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Heidorn et al.

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[54] **METHOD AND SYSTEM FOR COMPUTING SEMANTIC LOGICAL FORMS FROM SYNTAX TREES**

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[73] Assignee: **Microsoft Corporation**, Redmond, Wash.

[*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

[21] Appl. No.: **08/674,610**

[22] Filed: **Jun. 28, 1996**

[51] **Int. Cl.**[6] **G06F 17/27**

[52] **U.S. Cl.** **704/9**; 707/104

[58] **Field of Search** 704/9, 8, 1, 10; 395/12; 707/100, 101, 102, 104

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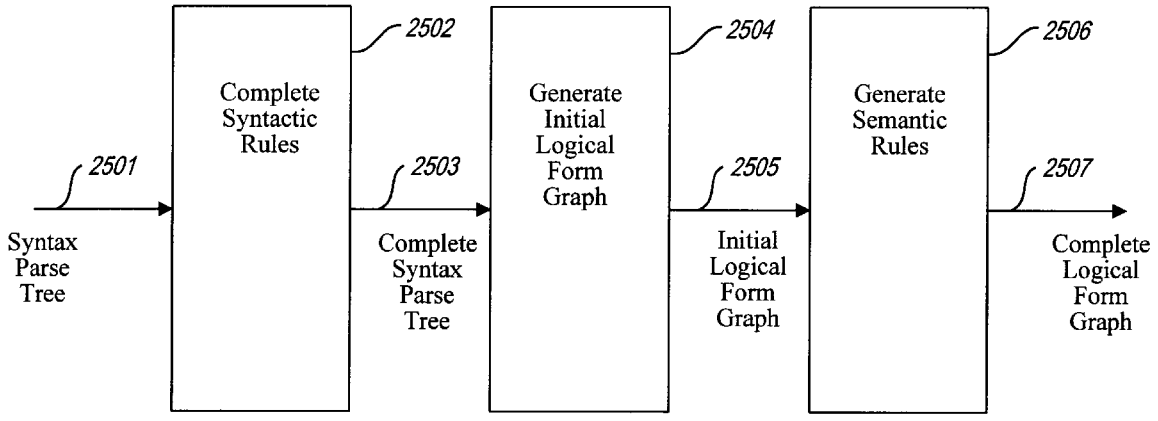
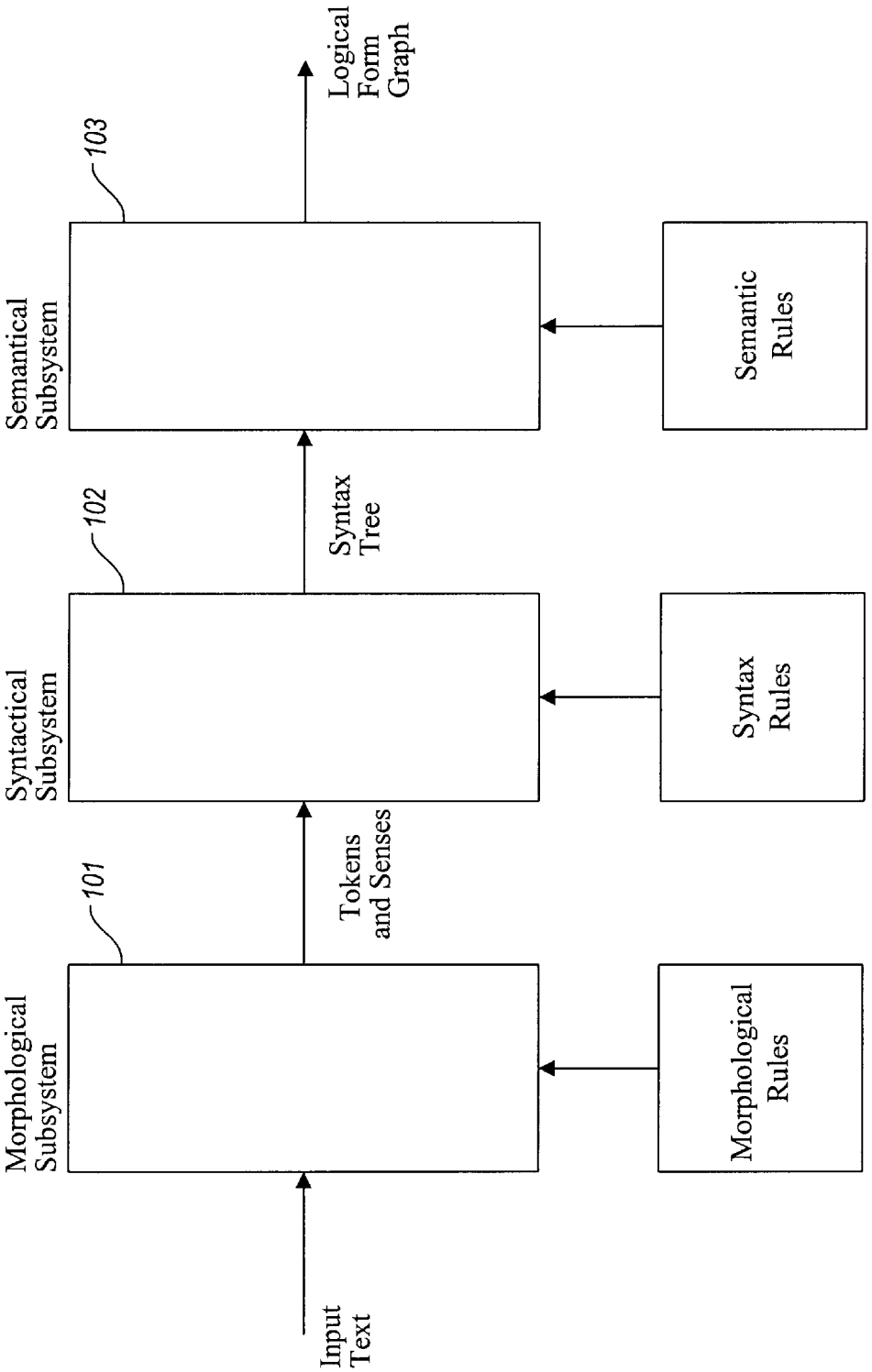
[57] **ABSTRACT**

Methods and computer systems for semantically analyzing natural language sentences. The natural language processing subsystems for morphological and syntactic analysis transform an input sentence into a syntax parse tree. Semantic analysis applies three sets of semantic rules to create a skeletal logical form graph from a syntax parse tree. Semantic analysis then applies two additional sets of semantic rules to provide semantically meaningful labels for the links of the logical form graph, to create additional logical form graph nodes for missing elements, and to unify redundant elements. The final logical form graph represents the complete semantic analysis of an input sentence.

9 Claims, 69 Drawing Sheets

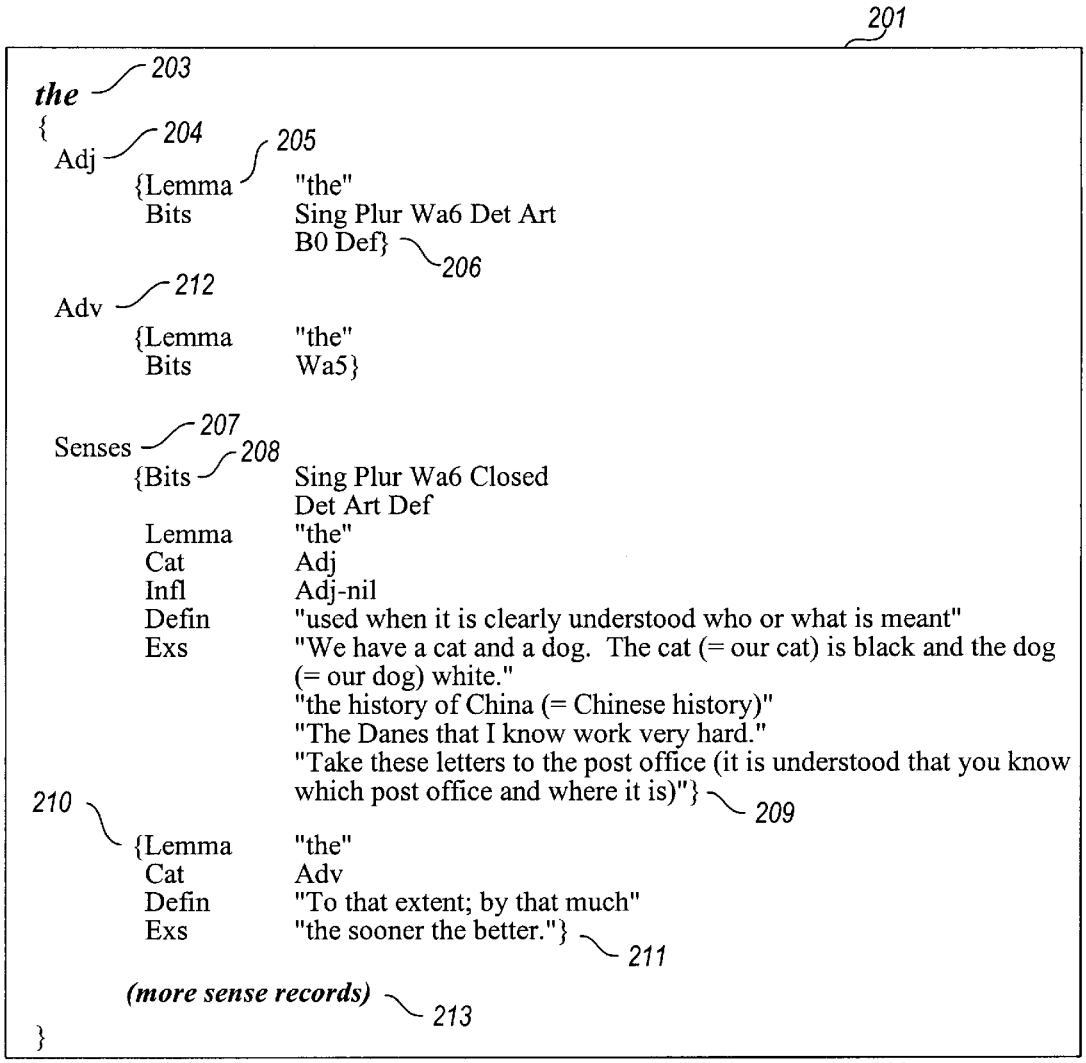
The New Semantic Subsystem





(PRIOR ART)

Fig. 1



(PRIOR ART) Fig. 2

```
whom
{
 Pron
            {Lemma      "who"
             Bits       Pers3 Sing Plur Rel Wh
                        Humn Obj Anim}
 Senses
            {Lemma      "who"
             Bits       Pers3 Sing Plur Rel Wh
                        Closed Humn Obj Anim
             Cat        Pron
             Defin      "(the object form of who, used esp. in writing and careful speech)"
             Exs        "With whom?"
                        "The man with whom he talked."
                        "You saw whom?"
                        "Whom did they see?"
                        "the man (whom) they saw arriving"
                        "a man (whom) you may know of"}
        (more sense records)
 }
```

```
i
{
 Noun
            {Lemma      "i"
             Bits       Pers3 Sing TakesAn
             Infl       Noun-irreg}
 Pron
            {Lemma      "I"
             Bits       Sing Nom TakesAn Persl
                        Humn Anim LexCap}
 Senses
            {Lemma      "i"
             Cat        Noun
             Infl       Noun-irreg
             Defin      "The ninth letter of the modern English alphabet."}

            {Lemma      "I"
             Cat        Pron
             Defin      "Used to refer to oneself as speaker or writer."}
        (more sense records)
}
```

```
met
{
  Verb
            {Lemma      "meet"
             Bits       Sing Plur Past
                        Pastpart
             Infl       Verb-meet}
  Senses
            {Lemma      "meet"
             Bits       Past Pastpart
             Cat        Verb}
}
```

(PRIOR ART) Fig. 3

```
was
{
  Verb
          {Lemma      "be"
           Bits       Pers3 Sing Past Pers1
           Infl       Verb-be } }

  Senses
          {Lemma      "be"
           Bits       Past Pastpart
           Cat        Verb}

          (more sense records)
}
```

```
my
{
  Adj
          {Lemma      "I"
           Bits       Wa5 Det Poss Pers1 Def
                      Gen A0
           Infl       Adj-none }

  Ij
          {Lemma      "my } }

  Senses
          {Lemma      "I"
           Bits       Wa5 Closed Det Poss
                      Pers1 Def Gen A0
           Cat        Adj
           Infl       Adj-none
           Defin      "belonging to me"
           Exs        "my car"
                      "my mother"}

          {Cat        Ij
           Defin      "Used as an exclamation of surprise, pleasure, or dismay"
           Exs        "Oh, my!  What a tiring day!"}

          (more sense records)
}
```

(PRIOR ART)
Fig. 4

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