

IMPROVED FASTENING DEVICE

This invention most generally relates to a two part device to fasten together a plurality of sheets of material, such as for example paper, which may have but need not have previously made holes in them. The device is composed of plastic, metal or other similar material which is resilient but form-retaining, and comprises a stud/male component which is press or snap-fitted into an aperture in a socket/female component.

Such devices are disclosed in US Patents Nos: 3,530,550 (White), 4,825,516 (Ackermann et al), 3,626,955 (Greenwood), 1,276,030 (Adler), 3,039,471 (Church), 2,583,224 (McDonald) and 2,590,175 (Hajdu).

For example, US Patent No: 3,530,550 (White) discloses a clamp composed of mating discs for engaging pliant sheet material, such as for fastening baby diapers without the use of pins or the like, and interengaging members provided on the discs for holding them together until released by pressure. An interconnecting flexible strap holds the discs together when they are not in clamping engagement. The opposed mating discs are frictionally held together when in clamping position and released by finger and thumb pressure of the user in a direction along the aperture axis. White relies on the material characteristics to provide the means for disengagement of 22 from 26.

US Patent No: 4,825,516 (Ackermann et al) teaches a snap-fastener comprising stud and socket components. This invention teaches the notion of placing a pliant substrate of material in such a position so that when the stud and socket components are closed they "pinch" the material therebetween.

Presently, there is nothing available that permits the attachment of two components and the release of such attached components, both steps being achievable using the squeezing or pinching forces on only the periphery of a so called socket component and exerable with the use of one hand; more specifically the use of the fingers of one hand.

The invention disclosed herein is based upon the deformation by a substantially cylindrically shaped member of a substantially oval or elliptically cross-sectioned aperture which results in forces, due to the deformation and due to the characteristics of the material in which the aperture is located, which cause the two components, a stud/male component and a socket/female component, to interengage, and the interengagement can be caused to be released by the simple squeezing or pinching of only the socket component using the fingers of one hand. In contrast, the prior art devices require pressure in the direction which is opposite to the direction of the insertion force, and very importantly, they require access to both components used in the clamping system. The fastener of the present invention can thus be engaged and disengaged having access to only the socket component.

According to one aspect of the invention, there is provided a fastening device comprising:

- a stud component;

- a socket component fabricated using material which is resilient but form-retaining, having a dimensionally deformable substantially elliptically shaped aperture therein adapted to receive and interengage said stud component when said stud component is inserted into said socket component and when said socket component is placed onto said stud component;

said stud component comprising a body portion, a substantially cylindrically shaped stud member projecting therefrom, and means for deforming said aperture to receive and interengage said stud component when said stud member is inserted into said aperture of said socket component and when said socket component is placed onto said stud component, thereby interengaging said stud and socket components;

a plurality of interengaging means integral with and positioned along said stud member, each adapted to cooperate with said socket component to interengage said stud and socket components; and

said socket component aperture having interior walls, a major axis dimension and a minor axis dimension, said major axis dimension being greater than said minor axis dimension, said aperture axes dimensions being deformable so that said minor axis dimension increases as said major axis dimension decreases upon insertion and extraction of said stud member into and from said socket component and upon squeezing of said socket component along a direction parallel to said major axis and perpendicular to said minor axis of said elliptically shaped aperture, said interengagement of said socket component with said stud component being only at both ends of said minor axis when said stud component is in interengagement with said socket component.

The interengaging means may comprise appropriately treated surfaces of the stud member, interior walls defining the aperture being such that interengagement of the stud and socket components results from friction forces between tangential contacting areas of the treated surfaces and the interior walls when the stud component is deformingly inserted into the socket component. The forces are

substantially created by the deformation of the aperture and the resilience of the material.

The means for deforming the aperture may comprise an appropriate taper of the aperture interior walls, or of the stud member, so that the minor axis dimension is increased and the major axis dimensions is decreased causing the aperture to admit the stud member, thus interengaging the stud and socket components. The stud component may be fabricated using material which is resilient but form-retaining.

The interengaging means may comprise a plurality of disc-like interengaging means integral with and distributed along the stud member between the body portion and protruding end of the stud member. Each of the disc-like interengaging means has an inner and an outer diameter, and each inner diameter is greater than the outer diameter and greater than the stud member diameter. The spacing between adjacent discs is not less than a dimension which is adequate to permit the interengaging of the stud and socket components.

The socket component is adapted to have at least one means for engagement which matingly cooperates with each of the plurality of interengaging means of the stud component. The means for engagement matingly cooperates with at least one of the plurality of disc-like interengaging means. The interengagement of the stud and socket components results from forces between tangential contacting areas of each of the plurality of the disc-like interengaging means and the means for engagement of the socket component when the stud member is deformingly inserted into the socket component causing deformation of the aperture and also when the socket component is placed onto the stud component. The forces are created by the deformation of

the aperture and the resilience of the material.

The means for deforming the aperture may comprise an appropriate thickness dimension and inner and outer diameter relationship of the disc-like interengaging means providing an adequate taper to cause the aperture deformation upon inserting of the stud member, the stud component being fabricated using material which is resilient but form-retaining. Further, there is provided means for flexibly connecting the stud component to the socket component.

From another aspect, the present invention provides a fastening device comprising:

a stud component having a body portion, a substantially cylindrically shaped stud member with a vertical length and a stud diameter and extending substantially vertically from a first inner surface, and a plurality of disc-like interengaging means integral with and distributed along said stud member between said body portion and protruding end of said stud member, the spacing between adjacent discs being not less than a dimension which is adequate to permit said interengaging of said stud and socket components; and

a socket component fabricated using material which is resilient but form-retaining, adapted to interfit and interengage with said stud component, and having an arcuate interior aperture surface defining a substantially elliptically shaped aperture through said socket component with a vertical aperture axis substantially in parallel alignment with said stud member, said elliptically shaped aperture having a vertical length not greater than said stud member length, a minor axis having a dimension not substantially less than and not substantially greater than said stud member diameter, and a major axis dimension greater than and orthogonal to said minor axis, one-half the sum of said

major and minor axes dimensions being greater than said inner diameter, and both said axes being orthogonal to said vertical aperture axis, said elliptically shaped aperture axes dimensions being deformable so that said minor axis dimension increases as said major axis dimension decreases upon insertion and extraction of said stud member into and from said socket component and upon squeezing of said socket component along a direction parallel to said major axis and perpendicular to said minor axis of said elliptically shaped aperture, said interengagement of said socket component with said stud component being only at both ends of said minor axis when said stud component is in interengagement with said socket component.

From a further aspect, the present invention provides a fastening device comprising: a stud component, said stud component comprising a body portion and a substantially cylindrically shaped stud member projecting therefrom; a socket component fabricated using material which is resilient but form-retaining, having a dimensionally deformable substantially elliptically shaped aperture therein adapted to receive and interengage said stud member when said stud member is inserted into said socket component and when said socket component is placed onto said stud member, said stud component and socket component being adapted to clamp material between them when said stud member is inserted into said socket component; each said component being adapted with cooperating, interfitting, interengaging means, to interengage said stud and socket components; said socket component aperture having interior walls, a major axis dimension and a minor axis dimension, said major axis dimension being greater than said minor axis dimension, said aperture axes dimensions being deformable so that said minor axis dimension increases as said major dimension

decreases upon insertion and extraction of said stud member into and from said socket component and upon squeezing of said socket component along a direction parallel to said major axis and perpendicular to said minor axis of said elliptically shaped aperture, said interengagement of said socket component with said stud component being only at both ends of said minor axis when said stud component is in interengagement with said socket component; wherein said stud member has interspersed thereon a plurality of interengaging means, and said socket component is adapted to have at least one means for engagement which matingly cooperates with each of said plurality of interengaging means of said stud component, said means for engagement matingly cooperating with at least one of said plurality of interengaging means when said stud member is inserted into said socket component and when said socket component is placed onto said stud member, thereby interconnecting said stud and socket components.

The stud component may be fabricated using material which is resilient but form-retaining, and further, the socket component is adapted to have a means for engagement which matingly cooperates with disc-like interengaging means of the stud component. The interengagement of the stud and socket components results from the forces between tangential contacting areas of the disc-like interengaging means and the means for engagement of the socket component, when the stud component is deformingly inserted into the socket component causing deformation of the aperture. The forces are created by the deformation of the aperture and the resilience of the material. Additionally, there may be provided means for flexibly connecting the stud component to the socket component.

From yet another aspect, the invention provides a fastening device comprising:

a first stud component having a substantially cylindrically shaped first stud member with a vertical length and a first stud member diameter, at least one first stud component interengaging means being integral with and appropriately located along said first stud member;

a second stud component having a substantially cylindrically shaped second stud member with a vertical length and a second stud member diameter, at least one second stud component interengaging means being integral with and appropriately located along said second stud member; and

a socket component fabricated using material which is resilient but form-retaining, adapted to interfit and interengage with both said first and second stud components, having an arcuate interior aperture surface defining a substantially elliptically shaped aperture through said socket component with a vertical aperture axis substantially in parallel alignment with said stud members, said elliptically shaped aperture having a vertical length not greater than said stud member length, a minor axis having a dimension greater than said outer diameter of each said interengaging means and not greater than said stud member diameter, and a major axis dimension greater than and orthogonal to said minor axis, one-half the sum of said major and minor axes dimensions being greater than said inner diameter and both said axes being orthogonal to said vertical aperture axis, said elliptically shaped aperture axes dimensions being deformable so that said minor axis dimension increases as said major axis dimension decreases upon insertion and extraction of said stud members into and

from said socket component and upon squeezing of said socket component along a direction parallel to said major axis and perpendicular to said minor axis of said elliptically shaped aperture, said interengagement of said socket component with said stud components being only at both ends of said minor axis when said stud components are in interengagement with said socket component.

Each of the first and second stud component interengaging means may be a disc having an inner and an outer diameter, with each inner diameter being greater than the outer diameter and greater than the stud member diameter. The spacing between adjacent discs is not less than a dimension which is adequate to permit the interengaging of the stud and socket components. The socket component further comprises at least one means for engagement which matingly cooperates with at least one of both the first and second stud component disc-like interengaging means when the first and second stud components and socket component are attached.

From a further aspect, the invention provides a fastening device comprising:

- a stud component;

- a socket fabricated using material which is resilient but form-retaining, having a dimensionally deformable substantially elliptically shaped aperture therein adapted to receive and interengage said stud component when said stud component is inserted into said socket component;

- said stud component and said socket component being adapted to clamp material between them when said stud component is inserted into said socket component;

- said stud component comprising a body portion, a substantially cylindrically shaped stud member projecting therefrom, and means for deforming said aperture causing

said aperture to receive and interengage said stud component when said stud member is inserted into said socket component, thereby interconnecting said stud and socket components;

interengaging means adapted to cooperate with said socket component to interengage said stud and socket components; and

said socket component aperture having interior walls, a major dimension and a minor axis dimension, said major axis dimension being greater than said minor axis dimension, said aperture axes dimensions being deformable so that said minor axis dimension increases as said major axis dimension decreases upon insertion and extraction of said stud member into and from said socket component and upon squeezing of said socket component along a direction parallel to said major axis and perpendicular to said minor axis of said elliptically shaped aperture, said interengagement of said socket component with said stud component being only at both ends of said minor axis when said stud component is in interengagement with said socket component.

The present invention also provides a method for engageably and releasably attaching together two components, namely the stud component and the socket component of the fastening device, as above described.

Thus, according to another aspect of the invention, there is provided a method for engageably and releasably attaching together two components, a stud component and a socket component, said socket component having a substantially elliptically shaped aperture therein, said stud component comprising a body portion, a substantially cylindrically shaped stud member projecting therefrom having interspersed thereon a plurality of interengaging means, said socket component being fabricated using material which

is resilient but form-retaining, and each said component being adapted with cooperating, interfitting, interengaging means, said socket component being adapted to have at least one means for engagement which matingly cooperates with each of said plurality of interengaging means of said stud component, said means for engagement matingly cooperating with at least one of said plurality of interengaging means when said stud component and said socket component are attached, said method comprising the step of:

deformingly inserting said substantially cylindrically shaped stud member into said substantially elliptically shaped aperture, causing said aperture to deform to receive said cylindrically shaped stud member, said deformation of said aperture and said resilient material providing forces which cause said at least one of said plurality of interengaging means to interengage said stud and socket components; and

squeezing said socket component along a direction parallel to a major axis and perpendicular to a minor axis of said elliptically shaped aperture in a manner so as to deform said aperture and release said forces, thus releasing said at least one of said plurality of interengaging means, said aperture deformation being from a substantially elliptically shaped aperture to an aperture which is sized to allow the removal of said stud component from said socket component without said stud component being subjected to any substantial tensile stresses, and to allow insertion of said stud member into said socket component without said stud component being subjected to any substantial compression stresses.

The invention also provides a method for engageably and releasably attaching together two components, a stud component and socket component, said socket component

having a substantially elliptically shaped aperture therein, said stud component comprising a body portion, a substantially cylindrically shaped stud member projecting therefrom, means for deforming said aperture when said stud component is inserted into said socket component, said socket component being fabricated using material which is resilient but form-retaining, and each said component being adapted with cooperating, interfitting, interengaging means, said method comprising the steps of:

deformingly inserting said substantially cylindrically shaped stud member into said substantially elliptically shaped aperture, causing said aperture to deform to receive said cylindrically shaped stud member, said deformation of said aperture and said resilient material providing forces which cause said interengaging means to interengage said stud and socket components; and

squeezing said socket component along a direction parallel to a major axis and perpendicular to a minor axis of said elliptically shaped aperture in a manner so as to deform said aperture and release said forces, thus releasing said interengaging means, said aperture deformation being from a substantially elliptically shaped aperture to an aperture which is sized to allow the removal of said stud component from said socket component without said stud component being subjected to any substantial tensile stresses, and to allow insertion of said stud component into said socket component without said stud component being subjected to any substantial compression stresses.

Various embodiments of the present invention will now be described with reference to the accompanying drawings, in which:-

Fig. 1 is a frontal perspective view of a first

embodiment of fastening device having a disc and cooperating interengaging means associated with the stud and socket components respectively, and showing the aperture somewhat deformed toward a circular cross-section with a diameter of about the diameter of the disc-like interengaging means;

Fig. 2 is a top view of the fastening device illustrating the substantially circular body portion of the stud component, and the flexible connector connecting the stud and the socket components;

Fig. 3 is a cross-sectional view of the fastening device illustrating a slightly curved first inner surface adapted to clamp material between such surface and the socket component, along with a cross-section of the stud member and the aperture showing the cooperating interengaging means of the stud and the socket components, and showing that the minor axis of the aperture is to be not more than the stud member diameter;

Fig. 4 is a bottom view of the fastening device, illustrating the cross-section of the aperture and the recess or ledge into which the disc-like interengaging means fits when the two components are interengaged;

Fig. 5 is a bottom view of the fastening device illustrating the cross-section of the aperture and the recess or ledge into which the disc-like interengaging means fits when the two components are interengaged, and further showing the major and minor axes dimensions;

Fig. 6 is a side view of the stud component of the fastening device illustrating the substantially circular body portion of the stud component, the stud member, and the stud interengaging means which comprises a tapered section;

Fig. 7 is a perspective view of the fastening device illustrating the stud component and the socket

component; and

Fig. 8 is a bottom view of the fastening device illustrating the stud component and the socket component in an interengaged state.

Fig. 9 shows a second embodiment of the invention, and is a bottom view of the socket component, and a side view of the stud component having more than one disc for engaging the socket component, and further shows the major and minor axes dimensions;

Fig. 9A is a side view of the stud component of the fastening device of Fig. 9, and a sectional view of the socket component, illustrating the connection of the two components showing the recess or ledge into which the disc-like interengaging means fits when the two components are interengaged, and also illustrating the stud interengaging means which comprises a tapered section;

Fig. 10 is a perspective view of the fastening device illustrating the stud component having a plurality of disc-like interengaging means and the socket component;

Fig. 11 is a bottom view of the fastening device illustrating the stud component and the socket component in an interengaged state;

Fig. 12 shows a third embodiment of the invention, and is a bottom view of the socket component, and a side view of the stud component having more than one disc-like interengaging means for engaging the socket component, and more than one recess in the socket component, and further shows the major and minor axes dimensions;

Fig. 12A is a side view of the stud component of the fastening device of Fig. 12, and a sectional view of the socket component, illustrating the connection of the two components showing the two recesses or ledges into which the disc-like interengaging means fits when the two

components are interengaged, and also illustrating the stud interengaging means which comprises a tapered section;

Fig. 13 shows a fourth embodiment of the invention, and is a perspective view of a fastening device having two stud components which are attachable end-to-end using a socket component with a recess in which the two disc-like interengaging means are contained when the two stud components are interengaged by the socket component;

Fig. 13A is a side view of the stud component of the fastening device of Fig. 13, and a sectional view of the socket component, illustrating the connection by the socket component of the two stud components showing the recess or ledge into which the two disc interengaging means fit when the two stud components are interengaged end-to-end, and also illustrating the stud interengaging means which comprises a tapered section; and

Fig. 14 is a perspective view of the fastening device of Fig. 13, illustrating two stud components which are in end-to-end relationship, and showing the relationship of the disc-like interengaging means when the two stud components are assembled.

The following is a description of preferred embodiments of the invention. It is clear that there may be variations in the size and the shape of the fastening device. However, the main features of the device is the deformation of the cross-section of an aperture from being substantially oval or elliptical toward a more circular cross-section. The degree of deformation will be dependent upon the intended use of the fastening device. The more the deformation the greater will be the clamping or the holding power of the device. The power of the device will also be a function of the material characteristics from which the two basic components are made. The device can be

interengaged and disengaged with the use of one hand and with access to only the socket component of the device. A simple "pinching" action will result in the disengagement of the components.

In order to describe the invention most clearly and simply, the fastening device 10 will be described as being a substantially circular shaped device with basically two components - a stud component 15 and a socket component 20 - both of which are designed or adapted to clamp material between them when the components are fastened together. The two components may be interconnected by a flexible connector 8. Clearly, where there is access only to one side of materials being clamped together or otherwise assembled or fastened, the connector 8 would not be used. However, if the device 10 is being used in a manner similar to paper clips where each of the sheets to be attached by use of the device 10 may or may not have a hole punched at an predetermined location around the periphery, connector 8 may be a part of the device 10.

Reference is now made to Figs. 1 - 8 all of which depict a first embodiment of the fastening device 10 of the invention. The stud component 15 has a substantially cylindrically shaped stud member 14 which extends about vertically from a body portion 16. In the embodiment illustrated in the various Figures, there is also interengaging means, comprising a disc 17, which is adapted to interengage or interconnect with a cooperating means for interengaging, comprising a recess 22, which engages disc 17 when the stud and socket components 15 and 20 are interfitted. I.e. the stud component 15 is pressed into the aperture 24 of socket component 20, deforming the aperture 24 by increasing the minor axis dimension D1 and correspondingly decreasing the major axis dimension D2, and the disc 17 interengages with

the corresponding recess 22. The extent of the contact between disc 17 and recess 22 is a function of the dimensions D1 and D2 relative to the stud member diameter D5. It is desirable that one-half of the sum of D1 and D2 be greater than or equal to the inner diameter D3, and that D1 be less than stud member diameter D5, but at the said time greater than the diameter D4 of the outer or free end of the stud member 14. The disc 17 is tapered in that the diameter D3 of the disc 17 axially inwardly of the location of the outer diameter D4 is larger than the outer diameter D4, and D3 is larger than the stud member diameter D5. It is also desirable, in order to permit relatively easy assembly or clamping of the two components, to have the outer diameter D4 be less than the minor axis dimension D1. The difference between D3 and D4 is the taper or means for deforming aperture 24. When the stud member 14 of the stud component 15 is deformingly inserted into aperture 24 of component 20, the disc 17 will snappingly interengage with recess 22. The properties of the material from which component 20 is made and the forces created by the deformation of the aperture 24 firmly interengage or interconnect components 15 and 20. If relatively flexible or soft material such as paper or cloth is positioned between components 15 and 20 prior to them being interengaged, such material may be clipped or snapped together by forcibly pushing component 15 onto the material and into aperture 24 until disc 17 engages recess 24 and "pinching" the material between the two components 15 and 20. Device 10 may also be used by inserting stud member 14 and disc 17 into a hole made in material, which material may be but need not be flexible. The component 20 is pressed onto stud member 14 and is caused to interengage with component 15. Thus a plurality of sheets of the material may be caused to be

attached. The number and the thickness of the sheets of material which may be attached together will depend upon the length dimensions of the stud member 14 and the depth of aperture 24. That is to say, the stud component 15 and the socket component 20 may be adapted in any number of dimensional ways to make device 10 useful as a fastening means for various purposes. A first inner surface 13 of body portion 16 may be designed with various surface finishes and radii adapted to more effectively clamp the material. The particular shape and surface condition of surface 13 will depend on the function of the fastening device 10. Device 10 may be adapted for the attachment of objects together, such as attaching an object to a wall, which object is not to be permanently attached. The object so attached may be easily and non-damagingly removed by simply squeezing component 20 in a manner which decreases D2 and increases D1 to the point where disc 17 releases from recess 22 and component 20 may be easily taken off of component 15.

At this point it should be clearly noted that the so-called interengaging means may be comprised of frictional forces which exist between the surface of the stud member 14 and the surface of the walls defining the aperture 24. When aperture 24 is deformed by the forceable insertion of stud member 14 (which need not have disc 17 at the end thereof, but instead may have a taper so that the small diameter end is easily insertable into aperture 24 because the small diameter is less than the minor axis dimension D1), forces which result from the deformation of aperture 24 - and of course component 20 is considered also to have been deformed - and which forces are also related to the material characteristics of component 20, act to

interengage the two components 15 and 20. The surface of the stud member 14 and the surface of the walls defining the aperture 24 may be treated such as by having serrates which will enhance the interengagement. In this instance it is desirable that one-half of the sum of D1 and D2 be greater than or equal to the stud member diameter D5, with D1 being less than D5. Such means for interengaging are not illustrated, however they are within the scope of the invention herein disclosed and claimed.

As easy as it is to cause the interengagement of the two components 15 and 20 and the possible clamping of a plurality of sheets of material such as paper, it is as easy to disengage the components 15 and 20. By simply squeezing component 20 in a manner which decreases D2 and increases D1 to the point where disc 17 releases from recess 22, component 20 may be easily taken off of component 15. A very important advantage of device 10 is that, for interengaging and for disengaging of the two components 15 and 20, a person need have access to only one component - the socket component 20. Thus items or objects may be attached to a wall in which stud components 15 are incorporated by simply clamping the objects or items using socket components 20. The objects may be easily removed by appropriately pinching component 20 thereby releasing the interengaging means and freeing the object. The device 10 can also be used for purposes similar to the purpose of paper clips, except that device 10 may be used anywhere, i.e. it is not restricted in use to the periphery of the items or sheets of paper being attached together.

The instant device 10 could also be used to attach two objects when the stud component 15 is attached to one object and the socket component 20 is attached to the second object, for example the snap closure for a garment

and the like.

Reference is now made to Figs. 9-11, all of which depict an embodiment of the fastening device 10A of the invention. Stud component 35 is shown having three discs 17, 17A and 17B on stud member 14. Discs 17 to 17B have substantially the same features as previously described for disc 17 of fastening device 10 of Figs. 1-8. Socket component 20 is also as previously defined and may be interengaged or in cooperative connection with any one of the three discs 17 - 17B, thus providing for an adjustment of the depth at which stud member 14 is inserted into aperture 24.

The fastening device 10B of the invention shown in Figs. 12 and 12A differs from the device 10A in that socket component 30 has a plurality of recess 22 and 22A on the interior wall of aperture 24. Clearly, recess 22A could be interengaged with disc 17 alone. There are many alternative ways in which component 30 may be placed onto and in interengagement with component 35. An example is for recess 22 cooperating with disc 17 and recess 22A cooperating with disc 17A. If socket component 30 is placed further onto stud member 14, discs 17A and 17B will be engaged by recesses 22 and 22A respectively. It is further possible to flip component 30 over so that recess 22 is closest to body portion 16. Recess 22A would then cooperate alone with one of discs 17 to 17B.

It is apparent that there are many additional variations. There could be additional discs and/or additional recesses in the case where additional or increased holding strength is desired. The spacing between the discs 17 - 17B and recesses 22 and 22A could be different so long as they remain in mating cooperation.

The fastening device 10C of the embodiment shown in Figs. 13, 13A and 14 differs from the device 10A and the device 10B in that socket component 40 has a recess 42 on the interior wall of aperture 24 and socket component 40 is used to connect together two "stud components" 45, a first component and a second component 45A and 45B respectively, and which may be connected together end-to-end using socket component 40 adapted to interengage with each of the two stud components 45. The end-to-end interengagement may be made and released by the one hand deformation of the socket component - that is the changing of the aperture from ellipse to oval by squeezing parallel to the major axis, and then releasing, allowing the aperture to tend toward an elliptical shape which results in the engagement of the two stud components. Disc 47 is located on second stud component at a distance D6, which distance D6 is appropriate relative to disc 17 of first stud component 45A so that when second stud component 45B is put in end-to-end relationship with 45A by, for example telescoping diameter D5b into or onto first stud component 45A (illustrated in Fig. 14), recess 42 will engage with both discs 17 and 47 on recess walls 42A and 42B respectively. Socket component 40 thereby effectively connects components 45A and 45B. Release is again accomplished by simply squeezing component 40 along D2 thus reducing D2 and increasing dimension D1 permitting the separation of 45A and 45B without the need to pull, turn or bend the two stud components 45.

Clearly there are many variations again possible. There may be a plurality of discs on each of the stud components 45A and 45B so that the effective length of the two stud components 45 may be changed. Additionally, there may be more than one recess of the type shown as 42. The socket component may be made larger in width to allow for a

plurality of recesses. All of these variations would likewise have advantages similar to those previously described.

The present invention, the method and the fastening device as disclosed herein and many of its attendant advantages, will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts thereof without departing from the scope of the invention as defined in the appended claims.



CLAIMS

1. A fastening device comprising:

a stud component;

a socket component fabricated using material which is resilient but form-retaining, having a dimensionally deformable substantially elliptically shaped aperture therein adapted to receive and interengage said stud component when said stud component is inserted into said socket component and when said socket component is placed onto said stud component;

said stud component comprising a body portion, a substantially cylindrically shaped stud member projecting therefrom, and means for deforming said aperture to receive and interengage said stud component when said stud member is inserted into said aperture of said socket component and when said socket component is placed onto said stud component, thereby interengaging said stud and socket components;

a plurality of interengaging means integral with and positioned along said stud member, each adapted to cooperate with said socket component to interengage said stud and socket components; and

said socket component aperture having interior walls, a major axis dimension and a minor axis dimension, said major axis dimension being greater than said minor axis dimension, said aperture axes dimensions being deformable so that said minor axis dimension increases as said major axis dimension decreases upon insertion and extraction of said stud member into and from said socket component and upon squeezing of said socket component along a direction parallel to said major axis and perpendicular to said minor axis of said elliptically shaped aperture,



said interengagement of said socket component with said stud component being only at both ends of said minor axis when said stud component is in interengagement with said socket component.

2. The fastening device according to claim 1, wherein said interengaging means comprises appropriately treated surfaces of said stud member and said interior walls defining said aperture such that interengagement of the stud and socket components results from friction forces between tangential contacting areas of said treated surfaces and said interior walls when said stud member is deformingly inserted into said socket component and when said socket component is placed onto said stud component, said forces being created by said deformation of said aperture and said resilience of said material.

3. The fastening device according to claim 1 or 2, further comprising a plurality of means for deforming said aperture, wherein each said means for deforming said aperture comprises an appropriate taper of said aperture interior walls and/or of said stud member so that said minor axis dimension is increased and said major axis dimension is decreased, causing said aperture to admit said stud member, thus interengaging said stud and socket components.

4. The fastening device according to claim 1, 2 or 3, wherein said stud and socket components are adapted to clamp material between them when said stud member is inserted into said socket component and when said socket component is placed onto said stud component.

5. The fastening device according to claim 1, wherein said plurality of interengaging means comprises:

a plurality of disc-like interengaging means integral with and distributed along said stud member between said body portion and protruding end of said stud member,



the spacing between adjacent disc-like engaging means being not less than a dimension which is adequate to permit said interengaging of said stud and socket components;

said socket component being adapted to have at least one means for engagement which matingly cooperates with each of said plurality of disc-like interengaging means of said stud component, said means for engagement matingly cooperating with at least one of said plurality of disc-like interengaging means when said stud component and socket component are attached, the interengagement of said stud and socket components resulting from forces between tangential contacting areas of each of said plurality of said disc-like interengaging means and said means for engagement of said socket component when said stud member is deformingly inserted into said socket component causing deformation of said aperture and when said socket component is placed onto said stud component, said forces being created by said deformation of said aperture and said resilience of said material.

6. The fastening device according to claim 5, wherein said means for deforming said aperture comprises an appropriate disc thickness dimension and inner and outer diameter relationship of each said plurality of disc-like interengaging means providing an adequate taper to cause said aperture deformation upon insertion of said stud member.

7. The fastening device according to claim 6, wherein each said disc-like interengaging means has an inner and an outer diameter with each said inner diameter being greater than said outer diameter and greater than the diameter of the stud member.

8. A fastening device comprising:

a stud component having a body portion, a substantially cylindrically shaped stud member with a vertical



length and a stud diameter and extending substantially vertically from a first inner surface, and a plurality of disc-like interengaging means integral with and distributed along said stud member between said body portion and protruding end of said stud member, the spacing between adjacent discs being not less than a dimension which is adequate to permit said interengaging of said stud and socket components; and

a socket component fabricated using material which is resilient but form-retaining, adapted to interfit and interengage with said stud component, and having an arcuate interior aperture surface defining a substantially elliptically shaped aperture through said socket component with a vertical aperture axis substantially in parallel alignment with said stud member, said elliptically shaped aperture having a vertical length not greater than said stud member length, a minor axis having a dimension not substantially less than and not substantially greater than said stud member diameter, and a major axis dimension greater than and orthogonal to said minor axis, one-half the sum of said major and minor axes dimensions being greater than said inner diameter, and both said axes being orthogonal to said vertical aperture axis, said elliptically shaped aperture axes dimensions being deformable so that said minor axis dimension increases as said major axis dimension decreases upon insertion and extraction of said stud member into and from said socket component and upon squeezing of said socket component along a direction parallel to said major axis and perpendicular to said minor axis of said elliptically shaped aperture, said interengagement of said socket component with said stud component being only at both ends of said minor axis when said stud component is in interengagement with said socket component.



9. The fastening device according to claim 8, wherein each said disc-like interengaging means has an inner and an outer diameter, with each said inner diameter being greater than said outer diameter and greater than said stud member diameter.

10. The fastening device according to claim 8 or 9, wherein said socket component further comprises at least one means for engagement which matingly cooperates with each said plurality of disc-like interengaging means of said stud component, said means for engagement matingly cooperating with at least one of said plurality of disc-like interengaging means when said stud component and socket component are attached, said stud component and socket component interengagement resulting from forces between tangential contacting areas of said disc-like interengaging means and said means for engagement of said socket component when said stud member is deformingly inserted into said socket component causing deformation of said aperture and when said socket component is placed onto said stud member, said forces being created by said deformation of said aperture and said resilience of said material.

11. The fastening device according to claim 8, 9 or 10, wherein said stud component and socket component are adapted to clamp material between them when said stud member is inserted into said socket component and when said socket component is placed onto said stud member.

12. A method for engageably and releasably attaching together two components, a stud component and a socket component, said socket component having a substantially elliptically shaped aperture therein, said stud component comprising a body portion, a substantially cylindrically shaped stud member projecting therefrom having interspersed thereon a plurality of interengaging means, said socket



component being fabricated using material which is resilient but form-retaining, and each said component being adapted with cooperating, interfitting, interengaging means, said socket component being adapted to have at least one means for engagement which matingly cooperates with each of said plurality of interengaging means of said stud component, said means for engagement matingly cooperating with at least one of said plurality of interengaging means when said stud component and socket component are attached, said method comprising the step of:

deformingly inserting said substantially cylindrically shaped stud member into said substantially elliptically shaped aperture, causing said aperture to deform to receive said cylindrically shaped stud member, said deformation of said aperture and said resilient material providing forces which cause said at least one of said plurality of interengaging means to interengage said stud and socket components; and

squeezing said socket component along a direction parallel to a major axis and perpendicular to a minor axis of said elliptically shaped aperture in a manner so as to deform said aperture and release said forces, thus releasing said at least one of said plurality of interengaging means, said aperture deformation being from a substantially elliptically shaped aperture to an aperture which is sized to allow the removal of said stud component from said socket component without said stud component being subjected to any substantial tensile stresses, and to allow insertion of said stud member into said socket component without said stud component being subjected to any substantial compression stresses.



13. The method according to claim 12, further comprising the step of clamping substantially flat material between said socket and stud components when said stud member is inserted into said socket component.

14. A fastening device comprising a stud component, said stud component comprising: a body portion and a substantially cylindrically shaped stud member projecting therefrom; a socket component fabricated using material which is resilient but form-retaining, having a dimensionally deformable substantially elliptically shaped aperture therein adapted to receive and interengage said stud member when said stud member is inserted into said socket component and when said socket component is placed onto said stud member, said stud component and socket component being adapted to clamp material between them when said stud member is inserted into said socket component; each said component being adapted with cooperating, interfitting, interengaging means, to interengage said stud and socket components; said socket component aperture having interior walls, a major axis dimension and a minor axis dimension, said major axis dimension being greater than said minor axis dimension, said aperture axes dimensions being deformable so that said minor axis dimension increases as said major dimension decreases upon insertion and extraction of said stud member into and from said socket component and upon squeezing of said socket component along a direction parallel to said major axis and perpendicular to said minor axis of said elliptically shaped aperture, said interengagement of said socket component with said stud component being only at both ends of said minor axis when said stud component is in interengagement with said socket component; wherein said stud member has interspersed thereon a plurality of interengaging means, and said socket component is



adapted to have at least one means for engagement which matingly cooperates with each of said plurality of interengaging means of said stud component, said means for engagement matingly cooperating with at least one of said plurality of interengaging means when said stud member is inserted into said socket component and when said socket component is placed onto said stud member, thereby interconnecting said stud and socket components.

15. A fastening device comprising:

a first stud component having a substantially cylindrically shaped first stud member with a vertical length and a first stud member diameter, at least one first stud component interengaging means being integral with and appropriately located along said first stud member;

a second stud component having a substantially cylindrically shaped second stud member with a vertical length and a second stud member diameter, at least one second stud component interengaging means being integral with and appropriately located along said second stud member; and

a socket component fabricated using material which is resilient but form-retaining, adapted to interfit and interengage with both said first and second stud components, having an arcuate interior aperture surface defining a substantially elliptically shaped aperture through said socket component with a vertical aperture axis substantially in parallel alignment with said stud members, said elliptically shaped aperture having a vertical length not greater than said stud member length, a minor axis having a dimension greater than said outer diameter of each said interengaging means and not greater than said stud member diameter, and a major axis dimension greater than and orthogonal to said minor axis, one-half the sum of said



major and minor axes dimensions being greater than said inner diameter and both said axes being orthogonal to said vertical aperture axis, said elliptically shaped aperture axes dimensions being deformable so that said minor axis dimension increases as said major axis dimension decreases upon insertion and extraction of said stud members into and from said socket component and upon squeezing of said socket component along a direction parallel to said major axis and perpendicular to said minor axis of said elliptically shaped aperture, said interengagement of said socket component with said stud components being only at both ends of said minor axis when said stud components are in interengagement with said socket component.

16. The fastening device according to claim 15, wherein each said first stud component and each said second stud component interengaging means is a disc having an inner and an outer diameter, with each said inner diameter being greater than said outer diameter and greater than said stud member diameter, the spacing between adjacent discs being not less than a dimension which is adequate to permit said interengaging of said stud and socket components.

17. The fastening device according to claim 16, wherein said socket component further comprises at least one means for engagement which matingly cooperates with at least one of said first stud component and at least one of said second stud component disc-like interengaging means when said first and second stud components and said socket component are attached, the interengagement of said first and second stud and socket components resulting from forces between tangential contacting areas of said disc-like interengaging means and said means for engagement of said socket component when said first and second stud members are deformingly inserted into said socket component causing



deformation of said aperture and when said socket component is placed onto said stud members, said forces being created by said deformation of said aperture and said resilience of said material.

18. A fastening device comprising:

a stud component;

a socket fabricated using material which is resilient but form-retaining, having a dimensionally deformable substantially elliptically shaped aperture therein adapted to receive and interengage said stud component when said stud component is inserted into said socket component;

said stud component and said socket component being adapted to clamp material between them when said stud component is inserted into said socket component;

said stud component comprising a body portion, a substantially cylindrically shaped stud member projecting therefrom, and means for deforming said aperture causing said aperture to receive and interengage said stud component when said stud member is inserted into said socket component, thereby interconnecting said stud and socket components;

interengaging means adapted to cooperate with said socket component to interengage said stud and socket components; and

said socket component aperture having interior walls, a major dimension and a minor axis dimension, said major axis dimension being greater than said minor axis dimension, said aperture axes dimensions being deformable so that said minor axis dimension increases as said major axis dimension decreases upon insertion and extraction of said stud member into and from said socket component and upon squeezing of said socket component along a direction parallel to said major axis and perpendicular to said minor



axis of said elliptically shaped aperture, said interengagement of said socket component with said stud component being only at both ends of said minor axis when said stud component is in interengagement with said socket component.

19. The fastening device according to claim 18, wherein said interengagement means comprises appropriately treated surfaces of said stud member and said interior walls defining said aperture such that interengagement of the stud and socket components results from friction forces between tangential contacting areas of said treated surfaces and said interior walls when said stud member is deformingly inserted into said socket component, said forces being created by said deformation of said aperture and said resilience of said material.

20. The fastening device according to claim 19, wherein said means for deforming said aperture comprises an appropriate taper of said aperture interior walls and/or of said stud member so that said minor axis dimension is increased and said major axis dimension is decreased, causing said aperture to admit said stud member, thus interengaging said stud and socket components.

21. The fastening device according to claim 18, wherein said interengaging means comprises:

a disc-like interengaging means integral with and at the protruding end of said stud member, said disc-like interengaging means having an inner and an outer diameter, with said inner diameter being greater than said outer diameter and greater than said stud member diameter; and

said socket component being adapted to have a means for engagement which matingly cooperates with said disc-like interengaging means of said stud component, the interengagement of said stud and socket components resulting from forces between tangential contacting areas of said



disc-like interengaging means and said means for engagement of said socket component when said stud member is deformingly inserted into said socket component causing deformation of said aperture, said forces being created by said deformation of said aperture and said resilience of said material.

22. The fastening device according to claim 21, wherein said means for deforming said aperture comprises an appropriate thickness dimension and inner and outer diameter relationship of said disc-like interengaging means providing an adequate taper to cause said aperture deformation upon insertion of said stud member.

23. A fastening device comprising:

a stud component having a body portion, a substantially cylindrically shaped stud member with a vertical length and a stud member diameter and extending substantially vertically from a first inner surface, and a disc-like interengaging means integral with and at the protruding end of said stud member, said disc-like interengaging means having an inner and an outer diameter with said inner diameter being not less than said outer diameter and greater than said stud diameter;

a socket component fabricated using material which is resilient but form-retaining, adapted to interfit and interengage with said stud component, and having an arcuate interior aperture surface defining a substantially elliptically shaped aperture through said socket component with a vertical aperture axis substantially in parallel alignment with said stud member, said elliptically shaped aperture having a vertical length not greater than said stud member length, a minor axis having a dimension greater than said outer diameter of said disc-like interengaging means and not greater than said stud member diameter, and a



major axis dimension greater than and orthogonal to said minor axis, one-half the sum of said major and minor axes dimensions being greater than said inner diameter, and both said axes being orthogonal to said vertical aperture axis, said elliptically shaped aperture axes dimensions being deformable so that said minor axis dimension increases as said major axis dimension decreases upon insertion and extraction of said stud member into and from said socket component and upon squeezing of said socket component along a direction parallel to said major axis and perpendicular to said minor axis of said elliptically shaped aperture, said interengagement of said socket component with said stud component being only at both ends of said minor axis when said stud component is in interengagement with said socket component; and

said stud component and said socket component being adapted to clamp material between them when said stud member is inserted into said socket component.

24. The fastening device according to claim 23, wherein said socket component is adapted to have a means for engagement which matingly cooperates with said disc-like interengaging means of said stud component, the interengagement of said stud and socket components resulting from forces between tangential contacting areas of said disc-like interengaging means and said means for engagement of said socket component when said stud member is deformingly inserted into said socket component causing deformation of said aperture, said forces being created by said deformation of said aperture and said resilience of said material.

25. The fastening device according to any of claims 1 to 11 or 14 to 24, wherein the or each stud component is fabricated using material which is resilient but form-retaining.



26. The fastening device according to any of claims 1 to 12 or 14 to 25, further comprising means for flexibly connecting the or each stud component to said socket component.

27. A method for engageably and releasably attaching together two components, a stud component and socket component, said socket component having a substantially elliptically shaped aperture therein, said stud component comprising a body portion, a substantially cylindrically shaped stud member projecting therefrom, means for deforming said aperture when said stud component is inserted into said socket component, said socket component being fabricated using material which is resilient but form-retaining, and each said component being adapted with cooperating, interfitting, interengaging means, said method comprising the steps of:

deformingly inserting said substantially cylindrically shaped stud member into said substantially elliptically shaped aperture, causing said aperture to deform to receive said cylindrically shaped stud member, said deformation of said aperture and said resilient material providing forces which cause said interengaging means to interengage said stud and socket components; and

squeezing said socket component along a direction parallel to a major axis and perpendicular to a minor axis of said elliptically shaped aperture in a manner so as to deform said aperture and release said forces, thus releasing said interengaging means, said aperture deformation being from a substantially elliptically shaped aperture to an aperture which is sized to allow the removal of said stud component from said socket component without said stud component being subjected to any substantial tensile stresses, and to allow insertion of said stud component into said socket component without said stud component being subjected to any substantial compression stresses.