Jan. 2, 1968 R. L. FOERTMEYER 3,360,835

PIN AND SOCKET THREADLESS BUTTON ASSEMBLY

Filed Dec. 21, 1966 2 Sheets-Sheet 1

Fig. 1.

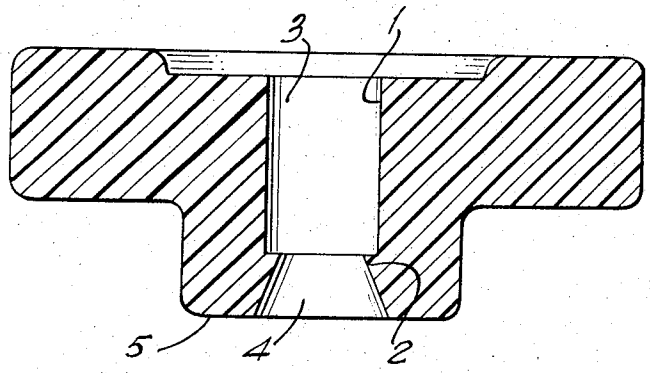
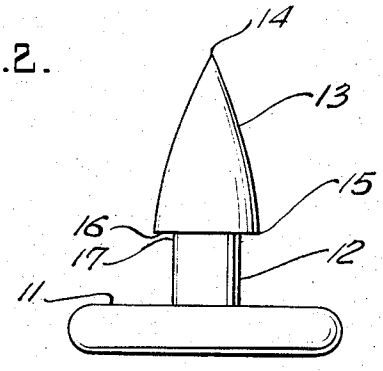



Fig. 2.



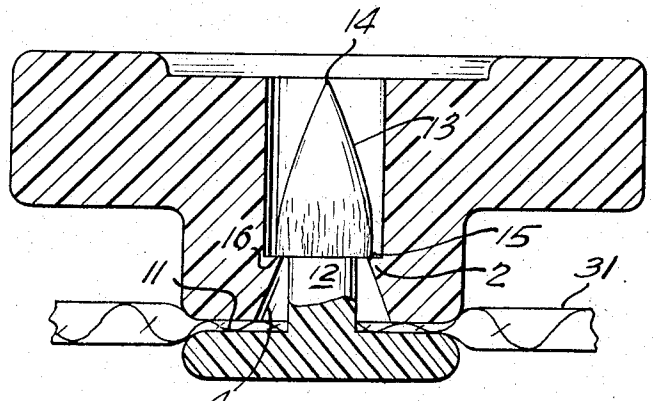




Fig. 3.

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PIN AND SOCKET THREADLESS BUTTON ASSEMBLY

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Fig. 4.

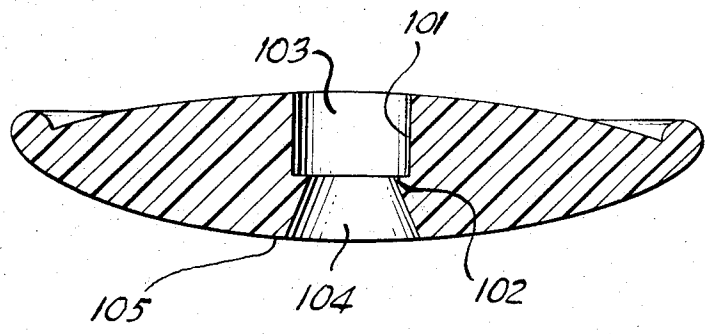
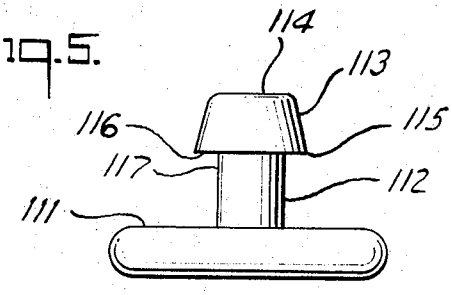



Fig. 5.



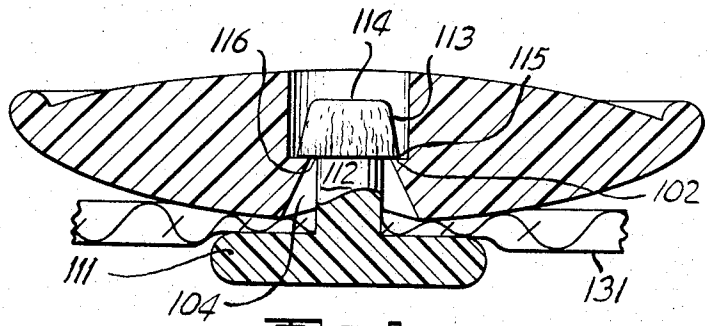




Fig. 6.

INVENTOR

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United States Patent Office 3,360,835 Patented Jan. 2, 1968



3,360,835

# PIN AND SOCKET THREADLESS BUTTON ASSEMBLY

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10 Claims. (Cl. 24—90)

## ABSTRACT OF THE DISCLOSURE

An extremely simple, lockable two-piece button assembly with a steeply shouldered pin piece and a steeply shouldered socket piece in which both pieces are of materials generally considered to be rigid and in which lock is achieved by permanent deformation of portions of one or both parts in passage of a larger portion of one piece through a smaller aperture in the other with expansion on the far side of the aperture of the permanently deformed portions.

This application is a continuation-in-part of my copending application Ser. No. 351,326 filed Mar. 12, 1964, now abandoned.

*Background of the invention*

(1) *Field of the invention.*—The field of the invention is that of fasteners, particularly threadless buttons in which larger pin heads are forced past smaller apertures in sockets.

(2) *Priort art.*—Prior art contains springless, steeply shouldered two-piece button assemblies having non-rigid resilient pins with rigid socket pieces or rigid pins with non-rigid resilient socket pieces. However, such prior art pins or sockets had fold-back shoulders or rims so that the surfaces on opposite sides of the fold came into contact and afterwards resumed initial shape when clear of the socket shoulder or pin shoulder. Such assemblies could only be mounted on compressible, resilient mounting material of thickness greater than the distance from pin head rim to the pin stem behind the head, since this was the distance beyond lock position the pin had to be permitted to travel for the fold-back rim to get clear of the pin rim or socket shoulder.

Such prior art fold-back button assemblies required exertion of insertion force beyond that necessary simply to bring the pin to the point of advance relative to the socket piece occupied when finally in lock position. This additional force was necessary to advance the pin far enough through the socket piece so that the pin rim or socket rim could unfold and resume initial shape and permit the trailing surface of the pin head rim and the inner surface of the socket piece to come into locking abutment.

This also required subjecting the mounting material to excess compression to pass the folded back portions clear of the aperture beyond the point of lock so that when the additional force was released and retraction to lock position occurred, the grip or pinch of the assembly on the mounting material between the opposed surfaces of the pin base and the socket piece was disadvantageously looser than it would have been if the grip or pinch could have been maintained at the point of farthest advance.

Some prior art constructions did not lock at all, but maintained tenuous attachment by sideward squeeze alone on the slightly tapered sides of a pin by a non-shouldered elastic ring in the socket place. Separation was inhibited only by frictional resistance of the ring against the sides of the pin more nearly parallel than normal to the pin axis. There was no shoulder to shoulder abutment as in this invention to prevent detachment and maintain the interval between the parts of the assembly occupied by the mounting material without regard to frictional engagement side to side which is purely optional as far as my constructions are concerned.



In prior art, crazing, splitting, scaling, flaking or other permanent deformation of parts was studiously avoided by use of materials for pin or socket piece which were so resilient that they folded back to contact themselves and did not permanently deform but resumed initial shape.

*Problems of prior art solved by the invention*

With resilient shouldered pins and/or sockets which folded back and then resumed initial shape, before lock could be achieved, disadvantageous crushing of mounting material, whether rigid or resilient, ensued along with inherently insecure attachment. This was because the pin always had to relax its tightest grip or pinch by a distance approximating the distance from the pin head rim to the pin stem behind and at the base of the rim. That distance had to be traversed to get the prior art pin head past the smaller socket aperture.

Unfortunately, the obligatory retracing of the course followed to clear the pin head rim past the aperture in order to seat the trailing pin head surface on the shoulder of the socket piece necessitated relaxation of the grip on the garment or other mounting material between the pin base and the bottom of the socket piece disadvantageously leaving a loosely attached button on a crushed mounting material. Furthermore, such prior art fold-back assemblies could not be attached to material thinner than the distance from pin head rim to the pin stem. The prior art problem has never been solved of how to achieve and maintain without relaxation a firm attachment to a garment or other mounting material of a simple, two-piece threadless, button assembly.

*Objects of the invention*

(1) Provide a snap-on button without the need for a functioning spring of the leaf or slit type.

(2) Provide a non-folding shouldered pin head and non-folding socket construction lockable by pinching mounting material between the pin base and the base of the socket piece without the obligatory advance beyond final lock position and subsequent retraction characteristic of folding constructions which resume starting shape after achievement of lock.

(3) Provide a two-piece button assembly one of which may be brittle and at least one of which must be deformable and incapable of resuming initial shape after the deformation necessary for locking.

(4) Provide a button assembly of materials resistant to dimension or color change upon exposure to dry cleaning, laundering and ironing temperatures, pressures and materials.

(5) Provide a shouldered pin and socket button assembly attachable to material thinner as well as thicker than the distance from the initially outermost extent of the pin head rim to the nearest point on the extended surface of the pin stem by selection of suitable pin stem length.

(6) Provide a button assembly for easy attachment, but difficult detachment; an assembly devoid of the necessity for collapsible necks, split-spring sockets, fold-back pin rims, or barbs to achieve lock or maintain lock.

(7) Provide a two-piece button assembly capable of attaining and maintaining lock without relaxation of its grip on incompressible as well as compressible mounting materials.

*Definitions and properties of materials*

A pin is a piece having a base, intermediate stem and larger shouldered head of decreasing size towards its end.

Non-rigid resilient materials are rubber and synthetic plastic materials which are deformable but resume initial

shape when deforming force is released. They are not machinable.

A socket piece is a piece having a shouldered aperture smaller at its narrowest point than the head of a pin piece at its widest.

Rigid materials are materials which are deformable when subjected to deforming pressures by breaking in pieces or by changing shape and which do not resume initial shape when deforming pressures are released. Some rigid materials such as steel when compressed deform without breaking and when decompressed do not expand in permanently deformed condition. Other rigid materials such as the acetal resins, Delrin and Celcon, when subject to deforming pressure deform without breaking into separate pieces, but when such pressure is released, expand although in permanently deformed condition. Still others are brittle and when subjected to great deforming forces break in pieces, for instance, melamine, the urea resins, phenolics and casein often used for buttons in button manufacture. Some acetal resins such as Delrin and Celcon permanently deform by crazing or splitting when highly stressed as by bumping a piece of given size through a smaller unyielding aperture, but on the far side expand although in permanently deformed condition. Being rigid and sufficiently hard and inflexible by conventional standards, that they may be used for instance as gears in machines, such deformable materials as Delrin and Celcon make possible lock of a steeply shouldered taper-nosed, blunt or pointed end pin head to a hard, smaller apertured socket piece when the shoulder of the pin deforms permanently, clears the aperture and expands in permanently deformed condition without having to advance the pin beyond final lock position relative to the socket piece.

Steep and steeply refers to angles normal or nearly normal with respect to the axis of the pin.

*Summary of the invention—solution to prior art problems*

I have now provided a two-part springless button assembly comprising

(a) A rigid, steeply shouldered, non-foldable, socket piece

(b) A rigid, steeply shouldered, non-foldable, pin piece having a base, a stem and an enlarged head

(c) Said socket piece and said pin piece being composed of materials which withstand laundering, dry cleaning and ironing temperatures and pressures, and also chemical attack by soaps, detergents, organic chemical solvents and the like used in such operations

(d) Said pin piece and said socket piece being lockable with each other shoulder to shoulder in pinching attachment to a garment or other compressible or incompressible mounting material by slideable passage of the pin head through a smaller aperture in the socket piece

(e) Of said pin and socket pieces at least one being permanently deformable, for instance by crazing and/or splitting under the great compressive forces exerted upon bumping extrusion of a larger pin head through a smaller aperture in a socket piece

(f) Said permanently deformable piece or pieces having the property of expanding in permanently deformed condition upon release of said great compressive force

(g) Wherein one of said pin piece and said socket piece can be non-deformable when subjected to said great compressive force

(h) Whereby after passage of the pin head through the aperture into lock, separation is prevented by juxtaposition of the steep trailing surface of the pin head and the steep inner surface of the socket piece.

Contrary to the prior art teaching of avoidance of permanent deformation, I deliberately achieve irrevocable, permanent deformation of at least one piece in order to make possible use of smaller parts and less final overlapping than otherwise in a button assembly with maintenance of locking effectiveness and without need as in prior art fold-back constructions to hyper-compress the mounting material with the disadvantageous, concomitant need to relax and withdraw from the position of tightest grip or squeeze in order to bring pin and socket into locking abutment. My assembly achieves and maintains its grip on the mounting material without such relaxation and retraction as in prior art since the pin rim has not folded back into contact with the structure behind it.



The button assembly of my invention gives greater locking strength with less need for overlap than in prior art fold-back construction.

My use of at least one permanently deforming and post-deformation expanding part facilitates (1) locking by sideward compression without fold-back of the rim of a tapering, steeply shouldered pin head and/or of the socket shoulder of a steeply shouldered socket piece into contact with structure of the same piece by passage of the pin head through the smaller aperture in the latter with permanent deformation of at least one followed by (2) steep sideward expansion in permanently deformed condition of the permanently deformed piece or pieces to provide shoulder to shoulder obstruction to withdrawal once the pin head is through the aperture.

The pin and socket pieces of the two-part button assembly of the invention are both made of materials considered hard and unyielding by most standards. In fact, acetal resins which may be used for the permanently deformable piece or pieces are often used for stable dimensioned, heavy duty parts such as gears. Actual resins are stiff, rigid and machinable and possess attributes never previously associated with rubber and like relatively resilient materials. Acetal resins are bendable much in the sense steel is bendable. Rods will bend and resume initial shape when released. Extrusion through smaller apertures of steepled pins, however, results in permanent deformation. Like steel and unlike rubber and similar materials, acetal resins once deformed, otherwise than by flexion, do not resume initial shape.

Nevertheless, unlike steel, acetal resins once deformed by great compressive force will expand markedly in permanently deformed condition although they never resume initial shape. This phenomenon makes possible use in applicant's invention to establish lock.

Button assemblies according to applicant's invention, once attached can be readily removed by using a knife or razor to sever the pin stem.

The pin can be made of material with a slick surface which can pass readily through clothing, textile and synthetic sheetings unlike some rubbers and the like which even in needle shapes frictionally resist being pushed through textile sheeting.

Prepared holes are not necessary for pins in needle nosed embodiments of my invention although holes may be provided if desired to ease attachment, especially with blunt nosed embodiments of the pin of my invention.

According to my invention, the mounting material is pinched between the upper surface of the pin base and the lowermost surface of the socket piece when the pin is standing with head up and base down.

The interval can be predetermined by dimensioning the pin and socket pieces appropriately according to the thickness of the mounting material so that the pinch will be adequate to keep the assembled button securely in place.

In attachment, the outermost pin portions passing through the socket aperture in embodiments where the pin is deformable remain permanently deformed although after passing through the aperture the very same outermost portions do expand outwardly to occupy positions radially outward beyond the innermost extent of the aperture, thus preventing withdrawal. It is vice versa when the socket piece is deformable and both deform and expand when both pin and socket are deformable.

The permanently deformed pin head rim and/or socket are steeply shouldered after attachment as well as before so that no frictional resistance to withdrawal by surfaces

parallel or nearly parallel to the pin axis is necessary to maintain lock because of abutment of the pin and socket shoulders more nearly normal than parallel to the pin axis.

The socket piece chamber if desired may be so small that the sides of the pin may be squeezed by the wall of the socket piece after attachment. The pin and socket piece are of materials slippably movable against each other when pressed together when moved in opposite directions while in compressive contact. The pin head rim before attachment must always be wider than the socket aperture at its smallest, and the softer the pin and socket material chosen, the greater this difference must be.

Acetal resins are not adversely affected by dry cleaning solvents, detergents, or washing and drying temperatures.

The invention is new and unobvious since (a) the invention has the operative mechanical distinction from many prior art assemblies of exhibiting no folding back upon traverse by a larger shouldered piece through a smaller shouldered tube by a distance approximating that from pin head rim to the stem behind the head, and (b) the invention provides the unusual, surprising and novel result of secure lock achieved and held without crushing the mounting material and without relaxation from the stage of tightest grip, with all the attendant advantages.

The pin may be pointed or blunt at the end opposite the base. The pin can pierce sheeting as a needle does if the pin used is pointed. Whether sharp nosed or blunt, a hole may be prepared by an awl or other instrument.

The aperture in the socket piece must be larger than the pin stem behind the pin head.

My invention provides unexpected results by passing a larger steeply shouldered pin head through a smaller steeply shouldered aperture into locking engagement:

(a) without fold-back of pin head rim or socket rim by a distance approximating that from pin rim to stem behind;
(b) without need for springs;
(c) without an obligatory collapsing socket neck;
(d) without need for barbs;
(e) without materials which resume initial shape following deformation;
(f) without reliance for lock on sideward squeezing of pin by socket surfaces parallel or nearly parallel to the pin axis.

Either or both of the pin and socket piece may swell slightly with passage of time or be reactive with air, water, laundering or dry cleaning materials to swell slightly. This enhances the security of locking engagement. My assembly is otherwise not altered in shape, appearance or otherwise by time or contact with chemically active agents more than conventional button materials such as melamine or the urea resins.

*Advantages*

The invention permits lock to be attained without advance beyond lock.

The invention provides a springless button assembly that can be attached to incompressible sheeting of a garment.

The invention provides a springless button assembly that can be attached more securely to a compressible garment sheeting.

The invention provides a springless button assembly that can be attached to incompressible sheeting or to thicker sheeting than in prior art assemblies having pins with stems of the same length but which had fold-back, rimmed heads and/or fold-up shouldered socket pieces. Such prior art assemblies, of course, could only be attached to compressible materials and could only be securely attached to resilient materials which expanded after the excess compression necessary to get the fold back rims clear of the aperture.



*Brief description of the drawing*

The invention will now be discussed with reference to the particular embodiments depicted in the drawing, which are, of course, only a few of the many possible embodiments of the invention.

It will be understood the shape and relative dimensions of pin and socket may vary from those depicted depending on the particular materials and design used of the many possible according to my invention.

FIGURE 1 depicts a socket piece in section according to one embodiment of the invention prior to lock.

FIGURE 2 depicts a pin piece in elevation according to the same embodiment of the invention prior to lock.

FIGURE 3 depicts the pin piece and socket piece of FIGURES 1 and 2 after lock, with the pin base and adjacent stem in section.

FIGURE 4 depicts another socket piece in section according to another embodiment of the invention prior to lock.

FIGURE 5 depicts another pin piece in elevation according to another embodiment of the invention prior to lock.

FIGURE 6 depicts the socket piece embodiment and the pin piece embodiment of FIGURES 4 and 5, respectively, after lock, with the pin base and adjacent stem in section.

In the embodiments illlustrated the socket piece is the button, but the pin piece can be the button in other embodiments.

In FIGURE 1, the socket piece has an aperture with a wall **1** and a shoulder **2** protruding inwardly of the wall intermediate the ends of the aperture. The aperture wall **1** defines a chamber **3** and an entryway **4**. The portion of the socket piece outward of the open end of the entryway **4** constitutes mounting surface **5**.

In FIGURE 2 the pin piece has a base **11**, an intermediate stem **12** and head **13**. Head **13** is steepled in outline having a pointed end **14**, an enlarged rim **15** larger in sideward extent than the stem **12**, and an under surface **16**. Stem **12** includes a portion **17** proximate the pin head.

In attaching the assembly to a garment or other mounting material, the head **13** of the pin is advanced into the entryway **4**. The portion of the wall **1** lining the entryway is larger than the pin rim **15** at the open end and smaller than the pin rim **15** at the end towards shoulder **2**. Force is applied which compresses and permanently deforms the pin head and/or the shoulder portion of the socket sufficiently to permit passage of the pin head rim **15** just past shoulder **2**. Due to the property of expanding upon release of permanently deforming compressive stress the permanently deformed pin head and/or shoulder then expand and establish a shoulder to shoulder locking abutment with each other. This is done without flexion of any part of under surface **16** of the pin head into contact with the portion **17** or stem **12** proximate to under surface **16**. Nor is there any folding up of the socket shoulder against the wall of chamber **3**. Thus there is no need to advance the pin relative to the socket piece by a distance approximating the distance from the proximate portion **17** of stem **12** to the outermost extent of rim **15** in order to achieve lock.

As the pin head **13** reaches shoulder to shoulder locked juxtaposition with respect to the socket piece, the mounting surface **5** and the surface of the pin base towards the pin head securely pinch the garment or other mounting material **31** as shown in FIGURE 3.

Note that the outer portion of pin head rim **15** remains permanetly deformed as shown in FIGURE 3 after reaching locked juxtaposition with respect to the socket piece.

Note also the secure pinch on the mounting material **31**.

The embodiment of the socket piece shown in FIGURE 4 is shankless but, similar to the embodiment of FIGURE 1, has an aperture with a wall **101** defining a shoulder **102** protruding inwardly of the wall intermediate the

ends of the aperture. The shoulder **102** divides the aperture into an upper chamber **103** and a lower entryway **104**. Even though this embodiment is shankless, the under surface of the socket piece immediately outward of the open end of the entry way **104** constitutes the mounting surface **105**.

In FIGURE 5, the pin piece differs from that shown in FIGURE 2 by having a blunt ended pin head **113**. The pin piece has a base **111**, an intermediate stem **112** and a head **113** with a flat blunt end **114**. The head **113** is tapered toward its blunt end **114** and terminates at its inner end with an enlarged rim **115** which is larger in sideward extent than the stem **112** thereby defining an under surface **116**. Proximate the pin head **113**, the stem **112** includes a portion **117**.

To attach the socket piece embodiment of FIGURE 4 to a garment with the pin piece embodiment of FIGURE 5, the pieces are assembled in the same manner as described above with respect to the embodiments depicted in FIGURES 1 and 2. The only additional step required is that the mounting material **131** (FIGURE 6) must first be provided with a preformed hole to receive and permit passage of the blunt end **114** of the pin head **113**. This can be accomplished by first piercing the material **131** with an awl like instrument or even by first piercing the material with a large sewing needle to separate the interwoven threads.

With the embodiments of my invention shown in FIGURES 4 and 5, note also the permanent deformation of the pin head **113** (FIGURE 6) after reaching locked juxtaposition with the socket piece and the secure pinch on the mounting material **131**.

Mounting on material thicknesses much smaller than the distance from the pin head rim to the stem immdiately behind the pin head is possible with assemblies according to the invention, although not with prior art constructions requiring flexion of the pin rim against the stem which could only be mounted on materials as thick or thicker than that distance. Even when mounted on thicker materials such prior art assemblies were more loosely mounted since they had to relinquish the pinch at the point of farthest advance to allow the pin rim to flex outward and then allow the pin head to move back into shoulder to shoulder abutment with the socket pieces.

EXAMPLE I.—DEFORMABLE PIN PIECE WITH NON-DEFORMABLE PIECE, e.g. SOCKET PIECE OF MELAMINE PIN PIECE OF DELRIN

EXAMPLE II.—SOCKET PIECE AND PIN PIECE OF DELRIN

EXAMPLE III.—SOCKET PIECE OF DELRIN PIN PIECE OF MELAMINE

I claim:

**1.** A two-piece button assembly comprising

(a) a rigid, non-foldable socket piece having an aperture comprising an entryway and a chamber which define an intermediate non-foldable steep shoulder, and

(b) a rigid, steeply shouldered, non-foldable pin piece having a base, a stem and an enlarged non-foldable head with respect to the aperture of the socket piece at the intermediate steep shoulder,

said socket piece and pin piece being composed of materials which withstand laundering, dry cleaning, ironing and chemical attack by soaps, detergents, organic solvents,

said socket piece and pin piece being formed so as to be permanently lockable to each other shoulder to shoulder and in gripping, pinching attachment to a garment or other compressible or incompressible mounting material by slideable passage of the pin head and associated shoulder through the garment and to only just past the shoulder in the aperture of the socket piece to prevent undesired crushing of the garment and accompanying lessening of pinching action caused thereby,

of said pin piece and socket piece at least one being permanently deformable under great compressive force at and near where said force is applied when subjected to bumping extrusion of the enlarged pin head just past the aperture of the socket piece at the shoulder and having the property of expanding in permanently deformed condition upon release of such great compressive force,

one only of said pin piece and said socket piece optionally being of material that is non-deformable when subjected to great compressive force in bumping extrusion of the enlarged pin head just past the aperture of the socket piece at the steep shoulder,

separation being prevented after passage of the enlarged pin head just past the aperture of the socket piece at the steep shoulder by juxtaposition of the steep trailing surface of the pin piece and the steep shoulder surface of the socket piece more nearly normal than parallel to the pin axis.

**2.** Assembly according to claim **1** in which said pin head is pointed at the end.

**3.** Assembly according to claim **1** in which said pin head is blunt at the end.

**4.** Assembly according to claim **1** in which of said socket piece and said pin piece one is button shaped.

**5.** Assembly according to claim **4** in which said button shaped piece is shanked.

**6.** Assembly according to claim **4** in which said button shaped piece is shankless.

**7.** Assembly according to claim **1** in which both the pin piece and socket piece are of a permanently deformable material such as an acetal resin.

**8.** Assembly according to claim **1** in which the pin piece is composed of a permanently deformable material such as an acetal resin and the socket piece is composed of a harder resin such as a polyester resin melamine, urea resin or other conventional plastic clothing button material.

**9.** Assembly according to claim **1** in which said entryway is larger than said pin rim at its external end and smaller than said pin rim at its internal end.

**10.** Assembly according to claim **1** in which said pin stem is smaller than said socket piece aperture at the intermediate steep shoulder.


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DONALD A. GRIFFIN, *Primary Examiner.*