FUNDAMENTAL MANUFACTURING PROCESSES

Threading

SCENE 1.
FMP01A, CGS: FBI warning
text centered on black to transparent gradient
FMP BKG, motion background

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SCENE 2.
continue motion background
FMP02A, CGS: DRL screen
text centered on black to transparent gradient

SCENE 3.
continue motion background
FMP03A, CGS: disclaimer
white text, centered on background

Always read the operating manual and safety information provided by the manufacturer before operating any manufacturing equipment.
Make sure all machine guards are in place, and follow all safety procedures when working with or near manufacturing equipment.

SCENE 4.
FMP SME, SME logo open, with music

SCENE 5.
FMP05A, FMP open, with music
TH05B, edited peter carey narration

MUSIC UP AND UNDER

NARRATION (VO):

THE FUNDAMENTAL MANUFACTURING PROCESSES VIDEO SERIES, EXAMINING THE TOOLS AND TECHNIQUES OF PRECISION MANUFACTURING.

SCENE 6.
continue FMP open
TH06A, CGS: Threading

NARRATION (VO):

white text, centered on background
FMP06B, blue background
FMP06C, sound slug

THIS PROGRAM EXPLORES THE BASICS OF THREADING.

SCENE 7.
TH07A, SME2578, 03:12:27:00-03:12:37:00
screw thread
TH07B, SME4389, 21:05:04:00-21:05:16:00
zoom out, lead screw turning
TH07C, SME3330, 08:04:48:00-08:05:58:00
screws used in assembly operation
TH07D, SME3928, 23:04:09:00-23:04:27:00
mechanical fasteners tightening composite assembly together, alternate shot

NARRATION (VO):

THE HELICAL THREAD OR SCREW FORM, AS USED IN MANUFACTURING, HAS TWO PRIMARY FUNCTIONS:
TO TRANSMIT POWER AND MOTION, AS WITH A LEAD SCREW THAT MOVES A MACHINE TABLE.
AND TO ATTACH AND SECURE PARTS TOGETHER, AS IN THREADED FASTENERS SUCH AS NUTS, SCREWS, AND BOLTS.

SCENE 8.
TH08A, SME2575, 01:15:22:00-01:15:30:00
pile of fasteners
TH08B, SME2520, 04:01:28:00-04:01:44:00
zoom out, watch works
TH08C, SME4385, 16:24:20:00-16:24:35:00
zoom out, mackinac bridge
TH08D, SME4385, 16:14:22:00-16:14:36:00
zoom out, mackinac bridge, alternate shot

NARRATION (VO):

MOST THREAD-MAKING IS PERFORMED BY FASTENER MANUFACTURERS. THESE FASTENERS CAN RANGE IN SIZE FROM TINY WRISTWATCH SCREWS, TO IMMENSE NUTS AND BOLTS THAT SUPPORT BRIDGES.

SCENE 9.
TH09A, zoom in, still of external threads
TH09B, zoom out, still of internal threads
TH09C, ANI: bolt edge
TH09D, ANI: bolt edge, crest lines
TH09E, ANI: bolt edge, groove lines too
TH09F, CGS: Outer Crest
TH09G, CGS: Inner Groove
TH09H, ANI: nut edge
TH09I, ANI: nut edge, crest lines
TH09J, ANI: nut edge, groove lines too
TH09K, CGS: Inner Crest
TH09L, CGS: Outer Groove
TH09M, alternate, still, external threads

NARRATION (VO):

THE TWO FUNDAMENTAL TYPES OF THREADS ARE THE EXTERNAL THREAD...,
AND THE INTERNAL THREAD.
THE EXTERNAL THREAD FORM HAS OUTER CRESTS AND INNER GROOVES TO MATCH AN INTERNAL THREAD'S INNER CREST AND OUTER GROOVES.

SCENE 10.
TH10A, SME3331, 12:20:40:00-12:20:55:00
tightening threaded fasteners manually and

NARRATION (VO):

with wrench
TH10B, SME3423, 17:15:40:00-17:15:52:00
bolts being tightened, alternate shot
TH10C, SME3423, 17:14:03:00-17:14:11:00
c.u. bolt being tightened, alternate shot
TH10D, SME4390, 23:04:27:00-23:04:39:00
zoom out, gas line hookup
TH10E, SME4413, 07:01:18:00-07:01:30:00
zoom out, gas line hookup

MOST THREADS ARE RIGHT-HANDED, AND ADVANCE WHEN ROTATED CLOCKWISE. LEFT-HANDED THREADS ARE ALSO MANUFACTURED FOR SPECIFIC APPLICATIONS, SUCH AS GAS-LINE CONNECTIONS.

SCENE 11.
TH11A, SME2575, 01:02:15:00-01:02:41:00
zoom out, threaded fastener production
TH11B, CGS: Major Diameter
Minimum Diameter
Thread Pitch
Thread Pitch Diameter

NARRATION (VO):

BOTH STANDARD AND METRIC THREADS ARE DEFINED BY SEVERAL DIMENSIONS. THOSE DIMENSIONS INCLUDE:

THE THREAD'S MAJOR DIAMETER...,

THE THREAD'S MINIMUM DIAMETER...,

THE THREAD PITCH...,

AND THE THREAD PITCH DIAMETER.

SCENE 12.
TH12A, CGS: Major Diameter
TH12B, ANI: bolt
TH12C, ANI: bolt, major diameter lines
TH12D, ANI: bolt, arrow and lines
TH12E, ANI: nut
TH12F, ANI: nut, major diameter lines
TH12G, ANI: nut, arrow and lines

NARRATION (VO):

THE THREAD'S MAJOR DIAMETER IS THE OUTSIDE CREST DIAMETER ON AN EXTERNAL THREAD...,

OR THE BASE OR ROOT DIAMETER ON AN INTERNAL THREAD.

SCENE 13.
TH13A, CGS: Minimum/Minor Diameter
TH13B, ANI: bolt
TH13C, ANI: bolt, minor diameter lines
TH13D, ANI: bolt, arrow and lines
TH13E, ANI: nut
TH13F, ANI: nut, minor diameter lines
TH13G, ANI: nut, arrow and lines

NARRATION (VO):

THE THREAD'S MINIMUM OR MINOR DIAMETER, IS THE SCREW DIAMETER AT THE BASE OF THE THREAD FOR AN EXTERNAL THREAD...,

AND THE THREAD CREST DIAMETER ON AN INTERNAL THREAD.

SCENE 14.
TH14A, CGS: Thread Pitch
TH14B, ANI: bolt edge

NARRATION (VO):

TH14C, ANI: bolt edge, thread pitch lines
TH14D, ANI: bolt edge, arrow and lines
TH14E, ANI: bolt
TH14F, ANI: bolt, thread pitch lines
TH14G, ANI: bolt, arrow and lines
TH14H, ANI: bolt, arrow, lines, text

THE THREAD'S PITCH IS THE DISTANCE BETWEEN TWO ADJACENT THREAD CRESTS. THREADS PER INCH IS THE NUMBER OF ADJACENT THREAD CRESTS IN ONE INCH.

SCENE 15.
TH15A, CGS: Thread Pitch Diameter
TH15B, ANI: nut edge
TH15C, ANI: nut edge with pitch diameter
TH15D, ANI: bolt/nut
TH15E, ANI: bolt/nut with pitch diameter

NARRATION (VO):

THE THREAD PITCH DIAMETER IS AN IMAGINARY DIAMETER THROUGH THE THREADS WHERE THE WIDTH OF THE GROOVE AND THREAD ARE EQUAL. BECAUSE IT IS THE DIMENSION FROM WHICH ALL OTHER THREAD MEASUREMENTS ARE MADE, THE THREAD PITCH DIAMETER IS THE MOST IMPORTANT DIMENSION ON A SCREW THREAD.

SCENE 16.
TH16A, CGS: Percent of Thread
TH16B, ANI: 70% & 100% screw threads
TH16C, ANI: c.u. 100% thread
TH16D, ANI: c.u. 70% thread

NARRATION (VO):

ANOTHER THREAD FEATURE IS THE PERCENT OF THREAD, OR THE ACTUAL MINIMUM DIAMETER OF THE THREAD. FOR EXAMPLE, A THREAD CUT TO FULL DEPTH IS A 100% THREAD. MOST THREADS ARE CUT TO LESS THAN 100% TO RETAIN STRENGTH, AVOID CRACKING, AND SIMPLIFY THE CUTTING OPERATION.

SCENE 17.
TH17A, ANI: bolt edge
TH17B, ANI: bolt edge, thread angle
TH17C, ANI: bolt edge, thread angle/arrow
TH17D, ANI: thread angle/arrow/60° text
TH17E, SME4389, 21:02:19:00-21:02:29:00 lead screw moving table
TH17F, SME4389, 21:01:48:00-21:02:01:00 zoom out leadscrew, square configuration

NARRATION (VO):

THE MOST WIDELY USED FASTENER THREAD ANGLE IS 60 DEGREES. BUT THERE ARE MANY THREAD CONFIGURATIONS TO FILL VARIOUS DESIGN NEEDS. ONE EXAMPLE WOULD BE THREADS USED FOR POWER TRANSMISSION.

THESE THREADS ARE CLOSER TO A SQUARE CONFIGURATION, ALLOWING THE THREAD TO TRANSMIT GREATER THRUST.

SCENE 18.
TH18A, CGS: Screw Lead
TH18B, SME2633, 01:09:09:00-01:09:25:00
c.u. fastener being driven

NARRATION (VO):

THE SCREW LEAD IS THE DISTANCE A FASTENER TRAVELS IN ONE REVOLUTION AND VARIES WITH THE FASTENER'S USE. MOST FASTENERS ARE SINGLE-LEAD, MEANING ONE FASTENER REVOLUTION ADVANCES THE FASTENER ONE THREAD PITCH.

SCENE 19.
SCENE DELETED

SCENE 20.
TH20A, SME2575, 01:18:23:00-01:18:42:00
tilt, fasteners piling up in bins
TH20B, ANI: split screen, coarse & fine thread shape
TH20C, CGS: Coarse
TH20D, CGS: Fine

NARRATION (VO):

THE SHAPE OF A THREAD IS DEFINED BY TYPE AND END USE. THE TWO BROADEST THREAD SHAPE DESIGNATIONS ARE COARSE AND FINE.

SCENE 21.
TH21A, SME2633, 02:05:35:00-02:05:54:00
pan, fine thread shape
TH21B, SME3928, 23:19:37:00-23:20:04:00
assemble using fine threaded bolts
TH21C, SME3331, 12:06:19:00-12:06:29:00
assemble using fine threaded bolts

NARRATION (VO):

FINE-THREAD FASTENERS HAVE MORE THREADS PER UNIT LENGTH THAN COARSE THREADS, AND GENERALLY HAVE MORE HOLDING POWER. FINE-THREAD FASTENERS ARE ALSO MORE RESISTANT TO VIBRATION.

SCENE 22.
TH22A, SME2633, 02:06:08:00-02:06:19:00
pan, coarse thread shape
TH22B, SME3330, 08:06:50:00-08:07:15:00
cone-point screws being used in assembly operation

NARRATION (VO):

COARSE-THREAD FASTENERS RESIST THREAD STRIPPING, AND CAN BE MADE FASTER AND CHEAPER. MOST AUTOMATIC ASSEMBLY USES

COARSE FASTENERS.

SCENE 23.
TH23A, SME4390, 22:28:12:00-22:28:49:00
various gaging of threaded fastener
TH23B, CGS: Thread Tolerance
The Amount a Thread Dimension is Allowed to Vary
TH23C, CGS: Thread Allowance
The Amount of Play Allowed Between External & Internal Threads
TH23D, SME2575, 01:12:23:00-01:12:49:00
tilt, fasteners piling up in bins, alternate shot

NARRATION (VO):

THREADED FASTENERS ALSO HAVE SPECIFICATIONS FOR TOLERANCES, WHICH INDICATE THE AMOUNT A THREAD DIMENSION IS ALLOWED TO VARY...,
AND ALLOWANCES, WHICH IS THE AMOUNT OF SPACE OR PLAY ALLOWED BETWEEN THE EXTERNAL AND INTERNAL THREADS.

--- FADE TO BLACK ---

SCENE 24.
TH24A, CGS: External Threads
white text, centered on background
FMP BKG, motion background

SCENE 25.
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 26.
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 27.
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 28.
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 29.
TH29A, SME2508, 10:14:34:00-10:14:48:00
thread turning

NARRATION (VO):

TH29B, SME2508, 10:23:45:00-10:25:04:00
thread turning, alternate shot

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

SCENE 30.
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 31.
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 32.
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 33.
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 34.
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 INFEED,

FLANK INFEED,

ALTERNATING FLANK,

AND MODIFIED FLANK.

SCENE 35.
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 INFEED IS THE MOST COMMON. THE INSERT PROGRESSES PERPENDICULAR TO THE CENTERLINE OF THE WORK AND BOTH FLANKS CUT SIMULTANEOUSLY.

SCENE 36.
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 INFEED, SUCCESSIVE PASSES ARE MADE AT THE SAME FLANK ANGLE, WITH ONLY THE LEADING EDGE IN THE CUT.

SCENE 37.
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

NARRATION (VO):

THE ALTERNATING FLANK METHOD MAY BE USED FOR CUTTING LARGE, COARSE THREADS IN WHICH THE INSERT CUTS WITH ONE FLANK AND

TH37I, ANI: alternating flank A 04
TH37J, ANI: alternating flank B 04
TH37K, ANI: alternating flank A 05
TH37L, ANI: alternating flank finished

SWITCHES TO THE OPPOSITE FLANK ON THE NEXT PASS.

SCENE 38.
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 39.
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 40.
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 41.
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 42.
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 43.
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 44.
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 45.
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 46.
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 47.
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 48.
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 49.
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
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

NARRATION (VO):

THREAD ROLLING IS A COLD-FORMING PROCESS 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 50.
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 51.
TH51A, SME2575, 01:10:28:00-01:10:53:00
blanks being fed between plates, slow motion
TH51B, CGS: Blanks Fed Manually to Show

NARRATION (VO):

THE FLAT-PLATE TECHNIQUE REQUIRES THE

Process

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 52.
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 53.
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 54.
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 55.
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 56.
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 ---

SCENE 57.
TH57A, CGS: Internal Threads
white text, centered on background
FMP BKG, motion background

SCENE 58.
TH58A, SME2575, 01:26:04:00-01:26:18:00
zoom out finished internal thread rolled parts

NARRATION (VO):

TO CREATE INTERNAL THREADS, IT IS POSSIBLE TO INTERNALLY THREAD ROLL A WORKPIECE. HOWEVER, THE METAL MUST BE FAIRLY SOFT AND THE WORKPIECE'S WALL MUST BE THICK ENOUGH TO RECEIVE THE THREAD.

SCENE 59.
TH59A, SME4391, 23:20:06:00-23:20:32:00
thread turning operation
TH59B, SME4384, 15:36:34:00-15:37:20:00
thread turning operation

NARRATION (VO):

INTERNAL THREADS CAN ALSO BE GENERATED

TH59C, SME4351, 03:44:23:00-03:44:41:00
thread turning operation, alternate shot

BY TURNING, USING A THREADING INSERT HELD IN A BORING BAR. BECAUSE THE CUTTING TOOL IS LONG, STABILITY AND TOOL DEFLECTION ARE IMPORTANT ISSUES TO ADDRESS.

SCENE 60.
TH60A, SME4384, 15:29:37:00-15:30:01:00
zoom in, large tapping operation
TH60B, CGS: Tapping

NARRATION (VO):

BUT BY FAR THE MOST TYPICAL PROCESS FOR GENERATING INTERNAL THREADS IS TO CUT THEM WITH A TAP. A TAP HAS A PROGRESSION OF SHARP THREAD-CUTTING SECTIONS ON ITS PERIPHERY.

SCENE 61.
TH61A, SME4367, 19:18:36:00-19:18:45:00
zoom out, tapping operation
TH61B, SME4389, 21:24:48:00-21:24:59:00
drilling hole
TH61C, SME4389, 21:26:49:00-21:27:10:00
zoom out, manually tapping hole

NARRATION (VO):

THE TAPPING OPERATION IS USUALLY A PROCESS OF TWO OR MORE STEPS. FIRST, A HOLE IS DRILLED INTO THE WORKPIECE WITH SLIGHTLY SMALLER DIAMETER THAN THE FINAL THREADED HOLE. THEN A ROTATING TAP IS DRIVEN INTO THE HOLE TO CUT A THREAD SHAPE INTO THE HOLE'S WALL AS THE TAP MOVES AXIALLY.

SCENE 62.
TH62A, SME4389, 21:28:29:00-21:28:41:00
tilt, square base of tap

NARRATION (VO):

BECAUSE TAPPING REQUIRES HIGH TORQUE, TAPS USUALLY HAVE A SQUARE BASE THAT CAN BE SECURELY GRIPPED.

SCENE 63.
TH63A, SME2631, 01:21:53:00-01:22:00:00
tap entering hole
TH63B, SME4389, 21:14:54:00-21:15:02:00
zoom out, split sleeve driver, compressing

NARRATION (VO):

THERE ARE THREE GENERAL TYPES OF TAP

tap tightly
TH63C, SME2577, 01:20:15:00-01:20:20:00
tap inserted into collet
TH63D, SME2631, 01:27:26:00-01:27:36:00
collet holder, holding tap

HOLDERS. THE MOST COMMON IS THE SPLIT-SLEEVE DRIVER, WHICH COMPRESSES TO HOLD THE TAP TIGHTLY. THERE ARE ALSO CONVENTIONAL COLLETS...,
AND COLLET HOLDERS WHICH ARE USED WITH THE COLLET, AND SPECIALLY SIZED TO THE TAP.

SCENE 64.
TH64A, SME4384, 15:26:29:00-15:27:12:00
zoom out, solid tap operation

NARRATION (VO):
SOLID TAPS ARE THE MOST COMMONLY USED TAPS. THEY CAN RANGE IN DIAMETER FROM ABOUT FIFTY THOUSANDTHS OF AN INCH OR ONE MILLIMETER, TO ABOUT TWO INCHES OR FIFTY MILLIMETERS.

SCENE 65.
TH65A, SME4388, 20:05:11:00-20:05:20:00
small tap, tapping multiple holes
TH65B, SME2577, 01:22:07:00-01:22:12:00
tap with steep chamfer, freeze last frame
TH65C, SME2577, 01:22:53:00-01:23:03:00
tap with no chamfer

NARRATION (VO):
THE MAIN DIFFERENCE AMONG TAPS IS THE AMOUNT OF CHAMFER AT THE CUTTING END. THE STEEPER THE CHAMFER, THE MORE GRADUAL THE CUTTING ACTION. THE LESS CHAMFER, THE GREATER THE CUTTING POWER.

SCENE 66.
TH66A, SME4388, 20:26:33:00-20:26:54:00
tapping on multiple holes

NARRATION (VO):
AS A RULE, THE LONGEST POSSIBLE CHAMFER ALLOWS THE BEST CUTTING EFFICIENCY, TAP LIFE, AND SIZE CONTROL.

SCENE 67.
TH67A, SME4393, 02:04:32:00-02:05:00:00
tapping operation on multiple holes
TH67B, CGS: Taper Tap
Plug Tap
Bottoming Tap

NARRATION (VO):
THREE COMMONLY USED SOLID TAP FORMS ARE:
THE TAPER TAP,

THE PLUG TAP,

AND THE BOTTOMING TAP.

SCENE 68.
TH68A, CGS: Taper Tap
TH68B, SME2652, 00:03:08:00-00:03:21:00
taper tap starting thread

NARRATION (VO):

THE TAPER TAP HAS THE GREATEST CHAMFER

AND DOES THE LEAST CUTTING OF THE THREE.

IT IS USED TO START THE THREADING.

SCENE 69.
TH69A, CGS: Plug Tap
TH69B, SME2577, 01:19:51:00-01:20:01:00
plug tap, tapping hole

NARRATION (VO):

THE PLUG TAP HAS AN INTERMEDIATE CHAMFER

AND IS A GENERAL PURPOSE TAP.

SCENE 70.
TH70A, CGS: Bottoming Tap
TH70B, SME2577, 01:23:16:00-01:23:26:00
bottoming tap finishing hole

NARRATION (VO):

THE BOTTOMING TAP HAS THE LEAST CHAMFER

AND IS USED FOR FINISHING OPERATIONS.

SCENE 71.
TH71A, SME2632, 02:06:54:00-02:07:06:00
tapping operation
TH71B, SME2632, 02:13:12:00-02:13:32:00
zoom out, tapping operation, alternate shot
TH71C, SME2652, 00:01:52:00-00:02:00:00
two flute tap
TH71D, SME2652, 00:01:30:00-00:01:38:00
four flute tap

NARRATION (VO):

TAPS HAVE FLUTES OR CHANNELS THAT CREATE

CUTTING EDGES. THESE FLUTES ALLOW CHIPS

OUT OF THE HOLE AND CUTTING FLUID IN.

TAPS USUALLY HAVE TWO...,

THREE...,

OR FOUR FLUTES.

SCENE 72.
TH72A, SME2652, 00:03:53:00-00:04:06:00
four flute tap threading
TH72B, SME2652, 00:03:25:00-00:03:40:00
two flute tap threading

NARRATION (VO):

A FOUR-FLUTE TAP CUTS BETTER AND

SMOOTHER BECAUSE IT HAS MORE CUTTING

EDGES. TWO- AND THREE-FLUTE TAPS HAVE

MORE SPACE FOR CHIPS, AND ARE STRONGER.

SCENE 73.
TH73A, still, straight flute tap
TH73B, still, spiral flute tap

NARRATION (VO):

TAPS MAY HAVE STRAIGHT...,

OR SPIRAL FLUTES.

SCENE 74.
TH74A, SME4389, 21:22:08:00-21:22:28:00
zoom out, straight tap producing chips

NARRATION (VO):

STANDARD STRAIGHT-FLUTE TAPS TEND TO PRODUCE SMALL CHIPS. ORDINARILY THIS IS NOT A PROBLEM, BUT IN A BLIND HOLE THESE CHIPS TEND TO COLLECT AT THE BOTTOM OF THE HOLE, OR CLOG THE FLUTES.

SCENE 75.
TH75A, SME2577, 01:03:48:00-01:04:00:00
manual spiral tapping operation

NARRATION (VO):

SPIRAL-FLUTE TAPS PULL LONGER CHIPS UP AND OUT OF THE HOLE, MAKING THEM PARTICULARLY USEFUL IN TAPPING BLIND HOLES.

SCENE 76.
TH76A, SME4393, 02:06:10:00-02:06:58:00
zoom out, tapping operation on multiple holes

NARRATION (VO):

MOST TAPS ARE MADE FROM HIGH-SPEED STEEL, BUT CARBIDE OR CARBON STEEL IS SOMETIMES USED. SOLID CARBIDE TAPS CUT FASTER AND CLEANER, AND LAST LONGER.

SCENE 77.
TH77A, SME4091, 07:26:28:00-07:26:46:00
tapping operation on multiple holes

NARRATION (VO):

TAPS ARE DESIGNED CHIEFLY TO CUT STEEL, BUT THERE ARE SPECIAL TAPS FOR WORKING WITH ALUMINUM, NICKEL ALLOYS, AND CAST IRON.

--- TOUCH BLACK ---

SCENE 78.
TH78A, SME4372, 02:15:14:00-02:15:26:00
tapping operation

NARRATION (VO):

HOW MUCH A TAP CUTS PER REVOLUTION DEPENDS ON THE ANGLE AT WHICH THE CUTTING TOOTH ON THE DIE CONTACTS THE WORKPIECE.

SCENE 79.
TH79A, CGS: Rake/Hook Angle
TH79B, ANI: tap
TH79C, ANI: tap, rake angle
TH79D, ANI: tap, rake angle, center line
TH79E, CGS: Negative Rake
TH79F, ANI: negative tap
TH79G, ANI: negative tap, rake lines
TH79H, CGS: Zero Rake
TH79I, ANI: zero tap
TH79J, ANI: zero tap, rake lines
TH79K, CGS: Positive Rake
TH79L, ANI: positive tap
TH79M, ANI: positive tap, rake lines

NARRATION (VO):

THIS ANGLE IS CALLED THE RAKE OR HOOK ANGLE, AND IS DEFINED AS THE ANGLE BETWEEN A LINE THROUGH THE CUTTING FACE AND A RADIAL LINE FROM THE TOOL CENTER TO THE TOOTH TIP. GENERALLY, THE MORE DUCTILE THE MATERIALS, THE GREATER THE RAKE ANGLE, BECAUSE THE DIE TOOTH CAN TAKE A BIGGER BITE OUT OF SOFTER MATERIALS.

SCENE 80.
TH80A, SME4372, 02:35:44:00-02:36:02:00
tapping operation on two holes
TH80B, SME2577, 01:23:59:00-01:24:08:00
tapping too fast, tool breakage
TH80C, SME2632, 02:09:32:00-02:09:44:00
tapping with lubrication
TH80D, SME4111, 02:33:16:00-02:33:34:00
tapping multiple holes with lubrication, alternate shot

NARRATION (VO):

TAPPING SPEED IS CRITICAL IN DETERMINING HOW A TAP CUTS, BECAUSE IT AFFECTS THREAD QUALITY AND TAP LIFE. TOO MUCH SPEED CAUSES THE TAP TO BECOME DULL OR BREAK, OR TEARS UP THE METAL. HIGH-SPEED TAPPING ALSO MAKES IT DIFFICULT TO ACHIEVE GOOD LUBRICATION AND CHIP REMOVAL.

SCENE 81.
TH81A, SME4388, 20:04:15:00-20:04:38:00
forming tap used on multiple holes
TH81B, zoom out, still, thread forming tap
TH81C, SME4388, 20:01:58:00-20:02:09:00
zoom out, forming tap used on multiple holes
TH81D, SME2632, 02:14:28:00-02:14:44:00

NARRATION (VO):

FOR SOFTER METALS, OR WHERE IT IS IMPORTANT NOT TO MAKE CHIPS, THREAD FORMING TAPS OR ROLL TAPS MAY BE USED.

thread forming tap operation, alternate shot

ROLL TAPS HAVE NO CUTTING EDGES OR FLUTES. THEY GENERATE MORE FRICTIONAL HEAT THAN STANDARD TAPS, BECAUSE THEY FORM RATHER THAN CUT THE THREAD.

--- TOUCH BLACK ---

SCENE 82.
TH82A, SME4389, 21:22:30:00-21:22:40:00
manual tapping
TH82B, SME4389, 21:20:13:00-21:20:28:00
hole being drilled
TH82C, SME4389, 21:30:53:00-21:31:03:00
zoom out, placing tap in tap wrench
TH82D, SME4389, 21:21:50:00-21:22:14:00
tapping operation on hole

NARRATION (VO):

TAPPING IS DONE MANUALLY FOR LOW-VOLUME PRODUCTION. MANUAL TAPPING INVOLVES DRILLING A HOLE...,
PUTTING A TAP IN A TAP WRENCH...,
AND MANUALLY THREADING THE HOLE.

SCENE 83.
TH83A, SME4386, 19:02:27:00-19:02:45:00
zoom out, flexible arm used to tap part

NARRATION (VO):

IN AN OPERATION WHERE PRECISION TAP POSITIONING IS NOT CRITICAL, IT MAY BE PRACTICAL TO MANUALLY PLACE THE TAPPING TOOL IN THE HOLE. IN THESE CASES, FLEXIBLE ARMS CAN BE USED.

SCENE 84.
TH84A, SME2632, 02:01:38:00-02:01:47:00
dedicated machine tool tapping
TH84B, SME4387, 19:12:28:00-19:12:34:00
tapping on lathe
TH84C, SME4308, 08:10:12:00-08:10:27:00
zoom in, tapping on mill
TH84D, SME4388, 20:03:28:00-20:03:36:00
zoom in, tapping on machining center
TH84E, still, drill & tap machine
TH84F, tapping with drill & tap machine
TH84G, SME4393, 03:21:42:00-03:22:11:00
zoom out, multi-spindle tapping operation

NARRATION (VO):

FOR HIGHER VOLUMES, TAPPING IS MOST COMMONLY ACCOMPLISHED USING DEDICATED TAPPING MACHINE TOOLS...,
LATHES...,
MILLS...,
MACHINING CENTERS...,
DRILL AND TAP MACHINES...,
OR SPECIALIZED MULTI-SPINDLE TAPPING

MACHINES.

--- TOUCH BLACK ---

SCENE 85.
TH85A, SME4372, 02:16:27:00-02:16:39:00
tapping operation

NARRATION (VO):

FOR ACCURATELY POSITIONING AND PROPERLY DRIVING TAPS, THREE TECHNIQUES ARE USED IN TAPPING OPERATIONS.

SCENE 86.
TH86A, SME2632, 02:02:28:00-02:02:48:00
floating head tap, tapping

NARRATION (VO):

THE FIRST TECHNIQUE USES A TAP HOLDER THAT CAN ACCOMMODATE BOTH MISALIGNMENT AND DIFFERENCES IN TENSION AND COMPRESSION BETWEEN THE TAP AND SPINDLE. THIS IS CALLED A FLOATING HEAD.

SCENE 87.
TH87A, SME2632, 02:06:29:00-02:06:45:00
rigid/synchronous tap driving operation
TH87B, SME4352, 04:40:09:00-04:40:49:00
zoom out, rigid/synchronous tap driving operation on multiple holes, alternate shot

NARRATION (VO):

THE SECOND REQUIRES THE ABILITY TO PROGRAM THE SPINDLE DRIVE SO THAT THE TORQUE DELIVERED TO THE TAP IS EXACTLY WHAT IS NEEDED. THIS IS CALLED RIGID OR SYNCHRONOUS TAP DRIVING.

SCENE 88.
TH88A, SME4387, 19:09:56:00-19:10:18:00
zoom in, tapping head operation

NARRATION (VO):

THE THIRD TECHNIQUE INVOLVES ADDING A TAPPING HEAD TO AN EXISTING MACHINE TOOL. THIS TAPPING HEAD ADAPTS THE MACHINE TOOL'S SPINDLE TORQUE TO THE TAPPING OPERATION, MAINTAINING THE BEST TAP CUTTING SPEED AND REVERSING DIRECTION AT THE END OF THE TAPPING

STROKE. THESE SELF-REVERSING TAPPING HEADS ARE OFTEN PROGRAMMABLE.

SCENE 89.
TH89A, SME4387, 19:08:34:00-19:09:02:00
tapping operation
TH89B, CGS: Accuracy Required
Production Volume
Tap Size
TH89C, SME4372, 02:37:15:00-02:37:24:00
rigid tapping operation
TH89D, SME4388, 20:01:31:00-20:01:40:00
zoom out, tapping using self-reversing head

NARRATION (VO):

DETERMINING WHICH OF THESE THREE TECHNIQUES IS BEST SUITED FOR A SPECIFIC TAPPING OPERATION DEPENDS ON THE ACCURACY REQUIRED, PRODUCTION VOLUME, AND TAP SIZE. RIGID TAPPING CAN CONTROL THE TENSION AND COMPRESSION ON THE TAP, BUT PROCESSES AT A SLOWER RATE THAN SELF-REVERSING HEADS.

--- FADE TO BLACK ---

SCENE 90.
TH90A, CGS: Thread Quality & Verification
white text, centered on background
FMP BKG, motion background

SCENE 91.
TH91A, SME4141, 12:41:02:00-12:41:18:00
zoom in, threading operation
TH91B, SME3330, 08:06:50:00-08:07:15:00
zoom out, cone-point screws being used in assembly operation
TH91C, SME4390, 23:00:36:00-23:00:44:00
zoom out, auto seat belt bolt
TH91D, SME4016, 00:50:38:00-00:50:55:00
space shuttle taking off
TH91E, still, medical screws
TH91F, SME3936, 01:03:56:00-01:04:10:00
spaceship one landing

NARRATION (VO):

THE CONTROL AND QUALITY OF THREADING OPERATIONS CAN BE PARTICULARLY IMPORTANT, COMPARED WITH OTHER METAL-WORKING OPERATIONS. THREADED PARTS HAVE COMMONLY BEEN USED FOR CRITICAL SAFETY-RELATED PURPOSES, SUCH AS BOLTS FOR SECURING AUTOMOTIVE SEATBELTS, OR FOR FASTENERS USED IN AEROSPACE, AND MEDICAL APPLICATIONS.

SCENE 92.
TH92A, SME4384, 15:37:52:00-15:38:22:00
production of large bolt

NARRATION (VO):

TH92B, SME4384, 15:08:52:00-15:09:10:00
go-no-go gages used on large bolt

BECAUSE THREADED PARTS ARE EXPECTED TO CARRY HIGH LOADS AND FASTEN ASSEMBLIES TOGETHER SECURELY AND RELIABLY, THEY MUST NOT BE WEAKENED BY VARIATIONS IN THE THREADMAKING PROCESS. CRITICAL THREAD DIMENSIONS MUST ALSO MEET SPECIFIC TOLERANCES.

SCENE 93.
continue previous shot
TH93A, SME4253, 10:18:38:00-10:18:53:00
zoom out, go/no-go gages used on fastener
TH93B, SME4141, 12:41:55:00-12:42:20:00
zoom out, go/no-go gage used on tiny fastener
TH93C, SME4141, 12:49:02:00-12:49:39:00
zoom out, go/no-go gage being used

NARRATION (VO):

THE DIMENSIONS OF THREADS CAN BE INSPECTED WITH DIFFERENT LEVELS OF VERIFICATION. IF A THREADED FASTENER IS ONLY REQUIRED TO ASSEMBLE OTHER PARTS TOGETHER WITHOUT SPECIFIC LOAD-CARRYING REQUIREMENTS, A BASIC "GO/NO-GO" GAGE MAY BE ADEQUATE FOR CHECKING ITS THREADS. HOWEVER, THESE GAGES ONLY CHECK WHETHER THE THREADS EXCEED THEIR MAXIMUM ALLOWABLE DIMENSIONS; THEY CANNOT CLEARLY VERIFY WHETHER THREAD DIMENSIONS MEET THEIR MINIMUM SIZE TOLERANCE, OR WHETHER THE THREAD PITCH DIAMETER AND THREAD SHAPE ARE CORRECT.

SCENE 94.
TH94A, SME4262, 19:05:18:00-19:05:30:00
zoom out, screw-pitch gage being used
TH94B, SME4253, 10:10:52:00-10:11:08:00
critical thread dimensions checked
TH94C, SME4262, 19:07:06:00-19:07:25:00
zoom out, threaded fastener checked for roundness

NARRATION (VO):

FOR THREADED PARTS HAVING SPECIFIC STRENGTH REQUIREMENTS IN SERVICE, A MORE COMPLETE INSPECTION OF CRITICAL THREAD DIMENSIONS IS REQUIRED. ALL MAXIMUM AND

MINIMUM DIAMETERS AND THREAD ANGLES ARE CHECKED AND CHARTED. THIS MAKES PROCESS VARIATIONS DUE TO TOOL WEAR VISIBLE OVER TIME. AT THE HIGHEST LEVEL OF INSPECTION, CHARACTERISTICS SUCH AS ROUNDNESS AND TAPER ARE MONITORED, REQUIRING EVEN MORE SOPHISTICATED THREAD INSPECTION GAGES.

SCENE 95.
TH95A, SME4079, 15:34:00:00-15:34:30:00
zoom out, fatigue testing of thread

NARRATION (VO):

MECHANICAL TESTING, WHICH IS ALSO KNOWN AS DESTRUCTIVE TESTING, IS USED TO GATHER SPECIFIC PERFORMANCE OR PROPERTY VALUES OF MATERIALS FOR DESIGN PURPOSES AND QUALITY CONTROL. THIS IS DONE BY FORCING MATERIALS TO FAIL USING VARIOUS TESTING LOAD APPLICATIONS.

SCENE 96.
TH96A, SME4384, 15:07:46:00-15:08:19:00
ultrasonic testing of bolt, edit at multiple points
TH96B, CGS: Magnetic Particle Inspection
Ultrasonic Testing

NARRATION (VO):

NON-DESTRUCTIVE TESTING IS OFTEN UTILIZED TO LOCATE FLAWS IN THREADED PARTS. TWO COMMONLY USED NON-DESTRUCTIVE TESTS ARE:

MAGNETIC PARTICLE INSPECTION...,

AND ULTRASONIC TESTING.

SCENE 97.
TH97A, CGS: Magnetic Particle Inspection
TH97B, SME4384, 15:03:23:00-15:04:17:00
multiple bolts inspected under black light

NARRATION (VO):

MAGNETIC PARTICLE INSPECTION IS USED TO LOCATE SURFACE AND NEAR-SURFACE FLAWS IN PARTS PRODUCED FROM FERROMAGNETIC

MATERIALS SUCH AS IRON, STEEL AND NICKEL AND COBALT ALLOYS.

SCENE 98.
TH98A, SME4384, 15:01:06:00-15:01:28:00
zoom in, magnetic particle inspection
TH98B, SME4384, 15:01:33:00-15:02:18:00
zoom out, magnetic particle inspection, alternate shot
TH98C, SME4384, 15:03:02:00-15:03:18:00
zoom out, bolt inspected under black light

NARRATION (VO):

THE PARTS BEING INSPECTED ARE MAGNETIZED AND FINE MAGNETIC PARTICLES ARE APPLIED TO THE SURFACE, TYPICALLY WHILE SUSPENDED IN A LIQUID MEDIUM. THESE PARTICLES ARE OFTEN COATED WITH A FLUORESCENT MATERIAL FOR INSPECTION USING AN ULTRAVIOLET OR BLACK LIGHT. DISCONTINUITIES PERPENDICULAR TO THE MAGNETIC FIELD CAUSE A LEAKAGE FIELD TO FORM AT AND ABOVE THE SURFACE OF THE PART AND HOLD THE PARTICLES THERE SO THAT THE DISCONTINUITY CAN BE VISUALLY EXAMINED.

SCENE 99.
TH99A, CGS: Ultrasonic Testing
TH99B, SME4384, 15:08:24:00-15:08:43:00
zoom in, ultrasonic testing of bolt
TH99C, SME4384, 15:07:08:00-15:07:28:00
zoom in, ultrasonic testing of bolt

NARRATION (VO):

ULTRASONIC TESTING INVOLVES THE USE OF HIGH-FREQUENCY SOUND-WAVES, INTRODUCED BY A TRANSDUCER INTO THE PART BEING INSPECTED TO DETECT FLAWS, MEASURE THICKNESS, OR EVALUATE PROPERTIES. THE ENERGY OF THE ULTRASONIC WAVES IS REFLECTED BACK TO THE TRANSDUCER BY ANY DISCONTINUITIES, INDICATING THEIR PRESENCE AND LOCATION.

--- FADE TO BLACK ---

SCENE 100.
FMP RVW, CGS: Review
white text, centered on background
FMP BKG, motion background

MUSIC UP AND UNDER

NARRATION (VO):

LET'S REVIEW THE MATERIAL CONTAINED IN

THIS PROGRAM.

SCENE 101.
TH07A, SME2578, 03:12:27:00-03:12:37:00
screw thread
TH07B, SME4389, 21:05:04:00-21:05:16:00
zoom out, lead screw turning
TH07C, SME3330, 08:04:48:00-08:05:58:00
screws used in assembly operation
TH07D, SME3928, 23:04:09:00-23:04:27:00
mechanical fasteners tightening composite assembly together, alternate shot

NARRATION (VO):

THE HELICAL THREAD OR SCREW FORM HAS TWO

PRIMARY FUNCTIONS:

TO TRANSMIT POWER AND MOTION...,

AND TO ATTACH AND SECURE PARTS TOGETHER.

SCENE 102.
TH09A, zoom in, still of external threads
TH09B, zoom out, still of internal threads

NARRATION (VO):

THERE ARE EXTERNAL...,

AND INTERNAL THREADS.

SCENE 103.
TH12A, CGS: Major Diameter
TH12D, ANI: bolt, arrow and lines
TH12G, ANI: nut, arrow and lines
TH13A, CGS: Minimum/Minor Diameter
TH13D, ANI: bolt, arrow and lines
TH13G, ANI: nut, arrow and lines
TH14A, CGS: Thread Pitch
TH14D, ANI: bolt edge, arrow and lines
TH14G, ANI: nut edge, arrow and lines
TH15A, CGS: Thread Pitch Diameter
TH15E, ANI: bolt/nut with pitch diameter

NARRATION (VO):

THREADS ARE IDENTIFIED CHIEFLY BY THEIR

MAJOR DIAMETER...,

MINIMUM DIAMETER...,

THREAD PITCH...,

AND THREAD PITCH DIAMETER.

SCENE 104.
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

NARRATION (VO):

EXTERNAL THREADS CAN BE GENERATED BY:

HAND THREADING,

TURNING,

CHASING,

MILLING,

GRINDING,

AND ROLLING.

SCENE 105.
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):

THREADS ARE HAND-CUT USING A DIE FITTED IN A HOLDING COLLET THAT SLIPS OVER THE WORKPIECE. THE DIE CARVES A THREAD INTO THE WORKPIECE AS IT IS TURNED.

SCENE 106.
TH28A, CGS: Thread Turning
TH28B, SME4391, 23:43:11:00-23:44:08:00
c.u. thread turning

NARRATION (VO):

IN THREAD TURNING, THE CUTTING TOOL MOVES ALONG THE AXIS OF A ROTATING WORKPIECE, CUTTING A HELIX. SEVERAL PASSES ARE REQUIRED TO COMPLETE THE THREADS.

SCENE 107.
TH39A, CGS: Thread Chasing
TH39C, SME4384, 15:19:26:00-15:19:54:00
chasing operation

NARRATION (VO):

IN THREAD CHASING, THREADS ARE PRODUCED BY FORCING CYLINDRICAL BLANKS INTO ROTATING DIES.

SCENE 108.
TH42A, CGS: Thread Milling
TH43A, SME4391, 23:30:33:00-23:31:12:00
thread milling operation

NARRATION (VO):

THREAD MILLING IS USED FOR VERY PRECISE THREADING OPERATIONS. THIS IS USUALLY ACCOMPLISHED ON A MACHINING CENTER WITH CNC HELICAL INTERPOLATION.

SCENE 109.
TH46A, CGS: Thread Grinding
TH46C, SME2621, 01:08:38:00-01:08:50:00
large part, thread grinding

NARRATION (VO):

THREAD GRINDING IS OFTEN USED TO GENERATE THREADS IN VERY HARD MATERIALS

OR WHERE HIGH PRECISION IS REQUIRED.

SCENE 110.
TH48A, CGS: Thread Rolling
TH49B, SME4390, 22:05:41:00-22:06:05:00
zoom in, roll forming operation

NARRATION (VO):

THREAD ROLLING PRODUCES A STRONGER THREAD THAN THE THREAD CUTTING PROCESSES BECAUSE THE METAL IS COLD-WORKED AS IT IS PLASTICALLY DEFORMED INTO THREADS.

SCENE 111.
TH60A, SME4384, 15:29:37:00-15:30:01:00
zoom in, large tapping operation
TH60B, CGS: Tapping

NARRATION (VO):

TAPPING IS THE MOST COMMONLY USED TECHNIQUE TO GENERATE INTERNAL THREADS.

SCENE 112.
TH61C, SME4389, 21:26:49:00-21:27:10:00
zoom out, manually tapping hole
TH87A, SME2632, 02:06:29:00-02:06:45:00
rigid/synchronous tap driving operation
TH88A, SME4387, 19:09:56:00-19:10:18:00
zoom in, tapping head operation

NARRATION (VO):

TAPS CAN BE MANUALLY DRIVEN...,
OR MOUNTED IN MACHINE TOOL SPINDLES...,
OR SPECIAL TAPPING HEADS.

SCENE 113.
TH81C, SME4388, 20:01:58:00-20:02:09:00
zoom out, forming tap used on multiple holes

NARRATION (VO):

THREAD-FORMING TAPS LOOK LIKE CONVENTIONAL SCREWS, BUT HAVE SMALL LOBES THAT FORM, RATHER THAN CUT, THE THREAD.

SCENE 114.
TH94B, SME4253, 10:10:52:00-10:11:08:00
critical thread dimensions checked
TH91D, SME4016, 00:50:38:00-00:50:55:00
space shuttle taking off
TH92B, SME4384, 15:08:52:00-15:09:10:00
go-no-go gages used on large bolt
TH94C, SME4262, 19:07:06:00-19:07:25:00
zoom out, threaded fastener checked for roundness
TH95A, SME4079, 15:34:00:00-15:34:30:00
zoom out, fatigue testing of thread
TH98C, SME4384, 15:03:02:00-15:03:18:00
zoom out, bolt inspected under black light
TH99B, SME4384, 15:08:24:00-15:08:43:00
zoom in, ultrasonic testing of bolt

NARRATION (VO):

THE QUALITY AND DIMENSIONS OF THREADED PARTS MUST BE VERIFIED, SINCE THEY ARE COMMONLY USED FOR CRITICAL SAFETY-RELATED PURPOSES. TO THIS END, DIFFERENT LEVELS OF THREAD INSPECTION ARE PERFORMED FOR BOTH HIGH- AND LOW-VOLUME MANUFACTURING. ADDITIONALLY, MECHANICAL,

OR DESTRUCTIVE TESTING, IS USED TO GATHER SPECIFIC PERFORMANCE OR PROPERTY VALUES OF MATERIALS, WHILE NON-DESTRUCTIVE TESTING IS OFTEN UTILIZED TO LOCATE FLAWS IN THREADED PARTS.

--- FADE TO BLACK ---

SCENE 115.
continue music, up and under
TH CRX, CGS, ROLL: credits
white text, fade up mid-screen
FMP EXM, extended motion background

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SCENE 116.
continue motion background
FMP DIS, CGS: disclaimer
white text, centered on background

Some machinery in this program had safety equipment removed to allow better recording of certain processes. Always read the safety information provided in the manufacturers' manual before machine operation.

SCENE 117.
FMP SME, SME logo open, with music