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MODERN UPHOLSTERY MATERIALS AND EQUIPMENT*

by

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Contents

Introduction

Despite the many innovations and technical changes which have taken place in upholstery production, the industry is still heavily dependant on traditional and largely manual skills. The changes therefore are more directly related to the use of new or substitute materials and the mechanisation of certain processes, but the fundamental design characteristics remain unaltered since ergonomic and comfort requirements must always suit the human frame. Thus it has much in common with the clothing and garment industry, which is highly developed, and many of the advances which have taken place in the latter are now being applied with advantage in upholstery production.

This is an important consideration especially from the point of view of the establishment of upholstery enterprises in developing countries. Despite the existence of a growing demand, many are discouraged from doing so because of the apparent lack of appropriate manual skills and technical know-how. If, however, it is recognised that there is already in existence a source for these skills, namely the local tailoring trade, which uses the same basic techniques, then the problems attached to establishing such an industry are not as formidable as they might once have appeared. Furthermore it remains highly labour intensive, can have a good profit ratio, and by comparison with the other two sectors of the furniture industry, case good and solid wood production, requires a modest capital investment to be viable.

Efficient modern upholstery production is then a combination of the skills of the sewing machine operator and cover upholsterer allied to the use of many ready-made materials which have both simplified

and speeded up the work. This is best illustrated by the changed ratio between sewing and covering processes. Traditionally there was one sewing machine operator to every three or four cover upholsterers. This has been reduced to that of a one for one basis, and reflects the great emphasis which is now placed on special cutting and sewing procedures. Indeed, most individual models rely on these procedures and especially sewing, for their special design characteristics. As a result, the industry may now be fairly described as a largely component industry, where single enterprises may choose between "buying in" components such as frames, cushions, springs or making them up themselves. If the latter is decided upon then the factory is made up of a series of sub-activities concerned with cover-cutting and sewing, springing systems, cushioning and upholstery covering, which may and indeed should be carried out independantly of one another and which, from the point of view of productivity, must always be a highly desirable objective.

Specialized exhibitions provide both existing and prospective upholstery producers with a unique opportunity to obtain up-to-date information on technological and managerial trends and developments in this industry. It covers every conceivable need and can provide answers to most of the problems faced in production. The object of this paper is to assist in identifying those problems as well as the aspects of greatest technological change and to give guidance on how they may be adopted and how these exhibitions can assist towards this end.

1. Materials

1.1 Frames:

Attention has been drawn in the previous paragraphs to the extent to which upholstery production has become a component industry where most items are processed outside the enterprise. This applies as much to frames as to any other component and there is no particular reason why a factory should produce its own if they can be made efficiently and competitively elsewhere. Hardwoods, especially beech, continue to be the major raw material input for upholstery frames, but its escalating cost plus the results of research into substitute materials (such as softwoods) and better methods of construction, provide scope for more efficient and economic usage. There is also a marked increase in the use of panel materials for upholstery frames and while this has required a major departure from traditional upholstery design, it has resulted in a higher degree of standardisation of components and vastly increased output.

Frames are also made from plastics either in expanded polystyrene or rigid polyurethane especially for complicated shapes. There are many standard designs on offer and suppliers will also produce according to the customer's specification provided there is sufficient volume. The most common frame now in use is a combination of wood and foamed plastic sections, the former being used for straight line parts and the latter for curved and other shaped parts. Other materials include moulded fibreboard, compressed cardboard and metal. **(See Figures No. 1 and 1(a), 2, and 2(a)).**

1.2 Covering Fabrics:

The variety of upholstery fabrics currently available to the manufacturer is almost limitless. There are the traditional wood and cotton fibres, which have proved their usefulness over centuries, rayons, and a multiplicity of synthetic fibres including nylons, polyesters, acrylics, polyolefils, and combinations of any or all of these. There are further variations in colour, shade, pattern and texture, which while adding to the choice available to the consumer, can if not properly controlled, cause serious problems for the unwary upholstery manufacturer.

Fifteen or twenty years ago, it was simply a choice between one uninspiring uncut moquette and another equally uninspriring one, since at that time this material accounted for up to 90% of the fabrics used by the industry, now it almost seems necessary for a manufacturer of any size to have at least one textile technologist on his staff to guide in the selection and use of the current assortment of fabrics. Problems arise in respect of the wearability of the material, it's colour fastness, it's variation in shading and pattern even in the same roll, it's stretch factor, it's resistance to the effects of soiling, it's cleanability, it's propensity or otherwise for seam slippage, it's variation in width from roll to roll and so on. Manufacturers in tropical countries have to face additional hazards like those relating to climate e.g. strong sunlight and heat, humidity and insect attack. We should also remember that the fabric can account for as much as 30% of the total cost of production so that selection of the wrong material can have serious consequences.

It would be impossible on this occasion to deal with all aspects concerning the selection and use of upholstery fabrics, and only the more important ones are emphasised here. Fortunately

such criteria are well established and known in most countries especially through British and other European standards, and are presented as standard specifications to which the manufacturer of the fabric should adhere and the user should insist upon. From the upholstery manufacturer's point of view, he should see that a proper account is kept of the construction, make up and performance of each cloth that he buys, and to provide as much information as possible for the retailer and his customer on the care of such fabrics and particularly how to clean them. No material is perfect and if the user is aware of how it should be cared for properly, then returns and rejects would be reduced dramatically.

1.3 Suspension Systems

Most forms of seating have in the past been built around the coil spring. To be effective it requires an elaborate frame structure, which, although resilient and long lasting, poses many problems for both designer and upholstery manufacturer which are not easily overcome. Probably its greatest disadvantages are the high cost of production its usage entails, and the fact that the resultant structure is often excessively heavy and unwieldly. It is still popular in many parts of the world possible because of the traditional nature of the trade and its reluctance to accept change.

Today there are many suitable alternatives to the coil spring available and while it is not suggested that the use of the latter should be discontinued, it is important that each should be considered according to its merits having regard to design and functional requirements. The most important of

these alternatives are helical springs, serpentine or no-sag springing, resilient webbing, moulded rubber webbing, elastic webbing, fabric and resilient webbing combination, and resilient platforms. By far, the most popular of these are the resilient webbings which are usually obtainable in three grades for seat application, depending on the degree of resiliency and comfort required, and one grade for back application. They may also be used in beds, divans and convertible settees and are available in 38, 51 and 57 m.m. ($1\frac{1}{2}$, 2 and $2\frac{1}{4}$ in. widths). For backs the widths are 19, 25 and 29 m.m. (3/4, 1 and 1 1/8 in.). Resilient webbing may be mounted or fixed in a variety of ways from stapling to special proprietary fittings which are normally supplied with the material.

The latest and probably the most interesting of the various suspension systems is the resilient platform or diaphragm for seats which is suspended from four points. It is manufactured in ethylene propylene elastomer, which has both the resilience and appearance of rubber whilst being considerably superior to natural plantation rubber in other properties. The platform is attached to the frame at the four corners under tension of between 8% and 15% of the unstretched size. The manufacturers claim with justification that it provides furniture designers with the freedom to provide deep comfort with simplicity of line.

Whatever system is decided upon and here marketing and production considerations will play an important part in the final decision, it is important to remember that springs, webbings or platforms should be judged one against the other, according to the criteria of basic design needs, style or appearance, appropriate level of comfort and performance requirements. **(Refer to Figures No. 3, 3(a), 3(b), 3(c)).**

2. Cushioning:

Generally speaking, there are two basic types of cushioning, fixed and loose, and the use of either or both depends on the required design characteristics such as appearance, function and degree of comfort. Fixed cushioning is generally associated with traditional types of upholstery and the filling mainly used were horsehair, cocoanut fibre, rubberised hair, flock and wadding in conjunction with coils springs usually made up into a "spring" unit.

In the late fifties new cushioning materials were introduced, the most notable being latex foam which is made from liquid foam rubber and is an extremely good cushioning material. A further development of this cushion is the high resilience foam with significant improvement in it's load bearing properties and resiliency. Latex foam was followed by flexible urethane foam or polyether, as it is more commonly referred to, and subsequent variations have included moulded flexible urethane foam and moulded high resilient flexible foam (cold cure).

As in the case of upholstery fabrics standard specifications have been drawn up for cushioning materials, especially urethane foams which form the bulk of normal usage in upholstery. It is important for the manufacturer to be aware of these specifications and to use them as a guide in selecting the most appropriate cushioning for particular purposes such as for arms, seats and backs where performance requirements vary considerably. These include tensile strength and elongation, compression set, fatigue and load deflection characteristics. Thin urethane foam is used for padding or softening of the basic frame, but it is important to note that this use is largely negated if it is used to "correct" faults inherent in the structure itself. Cushioning

may be made up satisfactorily from different grades of foam with the aid of a suitable adhesive and this ensures a low wastage factor, particularly for those manufacturers who do their own foam conversion.

The most recent innovation in cushioning is the wholly filled or partly filled polyester fibre cushion. The fibre itself may vary according to the way it is processed i.e. by crimping the fibres in different ways and varying the number of orimps. Fibre filled cushions may be reduced in cost by incorporating a core of polyurethane of latex in the cushions around which the fibre is wrapped. Tests by Furniture Industry Research Association, Great Britain indicate that there is little appreciable difference in use between the two types of oushion if the foam core accounts for no more than 25% of the thickness of the cushion. However, a high filling density should be used for seat cusions and a lower filling density is satisfactory for arms and backs and other applications with a lower load level. (Refer to Figure No. 4)

3. Sewing, buttoning and quilting:

Sewing threads naturally play a vital part in the make up of upholstery covers and again the manufacturer has a wide range from which to choose. There are several types of fibre suitable for upholstery threads of which the most important are cotton, nylon, polyester and combinations of all three. These are known as blended and core spun threads. The make up of the thread is very important because on it depend the strength and quality of the seam as well as its effectiveness in the whole sewing operation. The blended and core spun thread, which consists of several filaments of polyester inside an outer layer

of cotton, has been found suitable for most upholstery cover materials because of it's high tensile strength, good extensibility and good resistance to heat. Monofilament threads are translucent and therefore can be used on different shades and patterns. They have the advantage of reducing the number and variety of threads needed but tend to cause excessive wear of sewing machine parts with which they come in contact. Nevertheless, many manufacturers use this thread satisfactorily.

According to British Standard BS3870, a properly constructed seam should have adequate strength, elasticity, durability, security and good appearance. This is best achieved by using threads which have high tensile strength and loop strength, good loop formation, abrasion resistance, fastness to sunlight, washing, cleaning, etc., flammability, and are suitable for use in tropical countries.

Buttons serve the dual function of keeping filling materials in position and providing additional decoration. They are available in many shapes and sizes, covered and uncovered and may be fixed manually or with the aid of a buttoning machine. Because the incidence of button failure can be quite high and button replacement a difficult problem to solve, it is important to select the right fixing system. There are various types which include pre-tied loops, chain links, straps, tapes and fasteners. The pre-tied loop is used in conjunction with a buttoning machine but may also be fixed manually. It has been found in practice to be the most satisfactory.

4. Technology:

4.1 Cutting and sewing of upholstery material:

We have seen the importance, in the first instance, of the upholstery fabric being supplied according to a required specification. It is therefore necessary to have it inspected on arrival at the factory so that it may be returned immediately to the supplier if not found satisfactory. There can be simple visual inspection, and probably this is sufficient for the small manufacturer. However, if high volume production is involved then a proper inspection table should be installed, the material unrolled and rerolled over it mechanically and it should also incorporate a measuring device.

Storage and materials handling for fabrics should preferably be by means of specially designed trolleys, each carrying six to eight rolls and capable of being moved easily to the cutting table. The latter may be any convenient length having regard to the length of cloth or number of layers of cloth (called lays) to be cut at one session. There should be an overhead cloth spreader, operated mechanically or manually, fixed to the table, and many cutting tables now incorporate conveyorisation so that cutting and sorting may be carried out simultaneously.

Marking out may be done manually or mechanically. The markers can be produced from a master marker by duplicator on disposable paper, but permanent markers made from hardboard or plastic laminate are more satisfactory. The shape is outlined by means of perforations set at close intervals, powdered chalk is dusted on and when the marker is removed from the lay a dotted line for cutting is visible.

The cutting process is usually by means of the reciprocating knife which should incorporate automatic sharpening and lubricating. Many factories also use band knives - which are not unlike bandsaws - to ensure greater accurancy of cut and to negotiate more complex shapes and radiuses. The supply of power to cutting tables should preferably be by means of movable cable suspension which enables handling of the cutting machine without hindrance.

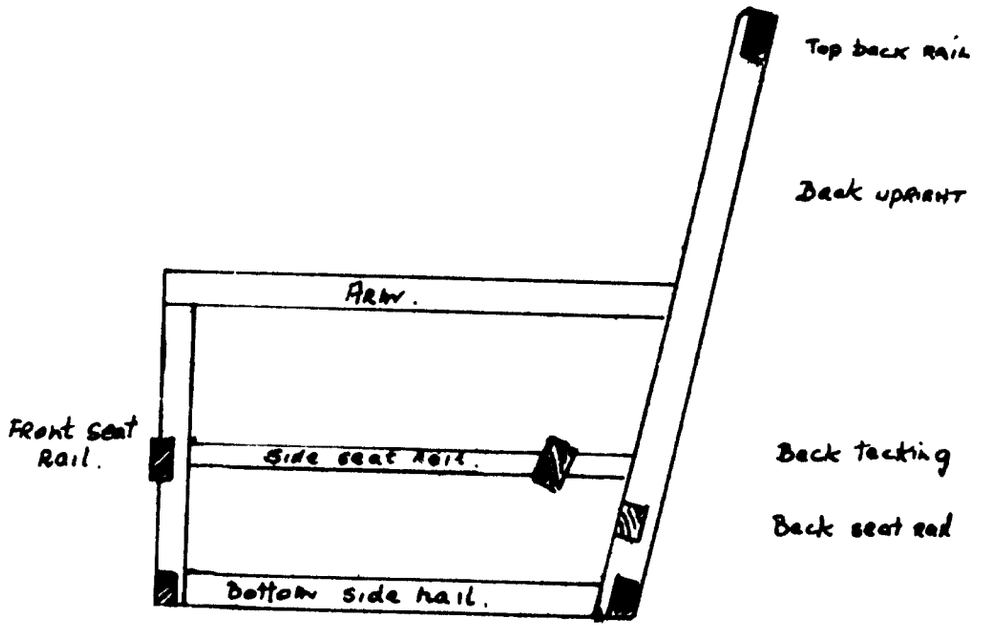
The basic sewing machine unit for the upholstery industry is the general purpose plain sewer or joiner which has a single or double needle lock stitch. It is important that whatever machine is chosen, it should be capable of handling a variety of fabrics of different weights, strengths and textures. Additional refinements should therefore include ready-wound or oversize bobbins to reduce down time, high lift needles and presser feet for various types of fabric including leather vinyl, reverse feed mechanisms for tacking and seam re-inforcements, and the capacity to produce even plies and consistently uniform stitching. Other machine types which are currently used include those for zip-fastening, cushion-boxing, ruffling and quilting in the case of long-arm sewing machines. All machines should have semi-automatic lubrication.

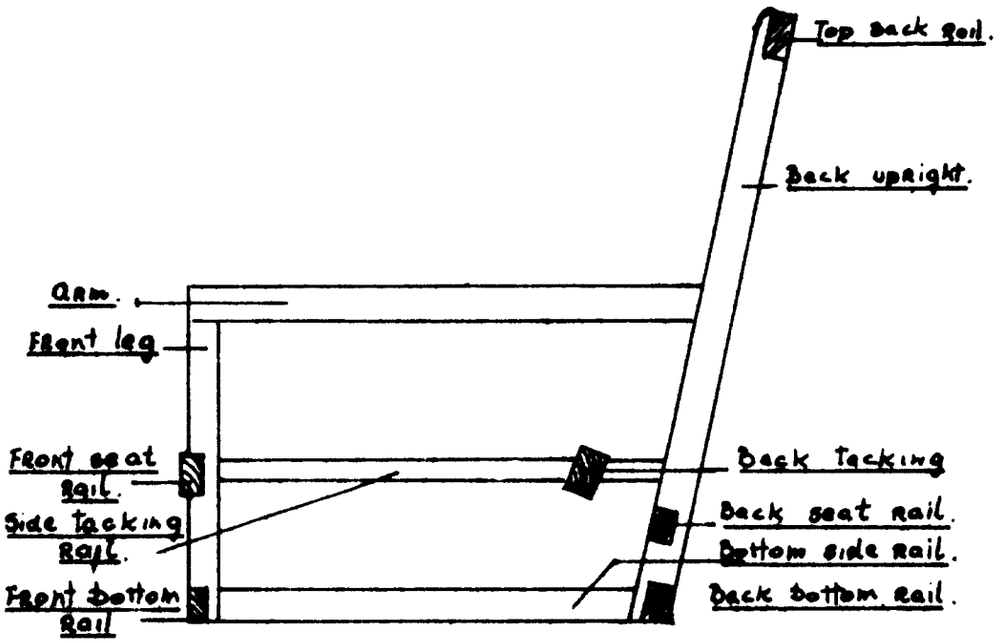
The correct choice of needle for a particular machine and a particular fabric is also very important. Generally, manufacturers should be guided in this by the suppliers of machines, needles and threads. They will also need to experiment with different types of needles on different fabrics bearing in mind the need to avoid as far as possible needle-breakdown caused by over-heating, distortion and breakage.

4.2 Upholstery Assembly:

The work concerned with upholstery assembly i.e. the fixing of the sewn cover to the frame, is, even in the most advanced enterprises, still done manually. It is important therefore to reduce the manual handling as much as possible, and this, as we have seen, begins with the basic design of the model so that when the components and elements reach the assember, they may be fitted together with a minimum of delay. The most important of these is the maximization of the sewing function so that the cover may be pulled on to the frame rather like a hand fitting into a glove.

While there is still no substitute for the conventional upholsterer's work bench, there are many work aids available which can reduce considerably the handling time and improve worker performance. **These include work holders, operated pneu-** matically and enabling the operator to have full use of both hands, loose seat presses, deep upholstery seat and back presses, final assembly presses, automatic buttoning machines, quilting machines and cushion filling and closing machines.





Seational side elevation of frame

Figure No. 1 - Wood frames

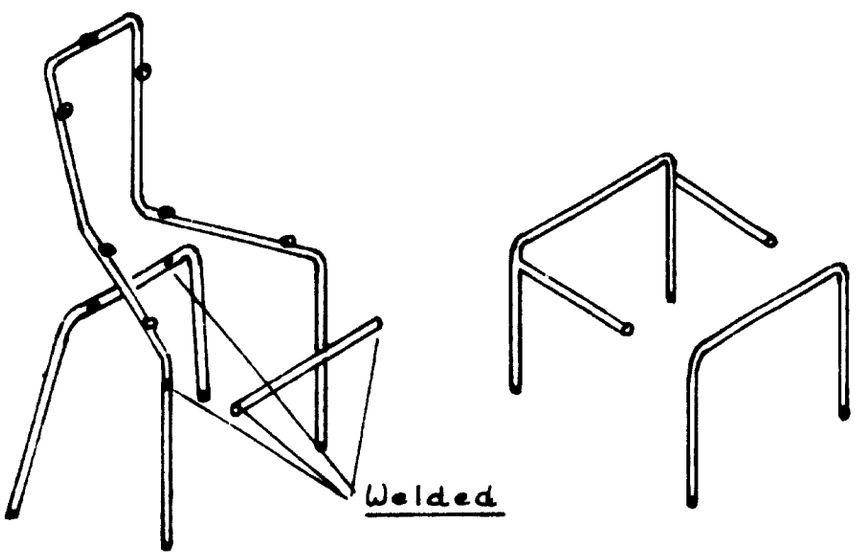
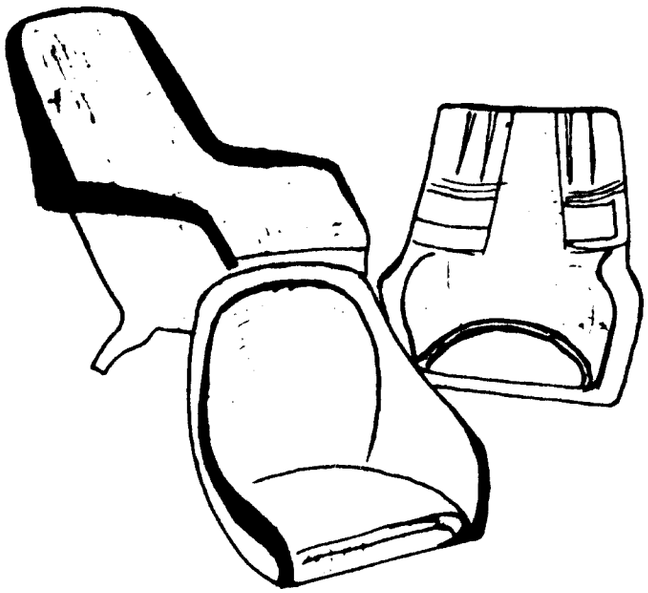
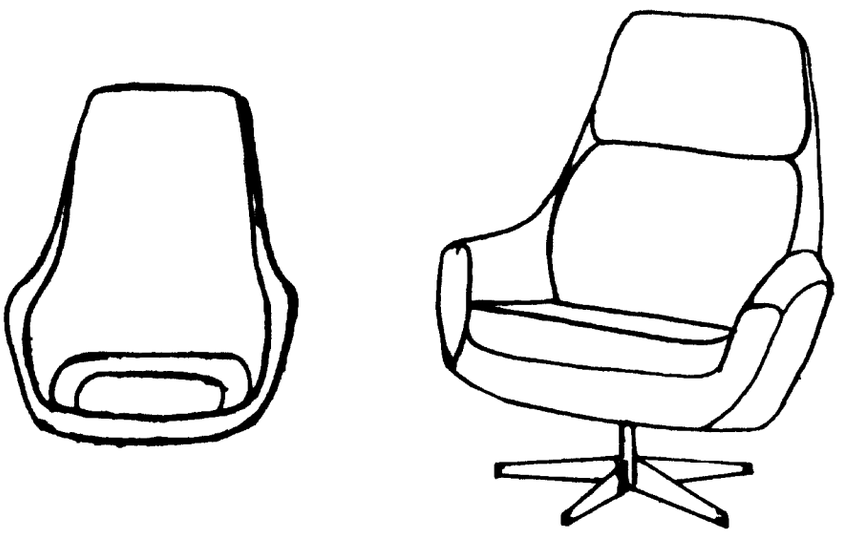


Figure No. 1(a) - Tubular steel frames



Expanded polystyrene chair shells with hessian reinforcement



Moulded urethane chair shells.

Figure No. 2 - Chair shells

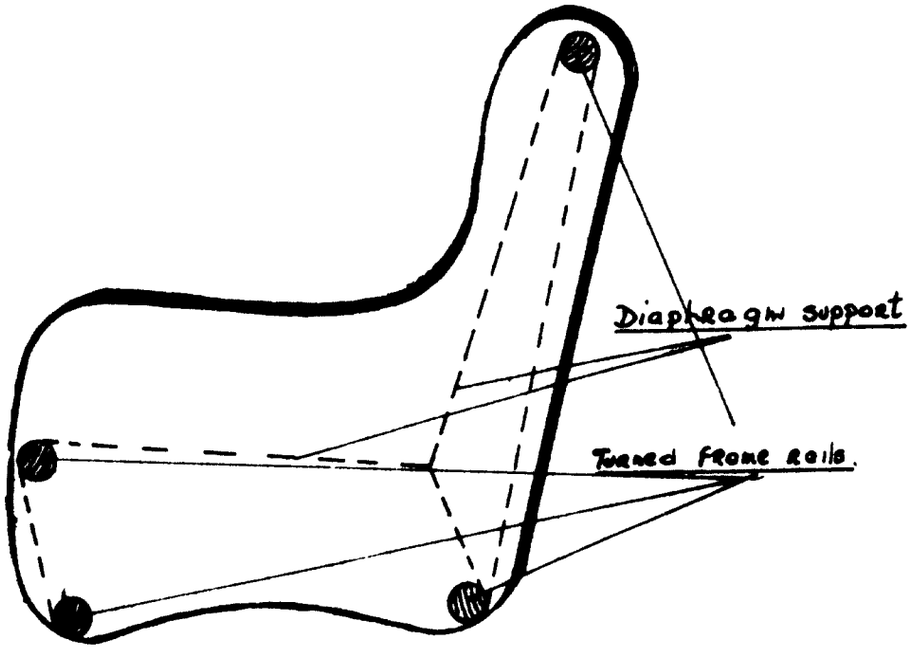
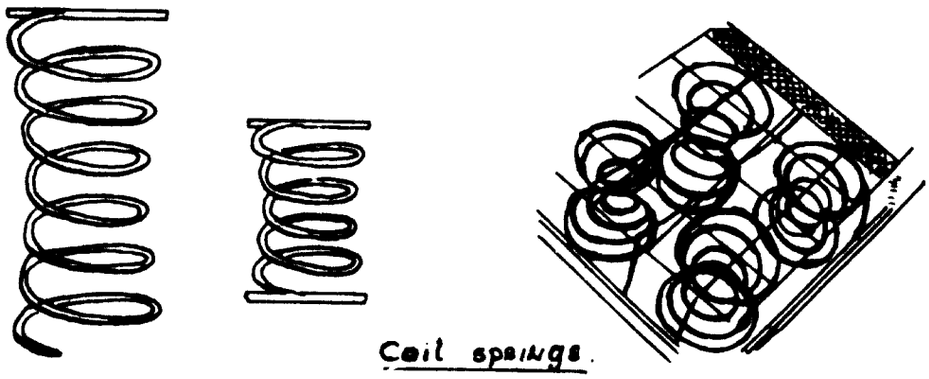
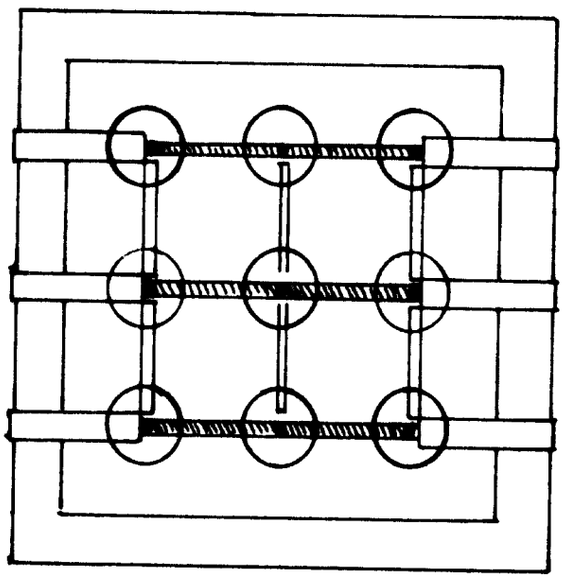


Figure No. 2(a)

Sectional side elevation
of frame with Particle-board sides

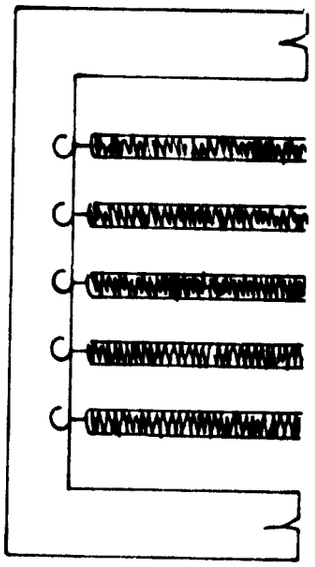


Coil springs.

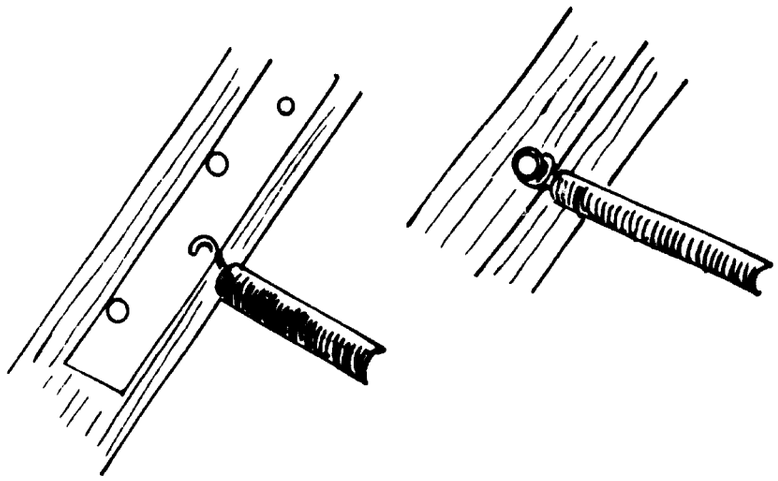


Spring Unit.

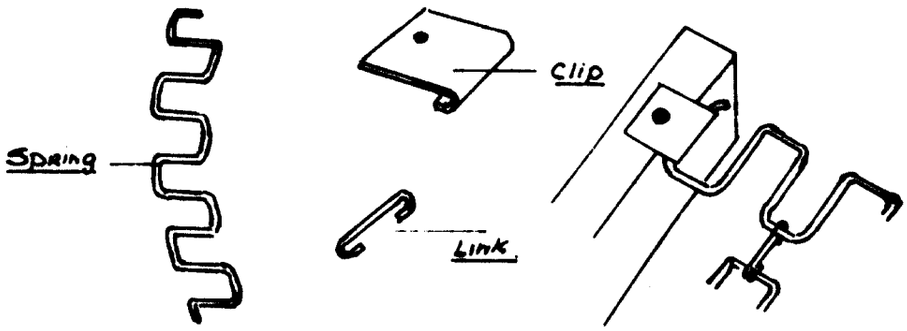
Figure No. 3 - Springs



Tension springs

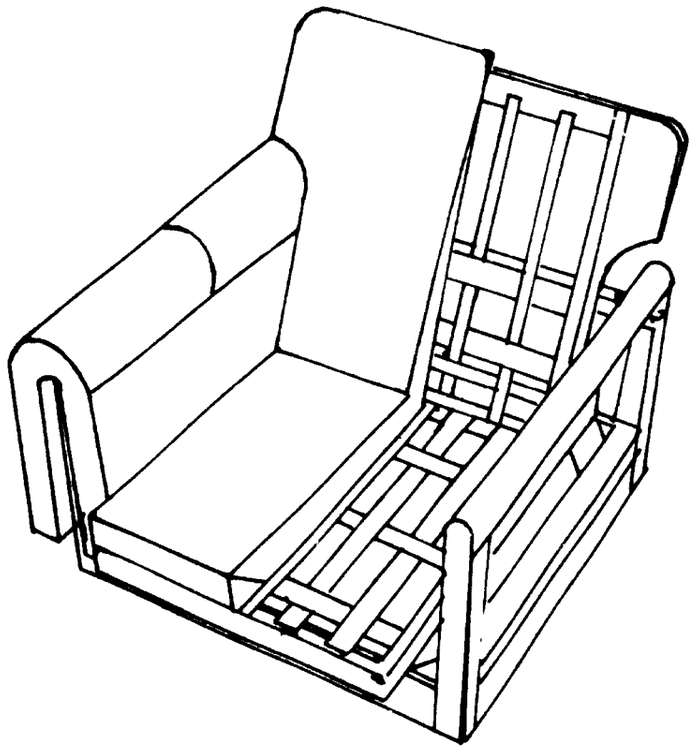


Methods of fixing

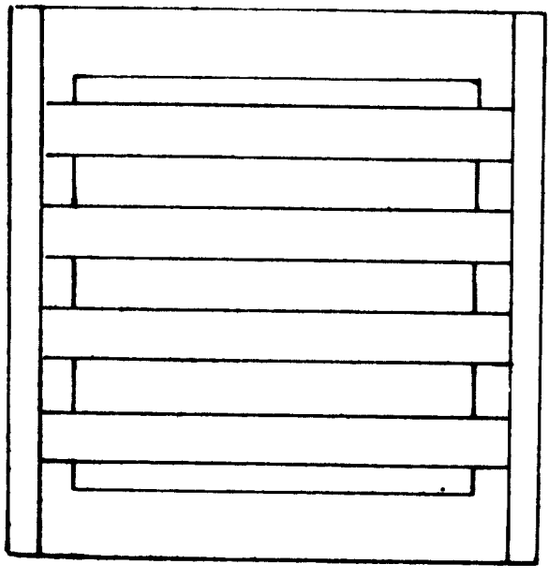


Serpentine springing

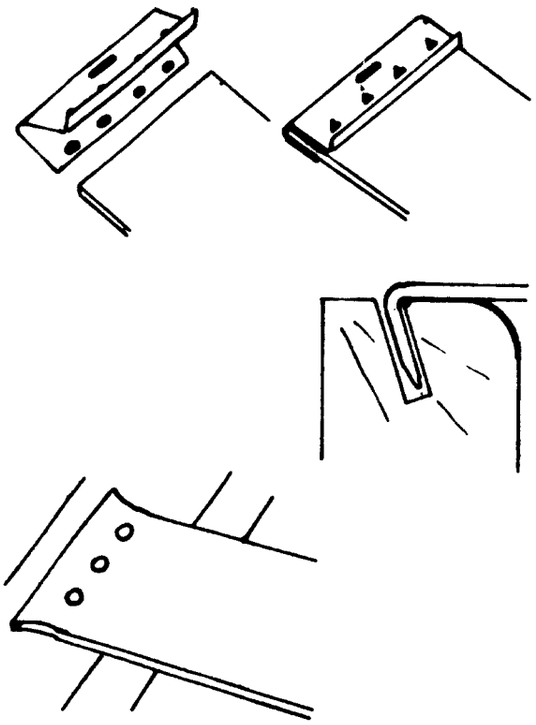
Figure No. 3(a) - Springs



Resilient webbing used in easy Chair.



Rubber webbing



Fixing rubber webbing

Figure No. 3(b) - Webbing)

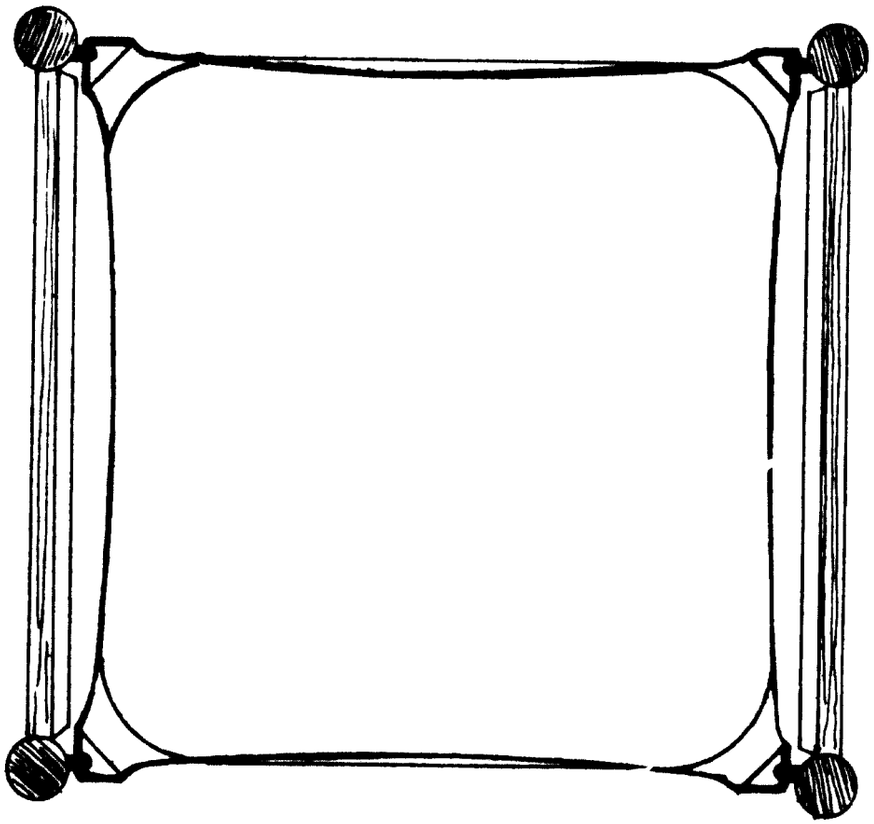
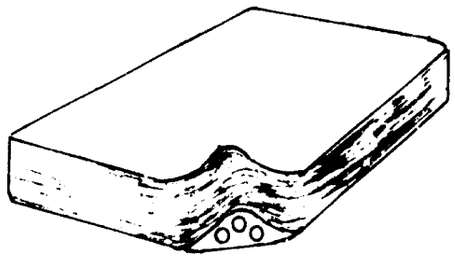
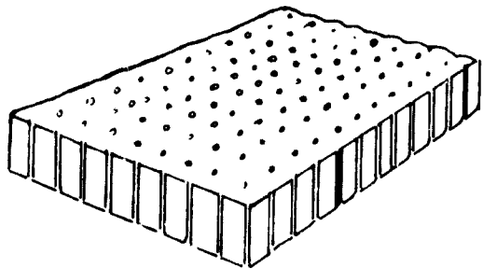


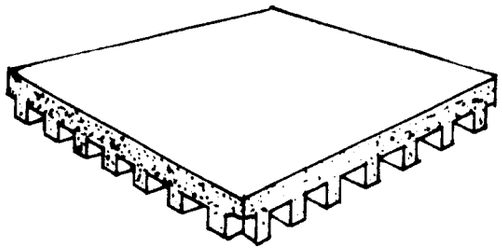
Figure No. 3(c) - 4-Point resilient platform



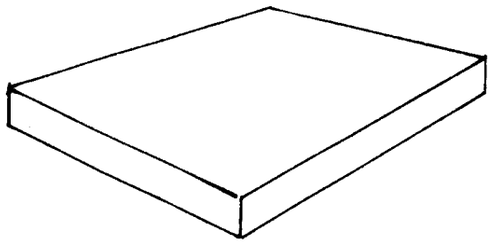
Non reversible latex.



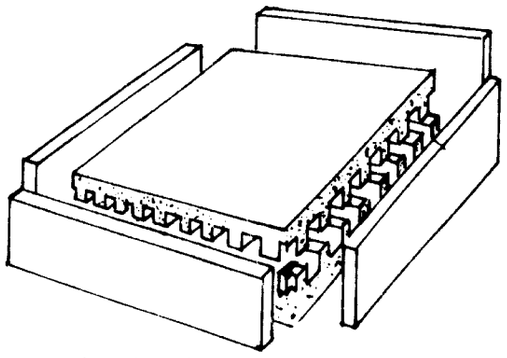
Pin core cavity latex.



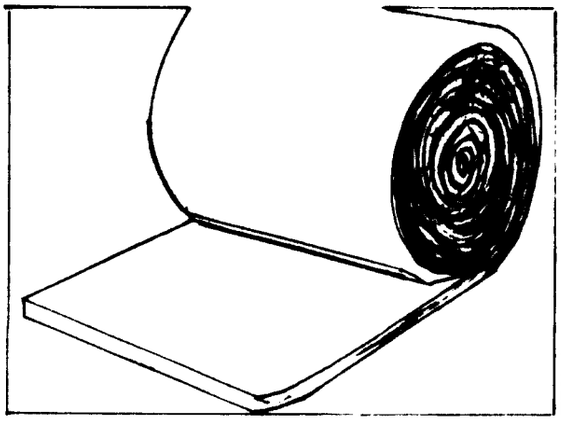
Cavity sheet latex.



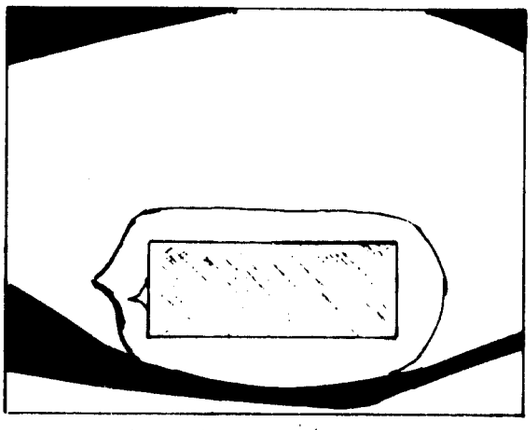
Polyurethane foam.



Handbuilding a cushion.



Fibrefill Roll.



Fibrefill cushion with foam core.

Figure No. 4 - Cushions

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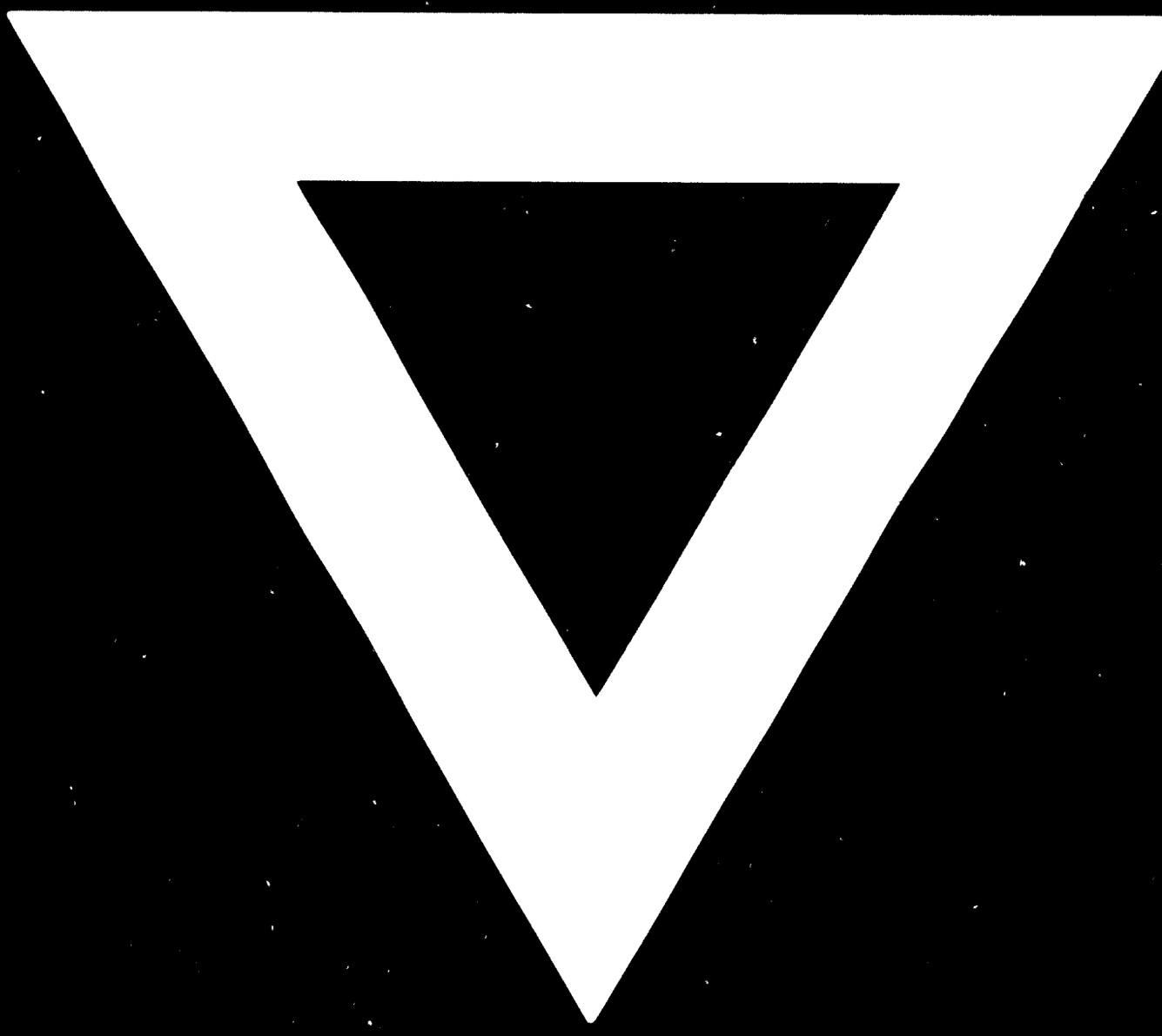

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