Aug. 18, 1953 N. E. LOOFBORO 2,648,884

MAGNETIC CLASP

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Fig. 1.

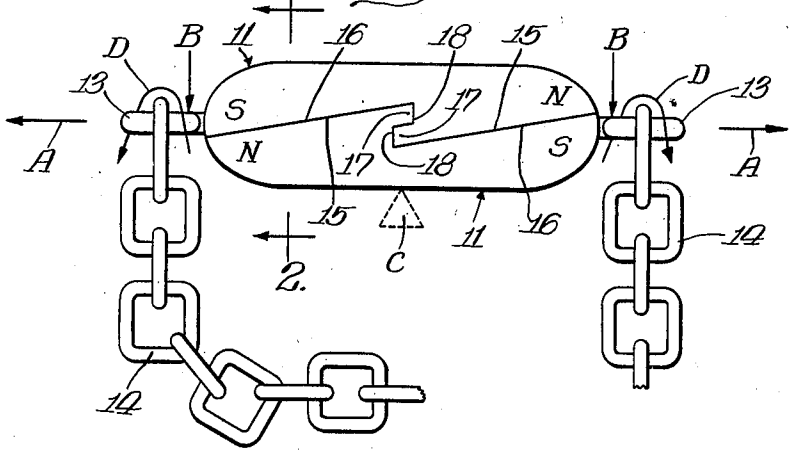


Fig. 2.

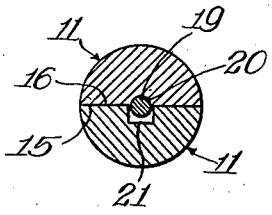


Fig. 3.

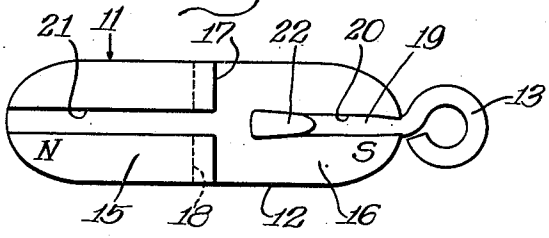
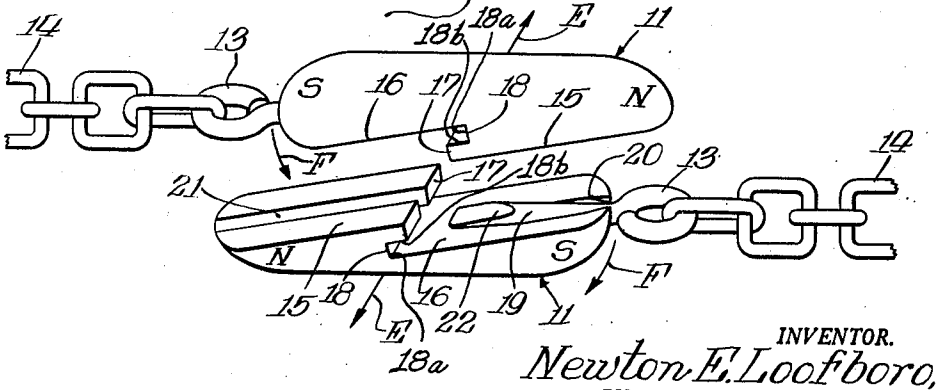


Fig. 4.



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MAGNETIC CLASP

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4 Claims. (Cl. 24—201)

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This invention relates generally to magnetic clasps and more particularly concerns an interlocking magnetic clasp that is especially well adapted for such uses as a connector for the ends of necklaces, bracelets and the like, a garment fastener, or a belt fastener.

An object of the invention is to provide an improved separable clasp in which the separable sections respectively are rigid and have no movable parts.

Another object is to provide a separable clasp in which at least one of the separable sections is a permanent magnet.

Another object of the invention is to provide a magnetic clasp having separable sections so formed that they separate only upon manipulation in a predetermined manner.

An additional object of the invention is to provide a separable clasp in which the separable sections are interlocked to prevent the separation when subjected to either an outward pull on the respective sections, forces tending to cause relative angular movement of the sections, forces tending to cause relative torsional movement of the separable sections, or forces tending to cause relative sliding movement in a lateral direction.

Another object is to provide a separable clasp having interlocking separable sections maintained in interlocked relation by magnetic attraction but readily separable by simple manipulation.

A still further object is to provide a magnetic clasp of the foregoing character in which the separable sections of the clasp may be separated simply by a preliminary sliding movement of the separable sections relatively axially inwardly to disengage their respective interlocked portions.

Another object of the invention is to provide an improved separable clasp in which the sections thereof are formed from permanently magnetized material having a very high residual induction.

A further object of the invention is to provide an improved magnetic clasp of compact size, which is simple and inexpensive to manufacture and neat and attractive in appearance.

In carrying out my invention, I utilize in the preferred embodiment of my magnetic clasp two similarly formed separable magnetic sections adapted to be attached respectively to the articles or portions of an article to be connected by the clasp. Each of the sections preferably constitutes a permanent bar magnet having the usual north and south magnetic poles. The clasp sections are shaped for registration and engagement one with the other in such manner that the lines of

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magnetic force of the north pole of one section cooperate with the lines of magnetic force of the south pole of the other section to magnetically and yieldably restrain against relative movement inwardly in a separating direction. It will be understood, however, that either one of the two separable sections may be formed as a permanent magnet and the other section serve as an armature therefor without departing from the scope of my invention. The two sections of the clasp are shaped for mutual interengagement to provide interlocking means effective to mechanically lock the sections against separation when separating forces are applied on the sections other than in a direction tending to move them relatively inwardly. In connecting articles or the respective portions thereof by the magnetic clasp construction of my invention, the magnetic sections are attached and detached with a relative sliding movement and in their connected position are magnetically and mechanically locked together.

These and other advantageous objects which will later appear are accomplished by the simple and practical construction and arrangement of parts hereinafter described and illustated in the accompanying drawing forming a part hereof, and in which:

Figure 1 is a side elevational view of a magnetic clasp embodying my invention, which for the purposes of illustration is shown in connection with a chain type of necklace;

Fig. 2 is a transverse sectional view taken along line 2—2 of the clasp of Fig. 1;

Fig. 3 is a view of the inner face of one of the sections of the clasp of Fig. 1; and

Fig. 4 is a perspective view of the clasp of Fig. 1 with the sections thereof in separated position.

The clasp in accordance with my invention includes two sections 11, 11, which preferably are identical, each of which sections includes a body portion 12 and an eyelet portion 13 for attaching the section to the article 14 with which the clasp is to be used. Although for the purposes of illustration the clasp sections 11 are shown as attached to the two ends of a chain type necklace, it will be understood that it is within the scope of the invention to employ the clasp, with appropriate modification where necessary, as a fastener for other articles, as, for example, bracelets, gloves, purses, garments, belts, and the like.

The clasp sections are formed with faces which are complemental in shape and adapted, when the sections are assembled in connecting relation, to mutually contact over a substantial area,

thereby providing a strong magnetic attraction between the sections for resisting separation. In addition the faces are so shaped that when the sections are assembled the several portions thereof interengage in such manner as to provide a mechanical interlock preventing separation in response to a separating pull on the sections, or forces tending to cause relative angular movement of the sections, or torsional forces tending to rotate the sections about the longitudinal axis of the clasp, or forces tending to slide the sections apart laterally.

To the foregoing ends the face of each section 11 is formed with two parallel, generally flat face portions 15 and 16 inclined to the longitudinal axis of the body portion 12 of the section. The face portions 15 and 16 are extended longitudinally inwardly in overlapping relation with the intervening portion of the body 12 undercut to provide a tongue 17 and complementally shaped groove 18, which latter has a bottom wall 18*a* and a side wall 18*b*.

Thus, when the sections 11, 11 are assembled in connecting relation the face portions 15 and 16 of one section contact the face portions 16 and 15, respectively, of the other section over a substantial area sufficient to insure a strong magnetic connection between the sections 11, 11, to thereby maintain the sections 11, 11 in assembled connecting relation. In the assembled position of the sections the tongue 17 of each section 11 is disposed in the groove 18 of the other section 11, whereby the end faces of each tongue 17 and the complemental groove serve as abutments to prevent separation of the sections in an axially outward direction in response to forces (indicated by arrows A, A in Fig. 1) such as are exerted on the sections by a separating pull on the ends of the chain 14. The interlocking tongues and grooves also prevent separation of the sections 11, 11 in response to forces tending to effect relative angular movement of the sections 11, 11 about an axis passing transversely through the clasp and parallel to the faces of the sections (such as the forces indicated by the arrows B, B in Fig. 1 tending to rock the sections respectively about the imaginary fulcrum point indicated by the letter C). At the same time the interengaging tongues and grooves prevent separation of the sections in response to torsional forces tending to rotate the sections in opposite directions about the longitudinal axis of the clasp (such as the forces indicated by the arrows D, D in Fig. 1).

A further interlock between the sections 11, 11 is provided for the purpose of preventing separation in response to forces tending to separate the sections by relative sliding or rocking movement in a lateral direction. Such interlock is formed by a key-like projection 22 on the one face portion of each section adapted to enter a suitably shaped and positioned groove 21 extending longitudinally in the complemental face portion of the other section from the inner end thereof substantially to the outer end. This projection 22 may conveniently be provided by a shank 19 of the eyelet member 13, which shank is located in a groove 20 in the face portion 16 and suitably secured as by soldering or force-fitting the shank in the groove. Alternatively, the shank 19 may be secured in the body 12 by molding the material around the shank where the body is formed by sintering, as hereinafter explained.

When the sections are assembled by placing them in juxtaposition and slid into fully engaged position, the projection or key 22 of each section is caused to enter the groove 21 of the other section. The projection 22 and groove 21 thus provide an interlock which prevents separation of the sections 11, 11 in response to forces (indicated by arrows E, E in Fig. 4) tending to slide the sections relatively in a lateral direction, or forces (indicated by arrows F, F in Fig. 4) tending to rock the sections 11, 11 relatively in lateral direction. This key and groove arrangement also aids in longitudinally aligning the sections as they are assembled.

The eyelet member 13 preferably is so attached to the body 12 of each section 11 that the eye portion is situated substantially on the longitudinal axis of the clasp and the clasp therefore is externally symmetrical. This is possible because the adjacent surface 16 of the body 12 is inclined as above described and as illustrated in the drawings. It should be explained at this point that while, preferably, the surfaces 15 and 16 are each flat and parallel, they may, if desired, be slightly arcuate with the surface 15 being convex and the surface 16 concave.

The body portion 12 of at least one of the sections and preferably both sections is formed from a suitable permanently magnetizable material and preferably one having a high residual induction. For this purpose I prefer to employ an aluminum-nickel-cobalt alloy, such as the alloy sold under the trade name "Alnico." Where such material is employed the body is formed by casting or grinding to the desired shape in view of the hard brittle nature of the material. Another material having desirable characteristics adapting it for use in making the body is a copper-nickel-cobalt alloy, sold under the trade name "Cunico." This material, while having somewhat less residual induction than "Alnico," and thus providing a magnet of somewhat less strength than the latter alloy, nevertheless has the desirable property of being machinable and, hence, a body made from "Cunico" may be made by appropriate machining operations. Because of the interlocking action between the sections, even the weaker magnetic action provided when the sections are formed from "Cunico" is adequate to securely retain the sections against accidental separation.

Instead of forming the body by casting, grinding or machining, it may be formed by powder metallurgy. In this case metallic powder of the proper composition together with a lubricant is molded to the desired shape and sintered in a known manner. As stated hereinbefore, the eyelet member is introduced into the powder in the mold and is sintered along with the molded powder so as to be integrally secured within the finished body member upon completion of the sintering operation.

The sections which constitute the clasp, after having been formed as above described, are each suitably magnetized in any conventional manner to produce a permanent magnet having north and south poles, as indicated by the letters N and S in Fig. 1 of the drawings. It will be understood, of course, that the polarity of the magnet may be reversed from that illustrated. It is preferable that the magnet shall have sufficient strength that, when the two sections are positioned at an angle with respect to the longitudinal axis of the clasp and with the tongues and grooves separated, the magnet force exerted by each of the sections on the other will cause the sections to rotate and dispose themselves in alignment and close to their connecting position,

whereupon a slight pull on each of the sections outwardly will cause the sections to slide relatively into fully interlocked position. Such pull may be very slight and may be caused by the weight of the adjacent portions of the article to which the sections are attached.

Although in the preferred embodiment of my invention both sections of the clasp are formed as permanent magnets, it is to be understood that it is within the scope of the invention to form one section as a permanent magnet and the other as an armature. When constructed in this manner and assembled as described, induced poles are formed on the armature section having polarities opposite to that of the juxtaposed portions of the permanently magnetized section, whereby the sections are magnetically held together, as will be understood.

From the foregoing it will be seen that the two sections 11, 11 may be readily brought into connecting relation in order to connect the two articles or portions of a single article to which the sections are attached. The members are assembled with their complementally formed face portions in juxtaposition and are urged into fully engaged interlocking relation, as explained above. In many cases it is not necessary to manually urge the members into fully engaged relation but this may be accomplished by the mutual magnetic attraction. In order to separate the sections whereby to disconnect the attached members or portions of a member, the sections are slid relatively in a longitudinally inward direction, at least until the initially interengaging tongues and grooves, as well as the initially interengaging keys and grooves, are disengaged, whereupon the sections may be separated by a rocking, a twisting, or a sliding movement. It will be understood that the separating movement of the sections just described must be effected against the magnetic attraction of the sections, which attraction, as explained, is sufficient to maintain them in connecting relation against all forces normally occurring in use. It will be seen from the foregoing that the clasp sections can only be separated by manipulating them in a predetermined manner, namely, by first sliding them in longitudinal, axial direction, as just described.

While for the purposes of illustration the clasp has been shown as of elongated, generally ovoidal shape, it will be understood, of course, that it may be formed in many other suitable shapes without departing from the spirit of the invention. One such other shape, which has been found desirable, is a generally rectangular, relatively flat and wide shape with the longitudinal edges and principal faces relatively arcuate and the corners slightly rounded.

It should be explained at this point that for convenience in explanation reference has been made to the "longitudinal axis" of the clasp. However, it will be understood that the imaginary line thus referred to will not necessarily be the true longitudinal axis of the clasp in cases where the clasp is of substantially equal dimensions both along the line between the eyes 13 and in a direction transverse thereto or is of greater dimension in the latter direction. The aforesaid expression "longitudinal axis" is used herein to designate the axis of the clasp which extends generally in direction from one eye to the other.

From the foregoing description, it will be evident that there has been disclosed a magnetic clasp which may be used with greater convenience than the usual clasp which has movable parts and that a very rugged clasp construction has been disclosed which will not become disengaged under normal usage and is much more rugged than the usual type of clasp having a resilient latch engaging a complementally formed latch member. With my separable magnetic clasp, although it is necessary to attach and detach the latch itself with a simple relative sliding movement along the faces of the sections either with an inward or outward motion depending upon whether it is desired to latch or unlatch the clasp, in either of these operations, the sections are magnetically coupled together and in the latched position are magnetically and mechanically interlocked.

The foregoing disclosure is to be regarded as descriptive and illustrative only, and not as restrictive or limitative of the invention, of which obviously an embodiment may be constructed including many modifications without departing from the general scope of the invention as herein indicated and denoted in the appended claims.

I claim:

1. A magnetic clasp comprising a pair of elongated sections formed of magnetic material at least one which sections is permanently magnetized, said sections having face portions for face-to-face contact, inclined at a small angle relative to the longitudinal axis of the clasp with the ends of the face portions closely adjacent the longitudinal axis, each section having keying and connecting means secured therein including a shank disposed substantially coaxial with the longitudinal axis of the clasp with a connecting element on its outer end beyond the end of the respective section and with its inner end projecting from the said face portion of the section, each section having a longitudinal groove in its said face portion for receiving the projection on the other section whereby the sections are permitted relative longitudinal sliding movement but restrained against relative transverse sliding movement, said section face portions having transverse tongue and groove elements respectively interengageable and effective for preventing relative sliding movement of the sections longitudinally outwardly.

2. A separable clasp comprising a pair of elongated, separable sections formed of magnetic material, at least one of said sections being a permanent magnet, in juxtaposition with the other of said sections, said other section serving as an armature for said one section, said sections having complementally shaped faces interengaging throughout substantially the length and breadth of the sections, each face including a pair of parallel, plane face portions similarly inclined at a small angle relative to the longitudinal axis of the clasp and extended longitudinally inwardly from the ends of the section in overlapping relation, a transversely extending tongue and adjacent groove, said groove having a bottom wall, and a side wall parallel with said face portions, each section also having a longitudinally extending tongue on one face portion and a longitudinally extending groove in the other face portion, whereby when said separable sections are in joined relation, the transverse tongue of each section extends into the transverse groove of the other section and abuts the said bottom side walls of the groove, and the longitudinal tongue of each section extends into the longitudinal groove of the other section, to

mutually lock said sections against relative outward movement along the longitudinal axis of the clasp, against relative rotational movement about the longitudinal axis of the clasp, against relative lateral sliding movement, and against relative angular rocking movement about all transverse axes of the clasp, and whereby said one section cooperates magnetically with said other section to yieldably resist relative inward movement of said sections along the longitudinal axis of the clasp.

3. A magnetic clasp comprising a pair of sections formed of magnetic material at least one of which sections is permanently magnetized, said sections being adapted for connection at longitudinally spaced points respectively with elements to be connected together, each of said sections having face portions shaped for face-to-face contact with complementally shaped face portions of the other section throughout substantially the length and breadth of the sections, said sections having respectively interengaging abutment surfaces between the face portions of the respective sections extending entirely transversely across the sections for mechanically locking the sections against relative sliding movement in longitudinally outward directions, said sections each also having a projection extending from one face portion spaced longitudinally from the abutment surface on the section, and a longitudinally extending groove in the other face portion for receiving the projection on the other section when the sections are in clasped relation to thereby provide an interlock for preventing relative lateral sliding movement of the sections.

4. A separable clasp comprising a pair of elongated, separable sections formed of magnetic material, at least one of said sections being a permanent magnet and the other section serving as an armature for said one section, said sections having complementally shaped interengageable faces, said faces being similarly shaped and dimensioned to interengage throughout substantially their length and breadth whereby their marginal edges are respectively in register entirely around the clasp, the face of each section including a pair of parallel, plane face portions similarly inclined a small angle relative to the longitudinal axis of the clasp whereby each end of the face is closely adjacent said axis, said face portions being extended longitudinally inwardly from the ends of the section in overlapping relation and thereby forming a tongue and adjacent groove extending entirely transversely across the section, said grove having a bottom wall and a side wall parallel with said face portions, whereby when the sections are in joined relation with said faces interengaged, the tongue of each section extends into the groove of the other section and abuts the said bottom and side wall of the groove to mutually lock the sections against relative outward movement along the longitudinal axis of the clasp, against relative rotational movement about the longitudinal axis of the clasp and against relative angular rocking movement about a transverse axis of said clasp, and whereby said one section cooperates magnetically with said other section to yieldably resist relative inward movement of said sections along the longitudinal axis of the clasp.

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