

1	<b>WITH RANDOMLY-ACTUATED STOPPING</b>	9.5	...Sensing tool or tool-linked part
2	.Manually controlled		
3	.Responsive to condition of work or product	10.1	...Sensing tool or tool-linked part
4	..Work feed or faulty work	10.2	...Sensing torque
5	...Termination or tangle of running-length work	10.3	...Sensing roll rotation (e.g., speed or distance)
6.1	<b>WITH USE OF CONTROL MEANS ENERGIZED IN RESPONSE TO ACTIVATOR STIMULATED BY CONDITION SENSOR</b>	10.4	...Sensing force
		10.5	....By sensor along roll surface and another sensor along roll axis
6.2	.Metal deforming by use of roller or roller-like tool element	10.6	....By sensing hydraulic pressure applied to roll
7.1	..Including use of sensor responsive to information carried by removable auxiliary record (e.g., recording disk, tape, or card)	10.7	...Sensing roll gap
		10.8	..Requiring operative intervention (e.g., for safety)
7.2	...Including plural sensors or sensor responsive to comparison between plural conditions	10.9	...With pause awaiting input from operative
7.3	....Sensing "pattern"	11.1	..Sensing work or product (e.g., by X-ray)
7.4	....Sensing work or product (e.g., by X-ray)	11.2	...Including plural sensors or sensor responsive to plural conditions
7.5	.....Sensing lead end or tail end	11.3	...Sensing temperature
7.6	.....Sensing cross sectional dimension	11.4	...Sensing slack or tension (e.g., by use of dancer)
8.1	..Including plural sensors or sensor responsive to comparison between plural conditions	11.5	...Sensing lead end or tail end
		11.6	...Sensing cross sectional dimension
8.2	...Sensing "memory" stored on tool or tool-linked part	11.7	....Sensing flatness (e.g., crown)
8.3	...Sensing work or product (e.g., by X-ray)	11.8	....Sensing thickness
8.4	....Work and product	11.9	.....Of edge of work or product
8.5	....Sensing temperature	12.1	...Sensing tool or tool-linked part
8.6	....Sensing slack or tension (e.g., by use of dancer)	12.2	...Sensing temperature
8.7	....Measuring tension distribution across width of work	12.3	...Sensing slack or tension (e.g., by use of dancer)
		12.4	...With deforming of work by sensor
8.8	....Sensing lead end or tail end	12.5	...Sensing lead end or tail end
8.9	....Sensing cross sectional dimension	12.6	...Including sensor responsive to infeeders or outpullers
9.1	.....Sensing flatness (e.g., crown)	12.7	...Sensing cross sectional dimension
9.2	.....Sensing thickness	12.8	...To control operation of deformer directly by sensor
9.3	.....Of edge of work or product	13.1	..Including use of sensor responsive to energy input to tool or tool driver
9.4	.....Sensor utilizes radiation to detect thickness (e.g., by X-ray)	13.2	...Including plural sensors or sensor responsive to plural conditions

13.3	...Sensing pressure of tool actuating fluid	16.6	...Sensing slack or tension (e.g., by use of dancer)
13.4	..Sensing tool or tool-linked part	16.7	...Sensing lead end or tail end
13.5	...To control predetermined sequence of operating movements (e.g., of one tool operating on work)	16.8	...Sensing cross sectional dimension
13.6	....Of different operating assemblages	16.9	....Sensing thickness
13.7	....Including plural sensors or sensor responsive to plural conditions	17.1	...Sensing tool or tool-linked part
13.8	....Including work handling or product handling	17.2	..Sensing tool or tool-linked part
14.1	...Including plural sensors or sensor responsive to plural conditions	17.3	.Sensing work or product (e.g., by X-ray)
14.2	...To control operation of interlock	18.1	..Including plural sensors or sensor responsive to plural conditions
14.3	...To stop machine	18.2	...Work and product
14.4	...Sensing force on tool	18.3	...Sensing temperature
14.5	....By sensing hydraulic pressure	18.4	...Sensing slack or tension (e.g., by use of dancer)
14.6	..To control different operating assemblages	18.5	...Sensing lead end or tail end
14.7	..Controlling deflector	18.6	...Sensing cross sectional dimension
14.8	..Including use of sensor responsive to information carried by removable auxiliary record (e.g., recording disk, tape, or card)	18.7	....Sensing flatness (e.g., crown)
14.9	..Including plural sensors or sensor responsive to comparison between plural conditions	18.8	....Sensing thickness
15.1	...Sensing "memory" stored on tool or tool-linked part	18.9	...Sensing tool or tool-linked part
15.2	...Sensing "pattern"	19.1	..Sensing temperature
15.3	...Sensing work or product (e.g., by X-ray)	19.2	..Sensing slack or tension (e.g., by use of dancer)
15.4	....Sensing lead end or tail end	19.3	...With deforming of work by sensor
15.5	....Sensing cross section dimension	19.4	..Sensing lead end or tail end
16.1	..Including plural sensors or sensor responsive to comparison between plural conditions	19.5	..Including sensor responsive to infeeder or outpuller
16.2	..Sensing work or product (e.g., by X-ray)	19.6	..Sensing cross sectional dimension
16.3	...Sensing performance of work or product	19.7	...To control operation of deformer directly by sensor
16.4	...Work and product	19.8	..Including use of sensor responsive to energy input to tool or tool driver
16.5	...Sensing temperature	19.9	..Sensing pressure of tool actuating fluid
		20.1	.Sensing tool or tool-linked part
		20.2	..To control predetermined sequence of operating movements (e.g., of one tool operating on work)
		20.3	...Of different operating assemblages
		20.4	....Including plural sensors or sensor responsive to plural conditions

20.5	...Including work handling or product handling	43	..With means to apply lubricant
21.1	..Including plural sensors or sensor responsive to plural conditions	44	...With means to transfer lubricant
21.2	..To control operation of interlock	45	...Force feed
21.3	..To stop machine	46	<b>WITH "COATING" OF WORK</b>
21.4	..Sensing force on tool	47	.Metal coating
21.5	...By sensing hydraulic pressure	48	<b>BY TOOL-COUPLE PRESSING TOGETHER ADJACENT SURFACE PORTIONS OF SAME WORK (E.G., TUBE-SEAMER)</b>
21.6	.To control different operating assemblages	49	.To form helically-seamed tube
28.1	<b>WITH USE OF SELF REGULATING CONTROL SYSTEM UTILIZING ELECTRICAL OR HYDRAULIC ENERGY</b>	50	..Using roller conforming to seam contour
28.2	.Metal deforming by use of roller or roller-like tool element	51	.To form longitudinally-seamed tube
29.1	..Utilizing electrical energy	52	..During longitudinal movement of work
29.2	.Utilizing electrical energy	53	<b>BY SHOT-BLASTING</b>
30.1	<b>WITH STOPPING UPON COMPLETION OF PRESCRIBED OPERATION</b>	54	<b>BY APPLICATION OF FLUENT MEDIUM, OR ENERGY FIELD</b>
30.2	.Metal deforming by use of roller or roller-like tool element	55	.With cutting
31.01	<b>WITH INDICATION OF CONDITION OR POSITION OF WORK, PRODUCT, OR MACHINE ELEMENT (E.G., BROKEN TOOL ALARM, ETC.)</b>	56	.By kinetic energy of fluid or field
31.02	.Trueness (e.g., devices for repairing, etc.)	57	.With actuated tool engaging work
31.03	..Elongate member straightening	58	..Expanding hollow work
31.04	.Tube or rod bending	59	...Corrugating tubular work
31.05	..Deflection angle	60	.Using fixed die
31.06	.Tube diameter resizing	61	..Expanding hollow work
31.07	.Including deformation by roller or roller-like tool	62	...In circular section die
31.08	..Distance between tools of tool couple	63	..Utilizing diaphragm between fluid and work
31.09	..Work guide position	64	<b>BY TWISTING AXIALLY MOVING WORK</b>
31.1	.Including deformation by simple bending	65	.With adjustment of machine or variation in effect of tool on product
31.11	..Tool or tool driver travel	66	<b>COILING BY WORK-GUIDE MEMBER ORBITING ABOUT LONGITUDINAL CENTERLINE OF FORMED COIL</b>
31.12	..Work stop position	67	<b>BY USE OF TOOL ACTING DURING RELATIVE ROTATION BETWEEN TOOL AND WORK ABOUT INTERNAL CENTER (E.G., GYRATING OR ROTATING TOOL)</b>
31.13	.Work drawn or extruded through die	68	.With metal deformation of different type
37	<b>WITH USE OF OPTICAL OR TRANSPARENT (E.G., VIEWING) MEANS</b>	69	.With modification or control of temperature of work, tool or machine, or with lubrication thereof
38	<b>WITH EXPOSURE OF WORK TO GAS, VAPOR, MIST, OR MODIFIED ATMOSPHERE</b>	70	.With cutting of work or product
39	<b>WITH CLEANING, DESCALING, OR LUBRICATION OF WORK OR PRODUCT</b>	71	..By composite cutting, deforming tool
40	.Mechanical cleaning	72	..With actuation of cutter in timed relation to movement of deformer or work
41	.Lubricating		
42	..With particular lubricant		

73	.With oscillation of work about work-axis	97	...Including work-piercing or work-expanding plug
74	.With oscillation of work-engaging tool surface about work surface	98	...Using tool-surfaces spaced along axis of work rotation
75	.Spherical tool	99	...Using hyperboloidal roller
76	.Work-hammering tool	100	...Using tool-cluster
77	.With tool surface orbiting around axis parallel to direction of travel of longitudinally moving work	101	..Using rotating tool-couple relatively adjustable about pivot normal to tool axis
78	..Including orbiting roller mounted on rotating carrier	102	..Using non-cylindrical rotating tool
79	..Including deflectors arranged to provide undulating path for work	103	...Having helical groove
80	.During rotation of work	104	...With cooperating tool rotating in same direction
81	..With "pattern" causing movement of presser member	105	..And cooperating, complementary tool
82	..Caused by work-holding, shape-imparting form (e.g., for "spinning")	106	...And circumferentially spaced, work-engaging elements
83	...With means causing cooperating presser member to traverse form surface	107	...Included in roller-cluster
84	..Using tool having rotating surface moving along it axis of rotation during deformation	108	...With cooperating tool rotating in same direction
85	...And means causing tool to traverse surface of cooperating rotatable member	109	...Including in tool-couple
86	..Using angularly related roller-couple acting parallel to axis of work rotation	110	..Using roller-cluster
87	...And additional work-engaging tool, circumferentially spaced about axis of work rotation	111	..Using tool-couple
88	..Caused by tools (e.g., "platens") relatively moving parallel to their surface	112	.Tool orbiting or rotating about an axis
89	...Including rotating tool (e.g., "disk-platen")	113	..Comprising transverse-axis roller inside hollow work
90	...Including stationary tool	114	..Helically-grooved tool threadedly engaging work
91	..Caused by rotating tool and opposing concave surface	115	..Comprising movable tool cooperating with fixed, work-spaced tool
92	...Non-rotating concave surface	116	...Plural, selectively usable fixed tools
93	...With means to adjust concave surface	117	...Outwardly acting movable tool
94	..And movement of work laterally of rotational axis during deformation	118	..Including tool surfaces spaced along orbital axis
95	..And longitudinal movement of work	119	...Including plural tools rotating on angularly related axes
96	...Using external rotating tool and internal core	120	..With actuation of tool radially
		121	...Wherein tool is actuated inwardly
		122	...Including rotating tool mounted on rotating carrier
		123	...Including roller having noncylindrical work-engaging surface
		124	..Comprising roller cooperating with work-spaced tool
		125	..With work or tool locator or work-clamp
		126	..Tool both orbits and rotates

127	<b>BY DEFLECTING SUCCESSIVELY- PRESENTED PORTIONS OF WORK DURING BODILY MOVEMENT THEREOF (E.G., FOR COILING, LEVELLING, CURVING OR TROUGHING MATERIAL IN MOVEMENT)</b>	152	..With deforming or work or product (other than by wiper and former)
128	..With modification or control of temperature or work, tool or machine	153	..And means to impart compound motion to form
129	..With cutting of work or product	154	..Including backed-up, travelling wiper (e.g., follow bar)
130	..And deforming of work or product (other than by deflecting)	155	..And means to urge wiper toward form surface
131	..And stopping of work movement during cutting	156	..And interrelated means to move form and gripper element thereon
132	..And actuation of cutter in timed relation to deflector or work movement	157	..Including interchangeable or adjustable wiper or form
133	..With feeding of discrete articles or orienting of work relative to deflector (other than by deflector)	158	...Comprising adjustable wiper
134	..With use of means to remove product from deflector	159	..And work-complementing gripper faces (e.g., contoured)
135	..To form helical coil or tube	160	..By use of deflected arranged to provide longitudinally undulating path for work (e.g., "leveling")
136	..Including thinning of helical portion of work section	161	..With deforming of work or product (other than levelling)
137	..With deforming of work or product (other than by coiler)	162	..Including relatively-inclined successive rollers
138	..By use of means acting by and during machine operation to form coil of irregular pitch and/or diameter	163	..And back-up means for roller- deflector
139	...Including non-cylindrical core	164	..And adjustable carrier for deflector
140	..By interchangeable or selectable tool portion	165	...Including tier of roller- deflectors on carriers
141	..By multi-convolitional tool	166	..By use of deflectors arranged to bend work longitudinally of direction of work-movement
142	..By work-guide and rotatable, work-holding core	167	..Including thinning of portion of work-section
143	..And means to change pitch of coil	168	..With deforming of work or product (other than bending longitudinally)
144	...And means to traverse work- guide	169	..With handling of curved product
145	..By movable-periphery tool external of coil	170	..Including three concurrently- acting delta-arranged deflector elements
146	..To form spiral coil	171	...And additional work-deflecting or work-constraining element
147	..With interposes to space adjacent coil convolutions	172	...Comprising two rollers and guide
148	..With core inside coil	173	...Including adjustable element
149	..By use of work-contacting wiper and moving, work-holding form	174	...And interrelated means to adjust plural elements simultaneously
150	..With core inside hollow workpiece	175	...Comprising rectilinearly reciprocable carrier for element
151	..With tensioning or work		

176	.By use of deflector arranged to bend work transversely of direction of work movement (e.g., troughing)	203	.With cutting of work or product
177	..With deforming of work or product (other than bending transversely)	204	..By composite cutting deforming tool
178	..Including roller-cluster	205	.Including tautening of work during deformation (e.g., "tension bridle")
179	..Including complementary roller-couple	206	.With non-roller Metal Deforming station
180	...Including plural, axially-spaced circumferential ribs and grooves	207	.Including rectilinearly moving tool cooperating with single roller
181	...Including plural, successively-acting roller-couples	208	.With tool inside hollow work
182	..Including roller-couple	209	..Comprising plug acting on longitudinally moving work
183	.By tension applied to work or product (e.g., uncoiling)	210	.Mounted on travelling, work-supported carriage
184	<b>BY USE OF "FLYING TOOL" ENGAGING MOVING WORK</b>	211	.Mounted on manually maneuverable carrier
185	.With cutting	212	.With work-forcer offset from, and relatively movable between, spaced rollers
186	..By composite cutting, deforming tool	213	..With use of means to move work-forcer
187	.Included in plural deforming stations or passes	214	.Comprising tool movable relative to stationary work-portion during deformation
188	..Passes spaced along axis of rotating tool	215	..Along a curved path
189	.Including arcuately oscillating tool-face	216	...About a fixed pivot
190	.Including orbitally-moving tool-face	217	...Work between movable tool and pivot (e.g., sweep-arm bender)
191	..Moving in circular orbit	218	....With means to apply torque to movable tool
192	..With cooperating rectilinearly-moving tool (e.g., "anvil")	219	....Including adjustable tool
193	...Comprising tool inside hollow work	220	..Along a straight path relative to stationary cooperating tool
194	...Included in tool-cluster	221	.Plural passes spaced along axis of one roller of tool-couple
195	...Circumferentially adjustable relative to work-spaced cooperating surface	222	..With use of means to displace work laterally into next pass
196	...With cooperating complementary (e.g., conjugate) tool-face	223	..Roller common to two tool-couples
197	..With cooperating roller	224	.Included in roller-cluster
198	..With cooperating allochiral tool-face	225	..Comprising diverse roller-pairs
199	<b>BY USE OF ROLLER OR ROLLER-LIKE TOOL-ELEMENT</b>	226	.Plural roller-couples (e.g., successively or optionally usable)
200	.With modification or control of temperature of work, tool or machine	227	..With material-handling between successive couples
201	..Including cooling	228	...Including optionally selectable work paths
202	..By means (other than a tool) modifying temperature of work	229	...To reverse-roll the workpiece
		230	...By curved guide (e.g., "loop return")
		231	...Changing orientation or direction of work

232	..Including one roller common to two roller-couples (e.g., three-high mill)	252	..By reciprocating or oscillating means
233	...Including roller shiftable between successive passes of work	252.5	.Roller or roller-like tool-element of particular configuration
234	..Including successively-acting roller-couples	253.1	<b>BY EXTRUDING THROUGH ORIFICE</b>
235	...Comprising relatively-inclined successive couples	254	.With cutting
236	.With cleaning or conditioning of tool, or lubrication of tool or machine	255	..Severing product from stock or residue
237	.With carrier for roller-couple or tool-couple	256	.With metal-deforming other than by extrusion
238	..With replacement of tool	257	.With product handling
239	...By means to replace tool	258	.Expressing polymetallic-layered product
240	..With variation of bite of roller-couple during deformation	259	.By plural impellers operating into one extrusion chamber
241.2	..Including back-up for roller	260	.Expressing non-uniform cross-section or non-linear product
241.4	..With means to relatively vary back-up force along roller axis	261	.Expressing plural products
241.6	...Hydraulic or pneumatic force appliers spaced along roller axis	262	.By rotating impeller means
241.8	...Means to apply bending moment to roller or back-up roll	263	.Non-axial movement of die, ram, mandrel or container
242.2	...Load bearing, equal size pair of back-up rolls	264	.Utilizing internal forming means (e.g., mandrel) or core tube (e.g., wire guide)
242.4	...And second stage, equal size pair of back-up rolls	265	..Movable longitudinally in ram
243.2	...Including reaction roll	266	..Integral with ram
243.4	...Equal size pair of reaction rolls	267	...Single element ("impact extrusion" type)
243.6	...Irregular, convex or hollow back-up roll	268	..Core tube
244	..With interposer (e.g., wedge or gag) between tool and pressure applier	269	..Bridge mandrel
245	..Including fluent-driven tool support	270	.Work supplying
246	..Including resiliently urged tool support	271	.Pressure or velocity conditioning
247	..Including means to position tool along axis	272	.Container and/or support therefor
248	..With "screw-down" to adjust bite of tool-couple	273	.Ram or ram element
249	..With means to drive tool	273.5	.Indirect extrusion
250	.With handling of, or guiding of, work or product relative to tool	274	<b>BY PULLING WORKPIECE THROUGH CLOSED PERIPHERY DIE (E.G., ROD-, TUBE-, OR WIRE-DRAWING)</b>
251	..By endless belt or conveyor roll	275	.With cutting
		276	.Producing a non-uniform product
		277	.With movement of discrete workpiece angularly, laterally, or in a reverse direction
		278	.Utilizing plural metal-deforming tools
		279	..Varying speed of continuous workpiece through successive tool stations
		280	..Accumulating work between successive tool stations

281	..Including non-coaxial closed dies	310	..Clamp rotatable about fixed axis (e.g., bending brake)
282	..All closed dies coaxially aligned	311	.Movable clamp
283	..Including a mandrel inserted within a hollow workpiece	312	.With interrelated clamp closer and tool mover
284	.And applying a "pushing" force	313	..Jaw actuator driven by tool or tool holder
285	.Movable die	314	..Mechanical actuator
286	.With heating or cooling	315	...Cam or toggle
287	.Utilizing specified work moving means	316	.Clamp structure constitutes sole initial metal-deforming force-reaction means (i.e., is passive tool)
288	..Varying speed of moving work	317	..With plural selectively usable clamps (e.g., tube flarer)
289	..Rotating a drum, roll, sheave, etc.	318	..Deforming indeterminate-length work
290	..Interrelated work gripper and carrier	319	..With pivotal tool (e.g., sheet metal bender)
291	..Maintaining a "straight-line-draw"	320	...With die surface extension on clamp
292	<b>BY TIGHTENING FLEXIBLE BAND OR CHAIN ABOUT WORK</b>	321	...Curved die surface
293	<b>BY USE OF NON-DEFORMING WORK-GRIPPING CLAMP AND RELATIVELY MOVABLE CLAMP, TOOL OR WORK-FORCER</b>	322	..With die surface extending from clamp jaw
294	.With cutting	323	...Plural die surface portions and coacting tools
295	.By individually non-deforming clamps	324	<b>WITH CUTTING</b>
296	..With coacting relatively movable tool	325	.By composite tool (e.g., piercing)
297	..With means to actuate tool	326	..Shear-type
298	..With means to rotate clamp about fixed axis	327	...With endless cutting edges
299	...About axis intersecting work-gripping regions of two clamps (e.g., twisting)	328	...Utilizing stripper or ejector
300	..With interrelated clamp closer and clamp mover	329	...Blank detaching
301	..With bodily motion in fixed path	330	..Blank detaching
302	...Substantially direct approach or recession (e.g., stretching)	331	...Severing (e.g., subdividing)
303	...Along curved path (e.g., tire upsetting)	332	.By shearing tool-couple
304	.With work-distorting clamp	333	..With endless cutting edges (e.g., for punching a hole)
305	.With plural spaced clamps	334	...After final metal-deforming operation
306	.Plural or complex apparatus (e.g., with plural operations)	335	...Pre-cutting (i.e., before metal-deforming)
307	..With means to advance elongated work (e.g., pipe elbow crimper)	336	...Blank detaching
308	.Clamp is active metal-deforming element	337	..Blank detaching
309	..With coacting movable tool	338	.Severing a discrete piece from stock, work, or product
		339	..Pre-cutting
		340	.Machining after final metal-deforming (e.g., grinding to size)
		341	.Machining between plural metal-deforming operations
		342.1	<b>WITH TEMPERATURE MODIFICATION OF TOOL OR OF SPECIFIED PORTION OF WORK</b>



- 342.2 .Cooling
- 342.3 ..Of tool
- 342.4 ...And heating of tool
- 342.5 ..And heating of work
- 342.6 ...Distinct temperature modifications at distinct locations of workpiece
- 342.7 .Of tool
- 342.8 ..Preheating
- 342.92 ..By electrical resistance heater within tool
- 342.94 .Distinct temperature modifications at distinct locations of workpiece
- 342.96 ..By passing electric current through work
- 343 **BY USE OF CLOSED-DIE AND COACTING WORK-FORCER (E.G., PUSH-DRAWING)**
- 344 .With stripping or ejecting from tool
- 345 ..Timed with tool motion
- 346 ...With work feeding
- 347 .Cup or shell drawing (i.e., deep drawing)
- 348 ..With additional metal-deforming
- 349 ...Plural deep drawing
- 350 ..With application of frictional restraining force to work during deformation
- 351 ...With yieldable actuation of work-gripper (e.g., spring-biased blank-holder)
- 352 .Forcing work into or within closed die; e.g., forging
- 353.2 ..By two or more coacting tools movable relative to closed die; e.g., tool complex
- 353.4 ...Symmetrically expanding tools
- 353.6 ...With tools converging to form annular surface; e.g., segments of closed die
- 354.2 ...With tools converging to form annular surface; e.g., segments of closed die
- 354.6 ...One tool telescoping into closed die
- 354.8 ....One yieldably connected to another
- 355.2 ....Coaxial opposed tools
- 355.4 .....Passing through work; e.g., punch
- 355.6 .....Both tools telescoping into closed die
- 356 ..With additional metal-deforming
- 357 ..With actuation of split die
- 358 ..Tool portion enters cavity of closed die
- 359 ...With telescoping engagement
- 360 ..Coacting closed-dies
- 361 ..With holding, handling or guiding of work or product
- 362 **PROCESS**
- 363 .Deforming stacked blanks
- 364 .With temperature maintenance or modification
- 365.2 ."Rolling"
- 366.2 ..Between disclosed rollers
- 367.1 .Tube making or reshaping
- 368 ..Making
- 369 ..Bending
- 370.01 ..Comprising use of internal tool
- 370.02 ...End necked down
- 370.03 ...End upset
- 370.04 ...Laterally pressed die(s)
- 370.05 ....Collapsible mandrel
- 370.06 ...Expanding tube
- 370.07 ....Sleeve expanded in passage
- 370.08 ....Expanding internal tool
- 370.1 ..End forming
- 370.11 ...Flange forming
- 370.12 ...End closing (e.g., crimping)
- 370.13 ...Compression die (e.g., swaging)
- 370.14 ..Changing wall thickness
- 370.15 ...Increasing wall thickness
- 370.16 ..Fin or thread forming
- 370.17 ...Internal
- 370.18 ....And external
- 370.19 ..Corrugations forming
- 370.2 ...Axial
- 370.21 ..Groove forming
- 370.22 ..Using pressurized fluid during deformation
- 370.23 ..Change in cross section
- 370.24 ...Change in circular tube diameter
- 370.25 ....Reduction in diameter
- 370.26 ...Polygon cross section (e.g., rectangular)
- 370.27 ..Forming holes in tube
- 371 .Coiling and/or twisting
- 372 .Involving use of claimed apparatus
- 373 ..Reciprocating tool
- 374 ...Opposed tool faces
- 375 ....Complementary
- 376 ....Single tool pair
- 379.2 .Deforming sheet metal

- 379.4 ..Container making
- 379.6 ..Forming undulations
- 377 ..With attenuation, thickening, elongating or shortening of work material
- 378 ..By application of tensile forces
- 380 **BY RELATIVELY MOVABLE OFFSET TOOL-FACES (E.G., FOR BENDING OR DRAWING)**
- 381 ..Embodying three or more coating relatively movable tools (i.e., tool complex)
- 382 ..Comprising yieldable tool or face portion
- 383 ..With concurrent actuation of tools
- 384 ..Plural
- 385 ..Multi-point tool-couple (e.g., corrugator)
- 386 ..With tool motion in fixed path
- 387 ..Pivotal motion only
- 388 ...Cantilever bender
- 389.1 ..Between and co-planar with opposed tools
- 389.2 ...For a small radius bend
- 389.3 ....Elongated knife edge die (i.e., press brake)
- 389.4 .....Adjustable tool face
- 389.5 .....Opposed tools having adjustable crown (i.e., provision for die crowning)
- 389.6 ...Fluid pressure actuated (i.e., hydraulically or pneumatically actuated)
- 389.7 ...Manually pumped (e.g., by use of a hydraulic jack)
- 389.8 ....Pivotable opposed tools
- 389.9 ...Rack and pinion actuated
- 390.2 ...Ratchet actuated
- 390.3 ...Cam actuated
- 390.4 ...Linkage actuated
- 390.5 ...Lever actuated
- 390.6 ...Screw actuated
- 390.7 ....Puller
- 391.2 ..Concentric or telescoped tools
- 391.4 ..Tool inside hollow fastener
- 391.6 ...With fastener loader or supply
- 391.8 ....Helicallly ribbed tool
- 392 **BY RELATIVELY RECEDING WORK-ENGAGING TOOL-FACES (E.G., FOR STRETCHING)**
- 393 ..Embodying three or more tools (e.g., tube expander)
- 394 **BY THREE OR MORE COACTING RELATIVELY MOVABLE TOOLS (I.E., TOOL-COMPLEX)**
- 395 ..With paired coplanar tool-faces (e.g., for stretching flat work)
- 396 ..Yieldable face portion or auxiliary tool on tool-couple element
- 397 ..On actuated tool
- 398 ..Movable toward and against portion of work (e.g., floating mandrel)
- 399 ..Concurrently actuated tools
- 400 ..With coating fixed tool
- 401 ...Between generally opposed-stroke tools
- 402 ..All tools movable radially inward
- 403 ..With means to actuate tools in sequence
- 404 **BY PLURAL TOOL-COUPLES**
- 405.01 ..With means to feed work between plural tool stations
- 405.02 ..Belt or chain work carrier
- 405.03 ..Rotary work carrier (e.g., Turret)
- 405.04 ..Threaded rod work carrier
- 405.05 ..Sliding table work carrier
- 405.06 ..Continuous stock feed
- 405.07 ..Work pushed between tool stations
- 405.08 ..Including means to store work
- 405.09 ..Work grasping
- 405.1 ...Suction device (e.g., suction cup)
- 405.11 ...Reciprocating work feeder
- 405.12 ...Having work grasping jaws
- 405.13 ...Adapted to grasp work laterally (e.g., by gripper rail or transfer fingers)
- 405.14 ....Telescoping work gripper
- 405.15 ....Rotational movement
- 405.16 ....Lifting movement
- 406 **WITH MEANS TO EFFECT COMPOUND MOTION OF TOOL (E.G., ROCKING)**
- 407 **WITH MEANS TO ACTUATE BOTH ELEMENTS OF TOOL-COUPLE**
- 408 ..By continuously rotating shaft
- 409.01 ..Handle actuated (e.g., plier type, etc.)
- 409.02 ..Hog ringer
- 409.03 ...With supply
- 409.04 ..With work supply or feed
- 409.05 ...Surgical clip

409.06	...Electrical connector	452.5	...Eccentric circle (e.g., crank)
409.07	..Multiple stroke actuator	452.6	...Radial cam face
409.08	..Tool having constant angular orientation	452.7	...Axial cam face
409.09	...Including cam	452.8	..Linear cam
409.1	..Including cam	452.9	...Inclined cam (eg., inclined plane)
409.11	..Plural tools pivotal with respect to plural handles	430	.Including magnet, solenoid or explosive
409.12	..Toggle	431	.Including yieldable connection in drive train to movable tool
409.13	..Including distinct work retaining or positioning means	432	..Including pneumatic or hydraulic connection
409.14	...Electrical connector	433	..Including metallic spring connection
409.15	...Belt clip	434	...Coil spring
409.16	..Including selectable or replaceable tool	435	.Mechanical potential-energy drive means only
409.17	..Spreader	436	..With means to check energy for subsequent release
409.18	..Flanger or beader	437	..Wherein energy is stored by retraction of tool
409.19	..Work comprises tube	438	...With means to control force of blow
411	<b>BY RELATIVELY MOVABLE TOOLS HAVING SLIDABLY-ENGAGED WORK-CONFINING WALL MEANS (E.G., EDGEWISE SHEET-METAL BENDER)</b>	439	...Wherein tool is retracted by pinch rolls acting on rectilinearly moving tool-support
412	<b>BY TOOL-COUPLE EMBODYING NONPLANAR TOOL-FACE</b>	440	...Wherein tool is retracted by flexible strap
413	.With adjustable or replaceable section of tool-face	441	.With means to selectably control movement of tool
414	.With complementary tool-faces (e.g., for embossing)	442	..By drive means common to optionally selectable tools
415	..Constant profile (e.g., cylindrical segments)	443	..To control speed of tool
416	.Similar tool-faces	444	..By means to connect and/or disconnect tool from its drive
417	<b>INCLUDING INTERRELATED TOOL-MOVER AND BLANKHOLDER-MOVER</b>	445	.With stored-energy means to retract tool
418	<b>INCLUDING TOOL MEANS TO MOVE WORK TO OR AGAINST COOPERATING TOOL</b>	446	.With means to permit tool positioning
419	<b>WITH MEANS TO HANDLE WORK OR PRODUCT</b>	447	..To reposition line-of-action of tool
420	.Including means to permit maneuvering of work or product at tool zone	448	..To position stationary tool of tool-pair
421	..With means to interrelate movement of tool and of work	449	.Including gear-actuated tool support
422	.By gripper and/or endless chain	450	.Including link-actuated tool support
423	..With drum carrier for gripper	451	..Toggle links
424	.With means to store workpieces (e.g., magazine)	453.01	.Including pneumatic- or fluid-actuated tool support
425	.Including variable-speed means	453.02	..Multiple or staged drive means
426	.Including product handling means	453.03	...With mechanical drive means
427	..Ejector		
428	.Including work guide		
429	<b>WITH MEANS TO DRIVE TOOL</b>		
452.1	.Including cam-actuated support		
452.2	..Pivotal cam		
452.3	...Internal cam		
452.4	...Rotary cam		

- 453.04 ...Fluid high pressure/  
mechanical low pressure
- 453.05 ...Displacement additive
- 453.06 ...Pressure additive
- 453.07 ...Axially aligned pistons
- 453.08 ...Independently actuated means
- 453.09 ...Pull-down press
- 453.1 ..Utilizing stored energy
- 453.11 ...Stored kinetic energy
- 453.12 ..Pull-down press
- 453.13 ..Including fluid cushion for die  
opposite to ram
- 453.14 ..With ram or tool support  
aligning means
- 453.15 ..Randomly manipulated or work-  
supported tool
- 453.16 ...With handle for manual  
manipulation
- 453.17 ...Riveting tool
- 453.18 ..Having hydraulic or pneumatic  
return
- 453.19 ...Riveting tool
- 454 ..Including screw-actuated tool  
support
- 455 **WITH TOOL CARRIER (E.G., PRESS  
FRAME)**
- 456 ..With guide for rectilinearly  
moving tool
- 457 **BY OR WITH WORK-CONSTRAINER AND/  
OR MANIPULATED WORK-FORCER**
- 458 ..Comprising lever manipulated to  
force work
- 459 ..With work-complementing tool-  
face adjacent to work-gripping  
clamp
- 460 ..Comprising nondeforming work-  
gripping clamp having adjacent  
tool-face
- 461 ..Comprising work-stopping  
abutment
- 462 **TOOL AND/OR TOOL HOLDER**
- 463 ..With nondeforming passageway
- 464 ..Including deforming tool and  
cutting tool
- 465.1 ..Including flexible or yieldable  
tool or support
- 466 ..Flexible or articulated back-up
- 466.2 ..Bending mandrel
- 466.3 ..Overload release
- 466.4 ..Riveting tool
- 466.5 ...Rivet buckler or dolly
- 466.6 ..Handtool (e.g., hammer or  
dolly)
- 466.7 ..Fluid pressure supported
- 466.8 ..Resilient material
- 466.9 ...Metal spring (e.g., coil or  
leaf)
- 467 ..Tool comprising closed periphery  
deforming passageway
- 468 ..Including adjustable size or  
multiple passageway
- 469 ..Tool-comprising die plate having  
ribs and/or grooves
- 470 ..Including tool couple or die  
couple (e.g., opposed die  
faces)
- 471 ..With intermediate tool
- 472 ..Including plural tool couples
- 473 ..Having adjustable face
- 474 ..Having nonsymmetrical faces
- 475 ...Complementary faces
- 476 ..Having unitary tool-face
- 477 ..Including optionally selectable  
faces
- 478 ..Comprising plural sections  
fixed together in use (e.g.,  
adjustable or collapsible)
- 479 ..With elongated extension fixed  
to tool face in use (e.g.,  
handle or shank)
- 480 ...Adjustable relative to tool-  
face before use
- 481.1 ..With support or holder for  
adjustable or removable tool  
face
- 481.2 ...Pneumatic- or fluid-actuated  
means to move or hold tool  
face
- 481.3 ...Threaded means to move or hold  
tool face
- 481.4 ...To move by threaded member  
that travels along tool face
- 481.5 ....Threaded means  
"telescopically" interfits  
with tool face
- 481.6 ...To hold by actuating a  
clamping mechanism
- 481.7 ....Threaded means comprising  
"fastener"
- 481.8 ...To hold by threaded means  
comprising "fastener"
- 481.9 ...To hold by binding tool face
- 482.1 ...Cam to move or hold tool face
- 482.2 ...To hold by actuating a  
clamping mechanism
- 482.3 ...Wedge shaped cam
- 482.4 ....To move tool face
- 482.5 ....Engaging dovetail on tool  
face
- 482.6 ...Lever to move tool face

- 482.7 ...Ratchet to move tool face
- 482.8 ...Gear to move tool face
- 482.9 ...Magnetic means to hold tool face
- 482.91 ...Spring to hold tool face
- 482.92 ...Pin to hold tool face
- 482.93 ...Tool face held by friction fit to support
- 482.94 ...Tool face threaded directly to support
- 483 **MISCELLANEOUS**

**CROSS-REFERENCE ART COLLECTIONS**

- 700 **DEFORMING SPECIFIED ALLOYS OR UNCOMMON METAL OR BIMETALLIC WORK**
- 701 **PREVENTING DISTORTION**
- 702 **OVERBENDING TO COMPENSATE FOR SPRINGBACK**
- 703 **KNURLING**
- 704 **CAMBER-ADJUSTING TOOL**
- 705 **VEHICLE BODY OR FRAME STRAIGHTENER**
- 706 **EXPLOSIVE**
- 707 **MAGNETISM**
- 708 **REVERSE DRAWING**
- 709 **SUPERPLASTIC MATERIAL**
- 710 **VIBRATING**
- 711 **HYDROSTATIC EXTRUSION**
- 712 **ELECTRICAL TERMINAL CRIMPER**
- 713 **METHOD OF MAKING VEHICLE POWER TRANSMITTING SHAFT**
- 714 **METHOD OF MAKING UNIVERSAL JOINT SHELL**
- 715 **METHOD OF MAKING CAN BODIES**

**FOREIGN ART COLLECTIONS**

- FOR **CLASS-RELATED FOREIGN DOCUMENTS PROCESS (72/362)**
- FOR 100 .Tube making and/or reshaping (72/367)
- FOR 101 ..Comprising use of internal tool (72/370)  
**TOOL OR TOOL HOLDER (72/462)**
- FOR 102 .Including flexible or yieldable tool or support (72/465)

