In FIG. **14** a different type of device (**101** as used in FIG. **6**) is shown. Passive ramp structure **169** is used to force all of the pins to the lowered position (retracted from surface **33**). Since pin shafts **83** must be able to pass unhindered through ramp structure **169**, ramp structure **169** includes plural ramp elements **171** defining slots **173** between element **171** (as shown in FIG. **15** for only three rows **121** of pins **81**, it being understood that a similar ramp structure for four rows of pins could be provided). Slots **173** are wide enough to allow passage of pin shafts **183**, but narrow enough to allow ramp engagement of pin heads **85**. Pins **81** in the lowered (retracted) position can be recessed well below the surface of the block of material, so pin configuration is not as critical for proper Braille reading as would be true for positioning of raised pins. Ramp elements **171** include a leading edge **175** at surface **104** of the block to engage pins **81** in slots **173** (thus the necessity for pin heads with rounded edges to assure smooth engagement). As wheel **27** passes ramp **169**, pins **81** are borne away from the surface **104** by their heads **85**.

FIGS. **16** and **17** illustrate use of passive device **99** to retain pins **81** in raised or lowered position for user reading, in whichever position they are in when they encounter device **99**. Leading edge **179** of device **99** is rounded or pointed or both to minimize the risk that a partially extended pin could jam the device (and thus the entire system). If a pin **81** is in the raised (extended) position, retaining device **99** maintains the pin thereat at top face **181** of head **85**, resisting external forces such as gravity, vibration, and finger pressure to retain the dots in a readable position with end **84** protruding from surface **33**. If a pin **81** is in the lowered position, the retaining device holds the pin in place by underface **183** of head **85** and shaft **83** of the pin passes through slot **185** formed by retainer elements **187** of retaining device **99** (FIG. **17**, only one retaining slot **185** being shown for one of the three or four rows **121** of pins **81**, it being understood that side by side elements **187** forming sufficient such slots **185** for all rows **121** would be provided).

Retaining device **99** serves multiple purposes. It separates pins **81** into distinct raised or lowered positions, allowing the maximum tolerance for pins that may not be in precisely the correct position as they approach and encounter retaining device **99**. It minimizes the risk of a pin jamming in an intermediate position and holds the raised pins with a tight tolerance while they pass through the reading aperture to assure that rounded ends **84** of pins **81** are a correct height above surface **33** of wheel **27** to serve as detectable Braille dots. Retaining device **99** is preferably narrower and/or more centered (relative to pin length at full retraction) at leading edge **179** of the device to better separate pins **81** into retracted or extended states, and is preferably thicker, and thereby closer to wheel surface **104** in the reading area for precise position control of raised pins **81**. Depending upon the dimensions of pin heads **85** with respect to the pin shaft **83** diameter, it may be sufficient to have passive position retention device **99** contact only one side of the pin (head and shaft) thereby eliminating the redundant elements **187** of the device utilized to define slots **185**.

For all passive positioning devices **165**, **101** and **99** shown hereinabove, pin head **85** configuration is important. The various ramps and elements that provide pin raising, lowering and/or retention must be able to contact underface **183** of pins **81** if they are to be lowered (retracted) or retained, and must be able to slide along the pin edge smoothly if they are to be raised (extended).

In particular, where a pin **81** is so extended as to be in contact with surface **104** of wheel **27**, a ramp structure **169** utilized for retracting the pin must be able to be inserted between pin head **85** and surface **104** at its leading edge **175**. In addition to the edges of pin heads **85** being well rounded or otherwise sloped, a thin ridge of material **191** is preferably incorporated with pins **81** (a collar as shown in FIG. **18**) and/or at openings **93** at surface **104** of wheel **27** (a surrounding lip as shown in FIG. **19**) to prevent pin movement to a fully flush position with surface **104** and allow a gap for more ready acceptance of leading edge **175** of ramp structure **169**.

In the event of geometric constraints, for example the diameter of each of the actuators **49** being greater than the spacing between adjacent rows **121** in a Braille cell, methods can be used to concentrate the effects of the multiple actuators **49** down into the space required (i.e., to fit the actuators to the available space). Some such methods include use of shaft linkages **195** (mechanical or flexible linkages, for example) as illustrated in FIG. **20**, or utilization of different pin and/or actuator shaft **51** lengths (see FIG. **21**, for example, wherein actuators **49** are staggered and employ different shaft **51** lengths).

FIG. **22** shows a combination actuator/passive position retention device **200** that includes a flexible or hinged extension **202** positionable by actuator **49** to act as a ramp, guiding pins **81** that contact the ramp from a default position to a non-default position. When extension **202** is raised by actuator shaft **51**, pin heads **85** pass underneath it and remain in the default position. The connection between actuator shaft **51** and extension **202** is offset relative to a line defined by a row **121** of pins **81** so that the moving pins do not impact actuator shaft **51**. This permits use of a relatively long ramping and, thus, a relatively shallow slope to move pins **81**. Changes in position of extension **202** while pins **81** are in transit therealong will cause those pins on the ramp defined by extension **202** to be immediately shifted by some amount but will not effect the final positions of the pins in the reading aperture.

The construction of rotatable outer rim **105** of FIG. **6** can be single piece, with pin shaft openings **93** drilled or molded, or multiple piece, one or two ring layers per row **121** of Braille pins. If assembly **92** is placed in an assembly workstation with drive shaft **109** pointed down, pins **81** may be inserted in openings **93** of outer rim **105** and then rotating assembly **92** lowered down and fitted into place in housing **37**. Non-rotating assembly **95** will prevent pins **81** from falling out of outer rim **105** once it is in place.

The techniques described for a wheel-based display could also be applied to a more conventional structure of a line display. As shown in FIG. **23**, pins **81** can be placed in a linear, nonmoving matrix **208** at a housing (not shown), and assembly **210** moved underneath pin matrix **208** to set pins **81** and thus the Braille dots as heretofore disclosed. Moving assembly **210** includes a passive pin default positioning device **212** (a two ramp structure generally of the type shown in FIGS. **14** and **15** for lowering pins **81**), followed by actuators **49** (one for each row of pins, three or four total for the entire line) and passive pin position retention device **99**. Assembly **210** as shown moves from left to right, with establishment of pin default position being assured at forward ramp **214** of device **212**, writing and fixing the Braille text as it moves. When the user is finished reading the line of Braille text streamed across reading area **33** and signals for a refresh, moving assembly **210** travels back (from right to left in the FIGURE), with actuator shafts **51** retracted. The reversed ramp **216** of passive default positioning device **212** lowers any pins **81** that were raised to allow passage of passive default positioning device **212** during return.