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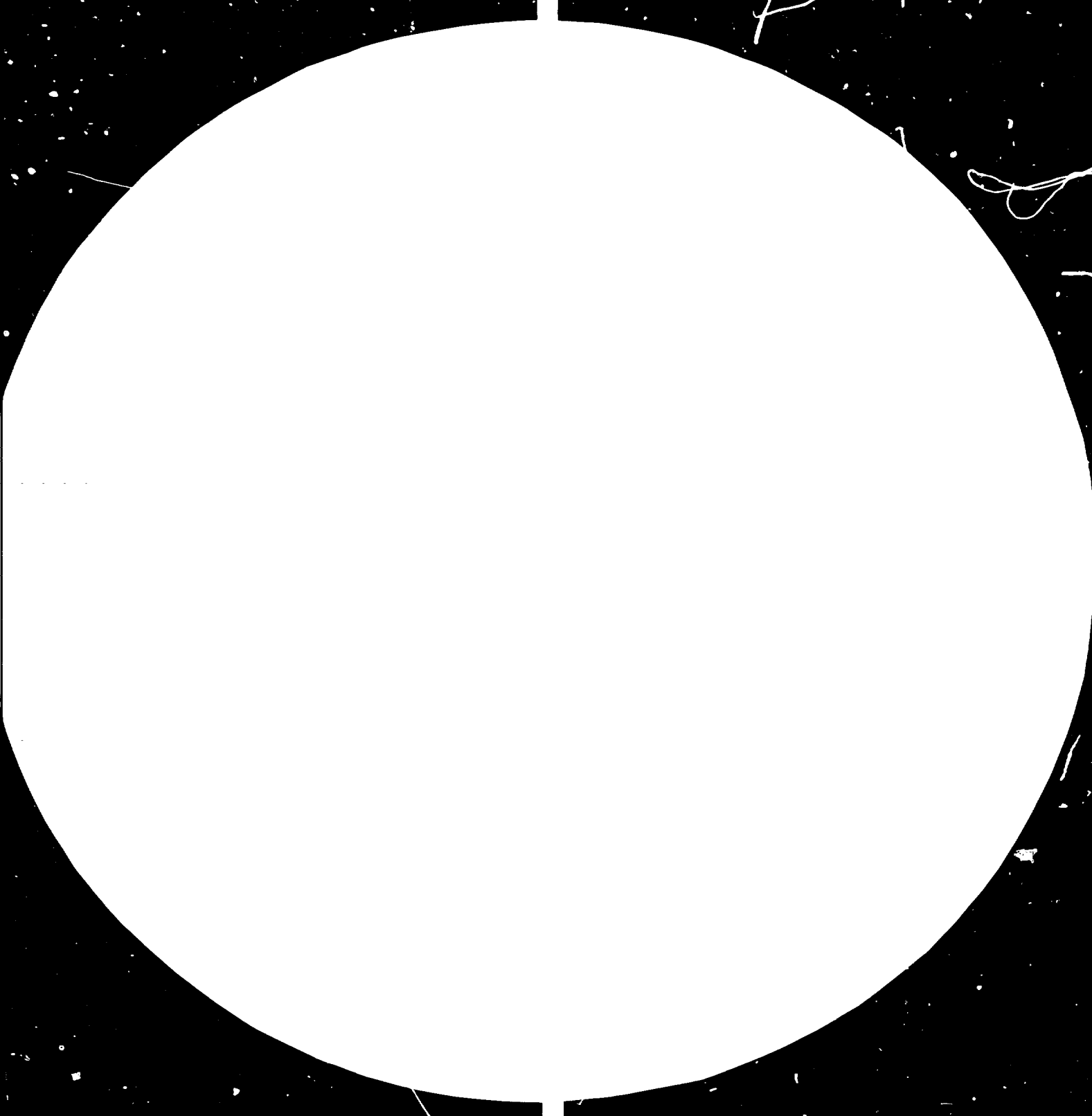
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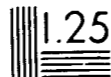
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UPHOLSTERY TECHNOLOGY\*

by

Arto Juva\*\*

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## Introduction

The main purpose of upholstery is to make the piece of furniture more comfortable to the end user. The main products are seats of all kinds. Sometimes other furniture, such as parts of beds, beds, parts of writing tables, bars, desks etc. are upholstered too.

The bedding and mattress industry is also related to the upholstery and in many factories these departments are combined.

Typical upholstered products are:

- Small chairs
- Small chairs with armrests
- Cosy chairs
- Sofa sets
  - A. With upholstered cushions
  - B. With upholstery but with visible wooden parts
  - C. Fully upholstered
- Bed sofas

There are many other different fancy products that through the upholstery department complicating the task of the production management.

The upholstery materials have become versatile and synthetics have replaced natural materials. The production methods are still very labour intensive, although many machines and/or work aids have been developed lately. The requirement of skill is high still, especially in efficient sewing and difficult upholstery. The constructions have been developed, standardized and modularized. The upholstery today is upholstery of components and parts, which then are put together during the final assembly stage. The following presentation will concentrate on modern upholstery technology, used to produce "modern" furniture.

Operations

The operations in an integrated upholstery department are shown in the flow chart (Figure 1). The wooden frames are often assembled in the upholstery department in order to save storage space. In frame assembly zig-zag springs or other elastic materials are inserted - if possible in one operation. Plastics have become a popular frame material. Plastic frames do not normally require any assembly or pre-upholstery work - the foam only will be glued. Metal is the frame material for furniture for public buildings and ships - because of its non combustibility (Figure 1).

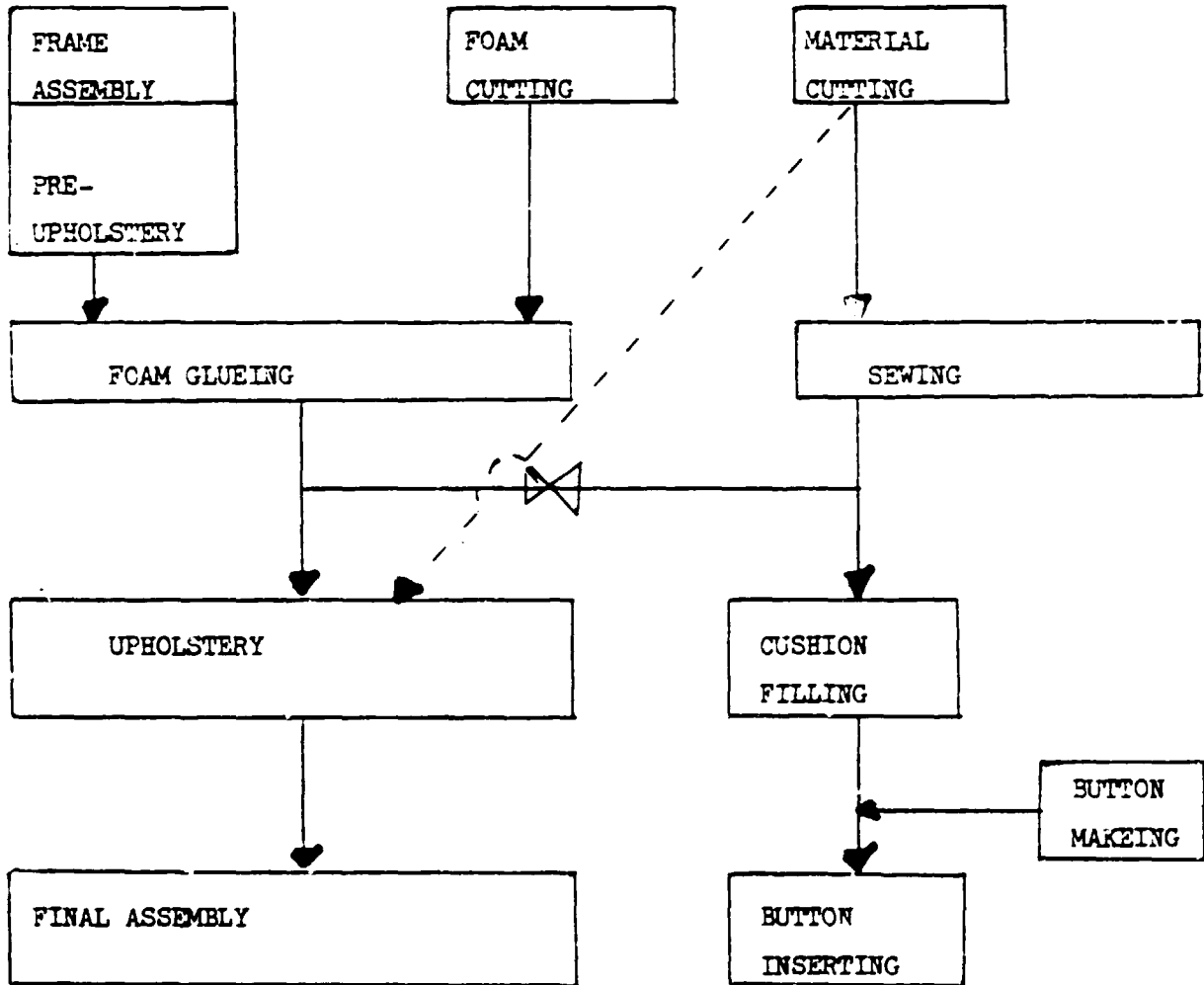


Figure 1. Flow chart of upholstery.

Knocked down-constructions are also used in upholstered products. The relative space savings are however smaller than with shelvings, tables, etc.

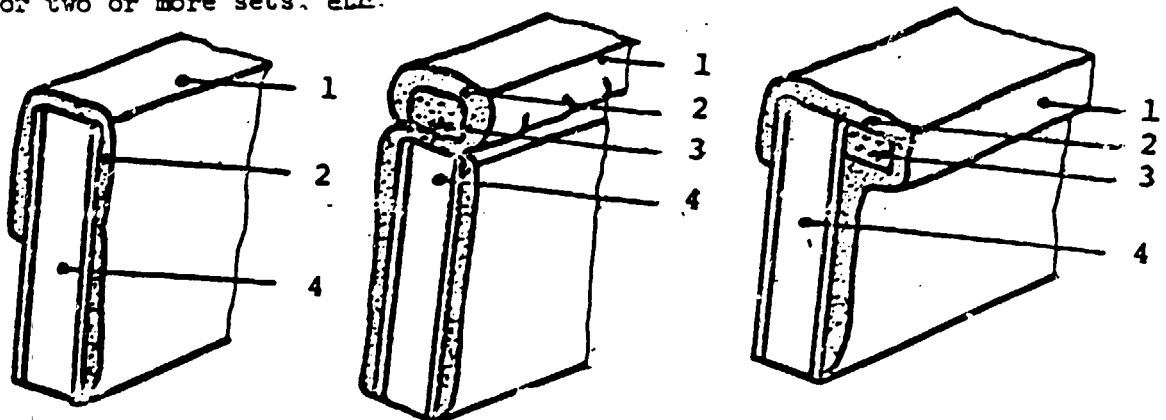
Even though the designs vary it is possible to standardize the products to a certain extent. The items that can be standardized are as follows:

- Parts and components
- Accessories
- Joints, seam constructions
- Methods, machinery and tools
- Materials, etc.

The goal of this is to simplify and improve:

1. Materials management. There are less items in stock and less items missing from stock.
2. Production planning and control. There are longer series and so there are less work orders to be planned and controlled.
3. Production management. There are less methods work, time studies, job training, etc.
4. Production efficiency. The workers learn faster.

As an example several designs can be made out of a standard seat and a standard back of a sofa by using different armrests (see Figure 2); and a standard upholstered seat can be used for various small chairs. The cushion constructions can be standard for two or more sets, etc.



1. Fabric 2. Standard polyester foam 3. Harder foam 4. Frame

Figure 2. Details of armrests construction

Foam can be cut at the supplier or at the furniture factory. This is of course a matter of price and availability, delivery times and warehousing cost. Instead of cutting from a block of foam it is possible to use mould casted foam. Although the moulds are costly, savings occur later in costs. The cutting waste can be used for chopped foam, which is then used for lower quality products (the cut foam and the frame are glued together in the foam glueing operation).

Meanwhile the fabric or leather has been cut in the cutting room and then sewn into covers for upholstery or cushions. In a modern factory it is common to have more sewing operators than upholsterers. This is because a big part of the upholstery can be constructed with various special sewing machines.

Finally the pre-upholstered frame and the cover come to the upholstery department where the cover will be pulled over and stapled to the frame.

The buttons and the cushions are prepared for final assembly in cushion making department. The operations are:

- Button making
- Cushion filling
- Button inserting

In final assembly the parts are assembled, all fittings are inserted, cushions put on the frames and the product is inspected in final quality control before packing and shipping to the client.

Constructions

The products shall be constructed so that the parts going through various operations are small and easy to handle. Assembling before upholstery is old fashioned and costs money due to extra handling. Upholstery of parts also facilitates the manual training of labour in the various operations.



Methods and Machinery

A closer look at the various operations referred to above will reveal the following:

The frame assembly will be done in a jig with pneumatic cylinders. This jig or press has to be flexible and easy to set up (Figure 3). It is possible to insert the zig-zags when the frame is in the press. Stapling of clips takes place before putting the components in to the jig. A template must be used for showing the correct places of the clips. Machines have been developed for automatic stapling of clips, too, but these are for very high production. Elastic webbings are stapled normally in a separate operation after frame assembly. The use of a pneumatic stretching machine results in better productivity and quality. Not only does it stretch always the same amount of webbing but it also stretches several hands at one time. For example with a specific webbing the machine stretches it 100 per cent but the operator working manually achieves 90 per cent in the morning and averages only 60 per cent in the evening. So not only is quality lost - but also additional material is utilized.

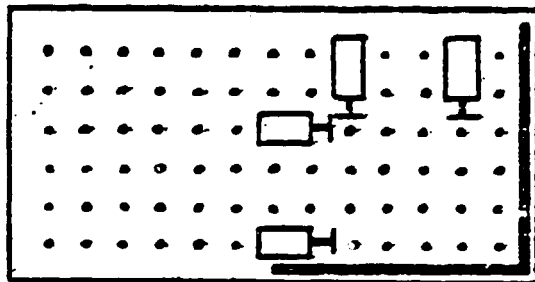


Figure 3. Pneumatic assembly jig.

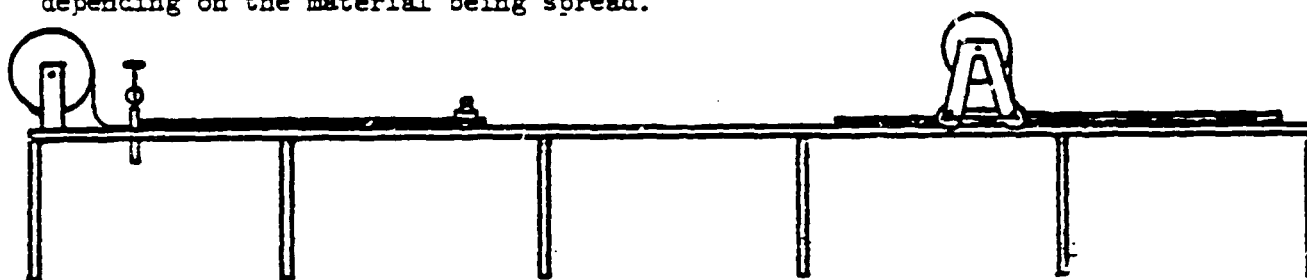
The operations in cutting are:

- Pattern layout
- Spreading
- Cutting
- Bundling

There are several ways of laying out pattern. It can be traced on fabric or on paper, or be sprayed on the top fabric, perforated, etc. The paper layout can be duplicated with carbon paper or be photocopied in a special machine.

Planning the layout of the patterns is normally done with full size patterns but big advanced factories use miniature patterns. This technique is widely used in the clothing industry. The reduced patterns can be made with a pantograph. The layout is planned using mini patterns on a special table, the whole having a scale of 1:5. With mini patterns it is easy to find out the combinations having the smallest material consumption. The best mini layout is then traced or photographed. The layout maker then follows the miniature layout when placing the actual patterns. With this technique substantive material savings have been achieved.

If it is possible to cut more than one fabric ply at one time the material has first to be spread. The spreading is either done from a stand (for short lays) or with a machine (for long lays - Figure 4). The machine can be driven manually or by motor. When spreading the material is cut with scissors, with a cutting device or with the cutter of the spreading machine. Normally two persons are needed but with machine spreading only one can be employed, depending on the material being spread.



(a) For short lays

(b) For long lays

Figure 4. Cutting table with material spreading device.

For actual cutting electric scissors (Figure 5) or straight knives are used (Figure 6). The electric scissors are used when cutting from one to five plies. The round knives (Figure 7) are commonly used in the mattress industry where many long straight

lines to be cut. They are normally not suited for the upholstered furniture industries.

After cutting, the material is bundled and taken to the sewing room. In some cases numbering of plies is necessary in order to avoid different color shades in different parts of the product. This can be done with a numerator machine.

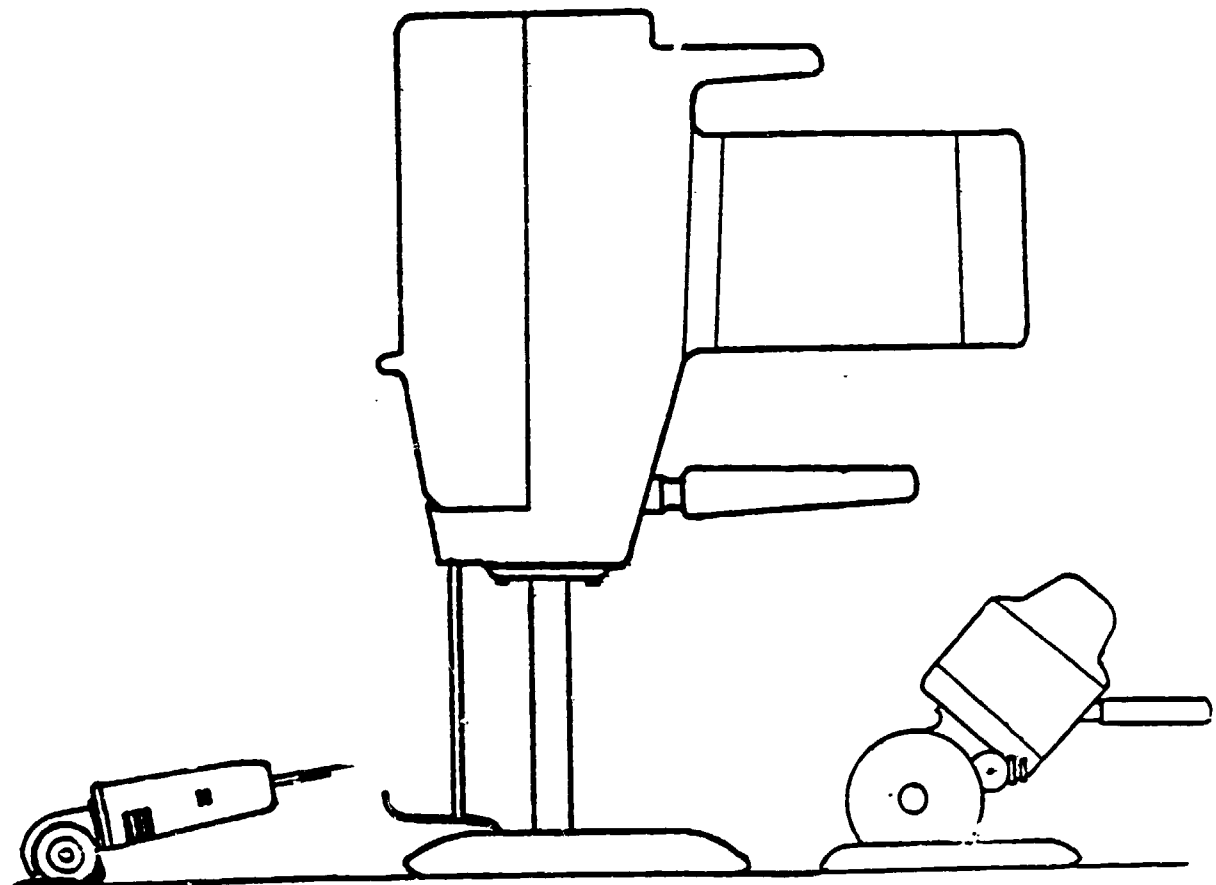


Figure 5.

Electric scissors

Figure 6.

Electric straight knife

Figure 7.

Electric cutter with  
Round knives

Leather can be cut efficiently with a sharp electric knife on a table with a glass or hard plastic top. The cutter's knife follows the pattern. In some cases die-cutting is being used but the investment is big and the savings are questionable, especially when compared with a skilled knife cutter.

The sewing machines are heavy duty machines. The machine types are:

- One - needle lock stitch

The machine is usually equipped with needle feed or unison feed to improve feeding of heavy materials like napped fabric, synthetic leather, leather, etc.

- Safety stitch

The machine makes the chain stitch and over lock simultaneously. So it can be used to eliminate one operation. It can be used for over edging only. The purpose of this is to make coarse materials stronger for actual sewing or stapling in upholstery.

- Two - needle machine

They are used for setting zippers and for decorative stitching

- Special machines and work aids

These are used for instance for pleating, ruffling, tacking, welting etc.

Various seam constructions can be seen in figure 8.

The plain sewing machine with an ordinary table is not enough for a work station. Table extentionts are needed for pick ups and disposals and to support the big upholstery piece when sewing. Note that the dimensions of standard sewing tables are for small parts of the clothing industry. Guides, binders, folders, thread trimmers etc. shall be used to make the operator efficient.

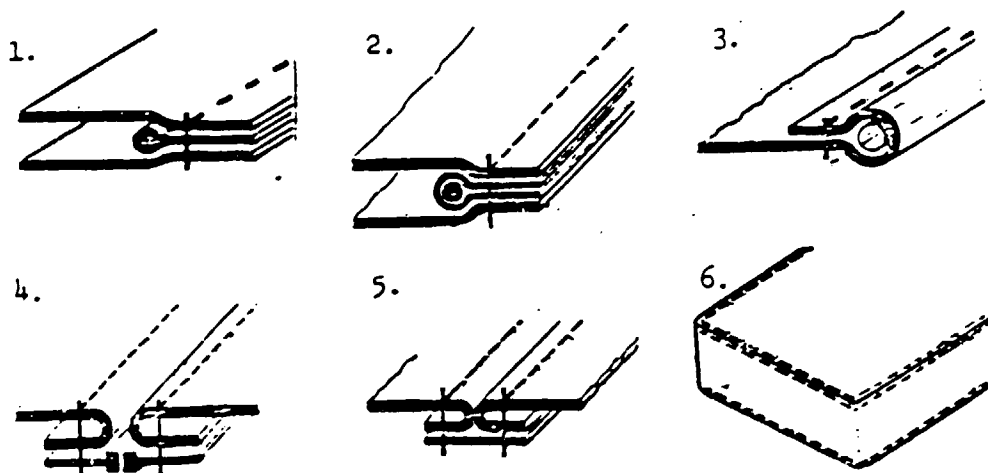


Figure 8. Various types of seams

The foam cutting can be started from a block or from a sheet. The block will be cut with a horizontal cutter. The next operation is the band saw. Sheets can be cut with a hand cutter which is quite like the fabric cutting machines. There are also many special machines for cutting special shapes. If polyester-padding is to be used it can be cut on a suction table which shrinks the lay so that 50 - 70 cm can be cut in one lay. The disadvantage is the cost of plastic needed to cover each lay when cutting.

In foam glueing one needs a suction table (Figure 9) for control of air pollution and a spray gun for glue. In small scale production glue can be applied with a brush too. At the work station a staple gun is possibly needed for cardboard supports. The modern glues need only to be applied on one side but most of the factories still use glue that has to be applied on both sides. The most usual mistake is to spray too much glue. The result will be:

- Glue will be wasted
- Drying time is longer and so is working time
- The quality is not good, the seams will open later on because the solvent has not evaporated
- The thick, hard seam may be felt in the final product
- More compressed air is needed

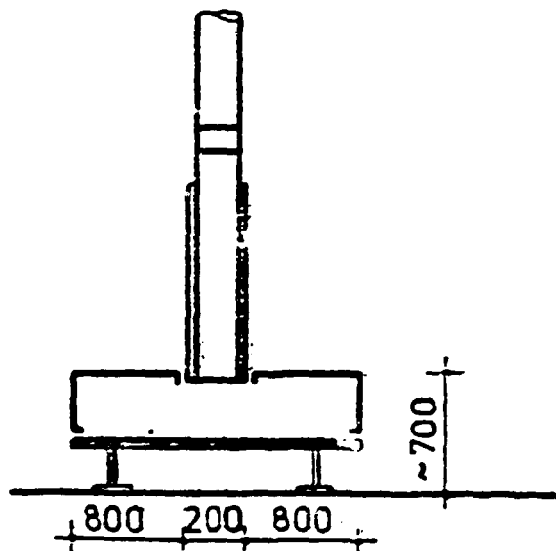


Figure 9. Suction table for spraying glue on to foam.

The covered buttons are made in two operations. The cover is cut from the waste that comes from fabric cutting. For that dies are used that normally cut several pieces and plies at one time. Depending on the size of the factory manual or pneumatic equipment is used for this. The second operation is to cover the button with the button making machine (Figure 10) The hand operated one is for small production then come first foot operated, then pneumatic ones with turning work head and then with rotating covering dies and finally automatic machines with automatic button feeding and disposing. The production can be as high as 2000 buttons per hour.

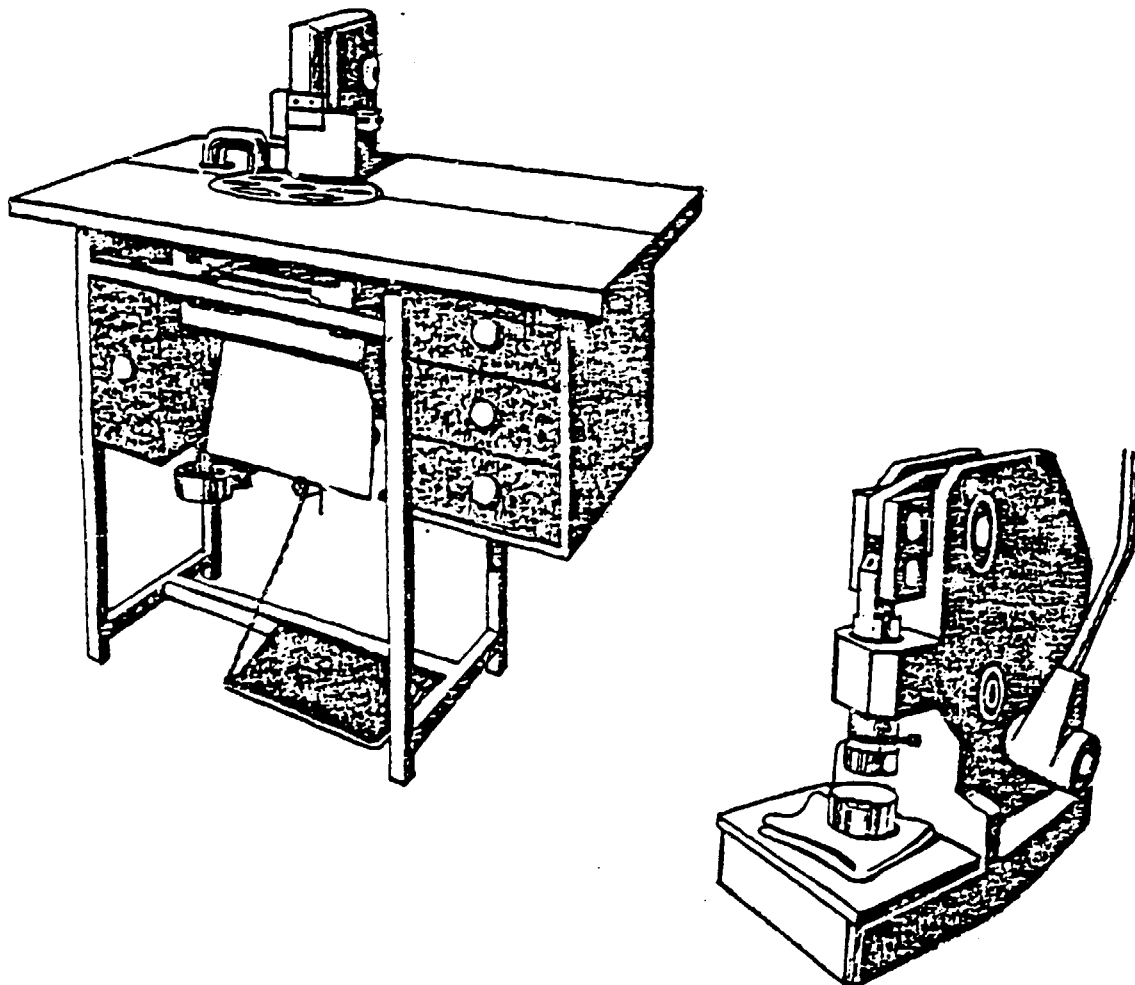


Figure 10. Button making machines

The cushion filling can be done by hand, by semi-automatic or fully automatic machines. After that the buttons are inserted - again depending on the size of the production - by hand or with a machine (Figure 11).

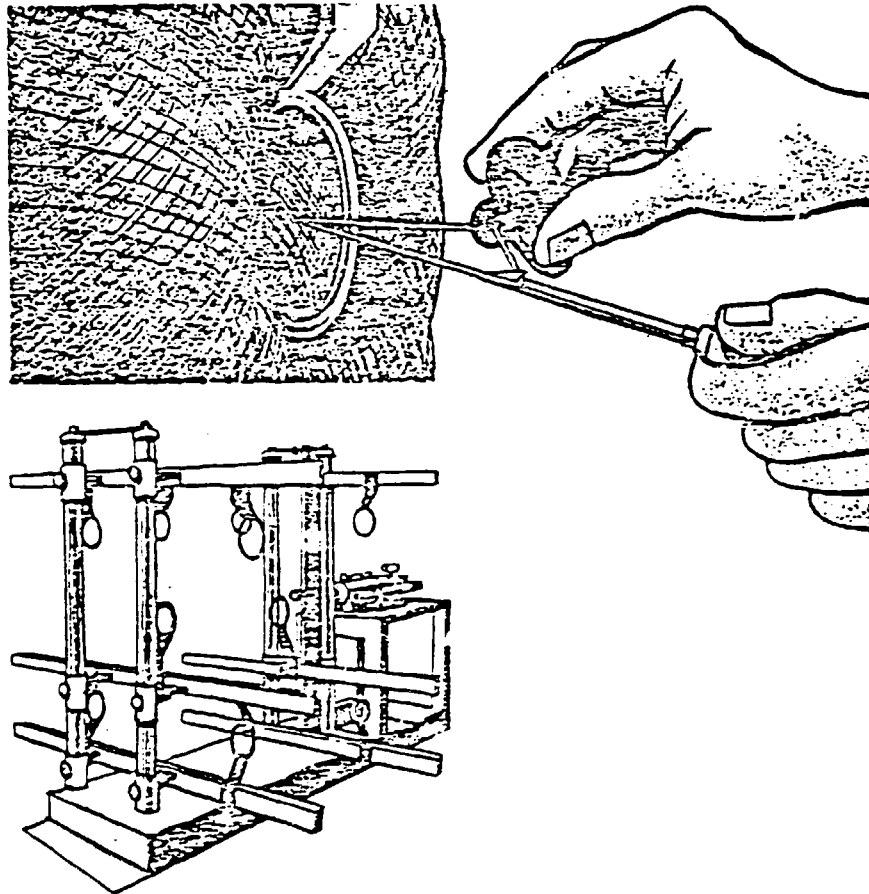


Figure 11. Button inserting machine

At the upholstery department a work table, benches or supports are needed and an upholstery column is a useful item (Figure 12). The purpose of the pneumatic column is to hold the piece in a proper position and leave both hands free for the work, where often more than two hands are needed for pulling, straightening, stapling, holding, measuring etc. The disadvantage is that the column is not suited for all constructions. The tool most used is the staple gun. Others are

hammer, glue applicators, needles, scissors, knives and tape measures, templates and staple disposers. In the past all the work stations were identical but today special stations are established for special jobs. For small parts there are upholstery presses (Figure 13) that hold the piece. With a proper jig the fabric is folded and the glueing of the foam may even be eliminated. Material is also saved because it is not needed for pulling the fabric (this is done by the jig).

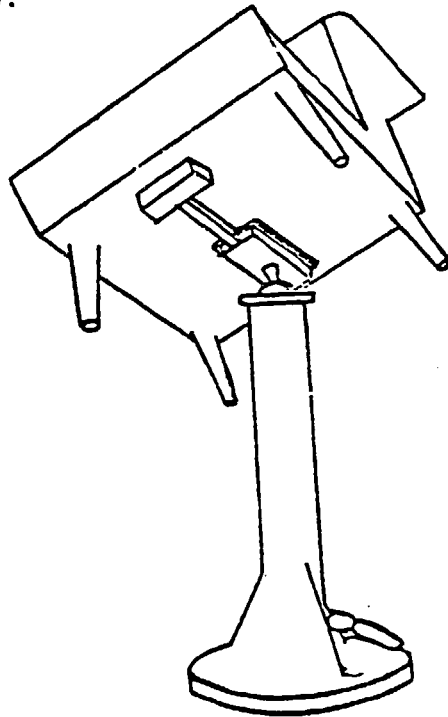
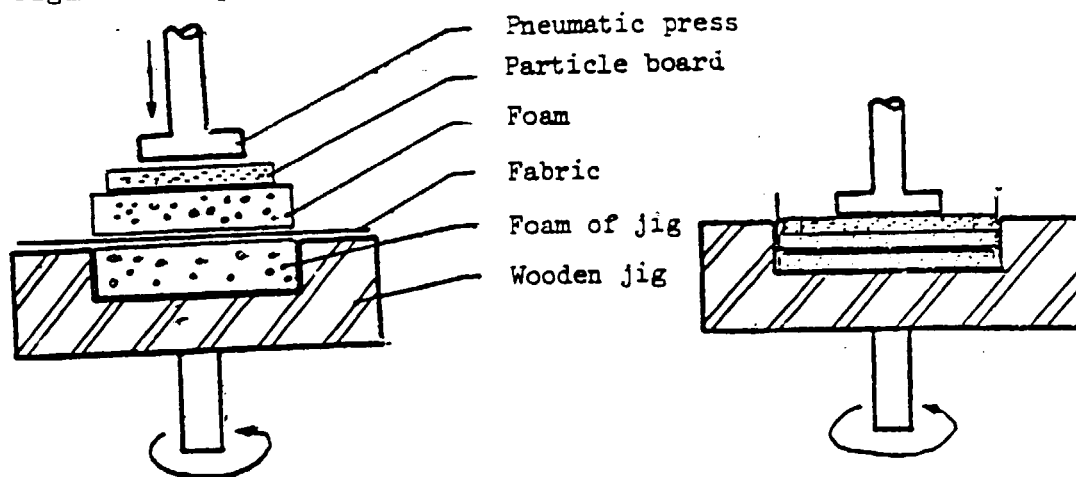


Figure 12. Upholstery column



Before pressing

After pressing

Figure 13. Upholstery jig for small chair seats - Note that the sides of fabric are turned up so that the stapling can be done quickly and with material savings.



Final assembly: the piece of furniture will be put together from upholstered components. The work will be done on tables or benches or with an assembly press. The most advanced presses are for sofa sets (Figure 14). The operator just puts the components with glue on dowels to the press, presses it together, turns the piece to fix the legs and the lining under the product. There are special presses for assembling small chairs.

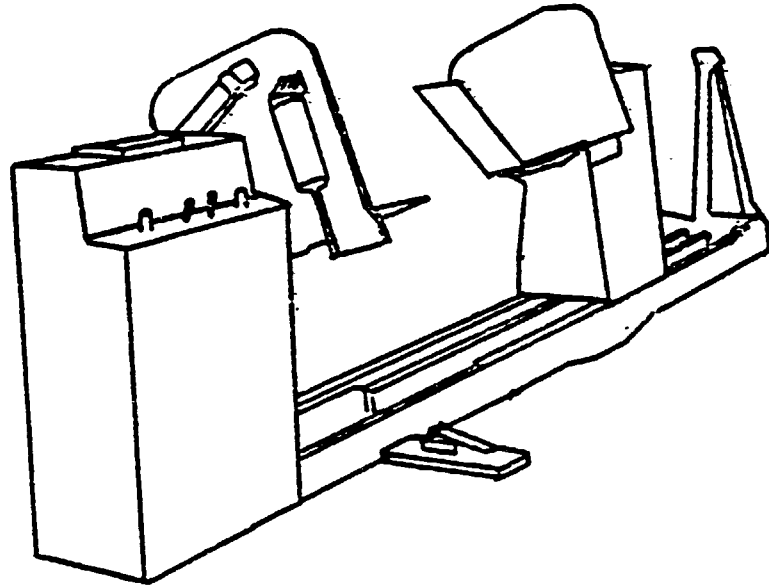


Figure 14. Upholstery presses

In small production where series are short work stations and tools also have to be flexible. For pressing carpenter clamps are used.

After final assembly normally comes final inspection, where the product is cleaned if damaged by dust, oil or dirt and it is steamed if wrinkled to get the napped material straight etc.



