

April 29, 1969

J. W. RYAN ET AL
METHOD OF MAKING ANIMATED FIGURE TOYS HAVING EMBEDDED CONNECTOR
MEANS AND A THICKENED AREA

3,440,714

Filed June 17, 1966

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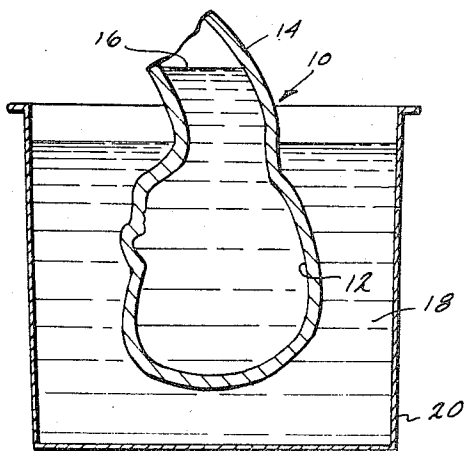


Fig. 1

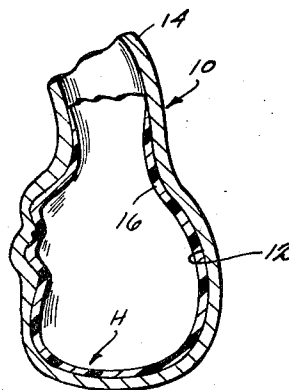


Fig. 2

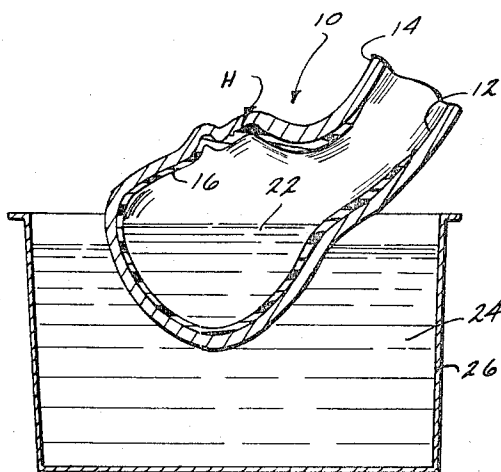


Fig. 3

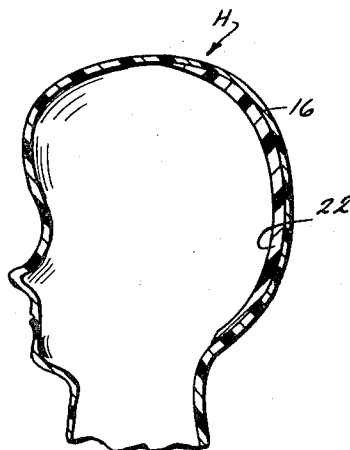


Fig. 4

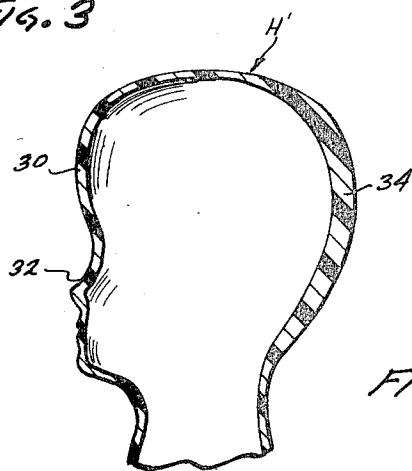


Fig. 5

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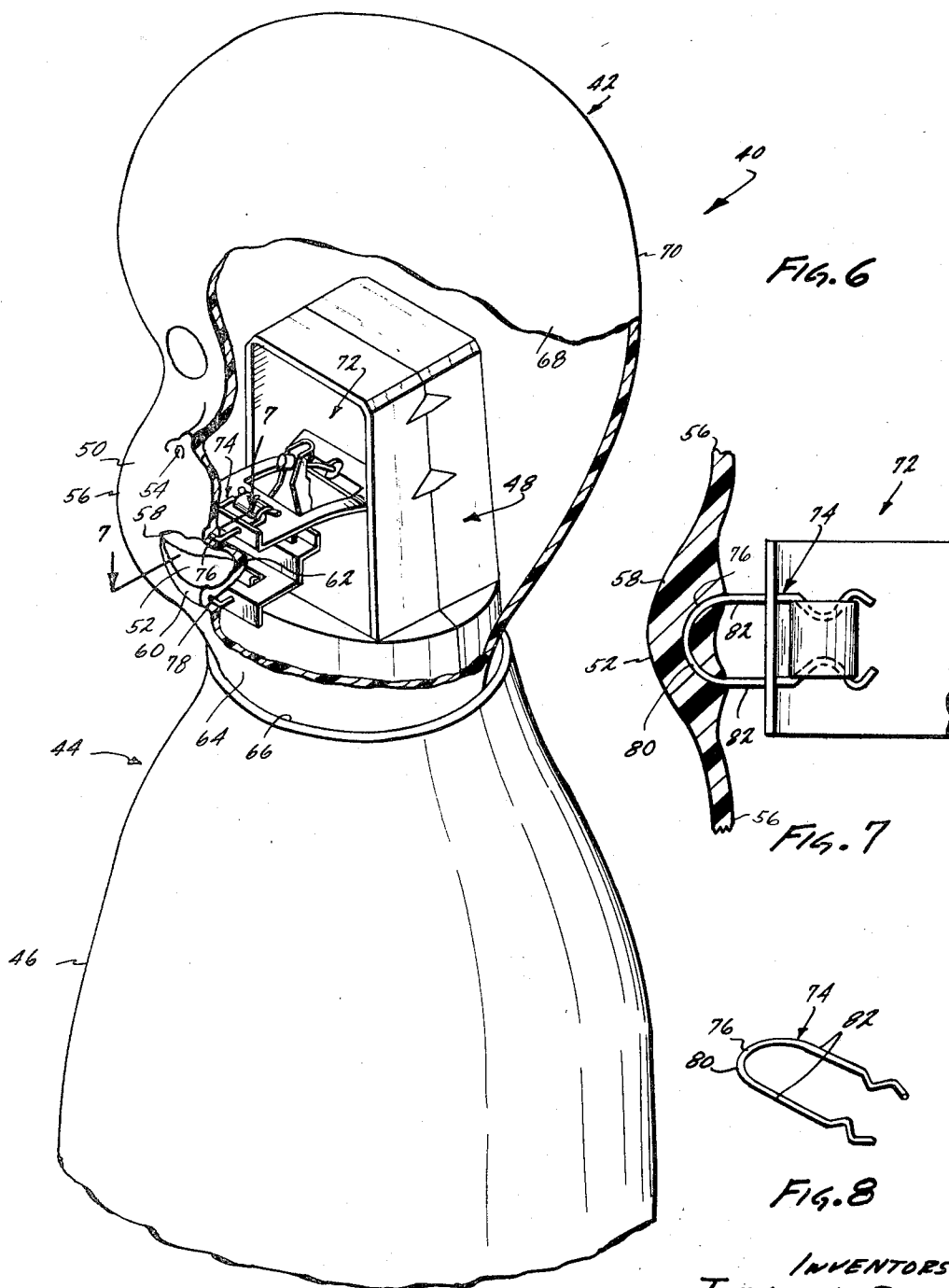
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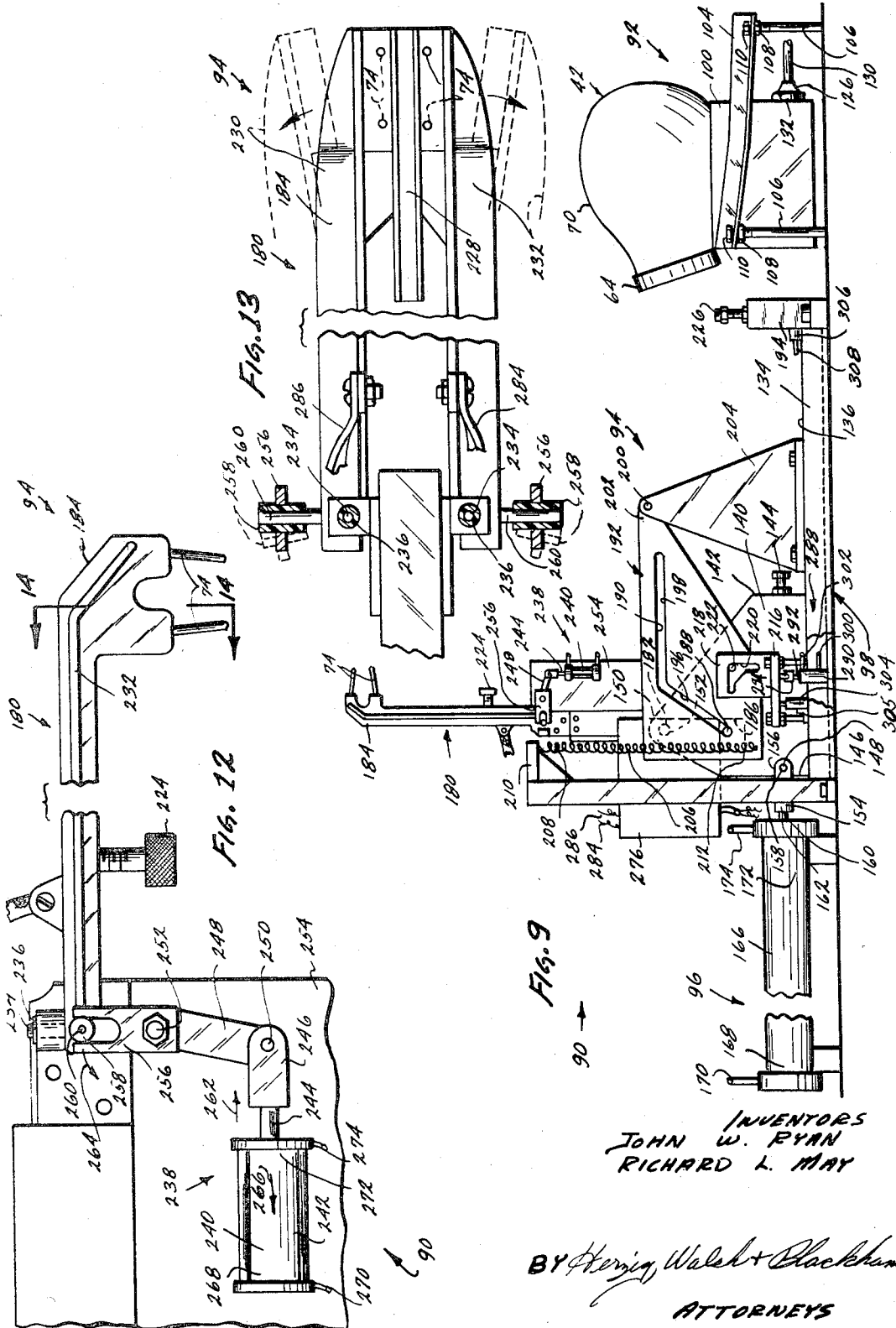
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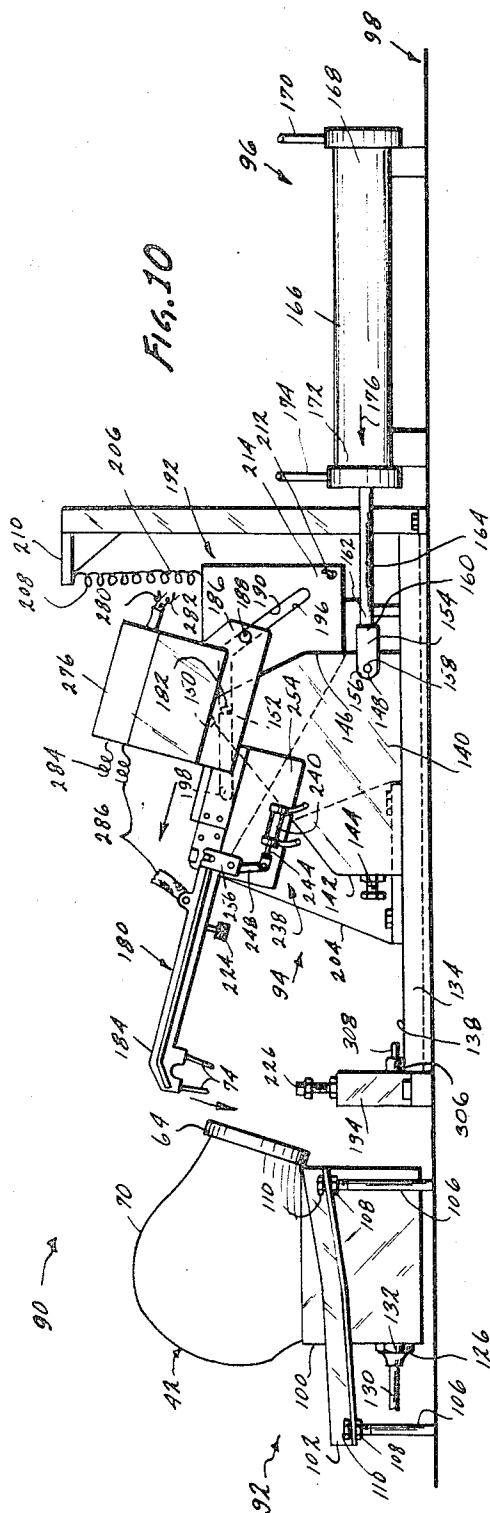
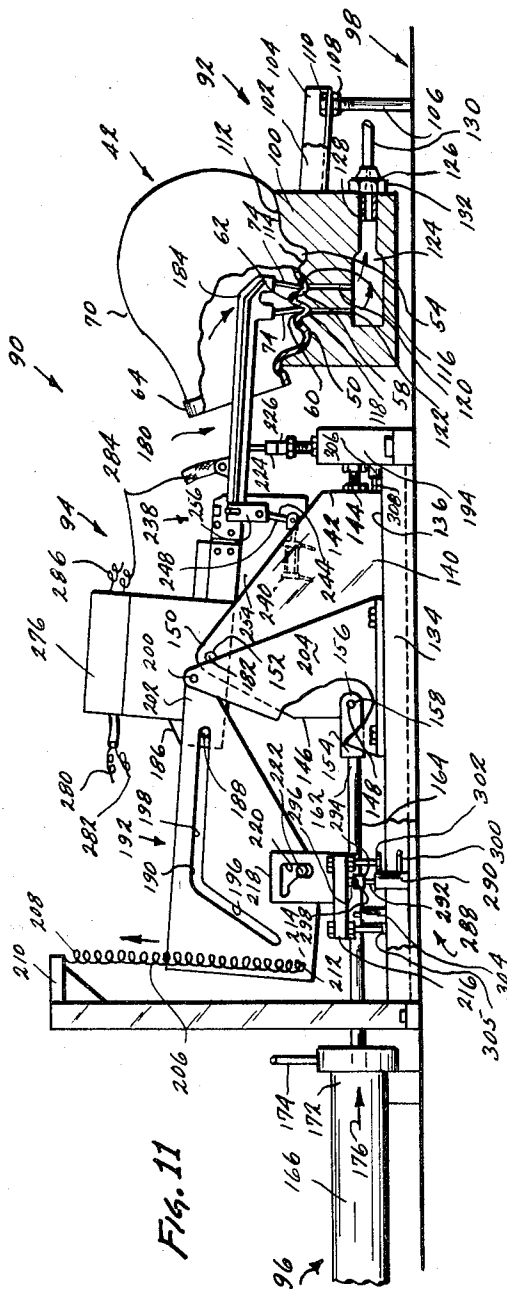


FIG. 11

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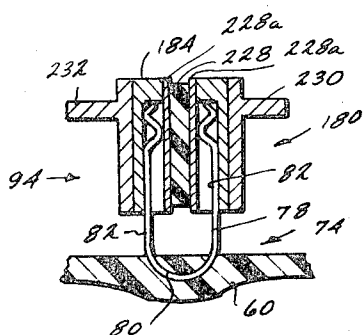


FIG. 14

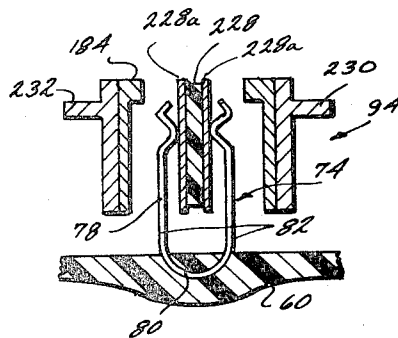
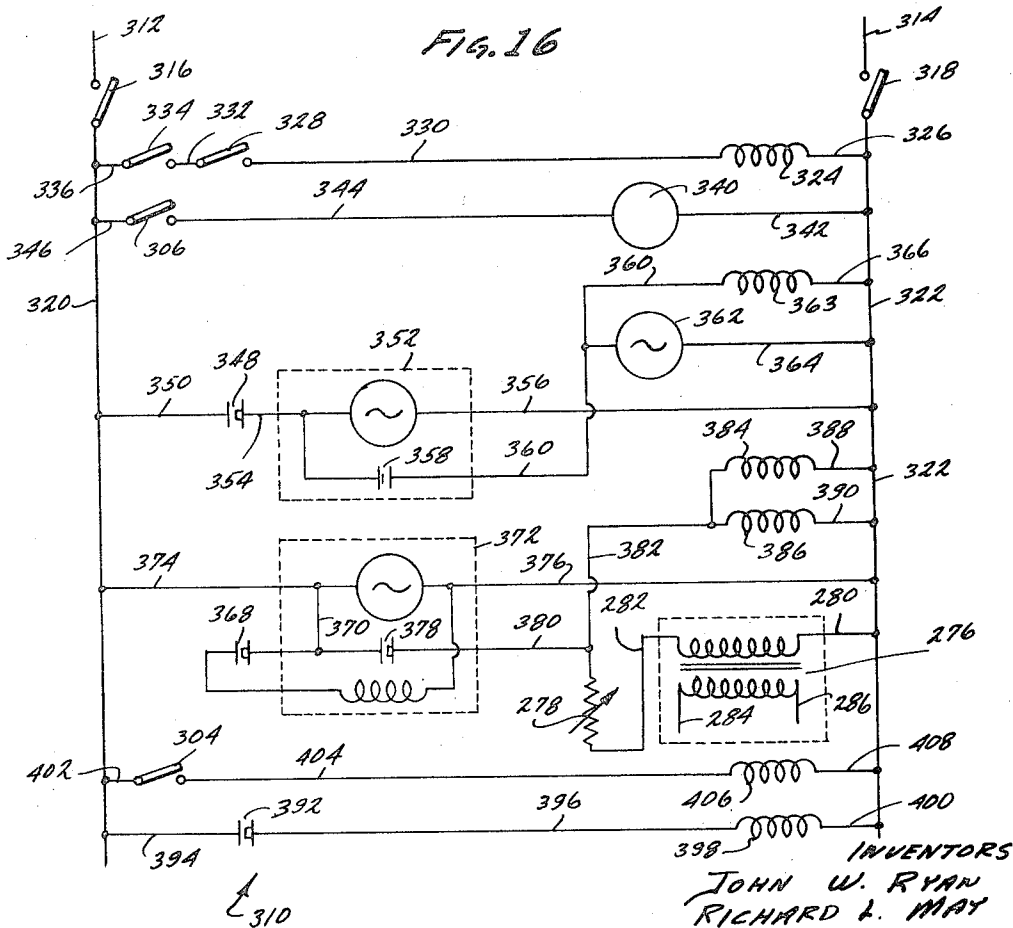


FIG. 15

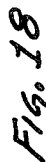
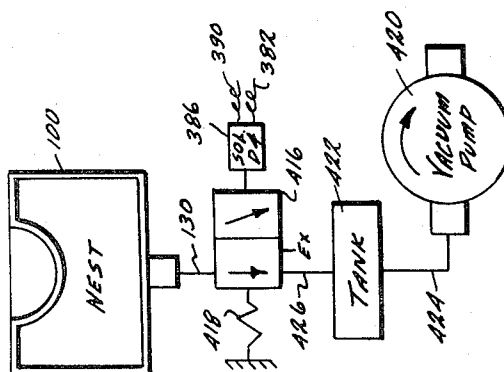


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METHOD OF MAKING ANIMATED FIGURE TOYS HAVING EMBEDDED CONNECTOR MEANS AND A THICKENED AREA

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6 Claims 10

ABSTRACT OF THE DISCLOSURE

A method of making animated figure toys having a unitary, hollow plastic portion that is formed with areas of different hardness and flexibility with one of the areas being formed from a thermoplastic material to which an animator means may be connected by heat-softening the material and embedding at least a portion of a connector means therein.

In the toy industry, the use of soft, flexible plastic materials, such as plastisol, and improved molding techniques make it possible to produce toy figures having face portions which are movable in a manner to closely simulate the movement of the face portion of a human being or an animal. While generally satisfactory for the face portion of the toy figure, such materials and molding techniques have the disadvantage that the head portion of the toy is also soft and flexible.

Another disadvantage resides in the fact that the means employed to impart movement to the face portion is sometimes rather difficult to attach to the soft plastic material satisfactorily.

In view of the foregoing factors and conditions characteristic of figure toys having soft, flexible plastic face portions, it is a primary object of the present invention to provide a new and useful apparatus for and method of making animated figure toys not subject to the disadvantages enumerated above and including method steps for producing a figure toy having a soft, flexible face portion and a skull portion which is harder and less flexible than the face portion.

Another object of the present invention is to provide a new and useful apparatus for and a method of connecting animating means to a soft, flexible portion of a figure toy.

Yet another object of the present invention is to provide a new and useful method for molding a hollow plastic article.

Still another object of the present invention is to provide a method of molding a unitary, hollow plastic article having portions of varying hardness.

A further object of the present invention is to provide a method of molding a unitary, hollow plastic article having portions of varying thickness.

A still further object of the present invention is to provide a method of molding a hollow, unitary, plastic article, such as the head of a toy figure, wherein the face portion of the head is softer and more flexible than the balance thereof, to thereby enable the face portion to be movable in a manner to closely simulate the movement of the face portion of a human being, or an animal.

Another object of the present invention is to provide a new and useful apparatus for and a method of connecting animator means to the soft, flexible plastic portion of a figure toy by embedding connector means in the thermoplastic material by heat-softening the material while pressure is applied to the connector means to embed it in the material.

According to one of the methods of the instant inven-

tion, a slush-type mold is first filled with a first liquified plastisol of a predetermined composition. The filled mold is then immersed in a hot bath or otherwise heated to a predetermined temperature and for a predetermined time period to effect an initial cure of the plastisol therewithin. Thereafter, the mold is drained to leave a jelled layer of the plastisol on the inner surface thereof. The mold is then partially refilled with a similar second plastisol which is harder than the first plastisol, and owing to a predetermined orientation of the mold, the second plastisol composition covers only a predetermined portion of the jell-coated mold. The partially filled mold then is subjected to a second curing step by immersing it in a hot bath or otherwise heating it to a predetermined temperature and for a predetermined time period. After the desired partial curing of the second plastisol composition in the mold, the mold is drained to leave a jelled layer of the second plastisol on the predetermined portion of the mold. Finally, the first and second plastisol layers are finally cured and cooled, and the molded, unitary, hollow article is removed from the mold in any suitable manner. The molded, unitary article comprises a first portion formed of the layer of the first plastisol, and a second predetermined portion formed of the layer of the first plastisol and the harder layer of the second plastisol, the second portion thus being harder and less flexible than the first portion.

Animator means may then be connected to the first portion by employing the apparatus of the present invention to place a connector means in an electrical circuit for heating the connector means by resistance-heating techniques. The connector means is pressed into the thermoplastic material during the supply of current to the connector means for melting the material to embed the connector means therein. The material is then cooled and resolidified around the embedded portion after which animator means may be connected to the connector means. Many thermoplastic materials serve this purpose very well. Although a vinyl composition is presently preferred, it is to be understood that the connector means may be used in accordance with the present invention in combination with any material that will melt and then resolidify around the connector means.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The present invention, both as to its organization and manner of operation, together with further objects and advantages thereof, may best be understood by reference to the following description, taken in connection with the accompanying drawings in which like reference characters refer to like elements in its several views.

IN THE DRAWINGS

FIGURES 1 through 3 are schematic views showing some of the steps of a preferred method of molding a hollow plastic article in accordance with the teachings of the instant invention;

FIGURE 4 is a side elevational view in section of a hollow article, such as a doll's head, formed in accordance with the method steps shown in FIGURES 1 through 3;

FIGURE 5 is a view similar to FIGURE 4, showing an article, such as a doll's head, formed in accordance with an alternate or modified method of the instant invention;

FIGURE 6 is a perspective view, with parts broken away to show internal construction, showing an article, such as a doll's head, having animator means connected to a soft, flexible portion thereof in accordance with the method of the instant invention;

FIGURE 7 is an enlarged, partial, cross-sectional view taken along lines 7—7 of FIGURE 6;

FIGURE 8 is an enlarged perspective view of a con-

nectors means which may be embedded in the doll's head of FIGURE 6 in accordance with the present invention for connecting the animator means to the soft, flexible portion of the doll's head;

FIGURE 9 is a front elevational view of an apparatus of the present invention which may be used for connecting the connector means of FIGURE 8 to the soft, flexible portion of a doll's head, as shown in FIGURE 6;

FIGURE 10 is a rear elevational view of the apparatus of FIGURE 9 showing the relative positions of certain parts thereof during the installation of the connector means of FIGURE 8 in the doll's head of FIGURE 6;

FIGURE 11 is a front elevational view of the apparatus of FIGURE 9 showing the relative positions of certain parts thereof during a later stage of the installation of the connector means;

FIGURE 12 is an enlarged, partial elevational view of the connector means carrying and positioning arm forming a part of the apparatus of FIGURE 9;

FIGURE 13 is an enlarged plan view of the arm shown in FIGURE 12;

FIGURE 14 is a cross-sectional view taken along line 14—14 of FIGURE 12;

FIGURE 15 is a cross-sectional view similar to FIGURE 14 showing the relative positions of the parts shown in FIGURE 14 at a later stage in the operation of the apparatus of the present invention;

FIGURE 16 is a wiring diagram of the electrical circuit employed in the apparatus of FIGURE 9;

FIGURE 17 is a flow diagram of the hydraulic circuit employed in the apparatus of FIGURE 9; and

FIGURE 18 is a schematic view of a vacuum pump and related equipment used in connection with the apparatus of FIGURE 9.

In accordance with a preferred or exemplary method of the instant invention for molding a hollow plastic article, there is illustrated in FIGURE 1 a slush-type mold 10 which may be of any suitable construction and may be formed of any suitable material, such as electroformed copper. The mold 10 comprises a hollow interior or cavity 12, preferably having a nickel surface, but not limited thereto, and having a predetermined shape; for example, in the form of a doll's head or other article to be molded therein. The mold 10 preferably is provided with a horn-shaped, reduced end 14 in order to facilitate the filling and emptying thereof with a material to be molded.

Pursuant to the instant method, the mold 10 is first placed in a position wherein the reduced end 14 faces upwardly, as shown in FIGURE 1, and is filled with a first liquified plastic material 16 to be molded therein. The plastic material 16 may comprise a vinyl plastisol, such as a polyvinyl chloride resin, in combination with a suitable vinyl plasticizer, as will be more specifically described hereinafter, or may comprise other suitable thermoplastic materials.

After the filling of the mold 10 with the first plastic material 16, the mold is placed in a hot oil or other type bath 18 within a tank 20 (see FIGURE 1), and is heated therein for a predetermined time period, the bath being maintained at a temperature which is sufficiently high to effect an initial cure of the portion of the material 16 in engagement with the surface of the cavity 12. It is noted that the mold may be heated in any manner other than by immersion in a hot liquid bath, without departing from the scope of the present invention.

Referring now to FIGURE 2, after the mold 10 has been disposed in the oil bath 18 for the predetermined time period, it is removed from the bath and drained off the mold material 16 to leave a first unset, jelled layer of the mold material 16 on the interior 12 of the mold 10, which defines a hollow doll's head H of substantially uniform thickness.

In order to provide the finally formed and cured doll's

head H with a relatively thin and flexible face portion, but with a predetermined portion, such as the upper and rear portion of the head, which is harder and less flexible than the face portion, the mold 10 thereafter is tilted to a predetermined position, as shown in FIGURE 3, while the plastic layer 16 therein is still in a jelled condition. In this position, the mold is partially filled with a second liquified plastic material 22 and is so oriented that the plastic material covers only the portion of the first plastic layer 16 defining the predetermined upper and rear portion of the doll's head H, which portion is intended to be finally formed in a harder and less flexible state than the face portion of the head. The second plastic material 22 may be substantially the same as the first material 16, or may be of any other suitable type of thermoplastic material. Preferably, the plastic material 22 is a vinyl plastisol comprising a polyvinyl chloride resin and a vinyl plasticizer of the same type as those used in the first plastic material 16, as will be more specifically described hereinafter, with the amount of the plasticizer being reduced on the second plastic material 22, so that the latter will be harder than the first plastic material 16. It is noted that, in accordance with this step of the instant method, the mold 10 could be filled or oriented either before or after it is partially filled with the second plastic material 22.

As further shown in FIGURE 3, the oriented mold 10, with the predetermined portion of the second liquified plastic material 22 therein, is inserted into a second liquid bath 24 within a tank 26 or otherwise heated to a predetermined temperature. The mold 10 is maintained in the liquid bath 24 for a predetermined time period, which is sufficient to partially cure a layer of the second material 22 in engagement with the jelled layer of the first plastic material 16 therein. The mold may be tilted or oriented during heating in the bath or by other means in order to distribute the second plastic material 22 over the predetermined area and to achieve various predetermined thicknesses within that area.

The mold 10 thereafter is emptied of the liquified portion of the second plastic material 22 to leave a jelled layer thereof on the predetermined upper and rear head portion of the first jelled layer 16. Finally, the mold 10 is again placed in a hot liquid bath (not shown) or otherwise heated to a predetermined temperature, and for a predetermined time period to finally cure and fuse the jelled layer 16 of the first plastic material and the jelled layer 22 of the second plastic material covering the predetermined portion of the first layer.

After this final curing and fusing step, the mold is cooled to room temperature in any suitable or conventional manner and the finally formed doll's head H is removed therefrom. The finally formed doll's head H is shown in FIGURE 4, wherein it will be readily seen that it is provided with a front face portion formed of the layer 16 of the first plastic material, and an upper and rear head portion which is formed of the fused layers of both the first plastic material 16 and the second, harder plastic material 22. The doll's head H, therefore, comprises a face portion that is thinner and more flexible than the predetermined upper and rear head portion.

Such a doll head construction is highly desirable in that it provides a hollow head which is sufficiently firm to retain its general preformed shape, even though subjected to considerable distortion by a child playing with it. Furthermore, since the face portion of the doll head is more flexible than the balance of the head, it is capable of more closely simulating the features of a human being. This type of doll head construction is especially useful with talking-type dolls or toys, wherein it is important that the face portion of the head be relatively soft and flexible so that it can be easily manipulated to closely simulate the talking or sound-producing movement and features of the face of a human being or an animal.

As a specific example of the preferred method of the instant invention, the first plastic material 16 preferably has a hardness of approximately 30 on the Shore durometer A scale, and comprises, by weight, 100 parts of a polyvinyl chloride resin such as; 150 parts of a vinyl plasticizer, such as dioctyl phthalate, diisodecyl adipate, or ditiodecyl phthalate; 10 parts of a stabilizing epoxy type plasticizer; 3 to 5 parts of a heat stabilizer; and 1 to 5 parts of a suitable coloring paste. The plastic material 16 may be prepared by dispersing finely divided polyvinyl resin powder in a liquid plasticizer to form a creamy liquid.

The initial cure of the plastic material 16 in the mold 10, when the latter is immersed in the hot liquid bath 18, as shown in FIGURE 1, is effected by maintaining the mold within the bath for approximately 1 minute and 30 seconds, with the bath at a temperature of approximately 400° F. The second partial cure of the jelled layer 16 and the liquified plastic material 22 within the mold 10, as shown in FIGURE 3, is effected by maintaining the mold for approximately 45 seconds within the hot liquid bath 24, the latter being at a temperature of approximately 400° F.

The second plastic material 22, as a specific example, has the same composition as that specified above for the first plastic material 16, with the sole exception that, in the second material 22, the parts of the vinyl plasticizer are reduced from 150 to 40 parts, thereby providing the second material 22 with a hardness that measures approximately 90 on the Shore A scale. It is obvious that by further reducing the plasticizer level in the second material 22, it may be made even harder. A harder plastic material, however, will require a longer cure time.

The final cure and fusing of the jelled layers 16 and 22 of the first and second plastic materials, respectively, is effected by maintaining the mold 10 for approximately 3 minutes in a hot liquid bath at approximately 400° F.

FIGURE 5 illustrates an alternate form of head H', which is provided with a face portion 116 that is thinner and more flexible than the upper and rear head portion 116' in a manner similar to that of the head H. The head H' differs from the head H, in that the former is formed entirely of the same plastic material composition.

The doll head H' of FIGURE 5 may be formed in accordance with an alternate method of the instant invention. In this alternate method, the plastic material 30 is poured in liquid form into a slush-type mold and initially heat-cured in the same manner as that disclosed in FIGURE 1. Thereafter, however the mold is only partially drained of the liquified plastic material 30, and oriented in a manner similar to that shown in FIGURE 3, so that the remaining plastic material 30 is in engagement with only a predetermined portion of the mold, namely, the portion defining the upper and rear portion of the doll head. This partial draining of the mold leaves a jelled layer of the plastic material 30 over the portion of the mold defining the face portion of the doll head, in a manner similar to that shown in FIGURE 3 in relation to the preferred method of this invention.

Thereafter, the mold is drained of the remaining liquified plastic material 30, again heated to finally cure and fuse the material, and then cooled in the same manner as that described above with respect to the preferred method, to form the head H' of FIGURE 5 wherein the face portion 32 is thinner and more flexible than the upper and rear head portion 34.

Referring now more in particular to FIGURES 6-8, a figure toy 40 is shown herein for purposes of illustration, but not of limitation, as constituting a hand puppet having a doll's head 42 and a body portion 44. The body portion 44 includes a cape 46 adapted to hide the hand of a user of the toy 40 and connected to the head 42 by an animator means 48 of the type disclosed in copending application Ser. No. 544,441, filed Apr. 22, 1966.

The doll head 42 may be made by any suitable method,

such as that heretofore described in connection with FIGURES 1-5, and includes a soft, flexible face portion 50 made from a suitable elastomeric material which may be softened and resolidified, such as the plastisol material heretofore described in connection with FIGURES 1-5. The face 50 includes a mouth 52, a nose 54 and a pair of cheeks, such as the one shown at 56. The mouth 52 may be molded with the normally-open, pleasant expression shown, if desired, and includes an upper lip 58 and a lower lip 60 which are joined together by an inwardly-extending member 62.

The head 42 also includes a neck portion 64 which may be connected to the animator means 48 within the open top portion 66 of the cape 44. The head 42 also includes an upper head portion 68 and a rear head portion 70 both of which may be made in accordance with conventional methods, or, alternatively, in accordance with the method of the instant invention described in connection with FIGURES 1-5.

The soft, flexible face portion may be animated by a suitable facial animator 72 which is shown herein for purposes of illustration, but not of limitation, as comprising the facial animator shown and described in detail in said copending application. The facial animator 72 may be connected to the soft, flexible face portion 50 by the method of the present invention using the apparatus shown in FIGURES 9-15 to install a connector means 74 of the type shown and described in detail in said copending application. The connector means 74 includes an upper-lip connector 76 and a lower-lip connector 78. The lip connectors 76, 78 each include an embedable portion, in the form of a bight portion 80, and a connector portion, in the form of a pair of parallel, spaced-apart arms 82. The bight portions 80 are embedded in and adhered to associated lips 58, 60 in accordance with the method of the present invention using the apparatus of the present invention to soften and resolidify the lips 58, 60 under the embedable portion. This may be done by pressure alone or by heating the connectors 76 and 78 sufficiently to heat-soften the material forming the lips 58, 60 while supplying sufficient pressure to an associated bight portion 80 to cause it to sink into the softened material to a suitable depth within an associated lip 58, 60, as will be hereinafter described in detail. The lips 58, 60 may then be treated by cooling, or the like, to cause the material to resolidify and adhere to the embedable portion.

Referring now more in particular to FIGURES 9-16, an apparatus of the present invention, generally designated 90, includes a doll-head positioning member 92, a connector-means heating and positioning means 94 and a positioning-means actuator means 96 all of which are mounted on a base member 98.

The positioning member 92 includes a matrix 100 to which a pair of angle irons 102, 104 are affixed for supporting the matrix 100 at a predetermined elevation above the base member 98 on externally threaded posts 106. This elevation may be determined by adjusting a plurality of internally threaded nuts 108 which threadedly engage an associated post 106 below an associated angle iron 102, 104, thereby providing an adjustable support for the matrix 100. A second plurality of nuts 110 threadedly engage associated posts 106 above associated angle irons 102, 104 for securing the matrix 100 against upward movement thereon. The matrix 100 includes an upper surface 112 which is hollowed out to conform in shape and size to the external configuration of the face 50 including a first recess 114 for receiving the nose 54, a second recess 116 for receiving the upper lip 58 and a third recess 118 for receiving the lower lip 60. A first small-diameter passageway 120 is provided in the matrix 100 in fluid communication with the cavity 116 and a second small-diameter passageway 122 is provided in the matrix 100 in fluid communication with the cavity 118. The passageways 120 and 122 both communicate with a large-diameter passageway 124 which is also provided in

the matrix 100 and which includes an internally threaded portion 126 which receives an externally threaded nipple 128 for connecting the passageway 124 to a conduit 130 by threadedly engaging the nipple 128 with an internally threaded nut 132. The conduit 130 may be connected to an exhaust pump, shown schematically at 420 in FIGURE 18, for exhausting the passageways 120 and 122 so that the lips 58 and 60 will firmly seat in their associated cavities 116 and 118, thereby assuring uniformly in the depth of penetration of the lips 58 and 60 by the bight portion 80, in a manner to be hereinafter described.

The heating and positioning means 94 includes a base plate 134 which is provided with a pair of ways 136, 138 slidably receiving a carriage 140 which is reciprocated by the actuator means 96. The carriage 140 includes a leading edge 142 which is provided with an adjustable stop member 144, a trailing edge 146 which is provided with an aperture 148 and an apex portion 150 which is provided with an aperture 152.

The carriage 140 is connected to the actuator means 96 by a clevis 154 having a first end 156 connected to the edge 146 by a pin 158 which engages the aperture 148 and a second end 160 which is connected to the end 162 of a piston rod 164 reciprocally mounted in a hydraulic cylinder 166 forming a part of the actuator means 96. The cylinder 166 includes an upstream end 168 which is connected to a source of fluid under pressure by a conduit 170 and a downstream end 172 which is connected to a source of fluid under pressure by a conduit 174. When fluid under pressure is admitted to the cylinder 166 through the conduit 170, the piston rod 164 moves in the direction of arrow 175 (FIGURES 10 and 11) and moves in the direction of arrow 178 when fluid is admitted to the cylinder 166 through the conduit 174.

The connector means 74 are positioned and heated by an arm 180 which is swingably connected to the apex portion 150 of the carriage 140 by a pin 182 engaged in the aperture 152 and carried by the arm 180 intermediate its first end 184 and its second end 186. The end 186 also carries a pin 188 which rides in a cam slot 190 provided in a cam assembly 192 for swinging the arm 180 about pin 182 from the position shown in FIGURE 9 to a substantially horizontal position during movement of the carriage 140 from the position shown in FIGURE 9 to the position shown in FIGURE 11 where the stop member 144 engages a fixed abutment 194. The cam slot 190 includes an upwardly and forwardly sloping leg 196, which coacts with the pin 188 causing the arm 180 to pivot to its substantially horizontal position, and a substantially horizontal leg 198, which coacts with the pin 188 to maintain the arm 180 in its substantially horizontal position during travel of the carriage 140 toward the matrix 100. This travel causes the end 184 of arm 180 to enter the head 42 for positioning the connector means 74 superjacent associated lips 58 and 60 when the stop member 144 strikes abutment 194. At this time, the cam 192 is caused to swing in a clockwise direction, as viewed in FIGURE 11, about its pivot 200 which connects its end 202 to a fixed supporting plate 204 under the influence of a spring 206. The spring 206 has an end 208 connected to a fixed support 210 and an end 212 affixed to the other end 214 of the cam 192. The spring 206 is prevented from swinging the cam 192 about pivot 200 before the connector means 74 are positioned superjacent their associated lips 58 and 60 by a holding means 216 which is reciprocally mounted on the base plate 134 and which carries a plate 218 having a shaped opening 220 provided therein. The cam 192 carries a pin 222 which is restrained by the plate 218 when the holding means 216 is in a lowered position, as shown in FIGURE 9. However, when the stop member 144 strikes the abutment 194, the holding means 216 is elevated to the position shown in FIGURE 11 where the pin 222 no longer engages the plate 218 so that the spring 206 is free to swing the cam 192 in a clockwise direction, as viewed in FIGURE 11.

The amount of clockwise swinging of the arm 180 is controlled by a stop member 224 provided thereon near the end 184 for engagement with an adjustable stop member 226 provided on the abutment 194.

The end 184 of the arm 100 includes a dielectric core 228 for insulating a first current-carrying finger 230 from a second current-carrying finger 232 (FIGURE 13). The fingers 230 and 232 are each swingably connected to the core 228 by vertical posts 234 and insulated bushings 236 for swinging movement between the solid line and broken line positions shown in FIGURE 13 to facilitate installing and removing the connector means 74. Such swinging movement is performed by a finger-swinging apparatus, which is generally designated 238 in FIGURES 10 and 12. The apparatus 238 includes a hydraulic actuator 240 having a hydraulic cylinder 242 and a piston rod 244. The piston rod 244 carries a clevis 246 which is connected to an actuating lever 248 by a pin 250. A pivot pin 252 pivotally connects the lever 248 to a plate 254 which is carried by the arm 180 for positioning an apparatus 238 adjacent each finger 230, 232, as shown for the finger 232 in FIGURE 12. Each lever 248 includes a bifurcated end 256 which straddles a dielectric bushing 258 carried by an arm 260 extending from an associated finger 230, 232 for swinging an associated finger about an associated post 234 when an associated lever 248 is pivoted by an associated piston rod 244. The fingers 230, 232 may be swung to their broken line, FIGURE 13 positions by moving an associated piston rod 244 in the direction of arrow 262 (FIGURE 12) swinging the end 256 of lever 248 rearwardly in the direction of arrow 264. This swings an associated end 256 to its broken line. FIGURE 13 position causing an associated arm 260 to swing an associated finger 230, 232 to its FIGURE 13 broken line position. The fingers 230, 232 may then be swung to their FIGURE 13 solid line positions by moving the piston rod 244 reversely in the direction of arrow 266. The piston rod 244 is moved in the direction of arrow 262 by admitting a fluid under pressure into the upstream end 268 of an associated piston 242 through an associated conduit 270. The piston rod 244 may be moved in the direction of arrow 266 by admitting a fluid under pressure into the downstream end 272 of an associated piston 242 through an associated conduit 274.

Electric current for resistance-heating the connector means 74 is supplied thereto through the fingers 230 and 232 by a transformer 276 which is attached to the arm 180. The transformer 276 may comprise a welding transformer having a conventional primary winding, not shown, which may be connected to a suitable source of house current through a variable resistor, shown schematically at 278 in FIGURE 16, by a pair of leads 280, 282. The primary winding (not shown) of the transformer 276 is connected by a first lead 284 to the finger 232 and by a second lead 286 to a finger 230 for supplying electrical current having a rating of approximately $\frac{1}{2}$ –5 volts and 70–200 amps to the connector means 74.

The output from the transformer 276 should be capable of heating the connector means 74 to a suitable temperature for melting the soft plastic material in the lips 58 and 60 sufficiently quickly that the connector means 74 may be installed on a mass-production basis while controlling the temperature in such a manner that the plastisol dissipates the heat as the bight portion 80 of the connector means 74 sinks therein due to the pressure applied to the arm 180 by the spring 206. It will, of course, be apparent to those skilled in the art that the parameters necessary to accomplish this result will depend, in part, on the physical characteristics and dimensions of the connector means 74. For example, it has been found that a fifteen gauge (0.0346" dia. to 0.0344" dia.) steel music wire having a 1010–1060 carbon range and having a length of approximately 1.75 inches may be satisfactorily heated by subjecting it to 150 amps of current at 3 volts for 4 seconds while pressing the connector means 74 into engagement

with the soft material with approximately 2-3 pounds of pressure. The bight portions 80 of the connector means 74 are preferably placed in contact with the soft material before heat is applied to the connector means 74 so that the bight portions 80 will melt the material and sink thereinto before the connector means 74 becomes oxidized due to exposure to air while in a heated condition. Such oxidizing of the connector means 74 results in oxide being introduced into the soft material and forming an unbondable surface. However, when the connector means 74 is not oxidized, the material in which the bight portion becomes embedded adheres thereto upon re-solidifying.

It was also found that a connector means 74 having these same physical characteristics and dimensions could be satisfactorily embedded in the soft plastisol by applying 70 amps at 3 volts for approximately 15 seconds while subjecting the connector means 74 to a few ounces of pressure. When a 10 pound force was used, it was found that the connector means 74 could be installed in 1/2 second by subjecting it to 300 amps at 1 1/2 volts.

The portion of the dielectric core 228 which is engaged by the connector means 74 is protected from excessive wear by a pair of wear plates 228a.

The plate 218 is caused to reciprocate by an actuator means 288 which includes a hydraulic cylinder 290 and a piston rod 292. The piston rod 292 is connected to the plate 216 by a clevis 294 which is pinned to a depending tang 296 by a pin 298. The piston rod 292 may be moved to raise the plate 216 by admitting hydraulic fluid under pressure to the cylinder 290 through a conduit 300 and is moved in the opposite direction to lower the plate 216 by admitting hydraulic fluid under pressure to a conduit 302. Downward travel of the plate 216 actuates an impulse switch 304 which is connected to the plate 134 adjacent the plate 216 by a plate 305.

A normally-open switch 306 is mounted on the abutment 194 in such a manner that an actuating rod 308 for the switch 306 extends toward the carriage 140 for contact thereby as the carriage 140 approaches the abutment 194.

The control means for controlling the operation of the apparatus 90 are shown schematically in FIGURES 16-18. The electrical portion of the control means, generally designated 310, is connected to an outside electrical power source by a pair of headers 312, 314 through switch blades 316, 318, respectively. A header 320 is connected to the switch blade 316 and a header 322 is connected to the switch blade 318 for supplying electrical current to the various components of the control means 310. These components include a first solenoid 324 which is connected to the header 322 by a lead 326 and to a normally-open switch 328 by a lead 330. The switch 328 is connected by a lead 332 to a switch 334 which, in turn, is connected to the header 320 by a lead 336. When energized, the solenoid 324 actuates a 4-way hydraulic valve 338 in such a manner that hydraulic fluid under pressure flows through conduit 170 into end 168 of cylinder 166 moving piston rod 164 in the direction of arrow 176.

The control means 310 also includes a double-pole, single throw, relay 340 which is connected to the header 322 by a lead 342 and to the switch 306 by a lead 344. The switch 306 is, in turn, connected to the header 320 by a lead 346. The relay 340 includes a first electrical contact 348 which is connected to the header 320 by a lead 350 and to an electronic timer 352 by a lead 354. The timer 352 is connected to the header 322 by a lead 356 and includes an electrical contact 358 which is connected by a lead 360 to a second electronic timer 362 and to a second solenoid 363 both of which are connected to the header 322 by leads 364 and 366, respectively. The relay 340 also includes an electrical contact 368 which is connected by a lead 370 to a third electronic timer 372. The timer 372 is connected to the header 320 by a lead 374, to the header 322 by a lead 376 and includes an electrical contact 378. The contact 378 is connected by a lead 380

to a conductor 382 which, in turn, is connected to the resistor 278, a third solenoid 384 and a fourth solenoid 386. The solenoids 384 and 386 are connected by leads 388 and 390, respectively, to the header 322.

The timer 362 includes an electrical contact 392 which is connected by a lead 394 to the header 320 and by a lead 396 to a fifth solenoid 398 which, in turn, is connected by a lead 400 to the header 322.

The impulse switch 304 forms part of the control means 310, is connected by a lead 402 to the header 320 and by a lead 404 to a sixth solenoid 406 switch, in turn, is connected by a lead 408 to the header 322.

The second solenoid 363 is connected to a 4-way, solenoid-operated, spring return hydraulic valve 410 which is biased to a first position by a spring 412. In the first position, the valve 410 permits the flow of fluid under pressure through conduit 270 into cylinder 240 causing piston rod 244 to move in the direction of arrow 266. Actuation of the second solenoid 363 overcomes the biasing spring 412 to position the valve 410 in such a manner that fluid under pressure flows through conduit 274 into cylinder 242 to move piston rod 244 in the direction of arrow 272.

The third solenoid 384 and the fifth solenoid 398 are connected to a 4-way, solenoid-operated hydraulic valve 414 which is connected to the hydraulic cylinder 290 by the conduits 300 and 302. When the solenoid 384 is actuated, hydraulic fluid under pressure flows through the conduit 302 into the cylinder 290 forcing the piston rod 292 downwardly so that plate 218 engages pin 222 returning cam 192 to its horizontal position. When the solenoid 308 is actuated, the valve 414 is positioned in such a manner that hydraulic fluid under pressure flows through the conduit 300 into the cylinder 290 for moving the piston rod 292 upwardly to bring the plate 218 out of engagement with the pin 222 so that the spring 206 is free to swing the end 184 of arm 180 toward the lips 58 and 60.

The sixth solenoid 406 is connected to the valve 338 and may be energized to position the valve 338 in such a manner that hydraulic fluid under pressure is free to flow through the conduit 174 into the end 172 of cylinder 166 causing piston rod 164 to move in the direction of arrow 178.

The fourth solenoid 386 is connected to a 3-way solenoid-operated, spring-return air valve 416 which is biased to a first position by a spring 418. When energized, the solenoid 386 overcomes the bias of spring 418 positioning the valve 416 in such a manner that air is exhausted from the matrix 100 through conduit 130. This air is exhausted by a vacuum pump 420 which is connected to the valve 416 through a tank 422 by conduits 424 and 426.

Hydraulic fluid for pressurizing the cylinders 166, 240 and 290 is supplied thereto through a header 428, a first branch line 430, which is connected to the valve 338, a second branch line 432, which is connected to the valve 414, and a third branch line 434 which is connected to the valve 410.

A few examples of the method of the present invention are set forth hereinafter as follows:

EXAMPLE 1

A toy figure represented by the hollow head 42 having a soft, thermoplastic plastisol portion represented by the lips 58 and 60 was placed in the matrix 100 with the lips seated in the cavities 116 and 118 when the apparatus 90 is in the operating position shown in FIGURE 9 with the arm 180 extending substantially vertically.

A pair of connector means 74 were then inserted in the end 184 of arm 180 between the fingers 230 and 232 with the arms 82 of the connector means 74 frictionally engaging the metal plates 228a, as shown in FIGURE 15 for one connector means 74.

The switch blades 316 and 318 were then closed energizing the control means 310, whereupon the switch blades 328 and 334 were closed completing a circuit to solenoid 324. The solenoid 324 positioned valve 338 in such a man-

ner that hydraulic fluid in header 428 flowed through branch line 430, valve 338, conduit 170 and into cylinder 166. This fluid forced the piston rod 164 in the direction of arrow 176 moving carriage 140 toward abutment 194. During this movement, pin 188 on arm 180 traveled up cam slot 190 causing arm 180 to swing counterclockwise, as viewed in FIGURE 10, toward a horizontal position. When the pin 188 reached leg 198 of cam slot 190, the arm 180 was lying in a substantially horizontal plane so that the end 184 could enter the open neck portion 64 of the head 42 as the carriage continued moving toward the abutment 194. This movement of carriage 140 was then arrested by stop means 144 engaging abutment 194 at which time the carriage closed switch 306 while the connector means 74 stopped superjacent associated lips 58 and 60.

The closing of switch 306 energized the relay 340 closing the contacts 348 and 368 to complete circuits to the timers 352 and 372, respectively. This energized the timer 372 closing its contacts 378 for a predetermined time within a range of $\frac{1}{4}$ to 20 seconds, which was previously programmed into the timer 372. Closing contacts 378 complete a circuit to the solenoids 384 and 386 and to the transformer 276 energizing them. The transformer 276 supplied current to the connector means 74 within the range previously mentioned heating the connector means to a predetermined temperature sufficient to melt the thermoplastic material in the lips 58 and 60. Simultaneously the solenoid 384 positioned valve 414 in such a manner that fluid under pressure in header 428 flowed through branch line 432, valve 414, conduit 300 and into cylinder 290 causing piston rod 292 to move upwardly releasing plate 218 from engagement with pin 222. The spring 206 then swung arm 180 about pivot pin 152 in such a manner that the connector means 74 engaged the lips 58 and 60. Meanwhile, the solenoid 386 had positioned valve 416 in such a manner that vacuum pump 420 was effective to evacuate the matrix 100 through conduit 130, valve 416, conduit 426, tank 422 and conduit 424. This firmly seated the lips 58 and 60 in their associated cavities 116 and 118.

The force in spring 206 applied approximately 1-3 pounds of pressure to the connector means 74 causing them to melt the plastic material in the lips 58 and 60 as soon as they became heated. This caused the bight portions 80 to become embedded in the material to a depth determined by the stops 224 and 226. The predetermined time set in the timer 372 then elapsed and the contacts 378 opened deenergizing the solenoid 384 and 386 and the transformer 276. In this example, the transformer supplied 150 amps at 3 volts and the timer 372 maintained the transformer 276 energized for approximately 4 seconds with a force of approximately 3 pounds being applied to the connector means 74.

Energization of the timer 352 permitted the contact 358 therein to be closed after the elapse of a predetermined time programmed into the timer 352. This time is preferably just sufficient to energize solenoid 363 and 362 shortly after the transformer 272 is de-energized. Energization of the solenoid 363 positions valve 410 in such a manner that fluid under pressure in header 428 flows through the branch line 434 into valve 410 and through conduit 470 into cylinder 240. This causes the piston rod 244 to move in the direction of arrow 262 swinging lever 248 about pin 252 in such a manner that the fingers 230 and 232 are swung to their FIGURE 13 broken line positions for releasing the connector means 74, as shown in FIGURE 13.

Energization of the timer 362 causes its contact 392 to close after the elapse of the predetermined time programmed into the timer which, in this specific example, was $4\frac{1}{2}$ seconds. The closing of contact 392 completed the circuit through solenoid 398 which, in turn, positioned valve 414 in such a manner that fluid in header 428 flowed through branch line 432, valve 414, conduit 302 and

cylinder 390 causing piston rod 292 to move downwardly bringing plate 218 back into engagement with pin 220 for swinging arm 180 counterclockwise, as viewed in FIGURE 9, to a substantially horizontal position so that it may be withdrawn from the head 42. As plate 218 moved downwardly, the member 216 engaged the impulse switch 304 to energize solenoid 406 after the elapse of the predetermined time set in the impulse switch 304 which, in this specific example, is $\frac{1}{2}$ second. This is sufficient time to permit the arm 180 to assume a substantially horizontal position and to permit the time set in timer 352 to elapse so that the solenoid 363 becomes deenergized permitting spring 412 to position valve 410 in such a manner that hydraulic fluid from header 428 flows through branch line 434, valve 410, conduit 274 and cylinder 240 moving the piston rod 244 in the direction of arrow 266 to close the fingers 230 and 232 so that the end 184 will clear the neck opening 64 when the arm 180 is withdrawn from the head 42.

Energization of solenoid 406 positioned valve 338 in such a manner that fluid in header 428 flowed through branch line 430, valve 338, conduit 174 and cylinder 166 moving piston rod 164 in the direction of arrow 178 to withdraw the carriage 140 from its position against abutment means 194 so that the carriage 140 and the arm 180 were returned to their FIGURE 9 positions.

The head 42 was then removed from the matrix 100 with the connector means 74 extending from their associated lips 58, 60. The lips were treated by cooling them to cause the material to resolidify and adhere to the connector means 74. The animator 72 was then connected to the connector means 74 by engaging the arms 82 into operative association therewith, as shown in FIGURES 6 and 7. The head 42 was then connected to the animating means 48 and the open end 66 of the cape 44 was inserted over the neck portion 64 of the head portion 42 and secured thereto.

EXAMPLE 2

A figure toy was constructed in accordance with the steps of Example 1 except that a head 16, made in accordance with the molding steps of the present invention, was employed to take advantage of its thickened portion 22.

EXAMPLE 3

A figure toy was made in accordance with the steps of Example 1 except that the connector means 74 were heated at 70 amps and 3 volts for 15 seconds and a spring pressure of approximately 4 ounces was used.

EXAMPLE 4

A figure toy was made in accordance with the steps of Example 1 except that the connector means 74 were heated for approximately $\frac{1}{2}$ second at 2 volts and 150-200 amps while a 10 pound force was applied to the connector means 74.

While the particular apparatus and method herein shown and described in detail are fully capable of attaining the objects and providing the advantages hereinbefore stated, it is to be understood that they are merely illustrative of the presently preferred embodiment of the invention and that no limitations are intended to the details of construction, design or method steps herein shown and described other than as defined in the appended claims.

What is claimed is:

1. A method of making an animated figure toy comprising the steps of:

(A) forming a figure toy having a predetermined shape, at least a portion of said toy being formed from a material which will soften and re-solidify, said forming including the steps of:

(I) forming a first layer of heated, gelled plastic material on the inner surface of a mold;

(II) forming a second layer of heated, gelled plastic material on a predetermined portion of said first layer on said inner mold surface; and

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- (III) curing said first and second layers to form a hardened, unitary, hollow article within said mold having a thickened portion corresponding to said second layer;
- (B) pressing an animator connector means into engagement with said softenable, re-solidifiable material; 5
- (C) softening said softenable, re-solidifiable material under said connector means while maintaining said pressure for embedding a portion of said connector means in said softenable, re-solidifiable material; 10
- (D) treating said softened material for adhering said material to said embedded portion of said connector means; and
- (E) connecting animator means to said connector means for moving said portion of said toy to animate said toy upon actuation of said animator means. 15
2. A method of making an animated figure toy comprising the steps of:
- forming a figure toy having a predetermined shape, at least a portion of said toy being formed from a material which will soften and re-solidify; 20
- placing said material in a matrix conforming in shape to the shape of said material;
- seating said material in said matrix by evacuating said matrix; 25
- placing an animator connector means in an electrical current-carrying fixture, said connector means comprising a U-shaped, wire clip having a bight portion; inserting said fixture into said toy with said connector means in juxtaposition to said material; 30
- lowering said fixture to press said connector means into engagement with said material with a predetermined pressure;
- passing current through said fixture and said connector means to heat said bight portion by electrical resistance heating for softening said material under said connector means while maintaining said pressure for 35

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- embedding said heated bight portion in said material; treating said softened material for adhering said material to said embedded portion of said connector means; and
- connecting animator means to said connector means for moving said portion of said toy to animate said toy upon actuation of said animator means.
3. The method of claim 1 wherein said first layer is formed by filling said mold with a plastic material in liquid form and partially curing it in said mold.
4. The method of claim 3 wherein said second layer is formed by maintaining said mold partially filled with a plastic material which covers only said predetermined portion of said inner mold surface, and partially curing said last mentioned plastic material in said mold.
5. The method of claim 4 wherein said second layer comprises a plastic material which is harder than that of said first layer, to thereby form an article having predetermined portions of varying thickness and hardness.
6. The method of claim 4 wherein said plastic material comprises a polyvinyl chloride resin and a vinyl plasticizer.

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