



THE WHEELBARROW

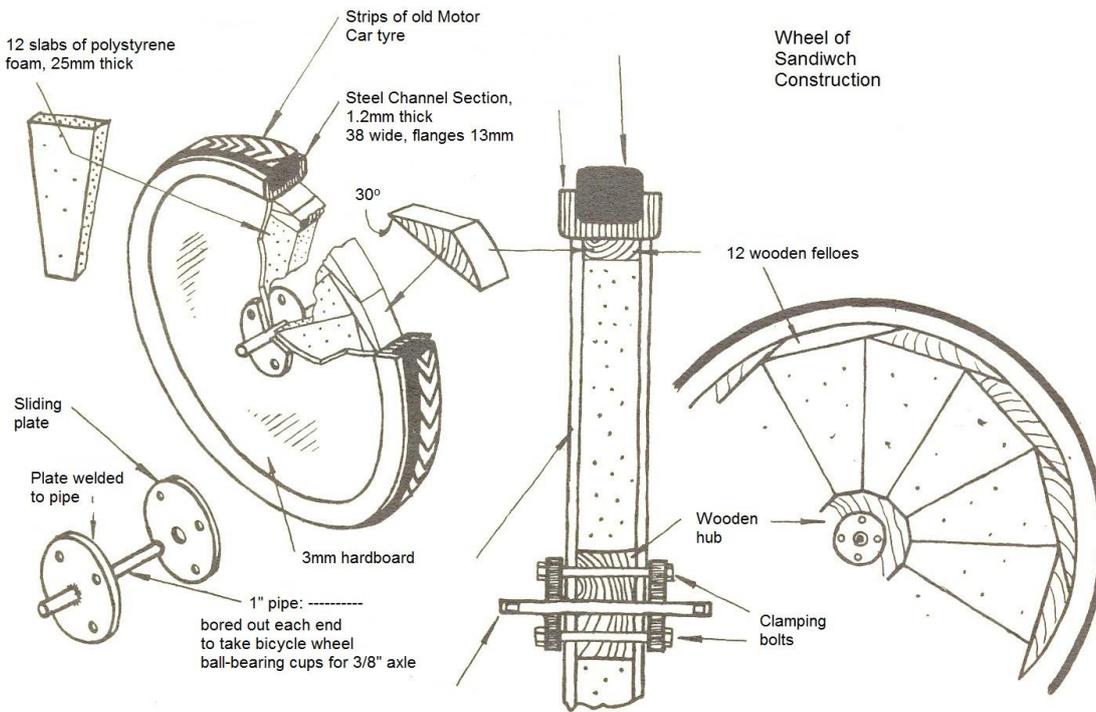
The wheelbarrow, like the bicycle, has been relegated to a humble role in the world's transport, yet it has the supreme virtues of effectiveness and simplicity. Although it appears too simple in concept to warrant explanation yet it is evident that the subtlety of its design has escaped all except the Chinese, who originated it some 2,000 years ago.

The prime feature is the use of a single large-diameter wheel; a single wheel because even on the roughest going the vehicle cannot easily be deflected from its course; a large diameter because this minimises resistance on hard or soft going and smoothes out rough roads. Next comes the proper disposition of the load; the obvious method of arranging it symmetrically about the wheel is not the best, since this makes it difficult to control. Instead there should be enough weight on the handles so that when the wheel hits a bump or a pot-hole there is no jerk at the handles (this is a similar condition to that for a trailer or caravan towed behind a car). Most of the load is then taken directly by the wheel, but the remaining load on the handles can be taken by a shoulder strap, as is done with the traditional Chinese wheelbarrow. All the bearer now has to do is to balance and push; if there is a following wind a simple square sail may be used to help progress. The result is a device which can transport up to six people or an equivalent weight of goods.

The modern Chinese version of such a wheelbarrow was shown in the figure on page 13 of the first issue (Spring 1974) of *Appropriate Technology*. It uses a large diameter pneumatic tyred wire-spoked wheel, instead of the former iron-tyred wooden wheel, but retains the traditional open framework covering the wheel and supporting the load; a simple brake is fitted. Another up-dated version for carrying earth, sand, gravel, etc. consists of a flat tray supported by a standard bicycle wheel. Both types are easily constructed and should - due to the use of a pneumatic tyre - be easier to push than the earlier types, besides being quieter and kinder to the road surfaces.

For constructing a large-diameter wheel in countries where wheelwrights are scarce and suitable large-diameter tyres are not available a simple method of making a suitable wheel with solid rubber tyre is shown below. The wheel is of 'sandwich' construction, with a lightweight core e.g. of polystyrene foam, sandwiched between outer layers of hardboard or plywood. The wooden rim is made up of 12 segments of wood; one end of each is cut at an angle of 30° to form a scarfed joint with the adjacent overlapping segment. The segments are glued and nailed into position on one hardboard disc. Also a central wooden hub, then the twelve segments of polystyrene, are glued into place and finally the other hardboard disc is glued and nailed on.

A steel rim of channel section (e.g. 18 s.w.g. thickness = 1.2mm., 38mm wide with flanges about 12mm long) is rolled to the required radius, welded or brazed to a size slightly less than that of the wheel so that it can be fitted by the traditional method of heating then shrinking into position. A simple tool for rolling the rim consists of three rollers supported on standard bicycle bottom bracket assemblies. The central roller is flanged and is adjustable vertically by means of a screw; it is rotated by means of a pedal used as a handle. By gradually screwing down the central roller a strip of steel sheet, previously cut and folded to a channel section, may be rolled - to a radius as small as 300mm or even less.



The rubber tyre is made of strips from old motor car or truck tyres and is held in place by hammering the flanges of the steel rim to clamp the rubber firmly, in the manner of a bicycle brake block; this technique is well established in Pakistan for use with wooden cart wheels.

Although the usual wheelbarrow has a revolving axle supported in simple bearings at either side a good alternative is to use a standard bicycle axle and bearings, which have proved so effective in cycle use. This may be accomplished by using a short length of pipe welded or brazed to a circular plate which is bolted through the wooden hub of the wheel. The ends of the pipe are machined to take standard bicycle ball bearings cups and the axle is fitted and adjusted in the normal way. Metal brackets are used to connect the axle to the body of the barrow.

If polystyrene foam slab is not available for the core of the sandwich other locally-available materials may be substituted; possibilities are:

- a) the use of straw glued together into bundles then cut into discs of uniform thickness. If the discs are formed into regular hexagons they can be glued in position to form a complete slab of any area; alternatively they could be shaped to form the wheel segments directly.
- b) bamboos can be cut into short lengths of the required size and glued in position individually.
- c) honeycomb slabs made from kraft paper, as used in making interior doors for houses.

By adoption of wheelbarrows made on the above lines goods or people can be transported even on rough or narrow tracks, at a cost far less than that of alternatives, particularly in these days of high energy costs and shortages. Arguably these wheel-barrows would be cheaper and more effective than the bicycle transporter made from a standard bicycle.

It is unfortunate that the normal European wheelbarrow, introduced into Europe from China in the Middle Ages, failed to copy the best feature of the original, the large central wheel. The reason may well have been that the barrow i.e. hand barrow (from the Teutonic for 'bearer') was well established and the early wheelbarrows were formed simply by replacing the front man by a wheel, thus leaving half the weight to be borne by the handles at the rear. The requirements of underground mining brought about the development of small four-wheeled trolleys running on wooden tracks, and this encourages the use of small wheels and later of iron rails, so that the virtues of large wheels were overlooked, though they were used on carts, coaches and, later, bicycles. But the design of wheelbarrows hardly changed and they never evolved into the effective vehicle so widely used in China, but hardly known in Africa and India. The scope for properly-designed wheelbarrows, locally made, is immense.

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technical brief