Title: WHEELCHAIR AND SEAT INTERFACE APPARATUS

Abstract: A universal wheelchair interface comprises a central frame member (27) and modular attachment arms (32,34) etc selected to suit the size, shape and spacing of the side frame members (24) of the wheelchair to which it is to be fitted. The frame member (27) includes two load-support tubes (28) for carrying a seating arrangement.
Wheelchairs and Seat Interface Apparatus

This invention relates to seat interface apparatus and to wheelchairs and associated kits incorporating such apparatus.

There is a large variety of wheelchairs available on the market ranging from simple inexpensive "L series Ministry Blueprint" folding wheelchairs designed in the UK in the 1940's to powered indoor/outdoor wheelchairs with an array of electronic devices. Additionally users require an equally diverse variety of specialist seating systems to address their many varied requirements. In many instances a seat may be custom designed to provide specialist postural support. A large amount of time is therefore spent by engineers to adapt the preferred seat arrangement to the particular wheelchair. This almost invariably requires an engineer to construct a custom mechanism or interface to couple the seating system to the wheelchair. Usually this device will be constructed to incorporate a quick release mechanism to facilitate separation of the items for transportation and storage. Custom interface mechanisms can take several weeks to design and construct and furthermore require documentation in the form of a "technical file" which is time-consuming to produce. Furthermore, many wheelchairs are designed to be collapsed to a stowed state for storage or transport and existing interfaces can effectively rigidise the wheelchair base so that it is no longer capable of being collapsed, which poses severe practical limitations.

Accordingly, we have identified a need for a wheelchair seat interface apparatus which is capable of being readily fitted to many different types of wheelchair base and equally capable of receiving many different types of seat
arrangement so that the many hours of engineering time spent customising a particular combination on a case by case basis can be saved and which also preferably allows typical folding wheelchairs to retain their folding capability. The interface is not of course restricted to use on folding wheelchairs.

Accordingly, in one aspect, this invention provides a wheelchair seat interface apparatus for a wheelchair having a base structure which includes two spaced parallel side frame members which extend generally horizontally in use, said interface apparatus comprising:-

an interface frame element having first attachment means at one side region thereof for being attached in use to one of the side frame members of a wheelchair, and second attachment means at an opposite side region for being attached in use to the other side frame member of said wheelchair when the wheelchair is in an operational configuration,

said interface frame element presenting one or more load-carrying regions for being connected in use to a seat arrangement.

In this arrangement, the interface frame element may provide one or more standardised load-carrying regions which engage similar standardised complementary regions on the seat arrangement, either directly or via a seat connector member which itself provides a standard connection region such as a flat surface, as to be described below.

In one embodiment, the first attachment means comprises a pivotal coupling and the second attachment means comprises a releasable coupling.

In this arrangement, the releasable attachment means provided on the interface, and the pivotal mounting at the other end mean that, where the
wheelchair is collapsible, the interface frame element may be swung clear to allow the wheelchair to be collapsed by releasing the releasable attachment means and pivoting the interface frame element about its pivotal coupling. This means that, in a typical folding wheelchair, the interface frame element does not interfere unduly with the collapsing of the wheelchair so that it can still be collapsed for storage or transport in the user’s vehicle.

Preferably, said interface apparatus is adjustable to allow the spacing between said pivotal coupling means and said releasable attachment means to be adjusted for use on wheelchairs having a different spacing between the side frame members of the base structure. In most UK designs, the side frame members are spaced at 15", 17" or 19" and so the interface element may be adjustable to suit these spacings. In USA and overseas other spacings are used and likewise the interface element may be designed accordingly to be adjustable for these different ranges.

Preferably said interface frame element comprises a rigid main frame portion with said first and second attachment means slidably mounted with respect to the main frame portion, with there being means for locking the first and second attachment means in a selected position. In this way the interface frame element may be adjusted as required.

In one embodiment, the interface frame element comprises a central rigid main frame portion which includes two spaced generally parallel elements which extend in use generally transversely to said wheelchair side frame members, with each tubular element receiving telescopically an associated modular attachment means in each of its ends.
In use an interface kit may be provided which includes the central rigid main frame portion and a selection of modular extension portions selected according to the wheelchair base structure to which the interface frame element is to be fitted.

Preferably the or each pivotal coupling means includes an anchor element for being secured non-rotationally on said wheelchair side frame member, and rotatably supporting a collar member connected to the interface frame element. The shape and size of the wheelchair side frame members differs according to the particular design of the wheelchair and this can be accommodated by providing a range of anchor elements generally of sleeve form having an internal bore of shape and size to suit the wheelchair side member and an outer cylindrical surface of standard dimension to be received in the respective collar element.

Preferably the or each releasable attachment means comprises an inverted channel element for receiving a section of said wheelchair side frame member, and a biased latch member for releasably retaining the section. Again a number of different channel elements may be provided of different size and shape according to the size and shape of the wheelchair side frame member.

For certain users it may be required to provide an adjustable amount of tilt whereby the seat is inclined at an angle to the horizontal. For this purpose, the interface frame element may include a load-carrying sub-frame element which is pivotally coupled to said interface frame element and which presents said one or more horizontal load-carrying regions, and locking means for locking the load carrying sub-frame element so that the plane defined by the one or more load-
carrying regions extends at a selected inclined angle to the horizontal.

The load-carrying regions in the interface frame element may typically comprise two spaced generally parallel and horizontal frame members which provide said one or more load-carrying regions.

Although the seat arrangement may connect directly to the load-carrying members, in one particular embodiment, the arrangement may include a seat connector member which comprises a main body portion defining in use an upwardly facing load-carrying region for direct connection to a seat arrangement, and releasable engagement means for releasably coupling in load transfer relationship with said one or more load carrying regions. The upwardly facing load-carrying region may be a simple flat surface or it may be an array of load-carrying points.

Where the one or more load-carrying regions comprise spaced generally parallel and horizontal frame members, the releasable engagement means preferably comprises a first channel section for fitting against one of said load-carrying frame members and a second channel section for fitting around the other of said load-carrying regions, and releasable biased latch means associated with said second channel section.

The invention also extends to a wheelchair comprising a base structure including two spaced generally parallel side frame members which extend generally horizontally in use, a wheelchair seat interface apparatus as described herein, and a seat arrangement connected to said wheelchair base structure via said wheelchair seat interface apparatus.

In particular embodiments, the wheelchair base structure is movable
between a stowed compact configuration and an erected operational conditional and said wheelchair may be prepared for stowage by removing said seat arrangement and thereafter releasing the releasable attachment means of said interface frame element from the associated side frame member of the wheelchair, to allow the interface element to be swung clear to allow the base structure to be moved to its stowed compact configuration.

In this specification, the terms horizontal, upwards, downwards, etc. refer to a wheelchair and interface apparatus when the wheelchair is in its erected condition on a horizontal surface.

Whilst the invention has been described above, it extends to any inventive combination of features described herein or in the following specific description.

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

Figure 1 is a front view of a wheelchair fitted with a universal interface in accordance with this invention with the wheelchair push handles and other components removed for clarity;

Figure 2 is a front view on the arrangement of Figure 1 but with the structure in a collapsed or stowed condition;

Figure 3 is a detailed view of the universal interface device used in the arrangement of Figures 1 and 2;

Figure 4 is a perspective view of a seat connector or docking mechanism for connecting to the universal interface of Figure 3;

Figures 5a to d are sequential views showing how the docking
mechanism of Figure 4 connects to the universal interface;

Figure 6 is a view of an alternative form of universal interface similar to that of Figure 3 but provided with a tilting facility;

Figures 7a and b show sequential stages in the coupling of the dock mechanism shown in Figures 4 and 5 to the interface at a relatively low angle of tilt;

Figures 8a and b are sequential views showing connection of the docking mechanism of Figures 4 and 5 to the interface mechanism at a relatively high angle of tilt;

Figure 9 is a perspective view of another embodiment of a universal interface device in accordance with this invention with different modular fittings for round-section tubes; and

Figure 10 is a perspective view of another embodiment of a universal interface device in accordance with this invention with different modular fittings for square-section tubes.

Referring initially to Figure 1, the device is illustrated connected to a particular type of folding wheelchair but it will be appreciated from the discussion above that the device is intended to be fitted to a wide range of different wheelchairs of the type which incorporate two spaced parallel side members capable of supporting the weight of the user.

In Figure 1 the wheelchair base 10 includes forward and rearward wheels 12 and 14, respective left and right side frames 16 which connect to a scissor frame made up of two diagonal elements 18 (only one of which is visible) and two similar members 20 pivoted together by a pivot 22. The upper ends of the
arms 18 and 20 support respective opposed, generally parallel side frame members 24. This base structure is generally conventional and is found in many wheelchairs.

Extending between the opposed side frame members 24 is a universal interface 26 in accordance with this invention. Referring to Figure 3, the wheelchair seat interface 26 comprises a central rigid frame 27 made up of parallel spaced transverse tubes 28 suitably connected to for-and-aft extending tubes 30. Extending out of the four open ends of the tubes 28 are respective modular fittings 32 and 34. The modular fittings 32 each comprise an apertured stem 36 which is slidably received in the open ends of the tubes 28 and terminating at its free end in a collar 38. Each collar slidably receives a sleeve 40 having an internal bore designed to match the shape and size of the side member 24 so that the sleeve 40 can be slid over the side member 24. The external surface of the sleeve 40 is stepped with the smaller cylindrical diameter being a rotatable fit within the collar 38 and a grub screw 42 provided on the larger diameter portion. In use the collars are fitted onto the side member 24 with their smaller diameter portions facing each other thereby to constrain the interface 26 against longitudinal movement.

The fittings 34 comprise apertured stems 42 which slidably fit in the other ends of the tubes 28 and terminate in generally U-shaped channel sections 44 which are designed to receive the other side frame member 24. A sprung latch member 46 is associated with each channel 44 to lock the channel against the side frame member 24. Fixing bolts 46 are associated with the free ends of the tubes 28 to cooperate with the apertures in the stems 36, 42, so that the spacing
between the channels 44 and collars 38 can be adjusted to suit different spacings of side frame members 24 on various wheelchairs.

The interface 26 may be fitted to a wide range of different wheelchairs using suitable interchangeable sleeves 40 and channels 44 as required, to provide a robust load-carrying support for a seat arrangement. Furthermore, when the wheelchair is to be moved from a configuration shown in Figure 1 to the collapsed configuration shown in Figure 2, the interface arrangement may be disconnected by withdrawing the latches 46 and swinging the interface arrangement about the collars 38 so that it does not project significantly beyond the stowage envelope of the unmodified wheelchair.

As noted above, the seat arrangement may be directly connected to the universal interface 26 but an alternative arrangement is shown in Figure 4 whereby a seat connector element 50 is provided which clips securely and releasably to the spaced tubes 28 of the interface arrangement in a manner similar to a ski binding arrangement. The seat connector provides a flat upper surface 52 for connection to the underside of any one of a number of seat arrangements. The connector has a rearward channel 54 which, as shown in Figures 5a to d hooks around one of the tubes 28, and a spaced downwardly open channel 56 with a sprung latch 58 which clips around the other tube 28. It will be appreciated that the seat connector 50 can be attached in one of two configurations depending on whether the seat is to be forward-facing or rearward-facing when located on the wheelchair base.

Referring to Figure 6, in this arrangement the interface element is provided with a sub-frame 60 which is pivotally coupled to the for-and-aft tubes
30 and is provided at its end remote from the pivotal coupling with spaced arcuate aperture tracks 62 which cooperate with fixing bolts 64 to allow the sub-frame 60 to be locked in one of a number of different inclinations to the horizontal. The seat connector 50 connects to the sub-frame in a manner similar to that shown in Figures 4 and 5.

The invention also extends to an arrangement which also includes a static interface for installation for example in a vehicle and which provides spaced generally parallel load-carrying tubes similar in form and configuration to the spaced tubes 28 of the wheelchair interface. This will allow a seat arrangement to be transferred from a wheelchair base fitted with the interface described above to the vehicle when the user is in transit.

Referring now to Figures 9 and 10, in this embodiment the universal interface comprises a central rigid frame 27 of generally similar construction to that shown in Figures 1 to 4, except that the transverse tubes 28 each carry clamping collars 70 at their opposite ends which are used to allow adjustment and clamping of the modular fittings 72 in the required positions.

Figure 9 shows an arrangement for a non-folding wheelchair in which the side frames are of round cross-section, whereas Figure 10 shows an arrangement of a non-folding wheelchair in which the side frames are of square-cross section, and the modular fittings 72 are shaped appropriately.
CLAIMS

1. A wheelchair seat interface apparatus for a wheelchair having a base structure which includes two spaced parallel side frame members which extend generally horizontally in use, said interface apparatus comprising:—

an interface frame element having pivotal coupling means at one side region thereof for being pivotally coupled in use to one of the side frame members of a wheelchair, and releasable attachment means at an opposite side region for being releasably connected in use to the other side frame member of said wheelchair when the wheelchair is in an operational configuration,

said interface frame element presenting one or more load-carrying regions for being connected in use to a seat arrangement.

2. A wheelchair seat interface apparatus according to Claim 1, wherein each of said first and second attachment means comprises at least one attachment arm adapted at one end for connection to said interface frame element and carrying at its other end a coupling for attachment in use to a respective side frame member of a wheelchair.

3. A wheelchair seat interface apparatus according to Claim 2, wherein each of said first and second attachment means comprises two attachment arms for connection to said interface frame element at spaced locations.

4. A wheelchair seat interface according to Claim 2 or Claim 3, wherein each attachment arm is arranged to be telescopically received in a
corresponding tubular portion of said interface frame element, the apparatus further including means for locking each of said arms relative to the interface frame element.

5. A wheelchair seat interface according to any of the preceding claims, wherein said first attachment means comprises a pivotal coupling for being pivotally coupled in use to a side frame member of a wheelchair, and said second attachment means comprises a releasable attachment coupling for being releasably connected in use to the other side frame member of the wheelchair.

6. A wheelchair seat interface according to any of the preceding claims, adapted to allow the spacing between said first attachment means and said second attachment means to be adjusted for use on wheelchairs having a different spacing between the side frame members of the base structure.

7. A wheelchair seat interface according to any of the preceding claims, wherein said interface frame element comprises a rigid main frame portion and with the first and second attachment means slidably mounted with respect to the main frame portion, with there being means for locking the first and second attachment means in a selected position.

8. A wheelchair seat interface according to any of the preceding claims, wherein the interface frame element comprises a central rigid main frame which includes two spaced generally parallel elements which extend in use generally transversely to said wheelchair side frame members, with each tubular element receiving telescopically an associated modular attachment means in each of its ends.

9. A wheelchair seat interface according to Claim 5 or any claims
dependent thereon, wherein the or each pivotal coupling means includes an anchor element for being secured non-rotationally on said wheelchair side frame member, and rotatably supporting a collar member connected to the interface frame element.

10. A wheelchair seat interface according to Claim 5 or any claim dependent thereon, wherein the or each releasable attachment coupling comprises an inverted channel element for receiving a section of said wheelchair side frame member, and a biased latch member for releasably retaining the section.

11. A wheelchair seat interface according to any of the preceding claims, wherein the interface frame element includes a load-carrying sub-frame element which is pivotally coupled to said interface frame element and which presents said one or more horizontal load-carrying regions, and locking means for locking the load carrying sub-frame element so that the plane defined by the one or more load-carrying regions extends at a selected inclined angle to the horizontal.

12. A wheelchair seat interface according to any of the preceding claims, wherein the load-carrying regions in the interface frame element comprise two spaced generally parallel and horizontal frame members which provide said one or more load-carrying regions.

13. A seat connector member for connection to a wheelchair seat interface apparatus as claimed in any of the preceding claims, said seat connector member comprising a main body portion defining in use an upwardly facing load-carrying region for direct connection to a seat arrangement, and
releasable engagement means for releasably coupling in load transfer relationship with said one or more load-carrying regions on said interface frame element.

14. A seat connector member according to Claim 13, wherein the releasable engagement means comprises a first channel section for fitting against one of said load-carrying frame members and a second channel section for fitting around the other of said load-carrying regions, and releasable biased latch means associated with said second channel section.

15. A wheelchair comprising a base structure including two spaced generally parallel side frame members which extend generally horizontally in use, in combination with a wheelchair seat interface apparatus as claimed in any of Claims 1 to 12, and a seat arrangement connected to said wheelchair base structure via said wheelchair seat interface apparatus.