

## A Final Year Design Project – Goldsmith's College

A 'design dissertation' submitted as part of the work for the London B.Ed. degree.

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The first problem was to find suitable problems to solve, and this involved observation in environments where it seemed likely that they would occur. I first went to a railway station, and one problem that was apparent was that of getting a push-chair (with the child in it) up and down steps. However, before making a decision, I thought of other situations where problems seemed likely, and visited the hospital at New Cross in South-East London.

The visits I made were to a geriatric ward, and I took notes, made sketches, and spoke to doctors and nurses. From my initial observations and enquiries, problems concerning eating, washing and storage were most evident, and all had both physical and psychological aspects. The physical problems were those concerning the proximity of storage space to the patient, the need for somewhere to rest trays whilst eating meals. The particular overbed tables at the hospital were too high and did not take into account specific disabilities of patients, so trays had to be put on the bed by the side of the patients or across their knees. Similarly, whilst washing, the patient had to rest the bowl on the edge of the bed causing a series of difficulties. It was also evident that used washing bowls or crockery had to be left on the bed by the patient until the nurse had time to collect them.

So the first two overall problems concerned the need for i) a stable surface or method of holding bowls and plates steady and ii) a means by which the patient could remove the plates or bowls away from the bed. In addition there was also a problem of storage. The existing bedside cabinets were not wholly appropriate; patients could not reach the top surface or take things out of the drawer while sitting up in bed.

These problems were related to three main areas; i) washing ii) eating and iii) storage. More detailed observations were made using notes, film and photographs to analyse the sequence of movements by the patient and attendant nurses. Some typical observations were:—

### i) *Washing:*

- a) The bowl is placed on the bed by the side of the patient, because the existing bed-table is too high.
- b) The patient depresses the mattress where she sits, so the bowl can easily spill.
- c) The soap box is also placed next to her and tends to slide down into the depression.

- d) Because she cannot wring the flannel thoroughly, it drips over the bedclothes when she lifts it from the bowl to her face.
- e) When she picks up the towel to wipe herself its end dips into the water, and this in turn dampens the mattress and pillow-case near where she has to lie. The damp towel is left on the bed.
- f) She then tries to lift the bowl away from her so she can make room to dress herself; lifting and gripping are difficult. At one point she almost completely tips the bowl, but manages to move it away from her with only a little water spilling.

ii) *Eating:*

- a) The bed-tables are too high to eat from. Therefore a tray is placed across the patient's legs. Sometimes the tray is placed by the side of the patient to diminish the possibility of it being tipped.
- b) When the tray with the food upon it is put on the patient's lap eating is precarious because the tray will tip if any pressure is exerted on any side of the tray that is not supported. Therefore the tray is usually placed by the patient's side.
- c) If the tray has been placed across the patient's legs, apart from not being able to move them she cannot lean over towards the bedside cabinet where a drink has been left. The drink cannot be placed upon the tray because it could easily spill and upset the balance.
- d) The patient cannot sit up straight but has to recline slightly while eating. Her mouth is not directly above the tray but 15 inches to one side therefore food being transferred from the tray to her mouth often falls off onto the bedclothes.
- e) When the patient has finished eating she has to wait until the nurse comes to collect the tray and empty plates. The patient cannot put things to one side herself.
- f) The cabinet is too high and on the wrong side of the bed for this particular patient who is right-handed.

iii) *Storage:*

- a) A brown paper bag is attached to the handle of the drawer with a bulldog clip. This is for waste paper, tissues, etc. The bottom of the bag becomes soggy. There is a problem of immediate waste disposal.
- b) The top surface of the cabinet is cluttered but there is nowhere else to put large bottles or bowls, and if room was made in the lower part of the cabinet the patient would be unable to reach them while in bed.
- c) No part of the cabinet is readily accessible to the patient while she is in bed. Apart from the surface being too high, both the drawer and cupboard open out

movement in  
other direction

suspending the  
surface on to  
which the bowl  
is placed

two overhead rails may  
be more appropriate, —  
But when the nurses are  
changing the sheets,  
lifting out the patients  
these structures would be  
in the way unless they were  
positioned higher.

A lower rail could  
be fixed prior to the  
patient washing and  
the bowl would again  
rest on a suspended  
surface.

utilising the frame

A surface  
supported at  
the side of the  
patient.

The bowl must  
be the supported level.

There must also  
be a provision for  
a towel preferably  
in this area.



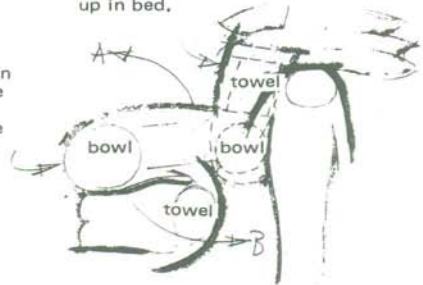
A bowl in one of these  
positions would be ideal.  
It needs to be placed  
just to the side of the  
patient (and not in front  
— unless there was  
provision for moving it  
aside) so that the patient  
can wash her body and  
legs.

The patient  
depresses the bed  
causing the bowl  
on the mattress  
to tilt.

F. Both positions of the patient must  
be taken into account in deciding on  
the most appropriate position and  
means of removal.

And this (dash outline)  
is the position  
required when the  
patient is partly sat  
up in bed.

This is the position  
required when the  
patient is seated  
on the edge of the  
bed.



On this and subsequent pages  
excerpts from the writer's  
folder of rough sketches and  
working drawings are reproduced  
to indicate the development of  
the design process.

Movement in the direction of  
arrows A and B would re-  
position the bowl/towel so  
that provision is made for the  
patient whether she is in or on  
the edge of the bed.





at the front. The cupboard is so low that when the patient sits on the edge of the bed she cannot bend to reach into it.

- (d) The contents of the drawer are mixed together. There is no separation of articles and the contents are not visible before the drawer is opened. Therefore the patient is often unsure where things are.

In brief, most of the stored items are beyond reach and some are out of sight. This is to the detriment of the patient's general comfort and limits what she can do for herself and, therefore, her independence.

Independence is an important psychological factor in rehabilitation in a geriatric ward. Every slight gain is important, so, while the patient is in bed, if she can wash, feed herself, and have access to her locker, this assists rehabilitation. So in analysing the problems and thinking of possible solutions, I had to bear in mind the desirability of encouraging the patient to do things for herself.

### The Design Analysis

I first looked at eating, washing, and storage separately.

It was evident from the observations that the plates and dishes needed to be supported in a way that they would not have to be balanced on a tray across the patient's legs or left on the bed by her side where they could slide off. The bed has a strong tubular metal frame which suggests it could be utilised for anchorage or support of some kind. I was not thinking of specific mechanical fixings at this stage but of general ideas for a solution that could be scrutinised in more detail later. There are sketches of frames within which plates could be placed, and which could be pivoted on the long horizontal rail just beneath the mattress or on one of the uprights of the bedframe. If it was pivoted on the horizontal rail it could swing upwards and away from the bed, but this would upset the plates. If a support was pivoted on an upright it could be swung away in a horizontal plane.

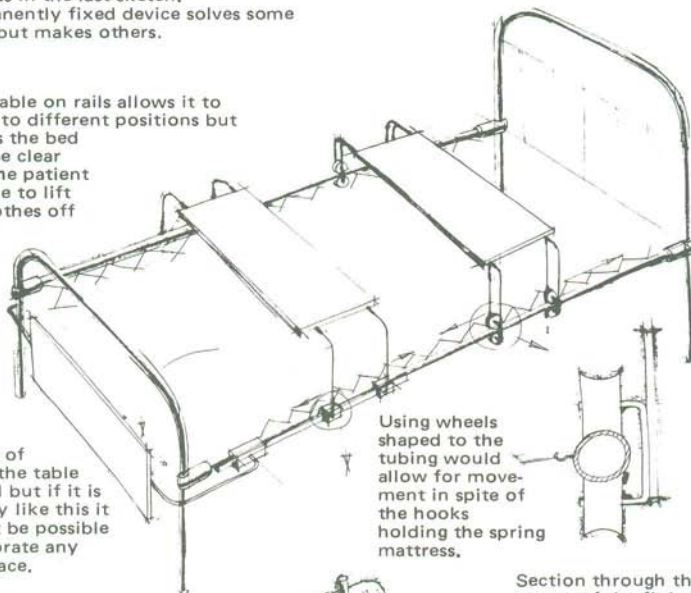
A variety of annotated sketch designs were drawn, with each one following logically from the last when modifications to the idea became necessary. For example since space is at a premium around the hospital bed, any device had to be such that it could be positioned unobtrusively when not being used, but be easily accessible and manoeuvrable when required.

At the beginning, I did not want to think exclusively of solutions to the problems in eating before I had seen what problems were involved in washing and storage. The working diagrams show sketches and photographs of the bed and its immediate surrounds while the patient was washing. The main problems were the instability of the bowl due to its being placed on the mattress, and the patient being unable to move it away from her when she had finished. I sketched in the areas near to the patient where the bowl, towel, flannel, soap, etc., need to be placed. I thought also of using the space above the patient and suspending a surface from overhead rails so it could slide into different positions over the bed and be lifted upwards when not required. Diagrammatic representations of the bed,

- B. Using the rail is beginning to seem inappropriate. Some of the ideas I touched on earlier share similar drawbacks to the ideas in the last sketch.

A permanently fixed device solves some problems but makes others.

Having a table on rails allows it to be moved to different positions but sometimes the bed needs to be clear eg when the patient has a frame to lift the bedclothes off her legs.



A method of removing the table is essential but if it is tilted away like this it would not be possible to incorporate any storage space.

Using wheels shaped to the tubing would allow for movement in spite of the hooks holding the spring mattress.

Being restricted to the bed frame these ideas back inability and limit versatility. (incorporating storage).

Even with the wheels the problem remains of removing the table from the rails when it is not required. Constructional details have not been worked out but disconnecting the table would be a job for the nurse and then it would have to be lifted away or be folded somewhere. There would be extra work for the nurse, especially as the top would usually have to be cleared first.

Section through the centre of the fixing.

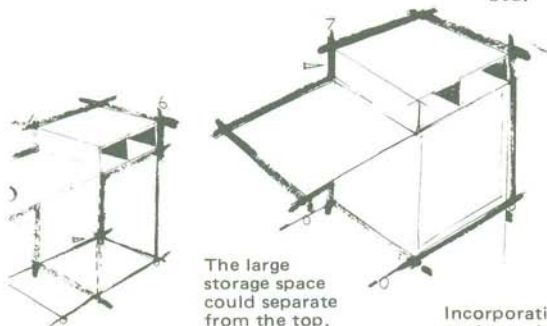


Shallow trays/drawers strung beneath the surface for soap, flannel



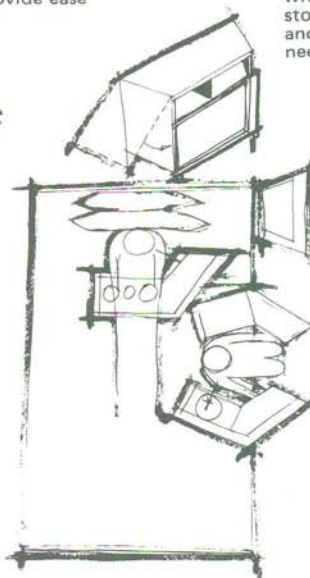
Ideally the surface and storage space would be angled to provide ease of access.

A pedestal to allow circular movement — but this would prevent the table reaching far enough over the bed.



The large storage space could separate from the top.

Incorporating a compartment beneath so that only the surface projects over the bed — or two units could fit together to form one.



The angled unit without the pedestal could be incorporated within a larger storage unit and detached when needed.

Distance it will have to reach over the bed will be critical in determining type of support structure

manoeuvrability essential



and of the required positions of any means of support are also shown, together with a breakdown of the required manoeuvrability and of the distance the support would need to be when in a variety of positions, in relation to the point, or points, of support on the bed frame. Several of the sketches show possible positions of the washing bowl, with a place to put the towel and soap, in relation to the position of the patient. The tilt of the bowl, and the patient attempting to lift it are features illustrated in some of the photographs on the design sheet.

I continued the analysis of problems that arose out of the washing situation and some specific ideas began to emerge concerning connecting a surface to a part of the bedframe, but I had not started to look in detail at constructional considerations, because it would have restricted the expression and development of ideas at this stage in the analysis.

I began to consider the storage by looking at what the patient needs, and how what she needs can be conveniently positioned when required. Problems of support, anchorage, and positioning are similar with washing, eating, and storage (e.g. soap, flannel, towel, and a collection of toilet articles are required while the patient is washing). So I began to think in terms of ideas that would provide a combined solution to the different problems. The sketch designs show storage units that are attached to the bedframe and can be swung into position near the patient when she needs them. Once again I concentrated mainly upon using the two horizontal rails that run along either side of the bed and also each of the uprights on the bed-head. The idea of overhead rails seemed less attractive because it could give the patient the feeling of being caged in.

The diagrams show a variety of possible solutions using the two horizontal rails. Other sketches on the sheet show ideas for separate surfaces that could extend over the bed and perhaps be clipped to the frame only when needed; otherwise they would stand independently. The ideas did not have the required versatility in that they did not allow the patient to remove either the washing bowl or the plates by herself. So I reverted to the earlier idea of using the bedframe as a pivot or means of support.

Ideas were produced for attaching a connecting arm to the upright of the bed-head. The criteria were that it must be capable of vertical adjustment (so that it can be set to the correct height for any patient), that it must not slip where it is attached to the upright, and that it must swivel at the point of fixing. The design sheet shows a sequence of ideas. It begins by looking at the overall principles involved; adjustment, swivel, and attachment. I thought of gripping the upright on the outside (e.g. by a collar) of cutting the upright and inserting a fitment, and of puncturing it. I then thought that the most appropriate type of solution would not require any alteration to the hospital bed, so I concentrated on methods of gripping the outside. Initial ideas arose from considering the overall requirements and adapting or rejecting ideas that did not fulfil them. The design analysis aims first at the ideal solution, but a compromise must be made between the ideas and what is practical, and this now plays a large part in determining the course of the design.

The ideas are a sequence, each one following from the last. It was not that each sketch began to look more and more like the eventual solution, because nearly all the ideas gave me a clearer notion of what *not* to attempt, and in this lay their value. Most were too complicated so that their feasibility was in doubt. Also many were mechanically unsound

in not allowing for the leverage that would be exerted on the connecting arm or how the arm would be connected to an adjustable fixing on the upright.

Before becoming too immersed in one particular part of the design, I attempted once again to get a more overall view of the requirements for a suitable surface. So I turned my attention to how an arm would connect to the surface because this could affect the design for a fixing at the opposite end, the upright.

The drawings show a general plan view of the bed and the necessary range of movements that are required of the surface. It also shows a sequence of ideas for attaching the arm to the surface and highlights the problem of swivel at this connection. Such ideas as brackets and other metal fixings were tried but if the surface swivelled freely on the arm it could also move away from the patient while she was using it. I thought of providing an adjusting screw, for the patient to use, that would overcome this problem but since her grip was weak this idea was rejected.

Tests were made to ascertain the leverage on the connecting arm and the extent of any depression that this would cause. I used a test-weight on mock-ups, trying different diameter tubing. Depression due to leverage occurred through bending of the arm and the surface, so I tested different strength materials for both, e.g. 3, 6 and 9mm. ply and blockboard for the surface and different diameter tubing for the connecting arm. On advice I assumed that any depression due to play in the joints would be minimal. Apart from using thicker tubing another method of minimising bend in the connecting arm was to use a frame instead of a single tubular connection. Therefore I tested different shaped frames, square and triangular. The corners of a square frame would tend to catch the blankets and the patient's legs as it swung over the bed so eventually a triangular frame was decided upon. All this is shown in detail on the design sheets by sketches and tabulated results. A manoeuvrable surface, that would solve the problems associated with eating and washing, now seemed feasible, if a replaceable nylon boss was used in a friction joint where the stable surface attached to the connecting arm. The surface could then be pushed away by the patient, when she no longer needed it.

Many of the solutions associated with manoeuvrability of the surface were applicable to storage problems. The inaccessibility of many smaller items was noted in the observations, so bringing these towards the patient when she needed them required similar manoeuvrability to that of the surface. Sketch designs were made for a storage unit that, like the surface, also connects to the upright. The plan and front elevation of the top storage unit are shown in position by sketches with overlays. Other sketches show how the unit could be fixed to a connecting arm. I thought of a special bracket that fixed to the side, or a flat disc shaped support so that there would be clearance between the top storage unit and the stable surface. Other sketches show various storage units in position. I had decided not to bring all the patient's clothes, shoes etc., nearer because this seemed impracticable, since in any case the nurse has to help the patient into outdoor clothes.

So far the emphasis in the design has tended to be functional and to have been concerned with the main problems associated with providing the required versatility. The other parts of the storage unit were not drastically altered functionally although I decided to have each unit separate so that the lower storage unit could be attached to either side of the tall one and thus placed on either side of the bed.



A sharp angular shape is dangerous and the corners are redundant when the surface is in use.

The patient can push it away herself.

Extra space is required at the side where drinks can be placed so they won't be tipped during eating

This distance remains the same

All these positions could be achieved if there was a revolving joint here, and if the device pivoted from the upright.

The correct position while the patient is washing. The bowl is placed in front of the patient where she can easily reach and where it will not wet the bed-clothes. The towel is placed on the side next to the patient right hand and where it won't trail in the water.

The nurse will place the food on it while it's in this position.



(previously drinks were placed almost out of reach: see photo)



A contact area shaped to give greater support.



Alternatively the connecting piece could be sandwiched between a laminated surface.

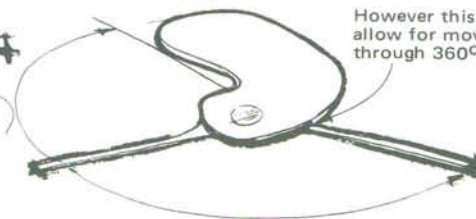
Bearing surface

projecting centre pivot covered by lamina

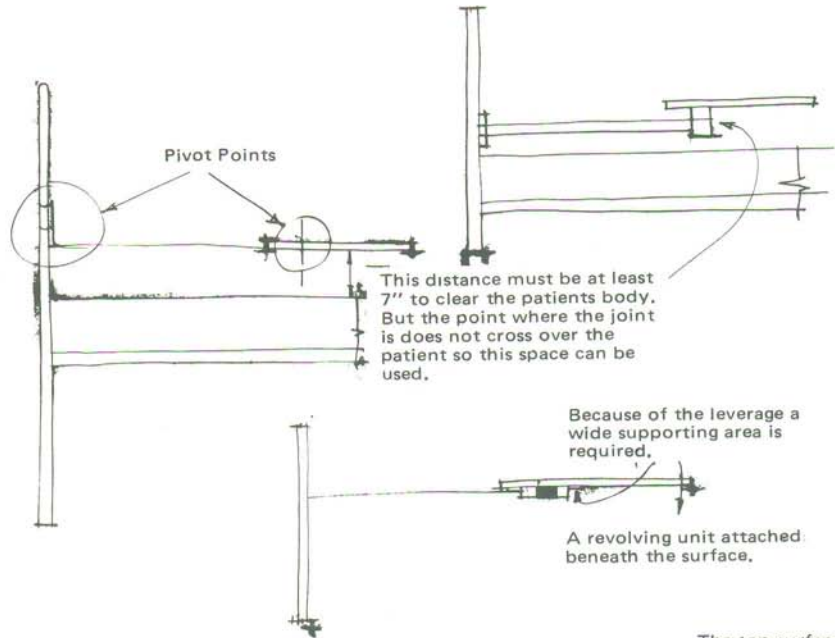
Pivot insert

However this would not allow for movement through 360°

Reversing the last ideas and sandwiching the surface— But since this part is also used an even surface is needed—Movement through 360° is again prevented.

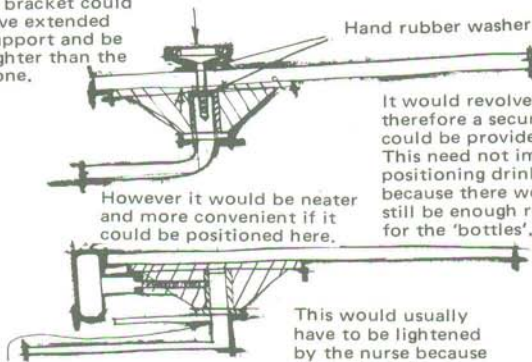






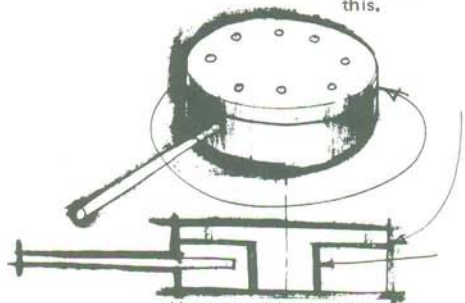
envisaged unit into which the road would fit.

A bracket could give extended support and be lighter than the cone.



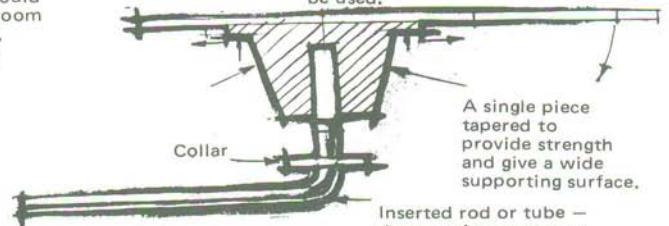
It would revolve freely therefore a securing unit could be provided, — This need not impede positioning drinks— because there would still be enough room for the 'bottles'.

This would usually have to be lightened by the nurse because the patients have difficulty in exerting pressure — A simpler device would be better.

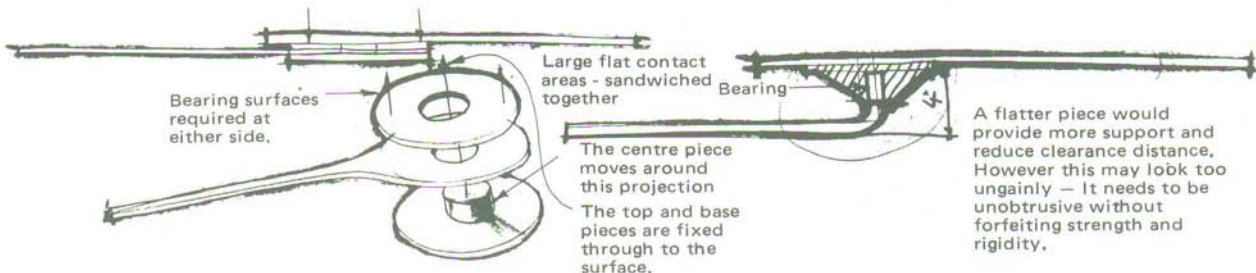


The top surface of the unit is fixed to the underside. The lower part revolves and the connection is made to this.

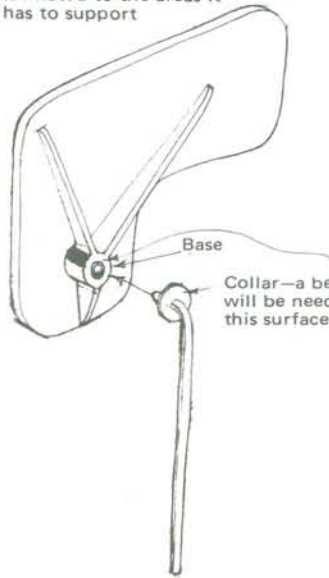
However this would be heavy and add to the leverage problem. Need to assess it with regard to type of metal to be used.



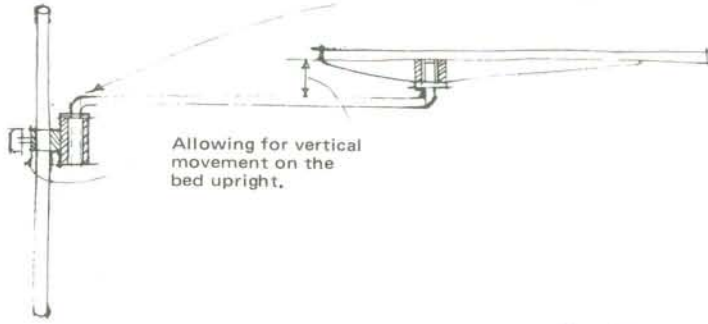
Inserted rod or tube — the top piece turns on this.



A bracket cast in a lightweight alloy giving diverse support from a common centre. The length of each extension is related to the areas it has to support



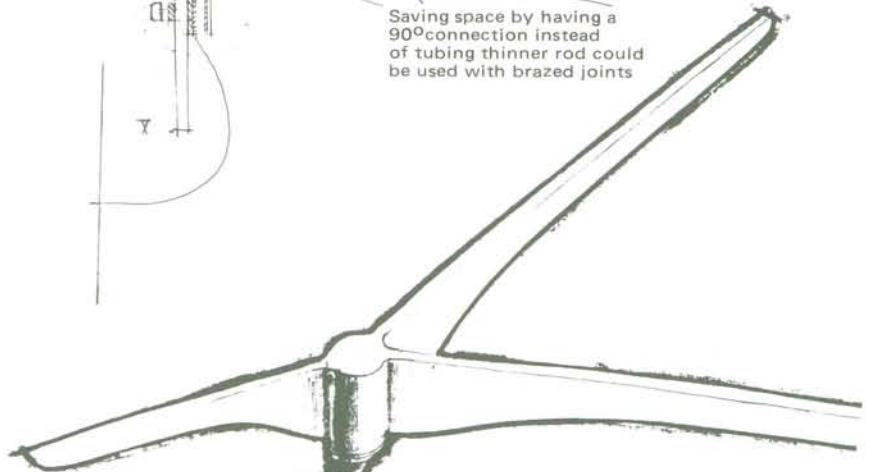
A similar arrangement but inverted, would allow movement at this point



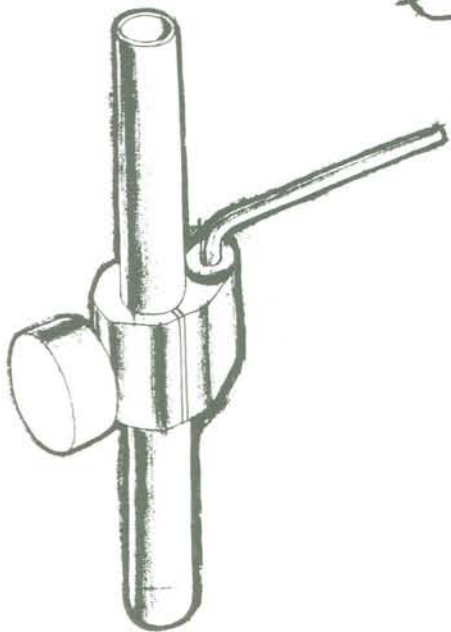
Shaping the bracket so it won't catch the patients legs.



Saving space by having a 90° connection instead of tubing thinner rod could be used with brazed joints



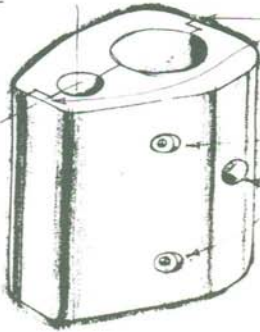
This is how the fitment would appear when in situ using tubing for the connecting link—and without the surface piece in position.



I think this shape is neater than the last — but the other details remain.

Reducing weight and giving a more streamline shape by removing surplus material and rounding the corners.

Leverage will be acting against the block — especially in this direction.

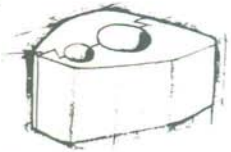


Locating the halves to give added strength because of the leverage that will act upon the block.

Hex socketed screws hold the halves together.

Location for the adjusting nut.

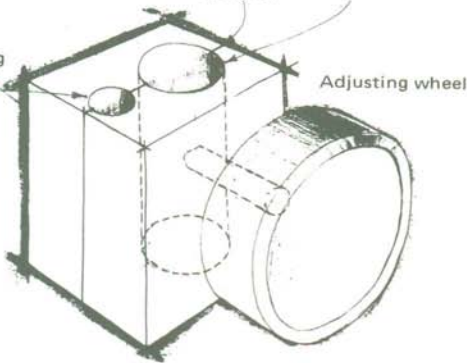
Shaping the halves so they can slide together.



However any shaping would increase the difficulty in making the block and not allow for any discrepancy in the dia. of the upright.

For this joint — a split block that fits on the upright.

The connecting piece swivels in here.

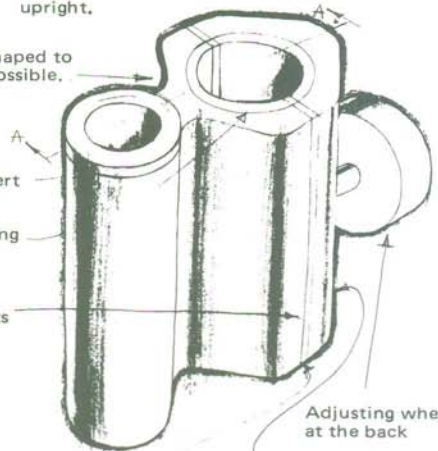


The unit could be shaped to make it as light as possible.

Bearing insert

Nylon bearing

Rubber or Nylon inserts



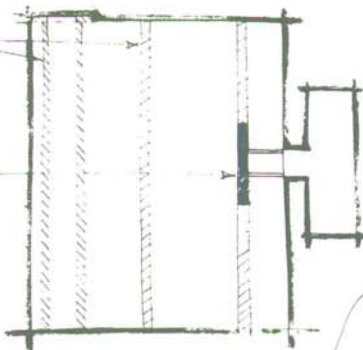
Adjusting wheel at the back

Hex socketed screws through the back hold the valves together.

This could be cast and then bored

Bearings

Hard rubber pressure pad on the adjusting wheel.

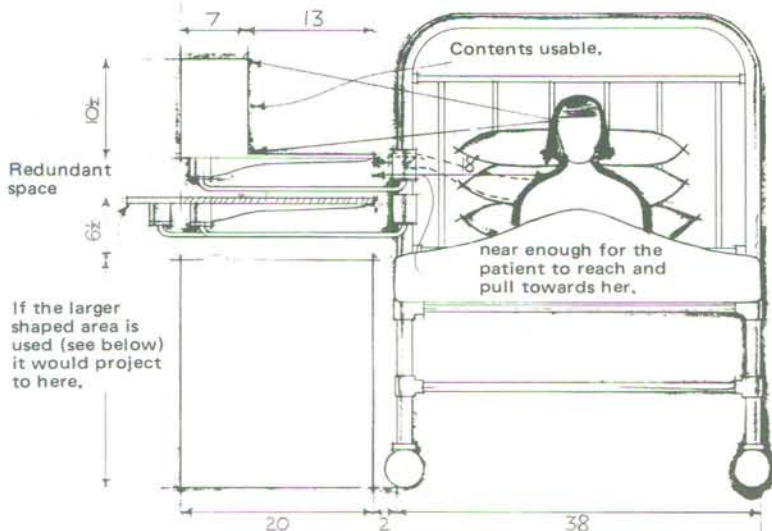


Section through AA

When this is cut (with a milling cutter) so that it can be fitted on the upright, the resulting parts would then not fit because of the waste removed. Since the upright is not exactly uniform this could be turned to advantage by inserting a piece of hard rubber into the gap at each side. The rubber would 'give' slightly when the socket screws were tightened or loosened. The unit could then be fitted to different beds or on either side of the same bed even if there were slight discrepancies in the diameter of the tubing. Alternatively, nylon strips could be used and fitted to the particular upright involved.

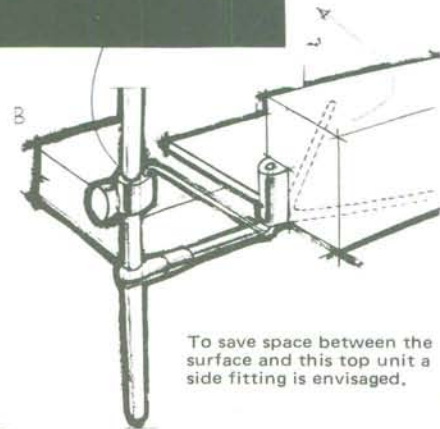






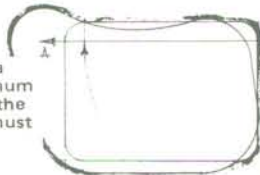
A scale drawing to ascertain the exact relationship of the equipment to the patient.

The difficulty the patient experiences in trying to obtain what she requires is overcome when a unit can be swung over.

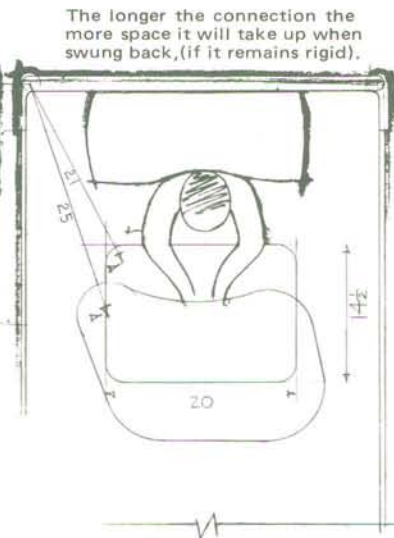


To save space between the surface and this top unit a side fitting is envisaged.

Since space is at a premium a minimum possible area for the pivoted surface must be calculated.

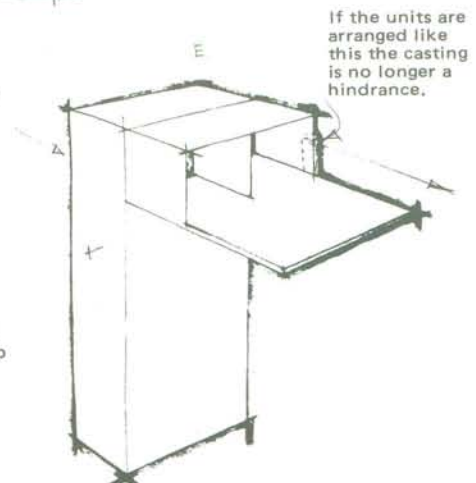


When the patient can sit up well this is her position and a shorter connecting arm can be used. If the device is for a particular patient who can sit up a fixed arm would be sufficient but to increase its versatility re a particular patients condition from day to day or to allow the same device to be used with other patients. Therefore an adjustable connecting piece may be required: from 21 to 25 inches.



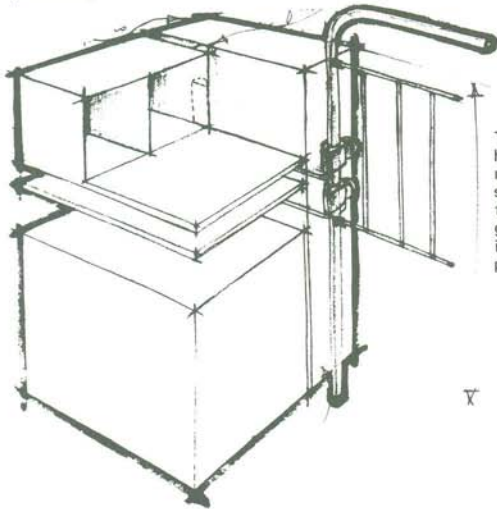
A simple enclosing unit is envisaged for the clothes to hang in.

If the unit is placed in this position it is more accessible to the nurse who has to take out the clothes for the patient.



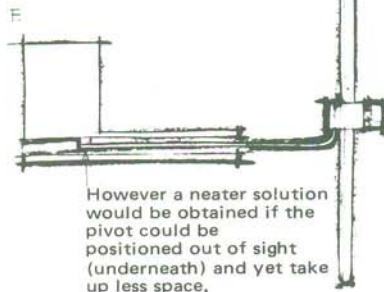


However when the unit is swung to the side the casting would catch against the tall section if it was in this position.



Tucked out of the way but not readily accessible.

The unit for hanging clothes needs only to be slightly taller than the suspended garments, 48 inches is sufficient for most patients.



However a neater solution would be obtained if the pivot could be positioned out of sight (underneath) and yet take up less space.

(Bearing Surface)  
nylon disc  
Separate nylon bearing

The idea could be effected with this arrangement



A means of compensating for wear, due to friction, will be required, adjustable nuts at A & B.

A shaped steel support that is fixed by screws beneath the top unit and the casting. The side of the unit would be fixed to this face and therefore provide a brace between the casting and the extended supports.

Nylon disc

Metal

Metal Casing

These three parts fit into this well

Fixed to the top surface through here.

Envisaged arrangement of parts — exact sizes to be worked out

Heads of bolts sunk beneath surface and bore filled in.



A friction bearing,—therefore there would be no need to devise a means of fixing the joint in position so it will not spin away while the patient is eating or washing.



The construction lends itself to mass production. Parts of the carcass are vacuum-formed veneer-faced multi-ply. Edges are rounded for safety and to facilitate cleaning. The top and the base of the storage units fit into grooves, cut by a spindle moulder, near the top and base of each side. The carcass is held rigid by the back and strengthened by mechanical fixings. The front is curtained to give a colourful 'homely' effect, and provide ease of access. Finally I considered making the surface in post-formed plastic with reinforcing ribs an integral part of it. This would be light and strong yet dispense with the need for a metal bracket supporting a blockboard top.

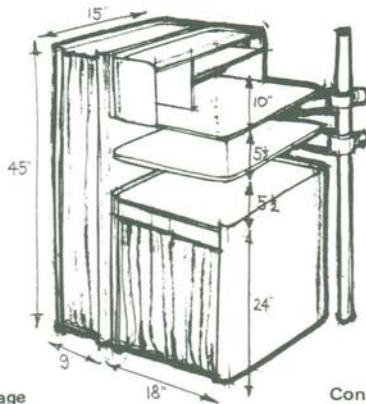
It has not been possible to go into every detail of the design, but I have tried to show the sequence by a selection of ideas that were pursued. Detailed comments are made on each sheet and, besides making a short film a considerable amount of information was prepared in book form and contained information on geriatric patients in general and also further observations made in the ward that was studied.

### Concluding Note

A crucial point in design seems to be thinking on paper, the sketch sequences showing modifications that have to be made. Rarely does one think out a problem in its entirety with a single sketch. Ideas become sketches and it is these that are modified, rearranged and developed. Sketching can begin without any clear ideas being 'already in the mind'. First the situation within which the problem occurs is sketched, and then the general requirements are indicated, perhaps just diagrammatically. While making tentative sketches the need for alterations often become apparent, or perhaps vague ideas that appear satisfactory 'in the head' are rejected. It is this notion of thinking with the pencil that needs to be grasped before meaningful and original ideas can enter into design, and this is an important means of communication for children at school. It is no good, on being told of a problem immediately to think only of what one has experienced, quickly make a few mental modifications and then attempt to draw it, and think that this is the solution. It is usually unproductive to try and think of an idea *in toto* and then try and draw it. In the case of this design, observations of the situation, the capabilities of the patient, and needs relating to her physical and psychological rehabilitation were the things which shaped the ideas. It was as though the solution, rather than being imposed, arose naturally out of a consideration of the physical and human situation.

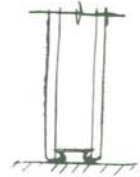
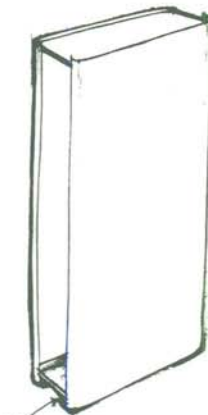
*Acknowledgements:* I wish to thank the Matron of New Cross Hospital, together with the nursing staff and patients of Ward 6A for their co-operation; also the staff of Goldsmiths' College, London, especially my personal tutor on the project, Mr. Michael Lewis.



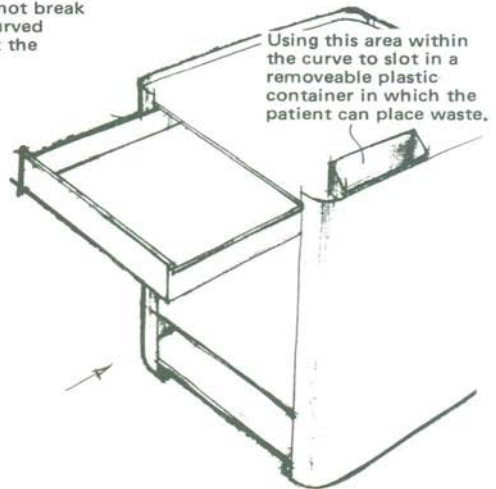
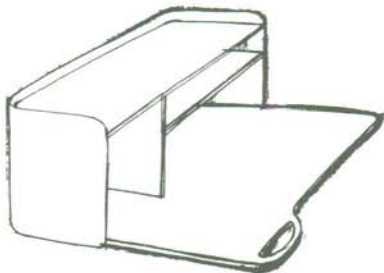


The stage reached so far and the final dimensions

Concealing the castors but fixing them under the raised base,

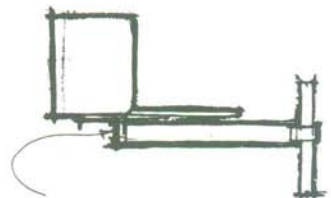
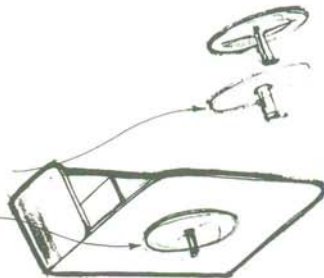


This drawer is fitted with nylon rails and suspended from above so it does not break into the curved position at the side.



Using this area within the curve to slot in a removable plastic container in which the patient can place waste.

The top part of the storage could either be provided with a bracket as proposed earlier, or have a thin metal plate, like this with a strong central projecting piece. The part of the unit does not have to swivel from one corner (as the surface does) because it does not have to be so versatile.



It will be connected in this position and thus take up minimum of space.