------------------|
| 1 | to move away |
| 2 | to take off |
| 3 | to kill |
| 4 | to dismiss from a position |
| 5 | to eliminate |
| 6 | a step or interval |

Patterns

- | | | |
|---------|----|---------------|
| 1, 4 | vt | S/(from S) |
| 2, 3, 5 | vt | S |
| 6 | n | from S/(to S) |

REMULTIPLY – see MULTIPLY

RENAME – see NAME verb only

RENAVIGATE – see NAVIGATE

REND

Meanings

- | | |
|---|------------------------------------|
| 1 | to tear away or separate violently |
| 2 | to pull apart or split violently |

Patterns

- | | | |
|---|----|-------------------|
| 1 | vt | /(away)S/(from S) |
| 1 | vt | /(off)S/(from S) |
| 1 | vt | S/out of S |
| 1 | vt | / up S/(from S) |
| 2 | vt | S |
| 2 | vi | 0 |

RENDER

Meanings

1	to deliver or submit
2	to surrender
3	to give in return
4	to restore
5	to pay
6	to cause to be
7	to give or provide
8	to depict
9	to perform
10	to put in words of another language or expression
11	to melt fat
12	to present oneself or take steps to be in a certain place

Patterns

1, 5, 8, 9, 11	vt	S
2	vt	/(up or over)S/(to S)
3	vt	S/ for S
4	vt	back S
6	vt	S/A
7	vt	S/(to S)
10	vt	S/ in S
12	vt	PX/(at S)/(in S)

RENDEZVOUS

Meanings

1	a place for meeting
2	an appointment for meeting
3	a meeting

Patterns

1	n	(_/to-be/at S/(NT))
2, 3	n	(with S)/(at S)/(NT)
1-3	n	(for S)

RENEGE

Meanings

- | | |
|---|----------------------------------|
| 1 | to play a card of the wrong suit |
| 2 | to go back on a promise |

Patterns

- | | | |
|---|----|------|
| 1 | vi | 0 |
| 2 | vi | on S |

RENOMINATE – see nominate

RENT

Meanings (verbal only)

- | | |
|---|--|
| 1 | to get temporary possession for a payment |
| 2 | to give temporary possession for a payment |

Patterns

- | | | |
|---|----|-----------------|
| 1 | vt | S/(for S) |
| 2 | vt | /(out)S/(for S) |

RENUMBER

Patterns

- | | |
|----|------------------------------|
| vt | S/(from S)/(to or through S) |
|----|------------------------------|

REPACK

Patterns

- | | |
|----|------------|
| vt | S/(with S) |
| vt | S/(for S) |

REPAIR

Meanings (verbal only)

- | | |
|---|--------------------------------|
| 1 | to mend, renew, compensate for |
| 2 | to go to |

Patterns

1	vt	S
2	vi	to S

REPAPER

Patterns

vt	S/(with S)
----	------------

REPARATION

Patterns

n	(to S)/(for S)
---	----------------

REPAY

Patterns

vt	S/(for S)/(with S)
----	--------------------

REPENT

Patterns

vi	of S
vt	S

REPINE

Patterns

vi	at S
vi	for S

REPLEDGE

Patterns

vt	(S)/(to inf)
----	--------------

REPLETE

Patterns

ajp (with S)

REPLY

Meanings

- | | |
|---|---------------------------------|
| 1 | to respond in speech or writing |
| 2 | to respond in action |

Patterns

1	vi	to S
1	vt	that + cl
1,2	vi	(to S)/(with S)

REPOLISH

Patterns

vt S/(to S)/(with S)

REPORT

Meanings (verbal only)

- | | |
|---|--|
| 1 | to notify authorities |
| 2 | to tell about, often formally |
| 3 | to complain about to an authority |
| 4 | to present oneself |
| 5 | to work as a reporter |
| 6 | to submit a formal report |
| 7 | to tell a fact |
| 8 | to carry a message or repeat something |

Patterns

1,3,8	vt	S/(to S)
7	vt	that + cl
2	vi	on S
4	vi	(to S)/(for S)/(at S)
5	vi	for S
6	vi	DT

REPOSE

Meanings (verbal only)

- | | |
|---|---|
| 1 | to lay or put to rest |
| 2 | to rest from work, travel, exercise, etc. |
| 3 | to rest in a grave |
| 4 | to depend upon |
| 5 | to lie quiet |
| 6 | to lie on, be supported |
| 7 | to place in the control of |
| 8 | to place |

Patterns

- | | | | |
|---------|----|---------|---|
| 1 | vt | PX/on S | |
| 1 | vt | PX/in S | |
| 2 | vi | DT | |
| 2 | vi | for NT | |
| 2 | vi | until S | |
| 3, 4, 5 | vi | (in S) | The land reposes in the dark
Our fate reposes in our own hands |
| 3 | vi | at S | |
| 6 | vi | on S | |
| 7, 8 | vt | S/in S | Repose your hope in God
Parliament reposes their fate in the courts |

REPOSSESS

Meanings

- | | |
|-----|----------------------------|
| (1) | to take possession again |
| (2) | to put in possession again |

Patterns

- | | | |
|---|----|---------|
| 1 | vt | S |
| 2 | vt | NM/of S |

REPOUR — see POUR

REPREHEND

Patterns

- | | |
|----|-----------|
| vt | S/(for S) |
|----|-----------|

REPRESENT

Meanings

- | | |
|---|---|
| 1 | to be a sign for |
| 2 | to correspond to |
| 3 | to be an agent for |
| 4 | to serve as a specimen |
| 5 | to set forth as |
| 6 | to present a likeness |
| 7 | to clarify to the mind by description or act of imagination |

Patterns

- | | | |
|------|----|--------------------|
| 1, 7 | vt | S/(with S) |
| 2, 7 | vt | S/(to S) |
| 3 | vt | S/(in S) |
| 3 | vt | S/(to S) |
| 4, 6 | vt | S |
| 5 | vt | S/as S or PS or PR |
| 1, 7 | vt | S/(by S) |
| 3 | vt | S/(before S) |

REPRESENTATIVE

Meanings (noun only)

- | | |
|-----|--|
| (1) | an example of a class or kind |
| (2) | a person authorized to speak or act for others |
| (3) | a member of the lower house of Congress or State legislature |

Patterns

- | | | |
|---|---|------------------------|
| 1 | n | of S |
| 2 | n | (in or to or before S) |
| 3 | n | from S |

REPRIEVE

Patterns

- | | |
|----|------------|
| nt | S/(from S) |
| n | (from S) |

REPRIMAND

Patterns

- | | |
|-----|------------------|
| vt | S/(for S or PR) |
| vip | (by S) |
| n | (from S)/(for S) |

REPRISAL

Patterns

n (for S)

REPROACH

Meanings

- (1) to rebuke
- (2) to bring shame, as this crime will reproach him
- (3) a source or cause of shame
- (4) shame or disgrace incurred
- (5) a rebuke or expression thereof

Patterns

1	vt	S/(for S)
2	vt	NM
3	n	to S
4	n	(to S)
4	n	(upon S)
5	n	(to S)/(for S)

REPROCESS – see PROCESS

REPROOF

Patterns

n (to S)/(for S)

REPROVE

Patterns

vt S/(for S)

REPUGNANT

Patterns

ajp	to S
aj	– S

REPURCHASE – see PURCHASE

REPUTATION

Patterns

n	(for S)
n	(of S)

REQUEST

Meanings

1	a petition, asking for
2	that which is asked for
3	the state of being asked for; demand
4	to ask for
5	in response to an asking

Patterns

1	n	(to S)/(for S)
2	n	(for S)
3	n	in _____
4	vt	S/(from S)/(for S)
5	n	by _____

REQUISITE

Patterns

aj	S
ajp	(for S)

REQUISITION

Patterns

n	(for S)
vt	S/(for S)

REQUITAL

Patterns

n	(in) _____ (of or for S)
n	(for S)/(from S)
n	(of S)/(from S)

REQUIRE

Patterns

vt S/(for S)/(with S)

REROUTE

Patterns

vt S/ through S
vt S/(from S)/(to S)

RESCUE

Patterns

vt S/ from S

RESEARCH

Meanings (noun only)

- (1) searching for or after something
- (2) investigation, study

Patterns

1	n	after S
1	n	for S
2	n	in S
2	n	into S

RESEMBLENCE

Patterns

n to S

RESENTMENT

Patterns

n	(toward S)/(for S)
n	(at S)/(for S)
n	(against S)/(for S)

RESERVATION

Meanings

- | | |
|---|---|
| 1 | a withholding of a right or interest |
| 2 | a limiting condition or qualification |
| 3 | public land set aside for special use |
| 4 | a prearrangement to buy a ticket, rent a room, etc. , which is then set aside |

Patterns

- | | | |
|-----|---|---------|
| 2 | n | about S |
| 2 | n | on S |
| 1,3 | n | of S |
| 3,4 | n | for S |

RESERVE

Meanings

- | | |
|----|--|
| 1 | to keep back, store |
| 2 | to set aside for someone |
| 3 | to retain for oneself |
| 4 | something kept back or stored |
| 5 | a self restraint, avoidance of intimacy, reticence |
| 6 | restraint in artistic expression |
| 7 | men in armed forces not on active duty |
| 8 | assets easily converted to cash |
| 9 | land set aside for special purpose |
| 10 | reserved for later use |
| 11 | subject to no limitation |

Patterns

- | | | |
|---------|----|-----------------------------|
| 1, 3 | vt | S/(to-inf) |
| 1, 3 | vt | S/(for S) |
| 1 | vt | S/(until S) |
| 2 | vt | S/(for S)/(on, at, or in S) |
| 4, 7, 8 | n | (of S) |
| 5 | n | (toward or with S) |
| 6 | n | (in S) |
| 8 | n | (to-inf) |
| 8, 9 | n | (for S) |
| 10 | n | in ____ |
| 11 | n | without ____ |

RESERVED

Meanings

- | | |
|-----|-----------------|
| (1) | kept in reserve |
| (2) | reticent |

Patterns

- | | | |
|---|-----|---------------------------|
| 1 | ajp | (for S) |
| 2 | ajp | (towards or with or in S) |

RESIDE

Patterns

vi	in S
----	------

RESIDENCE

Meanings

- | | |
|-----|---|
| (1) | the act of residing |
| (2) | the living in a particular place for a specific purpose such as going to school |
| (3) | a dwelling place |

Patterns

- | | | |
|------|---|---------|
| 1, 3 | n | (in S) |
| 2 | n | in ____ |

RESIDENT

Patterns

ajp	(in S)
aj	____ S
n	(of or in S)

RESIDUE

Patterns

n	from S
n	after S

RESIDUUM

Patterns

n	from S
n	after S

RESIGN

Meanings

- | | |
|-----|----------------------------------|
| (1) | to give up or relinquish |
| (2) | to give up an office or position |
| (3) | to accept passively |

Patterns

1	vt	S/(to S)
2	vi	(from S)/(as S)...
3	vt	PX/to S

RESIGNATION

Meanings

- | | |
|-----|------------------------------------|
| (1) | giving up of an office or position |
| (2) | passive acceptance |

Patterns

1	n	(from S)/(to S)
1, 2	n	(to S)

RESIST

Meanings

- | | |
|-----|----------------------------------|
| (1) | to withstand, stand firm against |
| (2) | to actively oppose |
| (3) | to keep from yield to |

Patterns

1, 2, 3	vt or vi	(S)/for S (S)/with S (S)/by S
---------	----------	-------------------------------------

RESISTANCE

Meanings

- (1) resisting, opposing, withstanding
- (2) capacity to resist or ward off, esp. disease
- (3) ability to oppose passage of electric current
- (4) an organization for resisting the current government or occupying power

Patterns

1, 2	n	to S
3	n	of S
4	n	0

RESISTANT

Patterns

ajp to S

RESISTIVE

Patterns

ajp to S

RESOLUTION

Meanings

- (1) breaking into parts
- (2) resolving, deciding
- (3) resolute quality of mind
- (4) formal statement of opinion and determination
- (5) a solving of a puzzle, etc., solution
- (6) medically, disappearance of a symptom
- (7) musically, passing of tone or chord to another tone or chord

Patterns

1	n	of S/into S and S
2, 5, 6	n	(of S)
3, 4	n	(to - inf)(S)
3	n	(in S)
5	n	(for S)
7	n	(of S)/to S

RESOLVE

Meanings

- (1) to break into parts
- (2) to transform or be transformed
- (3) to cause a person to decide
- (4) to reach a decision
- (5) to solve or explain
- (6) to decide by vote
- (7) medically, remission of symptoms
- (8) musically, to cause or undergo resolution
- (9) to make visible individual parts of an image

Patterns

- | | | |
|------|----------|-------------------|
| 1 | vt or vi | (S)/into S(and S) |
| 2 | vt | PX/into S |
| 3 | vt | NM/to - inf (S) |
| 4, 6 | vt | that + cl |
| 4, 6 | vt | to - inf (S) |
| 5, 9 | vt | S/by S) |
| 7 | vi | 0 |
| 8 | vi or vt | (S)/to or into S |

RESORT

Meanings

- (1) to go to a place of recreation (uncommon)
- (2) to have recourse to
- (3) place of recreation
- (4) a place of customary gathering (uncommon)
- (5) a person or thing one turns to for help, support, etc.
- (6) a going or turning for help, support, etc.

Patterns

- | | | |
|---------|-----|--------------|
| 1, 2 | vi. | to S |
| 3, 4, 5 | n | (for S) |
| 6 | n | to S/(for S) |

RESOUND

Meanings

- (1) of places: to ring or re-echo with sound
- (2) of things: to produce an echoing sound
- (3) of sounds: to echo or ring

Meanings

- (4) to be celebrated
- (5) to echo something back
- (6) to extol or celebrate

Patterns

- 1 vi with S
- 2 vi (for S)/(with S)/(through S)
- 3,4 vi (through S)/(for S)
- 5 vt S/(for S)
- 6 vt S

RESPECT

Meanings

- (1) to feel or show honor for
- (2) to show consideration for
- (3) to relate to, concern
- (4) a feeling of honor or esteem
- (5) a state of being held in honor
- (6) courteous regard
- (7) regards; expressions of respect
- (8) a particular point or detail
- (9) reference or relation
- (10) considering

Patterns

- 1 vt S/(for S)
- 2 vt S/(in S)
- 3 vt S
- 4,6 n for S
- 5 n (of S)
- 7 n s/ to S
- 8,9 n in
- 9 n with /to S
- 10 n in that S or CL

RESPECTFUL

Patterns

- ajp towards or to or of S

RESPITE

Patterns

n	(from S)
vt	S/(from S)

RESPOND

Patterns

vi	(to S)/(with S)
----	-----------------

RESPONSE

Patterns

n	(to S)
---	--------

RESPONSIBLE

Meanings

- (1) answerable, accountable
- (2) cause or agent or source of something
- (3) able to think & act rationally
- (4) trustworthy, dependable

Patterns

1	ajp	(for S)/(to S)
2	ajp	for S
3, 4	aj	<u> </u> S
3, 4	ajp	0

RESPONSIVE

Meanings

- (1) responding, answering
- (2) reacting easily or readily
- (3) containing or consisting of answers

Patterns

1, 2	ajp	to S
1, 2, 3	aj	<u> </u> S

REST

Meanings

- (1) refreshment by sleep, etc.
- (2) inactivity or period of inactivity
- (3) relief from something
- (4) repose of death
- (5) absence of motion
- (6) place of shelter
- (7) supporting device
- (8) interval of silence
- (9) to get refreshment by sleeping, etc.
- (10) to get refreshment by cessation of activity
- (11) to leave without change
- (12) to be supported
- (13) to be imposed as a burden or responsibility
- (14) to be or lie upon (e. g. , the fault rests with you)
- (15) to be directed or fixed upon (as eyes)
- (16) to rely on
- (17) to stay
- (18) to lie fallow (as ground)
- (19) to refresh something
- (20) to place for ease or support
- (21) to ground or use as basis
- (22) to direct or fix upon (as 15 transitive)
- (23) to end or stop (as the defense rests its case)

Patterns

1, 5, 8	n	0
1, 2, 4, 5	n	at _
2, 3	n	(from S)/(for NT)
4	n	in _
6	n	for S
7	n	(for S)
9	vi	(for S)
10	vi	(from S)/(for NT)
11, 17, 18	vi	(for NT)
12, 16	vi	in, on, upon S
13, 15	vi	on, upon S
14	vi	with S
19, 23	vt	S/(by, with S)
20, 21, 22	vt	S/on, upon S

RESTATE

Patterns

vt	S/(in S)/(for S)
----	------------------

RESTFULPatterns

ajp (for NM)/ to inf

RESTITUTIONMeanings

- (1) restoration
 (2) reimbursement or making good for damage

Patterns

- 1 n (of S)/(to S)
 2 n (to S)/(for S)

RESTIVEMeanings

- (1) balky, unruly or refractory
 (2) nervous or restless

Patterns

- 1, 2 ajp under S
 1 ajp with NM
 2 ajp with S

RESTLESSMeanings

- (1) uneasy, disturbed
 (2) inclined to action
 (3) discontented

Patterns

- 1, 3 ajp under S
 1 ajp with S
 1, 2 aj _S

RESTOREPatterns

vt S/(to S)

RESTRAIN

Patterns

vt S/(from S)/(by or with S)

RESTRICT

Patterns

vt S/from S

RESTUFF

Patterns

vt S/(with S)

RESULT

Meanings

- (1) to be the effect or consequence of a cause
- (2) to bring about some effect or consequence
- (3) a consequence or effect of some action, process, etc.
- (4) answer to a mathematical problem

Patterns

- | | | |
|---|----|---------|
| 1 | vi | from S |
| 2 | vi | in S |
| 3 | n | (of S) |
| 4 | n | (for S) |

RESUMMON

Patterns

vt S/(to S)/(for S)

RESUPPLY

Patterns

vt S/with S/(for S)

RETAIL

Meanings

- | | |
|---|--|
| 1 | to sell directly to the consumer |
| 2 | the sale of goods directly to the consumer |
| 3 | pertaining to the sale of goods directly to the consumer |
| 4 | to repeat as gossip |
| 5 | to be sold at retail |

Patterns

- | | | |
|---|----|-------------|
| 1 | vt | S/(for S) |
| 2 | n | at _____ |
| 3 | aj | _____ S |
| 4 | vt | NM/with S |
| 5 | vi | at or for S |

RETALIATE

Patterns

- | | |
|----|------------|
| vi | (for S) |
| vi | (with S) |
| vi | (by G) |
| vt | S/(upon S) |

RETALIATION

Patterns

- | | |
|---|---------|
| n | (for S) |
|---|---------|

RETICENCE

Patterns

- | | |
|---|---------------------|
| n | (with NM)/(about S) |
|---|---------------------|

RETICENT

Patterns

- | | |
|-----|---------------------|
| ajp | (with NM)/(about S) |
|-----|---------------------|

RETIRE

Meanings

- | | |
|---|--|
| 1 | to withdraw to privacy |
| 2 | to go to bed |
| 3 | to retreat |
| 4 | to withdraw from business or public life |
| 5 | to take or lead away |

Meanings

- | | |
|---|--|
| 6 | to take out of circulation, take up or pay off |
| 7 | to remove from position or office |
| 8 | in baseball, to put out |

Patterns

- | | | |
|------|----|------------------------|
| 1, 3 | vi | (from S)/(to S) |
| 2 | vi | (at NT) or (DT) |
| 4 | vi | (from S)/(at S)/(in S) |
| 5 | vt | S/(from S) |
| 6 | vt | S/(from S)/(in NT) |
| 7 | vt | NM/(DT) or (in NT) |
| 8 | vt | S/(with S) |

RETIREMENT

Patterns

- | | |
|---|----------|
| n | (from S) |
|---|----------|

RETOOL

Patterns

- | | |
|----|-----------|
| vi | (for S) |
| vt | S/(for S) |

RETORT

Meanings

- | | |
|---|---|
| 1 | to turn back something upon the person from whom it came |
| 2 | to answer or return in kind |
| 3 | to make a sharp or witty reply in kind or in the same terms as the previous speaker |
| 4 | a reply as in 3 |

Patterns

- | | | |
|---|----|-----------------|
| 1 | vt | S/on or upon S |
| 2 | vt | S/(with S) |
| 3 | vi | (to S)/(with S) |
| 3 | vi | (to S)/(by S) |
| 3 | vt | that + cl |
| 4 | n | (to S) |

RETREAT

Meanings

- | | |
|---|---|
| 1 | a going back or giving ground before opposition |
| 2 | a withdrawal to a safe or private place |
| 3 | a safe or private place to withdraw to |
| 4 | a period of contemplation |
| 5 | an asylum |
| 6 | to withdraw or give ground before opposition |
| 7 | to slope backward |

Patterns

- | | | |
|------|----|-----------------|
| 1, 2 | n | (from S)/(to S) |
| 3 | n | (from S) |
| 4 | n | (to-inf S) |
| 4 | n | (for NT)/(at S) |
| 5 | n | (for S) |
| 6, 7 | vi | (from S)/(to S) |
| 7 | vi | (from S)/(DJ) |

RETRIBUTION

Patterns

- | | |
|---|---------|
| n | (for S) |
|---|---------|

RETROACTIVE

Patterns

- | | |
|-----|--------|
| ajp | (to S) |
| aj | — S |

RETROGRESS

Patterns

- | | |
|----|------------------|
| vi | (to or toward S) |
|----|------------------|

RETURN

Meanings

- | | |
|---|---|
| 1 | to go back to a former place, condition, subject of conversation etc. |
| 2 | to revert to a former owner |
| 3 | to reply or respond |
| 4 | to restore, replace, take or send back |

Meanings

5	to give, send, or do in reciprocation
6	to yield, produce
7	to reelect
8	to report or turn in a statement officially
9	to render (verdict)
10	a going back to a former place, condition etc.
11	a restoration, repayment
12	a reappearance or recurrence
13	a profit
14	a bend in line, wall, etc.
15	a report, as election returns
16	card play in response to another
17	batting back a tennis ball or the ball so batted
18	of or for or in return

Patterns

1	vi	(to S)/(from S)
1	vi	DJ
2	vi	to S/(on or upon S)
3	vi	(D)
4, 8	vt	S/(to S)
5	vt	S/(with or by [S or G])
6	vt	S/(on S)
6	vt	S/(per S)
7	vt	NM/(to S)
9	vt	S/(of S)
10, 17	n	(to S)
11	n	(for S)
12	n	— (s)/of S
13	n	— (s)/on S
14, 15, 16, 17	n	(of S)
18	aj	— S

REUNITE

Patterns

vt or vi	(S)/(with S)
----------	--------------

REVEAL

Patterns

vt	S/(to S)
n	0

REVEL

Meanings

- | | |
|---|--|
| 1 | to be noisily festive |
| 2 | to take pleasure |
| 3 | boisterous festivity, revelry |
| 4 | to squander in boisterous festivity patterns |

Patterns

- | | | |
|---|----|--|
| 1 | vi | (in, at, after or other adverbial preposition S) |
| 2 | vi | in S |
| 3 | n | as 1 |
| 4 | vt | S away |

REVENGE

Meanings

- | | |
|---|---|
| 1 | to avenge oneself on a person for a wrong |
| 2 | to exact retribution for any injury |
| 3 | to avenge a person |
| 4 | the act of harming in return for wrong suffered, or desire for it |
| 5 | retaliation, as for defeat, or opportunity for it |

Patterns

- | | | |
|------|----|---------------------------|
| 1 | vt | PX/(on or upon S)/(for S) |
| 1 | vt | PX/(of S)/(for S) |
| 2 | vt | S/(on or upon S) |
| 3 | vt | NM/(for S) |
| 4, 5 | n | (on or upon S)/(for S) |
| 4 | n | (of S) |
| 4 | n | in ___ of S |

REVENUE

Patterns

- | | |
|---|-----------------|
| n | (to S)/(from S) |
|---|-----------------|

REVERBERATE

Meanings

- | | |
|---|---------------------------------------|
| 1 | to cast back, reflect or deflect |
| 2 | to be sent back, reached or reflected |
| 3 | to force back upon something |
| 4 | to rebound |

Patterns

1	vt	S
2	vi	from S
3	vi	on or upon S
4	vi	from or against S

REFERENCE

Patterns

n	(for S)/(for or because of S)
vt	S/(for S)

REVERSION

Patterns

n	(to S)
---	--------

REVERT

Patterns

vi	to S
----	------

REVEST

Patterns

vt	S/in S
vi	in S

REVOLT

Meanings

1	rebellion; insurrection
2	a refusal to submit or accept some authority or practice
3	the state of a person revolting
4	to rise against constituted authority
5	to cast off allegiance
6	to change allegiance
7	to be disgusted or shocked

Patterns

1	n	(against S)
2	n	against S
3	n	in ___/(against S)

Patterns

4	vi	(against S)
5	vi	from S
6	vi	to S
7	vi	at or against S
7	vip	by S

REVOLUTION

Meanings

1	movement in an orbit
2	time for an orbit
3	rotation on an axis
4	one complete cycle of rotation or events
5	a drastic change
6	overthrow of government

Patterns

1, 3	n	(of S)/(about or around S)
2, 4	n	(of S)
4	n	_____ s/DT
4	n	_____ s/per or every NT
5	n	in S
6	n	(of S)/(against S)

REVOLVE

Meanings

1	to consider, ponder over
2	to cause to travel in an orbit
3	to cause to rotate about an axis
4	to travel in a circle
5	to rotate
6	to recur in a cycle

Patterns

1	vt	S/in S
2, 3	vt	S/(about or around S)
4, 5	vi	(about or around S)
6	vi	0

REVULSION

Patterns

n	(of S)/(at or from or to S)
---	-----------------------------

REWARD

Patterns

n	(to S)/(for S)
vt	S/(for S)

RHAPSODIZE

Patterns

vi	(about S)
vt	S

RHYME

Meanings

- | | |
|---|---|
| 1 | a poem or poetry in general |
| 2 | like end sounds in words |
| 3 | a word that corresponds with another in end sound |
| 4 | to make a poem |
| 5 | to form 2 words with corresponding end sounds |
| 6 | to put something into rhyme form |

Patterns

1	n	(by S)
2	n	—
3	n	(with S)
3	n	(for S)
4	vi	0
5	vt	S/with S
6	vt	S

RICH

Meanings

- | | |
|---|---|
| 1 | having wealth |
| 2 | having natural resources |
| 3 | well supplied |
| 4 | of fine or valuable or luxurious or choice attributes |

Patterns

1, 2	ajp	0
3	ajp	in or with S
1, 2, 4	aj	___ S

RICOCHET

Patterns

vi (off or from S)/(to or toward S)
n (off or from S)

RID

Patterns

vt S/of S
vip of S
n get ____ of S

RIDDLE

Meanings

- 1 a puzzle, conundrum
- 2 a perplexing person or thing
- 3 a sieve
- 4 to sift
- 5 to puncture with holes
- 6 to speak in riddles or make riddles

Patterns

1, 3 n 0
2 n (to NM)
4 vt S/(out)
4 vt S/(through S)
4 vt S/(from S)
5 vt S/with S
6 vi 0

RIDE

Meanings

- 1 to be carried somewhere in or on something
- 2 to move directly along or over a fixed support (trains ride on rails)
- 3 to move or float in some medium like air or water
- 4 to function for riding (this car rides well)
- 5 to move out of place
- 6 to allow to continue
- 7 to sit on and control so as to move
- 8 to be carried or supported on (ship rides the waves)
- 9 to do by riding (he rode a race)

Meanings

10	to oppress (usually passive)
11	to overtake by riding
12	to knock down by riding against
13	to exhaust a horse by riding too long
14	to withstand successfully
15	to know how to manage a horse
16	a journey or drive
17	to overlap

Patterns

1	vi	(in or on or upon S)/(to or any adverb-prep S)
1, 2, 17	vi	along or over or on S
1, 3	vi	over or through S
4, 6, 15	vi	D
5	vi	up
6, 7	vi	until S
6, 7	vi	while + cl
7	vi or vt	(S)/(to or any adverb-prep S)
7, 10	vip	by S
8, 9	vt	S/(with S)
11, 12, 13	vt	/down S
14	vt	/out S
16	n	(to or any adverb-prep S)
6	vi	for NT
7	vt	S

RIFE

Patterns

aj	(with S)
----	----------

RIFT

Patterns

n	(in S)
vi or vt	(S)/(with S)

RIG

Meanings

1	to fit a ship with sails etc.
2	to fit a ships sails to the masts etc.
3	to assemble an aircraft
4	to equip
5	to prepare for use in a makeshift or hurried passion

Meanings

6	to arrange in a dishonest way
7	to dress
8	the arrangement of sails, masts etc. on a ship
9	any special-purpose gear
10	equipment for drilling oil
11	a carriage and horses
12	an odd or showy attire

Patterns

1	vt	/(out or up) S
2, 3, 6	vt	S
4	vt	S/up or out./(with S)
5	vt	/(up) S
7	vt	NM or PX/out or up/(in S)
8 - 12	n	0

RIGHT

Meanings

1	straight
2	perpendicular
3	face or upper surface
4	sound, normal
5	right hand side
6	correct by some standard
7	a claim or privilege
8	correctness or justice
9	true account or interpretation
10	right hand side or turn
11	politically conservative or politically conservative position
12	having a good relationship with
13	a privilege to buy a stock
14	directly
15	thoroughly
16	exactly
17	to the right hand
18	in a fitting manner
19	correctly
20	to correct or do justive
21	to bring back to vertical
22	to recover balance
23	to justify
24	to get into a vertical position
25	to put in order

Meanings

26	to understand (idiom)
27	to square things i.e., make more just (idiom)
28	to be OK (idiom)
29	to return immediately (idiom)

Patterns

1 - 6	aj	___ S
4, 6	ajp	in S
6	ajp	for S
6	ajp	to-inf
6	ajp	that + cl
7	n	to S
7, 13	n	to-inf (S)
7	n	by ___ of S
7, 9	n	of S
8	n	(in or on S)
8	n	by ___ (s)
4, 8	n	bring, put or set/to ___
10, 11	n	to the ___
10, 11	n	on PSS ___
10, 11, 13	n	0
12	n	with S
12	n	towards S
14	av	DJ
14	av	to or into or toward S
14, 16	av	under or on or next to S
14	av	from or thru or over S
14, 16	av	out or outside or beyond S
14	av	down S
14, 16	av	against S
14, 16	av	between or below or beneath S
14, 16	av	beside or alongside S
15	av	through S
16	av	here or there
16	av	now or then
17	av	(at S)
18, 19	av	0
20 - 22, 25	vt	S
23	vt	PX/(at or with S)
24	vi or vt	(PX)
26	av	to get it ___
27	av	to make it ___
28	ajp	all ___
29	av	to be ___ back

RIGID

Patterns

aj	_____ S
ajp	with S
ajp	at S

RIM

Patterns

vt	S/(with S)
vip	with S
n	(of S)

RING

Meanings

- | | |
|----|---|
| 1 | to give off a clear resonant sound |
| 2 | to produce a specified impression on a hearer |
| 3 | to cause a bell to (1) |
| 4 | to summon with a bell |
| 5 | to be full of sound |
| 6 | to have a sensation of ringing (ears or head) |
| 7 | to announce or proclaim |
| 8 | to test by sound |
| 9 | to call by telephone |
| 10 | the sound of a bell or any similar sound |
| 11 | a band for finger |
| 12 | a circular band for other uses |
| 13 | a circle |
| 14 | the rim of something |
| 15 | tree "rings" |
| 16 | things grouped together in a circle |
| 17 | a group of conspirators |
| 18 | an enclosed area for contests or exhibitions |
| 19 | boxing |
| 20 | a contest, especially political |
| 21 | to surround with or in a ring, encircle |
| 22 | to put a ring in the nose of an animal |
| 23 | to cut a circle of tree bark |
| 24 | to form in ring |
| 25 | to move in circles, especially falcons |
| 26 | to linger in or haunt the ears, heart, etc. |

Patterns

1	vi	(out)
2	vi	A
3	vi or vt	(S)
4	vi	for S
4	vi	to S
5	vi	with or of S
6	vi	ears or head ____
7	vi	in or out S
7	vt	S
8	vt	S/(on or upon S)
9	vt	/up S/(on S)
10 - 17	n	(of S)
11, 12, 18	n	(for S)
14	n	(around S)
20	n	in ____
21	vt	S/with or in S
21	vt	/in S/(by or with S)
22, 23	vt	S
24	vi	around S
25	vi	(into S)
26	vi	in S

RINGER

Meanings

1	one who rings or encircles
2	a dishonest entry in competition
3	a person or thing that resembles another

Patterns

3	n	for S
---	---	-------

RINSE

Patterns

vt	S/ in S
vt	S/with S
vt	/out S/(in or with S)

RIOT

Meanings

1	wild or violent disorder
2	wild public disturbance by a group

Meanings

- | | |
|---|---|
| 3 | unrestrained outburst |
| 4 | brilliant display |
| 5 | debauchery |
| 6 | to take part in (2) |
| 7 | to take part in (5) |
| 8 | to enjoy or indulge without restraint |
| 9 | to waste away something in riotous living |

Patterns

- | | | |
|------|----|--|
| 1 | n | (in or at S) |
| 2 | n | (in or at S) $\left(\begin{smallmatrix} \text{DT} \\ \text{or} \\ \text{NT} \end{smallmatrix} \right)$ (over S) |
| 3, 4 | n | of S |
| 5 | n | 0 |
| 6 | vi | (in or at S) $\left(\begin{smallmatrix} \text{DT} \\ \text{or} \\ \text{NT} \end{smallmatrix} \right)$ (over S) |
| 7 | vi | (in or at S) $\left(\begin{smallmatrix} \text{DT} \\ \text{or} \\ \text{NT} \end{smallmatrix} \right)$ |
| 8 | vi | in S |
| 9 | vt | /out or away S |

RIP

Meanings

- | | |
|---|--------------------------------------|
| 1 | to cut or tear apart or open |
| 2 | to remove by pulling vigorously |
| 3 | to split wood along the grain |
| 4 | a torn place |
| 5 | the act of tearing apart |
| 6 | rough water caused by cross currents |

Patterns

- | | | |
|------|---------|-----------------|
| 1, 2 | vt | /up S |
| 1 | vip | asunder or open |
| 2 | vt | /off S |
| 2 | vt | /out S |
| 2 | vt | S/from S |
| 2 | vt | S/out of S |
| 2 | vt | /away S |
| 1, 3 | vt | S |
| 6 | n or aj | 0 |
| 4 | n | in S |
| 4 | n | down S |
| 5 | n | 0 |

RIPE

Meanings

- | | |
|---|---|
| 1 | fully developed and ready for use (food) |
| 2 | advanced or highly developed |
| 3 | ruddy and full |
| 4 | ready to do, receive or undergo something |

Patterns

- | | | |
|---------|-----|----------|
| 1, 2, 3 | aj | S |
| 1, 2, 3 | ajp | (with S) |
| 4 | ajp | for S |

RIPEN

Patterns

- | | |
|----|------------|
| vi | towards S |
| vi | into S |
| vi | in S |
| vt | S/(for S) |
| vt | S/(into S) |

RIPPLE

Patterns

- | | |
|----|---------------------------------------|
| n | (down or in or on or along or over S) |
| vi | (down or in or on or over or along S) |
| vt | S/(with S) |

RISE

Meanings

- | | |
|----|--------------------------------------|
| 1 | to get up |
| 2 | to rebel |
| 3 | to adjourn |
| 4 | to ascend |
| 5 | to extend up |
| 6 | to go up in pitch |
| 7 | to increase in amount or size |
| 8 | to appear, originate, have a source |
| 9 | to cause to rise,, mostly in sense 8 |
| 10 | appearance above the horizon |
| 11 | ascent |
| 12 | hill or upward slope |

Meanings

13	increase in height
14	to cause to appear
15	to be capable of coping with
16	to rise in rank

Patterns

1	vi	(up from S)
1	vi	(from S)
2	vi	against S
3	vi	for S
4, 7, 8, 16	vi	(to S)
4, 5, 16	vi	(above S)
4, 5	vi	(from S)/(to S)
4	vi	(into S)
5	vi	(beyond S)
6, 7	vi	(NJ) or (DJ)
8	vi	(in S)
8	vi	(on S)
8	vi	up/(from S)
9	vt	S/(on S)
10	n	0
11	n	(to S)
12	n	(in or on S)
13	n	(in S)
14	n	give ____ to S
15	vi	to S

RIVAL

Patterns

n	(for S)
n	(in S)
vt	S/(in S)
vt	S/(for S)
aj	____ S

RIVET

Meanings

1	a bolt or pin
2	to fasten with or as with rivets
3	to fasten firmly
4	to fix or engross the eyes, or mind, or attention

Patterns

1	n	0
2, 3	vt	/(down)S(on S)

Patterns

2,3	vt	/(in) S
2,3	vt	/(together) S
2,3	vt	S/to S/(by S)
2,3	vt	S/into or in S
2,3,4	vt	S/onto or on or upon S
4	vt	S/to S

ROAM

Patterns

vi	(from S)/(to S)
vi	DJ
vt	S/(for DT)/(for S)

ROAR

Patterns

vi	(with S)
vi	out
vt	/(out) S

ROAST

Patterns

vt	S/(in S)
vt	S/(over S)
vt	PX/(at or by S)
vi	(for) DT
n	0
aj	S

ROB

Patterns

vt	S/(of S)
----	----------

ROBE

Patterns

vt or vi	(NM or PX)/with or in S
n	0

ROLL

Meanings (verbal only)

- | | |
|----|---|
| 1 | to move on an axis, |
| 2 | to move on wheels, or be moved in a wheeled vehicle |
| 3 | to pass or elapse |
| 4 | to flow and swell |
| 5 | to make a loud rising and falling sound |
| 6 | to form into a ball or cylinder |
| 7 | to turn or move in a circular motion |
| 8 | to rock, as the ship rolled |
| 9 | to flatten under a roller |
| 10 | to advance, as now we're rolling |
| 11 | to move in a circular motion |
| 12 | to beat a drum |
| 13 | to pronounce with a full or trilling sound |
| 14 | to wrap |
| 15 | to recur in a cycle |
| 16 | to reduce to a previous level |
| 17 | to arrive in great numbers |
| 18 | to abound in |
| 19 | to reduce to a smooth round form |

Patterns

- | | | |
|-------|----|---|
| 1 | vi | (about S) |
| 1 | vt | S/(about S) |
| 2, 10 | vi | (along)/(in S)/(to, toward, down, along, into, through, part, by S) |
| 2 | vt | S/(in S)/(to, toward, down, along, into, through, past, by S) |
| 3, 11 | vi | by or on |
| 4 | vi | against or along S |
| 5 | vi | 0 |
| 6 | vt | S/in or into S |
| 6 | vt | /up S |
| 7 | vt | S/(around)/(in S) |
| 8 | vi | 0 |
| 9 | vt | /out S/(with S) |
| 10 | vi | (along)/(with S) |
| 11 | vi | (down S) |
| 11 | vi | (along S) |
| 11 | vi | (through or between S) |
| 11 | vi | (into S) |
| 11 | vi | (by S) |
| 11 | vt | S/(down S) |
| 11 | vt | S/(along S) |
| 11 | vt | S/(through S) |
| 11 | vt | S/(by S) |
| 11 | vt | S/(into S) |
| 11 | vt | S/(to S) |

Patterns

12, 13	vt	S
14	vt	S/in S
15	vi	(a)round (again)
16	vt	/back S
17	vi	in
18	vi	in S
19	vt	S/into S

ROMP

Patterns

vi	(with S)/(in or at S)
----	-----------------------

ROOF

Meanings

1	top of something
2	top covering of a building
3	house or home
4	to provide with (2)

Patterns

4	vt	S/(with S)
3	n	over PSS head
1, 2	n	of S

ROOM

Meanings

1	space
2	scope or opportunity
3	interior space surrounded by walls
4	living quarters
5	people gathered in (3)
6	to occupy (4)
7	to provide with (4)

Patterns

1, 2	n	for S
3, 5	n	0
4	n	(in or at S)
6	vi	(with S)/(in or at S)
6	vi	together/(in or at S)
7	vt	S/(with S)

ROOT

Meanings

1	underground part or parts of plant
2	embedded part of bodily structure
3	source or origin
4	base
5	core or essence
6	basic tone or word part
7	to begin to grow by putting out roots
8	to establish
9	to remove completely
10	dig or turn up with the snout
11	to search by rummaging
12	to be based on

Patterns

1 - 6	n	of S
7, 8	n	take ____/(in S)
7	vt	S/(in S)
7, 10	vi	(in S)
7, 8, 12	vip	in or on S
9	vt	/up or out or away S
11	vt	through S

ROPE

Meanings

1	cord or specialized cord (lasso)
2	death by hanging
3	ropelike string of things
4	to tie with a rope
5	to tie together with a cord
6	to lasso
7	to mark off or enclose with a rope
8	to become ropelike

Patterns

1, 3	n	(of S)
1	n	(for S)
4	vt	/(up) S
5	vt	NM together
6	vt	S
7	vt	/in or off or out or round S
8	vi	0
5	n	?

ROT

Meanings

- | | |
|---|------------------------------|
| 1 | to decay |
| 2 | to fall or pass off by decay |
| 3 | to cause to decay by soaking |
| 4 | decay |
| 5 | diseases causing decay |

Patterns

- | | | |
|------|----|------------------------|
| 2 | vi | away or off or out |
| 3 | vt | (/out or off) S/(in S) |
| 1 | vi | 0 |
| 4, 5 | n | (in S) |

ROTATE

Meanings

- | | |
|---|---|
| 1 | to turn around or cause to turn around |
| 2 | to go or cause to go in a recurring succession of changes |

Patterns

- | | | |
|---|----------|-----------------------|
| 1 | vi | (around or about S) |
| 1 | vt | S/(around or about S) |
| 2 | vt or vi | (S)/(from S)/(to S) |
| 2 | vt or vi | (S)/(between S and S) |

ROTATION

Meanings

- | | |
|---|------------------------------|
| 1 | rotating in sense (1) rotate |
| 2 | rotating in sense (2) rotate |

Patterns

- | | | |
|---|---|---------------------------|
| 1 | n | of S/(around or about S) |
| 2 | n | of S/(from S)/(to S) |
| 2 | n | of S/(between or among S) |

ROUGH

Meanings (limited to governing verbal and 1 adjectival sense)

- | | |
|---|--|
| 1 | to make rough (not smooth) |
| 2 | to handle or treat roughly (violently) |

Meanings

- | | |
|---|--|
| 3 | to fashion, shape, plan, cut, roughly (incompletely) |
| 4 | to submit to hardship |
| 5 | violent |

Patterns

- | | | |
|---|-----|--------------|
| 1 | vt | S/(with S) |
| 1 | vt | S/(by G) |
| 2 | vt | /up S |
| 3 | vt | /in or out S |
| 4 | vt | it |
| 5 | ajp | (with S) |

ROUND

Meanings (limited to a few governing senses)

- | | |
|---|-----------------------------|
| 1 | to make or become rounded |
| 2 | to collect |
| 3 | to be circulated, as rumor |
| 4 | to wall a regular course |
| 5 | an arena |
| 6 | to haul in (naut) |
| 7 | to turn prow to wind (naut) |
| 8 | to develop |

Patterns

- | | | |
|------|----|-----------------|
| 1 | vt | off or out S |
| 2 | vt | up S |
| 3, 4 | n | go the ____ (s) |
| 5 | n | in the ____ |
| 6 | vt | /in S |
| 7 | vt | /to S |
| 8 | vi | into S |

ROUSE

Meanings (verb only)

- | | |
|---|----------------------------------|
| 1 | to cause game to rise from cover |
| 2 | to cause to awaken |
| 3 | to excite to action |
| 4 | to wake up |
| 5 | to become active |

Patterns

1, 2	vt	S/(from S)/(with S)
2	vt	/(up or out) S
3	vt	S/(from S)/(to S)
4, 5	vi	(from S)/(to S)

ROUTE

Meanings

1	a course traveled or to be traveled
2	set of customers on a regular (1)
3	business of dealing with (2)
4	to send along a given course
5	to fix the procedure for something

Patterns

1	n	(from S)/(to S)
2, 3	n	0
4, 5	vt	S/(through S)
4, 5	vt	S/(from S)/(to S)

ROYALTY

Meanings

1	rank, status, or power or privilege of king
2	royal person or persons
3	kingdom
4	kingliness
5	a right or payment for a right
6	share of proceeds from sales

Patterns

1, 2, 3, 4	n	0
5, 6	n	(to S)/(for S)
5, 6	n	from S/(in the amount of S)

RUB

Meanings (verb only)

1	to move (something) over something else with pressure in circular or back and forth motion
2	to put into special condition by (1) as to rub dry
3	to cause to be sore by (1)
4	to massage or polish
5	to be irritating
6	to force in by (1)
7	to remove by (1)

Patterns

1, 4	vt	S/(with S)
1	vt	S together
2	vt	S/NJ
3	vt	S
4	vt	/down S/(with S)
5	vt	S/the wrong way
6	vt	S/in or into S
7	vt	/off or out or away S
1	vi	against S
1, 3	vi	on S

RUDE

Meanings

1	coarse or crude in form or workmanship
2	ignorant or barbarous
3	discourteous
4	harsh
5	unfinished
6	sturdy and rugged

Patterns

3	ajp	to S
4	ajp	with S
1 - 6	aj	___ S

RULE (verbal and special only)

Meanings

1	to have influence over
2	to restrain
3	to govern
4	to settle by decree
5	to be the most important element of
6	to mark lines with a ruler
7	usually (fdiom)
8	to exclude by decision

Patterns

1	vip	by S
2, 3	vt	S/(with S)
4, 5, 6	vt	S
4	vi	on S
4	vt	that + cl
7	n	as a ___
8	vt	/out S

RUMMAGE

Meanings

- | | |
|---|-------------------------|
| 1 | odds and ends of things |
| 2 | a search |
| 3 | to search or ramsack |
| 4 | to turn up by searching |

Patterns

- | | | |
|------|----|-----------------------|
| 1 | n | (from S) |
| 1, 2 | n | (for S) |
| 3 | vi | through S/(for S) |
| 3 | vt | S/(for S) |
| 4 | vt | /out or up S/(from S) |

RUMOR or RUMOUR

Patterns

- | | |
|-----|---------------|
| n | that + cl |
| n | of S |
| vt | S/(about S) |
| vt | S/that + cl |
| vip | that + cl |
| vip | nominative cl |
| vip | to be S |

RUN

Meanings

- | | |
|----|--|
| 1 | to go faster than a walk |
| 2 | to move swiftly or sail |
| 3 | to move or grow unchecked |
| 4 | to flee |
| 5 | to make a quick trip |
| 6 | to take part in a contest or race |
| 7 | to finish a race in a specified position |
| 8 | to swim in migration |
| 9 | to go on schedule |
| 10 | to pass lightly and rapidly |
| 11 | to be current (story runs) |
| 12 | to climb |
| 13 | to move or speak out of control |
| 14 | to ravel |
| 15 | to be operating |
| 16 | to circulate or flow |

Meanings

- 17 to melt and flow or spread when moistened
- 18 to be wet or covered with a flow
- 19 to discharge a fluid
- 20 to extend in time, continue, be prolonged
- 21 to extend in space
- 22 to proceed into a specified condition
- 23 to be expressed
- 24 to continue at specified size, amount, etc.
- 25 to follow a specified course
- 26 to cover by running, grazing
- 27 to perform by (1)
- 28 to be subjected to
- 29 to escape by going thru
- 30 to pursue
- 31 to enter something into competition
- 32 to operate
- 33 to bring to a specified condition
- 34 to carry illegally
- 35 to thrust into something
- 36 to allow to accumulate
- 37 to make move into a specified place
- 38 to manage
- 39 to execute the step of
- 40 to trace
- 41 to publish
- 42 to stop operating from lack of power
- 43 to cause to (42)
- 44 to drive against and knock down
- 45 to speak disparagingly of
- 46 to encounter by chance
- 47 to deprive of self control
- 48 to outdo all other contestants
- 49 act, period or distance of (1)
- 50 scheduled trip of train, bus, etc. or regular delivery or sales route
- 51 a quick trip for a brief stay
- 52 continuous direction, cruise, duration
- 53 series of sudden urgent demands
- 54 a sequence, as in cards
- 55 a small swift stream, a rush of water
- 56 a period of operation of something or of liquid flow, or output of that period
- 57 a class of something
- 58 an enclosure thru which something else moves
- 59 freedom to move about
- 60 migration of fish

Meanings

61	a ravel in knitting
62	airplane approach to a target
63	scores in some sports
64	average
65	powerful competition
66	ultimately
67	hurrying
68	to collide with
69	to print
70	to come to an end
71	to force to leave
72	to use up a supply
73	to ride or drive over
74	to use up recklessly
75	to raise rapidly

Patterns

1	vi	(with S)/(to S)
2	vi	to S
2	vi	before S
2	vi	D
3	vi	(rampant)(in S)
3	vi	(riot)(over S)
3	vi	free
4	vi	from S
5	vi	(over or down or up)/(to S)/(for S)
5	vi	(over or down or up)/(to S)/to-inf
6, 16	vi	in S
6	vi	for S
7	vi	O/(in S)
8	vi	D or DT/(in S)/(to S)
9	vi	between S and S
10, 16, 21, 74	vi	through S
10, 21	vi	along S
11, 23	vi	that + cl
12	vi	over or up S
13	vi	on/(about S)
14, 19	vi	0
15, 19	vi	(D or DJ or NJ)/(for NT)
17	vi	over S
17, 20, 68, 22	vi	into S
18	vi	with S
24	vi	D or DJ/(NJ)
20	vi	DT or for NT

Patterns

25	vt	S/(NJ)
26, 27, 28	vt	S
29, 30		
30	vi	after S
31	vt	S/(in S)
32, 39	vt	S/(for NT) or (for S)/(NJ or DJ)
33, 37, 34,	vt	S/into S
35		
34	vt	S/out of S
34, 35	vt	S/thru S
35	vt	S/against S
36	vt	/up S/(at S)
38	vt	S
39	vt	S/(to-inf)
40	vt	S/back to S
40	vt	S/around S
41	vt	S/(on S)/(in S)
42	vi	down
30, 43, 44, 45	vt	/down S
46	vt	into or across S/(at S)
47	vt	away with P
48	vt	away with S
49, 55	n	0
62, 63		
50	n	from S/to S
50	n	between S and S
51	n	up to S/(for S)/(to inf)
52, 56, 57,	n	of S
59, 60		
53	n	on S
54, 61	n	in S
64	n	of the mill
65	n	for your money
66	n	in the long —
67	n	on the —
69	vt	/off S —
70	vi	out
71	vt	/out S
72	vi	out of S
73	vt	over S
75	vt	/up S
58	n	(for S)

RUPTURE

Patterns

n (in or of S)

RUSH

Meanings

- 1 to move or go swiftly
- 2 to make a swift attack
- 3 to dash rashly
- 4 to send or drive swiftly
- 5 to do or act with haste
- 6 any rushing
- 7 an eager movement of many people
- 8 haste, hurry, busyness
- 9 a sudden swift attack
- 10 necessitating hurry
- 11 characterized by hurry
- 12 to compete for a student for membership in a society
- 13 grasslike plant

Patterns

- 1 vi / (to S)
- 2 vi upon or on S/(with S)
- 3, 1 vi into S
- 4 vt S/out(of) S
- 4 vt S/through S
- 4 vt S/into S
- 5 vt S
- 6, 7 n to S
- 6, 7 n for S
- 6, 7, 9 n at S
- 6, 7, 9 n on or upon S
- 8 n (of S)
- 8 n (to inf)
- 10, 11 n S
- 12 vt NM
- 13 n 0
- 11 n in a

RUSTY

Meanings

- 1 coated with rust
- 2 not working well because of rust

Meanings

3	impaired by neglect or disuse
4	having color of rust
5	shabby, as with rust

Patterns

1, 2, 4, 5	ap	_____ S
1, 3, 5	ajp	0
2, 3	ajp	(from S)
2, 3	ajp	(with S)
2, 3	ajp	(through S)
3	ajp	(in S)