USE IT AGAIN, SAM

THE PROBLEM IS:
No 6

Preface

The Minimum Cost Housing Group is best known for developing methods and techniques for using waste sulphur as a low-cost building material. Our interest in sulphur was stimulated by the world-wide availability of this material and that it was a material which virtually had no value.

While our work with sulphur is continuing, we have turned our attention to another abundant resource, consumer-garbage. Our interest in re-usable containers has been stimulated by the work of my friend Martin Pawley in London. He has done much to clarify the implications, and necessity, of this approach to the housing problem, and his paper of 1972 to the Chilean Ministry of Planning which is included as the first chapter of this book, is a historic document in the development of garbage housing.

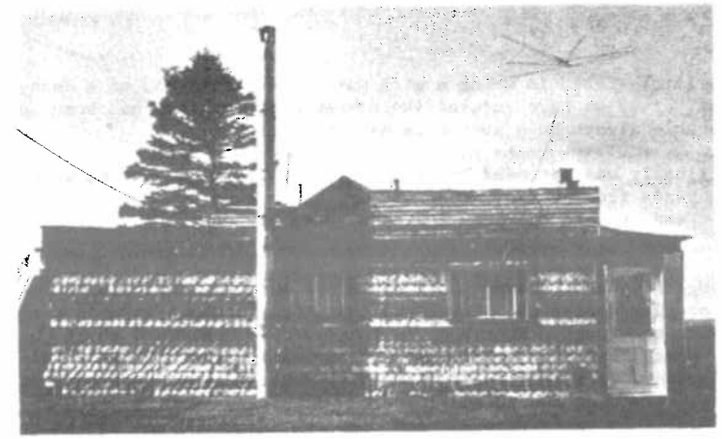
Another important event took place in December, 1974 in Puerto Rico, at the United Nations Ad-Hoc Meeting of Experts on the Use of Agricultural and Industrial Wastes in Low-Cost Construction. Both garbage housing and sulphur technology were introduced at this meeting, organized by Prof. Arthur Bowen of the University of Miami, and Alberto Gonzalez-Gandolfi of the Centre for Housing, Building and Planning of the United Nations, who has written the Foreword to "Use it Again, Sam", and whose support for our work is greatly appreciated.

The work of M.C.H.G. is always a collaboration and this book is no exception. Particular credit is due to Behrooz Nournia, whose thesis provided much of the material and Alvaro Ortega who contributed his usual enthusiasm and plenty of good advice.

Finally, our appreciation to the Central Mortgage and Housing Corporation of the Federal Government, whose support for our program in 1974 allowed this investigation to be carried on.

Witold Rybczynski

The oldest documented search for a perpetual motion machine is that of an imaginative French architect of the 13th century, Wilars de Honecort. This book is dedicated to him.



House out of flattened motor oil cans at Matane, Québec

Contents

Foreword

Saving a little case, in which a gift was presented to us, or a decorated box, after we have enjoyed its contents of cookies, has been and will probably always be a very personal and dear habit.

What originally was intended to serve as a temporary protection when changing hands from producer to consumer, has become in many cases a permanent and useful container for unforeseen purposes. This is all right.

But, along the years, wrapping and container material has becom a burden to our consumer societies. I believe that figures shown in this study are convincing enough. Everybody is increasingly concerned about the enormous waste that must be disposed of to leave room for new containers, wrappings, jars, bottles and boxes that keep coming into our homes every day. The question is how to reduce it. Among various ways of disposing of this waste, the Minimum Cost Housing Group has chosen the least expensive and perhaps the most rational one: RE-USE. It is not a new idea. Yet, it has not been adopted so far on a substantial scale. Isolated examples show successful results using existing commercial containers. The change of scale to mass utilization of containers carries, however, a number of unsolved problems.

It is necessary that producers, consumers and authorities co-operate in a concerted action towards mass RE-USE of containers. Proposals made in this study for the re-design of bottles and jars should be accepted by producers and its generalized use must be stimulated by authorities. From the consumers' side, there are also important problems to solve. If containers are used as building materials, as suggested, a considerable amount of units will be needed. Where to stock-pile them? I can foresee that a new kind of commercial activity will have to develop just to solve this problem alone.

Before the present proposal becomes a generalized RE-USE of containers, a long process must necessarily follow, consisting in negotiations, change of equipment and production processes and achieving the consumers' conviction on the advantages of the system. In any event, the initiative of McGill University constitutes a solid start in this process aimed at alleviating some of the most serious problems of the world today: the conservation of energy and raw materials, and the use of waste.

Alberto Gonzalez-Gandolfi,
Chief, Building Section
Centre for Housing, Building and Planning,
United Nations.

10 february, 1975.

1 GARBAGE HOUSING

The following paper was delivered by Martin Pawley of the Architectural Association, London. to the International Housing Conference held in Santiago, Chile, during September 1972. As a result of interest expressed in the paper, the Chilean Ministry of Planning (ODEPLAN) commissioned a research project into the development of an organized secondary use potential within the Chilean economy. The research project was carried out by the author of this paper together with twelve students from final year in the Department of Architecture, Cornell University, New York during the early months of 1973. Shortly after the submission of the research report the Unidad Popular administration in Chile was overthrown by a military coup and no further work on the project has been carried out.

A full account of the Chilean project, as well as other experimental and theoretical work on the subject of secondary use, can be found in Martin Pawley's Garbage Housing, to be published in England by Architectural Press in October 1975.

A STRATEGY FOR THE RESOLUTION OF THE CONFLICT BETWEEN MASS HOUSING AND CONSUMER ASPIRATIONS.

Hypothesis

That the principal reason for the failure of mass housing since 1919, whether industrialised or traditional, lies in the conflict between the organisational, economic and social requirements of a mass housing policy and the aspirations of the people the policy is intended to serve. Simply, that people world wide have absorbed an image of an affluent consumer lifestyle involving the use and enjoyment of products and services on a scale equivalent to the images projected by the major consumer product manufacturers of the Western world. The universal truths of our time are not idealogical but acquisitive: people do not want to live according to principles but according to desires.

Social factors

The resource of a developing nation consists in the aspirations and energies of its people.

Where a clearly defined class system still exists, the aspirations of the poorer majority have already been captured by the rich minority: poor people quite simply want to be rich, the type of wealth that they want is the type they see about them whether in actuality or by advertising. Thus to convince the poor that they do not wish to be rich is

more difficult than to maintain the *status quo*, for that inevitably offers at least the chance of wealth. An idealogical conversion can only be achieved in isolation: hence China and Cuba's isolation from foreign goods and invluences during the period of their cultural revolutions. In Cuba, the return of normalcy is heralded by the purchase of Japanese air-conditioned buses. In China, by the purchase of British and American jet airliners. Fifty years of socialism in the USSR did not expunge the consumer dream; on the contrary, it was always promised as a *reward* for the years of effort. The Soviet Union now builds Fiat cars under licence and plans the development of further consumer services. Socialist and Capitalist regimes alike tend toward the ideal of the service state and the consumer population. In this context the mass housing project, as exemplified by the industrialised apartment block, emerges as an alien force for the following reasons:

1. It is inevitably publicised as an *alternative* to wealth. Thus to live in a publicly financed or subsidised mass housing project is to admit to failure in the pursuit of wealth

2. The form of the housing itself never figures in influential consumer advertising campaigns, nor is it associated with received images of wealth such as are conveyed by a Ford, a Datsun or a Coca Cola can. *Products like these are never advertised in the context of the mass housing project.*

3. The administration of mass housing projects confirms (by means of regulations and restrictions) the occupant's notion of himself as an inferior class of citizen

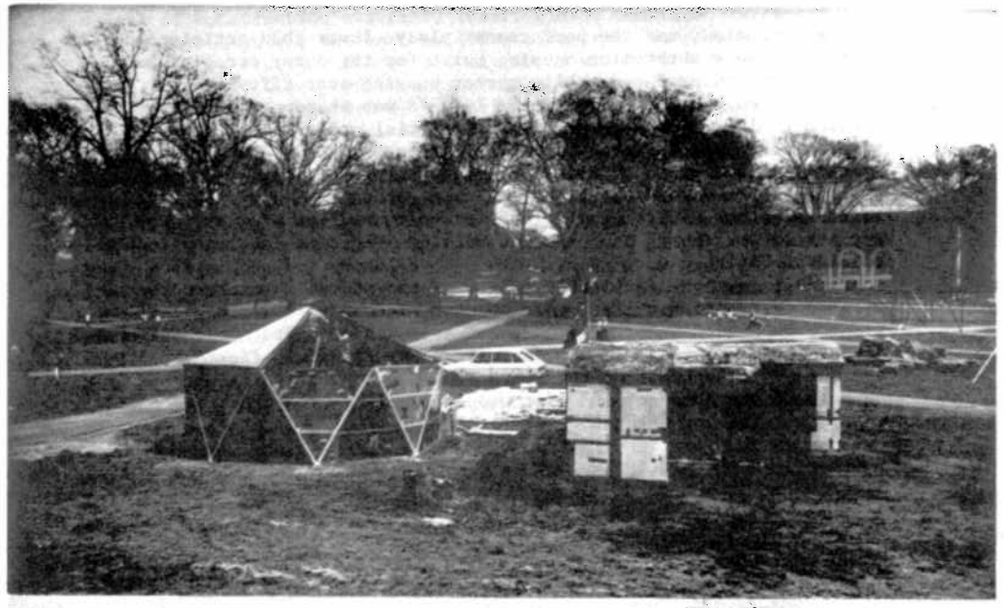
4. The houses or apartments themselves are easily distinguishable from affluent housing without at the same time achieving a coherent or desirable image of their own. In sum, identification between mass housing and affluence is negligible.

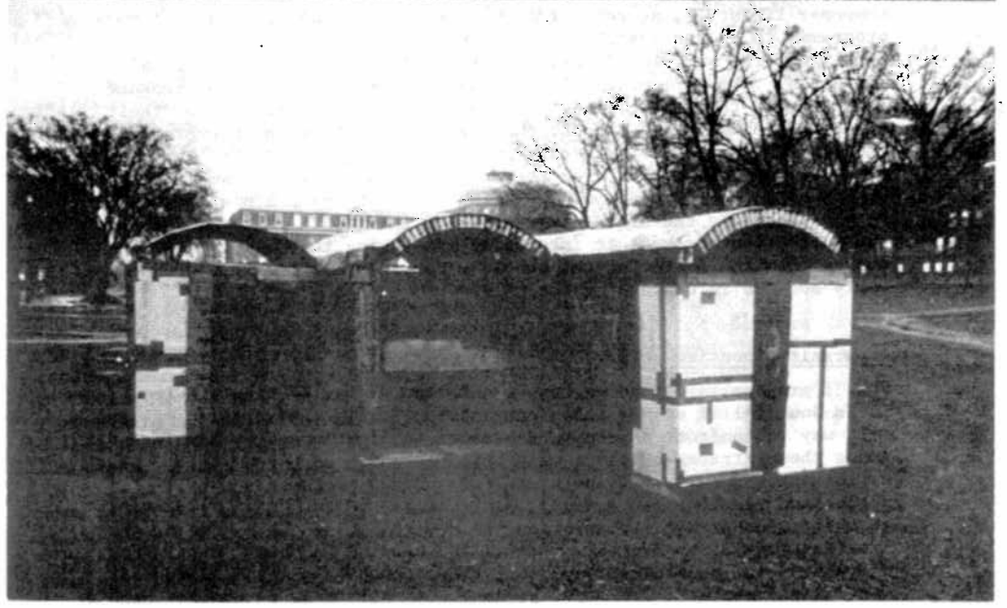
Technical factors

Despite fifty years of development in many nations, industrialised building is too expensive and too inflexible: not only in its form but in the economics of its production. Efforts to organise long production runs to obtain the benefits of scale that generally apply to manufacture have failed, particularly in the Western world. The promised reduction of on-site labour has not yet materialised, if only because site damage, inaccuracies and inadequate tolerances have always required the presence of teams of 'fixers' whose labour is skilled and expensive. Even with this additional expenditure in time and energy structural defects are not uncommon, so much so that extreme cases like the Venezuelan *superbloques* of the late 1950s or Ronan Point, which collapsed in London in 1968, have created much adverse propaganda.

Economic factors

The cost of establishing a large scale housing programme is always higher





Paperboard and Beverage Can Houses built at Cornell University, May 1973.[12]

than anticipated, and the performance always lower than anticipated. In Britain private enterprise housing built for the owner occupier has consistently outproduced public sector housing over fifty years. The prefabricated housing programme of 1944-48 was abandoned after the completion of 150,000 units, although an initial order for 500,000 had been placed - for largely economic reasons since building land was effectively nationalised at the time. The industrialised building programme of 1964-70 was unseccessful for the same general reason, with high labour costs defeating early calculations for reasons already given. For Chile, any attempt to embark on a massive housing programme involving industrialised building must require the use of labour and specialised plant, inevitably foreign, inevitably expensive and scarce. Furthermore the history of public works projects of this kind shows them to be inflationary in effect and slow in demonstrable achievement. In short such programmes represent a repetition of the unsuccessful efforts of other nations, with emphasis on the scarcest and most costly resources at the expense of the cheapest and most widely available resource, which is the energy and will of the people themselves.

Summary

A housing programme to be successful must correspond to the desire of the people for wealth, freedom and hope: it must therefore be consonant with their *evident* ambitions. At present, whether we like it or not, these ambitions are *universally* associated with the achievement of a consumer lifestyle, as reflected in international advertising. A housing programme to be successful must involve the labour of the populace, freely offered and clearly oriented towards helping their own local situation. The type of dwelling presented must relate to the consumer ambitions of the people, and to the self-conceived structure of their own communities. Thus the national housing programme must emerge from the reality of the people's pattern of consumption, from the investment of their own labour, and from the enthusiasm of their own ambition for betterment. Anything *imposed upon* the people in such a hostile context as that faced by the Allende regime, must inevitably fail, and with it the policy that brought it into being. Anything that can be made to emerge from the fabric of the people's consumer ambitions, must inevitably succeed in commanding their help.

A parasitic housing policy

What I propose is not an exclusive solution to the housing problem. Indeed it is doubtful if such a thing can exist. Multiple strategies are the only way to confront as compound a crisis as that posed by homelessness. Among these strategies there must be a place for a programme capable of exploiting the political and social advantages of rapid and well-publicised results. *Alongside a conventional housing effort*, there is room for a programme dependent on the assistance of the major consumer manufacturers of the Western world. The canning and bottling plants, the fibreboard and packaging companies, the automobile giants and the advertising agencies. The major producers in all these categories handle

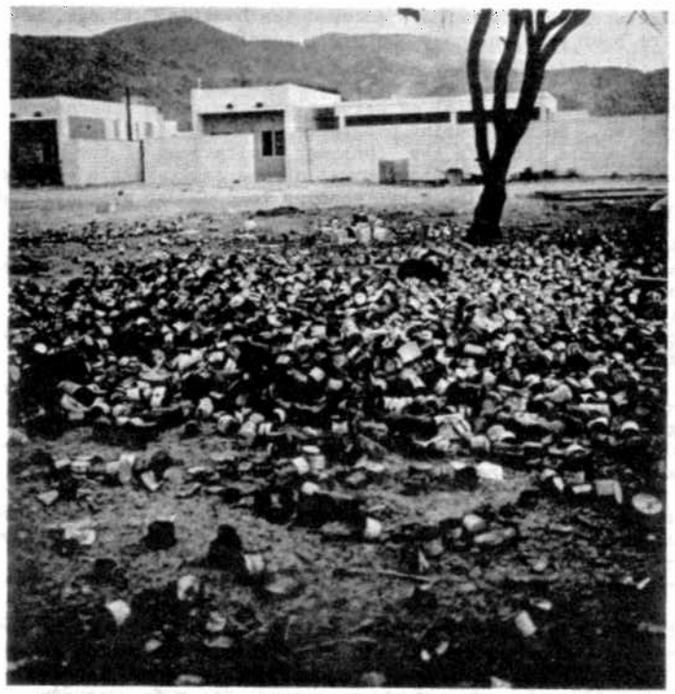
more weight of construction material, steel, glass, plastics, cardboard, paper and alloys than any national building industry. Guiness breweries sell *seven million* bottles of beer per day world wide. The Coca Cola company sells nearly *twenty million* cans and bottles per day. Similar astronomic figures are recorded by canners and bottlers and packagers of all kinds. These containers are all potential resources for home construction. Indeed the developing countries have for generations made their own adaptations of discarded products for housing purposes. What I propose is that by means of a highly visible, well-advertised government programme, this *bricolage* should be systematised and *technically assisted* by the redesign of containers to facilitate housing component adaptations. That the manufacturers themselves should be called upon to launch this process, not only in the interest of their own sales, but as part of the price of entry into a market of guaranteed demand where *all advertising would have to be framed in a secondary use context*. If they accepted these conditions, agreed to market extras such as clips, jointing devices, extension pieces, preformed blanks and so on, then they would find that the price of an expanding market in any socialist country would have become a simultaneous committment to that country's housing programme. That the price of a can of beans or a bottle of detergent would have become, in part, the price of a house. The commodity manufacturer would thus have entered the housing business, not as a secuder of poor peoples money, but as a supplier of subsidised housing materials, Withing the expanding Chilean market consumer spending would have become integral with public saving: work would have been provided, for which the usual industrial or service base would be unnecessary or self generating. Such a housing programme would be *parasitic* in the sense that it would feed off the consumer aspirations of the people, and socialistic in that its *détournement* of the capitalistic basis of consumer societies would give a new meaning to consumer products themselves. The cheapest resource base, plus the full power of product advertising would fall into line behind a national effort. Such a programme furthermore need not *replace* conventional housing, nor would it consume materials required by any conventional housing effort. Instead it could stand alongside it; hopefully as the forunner of a future economic integration based on the ecologically correct utilisation of resources.

Using the resources of the consumer industries performances of the following order should be possible. *Working on pilot designs for a 25m² minimum house of advanced geometry, using a steel or aluminum can frame and cardboard packaging infill, a small supermarket could generate materials for perhaps 20 houses per week. The ten largest soft drink and brewery corporations in the world could provide material for no less than one hundred million dwellings per year. Even assuming a loss factor of 50%, such an output would more than double world housing production at the present time.*

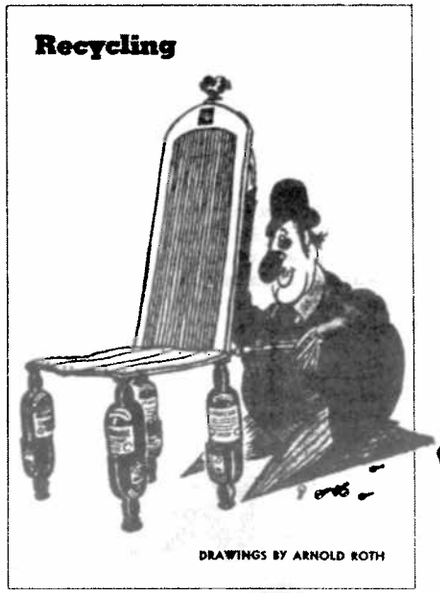
Such achievements however could only be realised if the products themselves were publicised in the context of the system of values and goals accepted by the mass of the world's population. A consumption based housing policy can only succeed if it succeeds first in capturing the dreams of the people.

The design problem

The irrelevance of conventional housing design to the problem of homelessness has been crusihingly demonstrated by the repeated housing crises of the present century. It is accepted that the world's urban population will rise from a present 1,330,000,000 to over three billion by the year 2000 (an increase equivalent to 1,760 new cities the size of Marseilles), surely then it must also be accepted that the resource base, both material and labour, presently employed is totally inadequate. A revolutionary integration of material use is urgently required. This is a *real* design problem - as opposed to the forms of environmental repression and exchange value accretion which presently occupy the skills of the design profession.



The consumer lifestyle comes to Dubai



One More Futile Bottle Bill

Garbage-Smothered Cities Face Crisis in Five Years

Wanted: 100 tons of glass

SELLING GLASS IS THEIR BUSINESS

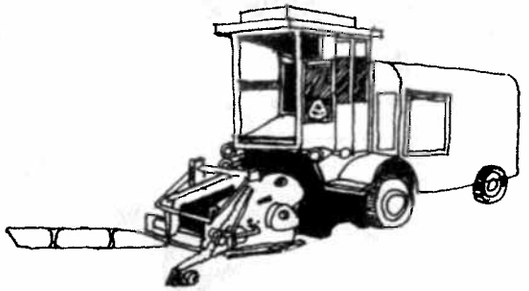
$60,000 house built of recycled material

Broken bottles + manure = house

2 IT'S ALL RUBBISH

Ancient man simply piled his refuse (broken pottery, bones, shells, etc.) on the ground and, when it became a nuisance, he moved to another campsite. But modern man cannot walk away from his trash. We can't move entire cities any more than you would move your home because there was too much garbage piled up in the back yard.

In the past few years, the quality of the environment has become one of the most popular issued of our time. Discussions, plans and actions for improving our environmental quality have received much time, energy and financial support from businesses and industries throughout the nation, though this is not always visible in our urban and rural landscapes.



CAN GOBBLER

Manufactured by Delitter Corp. This machine picks up, compacts and disintegrates highway litter. It costs $14,750.

More than 630,000 tons of dry trash and garbage are put out for collection in U.S. communities daily (7) and for collecting and disposing of this garbage, americans pay close to $5 billion a year.

The cost of collecting garbage is already high and rising. A 1969 report covering 166 cities showed a mean collection cost of $17.66 per ton or $9.50 per ton for cities of less than 100,000 people, $10.20 for cities with 100,000 to 500,000 and $24.00 for cities with over 500,000 people.

LITTERING

Litter contains many of the same items which are found in solid waste, and it is done by people who discard things in the wrong place either without caring that the act is not acceptable to society, or without even realizing it.

Litter may be a candy or cigarette wrapper, or a bottle. Litter is trash, it is right there in full unsightly view all the time. If the countryside were made as litter-free as most would like it, it would require more frequent litter collections and would substantially raise the "collection cost per container".

An American survey of roadside litter conducted for the National Academy of Sciences and National Academy of Engineering in 1969, found the composition to be as follows:

PAPER	*(newspapers, magazines, packages and other paper items)*		*59.5 %*
CANS			*16.32*
	beer cans	*11.75%*	
	soft drink cans	*3.11*	
	food cans & others	*1.46*	
PLASTIC	*(packages, containers and other plastic items)*		*5.77*
BOTTLES & JARS			*5.88*
	beer bottles	*2.72%*	
	soft drink bottles	*2.13*	
	wine & liquor bottles	*0.64*	
	other bottles & jars	*0.39*	
MISCELLANEOUS	*(auto parts, tires, lumber, construction items, etc.)*		*12.53*

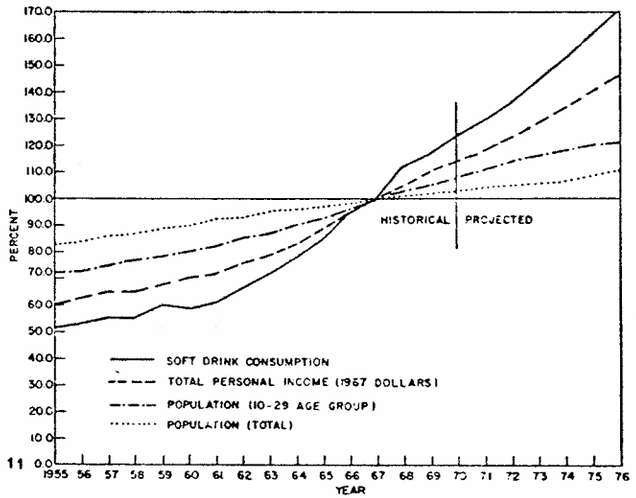
Litter is costly. Americans pay one billion dollars a year (8) to retrieve the bottles, cans, newspapers, etc. Half of this tax money is spent to clean up parks and recreational areas, another 28 million dollars is spent recovering trash from primary highways. Litter is ugly, unhealthy, a fire hazard, a traffic hazard and one of the worst aspects created by modern society.

The Environmental Protection Agency, in the U.S.A., has concluded that beverage containers are an environmental problem primarily because some consumers of beverages litter their empty containers rather than disposing of them properly. The American public spent $43 million in 1969 to collect littered beverage containers. The E.P.A. has stated that the most effective policy would be a low (5 to 10 cents per container) tax on beverages, with revenues being used for more frequent litter collections. This suggestion has been unpopular with the soft drink manufacturers who claim it will reduce their sales. It is a proposal that, in any case, is aimed solely at reducing littering and not waste.

Beverage containers are not considered a "resource problem" as they use relatively small quantities of steel and aluminum. They also constitute a relatively minor proportion of solid waste compared to say, newspapers. However, about 30% of roadside litter is made up of beverage containers, durable, non-degradable and often hazardous. It is projected that in 1976, annual beverage container production will reach 77 billion (US figures) of which about 75 billion will be of the throwaway variety. At least 4 billion of these will be littered.

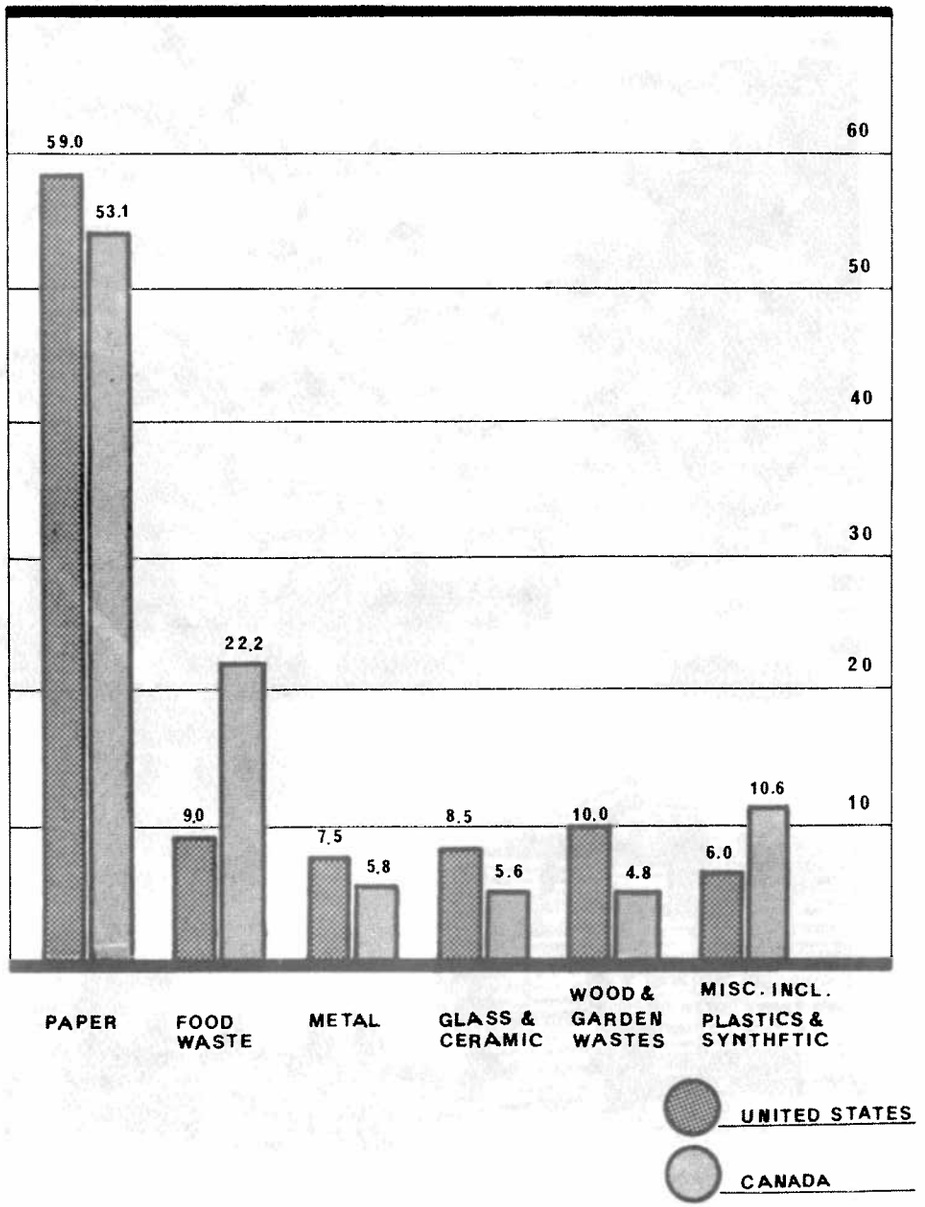
In 1960, all soft drink bottles in Canada (5) were in refillable bottles and, at that time, bottlers got an average of 20 "trips" out of each bottle. But throughout the 60's "trippage" dropped in some cases from 20 to 10 and, in extreme cases, to 5 or less.

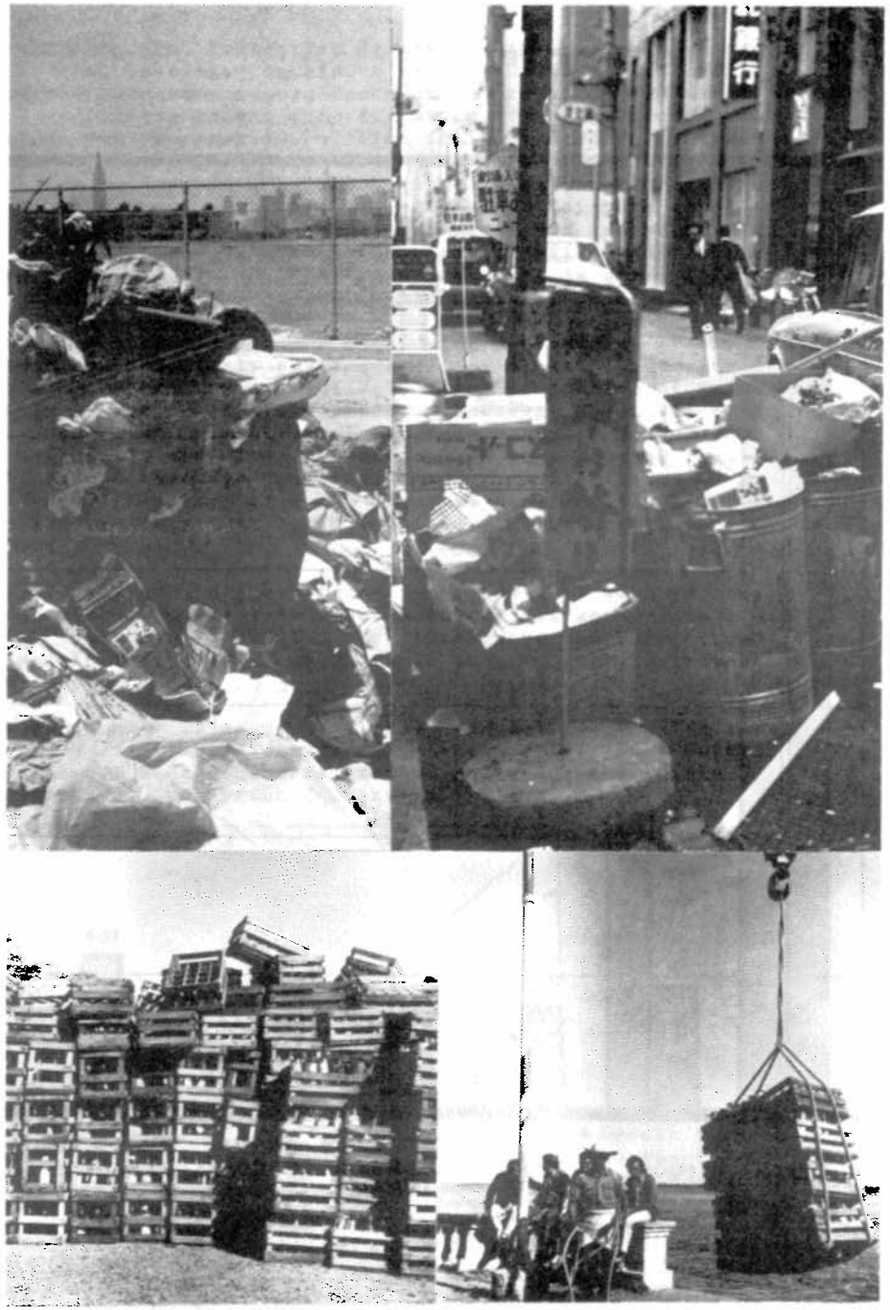
What happened? It seems that many consumers were using these expensive refillable bottles as if they were one-way metal containers. Some consumers stopped returning the bottles and "trippage" was reduced drastically.



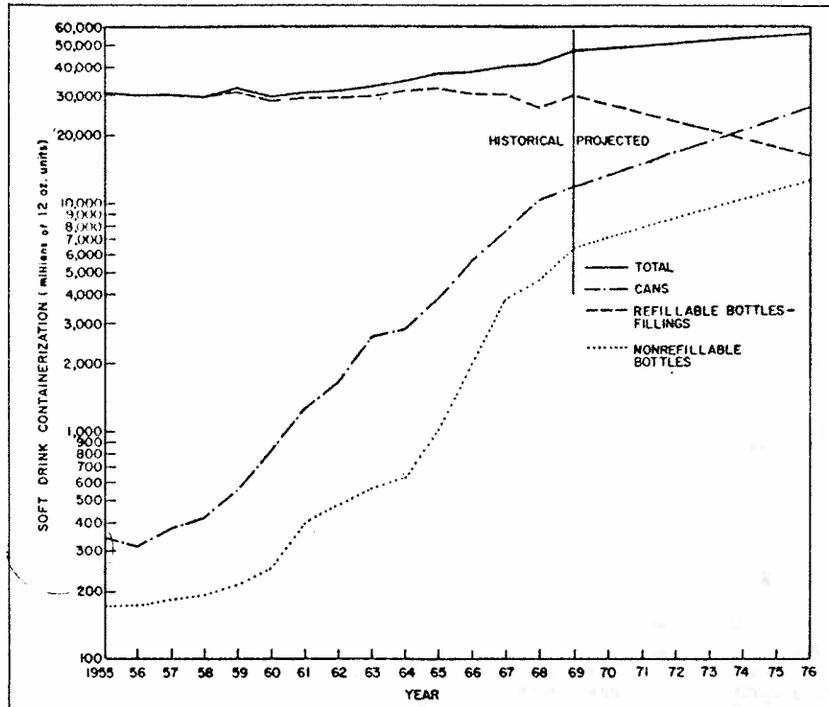
Growth of soft-drink consumption, population, and income (Research Triangle Institute)

***MUNICIPAL SOLID WASTE 5**
(PERCENTAGE BY WEIGHT)





Collecting returnable glass containers and transporting them to the manufacturer, Paraguay.



✱ Soft drink containerization trends (packaged). (Historical data, National Soft Drink Association, projections by Research Triangle Institute). (1)

✱ ESTIMATED DISPOSTION OF METAL AND GLASS CONTAINERS IN SOLID WASTE, 1969 (1)

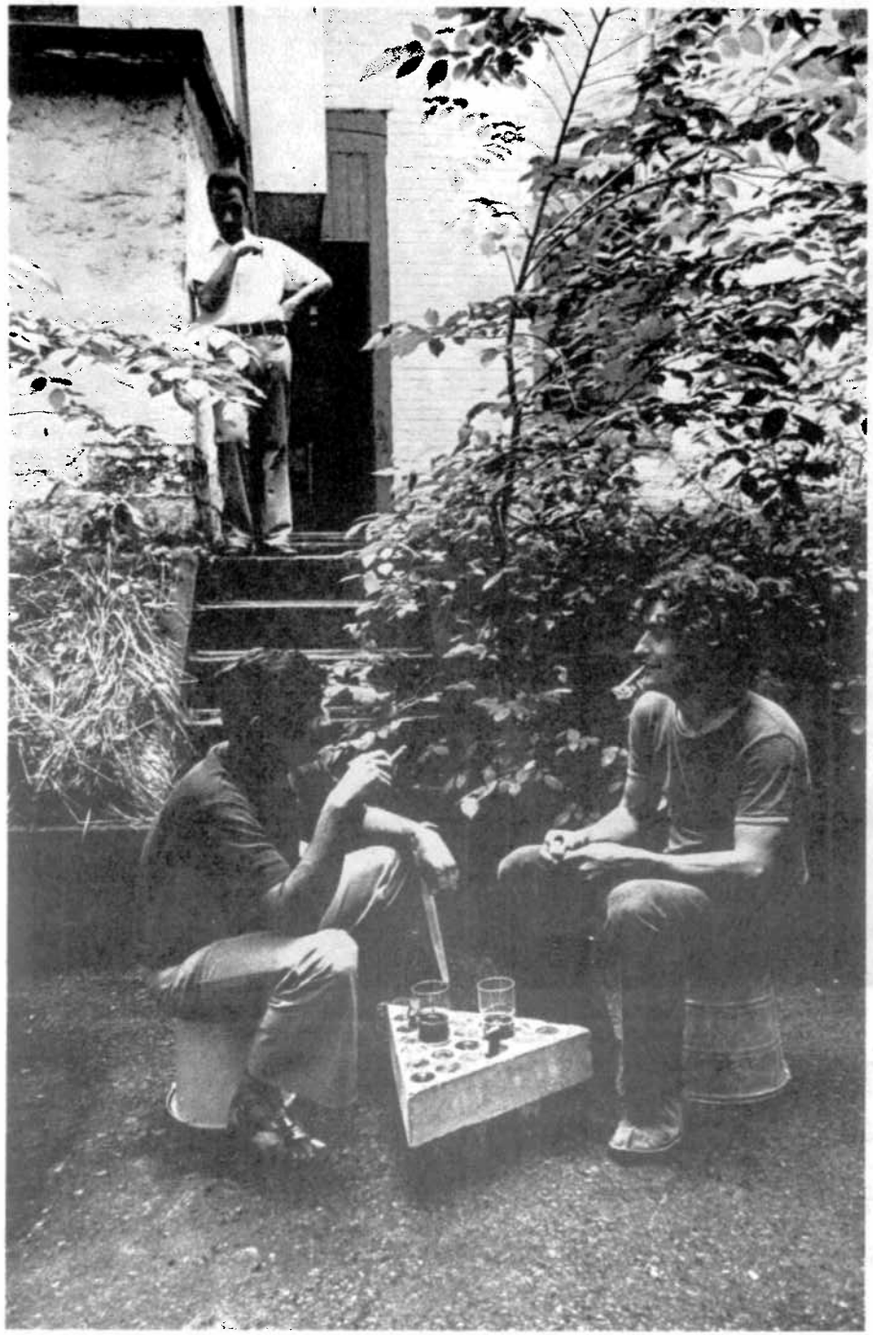
Type of beverage container	Weight of shipments* (million tons)	Estimated weight of littered containers† (million tons)	Estimated weight of containers in solid waste (million tons) self-collected‡	Estimated weight of containers in solid waste (million tons) services collected§
Cans				
Beer	1.214	0.096	0.112	1.006
Soft drink	0.898	0.038	0.086	0.774
Bottles				
Refillables				
Beer	0.139	0.015	0.012	0.112
Soft drink	0.794	0.113	0.068	0.613
Nonrefillables				
Beer	1.627	0.076	0.156	1.395
Soft drink	1.958	0.015	0.194	1.749
Total	6.630	0.353	0.628	5.649

WHY PEOPLE LITTER....a personal experience.

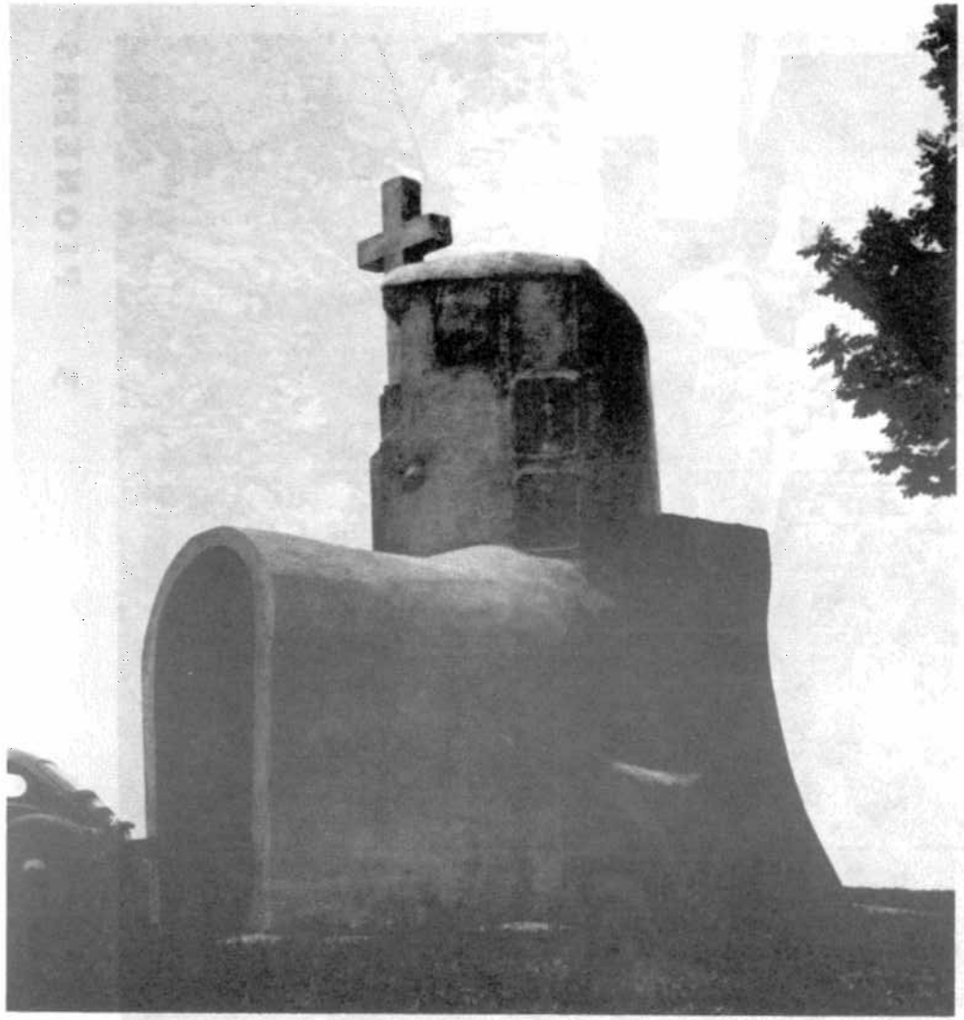
We had spent the weekend in Vermont, and since there was not garbage pick-up in the small community where we were staying, we were going to bring it back to Montreal.

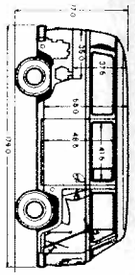
At the border, the Canadian guard informed us that we would not be allowed "for health reasons" to import our garbage (most of which was in fact Canadian). We returned five hundred feet to the American Customs, but they did not, they said, have a garbage can. We would have to leave it "somewhere else". Now the State of Vermont has a $500.00 fine for littering, which was a bit discouraging. The Landfill Area (garbage dump) of the closest town was padlocked, and in any case FOR RESIDENTS ONLY. *I was beginning to understand, with a sense of desperation, the piles of garbage, mattresses and old stoves that are frequently seen alongside our highways.*

At a roadside stop there were litter barrels, but apparently only for "travel trash" and not for "household trash" ($50.00 fine this time). Glancing furtively, we dropped our bag in and drove quickly off.

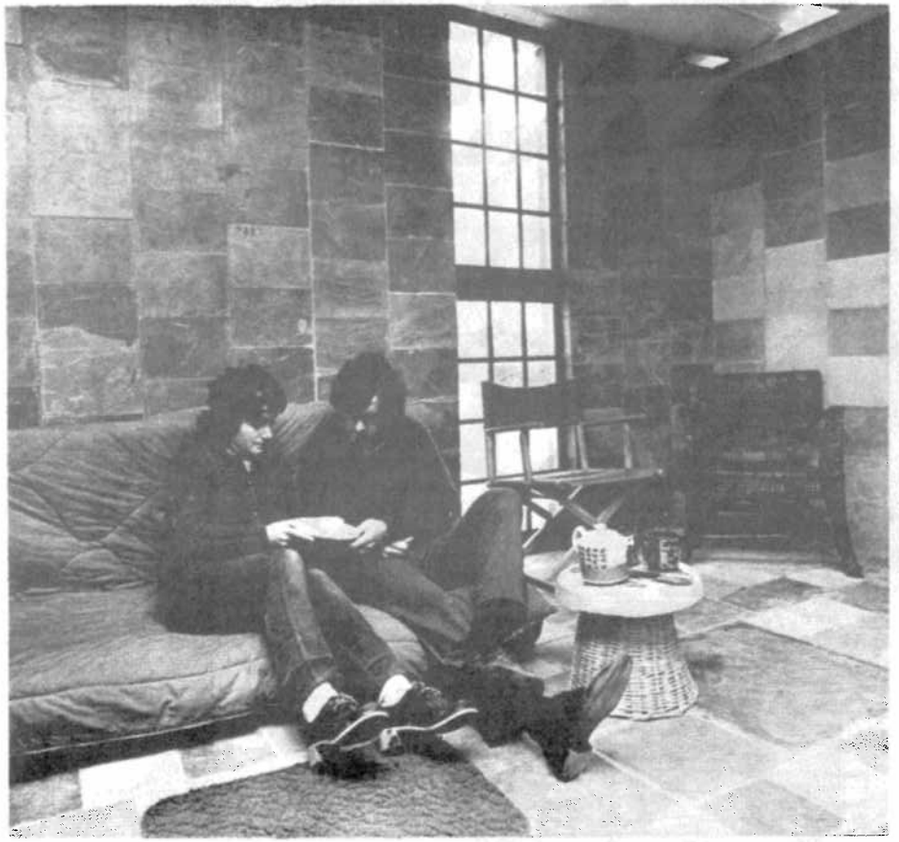


3 PIONEERS





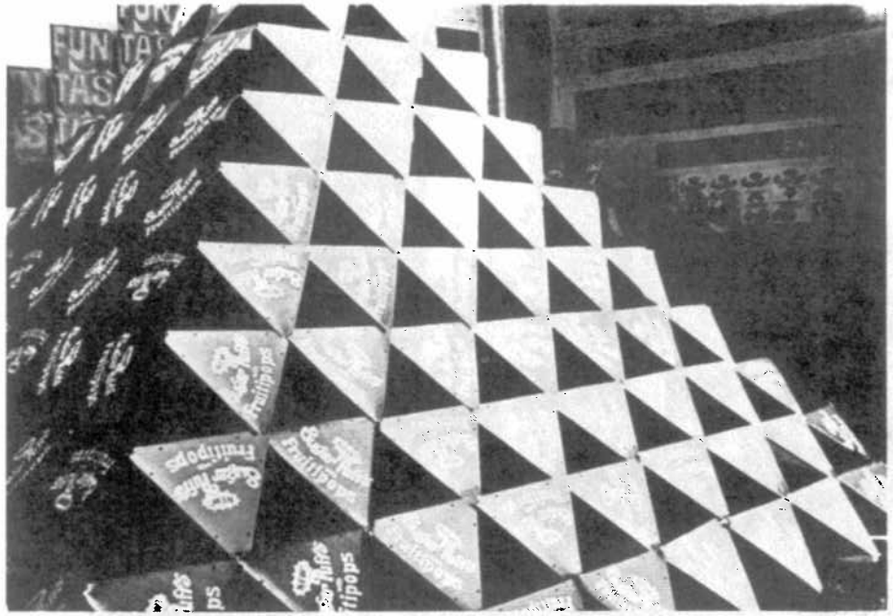
The Bavarian sculptor, Erwin Eisch, together with his friend Helmut Koller, built this wayside chapel (1970-1972) overlooking the village of Frauenau. The body of an abandoned Volkswagen bus was used to provide the vertical element. Gretl Eisch painted the stained glass windows. The whole is cemented and painted. The chapel stands on the site of the first building in Frauenau, built by the hermit Hermann in the Middle Ages.



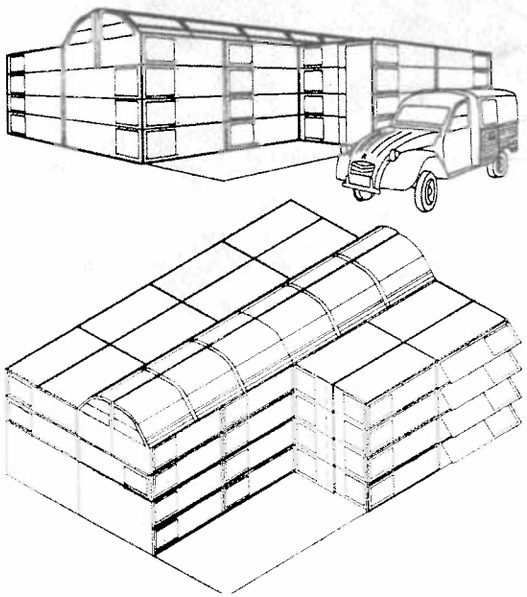
interior of Ecol House

Housing

The Ecol house, built by the Minimum Cost Housing Group in Montréal in 1972, shows the possibilities in a nationalized approach, to the use of industrial wastes - sulphur, slag and pyrites. A sulphur concrete is formed from which blocks, tiles and slabs can be manufactured. Modular Coordination is used to reduce cutting, fitting and wastage. The quantity and frequency of industrial wastes, particularly solid wastes, is as great as that of consumer garbage. [2]



secondary use for cardboard containers - AA Project David Hunt 1971 11

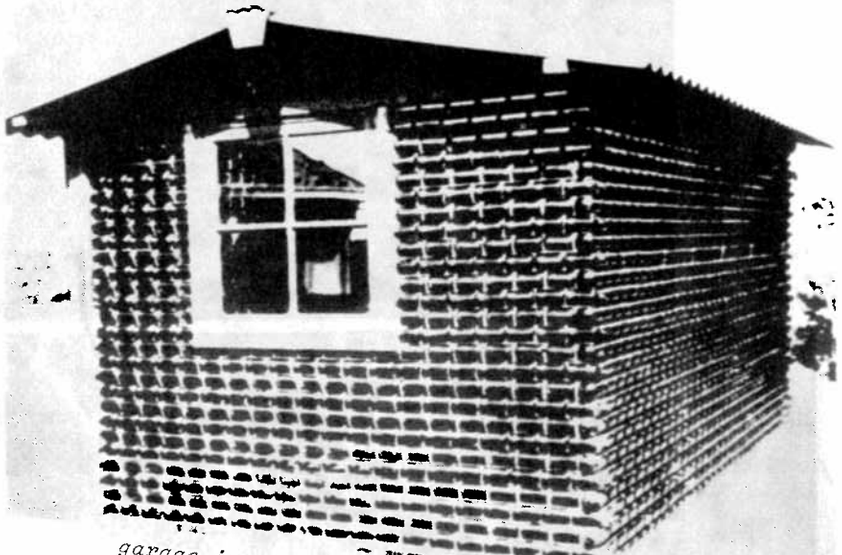


Citroen House designed by Jeff Skorneck 1973 - Cornell University

Garbage housing

Recent interest in building with waste has been stimulated by the work of Martin Pawley and his students both at the AA in London and at Cornell University. Pawley sees "garbage housing" as an alternative to the largely unsuccessful housing policies, both of developed and developing countries.

Pawley conducted a design program with students at Cornell aimed at ameliorating the housing situation in Chile.



garage in Alfred Heineken's garden

This bottle was designed by John Habraken, in 1962, for Alfred Heineken and the prototype structure was built in 1965. The utilization of this brick/bottle was to be in Latin America, but though developed to an advanced stage, the design was not put into production for marketting reasons.

1

2

Recycled

1 Colin Munro, Richard White and Richard Morrison, at the School of Architecture at McGill University, built this rooftop greenhouse in the centre of Montréal, in October 1973, using scrap materials: plate glass ends and packing cases. The total cost was less than $100.00. The greenhouse is designed with reflecting north-wall and has been in operation during the entire winter.

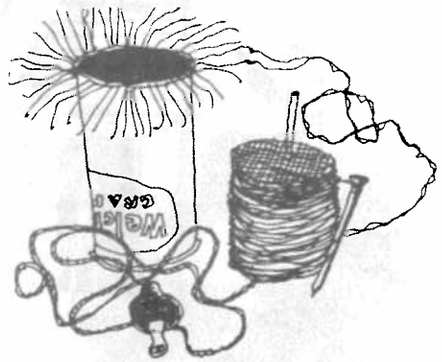
2

Swords into Plowshares

We visited a bicycle factory in Thanh Hoa City where almost 200 workers, 80 of whom are women, turn out 400 bicycle frames a month, mostly from scrap metal of downed U.S. aircraft and bomb casings. The debris is melted down and hammered into spokes and frames. The factory director proudly showed us his own bike, part of which was made from the debris of the Johnson bombing and part from Nixon's bombing. In an annex, the scrap metal is melted down into pots and pans. Elsewhere, U.S. bombers are resurrected as rings, combs, vases and statuettes, bomb casings become flower pots, the plastic-covered wire electronic barrier across the DMZ has now been fashioned into colorful woven purses sold in the marketplaces of Quang Tri. A miniature version of what a new village in Quang Tri will look like is made from unexploded shells. 4

"For the Americans in Vietnam it would be difficult to make this leap of perspective, difficult to understand that while they saw themselves as building world order, many Vietnamese saw them merely as the producers of garbage from which they could build houses." 3

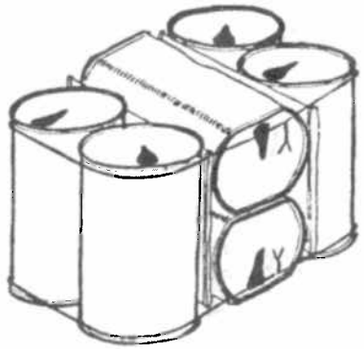
This device was conceived by Victor Papanek & Georges Seeger for developing countries. Using a tin can filled with wax and a wick which lasts 24 hours. The heat generates enough energy to operate a receiver with earphones. The device receives all the radio stations at once but, in the areas where they are used, there is only one radio station transmitting. If a person were to listen to the news on the radio 5 minutes each day, the wax would last one year. When the wax burns up all you have to do is refill the container with wax, wood or paper and the radio is in operation for another year.



All the components of this radio can be manufactured for less than 9 cents in the United States. 10

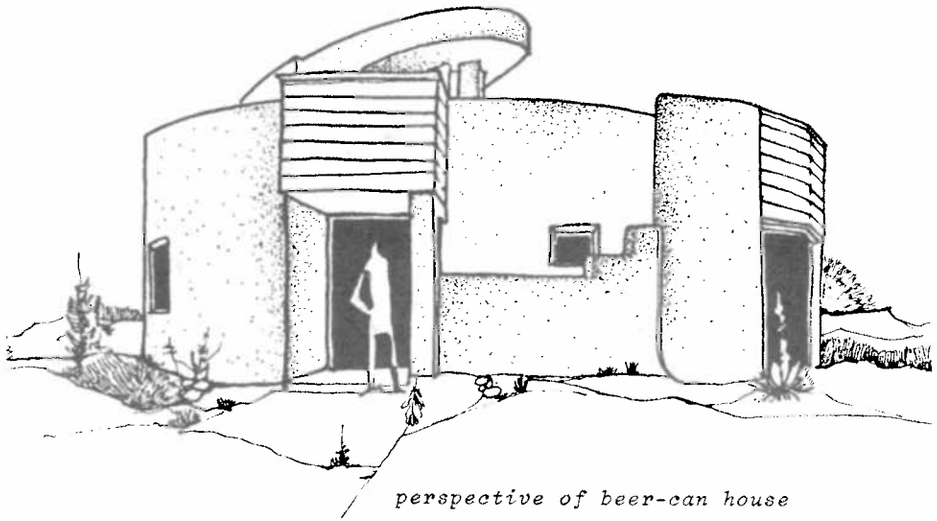
The home that beer built...

For a Beer-Can House, The Designer Learned Every Litter Bit Helps [16]

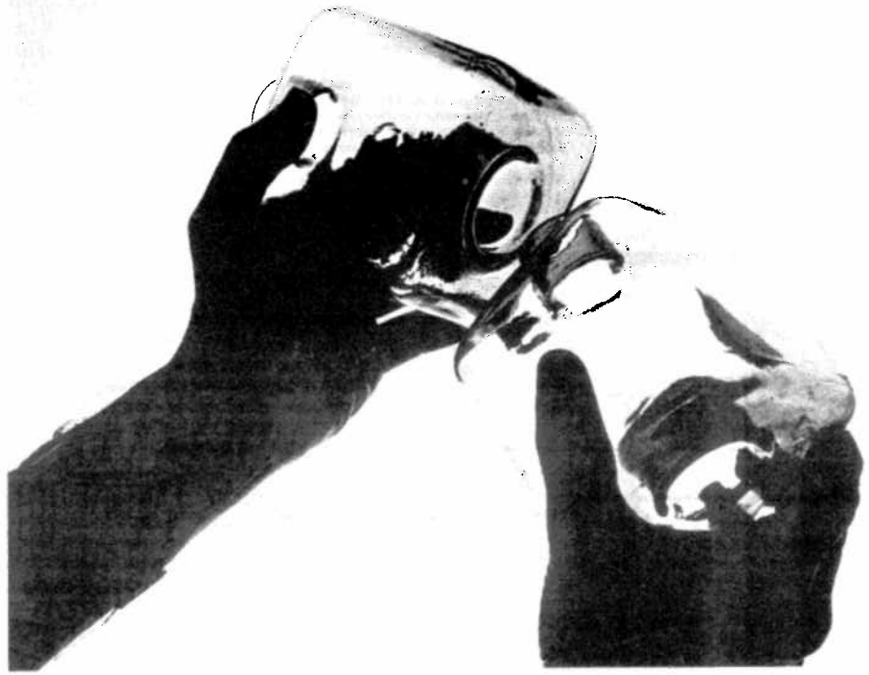


Michael Reynolds is an architect who has designed and built a house in Taos, New Mexico, using baled beverage cans in place of building blocks. The blocks are made from eight 12 oz. steel cans, two of them flattened, connected with baling wire. There are about 75,000 cans in the house; each wired "block" cost about 15 cents. The completed wall is plastered.

The 1100 ft^2 house cost $15,000. and was financed by a conventional bank mortgage. [13]



perspective of beer-can house



Glass container manufacturing process

1 - The 'batch' plant where raw materials are stored and mixed with computer-controlled precision before being fed into the furnace. The batch building is the most prominent feature of a glass container manufacturing plant and is often a landmark in the area.

2 - The furnace, standing about four storeys in height, is some 70 feet long and 60 feet wide. The melting chamber of the furnace can hold over 400 tons at a time and operates at temperatures up to 2800 degrees Fahrenheit.

3 - On leaving the furnace the molten glass flows through the refiner and then into the feeder channels where the glass drops through a small opening and is snipped off by huge shears into 'gobs', each of which contains exactly the right amount of glass to make the style of container being run.

4 - The automatic bottle making machines are single, double or triple gob machines on which one, two or three bottles can be made at the same time in each of the five, six or eight independent sections of the machine.

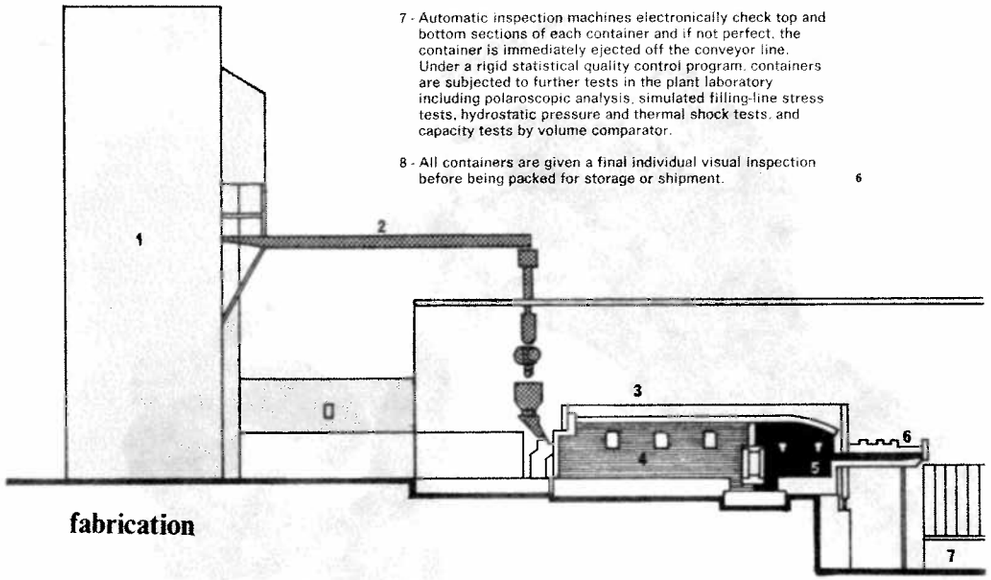
5 - The annealing oven, or 'lehr' is a long tunnel-like structure through which the bottles or jars pass on a wide conveyor belt. Temperature of the lehr at the hot end is 1000 degrees Fahrenheit. The containers are reheated and tempered during the hour-or-so they are in the lehr under strictly controlled heat conditions until at the cold end they can be handled without gloves.

6 - As the bottles leave the lehr they are sprayed with a protective coating to guard them against scratches and abrasions in shipping and handling.

7 - Automatic inspection machines electronically check top and bottom sections of each container and if not perfect, the container is immediately ejected off the conveyor line. Under a rigid statistical quality control program, containers are subjected to further tests in the plant laboratory including polaroscopic analysis, simulated filling-line stress tests, hydrostatic pressure and thermal shock tests, and capacity tests by volume comparator.

8 - All containers are given a final individual visual inspection before being packed for storage or shipment.

Glassmaking Revolutionized



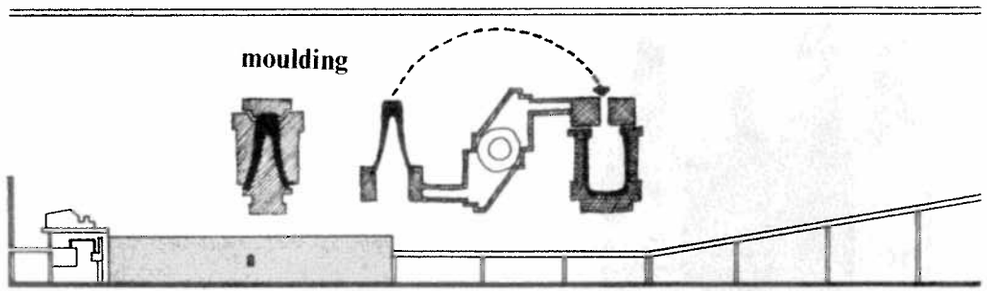
6

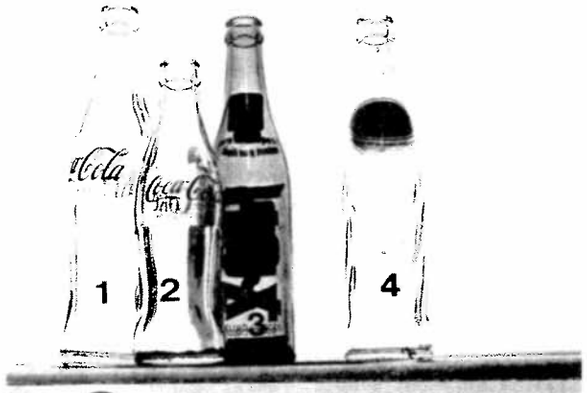
fabrication

Glass is made of highly abundant raw materials: silica sand, limestone (calcium carbonate) and soda ash (sodium carbonate). Sand accounts for 73% of the materials in glass containers thus glass manufacturing is not a serious drain on our natural resources. In fact, the raw materials used in the manufacture of glass containers are used in approximately the same proportions in which they are found in the earth's crust.

Clear bottle glass is made basically by melting almost pure silica sand in furnaces at about 2700°F. Burnt lime or limestone and soda are added to give the glass hardness and chemical durability. Crushed glass (known as cullet) has traditionally been added to make the mixture of raw materials more workable. In recent years, companies indicate that properly prepared crushed waste glass may be used to provide up to 50% of a glass plant's raw material requirements. Many plants are now making new container glass composed of 10 to 15% waste glass from these varied outside sources. This is up from 2 to 3% several years ago.

Colored glass is usually obtained by adding small quantities of selected oxides of metals. In the case of amber glass, carbon and sulfide or sulfat are added.





1- Soft drink ; 283 ml;423 gr; white; returnable; Canada.

2- soft-drink; 283 ml;230 gr; green; non-returnable; Canada.

3- soft-drink; 283 ml;467 gr; green; returnable; Canada.

4- soft-drink; 283 ml;388 gr; white; returnable; Canada.

5- wine; 638 ml; green; non-returnable; Spain.

6- scotch; 1140 ml; white; non-returnable; England.

7- gin; 453 ml; white; non-returnable; Amsterdam.

8- rhum; 728 ml; white; non-returnable; Martinique.

9- olive oil; 250 ml; white; returnable; Italy.

10- beer; 330 ml; 213.5 gr; green; non-returnable; Denmark.

11- beer; 360 ml; 238.5 gr; green; non-returnable; Canada.

12- beer; 340 ml; 238 gr; brown; returnable; Canada.

13- beer; 340 ml; 231 gr; green; non-returnable; Holland.

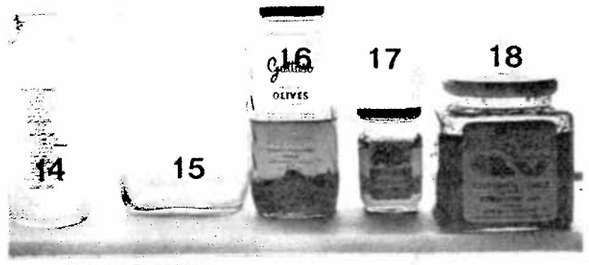
14- juice; 946 ml.; white.

15- juice; 2720 ml.; white.

16- olives; 946 ml.; white.

17- jelly; 180 ml.; white.

18- jam; 1360 ml.; white.



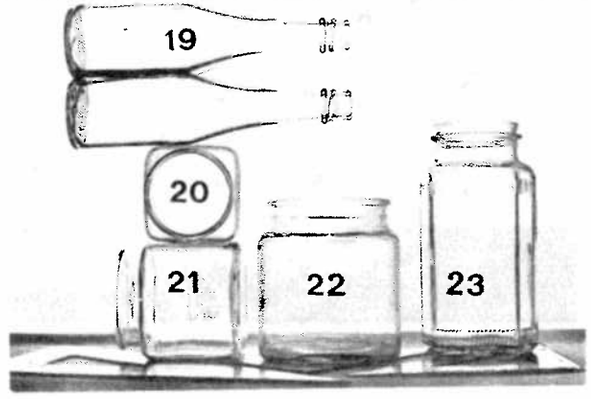
19- catchup; 330 ml.; white.

20- candy jar; 330 ml; white.

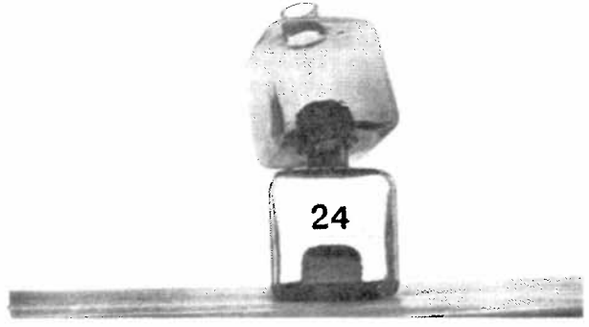
21- candy jar; 560 ml; white.

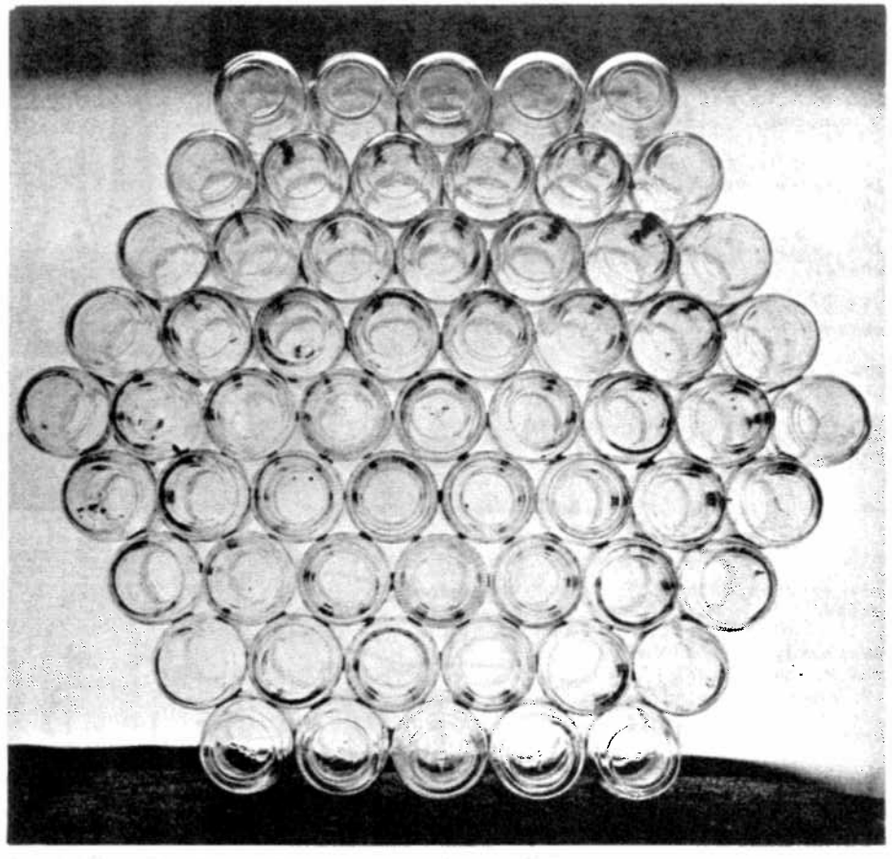
22- candy jar; 1120 ml; white.

23- jar; 849 ml.; white.



24- interlocking glass bottle.

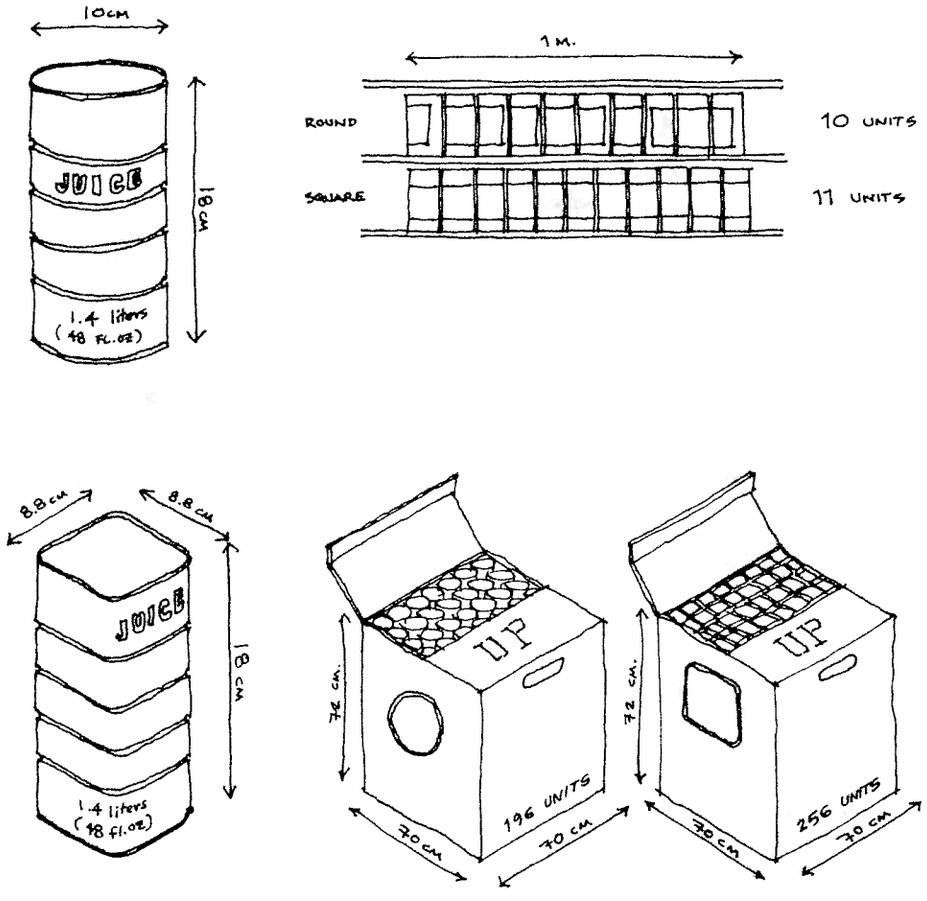




panel made out of baby food jars

STACKING

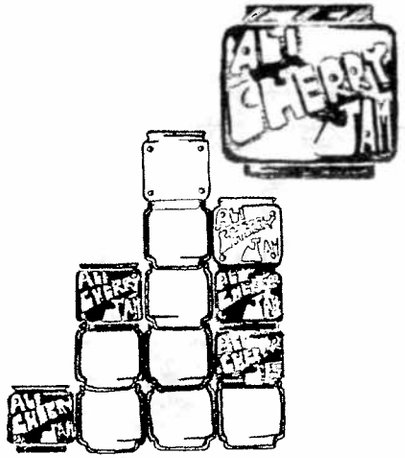
The essential characteristic of any building component is its ability to stack and interlock. Herein lies the basic problem of using existing bottles, whose predominantly cylindrical shapes do not lend themselves to easy packing. The photograph above shows a panel made out of baby food jars and illustrates the problem of joining jars and filling the numerous gaps that result. Though quite decorative, this panel is not suitable for wall or roof construction.



SQUARE CONTAINER VS. ROUND CONTAINER

The use of containers as building materials is dependant on the ability of the containers to be joined. It is obvious that round cans and bottles do not lend themselves to easy stacking. It is interesting that the adoption of square cans would also offer considerable saving (20%) in material used for the ends, as well as a reduction in cardboard (16%) used for packing, and a (12%) saving in linear shelf space. Thus the transporter, retailer and wholesaler all would gain.

ECO-JAR



The second use of glass containers as building components has a twofold aim: to make available to the owner-builder a building material that, being valueless, is most accessible, and secondly to reduce the amount of consumer waste that is littering the urban and rural landscapes, and whose disposal represents not only a loss of resources but an added cost.

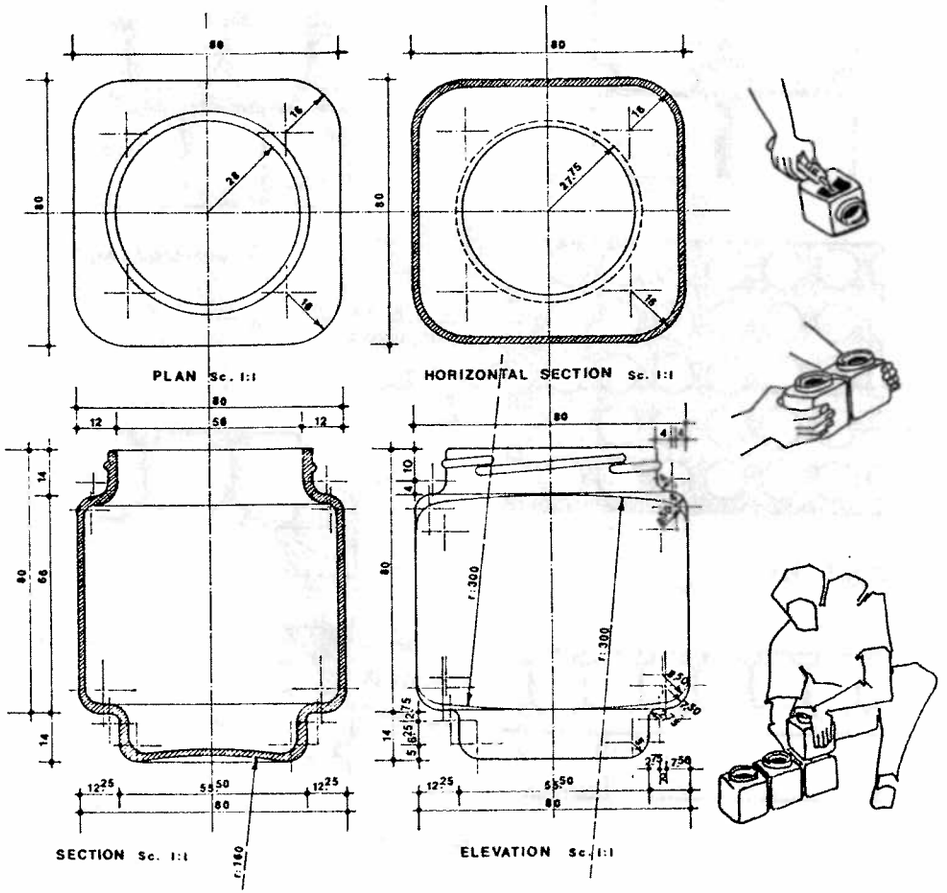
This experiment in the second use of glass containers (creating useful garbage) although to be initiated in an industrialized country, will have its greatest impact when it is accepted by developing countries whose apparent adoption of the consumer ethic will further paralyze their housing industry unless the products of that ethic can themselves be part of a solution to the problem of providing shelter. The Eco-Jar is one such approach to a design probe in this direction.

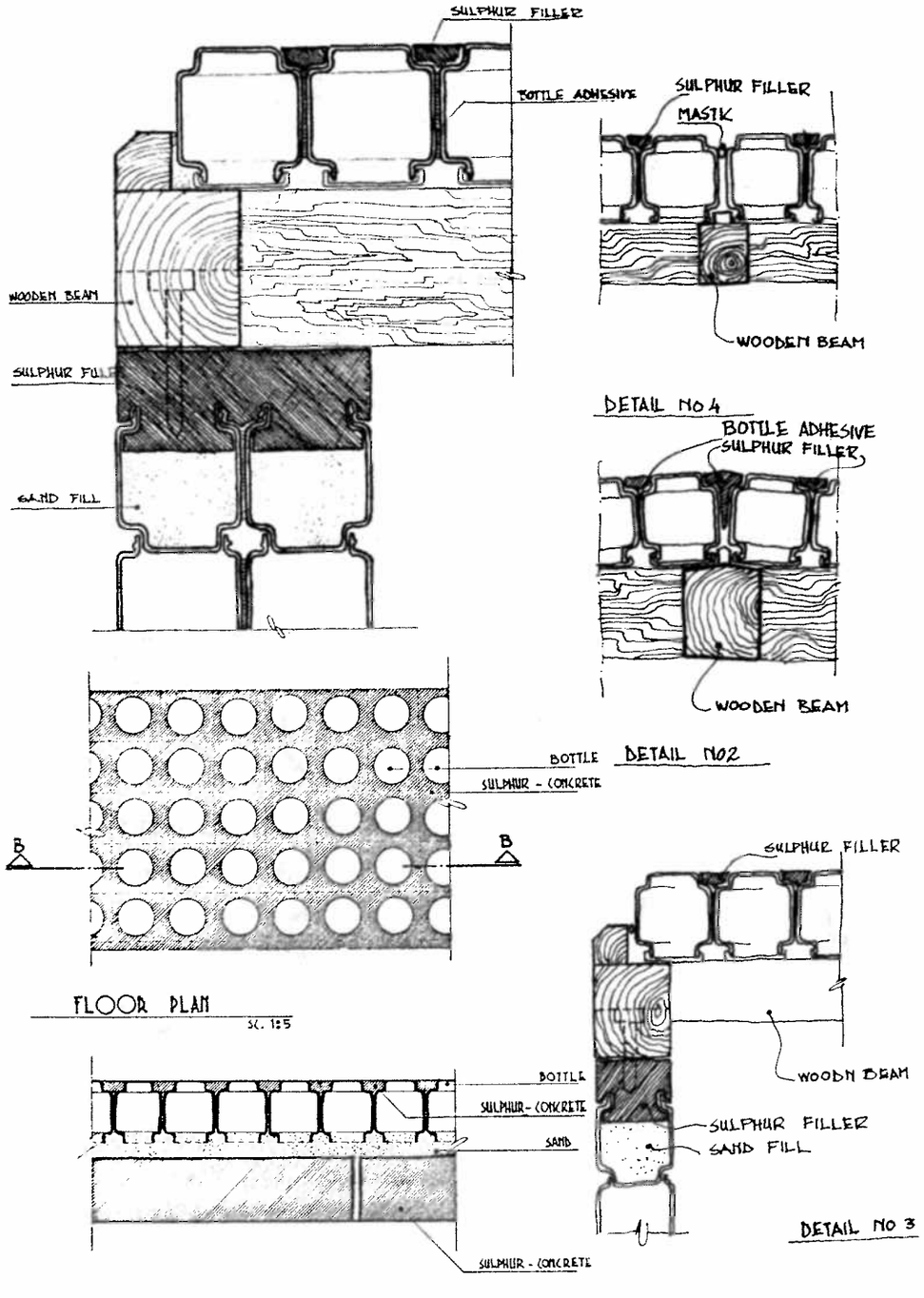
The shape of the Eco-Jar is simple and it is useful for many kinds of products: jams, medicines, pickles, baby foods, etc.

The Eco-Jar can be stacked vertically or horizontally, and joined with various devices: silicone, cement, plastic clips, and pins or bolts.

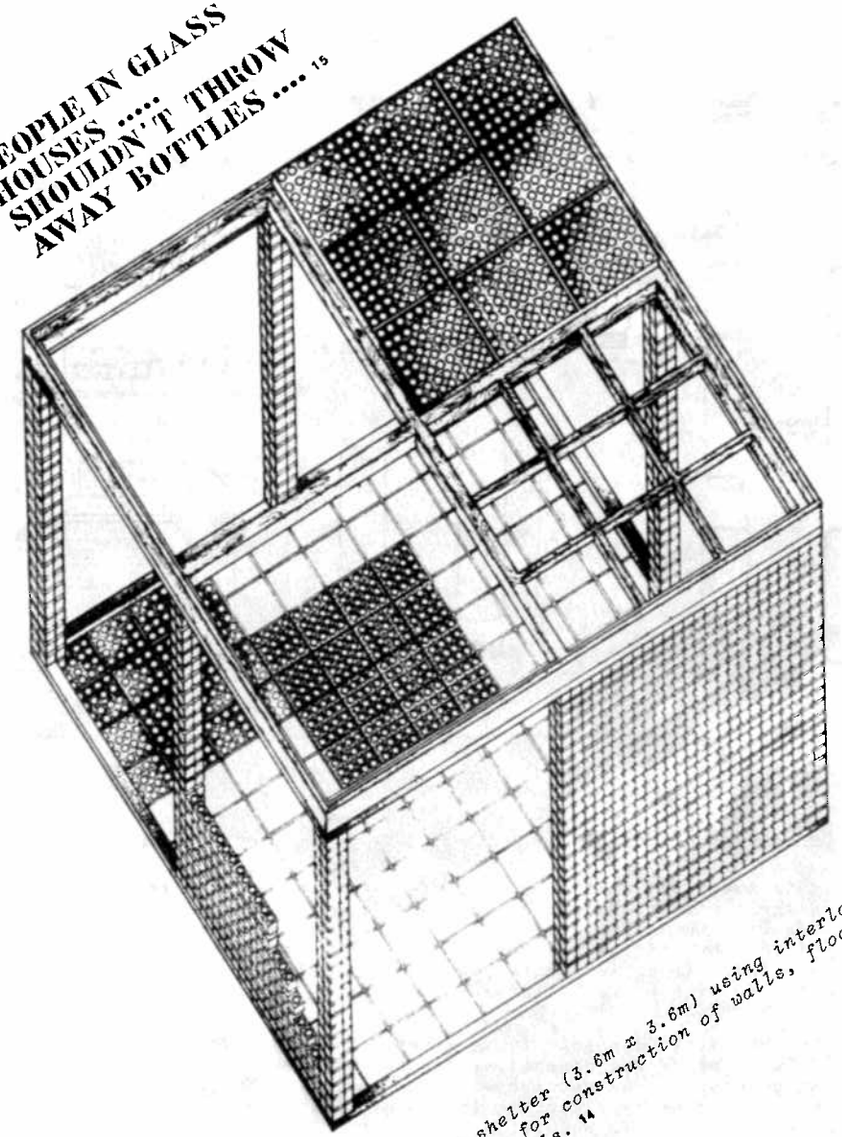
This section deals with designs of a simple shelter (3.6m x. 3.6m) built out of the Eco-Jars. The structure consists basically of six colums built up of glass jars. The voids between these columns are panelled with the same jars. The floor is made out of jars laid on a hard packed sub-surface (sulphur concrete blocks). The roof is flat and has wooden ties, the grid so formed being filled with jar tiles.

The jars are alternatively filled (sand, earth) or left empty to create opaque or transparent walls and roof surfaces.

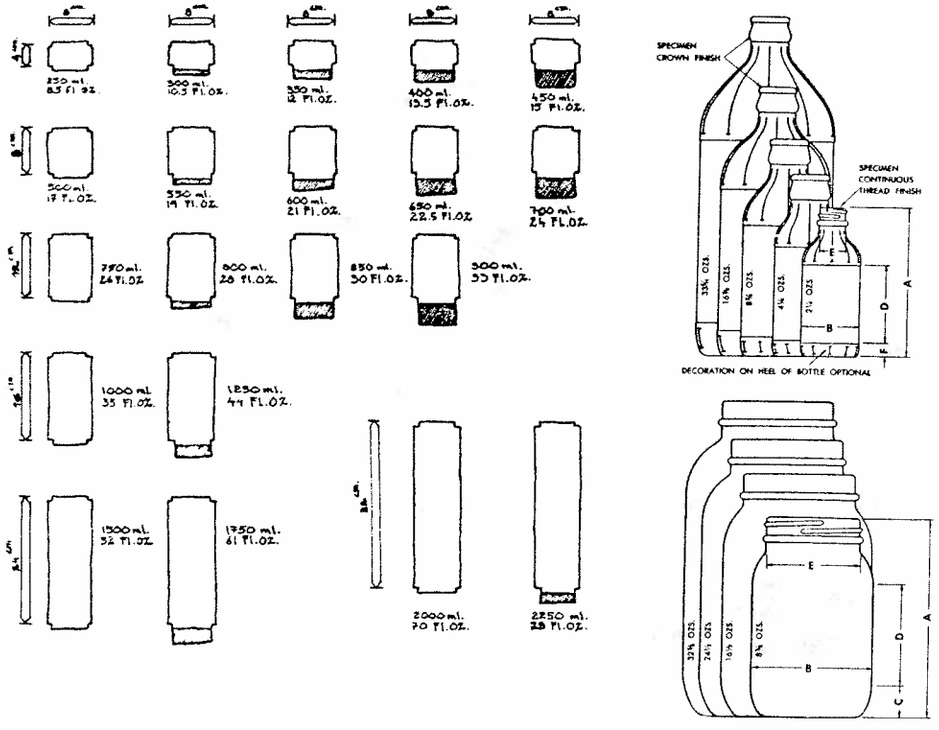




PEOPLE IN GLASS HOUSES .... SHOULDN'T THROW AWAY BOTTLES .... [15]



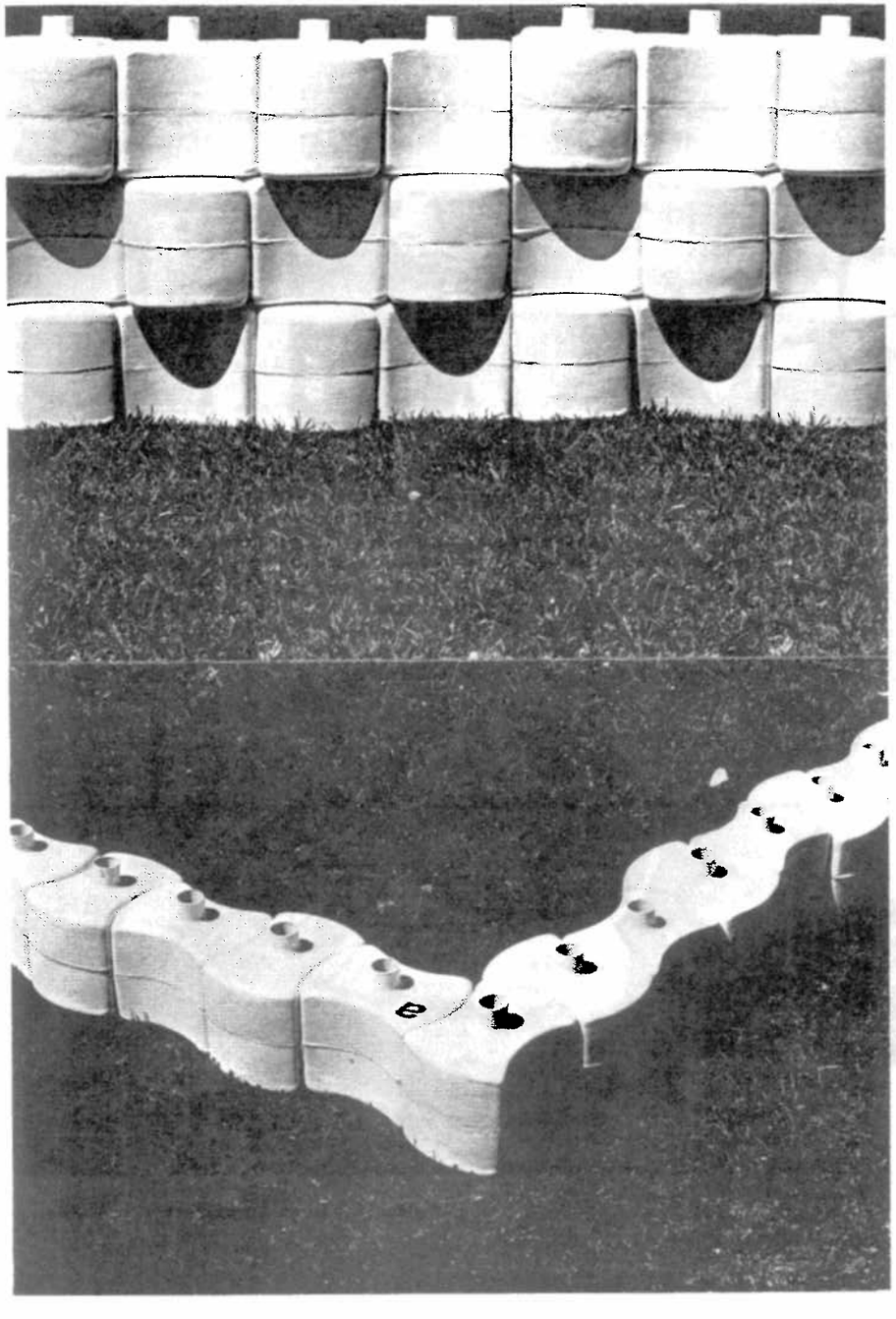
A small shelter (3.6m x 3.6m) using interlocking glass jars for construction of walls, floor and ceiling panels. [14]



MODULAR COORDINATION

It is important that from the outset re-usable containers be designed with the international module of M = 10cm (4") in mind. This will not only allow interchangeability between containers produced by different manufacturers, but also ensure that the container can be integrated, without wasteful fitting and cutting, with other building materials.

The Eco-Jar is designed in a variety of sizes, from 250ml. to 2250ml., which are dimensional on the 10cm module, and which can be used in conjunction with one another. The capacity of the jar varies by extending the interlocking base, without altering the basic module.



5 BILD-A-BOTTLE

Sidewalk plastic repair-shop - Bombay

The use of plastic has increased from 6 billion pounds in 1960 to 20 billion pounds in 1970 with a projection of more than 50 billion pounds by 1980 (in the U.S.).

Not all this material, however, goes immediately into the waste stream.

Plastics are strong, durable, light, easy to fabricate, inexpensive and are available in approximately forty families with a broad range of performance characteristics. New plastics have been developed to suit new uses and, with this versatility, it is fairly certain that the industry will continue to grow.

All plastics are either thermoplastic or thermosetting. Thermosetting plastics are set into permanent shape by the application of heat and pressure and cannot be re-shaped by re-heating. Thermoplastics become soft when exposed to heat and hard when cooled.

Since World War II, plastics have replaced -to varying degrees- wood, leather, glass, metal, fibers and ceramics in many of their traditional markets. For example, in 1971, 23% of plastics was used as packaging; 17% in building and construction; and 6% in transportation (each car manufactured in 1971 contained about 140 pounds of plastic and the manufacturers expect to use 400 pounds by 1980). (9)

In 1970, an estimated 3.9 million tons of plastic entered the solid waste stream.

Until recently, few efforts had been made to separate and salvage plastic after purchase by the consumer. Not long ago, in San Diego, a dairy using polyethylene milk bottles sponsored a special program whereby the bottles could be returned to the dairy to be ground and sold to a manufacturer of drainage tiles.

In 1972 in Wellsely, Mass., an organization called "Action for Ecology" located a nearby manufacturing firm which was willing to experiment with, and is now marketing, waste plastic as a binder for finely ground glass and metals for use as a core in weight-lifting equipment and patio blocks. The company accepts any plastic item, unseparated by type of polymer, heats it with the glass and metal and molds it to the desired shape. The core is then coated with a smooth, non-recycled plastic. In this instance, gross separation

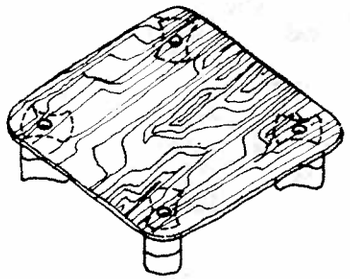
of plastics from glass, metal and paper is done by the householder rather than by mechanical means.

In 1970, 8 million refillable polyethylene containers were used in the United States for about 288 million fillings. This appears insignificant when compared to the 3.9 million pounds (*1*) of packaging plastic that enter the waste stream. The percentage of recycling would be only 1.65%.

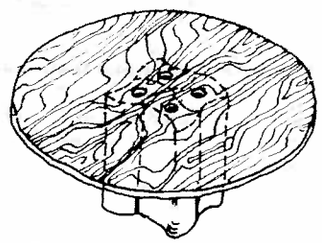
The design shown here was developed for plastic bottles which can have a second life as building components. The shape of the container is such that it interlocks vertically and horizontally. The curved shape of the sides makes laying and stacking of the containers in the horizontal direction very easy. The use of glue as a bond in the horizontal direction has proved effective.

The side curves, R_1 & R_2 (see drawing), were designed in such a way that they give flexibility in making either straight or curved walls. The capacity of this container is 4 litres (1 gallon) but the same principle can be applied to making containers of different sizes.

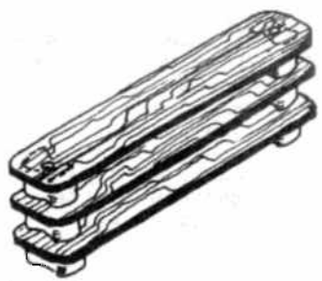
FURNITURE MADE WITH INTERLOCKING PLASTIC BOTTLES



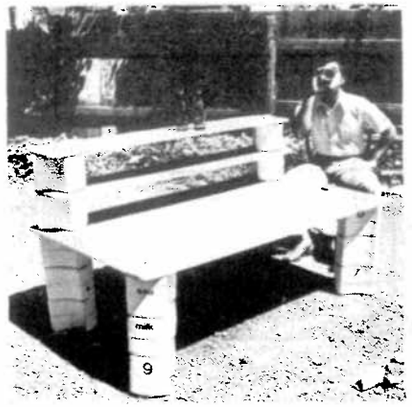
low table



table



shelves



MODEL DEVELOPMENT

Photos *1* to *4* show development of fiberglass mold for blow molding the plastic container.

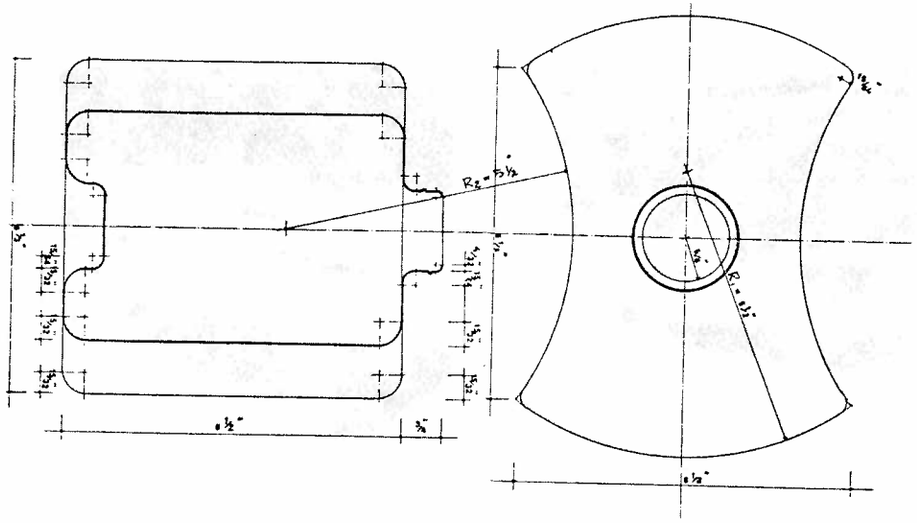
a) Positive wood mold.
b) 2" thick coat of fiberglass given to the mold.
c) Fiberglass mold cut in two halves.
d) Hole drilled in the top half for fixing plastic pipe used for blowing air to make container.
e) Fiberglass mold encased in the wooden frame to assure longer life and easy handling of the mold.

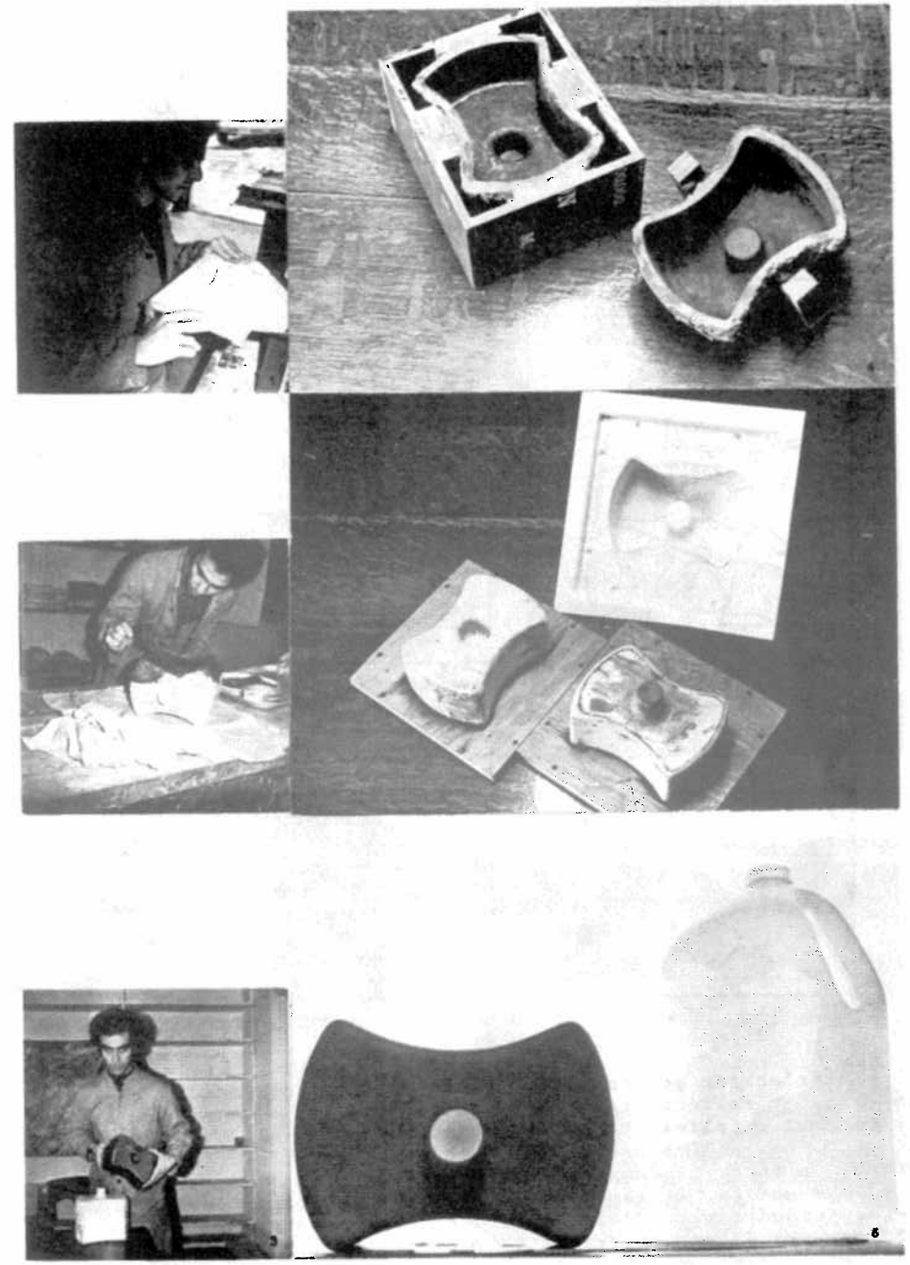
This mold was in fact not used and it was decided to produce a small number of containers using a vacuum forming machine.

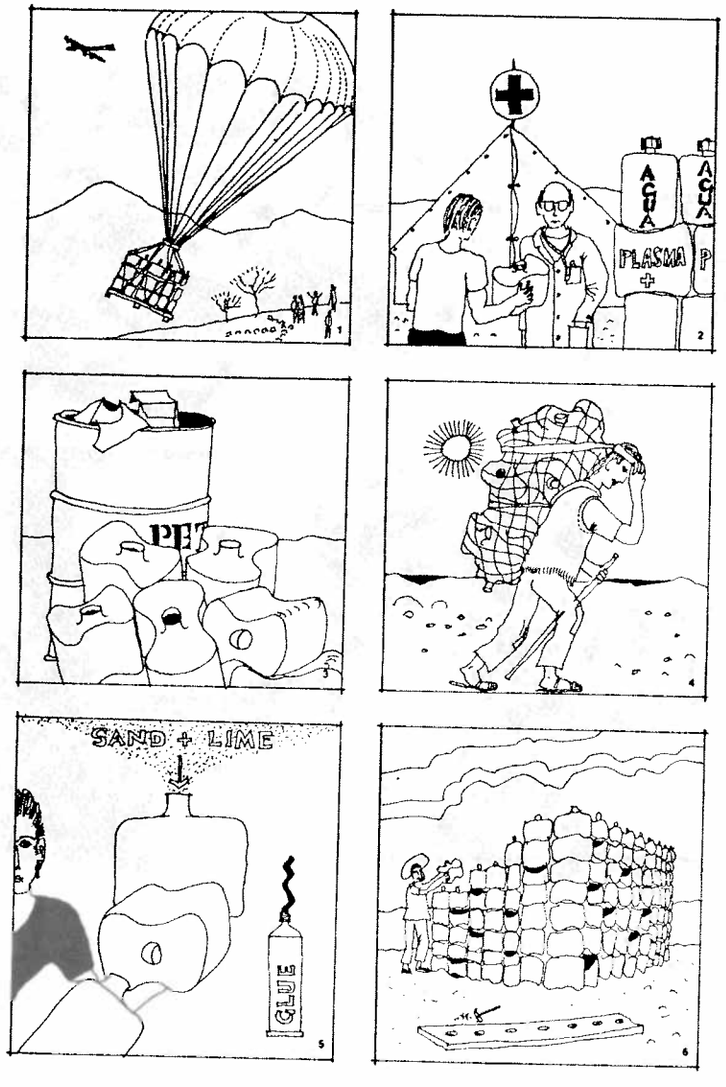
Photo *5* shows the mold for vacuum-forming from which these plastic containers were made in the Plastic Workshop of l'Ecole d'Architecture, Université de Montréal. The wooden mold had to be cut in half and fitted onto a base. After heating, the polystyrene sheet is placed on the mold; as shown, there is an extra part of the plastic around the container edge which then has to be trimmed to size, and the two pieces glued to each other.

This system was used for reasons of economy and time, otherwise, for this shape of bottle, blow-molding would normally be used for mass production.

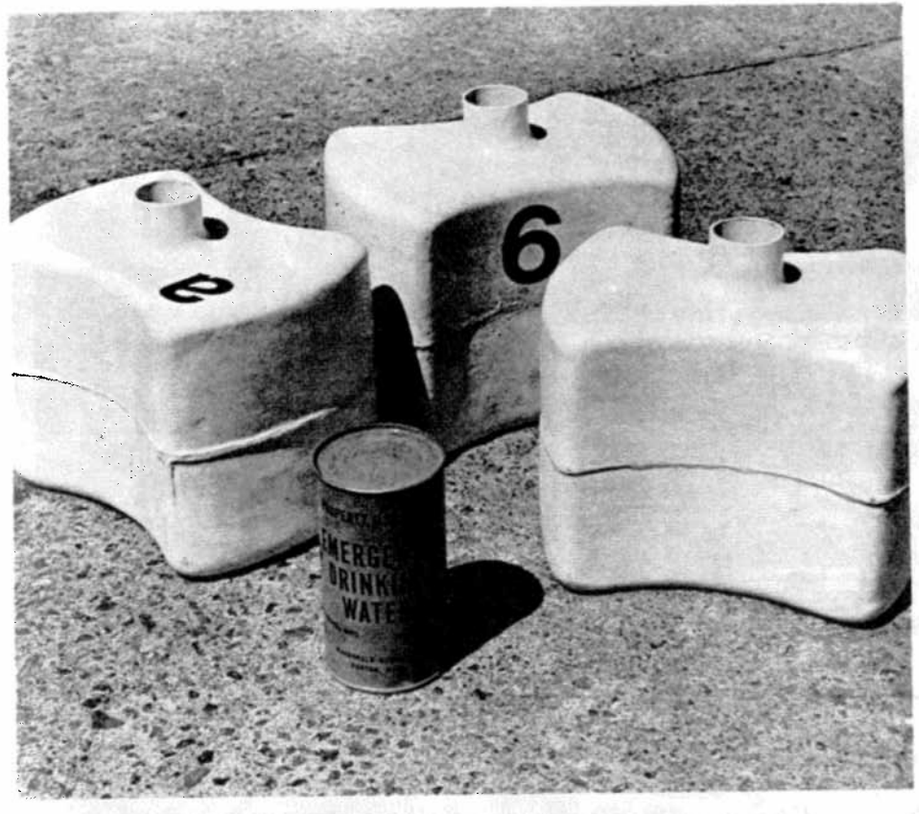
Photo *6* shows the new design with an existing plastic container of comparable capacity.

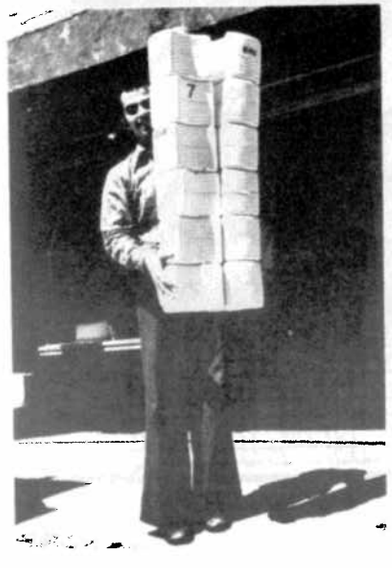


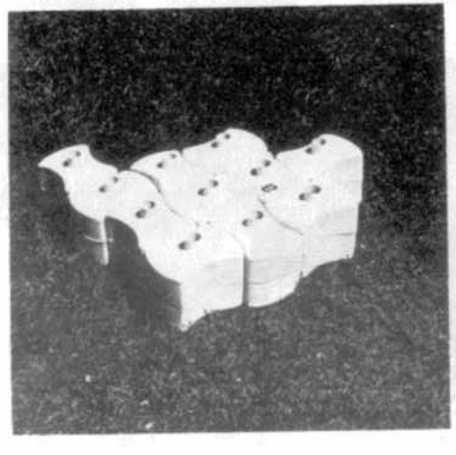




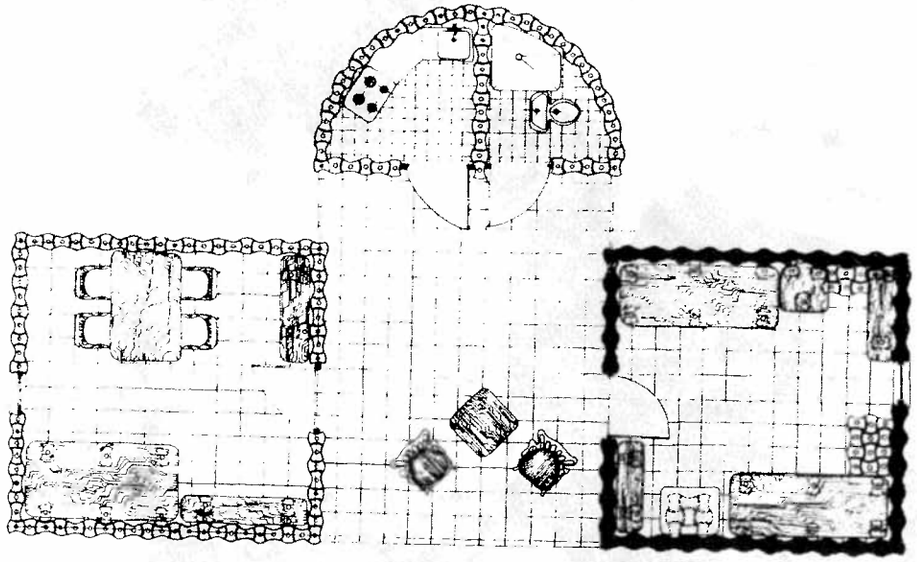
The interlocking gallon bottle could play an important role in disaster relief; starting its life as a container for water or medical supplies, it can be reincarnated as a building block. The bottles are filled with a wet sand/lime mixture which, in about six months, will harden to a rock-like block. In the meantime, it can immediately be used for building, being joined together with adhesive. The transportation of medicaments (first priority) thus expedites the provision of shelter (second priority).



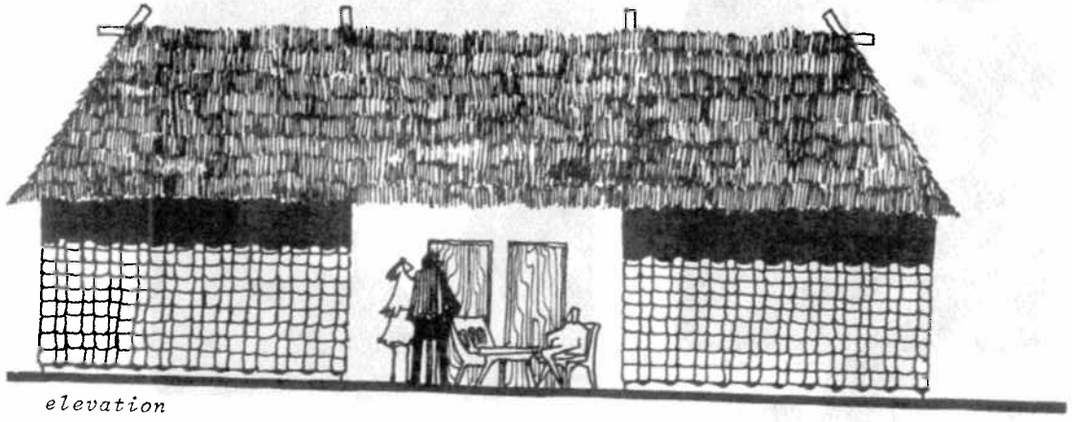




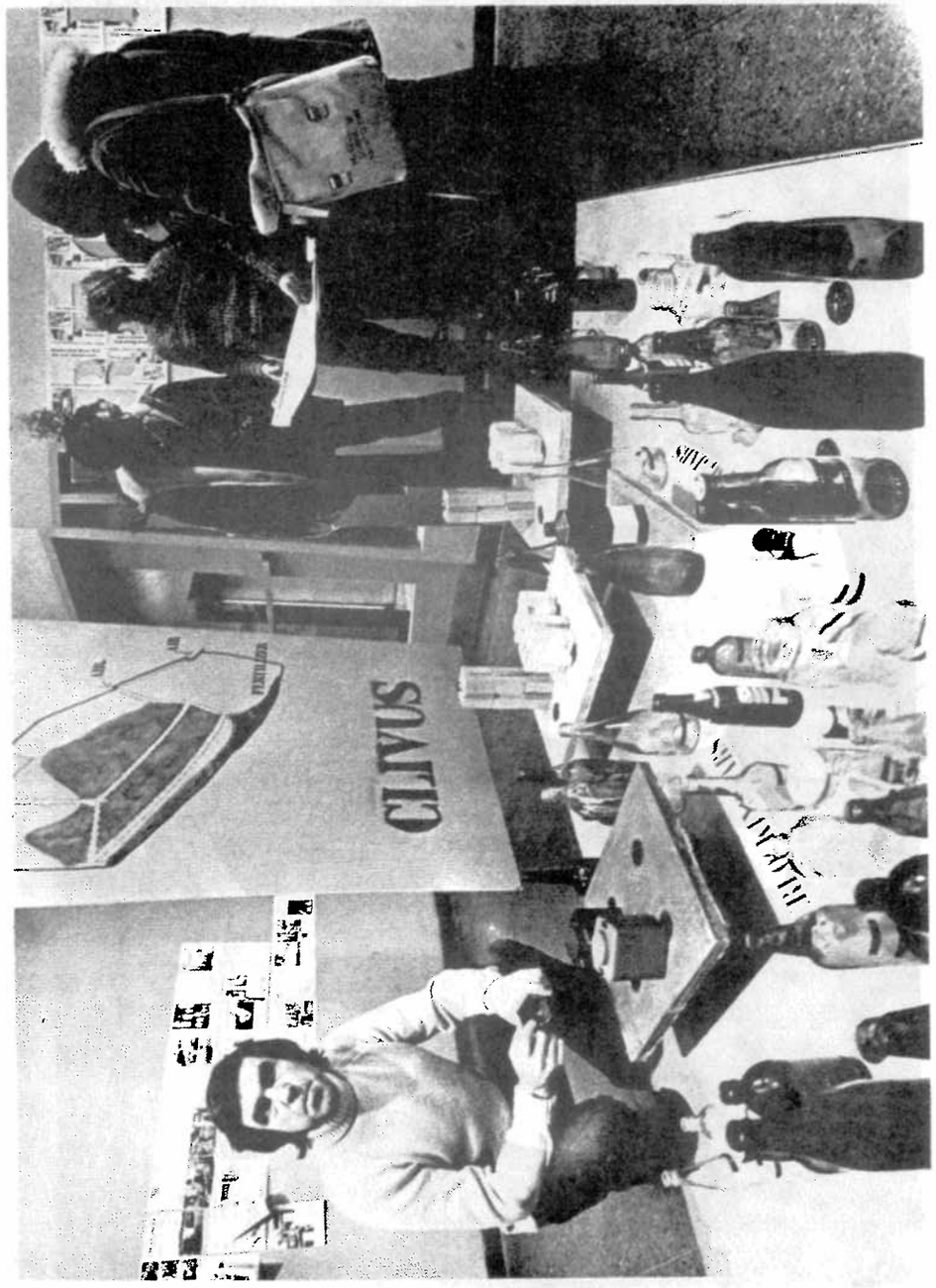
The combination of consumer garbage (plastic gallon bottles) with traditional building materials (palm thatching) illustrate the flexibility of a pragmatic anti-systems approach to housing.



plan



elevation



"RECOVER, RECYCLE, REUSE" Minimum Cost Housing Group exposition at School of Architecture, McGill University, Nov.15 - Dec.1,1973.

In addition to the designs already mentioned, during the last year we developed various other alternatives, both in glass and plastic, for interlocking containers. These include jars, soft-drink bottles, jugs and even a re-usable glass, which have been assessed from the point of view of manufacturing techniques, stacking and interlocking capability, and their function as containers.

LEGEND

1 A vertically interlocking glass jar which is connected in horizontal side with mastic or epoxy.

2. The jars interlock when stacked vertically. A plastic insert or cement compound is used in the double female joint.

3 An exagonal bottle of the simplest design to permit horizontal stacking. This proposal is for soft-drink and beer bottles.

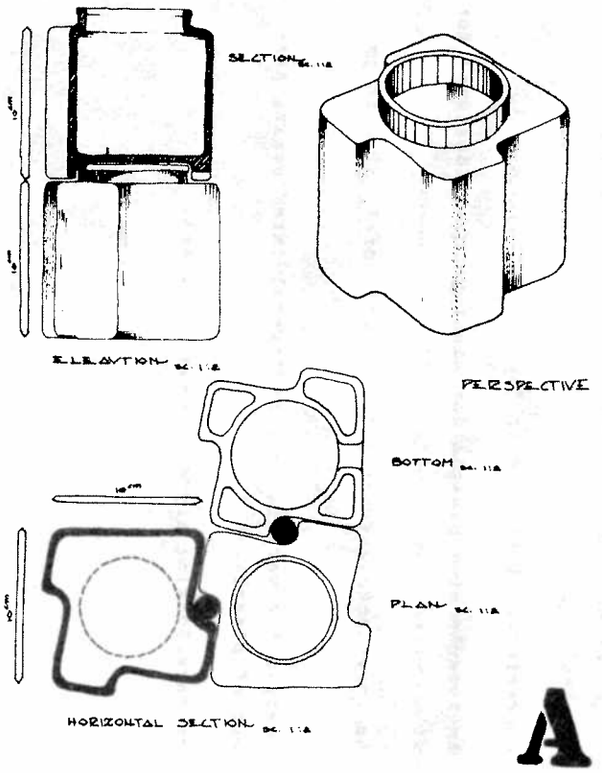
4 A vertically interlocking jar.

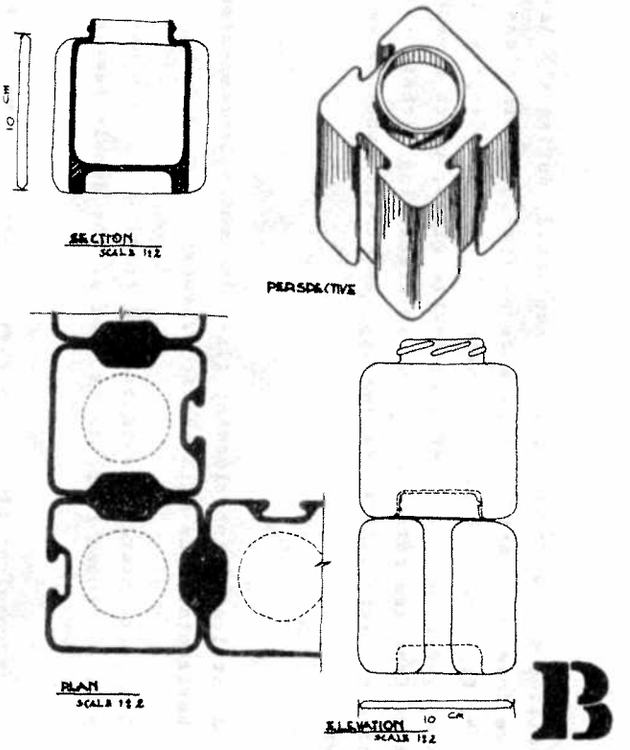
5 An interlocking plastic container which is designed for milk, water, blood, antifreeze, etc.

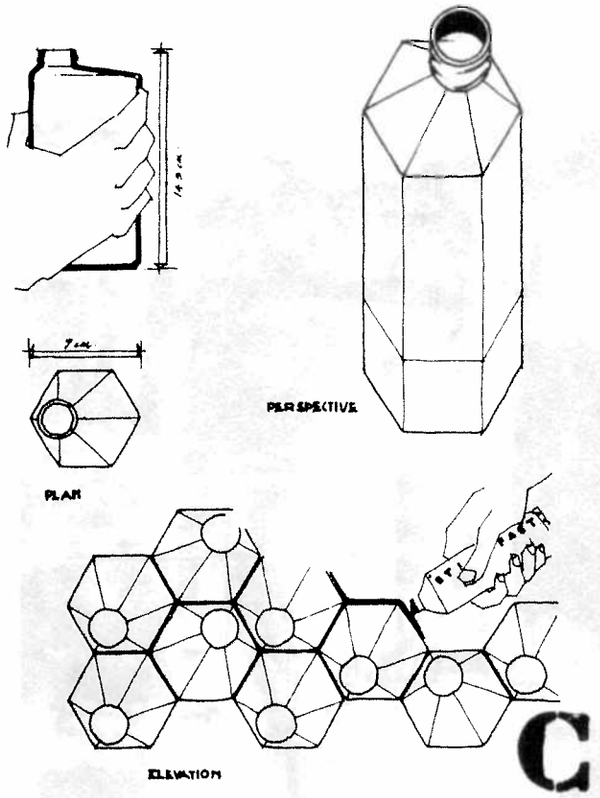
6 An interlocking (vertical and horizontal) plastic jar.

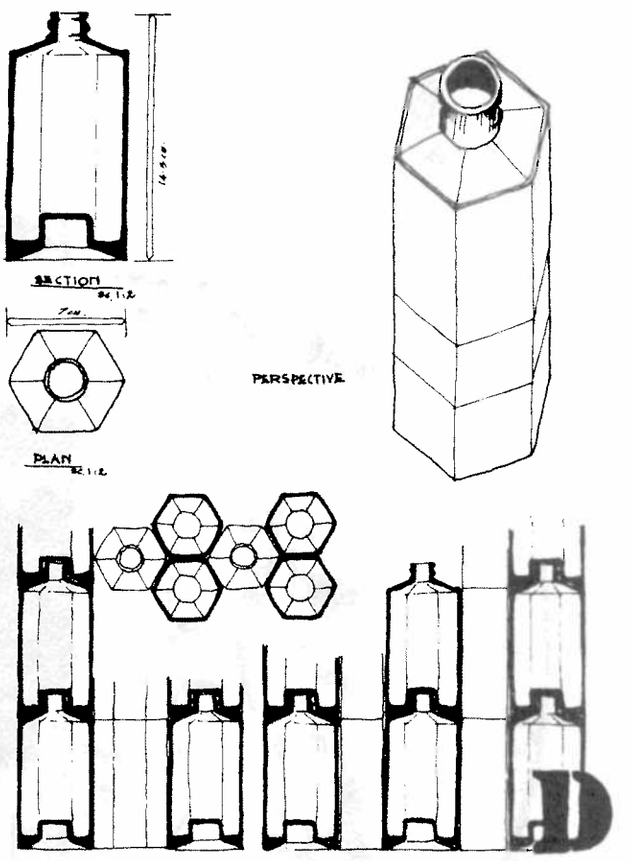
7 Designs for vertical and horizontal interlocking jars out of plastic.

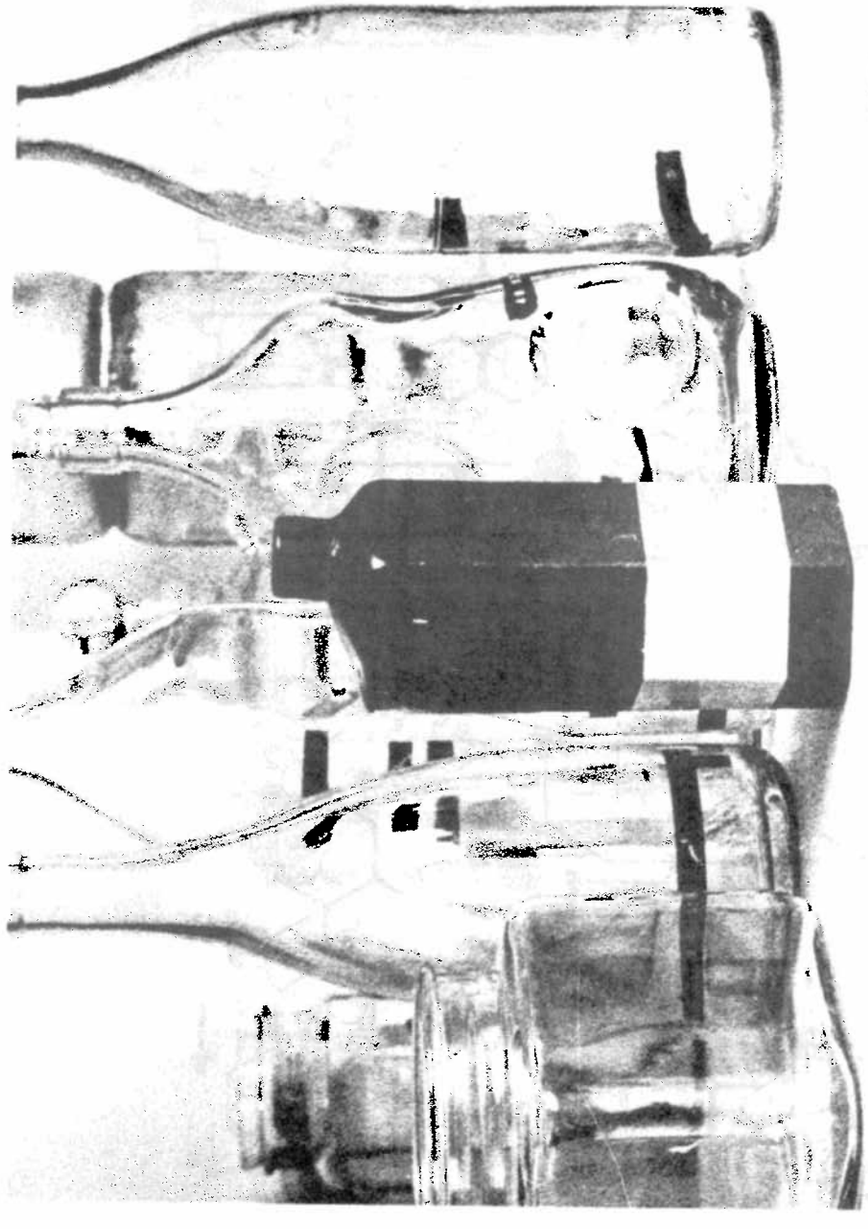
8 An interlocking styrene re-usable glass.


SECTION
ELEVATION
PERSPECTIVE
BOTTOM
PLAN
HORIZONTAL SECTION
A

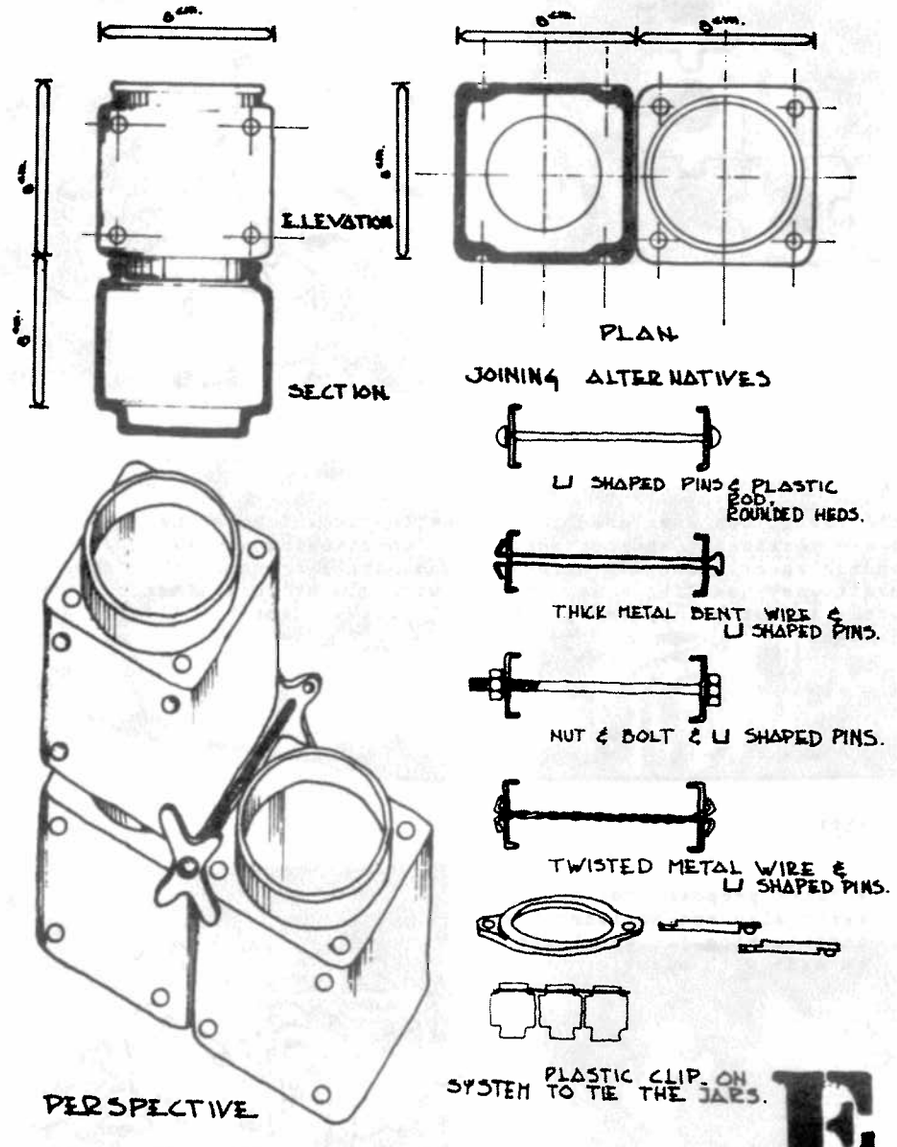

10 CM
SECTION
SCALE 1:2
PERSPECTIVE
PLAN
SCALE 1:2
ELEVATION
SCALE 1:2
10 CM
B


PERSPECTIVE
PLAN
ELEVATION
C

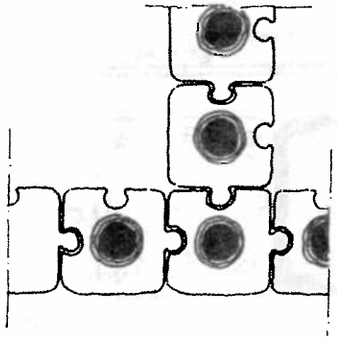

SECTION
PERSPECTIVE
PLAN
D

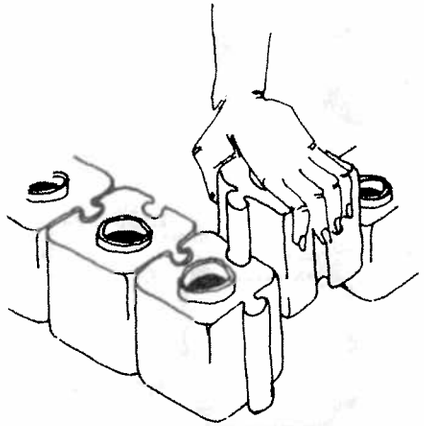


C


ELEVATION
SECTION
PLAN
JOINING ALTERNATIVES
U SHAPED PINS & PLASTIC ROD, ROUNDED HEDS.
THICK METAL BENT WIRE & U SHAPED PINS.
NUT & BOLT & U SHAPED PINS.
TWISTED METAL WIRE & U SHAPED PINS.
PLASTIC CLIP ON SYSTEM TO TIE THE JARS.
PERSPECTIVE

E





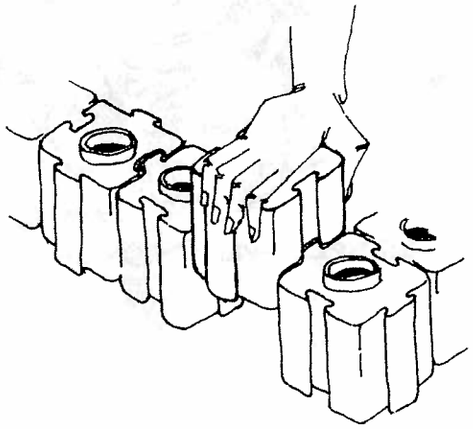
* TYPE F

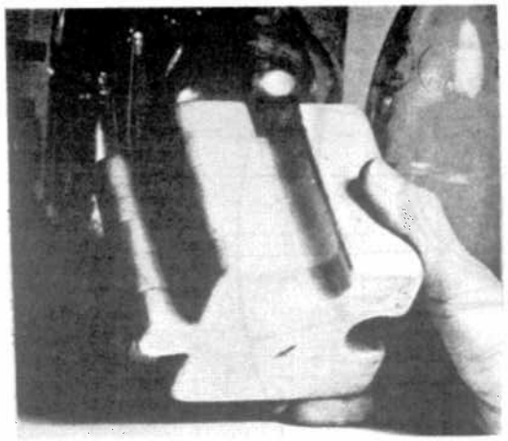
perspective

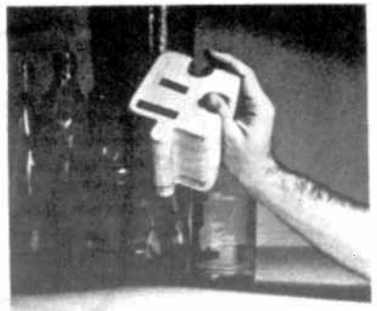
This design was developed for a plastic jar which can be interlocked vertically and horizontally without using any extra bonding agent. The dimentions of the bottle are such that they permit easy handling. As compared with glass, this plastic bottle is not transparent, but still allows light to filter through.

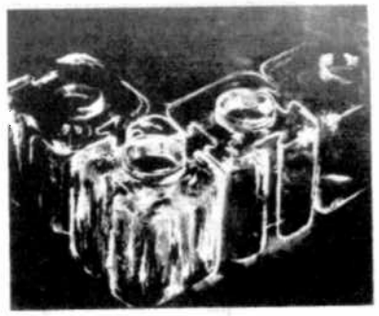
* TYPE G

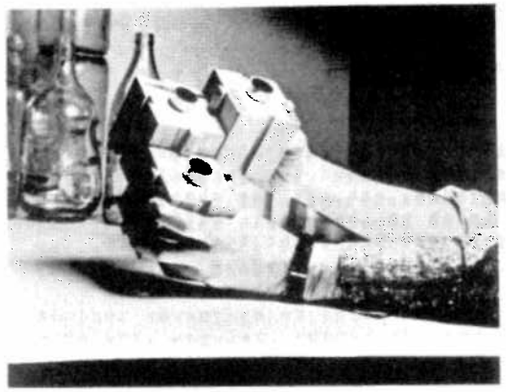
A later proposal for a vertically and horizontally interlocking jar which can be made with plastic.

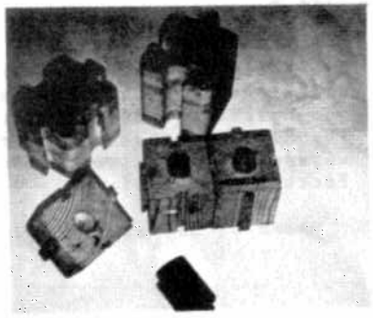


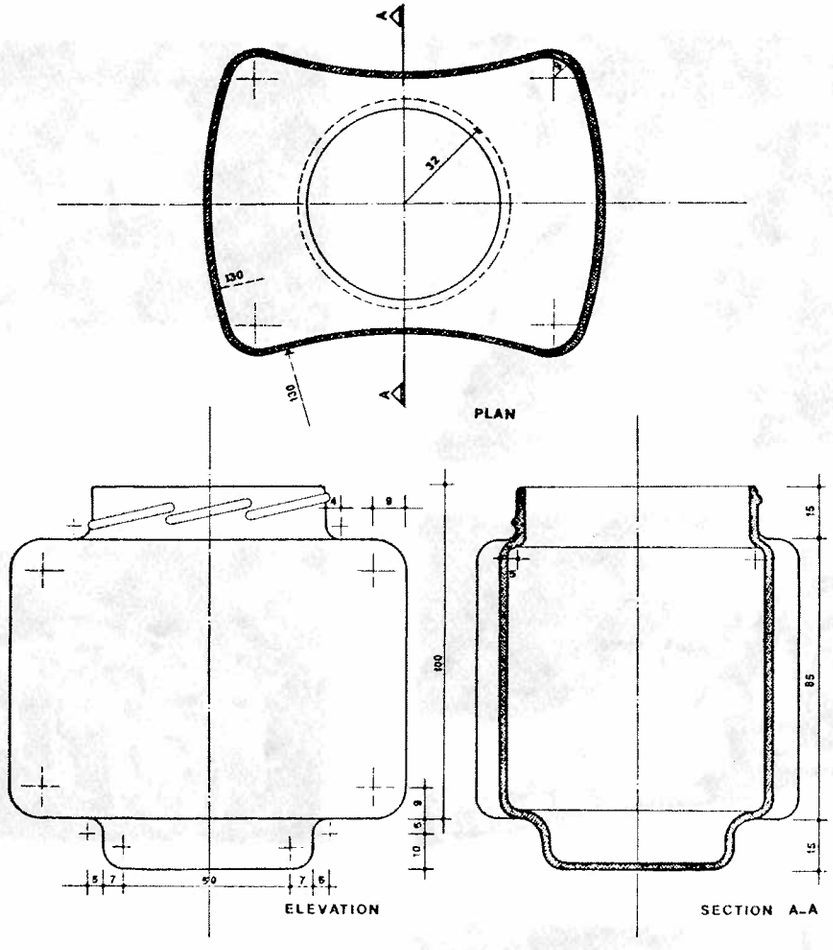






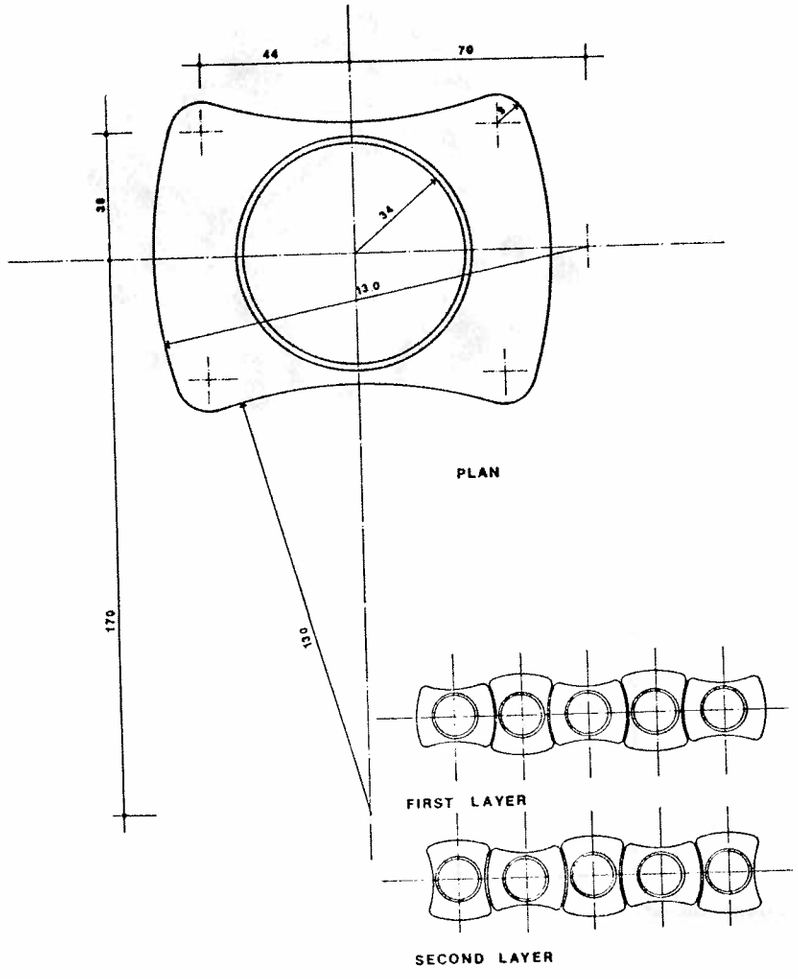






*TYPE H

The design of this jar was developed on the same lines as the plastic container. The small jar can be used for packaging jam, pickles, peanut-butter, baby food, etc... The shape of the sides gives an interesting finish to the wall. Different ways of laying gives different textures and light & shade effects to the wall.

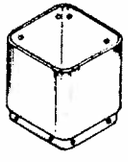


If filled with coloured water or sand before construction, the bottle can add a very nice character to the wall. The shape of the bottle facilitates construction. The vertical and horizontal joints are discontinuous as in any brick or concrete block wall. Staggering of the joint plus vertical interlocking gives considerable stability to the wall.

Another advantage of this bottle is that it is possible to make straight, angular, curved or wavy walls.

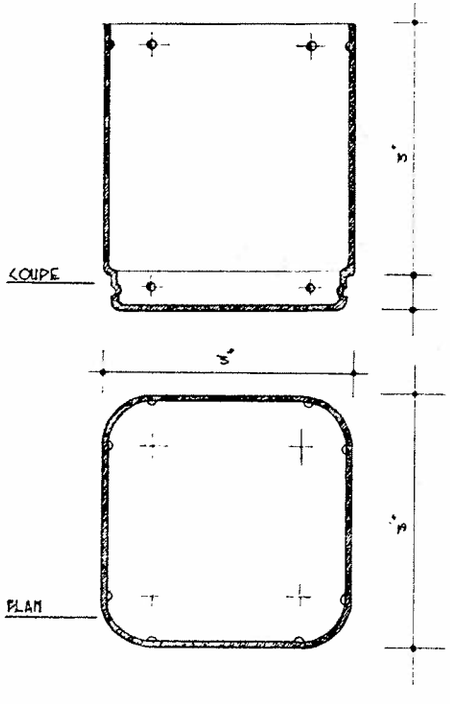
utilitasse®

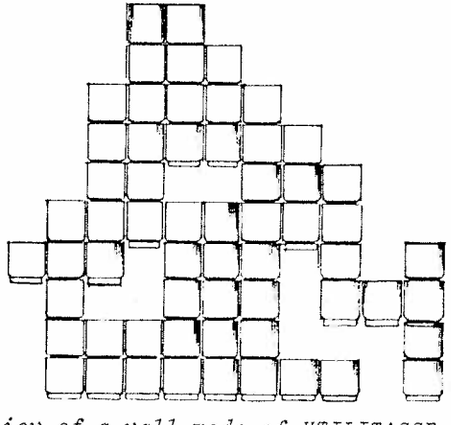
GRAND VERRE
(BIERE, LAIT)



PETIT VERRE
(CAFE, THE)

* Utilitasse was designed for the Atelier de Recherches sur l'Homme et son Environnement of the International Youth Festival to be held in Québec City in August 1974. Fifty thousand glasses were to be used during the Festival. The plastic glasses could find second use as furniture, screens, toys, etc. A large soft-drink manufacturer withdrew his support at the last moment.





view of a wall made of UTILITASSE cups

Conclusion

Implementation of consumer waste utilization in housing can only be achieved by observing the following salient points:

a) That the process of development as presently understood involves development in the consumer sector as well as infrastructural development,

b) that the consumer sector competes with the infrastructural sector for the same materials,

c) therefore, if the raw materials, absorbed by the growing consumer sector could, in part or whole, be made available for construction purposes, by way of product redesign for secondary use, increasing advantages in economic and material terms would accrue.

d) This process requires government initiatives by way of tax concessions or other inducements to encourage the development of secondary use containers and packaging for specific markets.

e) Research into building with such materials is urgently required.

f) Small-scale pilot projects would resolve questions pertaining to collection, storage, jointing and assembly and integration with conventional building techniques.

References

1. BINGHAM, T.H. & MULLIGAN, P.F. The Beverage Container Problem, U.S.E.P.A., 1972 Washington.
2. BOON, J. The Ecol Operation, Architectural Design, Vol.43, December 1973, London.
3. FITZGERALD, F. Fire in the Lake, New York, 1972.
4. FONDA, J. Viet-Nam Journal, Rolling Stone, No.164, July 1974, San Francisco.
5. GLASS CONTAINER COUNCIL OF CANADA, Glass Containers and the Environment, 1971, Toronto.
6. GLASS CONTAINER MANUFACTURING INSTITUTE, The Story of Glass Containers, Washington.
7. NATIONAL CENTER FOR RESOURCE RECOVERY, Garbage Fact Sheet, Mar.1973, Washington.
8. NATIONAL CENTER FOR RESOURCE RECOVERY, Litter Fact Sheet, Mar.1973, Washington.
9. NATIONAL CENTER FOR RESOURCE RECOVERY, Resource Recovery Fact Sheet, Mar.1973, Washington.
10. PAPANEK, V. Design for the Real World, 1972, New York.
11. PAWLEY, M. Garbage Housing, Architectural Design, Vol.41, Feb.1971, London.
12. PAWLEY, M. Garbage Housing, Architectural Design, Vol.43, Dec.1973, London.
13. PAWLEY, M. Michael Reynold's Beer Can House, Architectural Design, Vol.43, Mar.1975 London.
14. RYBCZYNSKI, W. et al. Eco-Jar, Canadian Interiors, Vol.11, June 1974, Toronto.
15. RYBCZYNSKI, W. People in Glass Houses...Shouldn't Throw Away Bottles, On Site, No.5 & 6, 1974, New York.
16. WALDRON, M. For a Beer-Can House, the Designer Learned Every Litter Bit Helps, New York Times, April 20, 1974.

Publications

* THE ECOL OPERATION = Ecology + Building + Common Sense

Describes the experience of developing and building a habitable low-cost house which incorporates asbestos super-tiles of sewer pipes, sulphur lock-blocks, modular logs, roof-top solar stills and a re-cycling toilet. Also includes excerpts from "The Problem Is".

Revised edition 128 pps, 1975 PRICE: Cdn $5.00 (postpaid)

* L'OPERATION ECOL = Ecologie + Construction + Bon Sens

"The Ecol Operation" *traduit au Français et inclu quelques chapitres de* "The Problem Is".

128 pages, 1974 PRIX: Can $5.00 (frais inclus)

* STOP THE FIVE GALLON FLUSH! - A Survey of Alternative Waste Disposal Systems

A classification and description of sanitation methods and a catalog of 66 systems. New chapter on composting.

82 pps, Revised edition April 1976 PRICE: Cdn $4.00 (postpaid)

* PATENT SURVEY 1859 - 1974 - *The use of elemental sulphur in building; abstracts of 86 patents*

29 pps, April 1975 PRICE: Cdn $3.00 (postpaid)

* ROOFTOP WASTELANDS - *A description of a two year project in community rooftop gardening, includes sections on organics, solar cold frames and container gardening.*

32 pps, November 1976 PRICE: Cdn $2.00 (postpaid)

PLEASE SEND PAYMENT WITH ORDER AS WE ARE NOT EQUIPPED TO INVOICE. THANK YOU.

USE IT AGAIN, SAM

first edition May 1975
revised edition July, 1977.

Published by : The Minimum Cost Housing Group,
School of Architecture
McGill University
3480 University St.
Montréal, Québec H3A 2A7
Canada

Price : Cdn. $ 3.00 postpaid (or equivalent in other currencies)

Editor : Witold Rybczynski

Container Designs : Behrooz Nournia

Layout : Vikram Bhatt & Bernard Lefebvre

Cover Graphics : Garo Kevorkian

Photographer : Randy Saharuni

Manuscript : Shirley Hallam

Photo credits : cover, 16, 24, 27, 28, 29, 36, 42, 44, 47, 57 - Randy Saharuni; 19, 20 - Martin Pawley; 18 - Perspectives Dimanche; 21 - Colin Munro; 46 - McGill Reporter; all other photos MCHG.

The Minimum Cost Housing Group, from left to right : Vikram Bhatt, Witold Rybczynski, Bernard Lefebvre, Behrooz Nournia, Makram Hanna, Wajid Ali and Alvaro Ortega. (June 1974)