I. Specific Binding Processes

A. Cutting

B. Folding

C. Adhesive Binding

D. Wire Stitching

E. Case Binding

II. Cutting

A. Components of a guillotine cutter (use overhead)

1. Knife

a) edge is sharpened to a bevel shape

(1) angle should be suited to the material being cut

(a) bonds and books = 22˚

(b) boards = 24˚

(c) Soft materials need a narrow angle and hard materials need a wider angle

(i) wider angle makes blade stronger for hard materials

(2) metals used for blades

(a) steel knife

(i) most common

(ii) easy to grind and hone

(iii) cost about $600 new

(b) high-speed tool steel

(i) more expensive than steel blades ($1,000)

(ii) are more abrasion and impact resistant than a steel blade

(iii) last 4–5 times longer than a steel blade

(c) Carbide insert knives

(i) steel backing with pieces of carbide soldered into them

(ii) most expensive to buy ($3,000)

(iii) hard and expensive to sharpen (5–7 times more than a standard steel blade)

(iv) used specifically for making clean cuts to labels (adhesive is a problem)

(3) sharpening

(a) must be sharpened when blade is too dull to quickly cut stock, when the force exerted by the blade pulls the paper away from the back gauge, or when diagonal ragged grooves appear on the side of a stack of cut paper (draw diagram)

(b) cutting hard materials requires more frequent sharpening

(c) sharper blades increase the smoothness and quality of cuts

(d) sharper blades reduce wear and tear on the cuter

(e) blades get shorter each time they are sharpened

(i) must be extended with spacers

(ii) eventually become too short to use

(f) you must have spare blade(s) on hand to replace one that must be removed and sent out for sharpening.

2. *Cutting stick (use overhead)*

a) positioned immediately under the low point of the blade

b) made of wood or plastic

c) blade is set to slightly penetrate cutting stick rather than hitting metal (causing dulling or breakage)

d) cutting sticks must be turned or replaced when their grooves become so deep and pronounced that the bottom sheet is torn instead of cut.

3. *Side and back gauges (use overhead)*

a) used to position sheets accurately

b) side guides are stationary while back gauge can be moved into the correct position by using a built-in measuring tape.

c) When making the first cut on a sheet of paper, it is important to always place the head and side guide sides of the sheet against the back gauge and one of the side guides.

d) Some cutters have split back gauges that can be separated to accommodate up to three different sized cuts at once (draw diagram).

4. *Clamp*

a) a metal bar (usually serrated) that runs parallel to the knife

b) functions

(1) to expel air from the pile

(2) to hold the sheets tightly in position while the blade cuts through the stack.

c) clamp pressure must be set tight enough to hold the paper in place while it is being cut, but not so soft as to damage or imprint the paper with the clamp's pattern.

(1) soft material = high clamping pressure

(2) hard material requires less pressure

(3) carbonless papers can be damaged by too heavy clamp pressure

(4) some newer cutters have clamps that automatically sense and apply the correct clamp pressure

B. Setting the cutter

1. most new cutters have electronically-controlled automatic spacers (back gauges)

a) automatic spacers greatly increase productivity—before them, an operator would have to move the back gauge over 200 times to cut 25,000 sheets of 25 X 38 paper to 9 X 12!

2. to program, enter the cuts, in order, using a keyboard

a) cuts are generally in order from longest to shortest

b) cutting sequence often requires paper to be turned around and around after each cut

(1) do example cutting sequence of 8 1/2 X 11 from 17 X 22 with no trims, and 8 1/2 X 11 from 17 1/2 X 22 1/2 with 1/4 trims around the perimeter.

c) cuts should correspond with trim marks printed on the paper

d) cuts can be programmed off-line with a personal computer. The job information is saved on a disk and loaded into the cutter when the job is begun.

C. Cutting process

1. each lift (define) must be winded and jogged before placing the lift into the cutter.

a) jogging machines

b) lifting tables

2. *lift must be aligned to the back gauge and the appropriate side guide*

a) air blasts in cutter bed

b) jogging blocks

3. *successive lifts must be aligned perfectly square on top of previous ones.*

4. *Make cuts, turning the lift appropriately.*

5. *remove and dispose of waste paper frequently (vacuum systems)*

III. Folding

A. Folding machines fold printed sheets into *signatures* in which the pages are *imposed* in the correct *sequence*.

B. Signatures usually have 4, 8, 16, or 32 pages, but can be any multiple of two

C. Folder makeready

1. *load the feeder*

a) must transfer press sheet head and side guide sides to folder side guide and lead edges.

b) either load by lifts or some folders allow a press palette to be loaded directly into the folder's feeder

c) many folders have continuous feeders in which singled tacks of paper are placed on top of the feeder—the machine feeds from the bottom—allowing the operator to reload without stopping the folder (use overhead)

2. *Set register board (side guide, feed tapes (angled)*

3. *Set folding units*

a) number of folds

b) length of folds

c) roller pressure (over overhead diagram of buckle folder) must be changed on each folding unit because sheets become more bulky (thick) with each fold

D. Folder Configurations

1. Knife folders (use overhead) — usually used for thicker stocks or signatures

a) sheet is fed by the feeder to the folding station, where it is stopped by a gauge and positioned against a side guide.

b) A knife descends vertically and drives the sheet between two rollers.

(1) the distance between the rollers must be set for the thickness of paper being folded.

c) The rollers nip the sheet and propel it between them

d) The folded sheet moves to the next folding station, beneath the first one.

e) Knife folders usually are equipped with perforators

(1) perfs allow air to escape, which prevents wrinkles

(2) perfs can also be part of the job's design

f) Other knife folder attachments

(1) glue applicator (used instead of saddle stitch)

(2) slitters to cut two (or more) up jobs as they're being folded

(3) edge trimmers (clean up edges of signatures in-line rather than using a cutter)

2. Buckle folders (use overhead) — usually used for thinner stocks

a) modular construction—additional folding units can be added or removed as necessary.

(1) Parallel unit — fastest operation

(2) right-angle units — slow down production because previous sheet must be out of the way before next one can be fed out of first folding unit.

b) buckle folders run faster with small sheets than large sheets (draw illustration of feedboard)

c) Feeder moves sheet to feedboard where diagonal tapes force sheet against side guide and propel sheets forward

(1) speed of tapes can be controlled independently from the speed of the folder

d) Sheet is propelled forward into the folding plate until it hits a buckle stop, which stops the leading edge from moving any further.

e) because the feeder is still feeding the sheet forward, the sheet buckles and is forced downward through the folding rollers.

(1) the gap between the rollers must be set for the appropriate thickness of the folded stock.

f) the sheet emerges from the folding rollers

(1) can be delivered

(2) can be passed to additional parallel folding plate

(3) can be passed to a cross carrier, which takes the sheet to a right-angle folding station.

(a) the sheet is folded by the right-angle station in the same way as the parallel station.

g) Finished folded signatures are delivered to a stacker

h) Buckle folders usually are equipped with perforators

(1) perfs allow air to escape, which prevents wrinkles

(2) *perfs can also be part of the job's design*

i) Other buckle folder attachments

(1) *glue applicator (used instead of saddle stitch)*

(2) *slitters to cut two (or more) up jobs as they're being folded*

(3) *edge trimmers (clean up edges of signatures in-line rather than using a cutter)*

3. *Combi folders (already discussed)*

E. Folder Developments

1. *computer control using video screens to set sheet size, side guides, fold size(s), and roller tension*

2. *electronic sheet detectors*

3. *setting roller pressures by inserting a representative thickness of paper between two jaws (one set on each side of the folder)*

4. *spring-loaded roller pressures that self adjust*

5. *vertical pile deliveries deliver folded signatures on their spines (faster post-folder handling than delivering shingled flat signatures)*

6. *counters*

7. *computer monitors that feed information about job production times into a central computer for cost analysis.*

IV. Adhesive Binding

A. Perfect binding is a method of binding that uses an adhesive to bind pages of a publication at its backbone

1. *soft cover—usually heavier stock that the inside pages*

2. *rectangular backbone*

3. *most often used by book and periodical printers*

B. Advantages of Perfect Binding

1. backbone can be printed with reference information

2. books can be bound in one continuous operation (one machine)

3. single sheets can be added (different stock, etc) that cannot be added with saddle binding

a) can customize products for demographic groups

4. modern glues make relatively permanently bond books

C. Perfect Binding Equipment—use overhead

1. Perfect binding is done in a finishing line of several machines that feed each other.

2. Gatherers

a) has a separate **hopper** for each signature (±10–32 hoppers)

(1) can handle wide variety of 4–64 page signatures

(a) from different sources

(b) on different papers

b) **Feeder**

(1) air blast separation

(2) feed from bottom of pile (important for continuous reloading)

(3) have sensors to report jams or misfeeds

(4) incomplete/damaged products automatically rejected

c) **Conveyor belt**

(1) signatures fed from feeder onto moving conveyor belt

*(2) each signature fed on top of previous ones in sequential orderfinished group of signatures is called a **book block.***

3. Backbone Cutter and Roughener

a) book block is jogged and turned to a vertical position by a spiral raceway.

b) clamps hold the book block tightly—the backbone extends 1/8" from vise.

c) the backbone is ground off using knives or saws

d) roughening tools and patterns roughen the backbone to better accept adhesive.

(1) paper can adversely affect adhesion

(a) short fibered paper

(b) dust particles left on backbone

(c) ink printed to bleed into bind

4. Gluer

a) clamped book block with bind edges exposed and roughened are sent to the gluing station.

b) a metered layer of adhesive is forced into the exposed paper fibers

(1) Two glues are usually used

(a) low-viscosity hot-melt glue

(i) seals in the paper fibers

(b) high-viscosity hot-melt glue

(i) used to bind book to cover

(2) Thick catalogs, like telephone books, may have three coats applied

(3) Hot melt glues:

(a) consist of polymers plus resins (sticky stuff)

(b) bond instantly when cooled

(c) Will not flow around paper fibers if less than 350–400˚F.

(d) too high temperatures weaken the adhesive's bond.

(4) Other glues

(a) Polyvinyl Acetate (PVA)

(i) applied cold

(ii) more flexible bind than hot-melt

(iii) requires an oven to dry

(b) Polyurethane Reactivate (PUR)

(i) applied hot

(ii) products lie flatter and have more durable binds than those made with other glues

(iii) high relative humidity reduces curing time.

(iv) set faster than other glues

(v) cost more than other glues

5. Cover feeder

a) cover falls from a hopper onto a feeder

b) cover is scored one–six times

c) jogged into alignment

d) pressed against the wet adhesive of the book block

e) cover is pinched around the backbone and pressed against the front and back covers.

f) book is unclamped and falls onto a conveyor completely assembled

6. Ovens/dryers

a) may be necessary at this time (depends on type of glue)

b) glue must cool before book is trimmed

7. Trimmer

a) Books may be bound one- or multiple-up

(1) multipl-up books must be cut apart with a splitting saw

b) Three-knife trimmer cuts signatures excess from the head, foot, and fore edge of each book or periodical.

(1) after jogging, head and foot cut off simultaneously with side knives.

(2) after the side knives move out of the way, the front knife cuts off the fore edge.

c) Most binders have dual trimming stations

(1) it takes more time to cut than bind

(a) perfect-binding = 12,000–18,000 per hour

(b) trimming = 6,600 per hour

(2) an electronically-controlled gate divides production to each trimming station.

8. Subsequent processes

a) counter/stacker

b) packing machine

c) palletizer

V. Wire Stitching

A. Difference between stitching and sewing

1. stitching uses wire

2. sewing uses thread

B. Uses of wire stitching

1. magazines

2. mail order catalogs

3. annual reports

4. booklets

C. Types of stitching

1. Saddle

a) stitched through bind fold

b) opens easily

c) lies flat

d) have rounded backbones

e) signatures **inserted** into each other

f) good for publications no more than 1/4" thick

(1) more than 1/4" requires too much creep allowance, which increases the size of the stock that must be used and the amount of wasted paper

2. Side

a) less common than saddle stitching

b) being replaced by perfect binding

c) have square backbones

d) stronger bind than saddle

e) cannot be opened fully

f) cannot lie flat

g) decreased use of inner margin

h) signatures are **gathered** rather than inserted

D. Equipment to stitch

1. Manual foot or hand operated models

2. fully automated in-line machines

E. Planning for stitching

1. performed in stripping/imposing department

2. requirements

a) number of pages per signature

b) signature imposition—depends on folder

c) sheetwise or work and-turn or -tumble

d) lip allowance—also known as lap or pickup (use overhead)—for saddle-stitched products

(1) usually 3/8"

(2) used by mechanical fingers to open the signature to the center spread

e) creep allowance—for saddle stitched

F. Saddle Stitchers

1. produce between 10,000 and 14,000 products per hour (depending on model)

2. Pockets

a) pockets hold the signatures (use overhead)

b) there may be 4–22 pockets on a saddle stitcher

c) signatures are fed from pockets onto a **saddle-bar** using vacuum and mechanical fingers in conjunction with the lip margin

d) A pin traveling along a continuous-loop conveyor pushes the signature to the second pocket where the next signature is dropped over it. And so on until last signature is dropped.

e) inserts, such as subscription cards or other advertisements, can be assembled as a signature by placing them into a pocket

(1) must be wrap-around

f) inserts can also be "blown in" using compressed air.

(1) a dab of adhesive or static electricity keeps the insert more or less in place until it falls out in the consumer's home!

g) In line addressing and personalizing are done in the pocket section of the stitching machine.

3. stitching heads

a) before stitching, a quality control device detects products that are defective and ejects them before stitching

(1) either too thick or too thin (extra or missing signature)

(2) unevenly jogged signatures

(3) the signatures can be re-fed into the proper pocket

b) signatures are jogged automatically as the conveyor pin pushes the booklet forward

c) wire is fed from a continuous roll

(1) thickness determined by requirements of machine and thickness of the publication (thicker publication = thicker wire)

d) wire is straightened—curl and kinks removed

e) wire is cut to preset adjustable length (thicker publications require longer wire)

f) bender block forms legs of staple

g) staple is forced through stationary publication

h) clinchers bend the wire legs together to secure the staple

i) conveyor moves publication to three-knife trimmer

4. three-knife trimmers

a) already discussed

5. Modular add-on equipment

a) in-line folder/feeder

(1) can fold covers before placing them onto the saddle chain

(2) saves folding machine time

(3) only good for 4-page signatures

b) counter/stacker

(1) counts and stacks lifts of finished products

(2) prevents tedious hand-counting of products

c) tip-in machines

(1) secures inserts to the back or front of saddle-stitched signatures with a thin strip of adhesive

(2) examples include reply cards, coupons, envelopes, and so on.

d) automatic bundling equipment

(1) tightly compress and bundle (tie or shrink wrap) stacks of products

e) multiple-hole punchers

(1) punch holes along the spines of pamphlets after stitching and trimming

(2) saves drilling time

f) vacuum disposal systems

(1) vacuum away trimmings

(2) place trimmings in trash compactor for later bundling and recycling

g) ink-jet addressing systems

h) automated postal sorting equipment