(51) International Patent Classification: G05B 19/418
(21) International Application Number: PCT/GB03/00538
(22) International Filing Date: 6 February 2003 (06.02.2003)
(25) Filing Language: English
(26) Publication Language: English
(30) Priority Data:
0202798.5 6 February 2002 (06.02.2002) GB
(71) Applicant (for all designated States except US): OXFORD NATURAL PRODUCTS PLC [GB/GB]; Combury Park, Charlbury, Oxfordshire OX7 3EH (GB).
(72) Inventor;
(75) Inventor/Applicant (for US only): WILSON, Timothy

(54) Title: METHOD AND SYSTEM FOR MANUFACTURING A PRODUCT AND/OR OPERATING A SUPPLY CHAIN IN RESPECT OF A PRODUCT

(57) Abstract: A method of manufacturing a product and simultaneously keeping a record of custody and/or location of the product is provided. The method provides a means for users to log details of product movements and process conditions to a central database such that the data is accessible further down the supply chain. This allows manufacturers to have instant access to information concerning the production of the starting materials or components that they purchase which can have many beneficial effects. The method is particularly applicable to the phyto-product industry. The invention also provides a system, preferably computer based, for recording data about the history of a product in which changes in location or custodian of a product can be logged to a central database such that an unbroken record of custody and location is provided for the product.
ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
METHOD AND SYSTEM FOR MANUFACTURING A PRODUCT AND/OR
OPERATING A SUPPLY CHAIN IN RESPECT OF A PRODUCT

The present invention relates to the operation of a supply chain in respect of,
and/or the manufacture of, a product. More particularly, it relates to the manufacture
of a product which, due to its method of manufacture, has a traceable history, that is
to say, certain details about the product and/or its starting materials are available to
the user of the system of the present invention. The invention has particular
application in the food, pharmaceutical and phyto-product fields where it can be
useful or legally essential to be able to confirm the provenance or origin of a product
or its ingredients.

The concept of providing an "audit trail" for a product is known.
Manufacturers have used various stock control systems in the past which have meant
that it is possible, for example, to determine which supplier each component of any
specific manufactured product originated from. This information has limited use in a
situation where one is considering which products to recall due to a faulty
component. The system allows the manufacturer to determine which products
contain the component from the same supplier as the component known to be faulty
and so allow the manufacturer to recall only a subset of the products on the market
rather than all of them. There are limitations to this, however, as will now be
described.

This known system breaks down at the boundaries of the organisation (e.g. a
company) which manufactures the product. That is to say, the product manufacturer
knows nothing about how the components it receives from its suppliers were made
and in turn knows nothing about how the products it sells are to be used (for example
the products may themselves be components of larger products). Thus, prior art
systems have concentrated on providing an audit trail limited to the operations of a
single organisation. A consequence of this is that when the custody of a product
changes, the audit trail ends and the user of the audit trail system can only look at
what a single organisation knows happened to the product. Other knowledge about
the product may exist, but it is confidentially retained by other parties. Taking again
the example of a product recall, this can be seen to have deleterious consequences as
will be described with reference to Figure 1.

Figure 1 shows part of the supply chain of a product P1 manufactured by
manufacturer M3. Manufacturer M3 sources ostensibly identical components from
two other manufacturers M1 and M2. Manufacturer M1 sources the starting
materials for the components from two suppliers S1 and S2 and manufacturer M2
sources the same starting materials from supplier S2 and supplier S3.

Suppose now that there is a problem at the site of supplier S1 such that all the
starting materials supplied by that supplier are below the required standard. Some of
the components made by manufacturer M1 will use the starting materials supplied by
supplier S1 and will thus also be defective. As a consequence of this, some of the
products P1 manufactured by manufacturer M3 will also be defective. Manufacturer
M3 may have in place a system which records whether the components for a
particular product were provided by manufacturer M1 or manufacturer M2. Thus, if
there were a problem with supplier S1, only some of the components made by
manufacturer M1 would be affected and manufacturer M3 would be able to recall all
of the products P1 made using components sourced from manufacturer M1 as a
result. In this way, products P1 made using components sourced from manufacturer
M2 would not need to be recalled. This is inefficient, however, because
manufacturer M3 is also recalling products P1 having components sourced from
manufacturer M1 which themselves were made from starting materials supplied by
supplier S2. These starting materials were to the required standard and so it can be
seen that M3 is recalling some products unnecessarily.

An even worse example is when a problem arises with supplier S2 such that
some of the starting materials supplied to manufacturer M1 and manufacturer M2 are
below standard. Then, only some of the components supplied by the manufacturer
M1 and manufacturer M2 to manufacturer M3 will be defective. Manufacturer M3
will, in general, have no way of telling which components are defective and which
are not by referring to whether the components were supplied by manufacturer M1 or
manufacturer M2 since some of the components supplied by each manufacturer are affected. M3 therefore has no choice but to recall all the products P1. This can be seen to be highly inefficient when it is considered that starting materials supplied by supplier S1 and S3 are perfectly good and these are used to make components of the product P1 which are not defective.

It can be seen that the above problems arise because manufacturer M3 is only able to determine whether the products came from manufacturer M1 or manufacturer M2 and is not able to determine whether the components from manufacturer M1 were made using starting materials from supplier S1 or from supplier S2.

There exists a further problem when the "required standard" referred to above changes, for example as a result of scientific advance. Of course, the tests performed on products to determine whether a standard is met are those that are necessary in that determination. Sometimes, it may be necessary to require that a product passes a certain new standard for which it has not been tested. Taking the discovery of BSE in UK animals as an example, the presence of prion proteins in animals suddenly became of critical importance. At this moment, the existing products in active supply chains were of unknown quality with respect to the new standard. Traditional gate-keeping mechanisms (at the point of product acceptance or rejection) became inadequate until all existing product was verified against the new standard, and indeed until appropriate quality assurance mechanisms were put in place to ensure that the new standard is consistently met (i.e. the removal of all animal protein from bovine feedstuff).

As a further example of this with reference to Figure 1, assume product P1 is a beefburger, manufacturer M3 receives raw unprocessed beef from manufacturers M1 and M2 and manufacturers M1 and M2 are slaughterhouses receiving live cows from suppliers S1, S2 and S3. If farm S3 is affected by BSE, manufacturer M3 can simply cease sourcing beef from manufacturer M2 and use manufacturer M1 as sole beef supplier. However, if the disease were to affect farm S2, manufacturer M3 would have to cease all production even though animals supplied from farms S1 and S3 are free of the disease.
A further problem is that manufacturer M3 has no means of determining whether the beef it receives has come from an animal that was reared on feed containing animal protein or not. Similarly, there is no way in general for manufacturer M3 to determine whether the beef it receives has come from an animal reared on a farm that uses particular chemicals or veterinary medicines. Furthermore, it is not possible for manufacturer M3 to obtain any information on the production process, environment health and safety or animal welfare at any of the farms S1 to S3. These factors may be important to the customers of manufacturer M3 and so it is desirable for M3 to have some way of obtaining this information.

A yet further problem exists when, say, products from suppliers S1 and S2 are mixed as part of the operations of M2, for example in a continuous process where all starting materials are fed to a hopper one after the other. There is traditionally no mechanism for determining which batch of starting materials are in use at any time.

Furthermore, there has been no previous attempt to take a record of how and when products are stored. For example, the acceptable product provided by supplier S2 may be contaminated in storage by the supplies from S1 due to the actions of manufacturer M1. Manufacturer M3 has no way of knowing about this using current systems.

It can therefore be seen that prior art methods of manufacturing a product are not amenable to recording data about the history of the product, its components and starting materials such that effective and punctilious product recall can be carried out.

The problems do not only reside when attempting to recall a product. The same problem occurs when developing a product after its first launch so as to improve it. In practice, any one of suppliers S1 to S3 could change the process by which they make the starting materials or subtly change the material composition itself. This may, or may not, have an adverse effect on the resulting product P1. Once manufacturer M3 receives the components from manufacturers M1 and M2, it may not be possible to analyse the starting materials used in the components. Thus, it is possible for the suppliers S1 to S3 to make changes that have an impact on the product but which manufacturer M3 does not know about. This can severely hinder
development work on product P1 if the changes occur at the same time as manufacturer M3 makes other changes to the design since manufacturer M3 is liable to put a change in performance of product P1 down to the modifications it knows it made rather than down to the real cause, a change made by supplier S1, S2 or S3.

In general, supply chains can be much longer with many more links than shown in Figure 1. In such cases, it is practically impossible for a manufacturer to have any information on the components or ingredients it buys other than information obtained by that manufacturer directly analysing those components or ingredients.

These problems have been addressed by the present invention which provides a method of manufacturing a product from one or more other products in which at least one of said products is subject to at least one change in custody or location, said method comprising keeping a record of custody and location of said products, and, in the course of handling the products, logging to a database the record of custody and location which applies to each of said products such that said record is unbroken. The method can involve simultaneously keeping a record of custody and/or location of the manufactured product and its starting materials (other products), where the record of custody and location is logged to a database in conjunction with the handling of the manufactured product or its starting materials.

In practice, this is achieved by each organisation involved in any given supply chain having access to the same database and each organisation entering information about the particular product or starting material that they handle. When a product or starting material moves location or changes custody (or both) this can also be logged in the database such that, for each finished product P1, a complete history of production can be obtained, including the locations, processes, starting and ending materials in each organisation involved. The chain is unbroken irrespective of the fact that different companies or entities were involved in producing different starting materials or components of the product and also despite the fact that products or starting materials may change custody many times during the manufacture of a product. This method of manufacturing can also be used to deliver consumer
confidence because the end manufacturer responsible for the (eg. food) product is more able to demonstrate that its products are safe and that they are what the consumer believed them to be in terms of their origins, production methods and societal acceptability.

In order that the database record of a product may be matched with an actual physical product, it is preferable that the products are packaged with an identifier (eg a bar code) effective as an accessor of the database record of the product. In this way, the, for example, bar code can be scanned and the entire history of the product and its starting materials and the processes used to transform the starting materials into the product can be accessed. In this way, information is metaphorically "attached" to the product itself as it makes its way through the supply chain rather than being attached to a particular company or entity that plays a small part in that supply chain.

Preferably, each location is defined by attributes in a database, these attributes being the key characteristics of a physical location.

Preferably, when a product or its starting material changes custody, the database logging step comprises associating an identity of that custodian and a time at which custody passed to that custodian with a product in the database. Similarly, when a product changes location, the logging step comprises associating an identifier of that location and a time at which the product arrived at that location with the product in the database. Furthermore, it is preferable that the method comprises logging in the database conditions relating to the location such that these conditions are associated with the location. These conditions may be, for example, temperature, pressure, humidity or whether or not the products of a certain type will be changed by being introduced to that location e.g. by cooking or blending or being mixed with other products/starting materials.

Preferably, the computer database provides that each location is represented by a location object in a computer system and each product and starting material are represented by product objects in the computer system. In this way, as real products move between real locations, product objects can be associated with the
corresponding location objects by virtue of event objects that represent the change in location.

Preferably, each product and location object is assigned a graphical icon so that they may be represented graphically on a display screen. This makes the system particularly easy and intuitive in its use. In particular, clicking and dragging actions may be accomplished with a mouse or similar so that product (and starting material) movements can be logged in the database (typically by creating event data in the form of dockets).

The system can preferably allow product objects to transform so as to more accurately model real life behaviour such as manufacturing processes and the growing of seeds into crops.

Each location object preferably has one or more attributes associated with it, these attributes being defined for all location objects in the system and serving to objectively describe the physical conditions at the respective location. The attributes typically indicate one or more of whether it is practically possible to move a location, whether it is practically possible to seal a location, whether it is intended that a location not be shown on the graphical user interface once the product is removed, whether certain products will be irreversibly changed by being put in that location and whether the location is capable of being divided into a plurality of separate identical locations.

The product objects may also have attributes associated with them which identify the (industry specific) category in which the product falls.

The system which operates the method also preferably supports the creation of a new product object when two product objects are associated with the same location object, depending on the attributes of the location and/or product.

The database is preferably remotely accessible by a plurality of users.

The invention is particularly applicable to phyto-products in which case the starting materials comprise seeds, plants, plant extracts. Typical locations include fields, barns, farm stores and agricultural packaging and containers.

The present invention also provides a method of operating a supply chain in
respect of a product in which the product or its starting material(s) is/are subject to at least one change in custody or location, said method comprising keeping a record of custody and location of said product and said starting material(s), and, in the course of the supply of said product, logging to a database the record of custody and location which applies to said product and its starting material(s) such that said record is unbroken.

The present invention also provides a product manufactured or supplied according to the above described method, the product being packaged with an identifier effective as an accessor of the database record of the product and its starting material(s).

The present invention furthermore provides a system for implementing the above described methods, the system comprising:

a graphical user interface including iconic representations of locations and products; and

means for manipulating said icons to represent changes in circumstance or condition of the products.

The present invention furthermore provides a system for recording data about the history of a product, the system comprising:

a database for storing details of locations and products;

means for logging to said database a change in location of a product; and

means for logging to said database a change of custodian of a location; wherein said database has stored in it a complete and unbroken record of custody and location for at least one product, despite said product having been subject to at least one change in custody or location.

Preferably the database is stored on a computer and the means for logging comprises a graphical user interface including iconic representations of locations, manufactured products and starting materials. The icons can ideally be directly manipulated (e.g. by clicking and dragging) by the user to effect logging of changes in location or conditions at a location. The icons can advantageously be presented in a hierarchical manner with sub-location icons and product icons depending from
location icons of the location which contains that sub-location/product. Additionally or alternatively, the icons can be presented in a geographical or process-oriented manner.

Database changes are preferably effected only by users who currently have custody of the product and database changes in custody are effected after input by both the new and old custodian.

Further, it is preferred that when a new location is defined by a user and it is indicated by the user that the new location is contained inside another location, that new location inherits the attributes of the other location, unless the new location is indicated as being sealed.

The present invention furthermore comprises a computer program capable of implementing the above described method or system.

The invention will now be described, by way of non-limitative example only, with reference to the accompanying drawings, in which:-

Figure 1 is a flow diagram of part of a supply chain according to the prior art;

Figure 2 schematically illustrates the movement of a product P2 from location 1 to location 2;

Figure 3 shows the associative relationship between location data, product data and events data;

Figure 4 schematically represents a series of product transfer events occurring between a location "Field 1" and various other locations;

Figure 5 schematically represents a series of product transfer events occurring between a location "Extractor 1" and various other locations;

Figure 6 schematically illustrates a supply chain, showing custody and location transfers of products;

Figure 7 schematically represents a series of product transfer events occurring between a location "Blender 3" and various other locations;

Figure 8 schematically illustrates the information recorded to an initiating docket during an internal transfer in accordance with the present invention;
Figure 9 schematically illustrates the information recorded to an initiating
docket during an external transfer in accordance with the present invention;
Figure 10 schematically illustrates the information recorded to a completing
docket during an external transfer in accordance with the present invention;
Figure 11 schematically represents the system structure in accordance with a
preferred embodiment of the present invention; and
Figure 12 schematically represents a hierarchical organisation of icons on a
computer display device in accordance with a preferred embodiment of the present
invention.

For the purposes of explaining the modelling of the physical attributes of the
product and its history, the following definitions are given

**Definitions**

A "location" is anything that is capable of "containing". It can contain other
locations, products or both. Locations have attributes which help to define their type
and how products flow into, out of and through these locations.

A "product" is anything that is not a location, but is capable of being
contained in/by a location. Thus, a "product" includes not only the finished product
that is sold to the end consumer, but also the components, starting materials and/or
ingredients of that finished product.

**Embodiments**

A detailed description of an embodiment of the invention now follows. The
embodiment comprises a computer-implemented system applied to the supply chain
of plant-based products (that is to say phyto-pharmaceuticals, nutraceuticals, herbal
remedies or the like). Of course, the invention can be applied in other product areas
and has general application to situations where it is desirable to know the history of a
finished product despite the fact that it has changed hands, possibly many times.

It is highly desirable to demonstrate the provenance of any materials used in
the production of consumer phyto-products. Without this ability, regulatory approval
is difficult (if not impossible) and consumer confidence in non-regulated products
can be easily shaken. The present invention addresses the requirement for complete
component traceability throughout the various supply chains involved in the
manufacture of products. In particular, the invention seeks to provide means by
which an "unbroken diary of responsibility" can be established for finished products
and components of finished products in their supply chains. This diary of
responsibility may also be referred to as a "chain of custody" in that it is a record of
all the persons who have at some stage been responsible for the product in question
or components used to make that product. The present invention operates by
providing that each person involved in the supply chain is given the means to input
data about what happens to a product while it is under their custody. When a product
changes custody, means are also provided for this to be logged so that there is built
up a complete chain of custody for a particular product. This allows the end seller
(who is exposed to the commercial risk by virtue of the fact that he sells directly to
the consumer) to monitor relevant aspects of the entire production process, even
though many of the production processes used would have taken place under the
responsibility of other commercial entities.

This embodiment of the invention comprises a relational database set up in a
specific way to allow the easy inputting of data and the easy generation of reports
relating to products. Firstly, the database allows details relating to "locations" to be
stored. A location is defined as any physical place that may contain a product. For
example, a storage warehouse is a "location" similarly, barrels, bottles, vessels, vats
and other containers are "locations". The database allows information about
locations to be inputted quite separately to information about any products stored at
those locations. For example, if the location is a barn, the custodian of the barn is
able to input (for example) a record of the temperature in the barn over time. This
can be done whether or not there are any actual products stored in the barn.
The database is also able to store information about products quite separately from the information regarding locations. For example, the product's name, colour, category and other attributes may be stored in the database. The interaction between products and locations are stored in a third data construct and are referred to as "events". These "events" represent changes in circumstances and are associated with locations and/or products. For example, suppose a product P2 is moved from location 1 to location 2 at a time \( t \). This is illustrated in Figure 2. The database knows of location 1 and location 2 because these locations have been defined by the respective custodian of each location. Similarly, the fact that product P2 is initially stored at location 1 has also been registered by the custodian of location 1. The location in which a product is stored is not thought of as an attribute of the product itself, but is rather considered to be as a result of some event. Thus, the fact that product P2 moved from location 1 to location 2 is recorded as an "event". When it is desired to log to the database that P2 has moved, event data is generated which indicates the time \( t \) when the change took place and also includes the various locations and products that were involved. This is schematically represented in Figure 3 where it is shown that the event data provides the bridge between the location data and the product data.

The history of product P2 can be determined by analysing the event data which mentions product P2. Once it is ascertained from this data that product P2 was in a particular location at a particular time, event data which mentions that location can then be analysed to determine the conditions at the location for the times when the product was present at that location. In this way, it is not necessary to associate directly the conditions in which a product is stored with the product. Instead, storage conditions are associated with a location and products are associated with locations via event data. In this way, changes of conditions at a location only need to be recorded once when they happen and only in respect of that location rather than being recorded in respect of every product at that location.

An example of this is illustrated by referring to Figure 4.

When a grower "drills" seed into a field, the seed (a product) is in effect being
moved from one location (a store) to another (a field) at a specific time. Data relating to this movement is stored as event data. The event data provides a link between locations, a product and a time. Figure 4 illustrates possible data for the process of growing a botanical crop from seed in a location known as "field 1". The thin arrows represent events, in this case product transfer events, the boxes at the bottom of the diagram represent various different locations and the boxes at the top of the diagram represent a single location (field 1) split into periods of time. Initially, fertiliser is moved from store 1 to the field. This fact is recorded as event (i). Event data relating to event (i) includes a record of the locations involved (i.e. identifiers of store 1 and field 1) and a record of the product involved (i.e. an identifier of the fertiliser). These identifiers are generally numbers which can, if desired, be represented by bar codes which are physically placed on the product or in the location. Subsequent to the fertiliser being applied to the field, the seeds of crop (a) are sown by moving them from store to the field. Again, this is recorded as event (ii). Later on, pesticide and water are transferred from respective store rooms to the field (identified as event iii and iv). Once the seeds have grown, the crop is harvested and removed from the field to store 5. This is identified as event (v). Thus, once the six locations (store 1, store 2, store 3, store 4, store 5 and field 1) have been set up in the system along with the four initial products (fertiliser, seed, pesticide and water) all of the movements of these products so as to produce the crop are monitored by event data. If crop (A) is later sold to a subscriber of the system of the present invention, the customer to whom it is sold can access the database which shows exactly what fertilisers and pesticides were used, in what quantities and when in order to produce crop (A). Furthermore, if, for example, the manufacturer of the pesticide also subscribes to the system of the present invention, the customer will be able to determine from what raw ingredients the pesticide was made and where it was bought from etc. In fact, it is envisaged that the buyer of the final product is able to trace all the components used in the manufacture of the product back to their raw starting materials.

The above example introduces some concepts which can be usefully
described now, in particular the concept of product transformation and reversibility.

**Product Transformation**

Two types of product transformation can be identified. A first type occurs when two products are mixed or interact at a location to create a new product. This might be thought of as a manufacturing operation. A second type occurs when products change at a location (either instantaneously or over time) due to the conditions at the location and without the assistance of other products.

The first type of change is modelled in the system of the present invention by prompting the user to name the new product whenever it is logged that two products have been brought together at the same location. This is because, in most instances, when two products become contained in the same location, with no other intervening containment, they affect one another in such a way as to create a new product. For example, in Fig 5, at some time (t), water is introduced to a location known as Extractor 1. Some later time (t1) crop (A) is also introduced into this location. As soon as this happens the water will begin to dissolve certain hydrophilic components contained in crop (A). The water will therefore contain components that it did not contain prior to the introduction of crop (A), and similarly, crop (A) will no longer contain certain corresponding components. Thus both products have been materially changed and something new has been created. At another time (t2) crop (B) is also introduced into Extractor 1. Once again the products already present in this location will be affected by the introduction of another and vice versa. The resultant product is known as Extract (F). The system of the present invention forces the user to name a new product as soon as it is logged that two products have been brought together in the same location at the same time. It also makes it impossible for the user to log a removal of the "ingredient" products (i.e. water, crop (A) and crop (B)) from the location. The system assumes that once the manufacturing process has started, the ingredient products are no longer present in their original form and so are no longer accessible to the user for the purpose of logging.
Regarding the second type of transformation, an example of this is when a first product (e.g. seed) is moved to the field at a certain time and then, some time later, a second, different, product (e.g. a crop) is removed from the field. Over time, the seed transforms into the crop. This transformation occurs even when no further products are logged as being moved to the field location. This situation is dealt with by the system of the present invention by storing an attribute of a location called "reversibility". This is described below.

**Reversibility**

Mixing two products together is not the only way to bring about change to a product. Consider the example of milk pasteurisation. Milk is exposed for a very short period of time to a high temperature in a pasteurising chamber. The product that goes into this process is milk. The product that comes out is pasteurised milk. These are clearly two different products, with two different safety profiles. No other product was involved in this transformation. Thus by introducing the product milk into the location pasteurising chamber a new product has been created. In the present invention, the pasteurising chamber is known as an irreversible location in respect of milk and the system behaves in a similar fashion to a reversible location when it contains two products, i.e. it makes the "ingredient" product unavailable to the user (as it is no longer possible to get the milk back) and forces the creation of a new product (in this case pasteurised milk) which the user must name. As mentioned above, irreversibility can also be associated with the passage of time. If seed material is planted in a field, it might be technically possible to retrieve it unchanged the following day. If the seed material is left there for, say, 6 months then it will clearly have changed and it will not be possible to get the seed back. This is dealt with by including a further location attribute which indicates how long the product must be present in the location in order for it to have changed to a new product. After this time period, the system prompts the user to name the new product.

In general, reversibility can be seen to be a measure of whether product
movements can be reversed, for example, if some pesticides are poured from one container to another container this might be described as reversible since it is possible to pour the pesticides back into the first container. However, if a pesticide is applied to a field, it is no longer possible to extract the pesticide from the field. The movement of pesticide from its container to a field can be seen to be an irreversible process. As just described, the database stores as an attribute of the location whether or not it is an irreversible location with respect to certain classes of product. For example, a field is an irreversible location with respect to fertiliser, pesticides and water, since none of these products can be removed from the field once they have been applied. This reversibility attribute is used in ensuring that the user interface is easy to use and reducing the likelihood of making mistakes. When a user logs that a fertiliser, for example, is moved from store 1 to field 1, the system asks whether the movement involves an application of the fertiliser to the surface of the field (irreversible) or the simple movement of the fertiliser in bulk (reversible). If the user indicates an application to the surface, it would not thereafter be possible to log that the fertiliser has been removed from the field and put somewhere else. The irreversibility of the field with respect to fertiliser would prevent such impossible actions being logged.

Figure 5 schematically shows the events that affect another stage in the process for manufacturing the phyto-product, namely the events relating to product transfers to and from the location called "extractor 1". By this stage, crop (A) has been taken from store 5 and loaded onto lorry 1. At extractor 1, sterilant and water are applied to the extractor to clean it and crop (A) is taken from the lorry and supplied to extractor 1. Next, crop (B) is taken from store 8 and supplied to extractor 1 and, after a certain amount of time, extract F is removed from the extractor. This sequence of events is logged in real time (or shortly afterwards) by the custodian of the extractor using a computer terminal connected to the central database. Extract (F) in this example comprises a single homogenous extract that results from a combination of crop (A) and crop (B). The user of the system who later comes into
possession of extract F is able to access all details pertaining to extract (F). That is to say, this user will be able to trace back the chain of custody of extract (F) and its components and will therefore know that extract (F) was formed from a combination of crop (A) and crop (B) in extractor 1 at a certain time and that crop (A) was grown in field 1 at a certain time and was treated by a certain pesticide at a certain time. This is despite the fact that field 1 was owned and operated by a completely different organisation to extractor 1.

It can thus be seen that the present invention operates by providing a means (for example a computer terminal connected to a central database via the internet) for the custodian of each location in which products or their components are processed to log event data pertaining to the processes and also to the products which flow through those processes. Recording the data in terms of locations, products and events gives much flexibility in how the data can be later recalled.

For example, events which mention "extractor 1" can be retrieved to give a complete log of which products entered and left extractor 1 when. Such a log might be useful if it is later determined that, say, extract (F) has a taint due to an earlier use of extractor 1 (or possibly due to ineffectual sterilisation). Thus, historical data for locations can be recalled as well as for individual products. In this example, field 1 is owned by organisation 1 and extractor 1 is owned by organisation 2. Similarly, store 5 is owned by organisation 1 and lorry 1 is owned by organisation 2. Thus, event (v) represents a change of location (i.e. from field 1 to store 5), but not a change of custody because organisation 1 is responsible for both locations. However, movement of crop (A) from store 5 to lorry 1 represents both a change in location and custody as store 5 has a different custodian to lorry 1. Such changes in custody will be described in more detail later.

Suppose now that a portion of extract (F) is subsequently sold to organisation 3 for blending with other extracts prior to formulation of the final product. The remainder of extract (F) is decanted into a sealed vessel (vessel 5) and put into cold storage (cold store 2) for later use. Organisation 3, a formulation company, takes receipt of extract (F) and places it in a blending vessel known as "blender 3" where it
will be blended with another herbal extract (extract (G)) to create a pre-formulation product known as product (K). The complete supply chain map detailing these and the other product movements is shown in Figure 6. The logged history for blender 3 is shown in Figure 7.

In Figure 6, a change of location, but not of custody is depicted by a large grey arrow and a change in location and custody is depicted by a large unfilled arrow. It can therefore be seen that the movement of some of the extract (F) to vessel 5 is all within the confines of organisation 2 and thus involves no change in custody (although no examples are given above, it is also possible for the custodian to change, without the location changing. This might occur if, for example, a field full of crops is sold).

Custodial Product Transfer

Where a product transfer event initiates a change of custody, both the initiating party and the receiving party must demonstrate their agreement to the transfer, before the system of the present invention records the transaction as completed. This is essential if products are not to exist in a responsibility vacuum. This implies the need for an event status for custodial product transfers; initiated, accepted, rejected, completed and withdrawn. The system of the present invention records the changing status of the event over time and will not commit the transfer of custody to the database until the transaction is accepted and completes. Custody remains with the initiating party if the transaction is rejected or withdrawn. Every custodial product transfer initiation is recorded, together with the length of time between state changes. This ensures that the initiating party does not believe that their responsibility for the product has passed before it actually has. A summary of the various product transfer events is given in the table below.
<table>
<thead>
<tr>
<th>Current Status</th>
<th>Destination Status</th>
<th>Custody</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Location</td>
<td>Organisation</td>
<td>Transfer</td>
</tr>
<tr>
<td>Store 1</td>
<td>Org. 1</td>
<td>Field 1</td>
<td>Org. 1</td>
</tr>
<tr>
<td>Field 1</td>
<td>Org. 1</td>
<td>Goods In</td>
<td>Org. 2</td>
</tr>
<tr>
<td>Goods In</td>
<td>Org. 2</td>
<td>Extractor 1</td>
<td>Org. 2</td>
</tr>
<tr>
<td>Extractor 1</td>
<td>Org. 2</td>
<td>Cold Store</td>
<td>Org. 2</td>
</tr>
<tr>
<td>Extractor 1</td>
<td>Org. 2</td>
<td>Blender 3</td>
<td>Org. 3</td>
</tr>
</tbody>
</table>

The present invention handles product transfer events by generating "dockets". A docket is automatically generated by the system of the present invention in response to every product transfer event request and every docket contains a persistent unique identifier (a number that is, and remains, unique within the system of the present invention which stays with the docket for as long as the docket exists within the system). Each docket contains sufficient information to describe accurately and completely any product transfer event. The docket mechanism helps to provide fast efficient traceability in the supply chain.

Figure 8 shows an example of a docket for the internal transfer of extract (F) from extractor 1 to cold store 2. As can be seen the request to move extract (F) from extractor 1 to cold store 2 is accepted and completed at the same time since the change of location is within the confines of the same organisation (organisation 2). However, when a custody transfer is requested, there is no completion until both the organisation requesting the transfer (i.e. the current custodian) and the organisation receiving the product (i.e. the potential custodian) both agree to the transfer. In this case, two dockets are generated, the first docket effectively places the product outside the organisational boundary for the initiating organisation, and the second docket accepts the product into the organisational boundary of the completing organisation. This is illustrated by Figures 9 and 10 which show two such dockets. Figure 9 shows the docket that is created when organisation 2 requests that extract (F) is transferred to organisation 3. Organisation 2 does not necessarily know which location (which will be registered with the system of the present invention by organisation 3) extract
(F) will be contained in and so the exact destination of extract (F) is not shown on this docket. Figure 10 shows that organisation 3 accepted the request to transfer extract (F) from extractor 1 and has indicated that it will be put in blender 3. As soon as the request is accepted, the docket completes and the transfer of extract (F) from organisation 2 to organisation 3 has been logged in the system.

Data confirming the date and time of acceptance is updated into the initiating docket as soon as the transaction completes. In the event of the product being rejected by organisation 3, no completing docket (as shown in Figure 10) is generated and instead the initiating docket (as shown in Figure 9) is updated with the rejection date and time. Under these circumstances, the system does not record any change in custody of the product. Similarly, the "withdrawn" flag provides the facility for organisation 2 to withdraw from the transaction before it completes (i.e. before organisation 3 accepts the product). This action is again updated on the initiating docket and no completing docket is generated.

When a new product is introduced into the system (as will be the case for all material initially), there is no "from" location in the docket file. At this point the traceability within the system of the present invention ceases.

Referring back to Figure 6, it can be seen that the items listed in the "IN" boxes all represent new products introduced into the system of the present invention. These are not of primary interest, and are not traceable. The "custody transfer" arrows (the large unfilled arrows) will each have two docket, one initiating the transfer and one completing it. The grey arrow within organisation 2 is an internal transfer of traceable material and initiates, accepts and completes on a single docket.

Additional Data

The above description describes a framework for correlating products and locations with information about those products and locations in such a way as to provide a complete diary of responsibility of any specified product and also, as a preferable feature, a diary of the history of certain locations. There is scope for
capturing, and providing controlled access to additional data, relating to both products and location. The additional data may, among other things:

- assist investigators in assimilating and understanding the chain of custody data.
- provide additional value to the users of the present system by providing important process level detail about the products passing through their supply chains and
- allow more accurate targeting of resource in the event of a product crisis.

In general, the additional data can be either product related or location related.

That is to say, the additional data can specify further attributes of particular products or further attributes of particular locations.

**Product Related Additional Process Data**

Consider the scenario presented in Figure 4, where organisation 1 (a farming enterprise) records the application of a product of type "pesticide" in field 1. So far, the only information gathered is that pesticide was applied, and this was after the seed had been drilled and before the crop was harvested.

Additional product data can range from simply recording which pesticide was applied (isoproturon (IPU) for example) through to the rate of application, the dose, the method of application, the reason for use, the operator's qualifications, the weather conditions at the time of application, the utilisation interval, which equipment was used etc.

Figure 4 also makes reference to "fertiliser" and "water". Clearly the data for these products are quite different to the pesticide data. For the fertiliser data such as the NPK value, or the method of application are relevant. For the water, the source, biological oxygen demand and turbidity may be important. In accordance with a preferred feature of the present invention, such data can be associated with categories
of product in the database.

**Location Related Additional Process Data**

Consider the scenario presented in Figure 5, where organisation 2 (a primary processor) records the introduction of sterilant, water, crop (A) and crop (B). No data is captured relating to the conditions under which these materials were introduced, or any processes carried out at this location whilst these materials were present. Extractor 2 actually incorporates a high-speed cutter/blender device, which is used to break down the structure of plant material and facilitate the extraction of active ingredients. This data is not related to materials in the extractor, but to the extractor itself. Details of the type of cutter blade used, the speed of rotation, the duration of use can also be significant. Figure 6 illustrates the example of the same product moving into different locations. The characteristics of each location are quite different, and potentially important. For example, if cold store 2 as depicted in Figure 6 is used to store raw materials as well as extracts there may be an effect on the quality of the materials stored in vessel 5 if vessel 5 is not sealed. Further, even if vessel 5 is sealed, the seal could fail or the cold store could fail leading to a rise in temperature. Thus, in the event of a product irregularity being discovered further down the production process, information about the processes used has been recorded and can only aid in identifying and taking appropriate action.

The fact that vessel 5 is a location that is itself contained within a location (cold store 2) is an example of the concept of "inheritance". Vessel 5 "inherits" some of the attributes of the location which contains it. An obvious example is that vessel 5 inherits the temperature conditions of cold store 2. Vessel 5 may inherit other conditions, depending on whether or not it is sealed. For example, if it is not sealed it will also inherit the atmospheric conditions (e.g. pressure and humidity) whereas if it is sealed it will not.
Further Additional Data

Further data relating to commercial factors can also be stored by the system of the present invention. In fact, any data which it is commercially useful to record can be associated with either organisations, products or locations.

Confidentiality

Information passed between two or more parties as part of a commercial exchange will often represent a commercial advantage by which an organisation competes in the market place. There is therefore a need that such data is handled confidentially and the present invention achieves this by allowing the supplier of information to indicate whether, or to what extent, such data is later accessible by other parties.

System Configuration

Figure 11 schematically shows how the various users of the present invention are connected to the central database server. Preferably, every link in the supply chain is connected to the central database via the internet. Each user is typically the custodian of one or more locations in which products may be contained. In accordance with the present invention, each user stores to the database details of when a product moves to or from a location of which they are a custodian. In this way, an unbroken diary of responsibility can be constructed for each product in the system. Although Figure 11 shows a central database which stores all of the information, there is no reason why distributed databases in which the information is distributed over a number of different locations cannot be used. The internet is preferred because it is already a well established method of communicating between remote computer systems. The present invention is preferably designed so that it can be used via a standard browser configuration on any platform (for example Internet
Explorer or Netscape on a personal computer). Use of the internet also allows the data to be accessed, as well as input from remote locations. However, other approaches such as dedicated networks can also be implemented.

Thus, organisations further down the supply chain can, if authorised, access data regarding products they intend to buy before they buy them. As already described, data relating to locations is stored separately from data relating to products. These two types of data are linked by "events". The unique separation of products and locations allows a user to view a chain of events involving a product or, alternatively, a chain of events involving a location. Thus, the system provides the ability to start looking at a product and its history to trace backwards to a certain location and from thence forth to look at everything which happened in that location in the past. This addresses the fact that problems with products may be related to how the location used to contain the product or one of its components (starting materials) was used before it contained the product. For example, if a container is used to store aluminium oxide is then cleaned and subsequently used to store navy beans, it is possible for the navy beans to become tainted with aluminium oxide due to the ineffectiveness of the cleaning routine in removing all the aluminium oxide from the container. The present system provides the user with the tool for determining this fact.

The system preferably comprises a graphical user interface which can be manipulated by the user using click and drag movements. In a preferred embodiment, each location and each product or starting material is represented by an icon. Figure 12 shows an example of the hierarchal way in which icons can be displayed. As can be seen in Figure 12, the locations "farm 1", "barn 1" and "vessel 1" and the product "sage" are represented by icons on the screen. The location of the products and locations (locations contained within other locations might be referred to as sub-locations) is displayed on screen in a hierarchal manner similar to the way folders and files are displayed in a computer system running Windows (TM) software.

The various logging steps can be carried out according to this preferred
embodiment by clicking on the product to be moved, dragging it away from its current location, and dropping it into its new location. This would initiate the generation of the docket described above. For example, suppose during a harvest the custodian of farm 3 (and therefore the custodian of field 2 and barn 2) decides to harvest the St. John's Wort growing in field 2 and place it inside sack 1 which is located in barn 2. Once he has physically completed this action, he can register it to the database simply by clicking on the St. John's Wort icon and dragging it over the sack 2 icon before dropping it. The system will then confirm that he has moved the St. John's Wort to sack 2 and if this confirmation is accepted, appropriate event data is written to the database. This provides an intuitive means for registering the change of location of products stored in the system. Similarly, to register process conditions occurring at a location, it is possible to simply click on the icon representing that location so as to enter a menu of possible choices from here it is possible to select or type in the data to be stored.

In the preferred embodiment each location and each product is represented by an icon. As an alternative to or in addition to the hierarchical structure shown in Figure 12, these icons can be arranged in such a way as to represent the physical layout of the organisation to which they relate. In effect the location icons can represent an aerial map of the custodial organisation. By clicking on a location such as Goods In, it is possible to see the sub-locations contained within Goods In, such as Bay 1, Bay 2 etc. Thus the hierarchy of locations is maintained (which is essential if environmental inheritance is to operate) but the user interface can be organised in an intuitive manner.

In addition there is the further possibility of graphically representing an organisation on screen in terms of the processes carried out within that organisation. For example, consider a farming enterprise involved in the production of a plant material. A typical process might be "Production of St. John's Wort". This process can be prescribed in terms of the locations and products required to complete the process. These details are programmed into the system by the user. For example, "Production of St. John's Wort" would require St. John's Wort seed, fertiliser,
pesticide, water and a suitable field to grow it in. When the user initiates the above process, the system requests the user to choose a suitable location from the list of locations already available in the system. Once chosen, the system knows that fertiliser must be taken from the fertiliser store and placed in the chosen field, then St. John's Wort seed must be taken from the seed store and placed in the field etc. The system simply requires the user to specify the dates on which these events happened in order to produce a representation of the crop, complete with all the relevant history and links to "ingredient" materials.

The system sees finished products and the starting materials used to make those products as product data (as distinct from location data). The system cannot therefore distinguish between the final product that reaches the end consumer and some intermediate product in the supply chain used in the manufacture of that final product.

Location Abstraction

In a preferred embodiment of the invention, means will be provided to ensure that various different descriptions of the same type of location products input by different users are recognised as being the same type of location or object respectively. For example, the words "field", "plot", "area", "production unit" and "tract" could all be used as descriptors of the same physical place or location. To overcome this, the presently preferred system allows a location of any type to be capable of identical treatment. As such the locations are described in an abstract way that is not reliant on descriptive language. Consider the example of Bay 6, a sub-location of Goods In. The system does not interpret any attributes or behaviour for this location from its descriptive name. Instead, Bay 6 has attributes such as "fixed", "not sealable", "not disposable", "surface = brick and concrete", reversible". In this way it is possible to model the behaviour of this location, and therefore the effect this location will have on any products it may happen to contain from time to time.
Using an appropriate set of attributes, it is possible to describe any location in exactly the same way, and to infer its behaviour without reference to its common-language name (e.g. "field"). It can be seen that "Bay 6" could be called "Location 17", and yet the system would still know how to treat it. This is useful when the same system is to be usable across a disparate community of users in extended supply chains. It is also necessary in order that the system knows how to treat a location even when no similar location has been encountered before, and can store information about any location in a well defined format.

To achieve location abstraction, the system when setting up the location data is adapted to ask specific questions that can always be asked of places rather than asking the user to give a description of the place. For example, when a user defines a new location, the system does not ask "what type of location is this?" but would instead ask "can crops be grown from seed at this location?". The answers to these specific questions are stored as attributes of the location (these attributes are described in greater detail later).

The system is preferably implemented using a computer system programmed in an object-oriented fashion. For example, the various icons shown in Figure 12 each represent an object (e.g. a location object or product object). Furthermore, each object represents a physical location or product. In accordance with the object-oriented methodology, each event is also represented by an object (an "event object"). Thus, the database contains data used by the computer system to define objects and associations between different objects, for example as shown in Figure 3.

Attributes of Locations

Custodian

All products and locations must have a custodian at all times. The custodian of a product will be the same as the custodian of the location which contains that product. Thus, the product "inherits" the custodian of the location to which it is
moved. Similarly, all sub-locations within a location will be under the custody of the same organisation. Thus, custodian is an attribute of every location defined in the system of the present invention.

5 **Movability**

This attribute determines whether it is logically possible to move a location or not. For example, a field cannot be moved but a pallet can. This attribute is somewhat incidental to the main goal of process level traceability but is useful in assisting the user (who may be many miles away from the location in question) in understanding something about the nature of that location.

**Sealability**

This attribute indicates whether or not the location in question is capable of being sealed against normal environmental ingress. There is a further attribute which is a flag that indicates whether or not the location is actually sealed. Only locations which are sealable can be sealed. If a location is not sealed (either because it is not sealable, or is sealable but has simply not been sealed), then there is a form of environmental inheritance wherein a sub-location inherits some of the environmental attributes of the parent location in which it resides. If a location is sealed, this serves to remove this environmental inheritance such that the child (sub-) location can have completely different environmental attributes to the parent location.

**Disposability**

This attribute indicates whether a location is intended to be disposed of once the product has been removed from it. For example, plastic packaging used to contain fertiliser is thrown away once the fertiliser has been applied to the field. The plastic packaging would be represented by a location object in the system of the present invention and the location object would have the attribute of "disposability". When the user moves (on the screen) the fertiliser from the plastic packaging to the field to indicate that the fertiliser has been spread on the field, the plastic packaging
location object is automatically deleted from the user interface by the system due to
the presence of the "disposability" attribute. The system implements this deletion by
creating a "disposal" event.

5 Reversibility

This attribute of the location has been already mentioned above and indicates
whether or not a product can be placed in a location then taken out again unchanged.
For example, if bread dough is placed in an oven at a suitable temperature, when it is
taken out, it is bread. The oven can be said to be an "irreversible" location with
respect to bread dough. However, if the bread dough is placed in a sealed vessel and
later removed, it has not changed in any practical sense and so the vessel might be
considered to be a reversible location with respect to bread dough. Another example
is when seeds are placed in fields and, after the passage of time, they transform into
crops. The reversibility attribute is therefore accompanied by a time attribute which
indicates how long the product has to be in the location before that location becomes
irreversible with respect to that product.

Environmental Control

This attribute indicates the parameters of any environmental control taking
place at the respective location. For example, control of temperature, atmosphere,
composition, pressure etc. can all be recorded and associated with the location by
appropriate setting of the environmental control attributes. In general, environmental
control is only possible in conjunction with sealability since an unsealable location
can by definition not have its environment controlled.

25 Plurality

This attribute indicates that a given location is in fact multiple, identical
locations. Consider the example of a box of 1000 high-density polyethylene bays.
Each bag is part of the same batch, with a stated batch number. Each bag was made
on the same production line, in the same place, using the same materials at virtually
the same time. It is not possible to distinguish between any two bags even using advanced analytical techniques. It is therefore possible to treat all 1000 bags as one single location until they are used. As soon as they contain something, it becomes possible, and indeed practically essential to be able to distinguish between any two bags. Say one bag was used to temporarily store some pesticide powder. It was subsequently emptied, and used to store some herbal plant material. Identical herbal plant material was also placed in a previously unused bag from the same batch of bags. Both bags are now delivered to another organisation to be used in a production process. Clearly the two samples of herbal plant material will be different as a result of being contained in the bags - one may have a taint of pesticide powder. Thus it becomes possible to distinguish between bags at the point of use, but not at the point of their manufacture.

The system represents the box of 1000 bags as a single location, with a single icon on screen. The icon is modified however to reflect the fact that this is in fact a plural location. It is then possible to click on this icon, and drag a new location (one of the bags) away and associate it with some other location. Clearly it is possible to do this up to 1000 times before the batch of bags is exhausted. In this way the system only creates a unique record for any of the bags at the point of use, and the user interface is not overwhelmed with 1000 irrelevant icons.

Calibration

This attribute indicates whether the location is calibratable. If so, the system allows the record of calibration to be stored in the database. Thus, the system offers the potential of providing calibration traceability, i.e. what the location was calibrated to and what that calibrator was itself calibrated to.

Attributes of Products

Product objects also have attributes associated with them in a similar way to location objects. This allows products to be categorised in a sensible way. The
actual categories used are in general industry specific - for example alcohol is both a solvent and a beverage depending on which industry is concerned. The preferred embodiment of the invention (which relates to the tracing of phyto-products) uses the following categories:

- seed/planting material
- fertiliser
- pesticide
- water
- solvent
- excipient

**Rules and Rule Setting**

In general in an industry, rules will exist about organisational behaviour. These may be from a standard setting authority (e.g. Soil Association, EMEA) or between commercial organisations. This can be reflected in the system of the present invention.

**Rule Authoring**

In general a rule will "belong to" the person who invented them. If a manufacturer sets a rule that any supplies given to it must be 98% pure, this rule can be thought of as belonging to that manufacturer rather than to the product or location at which the manufacturer resides. The system allows such rules to be set and can be used to prevent the movement of products which do not abide by the rules set. The rules can be altered using a publish and subscribe model in which rules sets are available to specify communities and/or organisations. Users who agree to the rules can subscribe to the rule set. Some manufacturers may require the subscription to their rule set before they deal with an organisation.
Responses and Auditing

Where rule set absolute values (e.g. temperature must be in the range of 50-55°C), it is possible to check whether the data entered at the process level complies with the rules. Thus, suppose supplier S agrees to sell to manufacturer M a batch of product P. If manufacturer M has set rules indicating that product P must not have been stored above 50°C, and supplier S initiates a product transfer event (for example by moving the icon for product P away from one of its own locations to a location of which manufacturer M is the custodian), the system can check to see if it has any process data regarding product P and warn manufacturer M that the product does not meet with its rules.
-33-

CLAIMS

1. A method of manufacturing a product from one or more other products in which at least one of said products is subject to at least one change in custody or location, said method comprising keeping a record of custody and location of said products, and, in the course of handling the products, logging to a database the record of custody and location which applies to each of said products such that said record is unbroken.

2. A method according to claim 1, wherein said logging step comprises associating in said database each of an identifier of a custodian and a time at which custody passed to said custodian with said product.

3. A method according to claim 1 or 2, wherein said logging step comprises associating in said database each of an identifier of a location and a time at which said product arrived at said location with said product.

4. A method according to any one of the preceding claims, wherein said logging step comprises logging conditions relating to a location in said database and associating said conditions with said location.

5. A method according to any one of the preceding claims, wherein said products are packaged with an identifier effective as an accessor of the database record of the respective product.

6. A method according to claim 5, wherein said identifier is a bar code.

7. A method according to any one of the preceding claims, wherein each location is represented by a location object in a computer system and each product is represented by a product object in said computer system.
8. A method according to claim 7, wherein logging a change in location of a product comprises creating an event object representing this change and associating said event object with two respective location objects and the product object.

9. A method according to claim 8 or 9, further comprising creating each said product object and location object in said computer system, and assigning a graphical icon to said objects so that said objects may be represented graphically on a display screen.

10. A method according to claim 9, wherein logging to a database a change in location of a product comprises dragging a product object icon out of association with a first location object icon and dragging it into association with a second location object icon.

11. A method according to any one of claims 7 to 10, wherein there is created an event object to represent a change of one product object into another product object.

12. A method according to claim 11, wherein said event object represents a change of a starting material product into said manufactured product.

13. A method according to claim 11, wherein said event object represents a change of a first starting material product into a second starting material product.

14. A method according to claim 13 wherein said first starting material product is seed and said second starting material product is plants.

15. A method according to any one of claims 7 to 14, wherein said location object has one or more attributes connected with it, such attributes
representing the physical conditions at the physical location that the respective location object represents.

16. A method according to claim 15, wherein one of said attributes is a custodian attribute which identifies who the custodian of the respective physical location is.

17. A method according to claim 15 or 16, wherein one of said attributes is a movability attribute which indicates whether it is practically possible to physically move the respective location.

18. A method according to any one of claims 15 to 17, wherein one of said attributes is a sealability attribute which indicates whether it is practically possible to physically seal off the location.

19. A method according to any one of claims 15 to 18, wherein one of said attributes is a disposability attribute which indicates whether it is intended to remove from the user interface of said computer system the location object representation when no product objects are associated with the respective location object.

20. A method according to any one of claims 15 to 19, wherein one of said attributes is a reversibility attribute which indicates whether product objects associated with the respective location object should be associated at the same time with an event object that represents a change in the condition or identity of the product object associated with the respective object.

21. A method according to any one of claims 15 to 20, wherein one of said attributes is plurality attribute which indicates whether said physical location is capable of being divided into a plurality of separate, identical physical locations.
22. A method according to any one of claims 15 to 21, wherein each product object has one or more attributes connected with it, such attributes representing categories of product type in which the respective product or starting material may fall.

23. A method according to claim 22, wherein said attributes indicate whether the product or starting material falls into the categories of "seed/planting material", "fertilizer", "pesticide", "water", "solvent" or "excipient".

24. A method according to claim 10 wherein when a change in location of a product is logged and the new location of the product is one which is logged as containing another product, an event object is created which records the mixing together of the two products and a new product object is created which represents the mixture product.

25. A method according to any one of the preceding claims wherein said database is accessible remotely by a plurality of users.

26. A method according to any one of the preceding claims, wherein said manufactured product is a phyto-product such as a phyto-pharmaceutical, nutraceutical, herbal remedy or the like.

27. A method according to any one of the preceding claims, wherein said one or more other products comprise plant extracts.

28. A method according to any one of the preceding claims, in which said products are packaged in packaging material.

29. A method according to claim 28, wherein said packaging material is represented by a location object.
30. A method of operating a supply chain in respect of a product in which
the product or its starting material(s) is/are subject to at least one change in custody
or location, said method comprising keeping a record of custody and location of said
product and said starting material(s), and, in the course of the supply of said product,
logging to a database the record of custody and location which applies to said
product and its starting material(s) such that said record is unbroken.

31. A product manufactured according to any one of claims 1 to 29 or
supplied according to claim 30, said product being packaged with an identifier
effective as an accessor of the database record of the product and its starting
material(s).

32. A system for implementing the manufacturing method of any one of
claims 1 to 29 or the supply chain of claim 30, said system comprising:
a graphical user interface including iconic representations of locations and
products; and
means for manipulating said icons to represent changes in circumstance or
condition of the products.

33. A system for recording data about the history of a product, the system
comprising;
a database for storing details of locations and products;
means for logging to said database a change in location of a product; and
means for logging to said database a change of custodian of a location;
wherein said database has stored in it a complete and unbroken record of
custody and location for at least one product, despite said product having been
subject to at least one change in custody or location.

34. A system according to claim 33, wherein said database is stored on a
computer or computer network and said means for logging comprises a graphical
user interface including iconic representations of locations and products.

35. A system according to claim 34, further comprising means for manipulating said icons to represent changes in circumstance or condition of the products.

36. A system according to claim 32 or 35, wherein said icons are manipulable by clicking on them and dragging them to other parts of the screen.

37. A system according to claim 32, 34, 35 or 36, wherein said icons are displayed in a hierarchical manner, with sub-location icons depending from location icons and product icons depending from the location icon of the location which physically contains the product.

38. A system according to any one of claims 32 to 37, wherein said system stores account details for a number of different users, said users accessing the system via their account, said system enabling those users who have custody of a product to log changes of location of said product.

39. A system according to claim 38, wherein, in order to log a change in custody of a product, said system is arranged to respond to a custody change request from the current product custodian by asking the potential new custodian if they accept custody of the product in question.

40. A system according to any one of claims 32 to 39, wherein said system is arranged to prompt a user to define a new product when it is logged that two products have been moved to the same location and it is determined that those products have been mixed to create a new product.

41. A system according to any one of claims 32 to 40, wherein said
system is arranged to prompt a user to define a new product when it is logged that a product has been moved to a location in which the "reversibility" attribute is set negative, said "reversibility" attribute indicating whether products are irreversibly changed in a location or not.

42. A system according to any one of claims 32 to 41, wherein said system is arranged to assign a set of default attributes to a newly defined location, if the user indicates that said newly defined location is a sub-location of an already defined location, said set of default attributes being the attributes of the already defined location.

43. A computer program comprising a set of machine readable instructions which implements the method of any one of claims 1 to 30 or the system of any one of claims 32 to 42.
**FIG. 4**

Location – Field 1

- Store 1: Fertiliser
- Store 2: Seed (a)
- Store 3: Pesticide
- Store 4: Water
- Store 5: Crop (A)

TIME

= Product Transfer Event

**FIG. 5**

Location – Extractor 1

- Store 6: Sterilant
- Store 7: Water
- Store 8: Crop (A)
- Store 9: Crop (B)
- Store 10: Extract (F)

TIME

From Store 5
**FIG. 6**
**FIG. 7**

**FIG. 8**

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>FROM</th>
<th>TO</th>
<th>WHEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extract (FF25648)</td>
<td>Extractor (1) (48022)</td>
<td>Cold Store (2) (33656)</td>
<td>(Unit 4)</td>
</tr>
</tbody>
</table>

---------- Event Status Flags ----------

<table>
<thead>
<tr>
<th>Status</th>
<th>Date: Time</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiated</td>
<td>01-07-00 17:34</td>
<td>113165</td>
</tr>
<tr>
<td>Accepted</td>
<td>01-07-00 17:54</td>
<td>113165</td>
</tr>
<tr>
<td>Rejected</td>
<td>01-07-00 17:54</td>
<td>113165</td>
</tr>
<tr>
<td>Completed</td>
<td>01-07-00 17:54</td>
<td>113165</td>
</tr>
<tr>
<td>Withdrawn</td>
<td>01-07-00 17:54</td>
<td>113165</td>
</tr>
</tbody>
</table>

Initiating Docker Number: 74541
Completing Docker Number: 74541
**FIG. 9**

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>FROM</th>
<th>TO</th>
<th>WHEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extract (P)</td>
<td>(Org 2)</td>
<td>(Org 3)</td>
<td>01/07/00 - 17:31</td>
</tr>
</tbody>
</table>

Initiating Docket Number: 7454
Completing Docket Number: 1585

**FIG. 10**

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>FROM</th>
<th>TO</th>
<th>WHEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extract (P)</td>
<td>(Org 2)</td>
<td>(Org 3)</td>
<td>01/07/00 - 17:31</td>
</tr>
</tbody>
</table>

Initiating Docket Number: 7454
Completing Docket Number: 1585
FIG. 11

- FARM 1
- PRIMARY PROCESSOR 1
- FARM 2
- SECONDARY PROCESSOR 1
- CENTRAL DATABASE
- MANUFACTURER
FIG. 12