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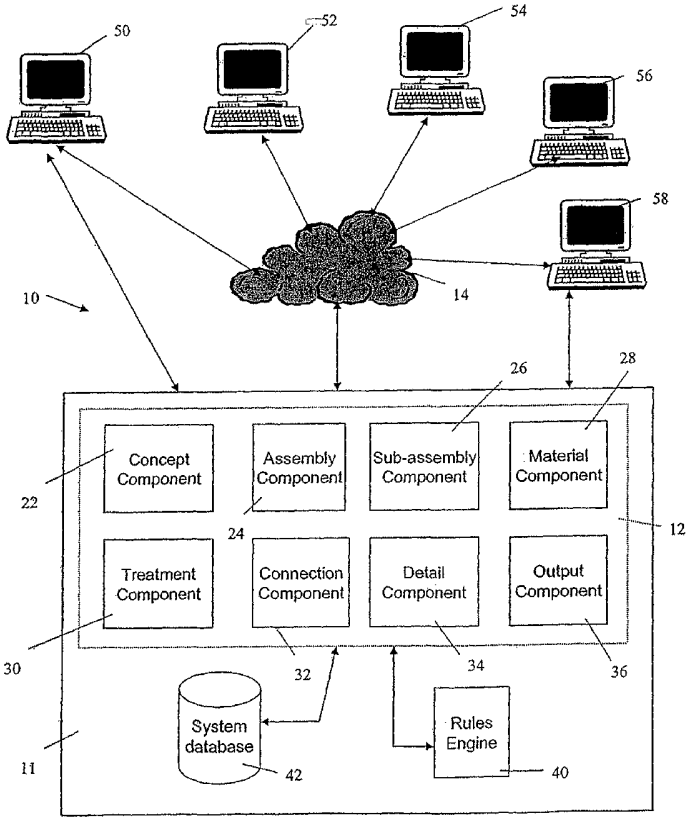
(54) Title: METHOD AND SYSTEM FOR BUILDING, DESIGNING WITH AND MANAGING ELEMENTS OF CONSTRUCTION



(57) Abstract: A comprehensive Classification System organizes all elements potentially used in the construction of building projects to assist decision makers in the pre-design search, selection, integration, evaluation, and customization decisions related to building projects. The present System also provides a mechanism for the review and approval of elements for use in a given project from the ränge of potential element alternatives. It further provides a mechanism for evaluating the aggregate Performance of construction built wiüi the approved elements. It further enables the compilation of graphic, textual, and numeric data describing the selected elements into integrated construction details, specifications, energy-use audits, cost estimates, and other such forms of construction documentation. It further provides a mechanism for tracking specific construction elements in a factory, warehouse, in transit or on a construction site, for example, and linking them to information that describes them.

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Method and System for Building, Designing With and Managing Elements of Construction

BACKGROUND OF THE INVENTION

Field of The Invention

The present invention relates to construction projects, and more particularly to a system and method for building, managing and employing technical building design configurations using a classification system.

Description of Related Art

MasterFormat™ is a classification standard for building design and construction projects organized roughly by material. It lists titles and section numbers for organizing data about construction requirements, products, and activities. By standardizing such information, MasterFormat™ facilitates communication among architects, specifiers, contractors and suppliers. MasterFormat™ is part of a larger classification system called the Omniclass Construction Classification System (OCCS™). MasterFormat™ and OCCS™ are trademarks of the Construction Specification Institute, Alexandria, VA.

Uniformat II™ is a classification standard for building design and construction projects organized roughly by location within a building. It lists titles and section numbers for organizing data about construction requirements, products, and activities. By standardizing such information, Uniformat II™ facilitates communication among architects, specifiers, contractors and suppliers. It provides a common structure linking the building program, specifications and estimates. Uniformat II™ is a trademark of Uniformat II, Plattsburgh, NY.

SpecLink™, MasterSpec™ and PerSpective™ are specification writing tools. A specifications writer using these products starts with an outline (based on MasterFormat™ or Uniformat II™, for example) of the various materials and assemblies that might be found or used in a project. Users identify those materials and assemblies that they will need for their project. Each time one is picked, others are "grayed-out" indicating that, because of the last selection, they now cannot be picked since they are incompatible with the previous selection. Not only does this reduce the possibility that a specification will be internally inconsistent, but it also simplifies and streamlines the work of the specifications writer.

CoStar™ is a software program used by commercial landlords and real estate brokers to organize and search through information about commercial leasing properties. It helps tenant brokers find space for their clients to rent, and helps landlord brokers get word to the tenant brokers. It is published in the form of an Internet-based computer application. To search its information, brokers open a blank form, type in the information they are looking for in a property, and CoStar finds all listed properties that fulfill the identified criteria.

Sweet's Catalog is a collection of manufacturer's product brochures in both hard copy and CD versions, which are used by architects to identify specific products that might be appropriate for the projects they design, and to get basic information on those they specify for use in construction. It contains information only, is classified by MasterFormat™, for example, and includes no methodology. It is published in hard copy (requiring about twenty hard-cover telephone-book-sized volumes), and as CDs that are updated quarterly and is available on the Internet. The information in Sweet's Catalog is provided by manufacturers, and its cost is largely underwritten by

insertion fees paid by the manufacturers. Even in electronic versions, although searchable, Sweet's Catalog is not interactive.

In addition to the above, U.S. Patent No. 6,625,619 to McClendon et al. describes an interactive construction product search engine, e.g., something an architect could use to connect with and download manufacturers' data describing product properties. A search engine available at www.4specs.com, provided by 4specs.com of Heber City, Utah, allows a user to search for web sites with construction production information. Other online references such as www.firstsourceonl.com, provided by First Source of Norcross, Georgia, provide a library of commercial building product information. Still other web sites such as www.wbdg.org, provided by the National Institute of Building Sciences of Washington, D.C., provide a portal for integrated whole building design techniques and technologies.

Also, Architectural Data Systems (ADS) produces a computer-aided design (CAD) interface that automates the creation of construction detail drawings, specifications, and schedules from standards contained in a data library. However, it has no inherent "intelligence", and does not guide users toward compatible selections or make recommendations. Instead, it requires users to have already selected the needed construction components. As objects are selected from the various 'object catalogs' in programs like Autodesk's Architectural Desktop, ADS simply but automatically generates the requested details, specifications, and schedules.

The related art is limited in that, among other things, it does not disclose standardizing a complete, comprehensive system for cataloguing construction elements at every scale, for example, from form to detail to connection to assembly to subassembly to material to treatment. Nor does the related art disclose automatically

compiling subassembly drawings into connections and complete detail drawings through the use of standardized "insertion points" and "stretch commands". Nor does the related art disclose automatically compiling property information to report back to the user on the combined effect of several subassemblies. A further drawback to the prior art is the inability to hold recommended solutions for all of the needed subassemblies for comparison against one another to ensure that all needed subassemblies have been identified and are compatible, and that, as a composite, they fulfill the needed criteria. Nor does the prior art provide options based on a user's experience level. Nor does this art allow for "what if" explorations to see the effect on a detail design of changing one or more of its performance criteria.

SUMMARY OF THE INVENTION

The present invention solves the above and other shortcomings by providing a system and methodology for classifying information related to the identification, selection, compilation, evaluation, customization, documentation and tracking of the elements of construction projects. The invention assists in organizing and navigating the enormous range, depth, and quantity of information published in the construction industry, facilitating its distribution to primary users such as design professionals, builders and property managers for their use in the technical design of projects and the preparation of the contract documents needed for construction. The present invention further assists secondary users such as manufacturers and trade associations in distributing and collecting information related to construction elements.

Definitions

As used in the description herein and throughout the claims that follow, the meaning of "a," "an," and "the" includes the plural reference unless the context clearly

dictates otherwise. Also, as used in the description herein and throughout the claims that follow, the meaning of "in" includes "in" and "on" unless the context clearly dictates otherwise. Terms used in the classification system have unique meanings influenced both from traditional construction usage and from the need for them to be unique and unambiguous within the classification system. In the present description, the following terms will have the following definitions unless the context clearly dictates otherwise.

Classification System: A system of organized elements such as described and illustrated herein.

Taxonomy: A classification system.

Element: A limited but relative scope of construction defined at any of several scales, or a specific physical piece of construction manifested at such a scale. Elements can therefore include forms, details, connections, assemblies, subassemblies, materials, and treatments (e.g., material modification processes), or a specific piece of construction at any of those scales.

Subclass/Subgroup: Any of the levels of hierarchy within a taxonomy.

Project: A building or other man-made construction. Projects are typically comprised of elements documented with details and specifications.

Detail: A drawn description memorializing decisions made related to the configuration and relationship of the elements located at a specific place within a built project.

Specification: A written description memorializing decisions made related to the selection and application of elements within a built project.

Contract Documents: The drawings, including details, and specifications that form a part of an agreement between a project owner and builder for construction of a project.

Criterion: Any term that establishes a measure of successful selection and implementation for an element.

Criteria: Plural of criterion.

Tag: A numeric designator for a particular item within the taxonomy.

According to a first broad aspect of the present invention, there is provided a classification system for organizing and managing information related to the selection and implementation of construction elements of a building, wherein the system operates at multiple levels of assembly from, for example, overall form to assembly to subassembly to product to material to material treatment to connection to detail.

According to a second broad aspect of the invention, there is provided a methodology for using the system of the present invention to guide users with various levels of expertise through the information to find appropriate construction elements based on the properties, or design criteria, required of the needed construction elements. In so doing, users can employ a variety of factors such has aesthetics, functionality, strength, durability, ease of installation, cost and environmental sustainability.

According to a third broad aspect of this invention, there is provided a system for assessing the combined performance levels likely to result from the selected combination of construction elements.

According to a fourth broad aspect of this invention, there is provided a standardized system for the preparation of graphic depictions of construction elements

in a way that allows depictions of different but alternative construction elements to be used interchangeably.

According to a fifth broad aspect of this invention, there is provided a system for compiling information about the selected construction elements into comprehensive, aggregated, coordinated, compatible documents including internally aligned details and interlineated specifications.

According to a further broad aspect of the present invention, there is provided a system for educating design professionals regarding the issues involved in selecting construction elements and designing details using them.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic depicting an architectural layout of one embodiment of the system of the present invention.

FIGS. 2 and 3 are portions of a sample classification system in accordance with one aspect of the present invention.

FIGS. 4-8 are flow charts depicting process steps taken in assisting users in building design details in accordance with several embodiments of the present invention.

FIG. 9 is a sample detail drawing in accordance with one aspect of the present invention.

FIGS. 10-17 are sample screen layouts depicting various aspects of the present invention in accordance with an online embodiment of the present invention.

FIG. 18 is a sample photograph of a construction element marked with a bar code in accordance with one aspect of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings, like numbers indicate like parts throughout the views.

As shown in the embodiment of the invention depicted in Fig. 1, the present invention comprises a system 10 having a detail engine 11 for building, storing and managing information related to the elements that constitute construction details and to design configuration, including the identification, selection, compilation, evaluation, customization and documentation of the elements of construction projects. Detail engine 11 can be provided with a component group 12 comprising one or more functional or logical components such as concept component 22, assembly component 24, sub-assembly component 26, materials component 28, treatment component 30, connection component 32, detail component 34, and output component 36, which are described more completely hereafter. Detail engine 11, component group 12 and individual components can be accessed by a stand-alone computer operating software embodying the present invention, or by computers over a network 14 such as the Internet, for example. It will be appreciated that system 10 can comprise component group 12, individual components, detail engine 11, and/or network 14 individually or in combination.

As further shown in Fig. 1, detail engine 11 can further comprise a rules engine 40 and a database 42 in communication with component group 12. Rules engine 40 comprises logic and rules which constrain the system so as to produce only valid configurations and combinations in accordance with the present invention. Such rules can be, for example, in the form of "if-then" type statements (e.g., "if a user selects a "roof" form, then provide options for a sloped and a pitched roof"), and/or in the form of "repeat-until" type statements (e.g., "repeat the offering of a construction

concept to the user until the user indicates that all concept information has been entered) and/or in the form of other logical constructs known to those skilled in the art. Database 42 stores information pertaining to concepts, details, assemblies, treatment options, sub-assemblies, connections, materials, outputs, rules, logic, users (e.g., consumer users, manufacturer users, architect/builder users, administrative users, etc.) and other information and programming in accordance with the present invention. In one embodiment, database 42 stores a classification system and/or taxonomy of building details to assist users in developing custom and acceptable building detail drawings and specifications.

Concept component 22 manages information about detailing concepts, such as levels and styles of detailing, and forms of construction, for example. Concept component is also in communication with rules engine 40 and the remaining components to ensure that design element selection options and product recommendations presented to users downstream of the concept component are appropriately adjusted to reflect only viable options. For example, if a user is determining options for roofing elements for a pitched roof, he or she will not be concerned with options for a sloped roof. Thus, in this example, the present invention operates through the concept component and rules engine to ensure that only appropriate selection and compilation functions are available at the time of selecting details from the detail component, based on elements selected via the concept component.

Assembly component 24 manages information about various assembly types and options, such as vertical assemblies (e.g., indoor, outdoor, enclosing), horizontal assemblies, and component assemblies, for example. Assembly component is also in communication with rules engine 40 and the remaining components to ensure that

design element selection options and product recommendations presented to users downstream of the assembly component are appropriately adjusted to reflect only viable options.

Sub-assembly component 26 manages information about available sub-assembly element options, such as surfaces, supports, separations, systems and subcomponents, for example. Sub-assembly component is also in communication with rules engine 40 and the remaining components to ensure that design element selection options and product recommendations presented to users downstream of the sub-assembly component are appropriately adjusted to reflect only viable options.

Materials component 28 manages information about available material options, such as inorganic materials, organic materials, and amalgams, for example. Materials component is also in communication with rules engine 40 and the remaining components to ensure that design element selection options and product recommendations presented to users downstream of the materials component are appropriately adjusted to reflect only viable options.

Treatment component 30 manages information about available material treatment options, such as cutting, shaping, texturing, modification and coating, for example. Treatment component is also in communication with rules engine 40 and the remaining components to ensure that design element selection options and product recommendations presented to users downstream of the treatment component are appropriately adjusted to reflect only viable options.

Connection component 32 manages information about available connection options, such as internal connections, terminations, interruptions and terminations, for example. Connection component is also in communication with rules engine 40 and the remaining components to ensure that design element selection options and product

recommendations presented to users are appropriately adjusted to reflect only viable options.

Detail component 34 manages information about construction details, such as underground details, facades, roof edges and mid-roof options, for example. Detail component is also in communication with rules engine 40 and the remaining components to ensure that design element selection options and product recommendations presented to users are appropriately adjusted to reflect only viable options.

Output component 36 manages information about documentation associated with selected options, such as drawings and text specifications, for example, as will be described more completely hereinafter.

In one embodiment, the present invention further includes a corrections component and a change management component (not shown in Fig. 1) as part of detail engine 11. Corrections component can include an assessment subcomponent so as to provide project assessments based on comparing user-identified performance criteria with performance levels achieved by selected elements from a user session, in terms of design aesthetics, constructability and required operations such as cleaning, maintenance and repair, for example. Corrections component can further include an adjustment subcomponent to allow for adjustments to be made to selected design elements for the purposes of reassessing the overall design and meeting stated (or re-stated) criteria, for example. In one embodiment, adjustments can be made by the user, or the user can ask the system of the present invention to make adjustments as deemed appropriate.

Change management component can be provided to receive inputs from external sources which require incorporation into the classification system of the

present invention. For example, if a manufacturer no longer provides a certain trim element in wood, the change management component can obtain and/or retrieve this information and update the classification system accordingly. Further, the change management component can obtain or retrieve zoning, building or other code information applicable in particular jurisdictions which may affect selection options from the classification system. In one embodiment, change management is passive and waits for external sources to access the system before communicating changes to the classification system. In another embodiment, change management component can employ agents as are known in the art to search a network such as the Internet for available changes, whether those changes are from standards-writing organizations, manufacturers, legislators or otherwise.

Users of the system of the present invention can be, for example, architects and other design professionals 50, builders 52, consumers 54, product manufacturers and trade associations 56, and system developers/administrative users 58 who help build, modify and maintain the system 10 of the present invention. One characterization of users of the system of the present invention is either to view a user as a data provider (e.g., a manufacturer submitting information about construction products) or a data user (e.g., a design professional using the manufacturer's submitted information in creating a detail and specification). The present invention provides interfaces and logic to assist individuals ranging from novices to experts.

Figs. 2 and 3 show an illustrative taxonomy for use in connection with the present invention. In order to be effective for the various user types, the present invention requires a comprehensive classification system. As shown in Figs. 2 and 3, for example, the present invention includes a Concept group 60, an Assembly group 61, a SubAssemblies group 62, a Materials group 63, a Treatments group 64, a

Connections group 65, a Details group 66, a Corrections group 67 and a Documents group 68. Each group represents a sample organizational hierarchy of information which may be stored and manipulated via corresponding components shown and described in connection with Fig. 1.

In one embodiment of the invention, the Concepts, Assemblies, Subassemblies, Materials and Treatments groups can comprise a Selection set 71. Further, the Connections and Details groups can comprise a Compilation set 72. The Corrections group can comprise a Corrections set 73 and the Documents group can comprise a Documentation set 74. In one embodiment of the invention, the Assemblies, Subassemblies, Material, Treatments and Connections categories are built using information provided by one or more manufacturers or trade associations 56.

As shown in Figs. 2 and 3, the Concept group can be designated as the 1000 group, with specific sub-group such as the "Levels" 1100, "Styles" 1200 and "Forms" 1300 sub-categories. The Levels sub-group can be used to identify the level of detailing complexity envisioned for a building project, for example, while the Styles sub-group represents the style of the detailing and the Forms sub-group represents the building's basic forms. Each sub-group can also be provided with its own sub-categories or divisions to ensure that all categorizations are documented and labeled. Similarly, the Assembly group 61 can be designated as the 2000 group, with a "Verticals" sub-group labeled as 2100, a "Horizontals" sub-group labeled as 2200, and a "Components" sub-group labeled as 2300. As further shown in Fig. 2, the Subassemblies group 62 can be labeled 3000, with various sub-group headers as the "Surfaces" (labeled 3100), "Supports" (labeled 3200), "Separations" (labeled 3300), "Systems" (labeled 3400) and "Subcomponents" sub-groups (labeled 3500).

As shown in Fig. 3, the Materials group 63 can be designated as the 4000 group, with an "Inorganics" sub-group labeled as 4100, an "Organics" sub-group labeled as 4200, and an "Amalgams" sub-group labeled as 4300. As further shown in Fig. 3, the Treatments group 64 can be labeled 5000, with various sub-group headers as the "Cut" (labeled 5100), "Shaped" (labeled 5200), "Textured" (labeled 5300), "Modified" (labeled 5400) and "Coated" sub-groups (labeled 5500). The Connections group 65 can be designated as the 6000 group, with an "Internal" sub-group labeled as 6100, an "Interruption" sub-group labeled as 6200, and a "Termination" sub-group labeled as 6300. As further shown in Fig. 3, the Details group 66 can be labeled 7000, with various sub-group headers as the "Underground" (labeled 7100), "Façade" (labeled 7200), "Roof Edge" (labeled 7300), and "MidRoof" sub-groups (labeled 7400).

As further shown in Fig. 3, the Corrections group 67 can be designated as the 8000 group, with an "Assessment" sub-group labeled as 8100, and an "Adjustment" sub-group labeled as 8200. The Documentation group 68 can be labeled 9000, with a "Drawings" sub-group labeled as 9100 and a "Specification" sub-group labeled as 9200.

The classification system in accordance with the present invention can also appear as shown in Table 1 below, with Level 1 representing the groups, Level 2 representing subgroups, and Level 3 representing divisions of the subgroups. As shown in Figs 2 and 3, the present invention contemplates that each division may be further subdivided into smaller elements depending upon the level of detail involved with the given division or element. It will be appreciated that the classification system in accordance with the present invention is organized using a hierarchy that

corresponds specifically to the process of detail design and can be used to organize various design approaches whether from materials to concepts or from concepts to materials, for example. It will be appreciated that construction elements can be identified using the particular sequential series of numerical identifiers pertaining to the element's connection type, assembly type, subassembly type, material type or treatment type, for example. It will also be appreciated that any given construction element can be marked with a bar code or other readable code corresponding to the particular sequential series of numerical identifiers that identify it for any relevant purpose, such as, for example, inventory control, linkage to installation instructions, or its location within a project. An example of this code information is shown at 245 in Fig. 18.

Table 1.

Level 1 **Groups**	**Level 2** **Subgroups**	**Level 3** **Divisions**
1000 Concepts	1100 Levels	1110 Perception 1120 Possibility
	1200 Styles	1210 Class 1220 Mode 1230 Strategy
	1300 Forms	1310 Roofs 1320 Facades 1330 Structures 1340 Cores 1350 Landscapes
2000 Assemblies	2100 Vertical	2110 Indoor 2120 Outdoor 2130 Envelope
	2200 Horizontal	2210 Indoor 2220 Outdoor 2230 Envelope
	2300 Components	2310 Glazed Walls 2320 Doors & Windows 2330 Stairs 2340 Railings 2350 Equipment 2360 Fixtures & Furnishings
3000 Subassemblies	3100 Surfaces	3110 Coatings 3120 Units 3130 Strips 3140 Panels 3150 Integrals
	3200 Supports	3210 Connectors 3220 Substrates

		3230 Planes 3240 Armatures 3250 Footers
	3300 Separations	3310 Multi-media 3320 Water 3330 Energy/Vapor 3340 Air 3350 Fire/Smoke 3360 Acoustic
	3400 Systems	3410 Mechanical 3420 Plumbing 3430 Electrical 3440 Data
	3500 Subcomponents	3510 Glazed Wall Subcomponents 3520 Door & Window Subcomponents
4000 Materials	4100 Inorganic	4110 Raw 4120 Hydrated 4130 Vitrified 4140 Smelted
	4200 Organic	4210 Raw 4220 Distilled 4230 Synthesized
	4300 Amalgams	4310 Mineral 4320 Wood 4330 Glass 4340 Stratified
5000 Treatments	5100 Cut	5110 Rough-Cut 5120 Trimmed 5130 Punctured
	5200 Shaped	5210 Machined 5220 Abraded 5230 Worked
	5300 Textured	5310 Machined 5320 Abraded 5330 Expanded
	5400 Modified	5410 Decay-resistant 5420 Corrosion-resistant 5430 Fire-resistant
	5500 Coated	5510 Surface 5520 Penetrating
6000 Connections	6100 Internal	6110 Run 6120 Corner
	6200 Interruption	6210 Transfer 6220 Joint 6220 Penetration
	6300 Termination	6310 End 6320 Surround
7000 Details	7100 Underground	7110 Footer
	7200 Façade	7210 Grade 7220 Spandrel 7230 Soffit 7240 Balcony
	7300 Roof Edge	7310 Stop 7320 Parapet 7330 Eave 7340 Base
	7400 MidRoof	7410 Ridge 7420 Valley 7430 Curb
8000 Corrections	8100 Assessment	8110 Design 8120 Constructability 8130 Operations
	8200 Adjustment	8210 Attachment 8220 Movement 8230 Closure

		8240 Water Penetration 8250 Accumulated Precipitation 8260 Energy Transfer 8270 Vapor Envelope
9000 Documents	9100 Drawings	9110 Drafting 9120 Organization
	9200 Specifications	9210 Text 9220 Schedule

Detailed information about each group, sub-group and division can be found, for example, in the book "The Cuisine of Construction" by Barry D. Yatt, © 2005, which is incorporated herein by reference in its entirety. It will be appreciated that database 42 can be populated with information about each available element, and rules engine 40 can be provided with one or more programs developed to specify relationships and constraints on the elements. For example, if gypsum board interior walls are selected for a construction project, the system of the present invention, through the rules engine, could be set up to exclude truss studs as a support subassembly option since such studs work only with plaster interior walls.

In one embodiment of the invention, manufacturers 56 can submit element information which is appropriately tagged so as to provide performance data, recommended configurations, pricing and availability information, and other information, to the user during the selection process in accordance with the present invention. In this way, the manufacturer can gain exposure to users it may not otherwise be exposed to, while the user can find out about suitable products not otherwise known, and gain more robust information about elements selected for the user's project. In addition, change management component can operate to ensure that the pricing, availability and other manufacturer information is kept current. As such, the present invention provides a highly dynamic construction project detail selection system, which can allow users to build price quotes and adjust designs based on price and other factors. The present invention further offers manufacturers an opportunity

to display advertising and other marketing materials in connection with available selection options. In the tagged implementation, the manufacturer user can, for example, download data formatting information appropriate to its particular tag from the system of the present invention, so as to be able to appropriately format the manufacturer's element information. Once this is done, the manufacturer can upload the tagged element information and the system of the present invention can then incorporate it into database 42. Once incorporated, the tagged element information can be readily accessed during use of the present invention, and alternative choices with respect to a particular element can be readily viewed and considered.

The system of the present invention can assist users of various experience levels. In one embodiment of the invention, the system provides a unique process flow depending upon whether the user is knowledgeable enough to make all selections without assistance, whether the user can make selections but needs performance confirmation, or whether the user desires or requires that the system of the present invention make selections based on required levels of performance, and also confirm achieved performance for the user.

Fig. 4 shows a flow chart illustrating how, for a highly experienced user A, the present invention operates to determine a building design output. Such a highly experienced user A is knowledgeable enough to make all selections without selection assistance from the present invention. As at step 80, the present invention initially receives and/or collects basic user and project information. Such basic data can include, for example, Project Name, Zip Code, Jurisdiction, Status (new or renovation), Size, Fire Suppression, Street Frontage, and Program (occupancy type or use group). The present invention can also determine and/or inquire of the user as to

the user's preferred focus at this step, such as whether that focus is generic (element-based) or proprietary (product-based). A generic or element-based focus proceeds based on elements, such as, for example, styles, forms, assemblies, subassemblies, materials, and treatments. A proprietary or product-based focus, in contrast, proceeds according to user-selected products, such as, for example, "Armstrong foil-faced R-19 fiberglass batts".

At step 80, the present invention can also receive/collect the user's designation of project areas, which can be subsets within the project that share a common set of elements (e.g., styles, forms, assemblies, subassemblies, materials, and treatments), and therefore a common set of details and specifications. Some projects may have only one such area, while others may have a few or even many such areas. In one embodiment of the invention, users can input a name for each area and provide a brief description of what makes it distinctive. Any such names can then be used in subsequent user interfaces to identify the area of the project currently being processed. At step 80, the present invention can further receive/collect a user's complete list of needed details (e.g.: parapets or eaves) based on the basic configuration of the design in each project area. In one embodiment, the users can simply pick detail types from an offered list in a drop-down menu on a user interface, for example.

From the inputted Zip Code, Jurisdiction, and Status, the present invention can access database 42 or an external information source (not shown in Fig. 1) to look up applicable building codes, for example. With knowledge of applicable building codes, the present invention can further assist in determining available options for a given project design. From the inputted Size (area and height), Fire Suppression, and Street Frontage, the present invention can suggest possible Construction

Classifications for selection by the user. From the selected Construction Classification and inputted Occupancy Type, the present invention can look up applicable provisions in applicable Building Codes, use them to narrow the range of qualified elements (e.g., assemblies, materials, etc.), and display only qualified elements in subsequent screens. Again, such a lookup can take place in database 42 to the extent database has been appropriately updated, such as through input from user 58 or through a direct connection to an external resource for such codes and provisions. It will be appreciated that any connection to an external resource can be accompanied by suitable programming to collect updates via upload/download at certain periodic times and dates, or upon receiving notification that any such updates are available, in accordance with procedures as are known in the art.

Upon a User type A selecting Focus G (generic), the present invention then receives the user selected elements at step 82. In one embodiment, the invention asks the user to choose element sets for each indicated area, including choices for Forms, Styles, Assemblies, Subassemblies, Materials, and Treatments. In one embodiment of the invention, in order to continue with this sequence, users must specify all elements at all levels, and those who do not can be directed to the User C approach described hereinafter, where the present invention can suggest choices for the missing elements. All selections made are saved for use in ensuing steps.

Upon receiving the user selected elements at step 82, and if so directed by the user, the present invention can then search the products database (e.g., as part of database 42) to find products whose performance fulfills the requested criteria, as at step 84. Found products can be listed and ranked in order of closeness of match. In one embodiment, the user can determine how many suggestions he or she wants presented.

In one embodiment, the user can be asked to identify products to be used from those suggested. If any are accepted, generic data can be replaced with appropriate proprietary data. In one embodiment of the invention, where no product is selected for a particular element or group of elements, the present invention will proceed using generic information. Alternatively, a User type A selecting Focus P (proprietary), would follow the procedure listed for Figure 7 or 8, as described hereinafter.

At step 86, the present invention can proceed to build the detail, and a sample detail portion 95 is shown in Fig. 9. This involves first compiling subassemblies and products into assemblies. In doing so, the present invention can search the database for the CAD drawing files, for example, that correspond to the selected subassemblies or products. In one embodiment, the search can be conducted using imbedded attributes that match the performance criteria categories and listings to the alternative elements.

The present invention can also format all drawings in the database in a standard way, such as by appropriate programming, for example, to make each drawing interchangeable with all other drawings showing subassemblies or products of the same type. This can involve drawing each with a standard element thickness, ready to be stretched to the specific thickness needed. This can further involve drawing each for a standard set of conditions, so that each drawing is actually a series of drawings depicting internal conditions such as straight and curved runs and inside and outside corners, termination conditions such as copings, casings, fascias, eaves, sills, heads, and jambs, and interruption conditions such as joints (shrinkage, knock-out, expansion, and geotech), penetrations, and transfers (vertical and horizontal), for example. This can also involve drawing each with an embedded set of insertion points at strategic locations (e.g., drawing support subassemblies with unique

insertions points embedded at top and bottom inside and outside edges, the places where interior and exterior surface subassemblies would be attached). This can also involve formatting drawings in compliance with the latest release of the National CAD Standard for layering conventions, line weights, and symbols, for example.

In addition, each series of drawings can be adjusted so that the thickness between faces corresponds to the subassembly thickness selected. This can be accomplished with no direct action by the user. The present invention can further gather the individual files for all of the subassemblies that constitute a single assembly, and align the individual thickness-adjusted subassembly drawings using their corresponding insertion points to create a series of assembly drawings for each of the specific conditions described above. Next, the invention can save the compiled set of drawings as a new file representing the selected assembly.

As part of building the detail, the present invention can further compile Assemblies into Connections. Each of the details previously identified by a user as being needed is composed of a series of connections. The present invention provides a system that knows which connections are needed to make each of those details, which enables further processing as described hereafter. For example, the present invention can gather all of the individual files that contain drawings of the assembly conditions needed for one of the connections. The present invention can then merge the assembly condition drawings into a single connection drawing using insertion points standardized to correspond to insertion points in a range of alternative adjacent construction elements. The present invention can further show compiled connections to the user. If several options meet a similar number of performance criteria, all options can be shown. The user can then be asked to select an option. If all proposed

connections are rejected, the user can be brought back in the process to make different selections.

As the final part of building the detail, the present invention can further compile connections into details. Since the present invention can deduce the needed connections from the requested details, going back from connections to details requires only re-assembly. As such, the present invention can gather all of the individual files that contain drawings of the connections needed for one of the details, and merge the connection drawings into a single detail drawing using standard insertion points. Then, the present invention can show the compiled details to the user, and ask the user to accept the proposed detail. If it is rejected, the user can be taken back in the process to make different selections.

At step 88, the present invention can produce output, such as through output component 36 shown in Fig. 1. In one embodiment of the present invention, the output comprises compiling the element specifications into a comprehensive specification. During this process, the present invention can search the database for the specifications files that correspond to the selected subassemblies or products. In one embodiment, specifications for different elements or products can be interleafed and compiled into a single specifications section as sections are defined by MasterFormat® or UniformatII®. In one embodiment, all text can be formatted using CSI SectionFormat™ standards and conventions. Once this process has taken place, the compilation can be shown to the user for confirmation.

Once these steps have been taken for a first area, the entire sequence can be repeated for each additional area. When drawings and specifications for all areas have been created, the user can then be queried for his or her desired output format. For example, the user can request that the drawings and specifications be outputted to

the user's computer (e.g., 50, 52, 54 in Fig. 1) in .doc, .rtf, .txt, .dwg, .dxf, .xls, or any number of other standard computer file formats. From this downloaded information, the user can then compile the drawings and specifications into a single set of drawings and a single specification book. Alternatively, the user can allow the present invention to manipulate the output. For example, the present invention can arrange the drawings into sheets guided by the National CAD Standard and arranged by areas where appropriate and produce a new compiled set. Similarly, the present invention can compile the individual specifications sections by DetaiLogic™, MasterFormat® or UniformatII® number into a complete specifications book.

Fig. 5 shows a process in accordance with the present invention for a user type B, which can be a user who makes selections but has the present invention compare predicted performance with desired performance levels. As shown in Fig. 5, user input project data can be received as at step 90 following substantially the same procedure described above in connection with step 80 for user A. Next, as at step 92, the present invention can receive user B's list of performance categories, identifying performance criteria for each category that they feel may be germane. In one embodiment, the present invention can ask the user to repeat the process for as many elements as the user cares to establish. In a particular embodiment of the present invention, the user can be asked for and can submit: the relative priority of each category of performance, a qualitative range of performance required, and a quantitative range of performance required. In one embodiment, the quantitative range of performance required can include a quantity, a unit of measure, and/or a standard test for measuring performance, such as for example, the test designation, test publisher and test version.

Where only qualitative criteria are identified, preventing the system of the present invention from conducting an objective search of its database, the system of the present invention can make the list available to manufacturers if so requested by a user, so that the manufacturer can help the user identify appropriate quantitative performance criteria. Where it is possible to describe the possible range of qualitative criteria through a limited number of easily-understood descriptors, the present invention can list them in a menu for selection by the user, and then propose corresponding quantitative criteria.

Once quantitative performance criteria are received, the system of the present invention can ask the user to choose element sets for each designated Area as at step 94, including choices for Forms, Styles, Assemblies, Subassemblies, Materials, and Treatments, for example. To continue with this sequence, Users must specify all elements at all levels. Those who do not can be directed to the User C approach as described below, and the system of the present invention will suggest choices for any missing elements. Under such a scenario, Users can choose any number of elements, in any order, and leave blanks for any for which they would like suggestions from the present invention. All selections made can be saved for use in ensuing steps.

Next, as at step 96, the present invention can compile performance data for each of the chosen element sets. For example, for all of the subassemblies in a given assembly, the present invention can add the R-values, the dollar costs, the weight, the STC rating, the fire-resistance rating, etc. Where a user requests values for assemblies as a whole, the present invention can tabulate such values along with the totaled values on the constituent subassemblies to be able to report any discrepancies. Next, as at step 98, the present invention can show results of the performance

compilation to the user, noting discrepancies between what was requested and what will likely be achieved, and ask for confirmation of the assessment as at step 100. If rejected, the user can either revise the performance criteria requested as shown by the dashed line in Fig. 5, or select a different combination of elements as shown by the dotted line in Fig. 5. If accepted, the system of the present invention can continue to select products as at step 102. In this step, the present invention can search the products database to find products whose performance fulfills the requested criteria. When the search is complete, the products can be listed for the user and ranked in order of closeness of match. The user can determine how many suggestions he or she wants presented.

In one embodiment, the user can be asked to identify products to be used from those suggested. If any are accepted, generic data can be replaced with appropriate proprietary data. In one embodiment of the invention, where no product is selected for a particular element or group of elements, the present invention will proceed using generic information. The steps of building the detail (step 104) and providing the output (step 106) can proceed as described above in connection with user type A.

Fig. 6 shows a process in accordance with the present invention for a user type C, which can be a user who desires or requires that the system of the present invention make selections and confirm performance. As shown in Fig. 6, user input project data can be received as at step 110 following substantially the same procedure described above in connection with steps 80 and 90 for users A and B, respectively. Further, steps 112 (receive performance criteria) and 114 (recommend elements) follow substantially the same procedure as described above in connection with user type B in steps 92 and 94, respectively, of Fig. 5. At step 116, the user is asked if the selected

element(s) are acceptable. If not, the procedure can return to step 112 to revise performance criteria. If so, the procedure can advance to step 118, where performance data are compiled, and step 120, where performance assessment is outputted. At step 122, the user is asked to confirm the assessment. If rejected, the user can either revise the performance criteria requested as shown by the dashed line in Fig. 6, or ask for a different combination of elements as shown by the dotted line in Fig. 6. If accepted, the system of the present invention can continue to select products as at step 102. In this step, the present invention can search the products database to find products whose performance fulfills the requested criteria. When the search is complete, the products can be listed for the user and ranked in order of closeness of match. The user can determine how many suggestions he or she wants presented.

In one embodiment, the user can be asked to identify products to be used from those suggested. If any are accepted, generic data can be replaced with appropriate proprietary data. In one embodiment of the invention, where no product is selected for a particular element or group of elements, the present invention will proceed using generic information. The steps of building the detail (step 104) and providing the output (step 106) can proceed as described above in connection with user type A.

It will be appreciated that the system of the present invention allows a user type C to choose any number of elements, in any order, and leave blanks for any for which he or she like suggestions from the system of the present invention.

For instances where a user selects a proprietary focus (Focus P), the present invention can operate as shown in Figs. 7 and 8.

As shown in Fig. 7, for a user type A, the invention can operate to receive user input project data at step 130 substantially as described above. Next, at step 132, the system of the present invention can allow a user to choose product sets for each Area

and for each Subassembly within each area. To continue with this sequence, Users must specify all products. Also, the present invention can ask Users to identify specific Assembly and Subassembly applications for each of the selected products. For example, a user might pick "Armstrong foil-faced R-19 fiberglass batts" and then identify it as applying to the thermal separation subassembly and to both enclosing wall and soffit assemblies. Any products that have been selected are saved as at step 134 along with corresponding elements for use in ensuing steps. The selected elements can then be shown to the user for confirmation as at step 136. If the user does not approve the selected elements, the present invention can return the user to step 134. If the user approves the selected elements, the present invention can proceed to build the detail as at step 138 and provide the output as at step 140.

For a user type C, the present invention can operate so as not to provide a product-focus option. For a user type B, the present invention can operate as shown in Fig. 8.

As shown in Fig. 8, the present invention can operate as at step 150 to receive user input project data as described above. At step 152, the system can receive and store the user's performance criteria. At step 154, the system of the present invention can receive the user's selection of products. At step 156, the present invention can record the elements corresponding to the user's selection of products. At step 158, the system checks with the user to see if the recorded elements are acceptable. If not, the present invention returns to record the corresponding elements step 156. If user B accepts the recorded elements, the present invention proceeds to assess the performance against the stated criteria, as at step 160. The performance assessment is outputted as at step 162, and proposed to the user at step 164 for confirmation. If the user does not confirm the assessment, the present invention can return the user to

revise the performance criteria as shown by the dashed line in Fig. 8, or the present invention can return the user to change the selection of products, as shown by the dotted line in Fig. 8. If the user confirms the assessment, the present invention proceeds to build the detail at step 166 and provide the output as at step 168.

It will be appreciated that the present invention can be provided with a determination engine to determine a user's type upon that user accessing the system of the present invention. In one embodiment of the invention, such a determination engine can operate in accordance with a question/answer format so as to make a determination of user type based on an interview through an interactive dialogue with the user.

It will further be appreciated that, at any time, users of the present invention can check their progress by consulting a chart of assemblies on which the present invention can indicate that specific subassemblies or products have been selected. By clicking on each indicator, for example, a user can display a thumbnail graphic of the associated subassembly or product. Progress can be gauged by noting the percentage of needed subassemblies or products that have been selected, for example. In a further embodiment, the system of the present invention can store hundreds of generic data sheets that provide information to guide users in making selections between alternative elements, including styles, forms, assemblies, subassemblies, materials, treatments, connections, and details. Context-sensitive help files can also be provided by the present invention for quick reference by users of the present invention.

Examples

All users and others who interact with the present invention start by identifying their mode of use. There are several modes available, depending on the user type, and example modes can be provided, for example, for:

A. Data users, such as a project team, which can include:

(1) Design user types, such as experienced design users such as architects, engineers, and interior designers, who do not seek independent confirmation of the elements they have chosen;

(2) Design user types, such as experienced design users who nonetheless want to check that the performance levels likely to be achieved by the elements they have chosen meet or exceed the levels of performance they want;

(3) Design user types, such as inexperienced design users such as architects, engineers, and interior designers working with a new project type, or such as interns and students, either of whom may not know enough about the available element choices to choose them but who can identify the performance levels they want the elements to achieve when such performance levels are presented to them in a list;

(4) Construction user types such as builders and construction managers who want to use the list of elements prepared by design users as a starting point for purchasing construction products, or who want to investigate substitution of other element selections for those selected by design users;

(5) Operations user types such as property managers who want to use the project database to order replacement products or maintenance materials or who want to get further information from the manufacturers of products used in their project; and

B. Data providers such as a product team. Data provider types can be, for example manufacturers, distributors, and trade associations, who deliver either generic or proprietary information about their products to those who specify those products, detail with them, buy them, build with them, or maintain them, assisted by the present invention, or who are interested in receiving information about the usage

patterns by the other user types of products in the database. In one embodiment of the invention, data providers can provide product marketing information for display to data users during use of the present invention.

Data provider types submit information to populate the database of elements contained in the present invention. They can download templates from the database of the present invention to use in creating and formatting their data prior to submittal. Such data providers can also submit data including detail drawings, specifications and performance levels for inclusion in the database. An example interface 200 for such users is shown in Fig. 10. The data could be stored on the data provider's server and accessed by the invention via Internet hyperlinks, for example. Alternatively, the data can be uplinked to a server installed as part of the system of the present invention, whereupon the server can store the data. The stored data can then be made available to data users using the system of the present invention. Data providers can also be provided with the ability to revise stored data at any time as the products being described are revised. In one embodiment of the present invention, the stored data can be audited periodically to ensure its quality and accuracy.

The following are provided as illustrative examples of use of the present invention, whereby data users are those who apply information contributed by data providers to a specific construction project. The first time a user uses the present invention for a particular project, he or she may be prompted via the detail engine 11 to input basic identifying information on the project such as, for example, its project number, name, location, and project team members. Returning users simply identify one of these factors, enter a password, and continue their work with the invention on a given project.

In one embodiment, the detail engine 11 of the present invention takes users other than data providers through a series of screens that ask them to select construction elements such as those in Figs. 11 through 17, for example, either on their own or by agreeing to recommended selections made by the detail engine 11 in fulfillment of performance levels requested by the user.

In one approach to using the invention, an experienced user can generate detail drawings and specifications simply by selecting elements from a list provided by the detail engine 11. The process can start, for example, with the user identifying areas within the project that share a common set of subassemblies because they share a common set of performance characteristics. These areas can be taken from a group of areas defined by the user or pre-defined by the detail engine 11, for example. Using a specific example, public spaces such as lobbies might be exposed to a lot of wear and intended for more luxurious finishes, so such areas might be identified as constituting Area 1. Area 2 might be established to meet the needs of rest rooms: surfaces that are easily cleaned, with low permeability, and high slip-resistance.

Once having done this, the user can select a palette of subassemblies, materials and/or treatments unique to each area by interfacing with the sub-assembly component 26 and material component 28 of detail engine 11. An example interface 205 for materials selection(s) is shown in Fig. 11. An example interface 210 for assembly selection(s) is shown in Fig. 12. An example interface 215 for sub-assembly selection(s) is shown in Fig. 13. An example interface 220 for connection selection(s) is shown in Fig. 14. An example interface 225 for treatment selection(s) is shown in Fig. 15. Subassemblies can be chosen for the surface subassemblies on each side of the assembly, for the support subassemblies that stabilize and connect the other subassemblies, and for the separation subassemblies that prevent leaks and

minimize energy transfer, for example. The same user might also choose system subassemblies for the ducts, pipes, and wires that constitute the assembly's infrastructure, or they could be selected by another user. This might be the case where an architect and mechanical engineer share the task of detail design, for example. In one embodiment of the invention, the identity of the user who makes each selection is stored for later reference.

The user has the option of selecting either generic or proprietary elements. Where proprietary elements are selected, the invention retrieves data prepared by the manufacturer of the requested product. Where generic elements are selected, the present invention can retrieve data prepared either internally or by the trade association that represents multiple manufacturers of the requested product type, for example. In one embodiment, the present invention can use generic element data as provided from the book "The Cuisine of Construction" referenced earlier herein. Such data, whether proprietary or generic, can be received by the detail engine 11 from users 56 and stored in database 42.

For example, a user might decide to leave options open by making generic selections. For one area, therefore, this user might decide that the best combination of surface subassemblies for a particular enclosing vertical assembly (exterior wall) is an exterior surface subassembly of tied units (masonry units and mortar) and an interior surface subassembly of filled panels (gypsum board, joint compound, and tape). The detail engine 11 and its components allow the user to get much more specific such as by, for example, identifying the tied masonry units in the exterior surface subassembly as uncored, velour-face, tumbled, standard modular units. Alternatively, the user can make a proprietary selection, choosing an exterior surface subassembly, for example, of Colonial Series, Patriot Red by Acme Brick of Lehigh, PA.

To continue the selections process, the user might select, for the support subassemblies needed to hold the surface subassemblies, a masonry continuous planar support (concrete block mortar, and reinforcement). The user might choose to attach the planar support subassembly to the surface subassemblies with an interlocked connector supports (masonry tie) on the exterior and with penetrated connector supports (screws) on the interior. Similar selections would be made for other subassemblies such as convective insulation and waterproofing.

Where generic elements are selected rather than proprietary ones, and where materials are not an inherent part of the generic element selected, the user can be prompted by the materials component 28 of the detail engine 11 of the present invention to select materials from which to make each subassembly. In the previous example, that might include clay vitrified inorganic materials (brick) for the exterior surface subassembly, and iron alloy smelted inorganic materials (steel) for the exterior-side connector subassembly.

In one embodiment, the detail engine can streamline the potentially exhausting process of selecting so many elements for so many areas by raising to the top of the selection list options for each element that are most commonly used in conjunction with those selections that were already made. In such an embodiment, the present invention can also store selection statistics and separately provide those statistics to outside entities, such as manufacturers, for their use in determining what products to focus on for marketing, for example.

When a user makes generic selections, the present invention can provide an opportunity at this point for the user to identify acceptable proprietary elements. If proprietary selections are made, and if preferred by the user, the invention can retrieve data for the proprietary selections for subsequent parts of the process.

As selections are made, the present invention can, in one aspect, post them to an elements matrix. Separate matrices are maintained for each of the Areas identified by the user at the beginning of the process. Each elements matrix has a place for each subassembly needed to complete each assembly. At any time, the user can consult the elements matrices for any of the areas to see which selections have been made and which remain to be made. Selections are identified by a verbal and numeric tag, and serve as hyperlinks to further information on the selection including educational materials. As selections are made, the detail engine compares their attributes, notifying the user when potentially incompatible selections are made.

When all of the needed selections are made, the user identifies the particular detail types needed. For example, the wall and roof could meet at a parapet, an eave, or a gravel stop, and the system of the present invention needs to know which of the three is being used on the user's project.

At this point, and in this embodiment of the present invention, the user's preliminary work is done and the detail component 34 of the detail engine takes over. It starts by retrieving the associated drawing and text files from database 42 and compiles them into detail drawings and specifications, using an insertion, alignment, and stretch process for drawings as described herein, and an interleaving process for specifications. It retrieves them by searching a database of proprietary information provided by manufacturers and generic information provided by trade associations, using numeric designators to find them, for example.

With compilation complete, the user can request a performance report. The output component 36 assembles such a report by totaling the individual attributes of the subassemblies and materials to arrive at performance prediction for the assembly as a whole. This report includes information to guide long-term maintenance and

repairs, information that is critical to property management and operations. These reports can be generated at any time including after completion of construction by any user with access to the database for a particular project.

Now the invention proceeds through connection component 32 to compile the assemblies into connections, and the connections into the details previously requested by the user. This step is needed primarily for the drawings only, but could have some effect on the specifications depending on the selections made.

With all of the compilation complete, the user can take the compiled drawings and specifications outside the invention and continue to customize them before releasing them for building permit, bid, or construction, for example. This is in recognition that some degree of customization will be needed for most drawings and specifications prepared by the detail engine. To do this, the user identifies to the invention the desired formats for the output. For example, a user who draws with AutoCAD software can request that the details be formatted as .dwg files. The user can then offload the details and customize them manually to fit the specific design needs of the project before printing them as a set of drawings. The user can also take performance and operations reports outside the detail engine to use as needed. To take any information outside the detail engine, the user need only indicate the preferred format of the outputted file.

The output component also has the capacity to organize the individual details into individual pages to form a set of hard copy documents using the National CAD Standard or any other standard format as a guide, for example.

In another approach to using the system of the present invention, an experienced user can generate detail drawings and specifications as noted above, but in addition, ask the invention to evaluate the likely performance of the requested

combinations against the levels of performance intended. Intended levels of performance can be established early in the process such as, for example, through interfaces 230 and 235 shown in Figs. 16 and 17, respectively. The primary step added to the process for such a user is the step of identifying the intended levels of performance for each subassembly, material and/or treatment selected. In response, the performance report can list not only the levels of performance achieved, but notes their variance from what was intended, highlighting areas where the achieved performance fails to meet the intended levels. In response, a user can simply go back to alter either the selected elements or the requested levels of performance via the corrections component, for example.

In a third approach to using the invention, an inexperienced user, including an intern or student, would not be required to select subassemblies or materials, but would instead identify areas as other users would, and then, when prompted to do so, simply identify the intended levels of performance for each needed subassembly and material. The present invention would, in response, search its database for elements that fulfill the requested levels of performance and are compatible with each other. Several elements would be proposed by the invention for each one needed, ranked by the degree to which they fulfill the selected performance levels. Users who provide more specific criteria are presented with fewer choices. Through this process, a user need not previously know of the existence of a particular element or product to end up using it in a design.

All proposed elements are displayed in the elements matrices for each area to which they apply, and listed in the performance reports. For each element needed, the user would select one from the potential choices identified by the invention, reviewing the performance report for guidance if needed. Where a user wishes to

leave the selection somewhat vague, perhaps to be decided later by the builder, a user may do so. In that case, the user would select an element heading as presented by the invention rather than a more specific element. Once all needed elements are selected, the invention proceeds to compile drawings and specifications as it would for more experienced users.

It will be appreciated that no user would be required to work within any single approach listed above. A user could use a hybrid form of the present invention, selecting some elements and for others identifying only desired performance levels. An experienced user who fails to identify any of the needed elements would be routed by the present invention to the third approach so the user could identify the relevant performance criteria.

Following the initial process of identifying or selecting elements, any user can use the detail engine 11 of the present invention to test alternative scenarios in "what if"-type scenarios. In this mode, a user can change one of the listed performance criteria, whereupon the detail engine repeats the search process, proposing a different set of elements in response. This form of use is very helpful to users who need to identify potential substitutions or determine how to respond to changes in code, budget, schedule, structural needs, or other factors.

In addition, any user can use the present invention to test the effect of any given substitution of elements on the performance criteria by reselecting elements and requesting a revised performance report. This aspect holds the prospect of greatly improving the reliability of the current construction industry substitutions process.

In addition, a user can place orders for construction products through hyperlinks within the invention to the websites of product manufacturers and distributors.

In one embodiment of the invention, the detail engine compiles use data, recording which products are selected most frequently and tracking product orders. The database it generates can be analyzed to discern trends in various product markets.

In addition, the system of the present invention gives users the option of establishing standards for their own work. A user can establish, for example, that light gauge metal support subassemblies are incompatible with masonry surface subassemblies, even though that combination may not generally be seen as incompatible by the invention, for example. A user can also save particular combinations of elements to be used again for other projects, in essence creating the user's own library of standard construction designs. A user can further use the detail engine to establish an alternate set of line weights, poché patterns, or other characteristics to replace the defaults used by the invention.

At any point, when a user feels incompetent to make a selection, the user can access educational materials imbedded in the present invention and stored in database, for example. Such information can include, for example, (a) reasons for selecting and reasons for rejecting; (b) compatibility issues; (c) basics (characteristics; types; components; processes; applicable code provisions; manufacturing, installation, and testing standards; industry websites) (d) constituent elements (attachment issues, permeability issues related to water, air, fire, and transmission issues related to energy, vapor, and sound) and (e) performance (minimums, maximums, tolerances, or ranges are given as appropriate).

Data can be updated at any time by whomever prepares them, whether the manufacturers, the trade associations or the inventor of this invention. Users who need the data are provided with access to the most current versions.

The detail engine can further include templates for use by those preparing data. These templates can include standards for detail drawings, for specifications, and for performance criteria, for example. Data is formatted in such a way that it is interchangeable so that one selection can easily be substituted for another and so as to enable the compilation of aggregate performance levels achieved by the individual materials and subassemblies that constitute an assembly or detail. The template for drawings standardizes insertion point types and locations, line weights (which can be changed later by users), element thicknesses, and other characteristics. It also establishes a standard format for the depiction of specific detail conditions, such as joints, caps, penetrations, interior corners, exterior corners, and wall-slab connections such that all details generated by the invention will show the same amount of wall adjacent to a joint, for example.

In addition, the invention can translate data to enable importing and exporting data that are organized by existing taxonomies such as MasterFormat and the OCCS, or UniFormat II, through the use of mapping tables that correlate the classes found in the classification systems of the invention to classes found in other classification systems.

In one embodiment of the present invention, a user can be offered the opportunity to change any number of performance criteria, elements, and/or products, and then resubmit the new combination to the search process. When an acceptable new combination is proposed by the system of the present invention, in compliance with the revised list of performance criteria, elements, and/or products, it can be sent through the final processes as discussed above.

In another aspect of the present invention, data from external sources such as trade associations and manufacturers can be accepted for performance criteria,

drawings, and specifications if it conforms with the present invention's formatting guidelines, and is labeled with numeric tags that either link the data with a network associated with the present invention or enable it to be recognized by network search engines looking for data tagged with such numbers.

It will be apparent to one skilled in the art that any computer system that includes suitable programming means for operating in accordance with the disclosed methods also falls well within the scope of the present invention. Suitable programming means include any means for directing a computer system to execute the steps of the system and method of the invention, including for example, systems comprised of processing units and arithmetic-logic circuits coupled to computer memory, which systems have the capability of storing in computer memory, which computer memory includes electronic circuits configured to store data and program instructions, programmed steps of the method of the invention for execution by a processing unit. The invention also may be embodied in a computer program product, such as a diskette or other recording medium, for use with any suitable data processing system. The present invention can further run on a variety of platforms, including Microsoft Windows™, Linux™, Sun Solaris™, HP/UX™, IBM AIX™ and Java compliant platforms, for example.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the claims of the application rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by Letters Patent is:

Claims

1. A method for assisting users of various experience levels in building a construction detail design, comprising the steps of:

providing an electronically accessible construction detail classification system;

providing programming for allowing a user to interact with said classification system, said programming capable of operating in a first mode to allow a user to select construction elements from said classification system, and to obtain at least one of a detail and a specification associated with said selected construction elements;

said programming capable of operating in a second mode to allow a user to select construction elements and input an intended performance, and to receive at least one of a detail, a specification, a performance assessment and an evaluation of the assessed performance against intended performance;

said programming capable of operating in a third mode to allow a user to define the user's intended performance, to receive recommendations for construction elements, and to provide a comparison of an assessed performance against intended performance, a detail or a specification.

2. The method of claim 1 wherein said programming capable of operating in a first mode allows said user to obtain a performance assessment associated with said selected construction elements.

3. The method of claim 1 wherein said construction elements include at least one of assemblies, sub-assemblies, treatments and materials.

4. The method of claim 1 wherein said intended performance comprises a user selection of performance categories and a user assignment of relative priorities for said categories.

5. The method of claim 1 wherein said intended performance comprises a quantitative range of performance or a qualitative range of performance.

6. A method for assisting users in editing a construction detail design, comprising the steps of:

providing an electronically accessible construction detail classification system storing elements that comprise construction design details;

providing at least one construction design detail or at least one construction design specification having construction elements selected from said classification system; and

providing programming for allowing a user to interact with said classification system, said programming capable of operating so as to allow a user to edit said construction elements associated with said at least one construction design detail or said at least one construction design specification.

7. A construction design tool, comprising:

an electronically accessible construction detail classification system storing elements that comprise construction design details pertaining to a plurality of construction design assembly levels, said design assembly levels comprising one or more of: at least one assembly level, at least one sub-assembly level, at least one material level, at least one treatment level and at least one connection level;

a first user interface for allowing a user to select construction elements from said classification system,

a second user interface for allowing a user to request recommendations for construction elements from said classification system;

a third user interface for allowing a user to request a performance assessment associated with said selected construction elements;

a fourth user interface for allowing a user to specify an intended level of performance for a design; and

means for obtaining a detail, a specification, or a performance assessment associated with said selected construction elements.

8. The tool of claim 7 further including means for evaluating an assessed performance against intended performance specified by a user.

9. The tool of claim 7 further including means for displaying product marketing information on or within any of said user interfaces, wherein said marketing information is pertinent to a construction element or design being displayed on said user interface.

10. The tool of claim 7 further including a user interface for uploading at least construction element information into said classification system.

11. The tool of claim 10 wherein said user interface is accessible by a manufacturer user, a distributor user or a trade association user.

12. The tool of claim 7 further including an output component for outputting a design document having graphic depictions of construction elements associated with one or more selected construction elements.

13. The tool of claim 12 wherein said graphic depictions include insertion points that correspond to insertion points in a range of alternative adjacent construction elements.

14. The tool of claim 12 wherein said graphic depictions are adjusted in thickness from a standard thickness prior to compilation in a complete assembly.

15. A construction design tool, comprising:

an electronically accessible construction detail classification system storing elements that comprise construction design details pertaining to a plurality of construction design assembly levels, said design assembly levels comprising one or

more of: at least one assembly level, at least one sub-assembly level, at least one material level, at least one treatment level and at least one connection level;

a first user interface for allowing a user to request a performance assessment associated with said selected construction elements; and

a second user interface for allowing a user to specify an intended level of performance for a design.

16. A tool for building construction detail libraries, comprising:

an electronically accessible construction detail classification system storing construction design details pertaining to a plurality of construction elements, said elements comprising at least one assembly, at least one sub-assembly, at least one material, at least one treatment and at least one connection; and

a user interface for uploading at least construction element information into said classification system.

17. The tool of claim 16 wherein said construction element information includes construction element performance information.

18. The tool of claim 16 wherein said construction element information includes at least product availability and pricing information.

19. The tool of claim 16 wherein said classification system includes means for tracking selection frequency information pertaining to individual construction elements selected by at least one detail design user, and further including means for reporting said selection frequency information to a user of said user interface.

20. A construction detail portal, comprising:

an electronically accessible construction detail classification system storing construction element details pertaining to a plurality of construction design assembly levels, said design assembly levels comprising at least one overall form level, at least

one assembly level, at least one sub-assembly level, at least one material level, at least one treatment level and at least one connection level;

a design professional user interface;

a builder user interface; and

a product manufacturer user interface for uploading at least construction element information into said classification system.

21. A construction detail classification system, comprising:

a concept component for categorizing detailing level, style and form options pertaining to one or more construction project types;

an assembly component for categorizing at least vertical, horizontal and component element options, said options being based on said options categorized by said concept component;

a sub-assembly component for categorizing at least surface, support, separation, system and subcomponent element options, said options being based on said options categorized by said concept and assembly components;

a material component for categorizing at least inorganic, organic, and amalgam element options, said options being based on said options categorized by said concept, assembly and sub-assembly components;

a treatment component for categorizing at least cut, shaped, textured, modified and coated element options, said options being based on said options categorized by said concept, assembly, sub-assembly and material components;

a connections component for categorizing at least internal, termination and interruption element options, said options being based on said options categorized by said concept, assembly, sub-assembly, material and treatment components;

a details component for categorizing at least underground, façade, roof edge and midroof element options, said options being based on said options categorized by said concept, assembly, sub-assembly, material, treatment and connections components;

an interface component for receiving at least one selection from a user of an element from said element options; and

an output component having at least a detail drawing output option, a specification output option or a performance assessment output option.

22. The system of claim 21 further including a corrections component having at least an assessment and an adjustment selection option.

23. The system of claim 22 wherein said output component can prepare output associated with said assessment and adjustment selection options.

24. The system of claim 22 wherein said adjustment selection option allows a user via said interface component to self-adjust a selected element and further allows a user to request that said system adjust a selected element.

25. The system of claim 21 wherein said categorized options of each of said components are electronically accessible via said interface component.

26. The system of claim 21 further including a change management component for receiving, obtaining and storing additional options for at least one of said components.

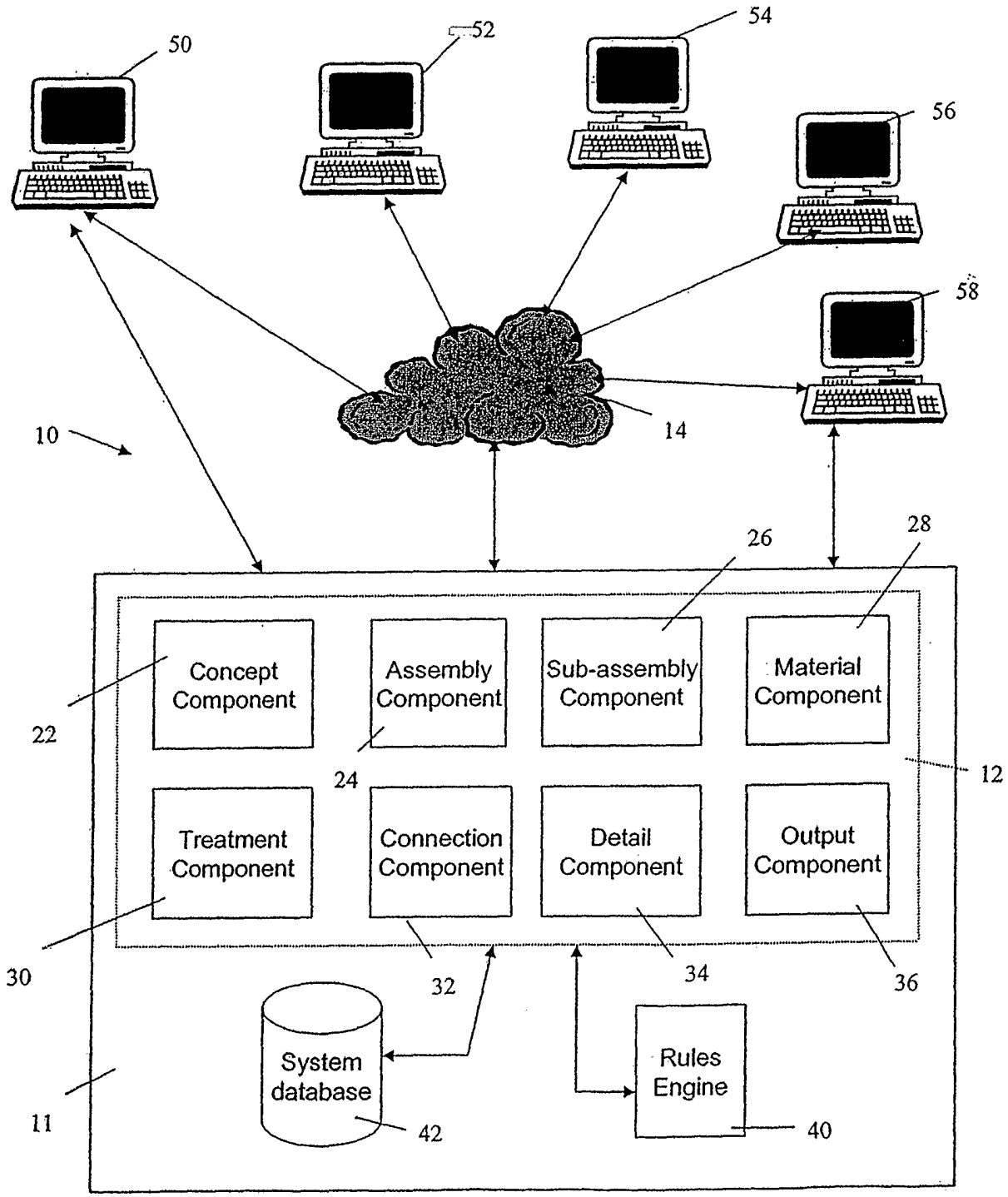
27. The system of claim 21 wherein each of said options is stored using both a numerical and a verbal identifier.

28. The system of claim 21 wherein said options are further categorized by converting data into or from forms that are compatible with a taxonomy from the group of: MasterFormat™, OCCS™, and Uniformat II™.

29. The system of claim 21 wherein any given construction element can be identified using a particular sequential series of numerical identifiers pertaining to that element's connection type, assembly type, subassembly type, material type or treatment type.

30. The system of claim 21 wherein any given construction element can be marked with a bar code or other code corresponding to the particular sequential series of numerical identifiers that identify it for any purpose including inventory control, linkage to installation instructions, or location within a project.

FIG. 1


50
52
54
56
58
14
10
26
28
Concept Component
Assembly Component
Sub-assembly Component
Material Component
22
24
12
Treatment Component
Connection Component
Detail Component
Output Component
30
32
34
36
System database
Rules Engine
11
42
40

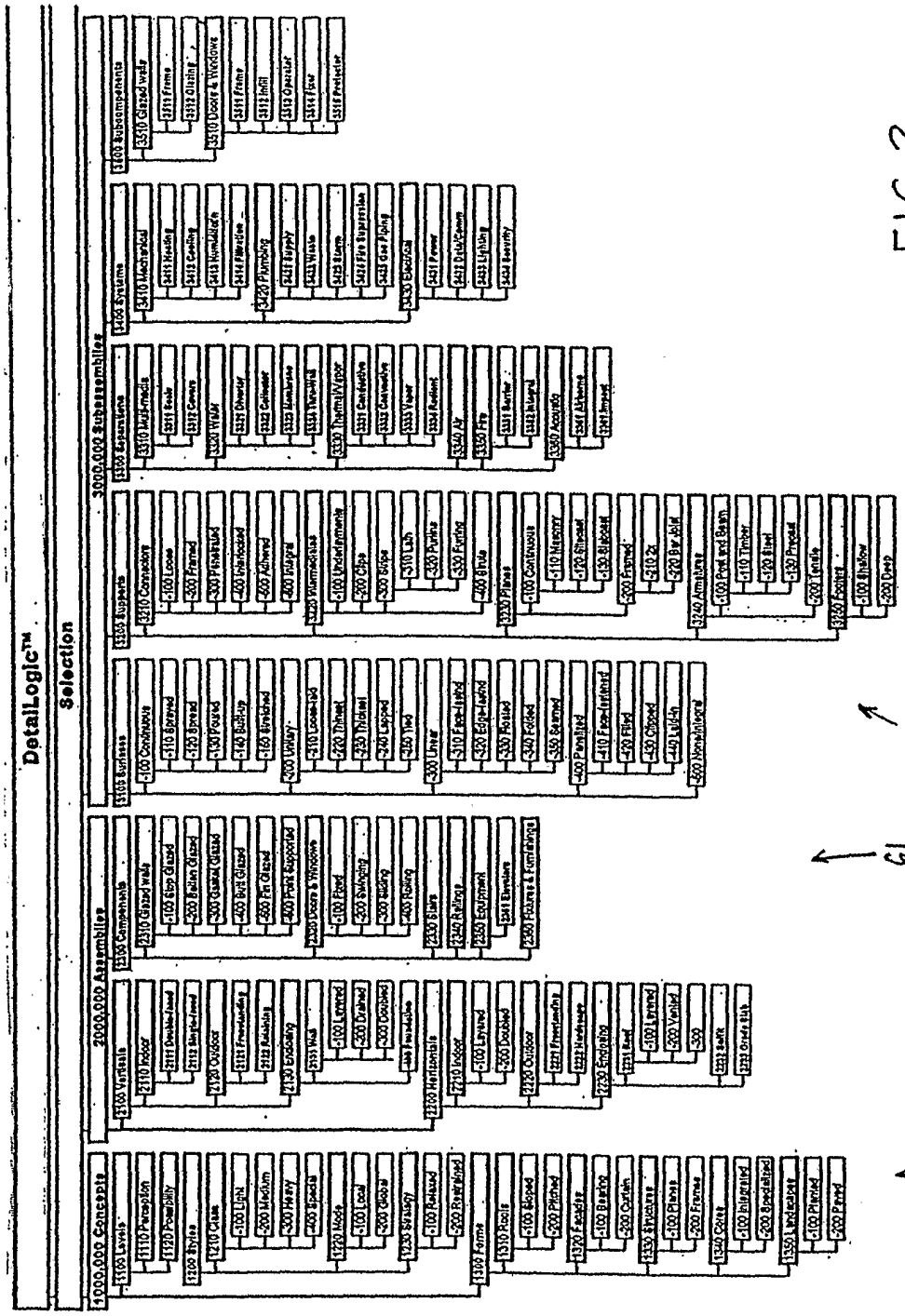

DetailLogic™
Selection
1000,000 Concepts
2000,000 Assemblies
3000,000 Subassemblies
60
61
62

FIG. 2

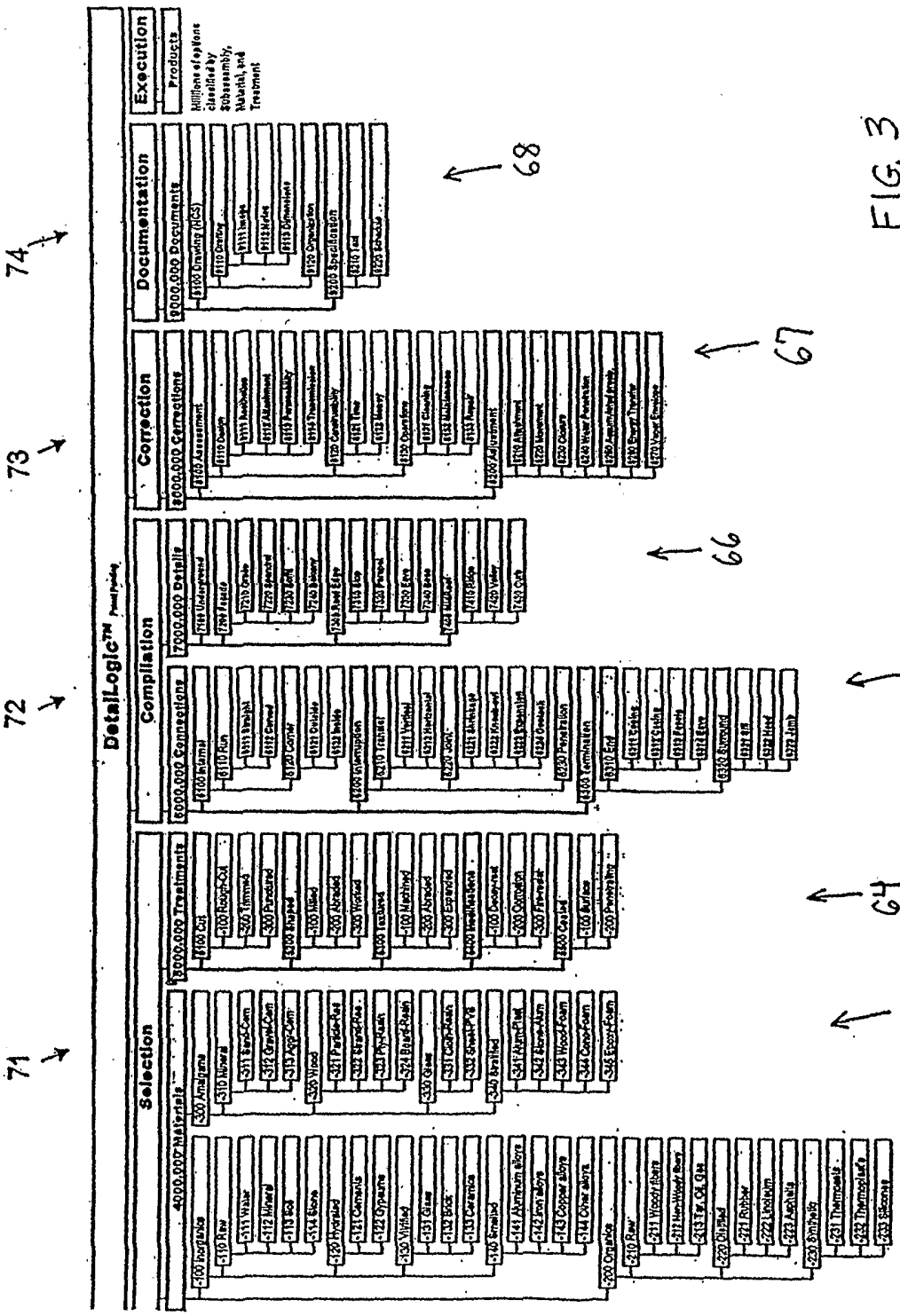

DetailLogic™
Selection
Compilation
Correction
Documentation
Execution
71
72
73
74
63
64
65
66
67
68

FIG. 3

FIG. 4

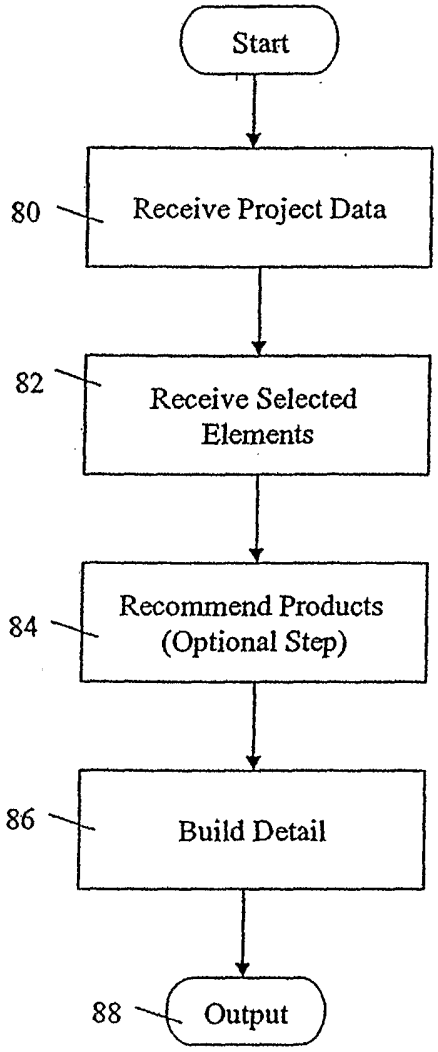

Start
80
Receive Project Data
82
Receive Selected Elements
84
Recommend Products (Optional Step)
86
Build Detail
88
Output

FIG. 5

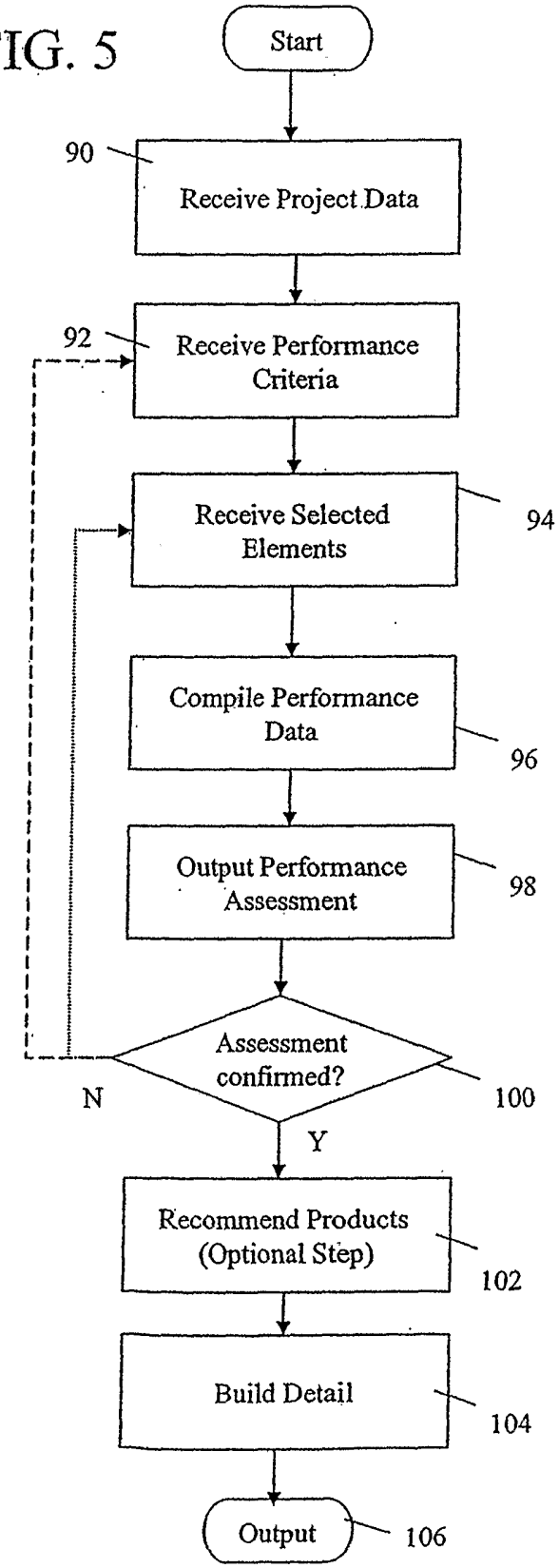

Start
90
Receive Project Data
92
Receive Performance Criteria
Receive Selected Elements
94
Compile Performance Data
96
Output Performance Assessment
98
Assessment confirmed?
100
N
Y
Recommend Products (Optional Step)
102
Build Detail
104
Output
106

FIG. 6

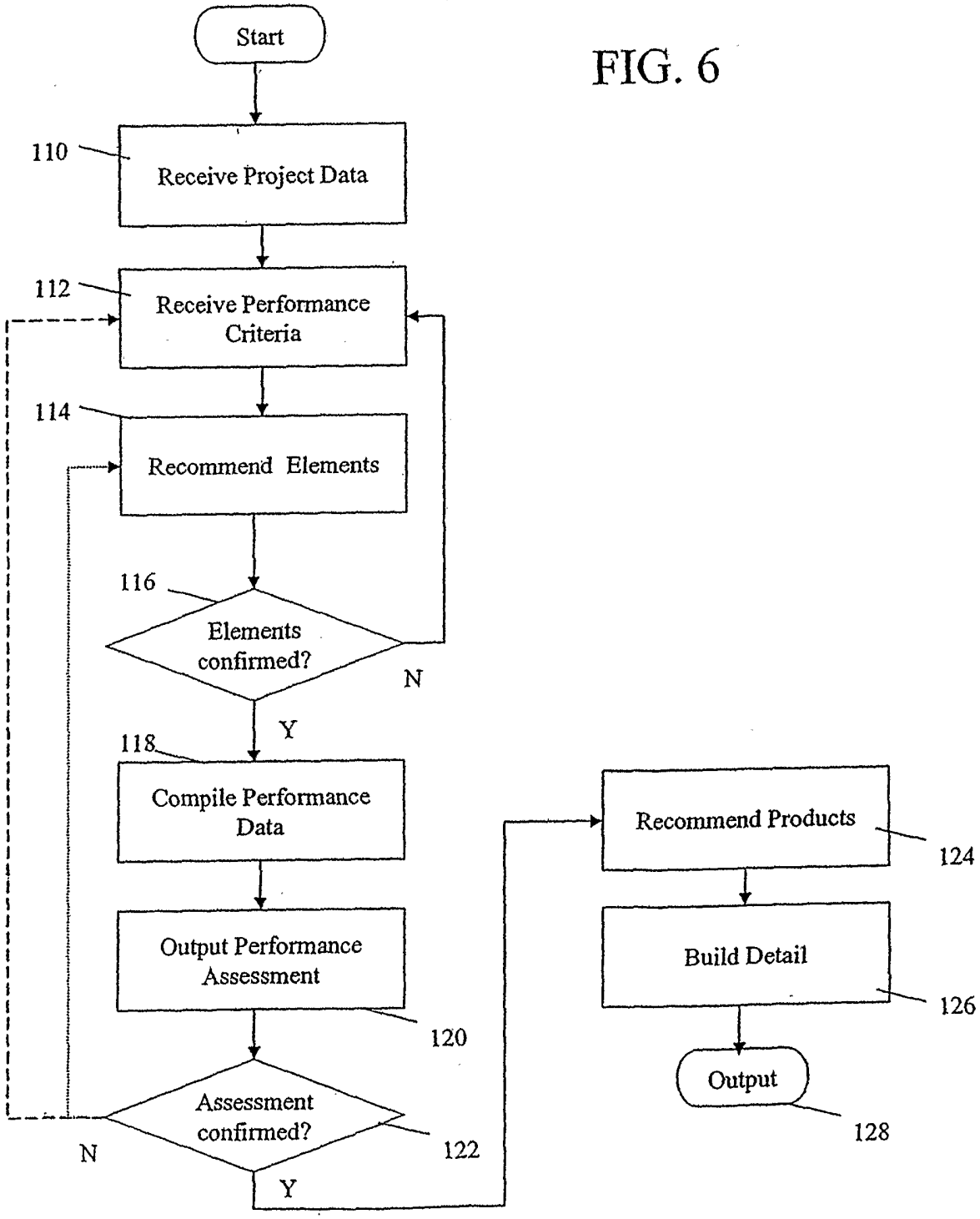

Start
110
Receive Project Data
112
Receive Performance Criteria
114
Recommend Elements
116
Elements confirmed?
N
Y
118
Compile Performance Data
Output Performance Assessment
120
Assessment confirmed?
122
N
Y
Recommend Products
124
Build Detail
126
Output
128

FIG. 7

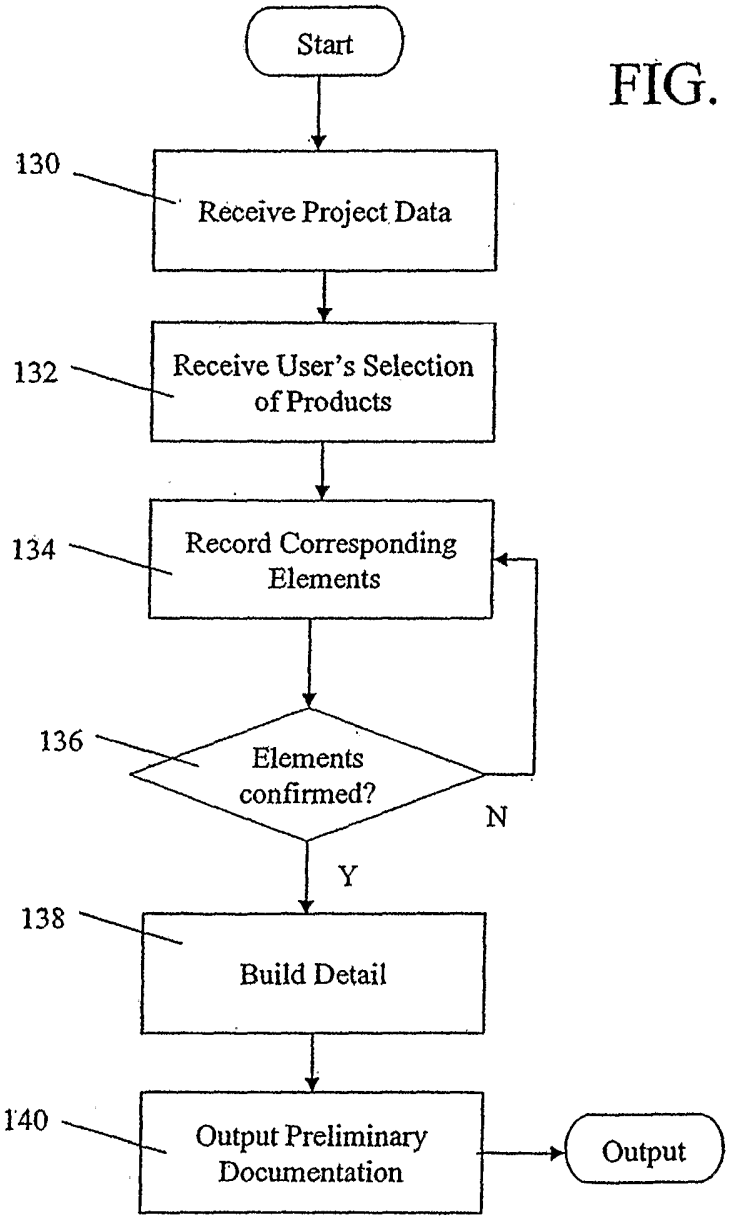

Start
130
Receive Project Data
132
Receive User's Selection of Products
134
Record Corresponding Elements
136
Elements confirmed?
N
Y
138
Build Detail
140
Output Preliminary Documentation
Output

FIG. 8

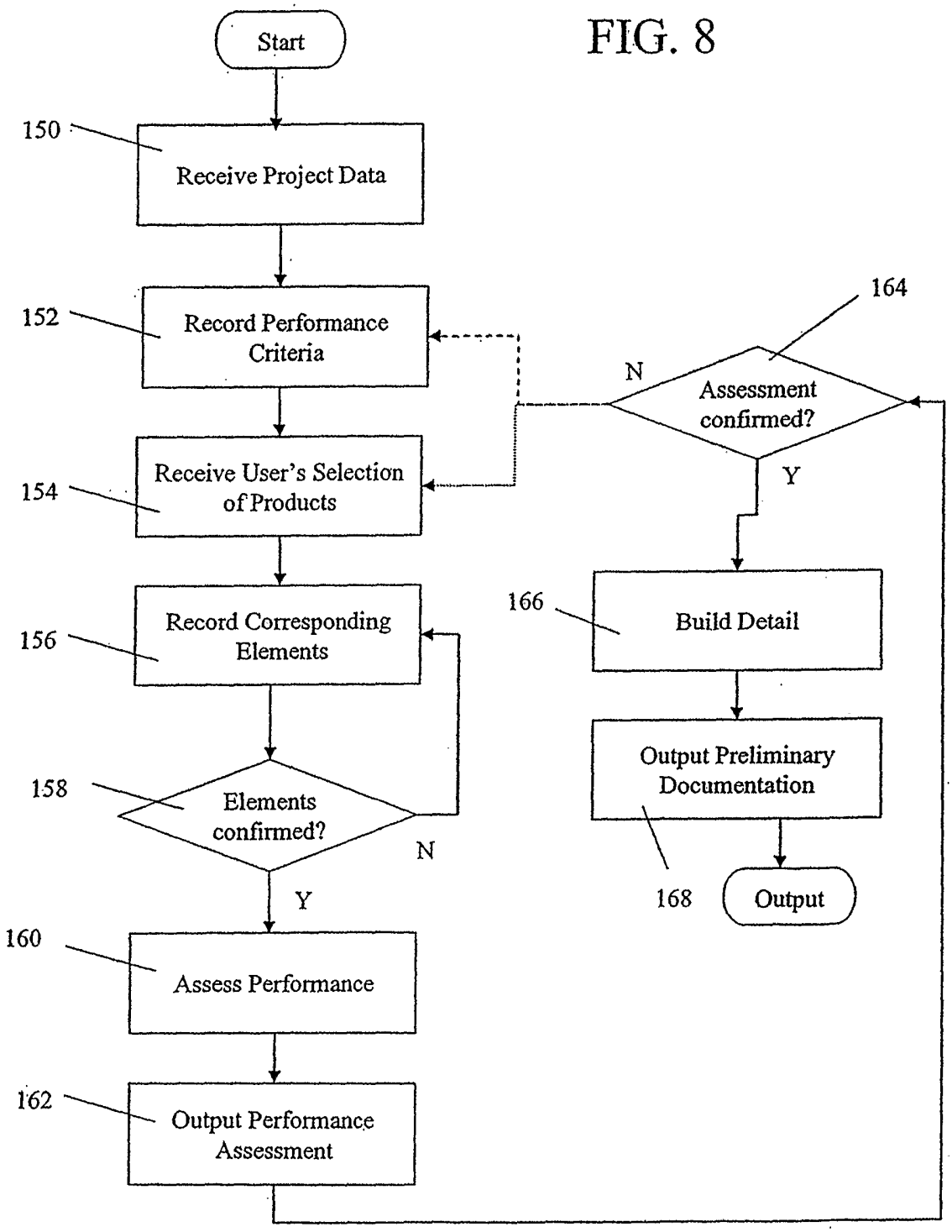
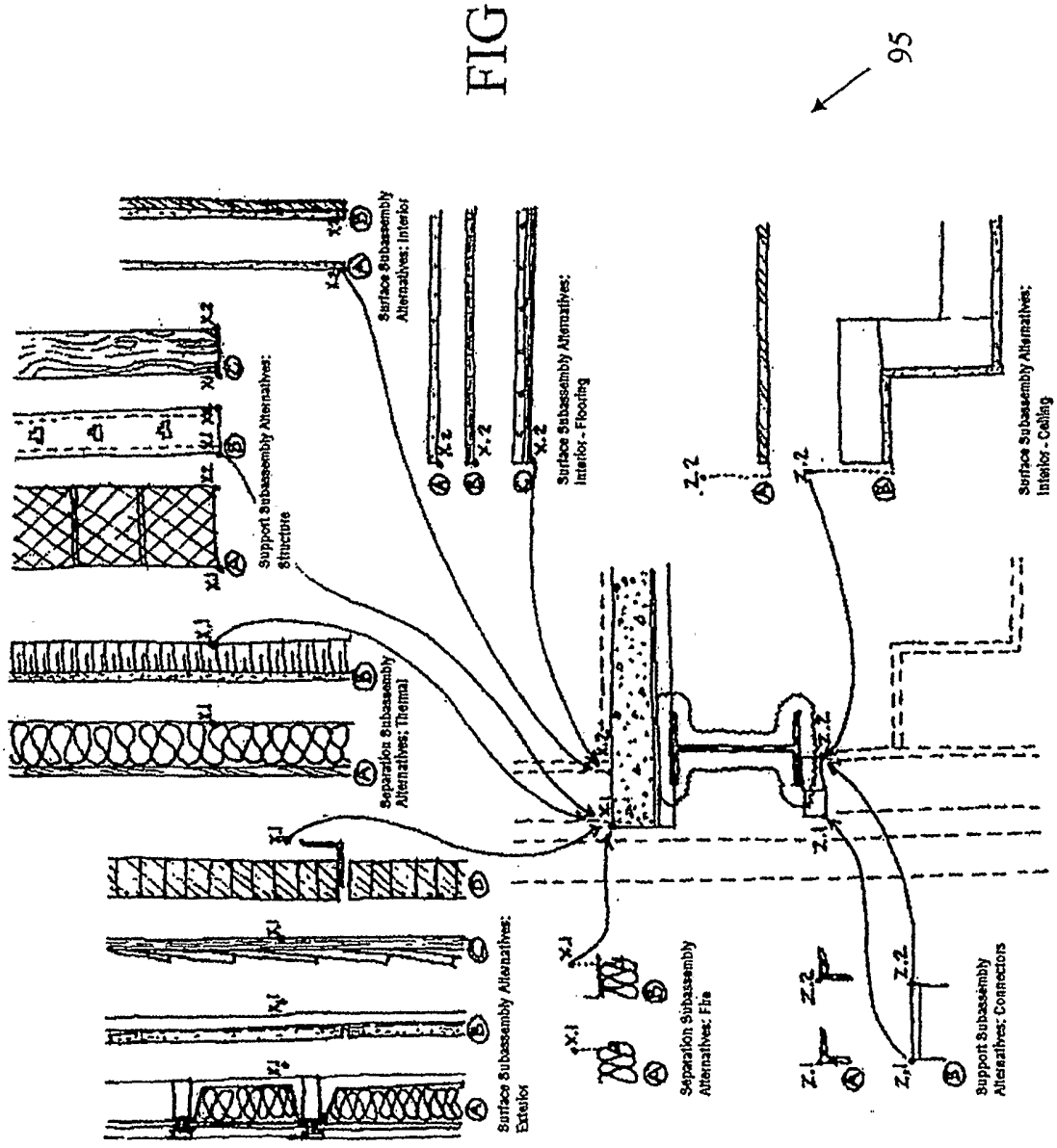

Start
150
Receive Project Data
152
Record Performance Criteria
154
Receive User's Selection of Products
156
Record Corresponding Elements
158
Elements confirmed?
N
Y
160
Assess Performance
162
Output Performance Assessment
164
N
Assessment confirmed?
Y
166
Build Detail
Output Preliminary Documentation
168
Output

FIG. 9


95
Surface Subassembly Alternatives: Interior
Support Subassembly Alternatives: Structure
Separation Subassembly Alternatives: Thermal
Surface Subassembly Alternatives: Exterior
Surface Subassembly Alternatives: Interior - Flooring
Separation Subassembly Alternatives: Fire
Surface Subassembly Alternatives: Interior - Ceiling
Support Subassembly Alternatives: Connectors

New Provider Basic Provider Information

Provider Information

What name do you want to use to identify yourself to DetaiLogic™?

What password do you to use to access DetaiLogic™?

What is your official or commercial name?

Contact Information

- Physical Delivery Contact Information
- Voice/FAX Contact Information
- Internet Contact Information

Provide type: Which of the following best describes you? Manufacturer Submit Reset

Product Information

	Name	Description	Uniformat	MasterFormat	DetaiLogic (if known)		
1							
2							
3							
4							

When you finish, click Submit to record all information entered above or Reset to delete all choices entered and start over

Click here to go to the next step:

200

FIG. 10

1 and 2-Step Identify Materials

Information recorded in the list below applies specifically to the [ ] area of this project, and only to [Vertical Exterior (Wall)] assemblies within it. *(If you have not yet defined areas, please go back to that screen and do so.)*

For the subassembly you just identified, and only for that subassembly, choose materials from those listed below.
When you finish, click "Submit" to continue the process.

Materials

Inorganic	Raw Water	Submit	Reset
Organic	Raw Wood	Submit	Reset
Amalgam	Mineral Stucco	Submit	Reset

Click here to select treatments for the material you just identified

Click here if no treatments are needed for this material, but other materials remain to be selected for the same subassembly

Click here if you are finished selecting ALL materials for this subassembly

205

FIG. 11

1 and 2-Step Identify Assemblies

Information recorded in the list below applies specifically to the [ ] **area of this project, and only to**
[Vertical Exterior (Wall)] **assemblies within it.** *(If you have not yet defined areas, please go back to that screen and do so.)*

Choose assemblies from the drop down menus listed below. As you pick each one, click "Submit".
Afterward, DetailLogic will ask you to pick the subcomponents for each assembly.
When done, it will return here so you can choose other assemblies.

Assemblies

Vertical assemblies			
Exterior (walls)	Layered	Submit	Reset
Interior (partitions)	Simple	Submit	Reset
Grade (walls)	Retaining	Submit	Reset
Horizontal assemblies			
Exterior (roofs)	Layered	Submit	Reset
Interior (floors)	Layered	Submit	Reset
Grade (slabs)	Slab on grade	Submit	Reset
Component assemblies			
Glazed walls		Submit	Reset
Windows and Doors		Submit	Reset
Stairs		Submit	Reset
Railings		Submit	Reset
Projections		Submit	Reset
Equipment		Submit	Reset

Click here to continue to select subassemblies

Click here if you are finished selecting ALL assemblies for this connection

210

FIG. 12

1 and 2-Step Identify Subassemblies

Information recorded in the list below applies specifically to the [ ] **area of this project, and only to** [Vertical Exterior (Wall)] **assemblies within it.** *(If you have not yet defined areas, please go back to that screen and do so.)*

Choose subassemblies from those listed below. When you finish, click "Submit" to continue the process.

Subassemblies

Surfaces			
Exterior or top	Continuous	Submit	Reset
Interior or bottom	Continuous	Submit	Reset
Supports			
Connector	Face	Submit	Reset
Plane		Submit	Reset
Intermediate		Submit	Reset
Armature		Submit	Reset
Footer		Submit	Reset
Separations			
Multi-media		Submit	Reset
Water		Submit	Reset
Thermal/Vapor		Submit	Reset
Air		Submit	Reset
Acoustic		Submit	Reset
Fire		Submit	Reset
Systems			
Mechanical			
HVA/C		Submit	Reset
Supply piping		Submit	Reset
Waste Piping		Submit	Reset
Fire Suppression		Submit	Reset
Electrical			
Power		Submit	Reset
Lighting		Submit	Reset
Data		Submit	Reset
Sub-components			
Glazed Wall			
Frame		Submit	Reset
Glazing panel		Submit	Reset
Doors and Windows			
Frame		Submit	Reset
Infill Leaf or Sash		Submit	Reset
Hardware			
Operator		Submit	Reset
Fixer		Submit	Reset
Protector		Submit	Reset

215

FIG. 13

Click here to select materials for the subassembly you just identified

Click here if you are finished selecting ALL subassemblies for this assembly

All Tracks Identify Connection Types

For the area of the project you just identified, and only for that area, choose from those listed below those connection types that will need to be designed.
When you finish, click "Submit" to continue the process. DetailLogic will take you to other menus where you can pick the subcomponents of these connections, and then return you here to continue the process of making selections.

Connections

Section

At Subgrade Footer	○ At slab	○ At crawlspace	○ At soil		Submit	Reset
At Grade	○ At grade slab	○ At supported slab	○ At thickened edge	○ At basement	Submit	Reset
At Spandrel	○ At bearing wall	○ At non-bearing wall			Submit	Reset
At Sill	○ At door	○ At window			Submit	Reset
At Head	○ At arch	○ At lintel			Submit	Reset
At Roof Edge	○ At eave	○ At parapet	○ At stop		Submit	Reset
At Rooftop	○ At ridge	○ At boot	○ At curb	○ At drain	Submit	Reset
At Interior	○ Fixed	○ Operable	○ Demountable		Submit	Reset

Plan

At Column					Submit	Reset
At Corner					Submit	Reset
At Jamb					Submit	Reset
At Partition					Submit	Reset
At Joint					Submit	Reset
At Interior					Submit	Reset

Axons

Dams					Submit	Reset
3-Way Connections					Submit	Reset
Special Connections					Submit	Reset

220

FIG. 14

1 and 2-Step Identify Treatments

Information recorded in the list below applies specifically to the [ ] **area of this project, and only to** [Vertical Exterior (Wall)] **assemblies within it.** *(If you have not yet defined areas, please go back to that screen and do so.)*

For the material you just identified, and only for that material, choose treatments from those listed below.
When you finish, click "Submit" to continue the process.

Treatments

Cutting	Rough-Cut	Submit	Reset
Shaping		Submit	Reset
Texturing		Submit	Reset
Modifying		Submit	Reset
Coating		Submit	Reset

Click here if you still need to select other materials for the same subassembly

Click here if you are finished selecting all materials for this subassembly

225

FIG. 15

Information recorded in the list below applies specifically to the [ ] area of this project, and only to [Vertical Exterior (Wall)] assemblies within it.

(If you have not yet defined areas, please go back to that screen and do so.)

Characteristic			Rank	Level of Performance			
			Scale of 1 to 5	Quality	Quantity (# and units)		Standard
Form	Visual	Color	N/A				
		Pattern (within units)	N/A	Continuous			
		Reflectivity	N/A				
		Range	N/A				
	Geometric	Face Shape	N/A	Square			
		Depth	N/A	Equal to face			
		H Scale (joint spacing)	N/A	< 4" o.c.			
		V Scale (joint spacing)	N/A	< 4" o.c.			
		3D Complexity	N/A	Flat			
	Acoustic	NRC	N/A			NRC	
	Tactile	Resilience	N/A				
		Slip-resistance	N/A				
		Texture	N/A				
	Other	[ ]	N/A				
Function	Maintenance	Stain-resistance	N/A				
		Cleanability	N/A				
		Dirt-hiding	N/A				
		Water-resistance	N/A				
	Strength	Tensile	N/A			psi	
		Compressive	N/A			psi	
		Shear	N/A			psi	
		Bending	N/A			psi	
		Hardness	N/A				

FIG. 16

230

	Energy efficiency	R-Value	N/A		R-			
		Perm rating	N/A			perms		
	Noise reduction	STC	N/A			STC		
		IIC	N/A			IIC		
	Fire resistance	Fuel Contributed	N/A				ASTM E84	
		Flame Spread	N/A				ASTM E84	
		Smoke Generated	N/A				ASTM E84	
	Other		N/A			$/		
Budget	Initial	Parts	N/A			$/		
		Labor	N/A			$/		
		Total (P+L+O)	N/A			$/		
	Life Cycle	Operations	N/A			$/		
		Maintenance	N/A			$/		
		Repairs	N/A			$/		
	Recycle/Disposal	Total	N/A			$/		
	Other		N/A			$/		
Environment	Embodied Energy	Total	N/A					
	Energy Use	Total	N/A					
	Air Quality	Offgassing	N/A					
		Allergens/Toxins	N/A					
		Particulates	N/A					
	Other		N/A					

When you finish, click here:

- Submit to authorize DetailLogic to start generating a list of recommended assemblies, subassemblies, materials, and treatments
- Reset to delete all choices entered and start over

Click here to continue to the next step: Identify connections

235

FIG. 17

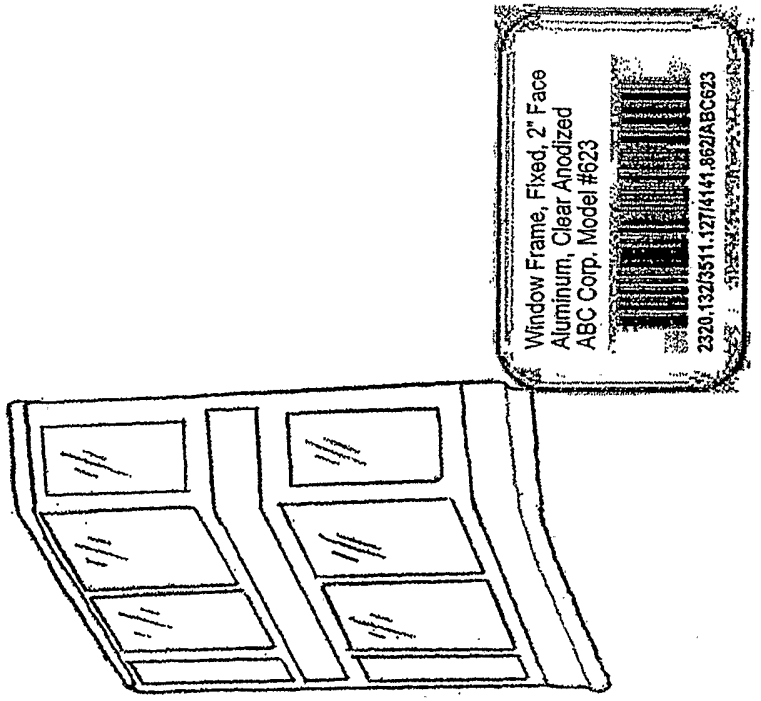

Window Frame, Fixed, 2" Face
Aluminum, Clear Anodized
ABC Corp. Model #623
2320.132/3511.127/4141.862/ABC623
245

FIG. 18