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US 20190094841 A1 US 20120258436 A1  
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(54) Title of the Invention: **Input device**  
Abstract Title: **Input device**

(57) An input device comprises a first element 12 and a second element 14, the first and second elements 12,14 each including sensors 20 to allowing monitoring of the positions and/or orientations of the elements 12,14; wherein the first and second elements 12,14 further include warning devices 30 operable to output a warning signal to a user. The warning given to the user may take the form of a vibration, or an audible or visible warning. The warning may indicate the incorrect positioning of an element. Each element may take the form of a construction block with projections 18 and recesses arranged such that a projection of one block can be received within a recess of the other block to allow the blocks to be connected to one another. The input devices may be used in the construction of a virtual assembly.

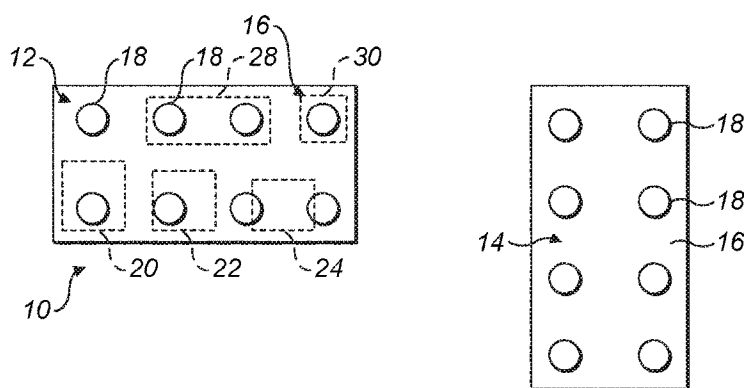


FIG. 1

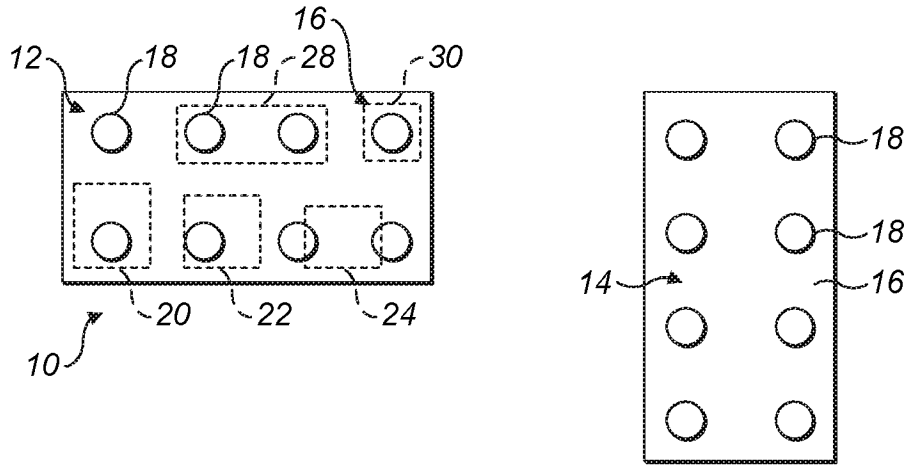


FIG. 1

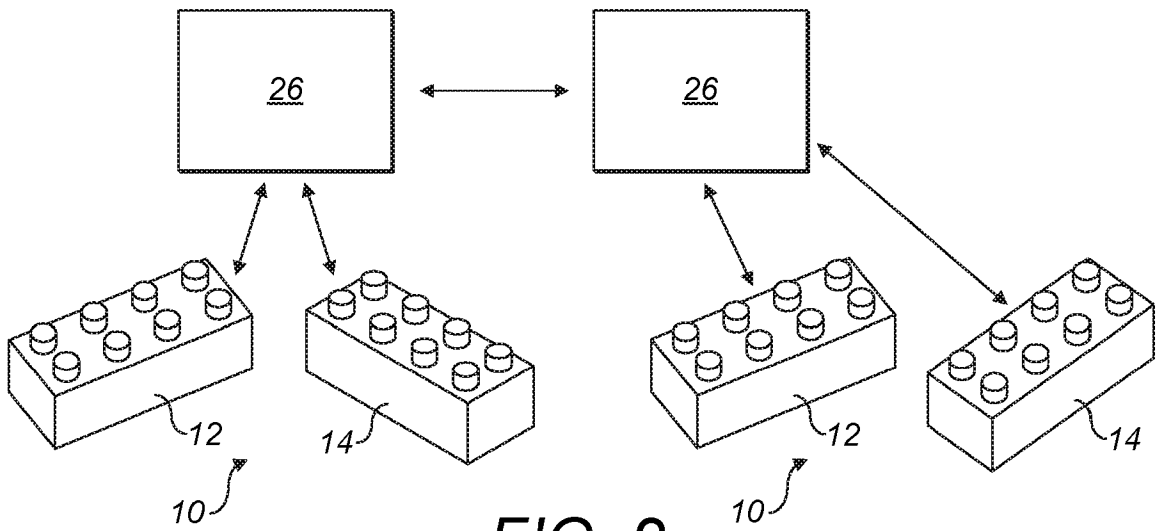


FIG. 2

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**INPUT DEVICE**

This invention relates to an input device for inputting information to a computer.

5 A number of computer input devices are known. By way of example, it is well known to input information using a keyboard, and to use a mouse or the like to control the position of a cursor on a screen, with buttons on the mouse being operable to instruct the computer to perform various functions. Increasingly, information and instructions are input onto a computer using a touch screen or the like. A number of wireless games controllers are also known. Whilst the various forms of input device function adequately in a number of situations, there is a desire to provide alternative forms of input device for use in certain applications. Furthermore, there is a desired be able to provide feedback to a user in the event that an action is being attempted that is not permitted.

15 According to a first aspect of the invention there is provided an input device comprising a first element and a second element, the first and second elements each including sensors to allowing monitoring of the positions and orientations of the elements, and a warning device operable to output a warning to a user.

20 The sensors monitoring the positions and orientations of the elements may also allow the generation and output of a trigger signal

The warning device conveniently comprises an electric motor operable to rotate an eccentric weight and thereby cause vibration of the associated element. However, other forms of warning device could be provided, such as other means for generating vibrations including suitable linear resonant actuators, or audible or visible warning devices. It will be appreciated that the use of a warning device operable to output a warning to a user increases the functionality of the input device as, for example, in the event that a user attempts an invalid operation, such as one in which the input device is in an inverted or sideways position, or in

which the user places the input device in a conflicting position, the warning device may be activated or triggered to generate a vibration or movement, for example, providing tactile or haptic feedback to the user indicating that the operation is invalid or is conflicting. In this manner, the user experience may be enhanced.

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The first and second elements each conveniently take the form of blocks, for example of construction blocks. The construction blocks may include one or more projections and recesses arranged such that a projection of one of the blocks can be received within a recess of the other of the blocks to allow the blocks to be connected to one another. Preferably, a detent or clutch arrangement is provided to provide positive feedback to the user of the attachment of the blocks to one another and to resist separation of the blocks from one another. The blocks may take the form of LEGO (RTM) blocks. Whilst the blocks are conveniently of this form, it will be appreciated that the invention is not restricted in this regard and other forms of block, or indeed elements of other forms, may be used.

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Each of the first and second elements may be provided with one or more three axis accelerometers providing information, in use, to the computer indicative of translational movement of the elements, and a three axis gyroscope, providing information, in use, to the computer indicative of angular or rotary motion of the element. The accelerometer and gyroscope of each element may take the form of a micro electromechanical systems (MEMs) device. The sensor outputs may be used by the computer to derive information relating to the positions and orientations of the elements, by way of example the accelerometers providing an indication of the magnitudes of accelerations experienced by the elements, and the gyroscopes providing information for use in ascertaining the directions in which those accelerations are experienced. The sensor outputs may be used to monitor absolute translational movement and angular movement of the elements and thus to provide information indicative of the absolute position and orientation of the elements in space. It will be appreciated that these merely represent examples of the types of sensor that may be provided, and the invention is not restricted in this regard.

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The sensors used to provide information relating to the relative positions of the elements may also provide information relating to the engagement of the elements with one another, by way of example through detection of vibrations or accelerations that may occur as a result of such engagement. The sensors may further be sensitive to tapping of the elements, or the like, by the user, for example using one or more of their fingers, such tapping generating a shock or vibration of magnitude detectable by the sensors. The sensors thus enable the generation and output of a trigger signal.

Each element is preferably arranged to communicate wirelessly, in use, with the computer. By way of example, a Bluetooth transmitter or the like may be incorporated into each element to transmit data representative of the outputs of the sensors to the computer. Each element preferably includes a battery or other electrical storage device, operable to supply power to the transmitter and sensors, as required. The battery or the like is preferably of a rechargeable form, conveniently being arranged to be recharged in a wireless manner.

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There are a number of applications in which groups use construction blocks as aids or tools in discussions, problem solving and the like. By using an input device of the type described hereinbefore, in conjunction with appropriate software, it will be appreciated that such aids or tools can be used in environments in which members of the group collaborate with one another whilst being located remotely from one another.

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According to another aspect of the invention there is provided a system for use in the construction of a virtual assembly, the system comprising a first computer, a first input device according to the first aspect of the invention and comprising a pair of elements communicating with the first computer, a second computer, and a second input device according to the first aspect of the invention comprising a pair of elements communicating with the second computer, the first and second computers being in communication with one another.

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The computers are preferably programmed and controlled in such a manner that, in use, the user of the first computer may, by manipulation of the first element of the first input device,

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move an image of a part constructed assembly displayed by the first computer, and may select a part thereof, for example by tapping, with a finger, the element and thereby generating and outputting a trigger signal to the computer. By manipulation of the second element of the first input device, he may move an image of a component to be added to the assembly, and the user  
5 may 'attach' the component to the assembly in a desired location by fitting the elements to one another or otherwise engaging the elements with one another. If desired, tapping of one or other, or both, of the elements, with a finger, may be used to generate and output a trigger signal indicating or confirming that the component is 'attached' in the desired position and orientation upon the assembly. Once 'attached' in this manner, the component becomes part  
10 of the assembly that is moved by manipulation of the first element, and the second element is used to move a new component to a desired position and/or orientation. It will be appreciated that in this manner, a larger virtual assembly may be constructed.

If the user attempts to position the parts of the image representing a component or components  
15 of the virtual assembly, through manipulation of the input devices, in an invalid position (for example an inverted or sideways position) or in a conflicting position (conflicting with other parts of the image already positioned and representing components of the assembly), then the computer may transmit a signal to one or other, or both, input device to cause operation of the warning device to provide the user with an indication, for example a haptic or tactile indication,  
20 that an invalid or conflicting operation has been attempted.

Through the communication between the first computer and the second computer, a user of the second computer may view an image showing the actions performed by the user of the first computer, and through manipulation of the second input device, may add further components  
25 to the assembly in substantially the manner described hereinbefore. It will be appreciated that in this manner, the assembly may be 'constructed' in a collaborative manner, with the users not needing to be in the vicinity of one another. Rather, they may be located remotely from one another.

30 Further computers and input devices may be provided, allowing a greater number of collaborators to work together.

It will be appreciated that the assembly and the component as displayed by the first and second computers need not be of the same shapes as the elements of the input devices. Indeed, as the assembly is constructed, the image representing the first element will change in shape, and the image representing the second element may be changed by the user as desired. The input devices are used to provide the user with a tactile mechanism for controlling the computer, to position and orientate images of the assembly and component and to allow the input of instructions through the generation and output of a trigger signal.

10 The invention further relates to a method of controlling a computer comprising using an input device according to the first aspect of the invention to control an image displayed by the computer, movement of the first element of the input device being used to cause the computer to adjust the position and/or orientation of an assembly displayed thereby, and movement of the second element of the input device being used to cause the computer to adjust the position and/or orientation of a component relative to the assembly.

The invention will further be described, by way of example, with reference to the accompanying drawings, in which:

20 Figure 1 is a diagrammatic representation of an input device in accordance with an embodiment of the invention; and

Figure 2 is a diagram illustrating an application in which the input device may be used.

25 Referring firstly to Figure 1, an input device 10 in accordance with an embodiment of the invention is illustrated. The input device 10 takes the form of a first element 12 and a second element 14, each of which comprises a construction block. In this embodiment of the invention, each of the first and second elements 12, 14 is of generally cuboid shape, having an upper surface 16 from which projections 18 extend, and a recess (not shown) in the underside thereof

into which one or more of the projections 18 of the other element can be received. Whilst not illustrated, associated with the recess is a detent or clutch member that, in use, is cooperable with one or more of the projections 18 when received within the recess, the detent or clutch serving to engage the projection(s) 18 to retain the elements 12, 14 in an assembled condition and to provide a tactile feel to the user that the elements 12, 14 have been secured together. The nature of the detent or clutch is such that the elements 12 can be pulled apart from one another when desired. It will be appreciated that the elements 12, 14 thus take the form of LEGO (RTM) or the like construction blocks.

10 The elements 12, 14 are conveniently the same shape as one another, but this need not always be the case and they could be of different shapes to one another, whilst containing substantially the same internal components (see below). They may be differently coloured or otherwise marked in order to distinguish them from one another. As the functions of the elements 12, 14, in use, differ from one another, the ability to easily identify which is which is desirable.

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Whilst a specific form of construction block is described hereinbefore, it will be appreciated that the invention is not restricted in this regard, and may be employed with construction blocks of a range of other designs. Indeed it may be embodied in arrangements in which the elements are not in the form of construction block.

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Within each element 12, 14 is provided a sensor or a series of sensors 20. In the arrangement shown, each element 12, 14 includes a pair of sensors 20 which take the form of a three axis accelerometer sensitive to translational movement of the element 12, 14 in which they are fitted and a three axis gyroscope sensitive to angular or rotary movement and so sensitive to changes in the orientation of the element 12, 14. The sensors 20 located within each element 12, 14 are conveniently contained within a single MEMs device. Each element 12, 14, further includes a battery 22 or other rechargeable electrical storage device, a wireless power transfer arrangement whereby recharging of the battery 22 may be undertaken in a convenient, wireless manner, and a communications module 24, for example in the form of a Bluetooth (RTM) transmitter whereby outputs from the sensors 20 can be transmitted to a remote location, such as to a computer 26 (see Figure 2) and whereby signals from can be received from the computer.



The receiver coil of the wireless power transfer arrangement may, if desired, be wrapped around the detent or clutch member. Each element 12, 14 further includes a processor 28 connected to the sensors 20, powered by the battery 22 and connected to the communications module 24, the processor 28 controlling the communications module 24 in such a manner that the outputs from the elements 12, 14 to the computer 26 is accurately representative of the positions and orientations of the elements 12, 14.

The elements 12, 14 further include warning devices 30 operable to output warning signals to the user, in use. By way of example, the warning devices 30 may take the form of electric motors operable to drive eccentric weights for rotation to cause vibration of the elements 12, 14 to provide a warning to the user. It will be appreciated, however, that other forms of warning device may be used. By way of example, other means for generating vibrations or movements of the elements 12, 14 could be used, such as suitable linear resonant actuators, or the warning devices 30 may be operable to generate audible warnings and/or visible warnings (for example in the form of flashing lights or the like). The warning devices 30 are operable under the control of the associated processor 28 that, in turn, controls the warning devices 30 in response to signals received via the communications modules 24 from the associated computer 26.

In use, a user holds the input device 10 with one of the elements 12, 14 in his left hand and the other of the elements 12, 14 in his right hand. As he moves his hands and manipulates the elements 12, 14, movement of the elements 12, 14 is detected by the sensors 20, and the sensor outputs are transmitted by way of the processor 28 and communications module 24 to the computer 26. The computer 26 can use the movement information received from the communications module 24 to determine the location of each of the elements 12, 14, and can thereby determine the relative positions thereof.

As the user moves the elements 12, 14 relative to one another, the computer can control an image displayed thereon to provide an indication of the relative positions of the elements 12, 14. Once the user has decided that he is happy with the relative positions of the elements 12, 14, he can attach them to one another by introducing the projections 18 of one of the elements 12, 14 into the recess of the other of the elements 12, 14, the detent or clutch arrangement

becoming engaged to secure the elements 12, 14 to one another in the desired configuration. The 'snap' that occurs upon such engagement not only provides a positive feel to the user that the elements 12, 14 have been secured to one another, but also will be detected by the sensors 20, and used by the processor 28 to generate a trigger signal, the output of which may be used  
5 by the computer 26 to provide an indication that the elements 12, 14 have been attached to one another. Rather than rely upon this 'snap' or in addition thereto, the user may tap one or other, or both, of the elements 12, 14 with one or more of his or her fingers to cause the generation of the trigger signal.

10 In the event that the user, through manipulation of the elements 12, 14, moves the parts of the image to an invalid position (for example the user may be attempting to connect displayed image parts in a manner that is not permitted such as with an image part in a sideways or inverted orientation) or in a conflicting position (conflicting with an image part that has already  
15 been positioned) then the computer 26 may transmit a signal for receipt by the communications module 24 and use by the processor 28 to control the warning device 30 in such a manner as to output a warning to the user that such an invalid or conflicting operation is being attempted. Upon activation of the warning device 30, the user will experience vibration of one or both of the elements 12, 14, providing an indication that this position is not permitted.

20 It is thought that by providing the user with tactile or haptic feedback in this manner, indicating when an invalid or conflicting operation is being attempted, the user experience will be enhanced.

If desired, the warning device 30 may also be used to output a signal to the user upon successful  
25 completion of an operation. Again, this may enhance the user experience.

As shown in Figure 2, it is envisaged that, in use, a number of users may each have their own input device 10 made up of a respective pair of elements 12, 14 wirelessly communicating with their own computer 26, and that the computers 26 will communicate with one another by way  
30 of the internet or the like. Each computer 26 may display substantially the same image as one

another, and may display a partially constructed assembly. For each user, the element 12 may be represented on the display as the partially constructed assembly, and the element 14 may be represented by an additional construction block component to be added thereto, the user moving his elements 12, 14 until the additional construction block component occupies a  
5 desired position relative to the partially constructed assembly, at which point he can connect his elements 12, 14 to one another whereon the computer adds the additional construction block to the partially constructed assembly, ready for the same or another of the users to add another block component.

10 It will be appreciated that, in this manner, a number of users that may be located remotely from one another can collaborate, working together in the construction of a final assembly. The construction of the assembly in this manner may be used as an aid or tool in a group discussion or problem solving environment or the like.

15 It is envisaged that in one embodiment of the invention, the computer program run by the computers may have a number of operating modes, and that switching between the modes may be achieved or instructed by the user tapping the elements 12, 14 to cause the generation of a trigger signal. By way of example, the program may initially be in an operating mode in which the first element 12 is used to manipulate the position and/or orientation of the displayed  
20 assembly, the second element 14 being inactive in this mode. Tapping of the elements 12, 14 may be used to switch to a mode in which, in addition, the second element 14 is active and is used to control the position and orientation of a component displayed by the computer, the shape of the component being selected from a displayed pallet by hovering the component over a part of the pallet and tapping the element 14 to select the desired component shape. After  
25 selection of the shape of the component in this manner, the program switches to a third mode in which the positions and orientations of the elements 12, 14 are used, respectively, to control the positions and orientations of the assembly and the component. Once the component is in a desired position relative to the assembly, tapping of the elements 12, 14 to generate a trigger signal switches the program to a mode in which the component is added to the assembly in the  
30 desired position and orientation, with the first element 12 being used to control the position

and orientation of the newly modified assembly, ready to return to the initial mode set out above.

The generation of trigger signals by the input devices used by others of the users may be used  
5 to switch control between different ones of the users.

As described hereinbefore, the warning devices 30 may be triggered, when appropriate, to output warning signals to users in the event that they are attempting invalid operations and/or to provide a signal indicative of successful completion of an operation.

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Whilst a specific embodiment of the invention is described hereinbefore with reference to the accompanying drawings, it will be appreciated that a wide range of modifications and alterations may be made thereto without departing from the scope of the invention as defined by the appended claims.

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**CLAIMS:**

1. An input device comprising a first element and a second element, the first and second elements each including sensors to allow monitoring of the positions and orientations of the elements, and a warning device operable to output a warning to a user.  
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2. A device according to Claim 1, wherein the warning device comprises an electric motor operable to rotate an eccentric weight and thereby cause vibration of the associated element.
- 10 3. A device according to Claim 1, wherein the warning device comprises a means for generating vibrations, or an audible or visible warning device.
4. A device according to any of the preceding claims, wherein the sensors monitoring the positions and orientations of the elements also allow the generation and output of a trigger  
15 signal.
5. A device according to any of the preceding claims, wherein the first and second elements each take the form of construction blocks.
- 20 6. A device according to Claim 5, wherein the construction blocks include one or more projections and recesses arranged such that a projection of one of the blocks can be received within a recess of the other of the blocks to allow the blocks to be connected to one another.
7. A device according to Claim 6, wherein a detent or clutch arrangement is provided to  
25 provide positive feedback to the user of the attachment of the blocks to one another and to resist separation of the blocks from one another.

8. A device according to any of the preceding claims, wherein each of the first and second elements is provided with one or more accelerometers providing information indicative of translational movement of the elements and a gyroscope providing information indicative of angular or rotary motion of the element.

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9. A device according to Claim 8, wherein the sensor takes the form of a micro electromechanical systems (MEMs) device.

10. A device according to any of the preceding claims, wherein the sensors used to provide information relating to the relative positions of the elements also provide information relating to the engagement of the elements with one another.

11. A device according to any of the preceding claims, wherein each element is arranged to communicate wirelessly, in use, with the computer.

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12. A device according to any of the preceding claims, wherein each element includes a battery or other electrical storage device.

13. A system for use in the construction of a virtual assembly, the system comprising a first computer, a first input device according to any of the preceding claims communicating with the first computer, a second computer, and a second input device according to any of the preceding claims communicating with the second computer, the first and second computers being in communication with one another.

14. A system according to Claim 13, wherein the first and second computers are programmed and controlled in such a manner that, in use, the user of the first computer may, by manipulation of the first element of the first input device, moves an image of a part constructed assembly displayed by the first computer, and may select a part thereof, by

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generating and outputting a trigger signal to the computer, and by manipulation of the second element of the first input device, may move an image of a component to be added to the assembly, and may 'attach' the component to the assembly in a desired location by fitting the elements to one another or otherwise engaging the elements with one another.

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15. A system according to Claim 14, wherein the warning device is triggered to output a warning signal in the event that the parts of the image are moved to an invalid and/or conflicting position.

10 16. A method of controlling a computer comprising using an input device according to any of Claims 1 to 12 to control an image displayed by the computer, movement of the first element of the input device being used to cause the computer to adjust the position and/or orientation of an assembly displayed thereby, and movement of the second element of the input device being used to cause the computer to adjust the position and/or orientation of a component  
15 relative to the assembly.



**Application No:** GB2100122.7

**Examiner:** Mr Paul Makin

**Claims searched:** 1-16

**Date of search:** 2 June 2021

**Patents Act 1977: Search Report under Section 17**

**Documents considered to be relevant:**

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-16	US 2012/0258436 A1 (LEE) whole document
X	1-16	US 2019/0094841 A1 (DENAYER) whole document
X	1-16	US 2002/0196250 A1 (ANDERSON) whole document

**Categories:**

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

**Field of Search:**

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC<sup>X</sup> :

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Worldwide search of patent documents classified in the following areas of the IPC

A63H
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The following online and other databases have been used in the preparation of this search report

WPI, EPODOC
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**International Classification:**

Subclass	Subgroup	Valid From
A63H	0033/04	01/01/2006
A63H	0033/08	01/01/2006
G09B	0019/00	01/01/2006