United States Patent [19]

Sherman

[11] **3,795,965**

[45] **Mar. 12, 1974**

[54] **APPARATUS FOR ASSEMBLING RAZOR BLADE UNITS**

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[73] Assignee: **The Gillette Company,** Boston, Mass.

[22] Filed: **June 29, 1972**

[21] Appl. No.: **267,521**

[52] **U.S. Cl.** ..... **29/208 D**

[51] **Int. Cl.** **B23p 19/04**

[58] **Field of Search** ..... 29/208 D, 208 R, 211 R, 29/211 D

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Primary Examiner—Thomas H. Eager

Attorney, Agent, or Firm—Willis M. Ertman

[57] **ABSTRACT**

Apparatus for assembling a razor blade unit having two housing components and a blade component is disclosed. The housing components have cooperating housing alignment and blade alignment surfaces. The apparatus includes support structure for holding a first housing component, first clamp structure for applying an aligning force to a second housing component to place the cooperating housing alignment surfaces of the first and second housing components in engagement, second clamp structure for applying a clamping force to the housing components to clamp the blade components between the first and second housing components, securing structure for modifying a portion of at least one of the housing components for permanently securing the first and second housing components with interposed blade components together as a unit, and common drive structure for operating the first and second clamp structure and the securing structure in coordinated relation to align, clamp and secure the housing components to form the blade unit.

17 Claims, 10 Drawing Figures

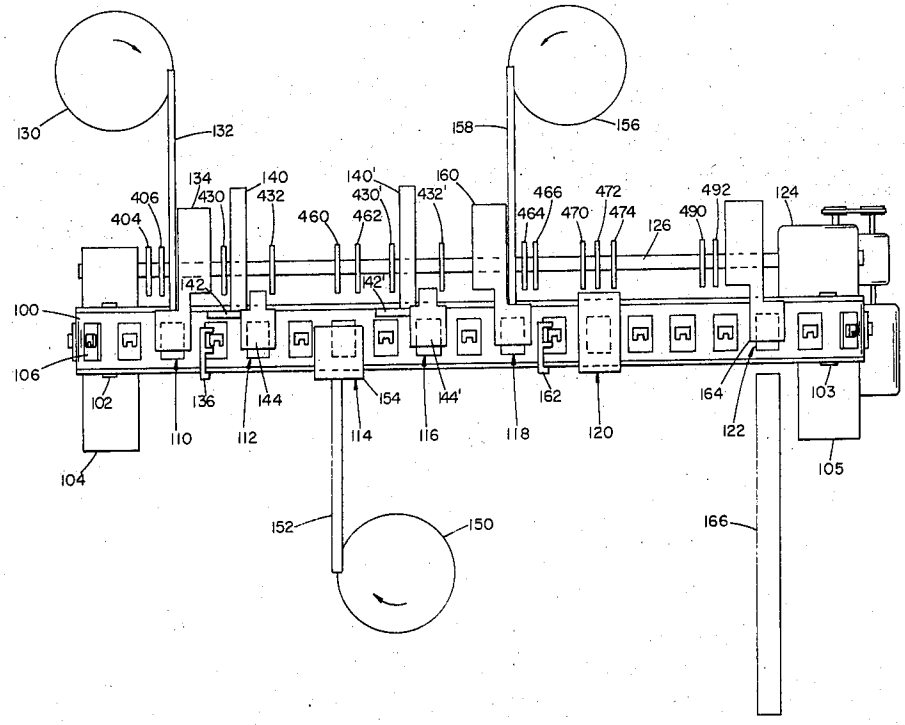
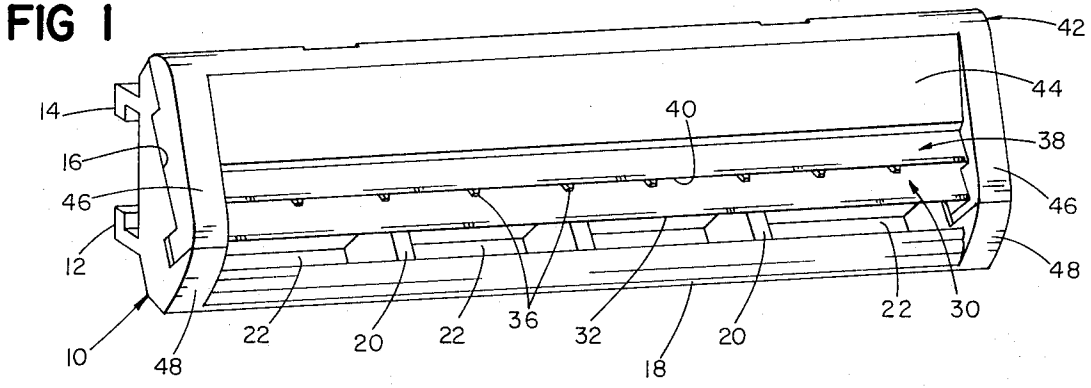


FIG 1


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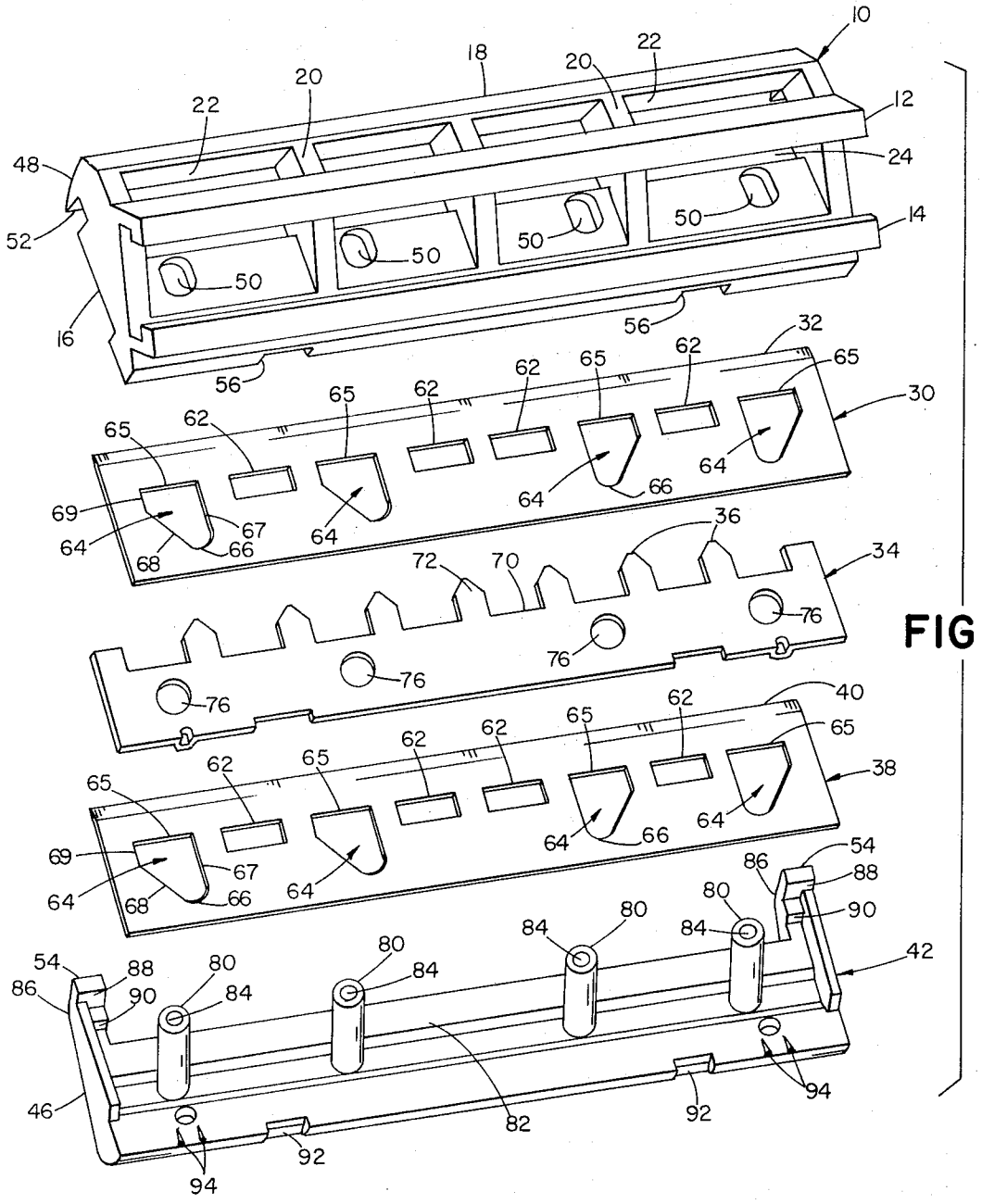

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FIG 2

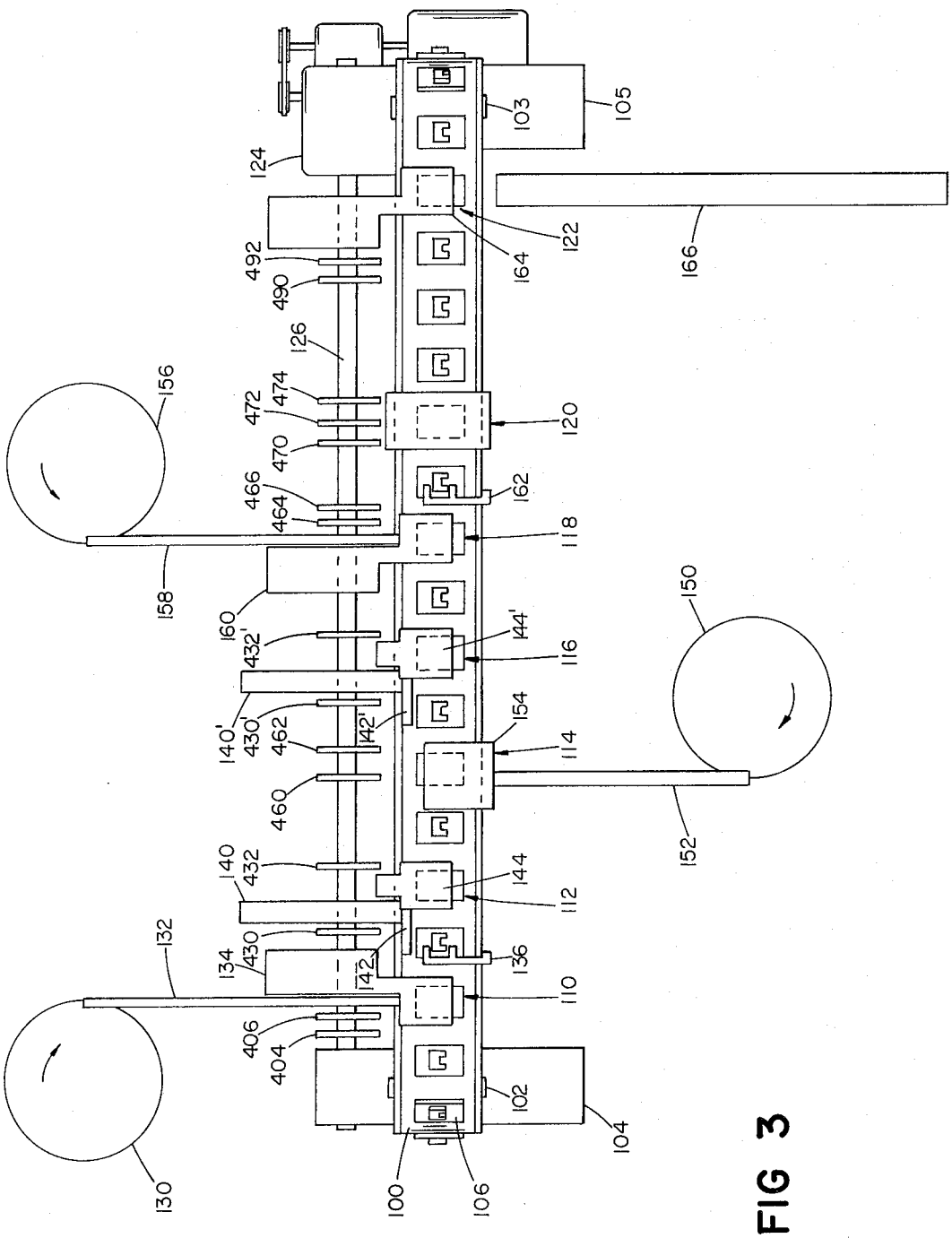

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FIG 3

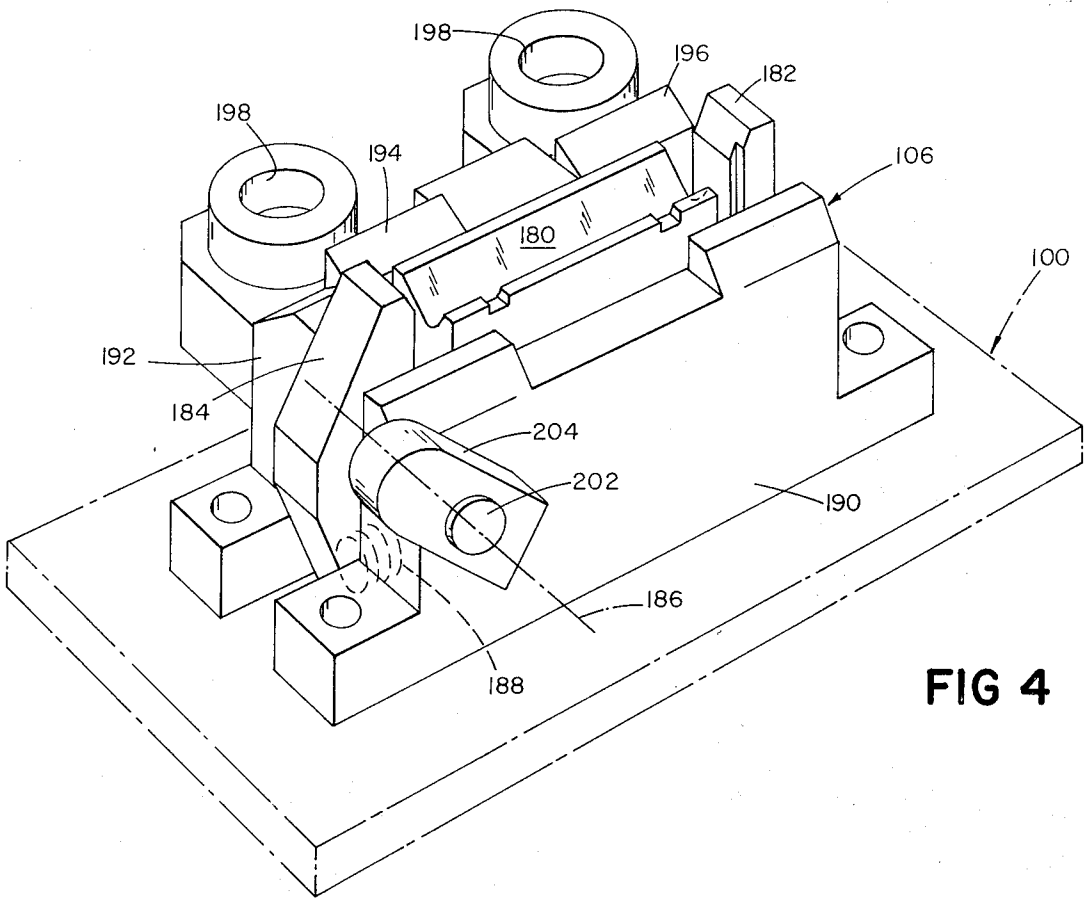

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FIG 4

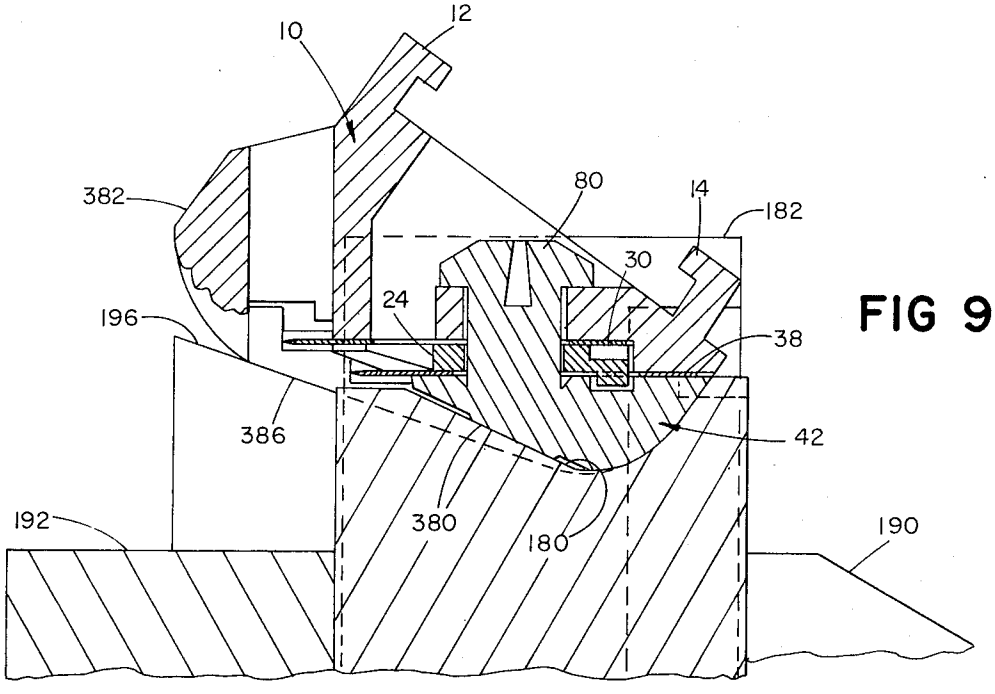

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FIG 9

FIG 5

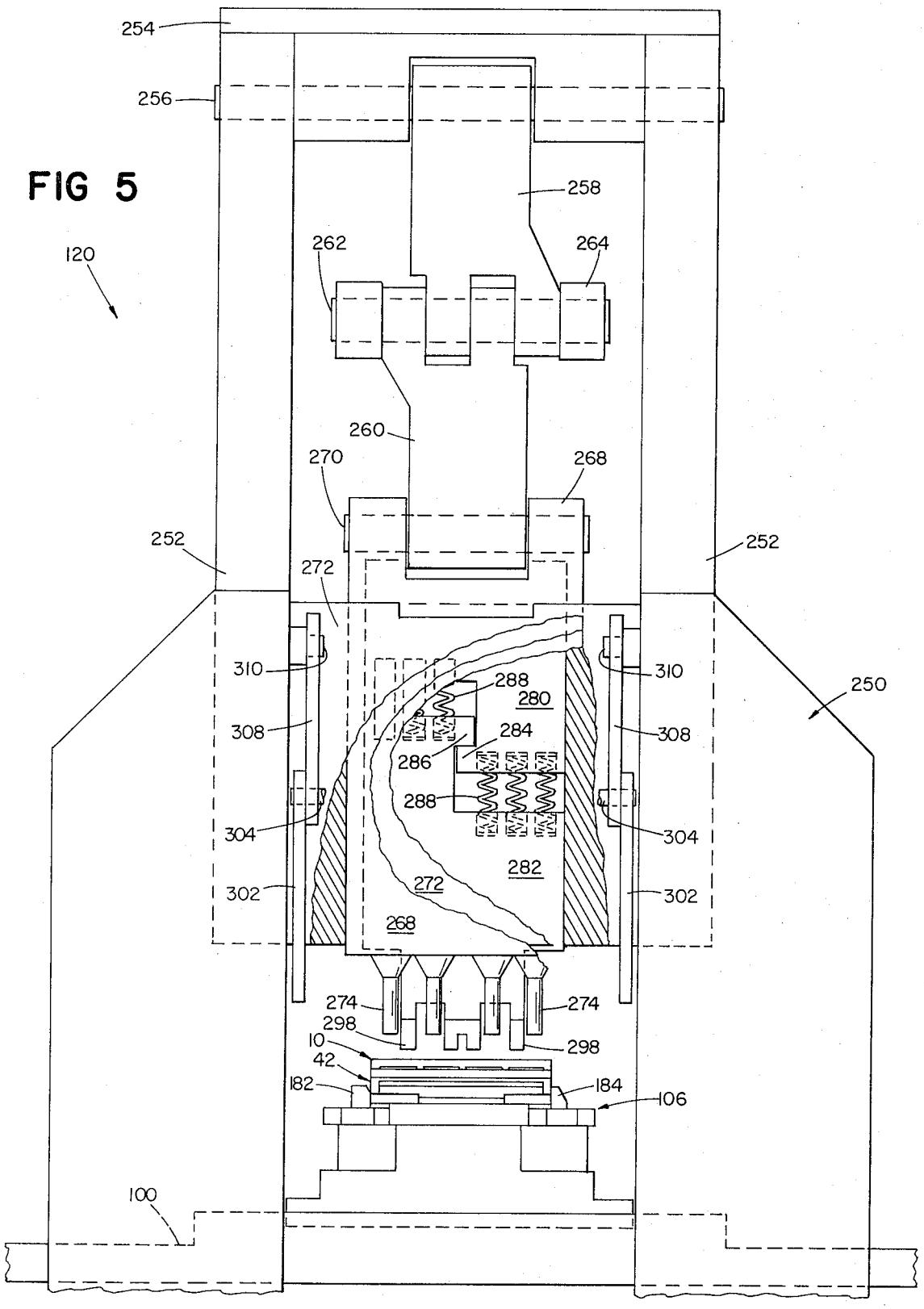
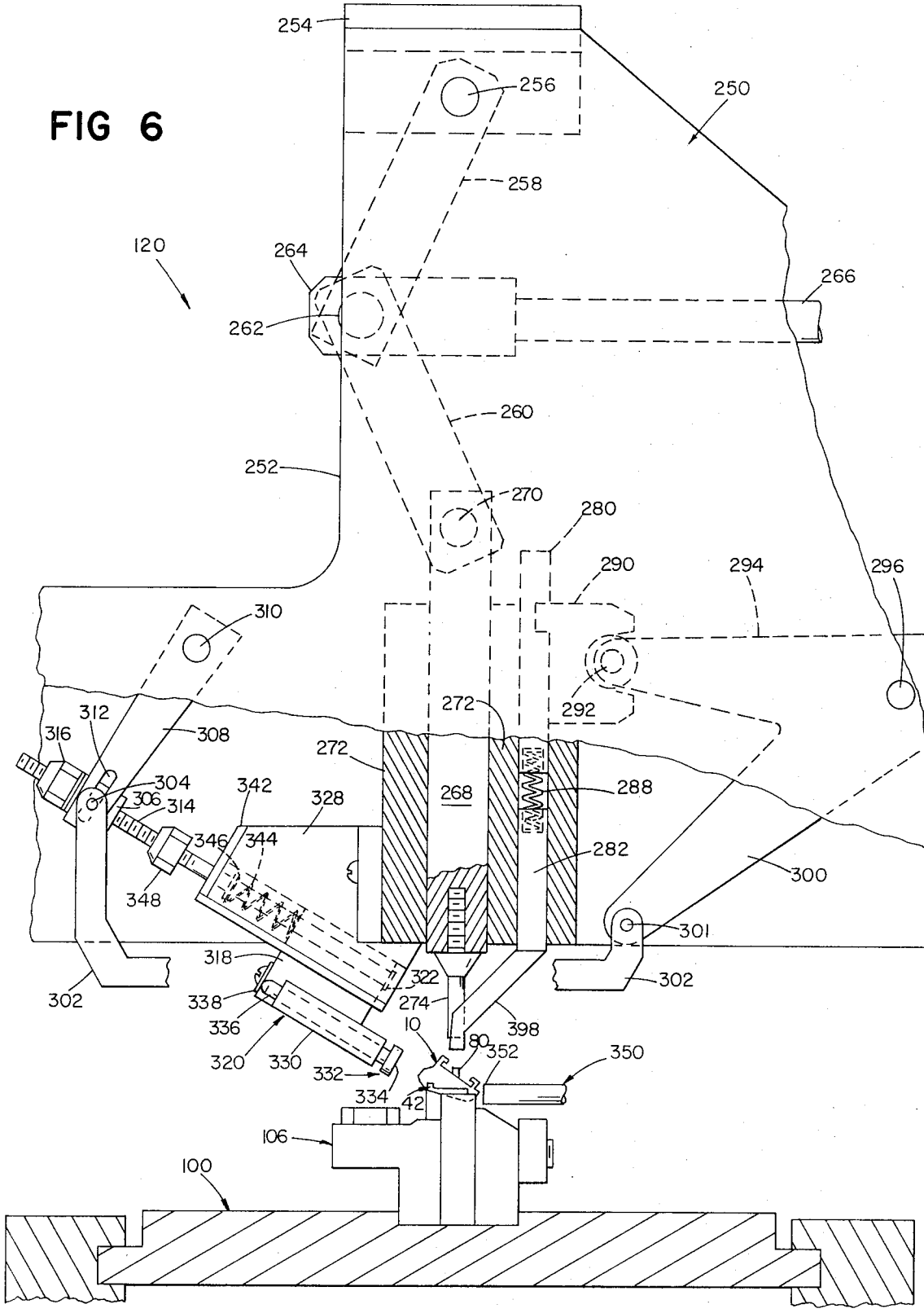

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106
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FIG 6


254
256
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258
120
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252
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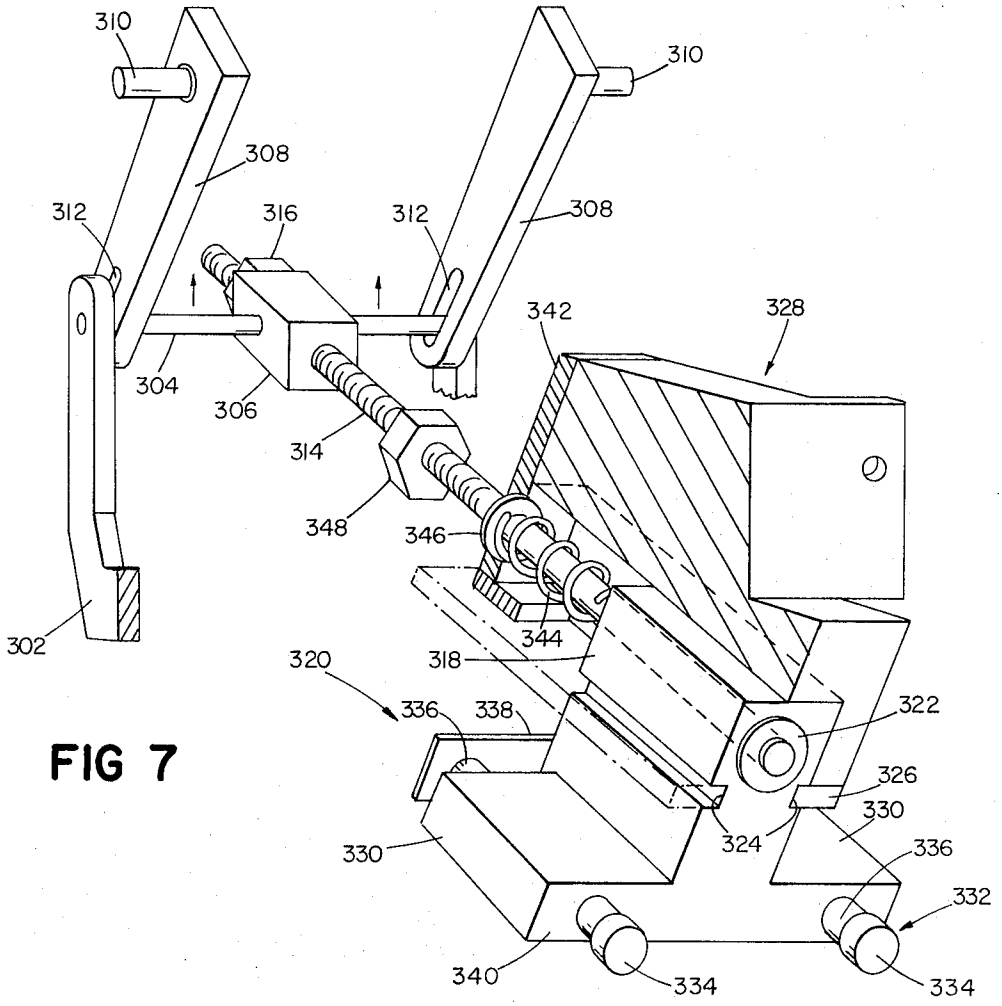

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FIG 7

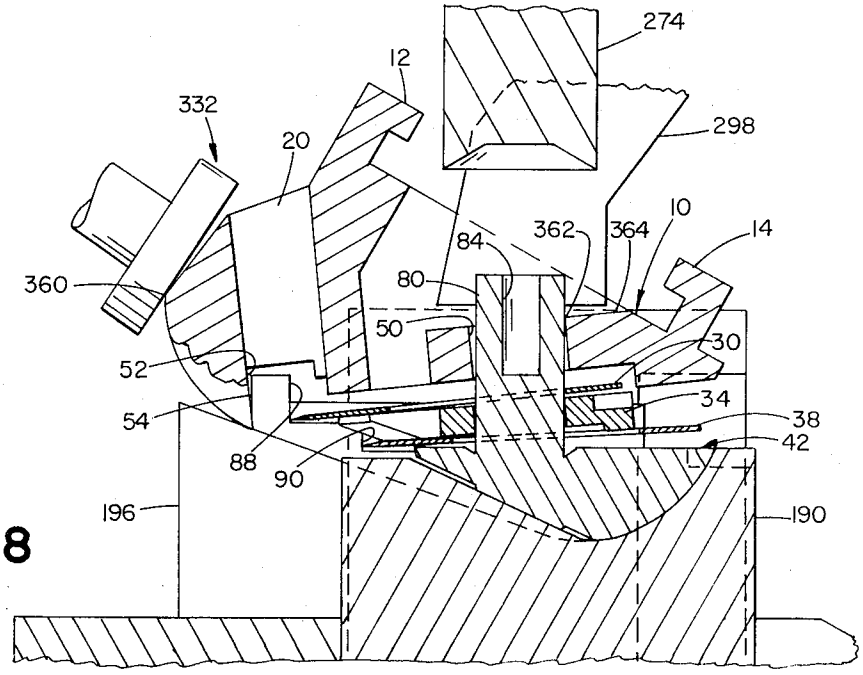
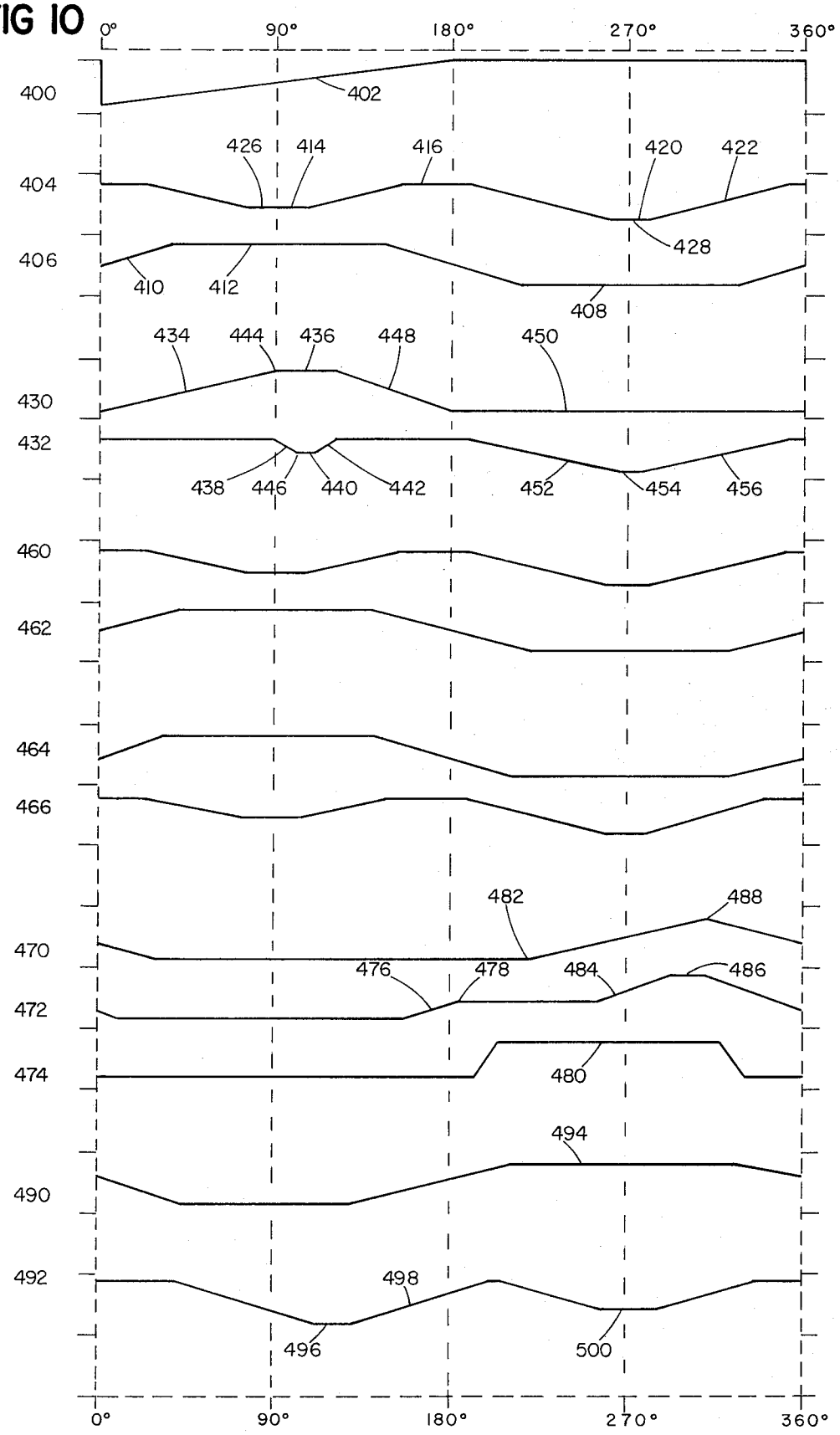

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FIG 8

FIG 10


0°
90°
180°
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360°
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APPARATUS FOR ASSEMBLING RAZOR BLADE UNITS

SUMMARY OF INVENTION

This invention relates to assembly apparatus and more particularly to apparatus for assembling components of a razor blade unit.

It is a principal object of this invention to provide novel and improved apparatus for assembling components of a razor blade unit. Another object of the invention is to provide novel and improved apparatus for assembling components of a plural cutting edge shaving system in an economical, efficient and rapid manner.

It has long been desirable in the shaving field to provide a shaving system which provides both a very close shave and a safe shave. It has been discovered that a plural cutting edge shaving system in which certain geometrical relationships are maintained with accuracy provides superior shaving characteristics. This shaving system includes two cutting edges and a guard structure disposed in fixed, parallel and spaced relation to one another so that both cutting edges are successively active with respect to the cutting of a single hair element during a single shaving stroke. This geometry is established in a blade unit in which the blade elements are permanently secured in fixed relations to the guard structure. Still another object of the invention is to provide automated apparatus for assembling components of such a razor blade unit in an economical, efficient and rapid manner.

In accordance with the inventin, there is provided apparatus for assembling a blade unit having a plurality of housing components and a plurality of blade components. The housing components have cooperating housing alignment surfaces and blade alignment surfaces and the apparatus includes support structure for holding a first housing component, first clamp structure for applying an aligning force to a second housing component disposed on the first housing component with the blade components disposed between them to place the cooperating housing alignment surfaces of the first and second housing components in engagement, second clamp structure for applying a clamping force to the housing components to clamp the blade components between the first and second housing components, securing structure for modifying a portion of at least one of the housing components for permanently securing the housing components with interposed blade components together as a unit, and common drive structure for operating the first and second clamp structures and the securing structure in coordinated relation to align, clamp and secure the housing components to form the blade unit.

In a preferred embodiment the apparatus also includes blade alignment structure for urging the blade components against the blade alignment surfaces by applying fluid pressure to the blade components. The first clamp structure imposes the aligning force on the second housing component at an angle greater than 25° to the direction of application of clamping force imposed by the second clamp structure and includes means for imposing an initial aligning force of low magnitude to the second housing component and a subsequent clamping force of magnitude at least 10 times the magnitude of the intial aligning force to the second housing component.

In a particular embodiment, one of the housing components has a plurality of apertures, the other housing component has a plurality of posts that extend through the apertures in the one housing component, and the securing structure includes means for deforming the posts in a cold heading operation to secure the housing components together. The second clamp structure and the securing structure are mounted for reciprocating movement along parallel paths and the second clamp structure includes a drive member, a clamping member and biasing means interposed between the drive and clamping members for resiliently urging them apart. The first clamp structure is mounted for reciprocating movement between first and second positions and includes a support member that has a seating surface, and a clamping member that is carried by the support member and movable relative thereto, and that has a clamp surface adapted to engage the second housing component and a second surface. A spring carried by the support member maintains the second surface spaced from the support member seating surface when the clamp structure is in said first position. The first clamp structure is movable to a position intermediate the first and second positions where the clamp surface is in engagement with the second housing component and the clamping member is shifted relative to the support member so that the spring applies an aligning force to the second housing component and to the second position where the clamping member is further shifted relative to the support member so that its second surface is in engagement with the seating surface and applies a subsequent clamping force to the second housing component.

Other objects, features and advantages of the invention will be seen as the following description of a particular embodiment progresses, in conjunction with the drawings, in which:

FIG. **1** is a perspective view of a blade unit assembled in accordance with the invention;

FIG. **2** is an exploded perspective view of components of the blade unit shown in FIG. **1**;

FIG. **3** is a plan view of a system for assembling blade units of the type shown in FIG. **1**;

FIG. **4** is a perspective view of a nest unit employed in the system shown in FIG. **3**;

FIG. **5** is a front elevational view, with parts broken away, of the aligning and securing apparatus employed in the system shown in FIG. **3**;

FIG. **6** is an end view, with parts borken away, of the apparatus shown in FIG. **5**;

FIG. **7** is a perspective diagrammatic view of the prebiasing and clamping mechanism employed in the apparatus shown in FIGS. **5** and **6**;

FIG. **8** is a sectional view showing the position of components of the blade unit during an alignment operation in the apparatus shown in FIGS. **5** and **6**;

FIG. **9** is a sectional view similar to FIG. **8** showing the configuration of the blade unit after the components have been secured together; and

FIG. **10** is a timing diagram indicating a sequence of operations of the assembly system shown in FIG. **3**.

DESCRIPTION OF PARTICULAR EMBODIMENT

The blade unit shown in FIG. **1** includes a base or platform member **10** molded of high impact polystyrene that includes depending coupling structure defined by flanges **12** and **14**. The base includes a blade

support surface **16** and a transversely extending guard structure **18** that is spaced forwardly of support surface **16** and connected to that surface by webs **20** that define a first row of slots **22.** A second row of slots **24** (shown best in FIG. **2**), are disposed parallel to the row of slots **22** and extend through platform **16.** Disposed on platform **16** is a leading steel blade member **30** having a sharpened cutting edge **32,** an aluminum spacer member **34** having **2** series of triangular projections **36** formed on its leading edge, and a follower steel blade member **38** having a sharpened cutting edge **40.** A cap structure **42,** also molded of high impact polystyrene, includes a cap surface **44** that extends transversely between end wall portions **46.** The forward ends of portions **46** mate with corresponding projecting surfaces of end wall portions **48** of base **10.**

Additional details of components of the blade unit may be seen with reference to the exploded view of FIG. **2,** which shows the blade unit component in inverted relation, that is the cap structure **42** is at the bottom and the base **10** is at the top of FIG. **2.** As indicated in FIG. **2,** base member **10** has a series of four apertures **50** which extend through the platform surface **16.** Each end portion **48** of the base includes a vertical surface **52** which is adapted to engage a cooperating vertical alignment surface **54** of the cap **42.** Recesses **56** are provided at the rear of the base member platform to facilitate blade alignment.

The leading and following blade elements **30, 38** are identical and each has a length of 1 ½ inches, a width of 0.28 inch and a thickness of 0.004 inch. The front and rear edges of each blade are parallel, the front edge being sharpened to a shaving edge. Formed in each blade member are a series of four axially extending rectangular slots **62,** each ⅛ inch long and 0.054 inch wide, and four irregularly shaped apertures **64.** The base surface **65** of each aperture **64** is of the same length as each slot **62,** the upper end of each aperture **64** is defined by a 0.046 inch radius surface **66,** with one end of surface **66** aligned with and connected to the corresponding end of the base surface **65** by surface **67** and the other end of surface **66** connected to the other end of surface **65** by inclined surface **68.** It will be noted that the bottom portion of each aperture **64** (defined by surfaces **65,** a portion of surface **67** and surface **69**) is of the same dimensions as slot **62.**

Spacer **34,** interposed between the blade elements **30** and **38,** has a length of 1 ½ inches, a width of 0.24 inch and a thickness of 0.020 inch. Formed in the forward edge of spacer **34** are a series of recesses **70,** each of which is 0.080 inch deep and about ⅛ inch long; and a series of spaced forwardly directed fingers **72,** each of which culminates in a triangular tip portion **36.** The spacer has holes **76** which are alignable with holes **50** in the base member **10** and holes **64** in the blade elements **30** and **38.**

The cap member **42** includes four posts **80** that project 0.154 inch above planar surface **82.** Each post has at its outer end a 0.038 inch diameter recess **84** that is 0.081 inch deep. The two inner posts **80** are spaced about ½ inch apart and each outer post is spaced about ⅜ inch from the adjacent inner post. Each end wall portion **46** includes a forwardly projecting wing **86** on the forward surface of which is formed aligning surface **54** and on the rearward surface of which are formed a second aligning surface **88** which is engaged by the sharpened edge **32** of the leading blade **30,** and a third aligning surface **90** which is engaged by the sharpened edge **40** of the trailing blade **38.** Recesses **92** are alignable with recesses **56** in the base **10** and ridges **94** engage the upper blade member **38.** Similar ridges are formed in the platform member portion **16** of the base **10.**

In the assembly process, the cap **42** is positioned with posts **80** extending vertically and then blade **38,** spacer **34,** blade **30,** and base **10** are sequentially deposited on the posts so that the posts **80** extend through the corresponding apertures in those members. After alignment by positioning blade edges **32** and **40** against aligning surfaces **88** and **90,** the assembly is firmly clamped together and the upper ends of posts **80** are cold headed to secure the components of the blade unit together.

Apparatus which sequentially performs these steps is shown in FIG. **3.** As indicated in that figure, a transport belt **100** is supported on spaced shafts **102, 103** which in turn are secured to support members **104, 105.** A series of nest structures **106** are secured to transport belt **100.** The nest structures are sequentially moved past a series of stations that include a cap loading station **110,** a first blade loading station **112,** a spacer loading station **114,** a second blade loading station **116,** a base member loading station **118,** an alignment and cold heading station **120,** and an unloading station **122.** The transport belt **100** and the mechanisms at the several stations are driven in coordination by drive unit diagrammatically indicated at **124** which includes drives for the cam shaft **126** and for indexing the transport belt **100.**

Cap members **42** are fed from supply **130** along track **132** to transfer mechanism **134** which loads a cap member **42** into each nest structure where it is clamped in position with posts **80** extending vertically. Sensor **136** photoelectrically senses the presence of upstanding posts **80** of a cap member **42** in each nest. At station **112,** a stack of blades **38** is disposed in supply channel **140.** The bottom blade of the stack is engaged by slide mechanism **142** which transfers that blade to a transfer mechanism **144** which in turn deposits the blade on posts **80** of cap member **42** secured in the nest **106** at that station. At station **114** a spacer member **34** is transferred from supply **150** along track **152** to transfer mechanism **154** for deposit in similar manner on posts **80.** At station **116,** a second (loading) blade **30** is transferred, in a manner similar to that of station **112,** by slide member **142'** from supply channel **140'** to transfer mechanism **144'** for loading onto the spacer member **34** on posts **80** of the cap member **42** held in the nest at that station. A base member **10** is transferred from supply **156** along track **158** to transfer mechanism **160** for loading onto the posts **80** of the cap member at station **118;** and the presence of base structure on the stack of components is then detected by sensor **162** as the nest is indexed past that sensor.

As indicated above, at station **120,** the blade elements **30** and **38** and base **10** are aligned with respect to alignment surfaces **54, 88** and **90** of cap member **42,** and then the blade unit assembly is clamped together and the posts **80** are deformed in a cold heading operation to secure the components of the blade unit assembly together. The belt **100** is then indexed to transfer the blade unit to unloading station **122** where transfer mechanism **164** removes the assembled blade unit from its nest **106** and places it on transfer conveyor **166** for transport to another area for further processing such as inspection and packaging.

A persepctive view of a nest assembly is shown in FIG. 4. That nest assembly **106** includes a surface **180** configured to conform to the configuration of surface **44** of cap member **42** which is arranged to receive cap member **42** in supporting relation. Spaced from one end of support surface **180** is fixed post **182** and spaced from the other end is post **184** which is mounted for rotation about axis **186**, post **184** being biased for rotation by compression spring **188** which acts between the lower end of post **184** and the body of nest assembly to rotate the upper end of post **184** towards post **182.** Side plates **190** and **912** define side walls of the nest assembly. Projecting above side plate **192** are two structures **194, 196** which support the projecting "wings" **86** of the cap member **42** when it is clamped in the nest. Alignment bushings **198,** offset laterally from side plate **192,** are arranged to receive alignment pins from transfer mechanisms at stations **110, 114** and **118** so that the component being loaded into the nest is disposed in proper alignment with components of and/or in the nest. A shaft **202** extends through side plates **190** and **192** along axis **186** and is secured to post **184.** A cam lever **204** is secured to shaft **202** and is arranged to rock end post **184** in a counterclockwise direction (compressing spring **188**) to move the upper end of post **184** outwardly to permit insertion of cap member **42** or removal of an assembled blade unit. The space at either end of surface **180** between that surface and the posts **184, 184** receives the end surfaces **46** of the cap member **42.**

As indicated above, each blade loading station includes an inclined guide channel **140** in which is disposed a stack of blade elements; a slide mechanism **142** which is reciprocal in guideways for transferring the lowermost blade in the stack in channel **140** from that stack and a transfer mechanism **144** which is vertically reciprocated by a drive mechanism to receive the transferred blade from slide mechanism **142** and then deposit the blade on posts **80** of a cap member **42** held in a nest **106.** The spacer **34,** a second blade **30** and base member **10** are deposited in similar manner at stations **114, 116** aand **118,** respectively.

Details of the mechanism at the alignment and securing station **120** may be seen with reference to FIGS. **5–8.** The apparatus at that station includes a support framework **250** with upstanding wall members **252** and cross member **254** which carries shaft **256** to which the upper end of a toggle linkage including links **258** and **260** is attached. Shaft **262** couples links **258** and **260** together and is connected to coupling **264** which is driven by rod **266.** The lower end of link **260** is pinned to drive block **268** by shaft **270.** Block **268** is received and guided for vertical reciprocation in a channel in frame member **272** and carries four spaced cold heading members **274** that extend vertically downward from the bottom surface of block **268.**

Mounted for vertical movement parallel to block **268** is a clamping mechnism that includes two blocks **280, 282** that have interengaged flanges **284, 286,** respectively. Clamping springs **288** urge blocks **280, 282** apart. A coupling structure **290** (FIG. **6**) secured to the rear of upper block **280** is connected by means of pin **292** to drive linkage **294** which is mounted for rotation about pin **296.** Clamp finger structure **298** extends downwardly from the lower end of block **282.**

A second arm **300** of drive link **294** is coupled by pin **301** to link **302,** the other end of which is coupled by pin **304** to drive member **306.** Auxiliary support links **308,** each mounted for pivoting movement on a support shaft **310,** have apertures **312** through which shaft **304** extends. Drive rod **314** is threadedly attached to drive member **306** and fixed in position relative thereto by lock **316.** Rod **314** passes through a bore in member **318** of clamp structure **320,** and is latched to member **318** by retainer disc **322.** Member **318** includes two grooves **324** which receive the inside portions of plates **326** that are secured to fixed support structure **328.** Thus, parallel support plates **326** define a track along which clamp structure **320** slides. Member **318** further includes two flanges **330** at its base, each of which has a bore through it. Mounted for sliding movement on clamp structure **320** are two bias pads **332,** each of which has a forward surface **334** and a rearwardly extending shaft **336.** Each shaft **336** passes through a corresponding bore in a flange **330.** A leaf spring **338** engages the ends of shafts **336** and provides a biasing force tending to space bias pads **332** forward of surface **340** of the support member **318.**

Rod **314** also passes through a hole in plate **342** and carries a spring **334** and washer **346.** Spring **344** urges the sliding clamp structure **320** to the right as viewed in FIG. **6** against retainer disc **322.** Stop nut **348** mounted on shaft rod **314** is arranged to engage support plate **342** to limit the movement of drive rod **314.**

Also at station **120** is aligning structure **350** which includes two nozzles **352,** each having a 1/16 inch I.D. outlet orifice that is spaced apart about 0.050 inch from the components of the blade unit held in the nest **106,** the nozzles being aligned with recesses **56** and **92** in the base and cap members, respectively.

In operation, when a nest **106** is in position at station **120,** clamp drive link **294** is rotated to move clamp members **298** down towards the components of the blade unit in the nest and to move bias pad **332** forward to engage surface **360** of guard **18** as shown in FIG. **8.** The leaf spring **338** in this position applies a prebiasing load of about 10–50 grams to guard surface **360** tending to tilt the base structure **10** as indicated in FIG. **8.** Air pressure is applied through nozzles **350** (at pressure of 60 psi) tending to further lift the base **10.** The bias pads **332** maintain aligning surface **52** of each wing in contact with the mating surface **54** of the cap **42** while the engagement of the edges of apertures **50** with posts **80** at point **362** limits the amount that the base **10** can tilt in this motion. The air blast forces the sharpened edges **32, 40** of the blades **30, 38** against reference surfaces **88, 90,** respectively, in an aligning operation. Additinal clamp force (about 8 pounds) is then applied to drive rod **314** so that the bias pads **332** seat against surface **340** to further urge the aligning surface **52** into engagement with surface **54.** At the same time, the clamping plate **280** is moved downwardly so that clamp members **298** engage surface **364** of the base member **10** with a clamping force of 22 pounds. After these clamping forces have been applied, the cold heading tools **274** are moved downward by operation of the toggle mechanism (links **258, 260**) to distort the tops of posts **80** as indicated in FIG. **9** to secure the components of the blade unit together. The blades are secured in proper position against their respective aligning surfaces by clamping pressure provided by the deformed posts **80** and by the ridges **94** in the cap **42** and corresponding ridges in the base member **10.**

After this operation, the nest is transferred to station **122** where the clamping lever **204** is rotated to release clamping pressure on the assembled blade unit in the nest **106** and then the blade unit is removed and transferred to conveyor **166.**

The timing diagram shown in FIG. **10** indicates the timing relationships of the several drive cams employed in the coordinated indexing and operation of the several stations in this system. The motion of the cam that controls the indexing of nests **106** is indicated at **400,** the nests being indexed from one station to the next as the cam moves from 0° to 180° as indicated by portion **402.** The path of the cam that controls the transfer or loading mechanism at the cap loading station **110** is indicated at **404** and the motion of the pickup cam at station **110** is indicated at **406.** A cap is picked up by the pickup head when it is in position as indicated at **408** and that head is moved as indicated by line **410** to a transfer position **412.** The transfer head is moved into position (**414**) to accept the cap from the pickup head and then raised to position **416.** After the pickup head is returned to the pickup position (line **408**), the transfer head is lowered to the position indicated at line **420** to deposit a cap in the nest **106.** As the transfer head lowers, it engages the lever **204** to rotate the end post **184** and as it rises (line **422**) the end post is rotated by spring **188** to clamp the deposited cap member in the nest. Vacuum is applied at point **426** and released at point **428.**

Motions of the slide and transfer mechanisms at the blade loading stations **112** and **116** are indicated at **430** and **432,** respectively. Line **434** indicates the lateral motion of the slide **142** from the supply channel **140** to the transfer mechanism **144.** While the slide is in the position indicated by line **436,** the transfer mechanism is moved down about 0.010 inch towards the slide member **142** as indicated by line **438,** picks up the blade during the interval indicated by line **440,** and then is retracted as indicated by line **442.** Vacuum is turned off slide **142** at point **444** and applied to transfer member **144** at point **446** so that a blade is transferred from the slide to the transfer head. After transfer head has been raised away from slide member **142** (line **442**), the slide is retracted, as indicated by line **448,** to its initial position in alignment with the supply channel **140** as indicated by line **450.** As indicated by line **452,** the transfer structure is lowered 2 1/16 inches and the blade is deposited on the posts **80** of the cap member with vacuum being released at point **454.** After deposit, transfer structure **144** is returned to its initial position as indicated by line **456.**

Deposit of the spacer **34** at station **114** is indicated by lines **460** and **462,** the motion being similar to the cap deposit operations indicated at lines **404** and **406;** and the base **10** is loaded at station **118** under controls of cams whose travels indicated by line **464, 466,** that motion also being similar to the operation at cap loading station **110.**

The cams indicated by lines **470, 472** and **474** control operations at the cold heading station **120** (alignment and securing). The cam indicated by line **470** controls the motion of toggle drive member **266;** the cam indicated by line **472** controls the clamping motion provided by lever **294;** and the cam indicated by line **474** controls application of air pressure to nozzles **352.** As the nest is being indexed into position at the station **120,** lever **294** starts to rotate as indicated by line **476** to apply a prebias force at point **478.** The aligning air blast is applied at **480** to force the blades **30, 38** against their reference surfaces **88, 90** and toggle mechanism drive **266** is started at point **482.** Additional clamping force is applied as indicated by line **484** and after the full clamping force is applied (line **486**) the full travel of the toggle mechanism is reached at point **488** to cold head the posts **80** as indicated in FIG. **9.**

The motion of the blade unit lifting mechanism at unloading station **122** is controlled by the cam indicated by line **490** and the motion of the transfer mechanism is controlled by the cam indicated by line **492.** The blade assembly is picked up when the lift cam is in the position **494** and raised to transfer the assembly to the transfer head at point **496.** The transfer head then rotates as indicated by the line **498** to transfer the assembly to the output conveyor as indicated at line **500.**

Thus is will be noted that operations are concurrently being performed at each of the stations during the interval of cam travel from 180° to 360° at which point the nests **106** on belt **100** are stopped. During each such interval, a cap member is loaded into and clamped in one nest (line **404**), blades are being deposited in two other nests (line **432**), a spacer member is being deposited in a fourth nest (line **462**), a base member is being deposited in still another nest (line **466**); the components of the assembly are being aligned and clamped together in still another nest (lines **470, 472** and **474**); and the blade unit is removed from still another nest (line **490**).

Thus the invention provides methods for assembling components of a multiple blade unit which achieves a desired precise geometry in an efficient and economical manner in a system that can be operated reliably and at mass production speeds.

While a particular embodiment of the invention has been shown and described, various modifications thereof will be apparent to those skilled in the art and therefore it is not intended that the invention be limited to the disclosed embodiment or to details thereof and departures may be made therefrom within the spirit and scope of the invention as defined in the claims.

I claim:

1. Apparatus for assembling a blade unit having a plurality of housing components and a plurality of blade components, said housing components have cooperating housing alignment surfaces and blade alignment surfaces, comprising:

support structure for holding a first housing component,

first clamp structure for applying an aligning force to a second housing component to place the cooperating housing alignment surfaces of said first and second housing components in engagement,

second clamp structure for applying a clamping force to said housing components to clamp said blade components between said first and second housing components,

securing structure for modifying a portion of at least one of said housing components for permanently securing said first and second housing components with interposed blade components together as a unit,

and common drive structure for operating said first and second clamp structure and said securing structure in coordinated relation to align, clamp

and secure said housing components to form said blade unit.

2. The apparatus as claimed in claim 1 wherein each said blade component is a planar blade member that has a sharpened cutting edge, and further including blade alignment structure for generating a force against an edge surface of each said planar blade member, said force tending to urge each said planar blade member forward to position the sharpened cutting edge of said planar blade member against said blade alignment surface.

3. The apparatus as claimed in claim 1 and further including blade alignment structure for urging said blade components against said blade alignment surfaces, said blade alignment structure including means for applying fluid pressure to said blade components for urging said blade components against said blade alignment surfaces.

4. The apparatus as claimed in claim 1 wherein one of said housing components has a plurality of apertures and the other of said housing components has a plurality of posts that extend through said apertures in said one housing component,

and said securing structure includes means for deforming said posts in a cold heading operation to secure said first and second housing components together.

5. The apparatus as claimed in claim 4 wherein said second clamp structure includes a member for applying clamp force generally parallel to the axes of said posts.

6. The apparatus as claimed in claim 1 wherein said second clamp structure and said securing structure are mounted for reciprocating movement along parallel paths.

7. The apparatus as claimed in claim 1 wherein said second clamp structure includes a drive member, a clamping member and biasing means interposed between said drive and clamping members for resiliently urging said members apart, said clamping member carrying a plurality of spaced clamping elements and said drive member being connected to said drive structure.

8. The apparatus as claimed in claim 1 wherein said first clamp structure imposes said aligning force on said second housing component at an angle greater than 25° to the direction of application of clamping force imposed by said second clamp structure.

9. The apparatus as claimed in claim 1 wherein said first clamp structure includes means for imposing an initial aligning force of low magnitude to the second housing component and a subsequent clamping force of magnitude at least ten times the magnitude of said initial aligning force.

10. The apparatus as claimed in claim 1 wherein said first clamp structure is mounted for movement between first and second positions and includes a support member, a clamping member carried by said support member and movable relative thereto, said clamping member having a clamp portion adapted to engage said second housing component, and biasing means for maintaining said second portion spaced from said support member when said clamp structure is in said first position, said first clamp structure being movable to a position intermediate said first and second positions where said clamp portion is in engagement with said second housing component and said clamping member is shifted relative to said support member so that said biasing means applies said aligning force to said second housing component.

11. The apparatus as claimed in claim 10 wherein said first clamp structure imposes said aligning force on said second housing component at an angle greater than 25° to the direction of application of clamping force imposed by said second clamp structure.

12. The apparatus as claimed in claim 11 wherein said second clamp structure includes a drive member, a clamping member and biasing means interposed between said drive and clamping members for resiliently urging said members apart, said clamping member carrying a plurality of spaced clamping elements and said drive member being connected to said drive structure.

13. The apparatus as claimed in claim 12 wherein said second clamp structure and said securing structure are mounted for reciprocating movement along parallel paths.

14. The apparatus as claimed in claim 13 wherein one of said housing components has a plurality of apertures and the other of said housing components has a plurality of posts that extend through said apertures in said one housing component,

and said securing structure includes means for deforming said posts in a cold heading operation to secure said first and second housing components together.

15. The apparatus as claimed in claim 14 wherein said first clamp structure is mounted for reciprocating movement between said first and second positions, said suppprt member has a seating surface, said clamping member has a second surface, said biasing means maintains said second surface spaced from said support member seating surface when said clamp structure is in said first position and further including a drive member, and second biasing means coupled between said drive member and said support member, said first clamp structure being movable to said second position where said clamping member is further shifted relative to said support member so that said second surface is in engagement with said seating surface and said second biasing means applies said subsequent clamping force to said second housing component.

16. The apparatus as claimed in claim 15 wherein each said blade component is a planar blade member that has a sharpened cutting edge, and further including blade alignment structure for generating a force against an edge surface of each planar blade member, said force tending to urge each said planar blade member forward to position the sharpened cutting edge of said planar blade member against said blade alignment surface.

17. The apparatus as claimed in claim 16 wherein said blade alignment structure includes means for applying fluid pressure to said blade components for urging said blade components against said blade alignment srufaces.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,795,965 Dated March 12, 1974

Inventor(s) Everett L. Sherman

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 27, "relations" should be --relation--;
line 32, "inventin" should be --invention--.
Column 2, line 49, "borken" should be --broken--.
Column 3, line 9, "2" should be --a--.
Column 5, line 12, "912" should be --192--;
line 43, "alignment" should be --aligning--.
Column 6, line 23, "334" should be --344--;
line 41, "10-50" should be --40-50--;
line 52, "ditinal" should be --ditional--.
Column 8, line 47, "have" should be --having--.
Column 10, line 54, after "each" insert --said--.

Signed and sealed this 16th day of July 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.