

FUNDAMENTAL MANUFACTURING PROCESSES

Threading

SCENE 1.

TH24A, CGS: External Threads
white text, centered on background
FMP BKG, motion background

SCENE 2.

TH25A, **SME4384**, **15:40:11:00-15:40:28:00**
c. u. external thread being produced
TH25B, CGS: Hand Threading
Turning
Chasing
Milling
Grinding
Rolling
TH25C, ANI: cut thread, rolled thread
TH25D, CGS: Cut
TH25E, CGS: Rolled
TH25F, CGS: Formed

NARRATION (VO) :

EXTERNAL THREADS ARE MADE IN SEVERAL
WAYS:
BY HAND THREADING,
TURNING,
CHASING,
MILLING,
GRINDING,
AND ROLLING.
IN ALL OF THESE PROCESSES EXCEPT
ROLLING, THE THREAD IS CUT INTO THE
METAL. WITH ROLLING, THE METAL IS FORMED
INTO A THREAD SHAPE.

--- TOUCH BLACK ---

SCENE 3.

TH26A, CGS: Hand Threading
TH26B, **SME4389**, **21:08:40:00-21:08:56:00**
threading die fitted into holding collet
TH26C, **SME4389**, **21:12:12:00-21:12:18:00**
die positioned over hole, manually turned
TH26D, **SME4389**, **21:12:38:00-21:13:35:00**
c.u. die carving thread

NARRATION (VO) :

HAND THREADING USES DIES THAT ARE FIT
INTO A HOLDING COLLET...,
POSITIONED OVER A WORKPIECE...,
AND THEN MANUALLY TURNED.
THE DIE CARVES A THREAD INTO THE
WORKPIECE AS IT TURNS.

SCENE 4.

TH27A, SME4389, 21:05:36:00-21:05:44:00
solid die
TH27B, SME4389, 21:06:24:00-21:06:31:00
adjustable die
TH27C, SME4389, 21:08:20:00-21:08:32:00
adjustable die being adjusted

NARRATION (VO) :

DIES CAN BE SOLID, TO CUT SPECIFIC
DIAMETERS...,
OR ADJUSTABLE, SET TO VARIOUS DIAMETERS
WITH A SCREW.

--- TOUCH BLACK ---

SCENE 5.

TH28A, CGS: Thread Turning
TH28B, SME4391, 23:43:11:00-23:44:08:00
c.u. thread turning

NARRATION (VO) :

IN THREAD TURNING, A CUTTING TOOL MOVES
ALONG THE AXIS OF A ROTATING WORKPIECE,
CUTTING A HELIX. SEVERAL PASSES ON THE
LATHE ARE REQUIRED TO COMPLETE THE
THREAD. BY CHANGING ROTATION SPEED AND
LONGITUDINAL FEED, A WIDE VARIETY OF
THREAD SIZES, SHAPES, AND PITCH CAN BE
CREATED. THREAD SHAPE IS DETERMINED BY
TOOL SHAPE.

SCENE 6.

TH29A, SME2508, 10:14:34:00-10:14:48:00
thread turning
TH29B, SME2508, 10:23:45:00-10:25:04:00
thread turning, alternate shot

NARRATION (VO) :

THREAD TURNING CAN CREATE RIBBON CHIPS,
BUT THREADING INSERTS WITH A CHIP
CONTROL GROOVE BREAK THESE LONG CHIPS.

SCENE 7.

TH30A, SME2537, 01:17:51:00-01:17:59:00
thread turning operation
TH30B, SME4391, 23:01:05:00-23:01:17:00
zoom out, full profile insert
TH30C, still, partial profile insert
TH30D, SME4391, 23:38:03:00-23:38:10:00
zoom in, multi-tooth insert
TH30E, SME4413, 06:07:38:00-06:07:55:00
thread turning plastic bolt

NARRATION (VO) :

THERE ARE THREE PRIMARY TYPES OF
THREADING INSERTS...,
THE FULL PROFILE OR TOPPING INSERT...,
THE PARTIAL PROFILE OR NON-TOPPING
INSERT...,

AND THE MULTI-TOOTH INSERT.

SCENE 8.

TH31A, SME4391, 23:12:44:00-23:13:04:00

c.u. full profile insert, thread turning

TH31B, SME4391, 23:09:44:00-23:10:06:00

c.u. full profile insert, thread turning,
alternate shot

NARRATION (VO) :

A FULL PROFILE INSERT CUTS THE FULL
THREAD FORM -- THE ROOT, FLANK, AND
CREST -- TO REQUIRED SPECIFICATIONS --
BUT ONLY FOR ONE THREAD PITCH.

SCENE 9.

TH32A, SME4391, 23:36:26:00-23:37:38:00

c.u. partial profile insert, thread
turning

NARRATION (VO) :

THE PARTIAL PROFILE INSERT CAN BE USED
FOR DIFFERENT THREAD PITCHES. BUT IT
DOES NOT CUT THE CREST FLAT, THUS
REQUIRING A SECONDARY OPERATION.

SCENE 10.

TH33A, SME4391, 23:39:38:00-23:40:02:00

c.u., multi-toothed turning operation

NARRATION (VO) :

FOR MORE RAPID THREAD CUTTING, A MULTI-
TOOTHED TOOL IS AVAILABLE. THE TOOL IS A
INSERT WITH 3 TO 10 TEETH AT INCREMENTAL
DEPTHS. WHEN FED INTO THE WORKPIECE IT
PROGRESSIVELY CUTS AND FINISHES THE
THREAD.

SCENE 11.

TH34A, SME4391, 23:07:26:00-23:07:43:00

thread turning, freeze last frame if
necessary

TH34B, CGS: Radial Infeed
Flank Infeed
Alternating Flank
Modified Flank

NARRATION (VO) :

THERE ARE FOUR WAYS TO FEED A THREADING
TOOL TO THE ROTATING WORKPIECE,
INCLUDING:
RADIAL INFEEED,
FLANK INFEEED,
ALTERNATING FLANK,
AND MODIFIED FLANK.

SCENE 12.

TH35A, CGS: Radial Infeed
TH35B, ANI: radial infeed whole
TH35C, ANI: radial infeed 01
TH35D, ANI: radial infeed 02
TH35E, ANI: radial infeed 03
TH35F, ANI: radial infeed 04
TH35G, ANI: radial infeed 05
TH35H, ANI: radial infeed 06
TH35I, ANI: radial infeed 07
TH35J, ANI: radial infeed 08
TH35K, ANI: radial infeed finished

NARRATION (VO) :

RADIAL INFEEED IS THE MOST COMMON. THE
INSERT PROGRESSES PERPENDICULAR TO THE
CENTERLINE OF THE WORK AND BOTH FLANKS
CUT SIMULTANEOUSLY.

SCENE 13.

TH36A, CGS: Flank Infeed
TH36B, ANI: flank infeed whole
TH36C, ANI: flank infeed 01
TH36D, ANI: flank infeed 02
TH36E, ANI: flank infeed 03
TH36F, ANI: flank infeed 04
TH36G, ANI: flank infeed 05
TH36H, ANI: flank infeed 06
TH36I, ANI: flank infeed 07
TH36J, ANI: flank infeed 08
TH36K, ANI: flank infeed finished

NARRATION (VO) :

IN FLANK INFEEED, SUCCESSIVE PASSES ARE
MADE AT THE SAME FLANK ANGLE, WITH ONLY
THE LEADING EDGE IN THE CUT.

SCENE 14.

TH37A, CGS: Alternating Flank
TH37B, ANI: alternating flank whole
TH37C, ANI: alternating flank A 01
TH37D, ANI: alternating flank B 01
TH37E, ANI: alternating flank A 02
TH37F, ANI: alternating flank B 02
TH37G, ANI: alternating flank A 03
TH37H, ANI: alternating flank B 03
TH37I, ANI: alternating flank A 04
TH37J, ANI: alternating flank B 04
TH37K, ANI: alternating flank A 05
TH37L, ANI: alternating flank finished

NARRATION (VO) :

THE ALTERNATING FLANK METHOD MAY BE USED
FOR CUTTING LARGE, COARSE THREADS IN
WHICH THE INSERT CUTS WITH ONE FLANK AND
SWITCHES TO THE OPPOSITE FLANK ON THE
NEXT PASS.

SCENE 15.

TH38A, CGS: Modified Flank
TH38B, ANI: modified flank whole
TH38C, ANI: modified flank 01
TH38D, ANI: modified flank 02
TH38E, ANI: modified flank 03
TH38F, ANI: modified flank 04
TH38G, ANI: modified flank 05
TH38H, ANI: modified flank 06
TH38I, ANI: modified flank 07
TH38J, ANI: modified flank 08
TH38K, ANI: modified flank finished

NARRATION (VO) :

THE MODIFIED FLANK METHOD COMBINES THE
RADIAL AND FLANK IN-FEED APPROACHES
USING BOTH SIDES OF THE INSERT TO CUT.
THIS METHOD OFFERS THE BEST COMPROMISE
OF CHIP CONTROL, HEAT DISSIPATION, AND

SURFACE FINISH.

--- TOUCH BLACK ---

SCENE 16.

TH39A, CGS: Thread Chasing

TH39B, SME4384, 15:22:22:00-15:22:37:00
zoom out, chaser dies

TH39C, SME4384, 15:19:26:00-15:19:54:00
chasing operation

NARRATION (VO):

THREAD CHASING USES A DIE OR CUTTERS CALLED CHASERS THAT ARE MOUNTED IN HOLDERS ON A HEAD CARRIED BY A MACHINE TOOL SPINDLE. THREADS ARE CREATED BY FORCING CYLINDRICAL BLANKS INTO THESE ROTATING DIES.

SCENE 17.

TH40A, SME2610, 02:27:18:00-02:27:23:00
adjustable die

TH40B, SME2610, 02:27:32:00-02:27:36:00
adjustable die

TH40C, SME2610, 02:28:00:00-02:28:07:00
adjustable die

TH40D, SME4384, 15:20:50:00-15:21:32:00
zoom in, automatic chasing

NARRATION (VO):

THE CHASERS CAN BE SOLID, OR ADJUSTABLE FOR MANUAL THREADING..., OR AN OPEN DIE WHICH IS MORE SUITED TO AUTOMATIC THREADING. THIS DIE OPENS AFTER A PASS TO EJECT THE FINISHED PART AND RECEIVE THE NEXT WORKPIECE. THE CHASER DOES NOT HAVE TO BE BACKED OFF THE WORKPIECE, AS IS NECESSARY WITH A FIXED DIE.

SCENE 18.

TH41A, SME2610, 02:19:53:00-02:20:02:00
c.u., automatic chasing

TH41B, SME2610, 02:01:20:00-02:01:26:00
old chasers before removal

TH41C, SME2610, 02:05:45:00-02:05:56:00
new chasers after installation

NARRATION (VO):

CHASERS ARE MADE OF HIGH-SPEED STEEL, OR USE CARBIDE INSERTS AS THEIR CUTTING ELEMENTS. THEY CAN BE CHANGED TO VARIOUS PITCH DIAMETERS FOR A GIVEN THREAD SIZE.

--- TOUCH BLACK ---

SCENE 19.

TH42A, CGS: Thread Milling

TH42B, **SME4378**, **08:10:12:00-08:10:25:00**
internal thread milling operation

TH42C, **SME4391**, **23:32:41:00-23:32:53:00**
zoom in, multitooth thread milling tool

TH42D, **SME4391**, **23:28:21:00-23:28:42:00**
zoom in, internal thread milling

NARRATION (VO):

THREAD MILLING CAN BE DONE ON INTERNAL AND EXTERNAL SURFACES, WITH SOLID OR INDEXABLE INSERT-TYPE TOOLS. ON INTERNAL SURFACES, THREAD MILLING IS PREFERRED OVER TAPPING FOR HOLES LARGER THAN AN INCH AND A QUARTER, OR THIRTY MILLIMETERS.

SCENE 20.

TH43A, **SME4391**, **23:30:33:00-23:31:12:00**
thread milling operation

NARRATION (VO):

THREAD MILLING REQUIRES A MACHINE WITH THREE-AXIS CONTROL, CAPABLE OF HELICAL INTERPOLATION.

SCENE 21.

continue previous shot

NARRATION (VO):

THREAD MILLING COMBINES THREE MOTIONS: THE CIRCULAR ROTATION OF THE MILLING TOOL CARRYING THE THREAD PROFILE SHAPE ABOUT ITS OWN AXIS, THE ORBITING MOTION AROUND THE WORKPIECE, AND THE LONGITUDINAL MOTION OF THE TOOL.

--- TOUCH BLACK ---

SCENE 22.

TH45A, **SME2577**, **01:08:14:00-01:08:17:00**
external manual threading

TH45B, **SME2537**, **01:04:36:00-01:04:48:00**
external thread turning

TH45C, **SME2610**, **02:07:57:00-02:08:01:00**
chasing operation

TH45D, **SME4391**, **23:31:15:00-23:31:25:00**
zoom out, external thread milling

NARRATION (VO):

THE EXTERNAL THREAD CUTTING TECHNIQUES COVERED SO FAR WORK BEST WITH RELATIVELY SOFT METALS.

SCENE 23.

TH46A, CGS: Thread Grinding

TH46B, **SME2621**, 01:05:02:00-01:05:14:00
small part, thread grinding

TH46C, **SME2621**, 01:08:38:00-01:08:50:00
large part, thread grinding

TH46D, **SME2621**, 01:12:33:00-01:12:41:00
internally threaded part

NARRATION (VO):

FOR HARD MATERIALS, OR WHERE HIGH
PRECISION IS ESSENTIAL, THREADS CAN BE
GROUND. THIS IS A MORE COSTLY TECHNIQUE
REQUIRING SPECIALIZED EQUIPMENT AND
GRINDING WHEELS. THREAD GRINDING CAN BE
USED FOR BOTH EXTERNAL...,
AND INTERNAL THREADS.

--- TOUCH BLACK ---

SCENE 24.

TH47A, **SME4391**, 23:15:50:00-23:16:12:00
external thread turning with cutting
fluids

TH47B, **SME2632**, 02:05:16:00-02:05:30:00
cutting fluid in threading operation

TH47C, **SME2631**, 01:23:39:00-01:23:52:00
cutting fluid in threading operation

TH47D, **SME4384**, 15:15:03:00-15:15:20:00
fluid used in threading chasing operation

TH47E, **SME2621**, 01:02:45:00-01:03:08:00
cutting fluid in thread grinding operation

NARRATION (VO):

IN ALL THREAD-CUTTING OPERATIONS,
CUTTING FLUIDS ARE IMPORTANT FOR COOLING
THE WORK AREA, FLUSHING AWAY CHIPS, AND
MAINTAINING LUBRICITY BETWEEN THE
CUTTING OR FORMING TOOLS AND THE
WORKPIECE. AN EXCEPTION TO THIS RULE ARE
CAST IRON PARTS, WHICH ARE USUALLY CUT
DRY.

--- TOUCH BLACK ---

SCENE 25.

TH48A, CGS: Thread Rolling

TH48B, **SME2575**, 01:08:15:00-01:08:29:00
thread rolling operation

NARRATION (VO):

THREAD ROLLING IS USED CHIEFLY TO MAKE
EXTERNALLY THREADED COMMERCIAL FASTENERS
IN HIGH VOLUMES.

SCENE 26.

continue previous shot

TH49A, **SME2575**, 01:23:05:00-01:23:20:00
c.u. die plates

TH49B, **SME4390**, 22:05:41:00-22:06:05:00

NARRATION (VO):

THREAD ROLLING IS A COLD-FORMING PROCESS

zoom in, roll forming operation
TH49C, SME2575, 01:24:26:00-01:24:45:00
roll forming operation
TH49D, SME2612, 03:04:52:00-03:06:13:00
zoom in, roll forming operation

THAT USES TWO FLAT DIES, CALLED PLATES,
OR TWO OR MORE AXIALLY PLACED DIE
ROLLERS TO FORM A THREAD ON A WORKPIECE
BLANK. THE THREAD-SHAPED DIE SURFACES
FORCE A THREAD CONFIGURATION ONTO THE
WORKPIECE SURFACE. THREAD ROLLING
PRODUCES A STRONGER THREAD THAN THE
THREAD CUTTING PROCESS BECAUSE THE METAL
IS COLD-WORKED AS IT IS DISPLACED OR
REARRANGED.

SCENE 27.

TH50A, SME2575, 01:15:52:00-01:16:09:00
threads rolling out of machine, tilt to
fasteners in bin
TH50B, SME3100, 05:22:16:00-05:22:28:00
stress relieving operation on fasteners

NARRATION (VO) :

THREAD ROLLING IS DONE AT ROOM
TEMPERATURE ON SOFTER MATERIALS SUCH AS
ALUMINUM OR LOW-CARBON STEELS. HARDER
METALS MUST BE HEATED PRIOR TO THREAD
ROLLING TO PROMOTE METAL FLOW. AFTER
ROLLING, PARTS MAY BE HEAT-TREATED TO
CHANGE THEIR MECHANICAL PROPERTIES.

SCENE 28.

TH51A, SME2575, 01:10:28:00-01:10:53:00
blanks being fed between plates, slow
motion
**TH51B, CGS: Blanks Fed Manually to Show
Process**

NARRATION (VO) :

THE FLAT-PLATE TECHNIQUE REQUIRES THE
PLATES BE POSITIONED A FIXED DISTANCE
APART, WHICH ESTABLISHES THE FASTENER'S
MINOR DIAMETER. BLANKS ARE FED BETWEEN
THE PLATES AS THEY MOVE RELATIVE TO EACH
OTHER. THE BLANK IS USUALLY TURNED FROM
5 TO 10 REVOLUTIONS TO COMPLETE THE
THREAD.

SCENE 29.

TH52A, SME2575, 01:10:56:00-01:11:04:00
flat plate rolling on reciprocating die
machine

NARRATION (VO) :

FLAT-PLATE THREAD ROLLING IS DONE ON A
RECIPROCATING DIE MACHINE.

SCENE 30.

TH53A, SME2612, 03:03:08:00-03:03:21:00
cylindrical thread rolling workpiece

NARRATION (VO) :

RADIAL OR CYLINDRICAL DIE ROLLING
MACHINES ARE CAPABLE OF GENERATING
THREADS ON LARGER DIAMETER WORKPIECES
THAN WITH FLAT PLATE ROLLING.

SCENE 31.

TH54A, SME4384, 15:37:36:00-15:38:02:00
zoom in, cylindrical rolling operation

NARRATION (VO) :

IN CYLINDRICAL THREAD ROLLING, THREADS
ARE PRODUCED BY AN IN-FEED PROCESS. TWO
OR THREE CIRCULAR DIES ARE FED AGAINST A
WORKPIECE, FORMING THE DESIRED THREAD.

SCENE 32.

continue previous shot

NARRATION (VO) :

MACHINES USING TWO DIES FOR RADIAL
THREAD ROLLING CAN APPLY GREATER
PRESSURE TO THE WORKPIECE THAN THREE-DIE
MACHINES, SINCE THEY CAN USE LARGE
DIAMETER DIES REGARDLESS OF WORK
DIAMETER.

SCENE 33.

TH56A, SME2629, 02:01:44:00-02:01:53:00
rolling attachment on lathe
TH56B, SME2629, 02:13:46:00-02:13:56:00
rolling operation on lathe
TH56C, SME2629, 02:11:26:00-02:11:44:00
attachment contacting workpiece
TH56D, SME2629, 02:12:27:00-02:12:42:00
attachment retracting
TH56E, SME2629, 02:13:24:00-02:13:35:00
small rolling attachment

NARRATION (VO) :

THREAD ROLLING ATTACHMENTS CARRYING ONE
OR MORE CIRCULAR THREAD DIES ARE ALSO
AVAILABLE FOR MOUNTING ON MACHINE TOOLS,
USUALLY LATHES. IN OPERATION, THE
ATTACHMENT EASES INTO THE ROTATING

WORKPIECE TO FORM THE THREAD. ONCE THE
THREAD IS COMPLETELY FORMED, THE
ATTACHMENT RETRACTS. BECAUSE THE
WORKPIECE IS UNSUPPORTED, THIS TECHNIQUE
IS LIMITED TO SHORT OR VERY STIFF
WORKPIECES.

--- FADE TO BLACK ---