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FUNDAMENTAL MANUFACTURING PROCESSES

Plastic Injection Molds

SCENE 1.
IM59A, GRAPHIC: Plastic Injection Mold Production
white text centered on black

SCENE 2.
IM60A, peter carey narration
IM60B, tape 908, 03:05:12-03:05:43
zoom out, production mold being machined
IM60C, tape 397, 01:06:45-01:06:51
mold on screen
IM60D, tape 827, 03:05:45-03:06:00
stereolithography operation

NARRATION (VO):

PRODUCTION MOLDS ARE EXPENSIVE TO MANUFACTURE AND ANY MISCALCULATIONS IN THEIR DEVELOPMENT AND MANUFACTURE CAN BE COSTLY IN BOTH TIME AND MONEY. TO MINIMIZE POTENTIAL ERRORS, MOLDERS FREQUENTLY RELY ON SOFTWARE SIMULATIONS..., AND PROTOTYPING TECHNIQUES TO PROVE OUT THEIR DESIGNS.

SCENE 3.
IM61A, tape 397, 01:08:28-01:08:43
c.u. injection mold simulation
IM61B, CGS: Injection Pressure
Temperature
Differentials
IM61C, tape 397, 01:05:08-01:05:13
injection mold simulation

NARRATION (VO):

SIMULATION SOFTWARE PACKAGES ARE USED TO APPROXIMATE AND VISUALIZE VARIOUS CONDITIONS WITHIN THE INJECTION MOLD, SUCH AS:
INJECTION PRESSURE,
AND TEMPERATURE DIFFERENTIALS, PROVIDING VALUABLE FEEDBACK FOR THE PART AND MOLD DESIGN.

SCENE 4.
IM62A, tape 909, 04:12:51-04:13:00
zoom out, simulation being printed out
IM62B, tape 668, 01:13:47-01:14:09
zoom out, part program running
IM62C, tape 418, 13:04:21-13:04:41
cutter machining injection mold cavity

NARRATION (VO):

SIMULATION PACKAGES CAN ALSO CONVERT DESIGNS INTO DRAWINGS...,
AND PROVIDE PROGRAMMING DATA TO CONTROL THE MACHINES THAT MANUFACTURE THE MOLD BASES, CAVITIES AND CORES.

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SCENE 5.
IM63A, tape 418, 13:06:31-13:06:49
zoom out, aluminum prototype mold being machined
IM63B, CGS: Copper
Brass
Soft Steels
Epoxies

NARRATION (VO):

IF PROTOTYPE PRODUCTION MOLDS ARE REQUIRED,

THEY ARE COMMONLY PRODUCED USING LOW-GRADE

ALUMINUM. OTHER MATERIALS USED TO PRODUCE

PROTOTYPE MOLDS MAY INCLUDE COPPER,

BRASS,

SOFT STEELS,

AND EPOXIES.

SCENE 6.
IM64A, tape 914, 08:17:22-08:17:31
tilt, prototype mold
IM64B, tape 914, 08:14:53-08:15:10
prototype part falling out of molding machine, inspected

NARRATION (VO):

THESE MOLDS ARE USUALLY REFERRED TO AS 'SOFT'

TOOLING. PROTOTYPES ARE DESIGNED AND BUILT FOR

VERY SHORT RUNS AND LOW VOLUME PARTS

PRODUCTION. THESE PARTS ARE TESTED AND

ANALYZED TO DETERMINE THE VIABILITY OF THE

FINAL PRODUCTION MOLD DESIGN.

SCENE 7.
IM65A, tape 825, 01:16:04-01:16:23
stereolithography operation
IM65B, tape 835, 12:28:12-12:28:20
ultrasonic consolidation mold being produced
IM65C, tape 829, 07:06:14-07:06:24
parts pulled from room temperature vulcanized tooling

NARRATION (VO):

RAPID PROTOTYPING SYSTEMS HAVE ALSO BECOME

POPULAR IN PRODUCING PART MODELS FOR

ANALYSIS...,

MOLD DESIGNS...,

AND EVEN INJECTION PARTS PRODUCTION.

SCENE 8.
IM66A, tape 915, 09:07:46-09:07:57
solid modeling of mold
IM66B, tape 905, 01:16:42-01:16:54
pro metal operation, layer added
IM66C, tape 905, 01:17:15-01:17:25
pro metal operation, layer cured
IM66D, tape 914, 08:13:28-08:13:42
selective laser sintering part pulled from material, cleaned

NARRATION (VO):

THESE SYSTEMS USE COMPUTER-AIDED DESIGN, OR

'CAD' SOLID MODELING DATA TO BUILD

FABRICATIONS LAYER-BY-LAYER IN EXTREMELY THIN

CROSS-SECTIONS. THESE CROSS-SECTIONS, OR

SLICES, ARE STACKED...,

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AND THEN FUSED ONE ATOP ANOTHER IN SUCCESSION UNTIL THE SHAPE IS COMPLETE. THIS PERMITS MANUFACTURE OF INTRICATE AND COMPLEX SHAPES AND SURFACES MUCH MORE SIMPLY THAN BY CONVENTIONAL METHODS.

SCENE 9.
IM67A, tape 835, 12:49:59-12:50:18
ultrasonic consolidation mold being produced
IM67B, tape 841, 00:31:45-00:32:30
pro metal system molding
IM67C, tape 826, 02:15:21-02:15:31
selective laser sintering
IM67D, tape 825, 01:20:04-01:20:11
stereolithography operation, dissolve to next shot
IM67E, tape 825, 01:20:21-01:20:28
stereolithography operation
IM67F, tape 826, 02:12:18-02:12:36
selective laser sintering
IM67G, tape 833, 11:04:09-11:04:26
fused deposition modeling operation
IM67H, tape 835, 12:37:14-12:37:36
ultrasonic consolidation mold being produced
IM67I, tape 841, 00:51:11-00:52:04
pro metal system mold being produced
IM67J, tape 829, 07:18:27-07:18:36
parts pulled from room temperature vulcanized tooling

NARRATION (VO):

WITH REGARDS TO PLASTIC INJECTION MOLDING, THERE ARE SEVERAL RAPID PROTOTYPING TECHNOLOGIES AND SYSTEMS THAT CAN ASSIST IN PRODUCT AND MOLD DESIGN DEVELOPMENT. THESE RAPID PROTOTYPING TECHNOLOGIES AND SYSTEMS INCLUDE:

STEREOLITHOGRAPHY...,

SELECTIVE LASER SINTERING...,

FUSED DEPOSITION MODELING...,

ULTRASONIC CONSOLIDATION...,

THE PRO METAL SYSTEM...,

AND ROOM TEMPERATURE VULCANIZED TOOLING.

--- TOUCH BLACK ---

SCENE 10.
IM68A, tape 913, 08:22:01-08:22:14
damaged mold being welded

NARRATION (VO):

OVER TIME, ALL MOLDS WILL REQUIRE A CERTAIN AMOUNT OF REPAIR FOR DAMAGE THAT OCCURS DURING THE USE AND STORAGE OF THAT MOLD.

SCENE 11.
IM69A, tape 906, 01:21:25-01:21:37
zoom out, damaged mold
IM69B, CGS: Bent or Broken Ejector Pins
Worn Gate Areas
Peened Parting Lines
IM69C, tape 913, 08:13:50-08:14:00

NARRATION (VO):

MOLD DAMAGE THAT COMMONLY OCCURS DURING USE INCLUDES BENT OR BROKEN EJECTOR PINS,

WORN GATE AREAS,

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zoom out, mold with rust

AND PEENED PARTING LINES.

THE DAMAGE MOST COMMON DURING STORAGE IS THE FORMATION OF RUST.

SCENE 12.
IM70A, tape 906, 01:14:07-01:14:15
mold insert placed back in plate, dissolve to next shot
IM70B, tape 906, 01:14:26-01:14:35
mold insert placed back in plate
IM70C, tape 906, 01:21:00-01:21:10
laminated mold element placed back into mold

NARRATION (VO):

FOR MOLDS USED IN HIGH VOLUME OR LONG RUN PRODUCTION OPERATIONS, THE USE OF INSERTS AND LAMINATED CONSTRUCTIONS FOR VULNERABLE COMPONENTS IS ADVISABLE. INSERTS AND LAMINATED CONSTRUCTIONS ARE EXPENSIVE TO INCORPORATE IN A MOLD DESIGN, BUT THEY PROVIDE A SIMPLER METHOD FOR CLEANING AND REPAIRS.

SCENE 13.
IM71A, tape 913, 08:12:42-08:13:05
zoom out, mold being cleaned, lubricated

NARRATION (VO):

PREVENTATIVE MAINTENANCE IN THE FORM OF CLEANING AND LUBRICATION IS ALSO ESSENTIAL IN MINIMIZING MOLD DAMAGE.

SCENE 14.
IM72A, tape 907, 02:02:03-02:02:30
zoom out, molds on rack

NARRATION (VO):

BETWEEN RUNS, MOLDS ARE COMMONLY PLACED IN SOME TYPE OF STORAGE, SUCH AS HEAVY-DUTY METAL RACKS.

SCENE 15.
continue previous shot
IM73A, tape 911, 06:16:20-06:16:31
cooling lines being blown out
IM73B, tape 911, 06:19:01-06:19:15
mold surfaces being sprayed
IM73C, tape 415, 10:05:58-10:06:08
mold being inspected

NARRATION (VO):

FOR SHORT-TERM STORAGE UP TO 30 DAYS, THE MOLD'S COOLING LINES SHOULD BE BLOWN DRY WITH COMPRESSED AIR. ALL MOLD SURFACES SHOULD BE CLEANED WITH AN ACID NEUTRALIZER AND THEN COATED WITH A RUST PREVENTATIVE. THE MOLD COMPONENTS SHOULD ALSO BE INSPECTED FOR WEAR OR DAMAGE AND ANY REPAIRS SHOULD BE MADE.

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SCENE 16.
IM74A, tape 906, 01:10:28-01:10:46
mold pins being cleaned
IM74B, tape 906, 01:20:19-01:20:34
mold pins being cleaned for short term storage

NARRATION (VO):

IN SOME CIRCUMSTANCES, THE MOLD MAY NEED TO BE DISASSEMBLED TO CLEAN EJECTOR PINS, MOLD CAVITY SURFACES, RUNNERS, AND ANY OTHER SURFACES COMING INTO CONTACT WITH THE MOLDING MATERIAL, ESPECIALLY WHEN MOLDING WITH CORROSIVE PLASTICS.

SCENE 17.
IM75A, tape 908, 03:20:26-03:20:37
mold being disassembled for long term storage
IM75B, tape 913, 08:23:50-08:24:05
mold being reassembled
IM75C, tape 909, 04:01:06-04:01:19
zoom out, mold coated with heavy coating of rust preventative

NARRATION (VO):

FOR LONG-TERM STORAGE LASTING PAST 30 DAYS, THE MOLD SHOULD DEFINITELY BE DISASSEMBLED AND INSPECTED. DAMAGE SHOULD BE REPAIRED AND THE MOLD COMPONENTS AND BASE SHOULD BE THOROUGHLY CLEANED, NEUTRALIZED, AND REASSEMBLED. ALL SURFACES SHOULD THEN BE COATED WITH A HEAVY COATING OF RUST PREVENTATIVE.

--- FADE TO BLACK ---