## COMPOSITES MANUFACTURING

Compression Molding

SCENE 1. WARNING CM01A, GRAPHIC: FBI warning Federal law provides severe civil and white text centered on black to blue criminal penalties for the unauthorized gradient reproduction, distribution or exhibition of copyrighted media. Copyright © 2005 Society of Manufacturing Engineers SCENE 2. Always read the operating manual and safety CM02A, GRAPHIC: disclaimer information provided by the manufacturer white text centered on black to blue before operating any composite or gradient compression molding equipment. Make sure all machine guards are in place, and follow all safety procedures when working with or near composite or compression molding equipment. This program was produced using the technical SCENE 3. CM03A, GRAPHIC: PCC/SME screen resources of the Plastics, Composites & white text centered on black to blue gradient Coatings Community of SME. For more information on composites and compression molding, please visit our website at: www.sme.org SCENE 4.

CM04A, SME logo open, with music

SCENE 5.
CM05A, composites manufacturing
open, with music
CM05B, peter carey narration

## MUSIC UP AND UNDER

# NARRATION (VO):

THE COMPOSITES MANUFACTURING SERIES, EXAMINING THE MATERIALS, TOOLS AND TECHNIQUES USED FOR COMPOSITES FABRICATION.

SCENE 6. **CM06A**, GRAPHIC: Compression Molding white text centered on black

CM07A, tape 42, 14:14:14-14:14:24

CM07B, tape 44, 16:19:32-16:20:18

CM08A, tape 43, 15:24:53-15:25:11

compression mold opening

shower pan being produced

# NARRATION (VO):

THIS PROGRAM IS AN INTRODUCTION TO COMPRESSION MOLDING.

## NARRATION (VO):

COMPRESSION MOLDING IS ONE OF THE MOST COMMON METHODS OF PRODUCING HIGH VOLUME COMPOSITE PARTS AND COMPONENTS.

#### NARRATION (VO):

mold opening, quarter panel part THESE PARTS AND COMPONENTS ARE MANUFACTURED CM08B, tape 32, 04:11:29-04:11:36 zoom out, electrical compression FOR USE THROUGHOUT VARIOUS INDUSTRIES, CM08C, tape 47, 19:04:51-19:05:01 INCLUDING: TRANSPORTATION..., ELECTRICAL..., CONSTRUCTION...,

AND MORE.

SCENE 9. CM09A, tape 42, 14:28:13-14:28:27 thermoset molding compound cut

NARRATION (VO):

BOTH THERMOSETS AND THERMOPLASTICS MAY BE COMPRESSION MOLDED, WITH THERMOSETS BEING THE PRIMARY TYPE OF MATERIALS USED.

#### SCENE 10.

SCENE 7.

room tone

SCENE 8.

molded parts

CM10A, tape 42, 14:26:34-14:26:52 molding compound placed in mold, dissolve into next image

## NARRATION (VO):

THE COMPRESSION MOLDING PROCESS TYPICALLY INVOLVES PLACING A PRECUT, PRE-WEIGHED CHARGE OF MATERIAL ONTO THE LOWER HALF OF A HEATED MOLD.

SCENE 11. CM11A, tape 42, 14:27:04-14:27:20 upper mold lowered on molding compound CM11B, tape 42, 14:13:13-14:13:29

## NARRATION (VO):

THE HEATED UPPER HALF OF THE MOLD IS THEN

lower mold moving upwards, closing mold halves together

LOWERED RAPIDLY CAUSING THE CHARGE TO FLOW, COMPRESSING IT TO THE REQUIRED DENSITY AND SHAPE AS DEFINED BY THE MOLD. WITH SOME PRESSES, THE LOWER HALF OF THE MOLD MOVES UPWARDS FORCING THE MOLD HALVES TOGETHER.

SCENE 12.
CM12A, tape 42, 14:12:36-14:12:51
press opening, dissolve into next
shot
CM12B, tape 42, 14:12:55-14:13:05
part demolded using ejector system

# NARRATION (VO):

ONCE THE MATERIAL CURES UNDER THE HEAT AND PRESSURE, THE PRESS OPENS..., AND THE COMPRESSION MOLDED PART IS DEMOLDED, TYPICALLY WITH THE ASSISTANCE OF AN EJECTOR SYSTEM.

SCENE 13.
CM13A, tape 42, 14:21:26-14:21:36
flash manually sanded off
CM13B, tape 41, 13:28:21-13:28:34
pan, abrasive blasting of
compression molded parts

# NARRATION (VO):

After demolding, any flash is removed. this is done either manually..., or through the use of deflashing processes such as Abrasive blasting.

--- TOUCH BLACK ---

SCENE 15. CM15A, tape 703, 17:08:57-17:09:25 material placed in mold, mold closed CM15B, CGS: Mold Temperature Molding Pressure Molding Material

#### NARRATION (VO):

11.03.23	
old closed re	SEVERAL FACTORS INFLUENCE THE MOLDING
re al	CONDITIONS DURING COMPRESSION MOLDING,
	INCLUDING:
	THE MOLD TEMPERATURE,
	THE MOLDING PRESSURE,
	AND THE MOLDING MATERIAL.

SCENE 16. CM16A, CGS: Mold Temperature CM16B, tape 32, 04:20:35-04:20:54

#### NARRATION (VO):

pull out, temperature to mold CM16C, tape 42, 14:25:41-14:25:51 mold opening, big part COMPRESSION MOLD TEMPERATURES GENERALLY RANGE FROM TWO HUNDRED EIGHTY FIVE DEGREES TO THREE HUNDRED TWENTY DEGREES FAHRENHEIT, OR ONE HUNDRED FORTY ONE DEGREES TO ONE HUNDRED SIXTY DEGREES CELSIUS. ALL MOLDING TEMPERATURES ARE DEPENDENT UPON THE TYPE OF MATERIAL BEING PROCESSED.

SCENE 17. CM17A, CGS: Molding Pressure CM17B, tape 43, 15:14:02-15:14:23 mold opening, part removed NARRATION (VO):

MOLDING PRESSURES RANGE FROM 500 TO 1,250 POUNDS PER SQUARE INCH, OR ABOUT 3.4 TO 8.6 MEGA-PASCALS. THE HIGHER PRESSURES ARE REQUIRED FOR PARTS CONTAINING BOSSES OR DEEP RIBS.

# SCENE 18. CM18A, CGS: Molding Material CM18B, tape 33, 05:14:49-05:15:21 molding compound placed in mold, mold closed CM18C, CGS: Sheet Molding Compound Thick Molding Compound Bulk Molding Compound

#### NARRATION (VO):

THE MOST COMMONLY USED MATERIALS FOR COMPRESSION MOLDING ARE MOLDING COMPOUNDS MADE UP OF GLASS FIBERS ALONG WITH UNCURED VISCOUS RESIN PASTE. THE PRINCIPAL TYPES OF MOLDING COMPOUND INCLUDE: SHEET MOLDING COMPOUND, OR 'SMC', THICK MOLDING COMPOUND, OR 'TMC',

AND BULK MOLDING COMPOUND, OR 'BMC'.

SCENE 19. CM19A, CGS: Sheet Molding Compound CM19B, tape 42, 14:02:52-14:03:09 pan, chopped fiber sandwiched between layers of resin

## NARRATION (VO):

SHEET MOLDING COMPOUNDS CONSIST OF TWO LAYERS OF RESIN PASTE, WITH A FLAT LAYER OF CHOPPED, AND OR UNIDIRECTIONAL GLASS FIBERS SANDWICHED BETWEEN. TYPICAL SHEET MOLDING COMPOUNDS

CONTAIN 30% GLASS FIBERS BY WEIGHT.

## NARRATION (VO):

THE RESIN PASTES ARE TYPICALLY EITHER POLYESTER OR VINYL COMPOUNDS. THESE COMPOUNDS COMMONLY INCORPORATE FILLERS, ADDITIVES, AND OTHER MATERIALS TO REDUCE MATERIAL SHRINKAGE DURING MOLDING, INCREASE DIMENSIONAL PART STABILITY, AND TO REDUCE OVERALL MATERIAL COSTS.

SCENE 21.

SCENE 20.

out of machine

CM21A, tape 42, 14:10:50-14:11:11
zoom out, sheet molding compound
filling bin
CM21B, tape 42, 14:29:32-14:29:58
part produced from sheet molding

CM20A, tape 42, 14:08:53-14:09:17

Molding

Costs

CM20B, CGS: Reduce Material

pan, sheet molding compound coming

Shrinkage During

Increase Dimensional Part Stability

Reduce Overall Material

compound

#### NARRATION (VO):

SHEET MOLDING COMPOUNDS ARE MANUFACTURED IN ROLLS OF VARIOUS THICKNESSES UP TO ABOUT ONE QUARTER INCH, OR 6 MILLIMETERS. ONCE MANUFACTURED, THESE ROLLS ARE USED IMMEDIATELY, OR STORED WHILE THE MOLDING COMPOUND MATURES TO THE DESIRED MOLDING VISCOSITY.

SCENE 22. CM22A, tape 42, 14:18:28-14:18:43 molding compound cut, film being removed before use

#### NARRATION (VO):

SHEET MOLDING COMPOUNDS ARE PRODUCED SANDWICHED BETWEEN THIN POLYETHYLENE FILMS TO AID IN HANDLING. THIS FILM IS REMOVED FROM THE SHEET MOLDING COMPOUND BEFORE COMPRESSION MOLDING.

# NARRATION (VO):

THICK MOLDING COMPOUNDS ARE SIMILAR TO SHEET MOLDING COMPOUND IN COMPOSITION AND BY WEIGHT OF GLASS FIBER CONTENT, BUT ARE MANUFACTURED

SCENE 23. CM23A, CGS: Thick Molding Compound CM23B, tape 32, 04:01:40-04:01:55 zoom out, box of thick molding compound CM23C, tape 32, 04:09:30-04:10:02 pulling plies of thick molding compound out of box, weighing

compound

SCENE 25.

SCENE 24. continue previous shot UP TO A THICKNESS OF ABOUT 2 INCHES, OR 50 MILLIMETERS.

## NARRATION (VO):

FIBERS IN THICK MOLDING COMPOUNDS ARE RANDOMLY DISTRIBUTED IN ALL DIRECTIONS THROUGHOUT THE ENTIRE COMPOUND.

# NARRATION (VO):

CM25A, tape 32, 04:18:40-04:19:05 placing thick molding compound in mold

SCENE 26. CM26A, CGS: Bulk Molding Compound CM26B, tape 46, 18:12:03-18:12:30 zoom in, bulk molding compound extruded HAVING TO USE SEVERAL PLIES OF SHEET MOLDING COMPOUND TO BUILD UP CHARGE THICKNESS. DUE TO ITS GREATER THICKNESS THOUGH, THICK MOLDING COMPOUNDS ARE LESS PLIABLE THAN SHEET MOLDING COMPOUNDS.

THICK MOLDING COMPOUNDS REDUCE OR ELIMINATE

# NARRATION (VO):

BULK MOLDING COMPOUNDS ARE A MIXTURE OF RESIN PASTE WITH SHORT GLASS FIBERS. THESE MIXTURES ARE EXTRUDED INTO LOG OR ROPE SHAPES, AND THEN CUT TO THE DESIRED LENGTH FOR INSERTION INTO THE COMPRESSION MOLD.

SCENE 27. CM27A, tape 46, 18:08:28-18:09:03 bulk molding compound placed in extruder

#### NARRATION (VO):

GLASS FIBER CONTENT FOR BULK MOLDING COMPOUNDS COMMONLY RANGES FROM 15 TO 20% BY WEIGHT. DUE TO THE LOWER GLASS FIBER CONTENT AND SHORT GLASS FIBERS USED, BULK MOLDING COMPOUNDS ARE GENERALLY USED AS FILLERS AND FOR NON-STRUCTURAL ELEMENTS.

--- TOUCH BLACK ---

SCENE 28. CM28A, tape 46, 18:05:26-18:05:48 preform being sprayed up robotically

## NARRATION (VO):

COMPRESSION MOLDING IS ALSO DONE USING PREFORMS THAT ARE PRESHAPED BY SPRAYING CHOPPED REINFORCEMENT AND BINDER ONTO A HEATED SHAPED FORM.

SCENE 29. CM29A, tape 46, 18:15:26-18:15:46 resin, reinforcement material placed

on preform CM29B, tape 46, 18:17:03-18:17:15 preform placed in molding press NARRATION (VO):

IN OPERATION, THE PREFORM IS COVERED WITH THE APPROPRIATE AMOUNT OF CATALYZED RESIN AND ANY ADDITIONAL REINFORCEMENT AND SURFACING MATERIALS...,

THE PREPARED PREFORM IS THEN PLACED WITHIN A COMPRESSION MOLDING PRESS FOR COMPACTION.

# SCENE 30. CM30A, tape 46, 18:18:57-18:19:15 wide, large press opening

CM30B, tape 33, 05:15:24-05:15:36 smaller press closing

SCENE 31.

CM31A, tape 45, 17:04:07-17:04:22 wide, dedicated compression molding machine running CM31B, tape 45, 17:17:06-17:17:23

c.u. mold opening, finished parts ejected

CM31C, tape 45, 17:19:39-17:19:53 compound shot cut, dropped in mold CM31D, tape 45, 17:13:04-17:13:16 mold closing, compressing molding compound

# NARRATION (VO):

COMPRESSION MOLDING IS TYPICALLY PERFORMED USING VERTICAL MOLDING PRESSES. THESE PRESSES ARE USUALLY HYDRAULICALLY DRIVEN, ALTHOUGH SMALLER PRESSES MAY BE AIR DRIVEN.

## NARRATION (VO):

HIGH VOLUME, DEDICATED COMPRESSION MOLDING MACHINERY IS ALSO USED. THESE MACHINES HAVE UP TO TEN OR MORE COMPRESSION MOLDS THAT

SEQUENTIALLY OPEN...,

EJECT THE FINISHED COMPRESSION MOLDED PARTS...,

GET NEW PRE-WEIGHED SHOTS OF MOLDING COMPOUND DROPPED IN THE MOLDS...,

THEN SUBSEQUENTLY CLOSE TO COMPRESS AND CURE

THE MOLDING COMPOUND.

--- TOUCH BLACK ---

SCENE 32.

# NARRATION (VO): CM32A, tape 47, 19:13:28-19:13:48

zoom out, milling of compression mold CM32B, tape 47, 19:18:32-19:18:45

zoom out, edming of compression mold

COMPRESSION MOLDS ARE PRODUCED FROM SPECIAL MOLD STEELS, AND ARE MANUFACTURED USING A VARIETY OF METHODS INCLUDING: MACHINING...,

THE MOLDS ARE SIMILAR TO THOSE USED FOR

INJECTION MOLDING EXCEPT THAT THEY TYPICALLY

EDM'ING...,

AND OTHERS.

NARRATION (VO):

SCENE 33. CM33A, tape 42, 14:22:40-14:22:54 zoom out, compound placed in mold, mold closed

> MATE BY TELESCOPING TOGETHER INSTEAD OF PRESSING TOGETHER ON LANDS.

SCENE 34. CM34A, tape 43, 15:17:46-15:17:57 compound in mold, mold closed, dissolve into next shot

SCENE 35. CM35A, tape 43, 15:18:32-15:18:52 mold opening, part removed

SCENE 36. CM36A, tape 54, 09:19:00-09:19:12 zoom out, mold heated oil lines CM36B, tape 43, 15:10:32-15:11:03 zoom out, compound placed in mold, mold closed

## NARRATION (VO):

TELESCOPING KEEPS THE MOLD HALVES FROM RESTING TOGETHER SO THAT THE COMPOUND WILL BE UNDER PRESSURE THROUGHOUT PRESSING AND CURING.

# NARRATION (VO):

TELESCOPING ALSO PREVENTS COMPOUND LOSS FROM THE MOLD CAVITY AND MINIMIZES FLASH THICKNESS SO THAT IT CAN BE EASILY REMOVED AFTERWARDS.

## NARRATION (VO):

ALTHOUGH ELECTRICALLY HEATED OIL CAN BE USED TO HEAT MOLDS, STEAM IS ALSO COMMONLY USED BECAUSE STEAM PRESSURES ARE MODERATE AND

EASILY REGULATED.

SCENE 37. continue previous shot

NARRATION (VO):

HEATING LINES SHOULD BE CLOSE TO THE MOLD CAVITY, FOR EXAMPLE JUST 1 TO 2 INCHES OR 25 TO 50 MILLIMETERS FROM CAVITY SURFACES. THIS WILL MINIMIZE TEMPERATURE DROP BETWEEN THE LINES AND SURFACES.

SCENE 38.

NARRATION (VO):

CM38A, tape 54, 04:21:07-04:21:27 zoom out, mold opening, part removed THE PRIMARY MOLD TYPES FOR COMPRESSION MOLDING CM38B, CGS: Flash-Type Mold Positive-Type Mold INCLUDE: Semi-Positive-Type Mold THE FLASH-TYPE MOLD, THE POSITIVE-TYPE MOLD,

SCENE 39. CM39A, CGS: Flash-Type Mold CM39B, ANI: flash type mold, mold closing on material, material filling mold, creating flash CM39C, ANI: c.u. one side of flash type mold, mold closing on material, material filling mold, creating flash

## NARRATION (VO):

AND THE SEMI-POSITIVE-TYPE MOLD.

THE FLASH-TYPE MOLD IS SIMPLE IN DESIGN AND CONSTRUCTION, AND IS USED WITH A SLIGHTLY LARGER AMOUNT OF MOLDING COMPOUND THAN THE MOLD'S CAPACITY. AS THE NAME INFERS, FLASH-TYPE MOLDS GENERATE FLASH, WHICH REQUIRES SUBSEQUENT REMOVAL. THE MAIN DRAWBACK OF FLASH-TYPE MOLDS IS THAT THE FLASH INHIBITS FULL CLOSURE OF THE MOLD, THUS GENERATING MINIMAL BACK PRESSURE WHICH IS NEEDED TO CONTROL PART DENSITY AND PART DIMENSIONS.

SCENE 40.
CM40A, CGS: Positive-Type Mold
CM40B, ANI: positive type mold, mold
closing on material, material
filling mold, no flash
CM40C, tape 45, 17:12:08-17:12:15

#### NARRATION (VO):

THE POSITIVE-TYPE MOLD IS USED FOR HIGH-BULK MATERIALS AND DEEP-DRAWN PARTS THAT REQUIRE c.u. positive-type mold producing limited flash

MAXIMUM DENSITY. POSITIVE-TYPE MOLDS ARE TYPICALLY SINGLE-CAVITY MOLDS AND MUST USE AN ACCURATELY WEIGHED CHARGE OF MATERIAL. THIS TYPE OF MOLD PRODUCES MINIMAL FLASH.

## NARRATION (VO):

SCENE 41. **CM41A**, CGS: Semi-Positive-Type Mold **CM41B**, ANI: semi-positive type mold, mold closing on material, material filling mold, no flash

THE SEMI-POSITIVE-TYPE MOLD IS USED TO PRODUCE CLOSE-TOLERANCE PARTS OF MAXIMUM DENSITY WHILE CONTROLLING FLASH CREATION.

--- TOUCH BLACK ---

## NARRATION (VO):

CM42A, CGS: Transfer Molding CM42B, tape 41, 13:02:56-13:03:07 c.u. transfer mold opening, dissolve into next image CM42C, tape 41, 13:03:18-13:03:31 c.u. lower cavity closing CM42D, tape 41, 13:07:12-13:07:26 zoom in, upper cavity CM42E, tape 41, 13:12:24-13:12:38 lower cavity moving up into position with upper cavity

SCENE 42.

TRANSFER MOLDING IS A TECHNOLOGICAL EXTENSION OF COMPRESSION MOLDING. THE LOWER CAVITY SECTION OF THE MOLD IS MOUNTED TO A MOVABLE LOWER PLATEN, WHICH IS DRIVEN BY A CLAMP RAM. THE UPPER MOLD HALF, ALSO COMMONLY REFERRED TO AS THE FORCE HALF, IS MOUNTED TO THE BOTTOM OF A FLOATING PLATEN. IN OPERATION, THE CLAMP RAM IS ACTIVATED UPWARDS FORCING THE CAVITY AND FORCE HALVES OF THE MOLD TOGETHER.

SCENE 43. CM43A, tape 40, 12:18:28-12:18:42 zoom out, molding material, pan to placing in machine, cut to next shot CM43B, tape 40, 12:05:20-12:05:38 c.u. material placed in machine, plunger activated

#### NARRATION (VO):

THE MOLDING MATERIAL, WHICH MAY BE GRANULAR OR A PREFORMED SHOT, IS LOADED INTO A POT OR TRANSFER SLEEVE...,

HIGH TRANSFER PRESSURE IS THEN APPLIED USING EITHER A RAM, PLUNGER, OR ROTATING SCREW-FEEDER FORCING THE MOLDING MATERIAL TO FLOW INTO THE MOLD. SCENE 44. CM44A, tape 40, 12:26:33-12:26:51 zoom in, material placed in machine, plunger activated

## NARRATION (VO):

THIS FORCE GENERATES SUBSTANTIAL HEAT, MELTING AND HOMOGENIZING THE MOLDING MATERIAL AS IT ENTERS THE MOLD CAVITY.

SCENE 45. CM45A, tape 40, 12:27:03-12:27:17 wide, mold opening, parts ejected

## NARRATION (VO):

THE MOLDING MATERIAL IS HELD UNDER PRESSURE UNTIL THE CURING CYCLE IS COMPLETE. AFTERWARDS, THE CLAMP RAM IS LOWERED AND THE MOLD OPENS FOR PART EJECTION.

SCENE 46. CM46A, tape 40, 12:22:16-12:22:25 zoom out, intricate parts connected to runner system

SCENE 47.

CM47A, tape 41, 13:16:05-13:16:18
inserts placed in transfer mold,
dissolve into next shot
CM47B, tape 41, 13:17:00-13:17:09
transfer molded parts with inserts
demolded

SCENE 48. CM48A, tape 41, 13:19:28-13:19:45 c.u. transfer molded parts with inserts demolded

## NARRATION (VO):

TRANSFER MOLDING IS PARTICULARLY SUITED FOR PRODUCING INTRICATE PARTS HAVING VARYING WALL THICKNESSES.

## NARRATION (VO):

TRANSFER MOLDING IS ALSO USED EXTENSIVELY FOR INSERT MOLDING, INCREASING OPPORTUNITIES FOR PARTS INTEGRATION, REDUCING PART PIECES AND PARTS ASSEMBLY REQUIREMENTS.

#### NARRATION (VO):

TRANSFER MOLDS TEND TO BE MORE EXPENSIVE THAN COMPRESSION MOLDS THOUGH, AND THE EXCESS MATERIAL USED DURING THE MOLDING PROCESS MUST BE REMOVED AS SCRAP.

--- FADE TO BLACK ---

SCENE 49. CM49A, GRAPHIC: Review white text on black CM49B, peter carey narration MUSIC UP AND UNDER NARRATION (VO):

LET'S REVIEW THE MATERIAL CONTAINED IN THIS PROGRAM.

SCENE 50.
CM50A, tape 42, 14:14:14-14:14:24
compression mold opening
CM50B, review music, up and under

SCENE 51. CM51A, tape 42, 14:28:13-14:28:27 thermoset molding compound cut

SCENE 52. CM52A, tape 42, 14:26:34-14:26:52 molding compound placed in mold, dissolve into next image

CM53A, tape 42, 14:27:04-14:27:20 upper mold lowered on molding

CM53B, tape 42, 14:13:13-14:13:29

lower mold moving upwards, closing

NARRATION (VO): COMPRESSION MOLDING IS ONE OF THE MOST COMMON

METHODS OF PRODUCING HIGH VOLUME COMPOSITE PARTS AND COMPONENTS.

# NARRATION (VO):

BOTH THERMOSETS AND THERMOPLASTICS MAY BE COMPRESSION MOLDED, WITH THERMOSETS BEING THE PRIMARY TYPE OF MATERIALS USED.

# NARRATION (VO):

THE COMPRESSION MOLDING PROCESS TYPICALLY INVOLVES PLACING A PRECUT, PRE-WEIGHED CHARGE OF MATERIAL ONTO THE LOWER HALF OF A HEATED MOLD.

## NARRATION (VO):

THE HEATED UPPER HALF OF THE MOLD IS THEN LOWERED RAPIDLY CAUSING THE CHARGE TO FLOW, COMPRESSING IT TO THE REQUIRED DENSITY AND SHAPE AS DEFINED BY THE MOLD. WITH SOME PRESSES, THE LOWER HALF OF THE MOLD MOVES UPWARDS, FORCING THE MOLD HALVES TOGETHER.

## NARRATION (VO):

ONCE THE MATERIAL CURES UNDER THE HEAT AND PRESSURE, THE PRESS OPENS..., AND THE COMPRESSION MOLDED PART IS DEMOLDED, TYPICALLY WITH THE ASSISTANCE OF AN EJECTOR

mold halves together

SCENE 54.

SCENE 53.

compound

CM54A, tape 42, 14:12:36-14:12:51 press opening, dissolve into next shot

CM54B, tape 42, 14:12:55-14:13:05 part demolded using ejector system

SYSTEM.

## NARRATION (VO):

CM55B, tape 33, 05:14:49-05:15:21 molding compound placed in mold, THE mold closed CM55C, CGS: Sheet Molding Compound CON CM55D, tape 42, 14:18:28-14:18:43 molding compound cut, film being UP removed before use CM55E, CGS: Thick Molding Compound RES CM55F, tape 32, 04:01:40-04:01:55 zoom out, box of thick molding CON compound CM55G, CGS: Bulk Molding Compound SHE CM55H, tape 46, 18:12:03-18:12:30 zoom in, bulk molding compound THI extruded

SCENE 56. CM56A, tape 46, 18:15:26-18:15:46 resin, reinforcement material placed on preform

SCENE 57.
CM57A, tape 46, 18:18:57-18:19:15
wide, large press opening
CM57B, tape 33, 05:15:24-05:15:36
smaller press closing

SCENE 58. CM58A, tape 45, 17:04:07-17:04:22 wide, dedicated compression molding machine running

THE MOST COMMONLY USED MATERIALS FOR COMPRESSION MOLDING ARE MOLDING COMPOUNDS MADE UP OF GLASS FIBERS ALONG WITH UNCURED VISCOUS RESIN PASTE. THE PRINCIPAL TYPES OF MOLDING COMPOUND INCLUDE: SHEET MOLDING COMPOUND, OR 'SMC'..., THICK MOLDING COMPOUND, OR 'TMC'...,

AND BULK MOLDING COMPOUND, OR 'BMC'.

#### NARRATION (VO):

COMPRESSION MOLDING IS ALSO DONE USING PREFORMS.

## NARRATION (VO):

COMPRESSION MOLDING IS TYPICALLY PERFORMED USING VERTICAL MOLDING PRESSES. THESE PRESSES ARE USUALLY HYDRAULICALLY DRIVEN, ALTHOUGH SMALLER PRESSES MAY BE AIR DRIVEN.

## NARRATION (VO):

HIGH VOLUME, DEDICATED COMPRESSION MOLDING MACHINERY IS ALSO USED.

--- TOUCH BLACK ---

#### SCENE 59.

SCENE 55.

CM59A, tape 47, 19:13:28-19:13:48 zoom out, milling of compression mold CM59B, tape 42, 14:22:40-14:22:54

zoom out, compound placed in mold, mold closed

#### NARRATION (VO):

COMPRESSION MOLDS ARE PRODUCED FROM SPECIAL MOLD STEELS, AND ARE SIMILAR TO THOSE USED FOR INJECTION MOLDING EXCEPT THAT THEY TYPICALLY

MATE BY TELESCOPING TOGETHER INSTEAD OF PRESSING TOGETHER ON LANDS.

SCENE 60. CM60A, tape 43, 15:17:46-15:17:57 compound in mold, mold closed, dissolve into next shot

SCENE 61. CM61A, tape 43, 15:18:32-15:18:52 mold opening, part removed

## NARRATION (VO):

TELESCOPING KEEPS THE MOLD HALVES FROM RESTING TOGETHER SO THAT THE COMPOUND WILL BE UNDER PRESSURE THROUGHOUT PRESSING AND CURING.

# NARRATION (VO):

TELESCOPING ALSO PREVENTS COMPOUND LOSS FROM THE MOLD CAVITY AND MINIMIZES FLASH THICKNESS SO THAT IT CAN BE EASILY REMOVED AFTERWARDS.

#### NARRATION (VO):

THE PRIMARY MOLD TYPES FOR COMPRESSION MOLDING INCLUDE: THE FLASH-TYPE MOLD,

THE POSITIVE-TYPE MOLD,

AND THE SEMI-POSITIVE-TYPE MOLD.

--- TOUCH BLACK ---

#### NARRATION (VO):

SCENE 63.
CM63A, CGS: Transfer Molding
CM63B, tape 41, 13:02:56-13:03:07
c.u. transfer mold opening

TRANSFER MOLDING IS A TECHNOLOGICAL EXTENSION OF COMPRESSION MOLDING.

#### NARRATION (VO):

IN OPERATION, THE MOLDING MATERIAL, WHICH MAY BE GRANULAR OR A PREFORMED SHOT, IS LOADED INTO A POT OR TRANSFER SLEEVE..., HIGH TRANSFER PRESSURE IS THEN APPLIED USING EITHER A RAM, PLUNGER, OR ROTATING SCREW-

SCENE 64. CM64A, tape 40, 12:18:28-12:18:42 zoom out, molding material, pan to placing in machine, cut to next shot CM64B, tape 40, 12:05:20-12:05:38 c.u. material placed in machine, plunger activated

FEEDER FORCING THE MOLDING MATERIAL TO FLOW INTO A CLOSED MOLD.

# SCENE 65. CM65A, tape 40, 12:27:03-12:27:17 wide, mold opening, parts ejected

SCENE 66.

demolded

NARRATION (VO):

THE MOLDING MATERIAL IS HELD UNDER PRESSURE UNTIL THE CURING CYCLE IS COMPLETE. AFTERWARDS THE MOLD OPENS AND THE PART IS EJECTED.

## NARRATION (VO):

CM66A, tape 40, 12:22:16-12:22:25 TRANSFER MOLDING IS PARTICULARLY SUITED FOR zoom out, intricate parts connected to runner system PRODUCING INTRICATE PARTS HAVING VARYING WALL CM66B, tape 41, 13:17:00-13:17:09 transfer molded parts with inserts THICKNESSES, AND is used extensively for

insert molding.

--- FADE TO BLACK ---

SCENE 67. CM67A, CG, ROLL: credits white text on black, fade up midscreen

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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 68. CM68A, GRAPHIC: disclaimer white text centered on black

SCENE 69. CM69A, SME logo open, with music