July 2, 1940. J. H. DEARBORN 2,206,223

FASTENING MEANS

Filed Feb. 26, 1938 2 Sheets-Sheet 1

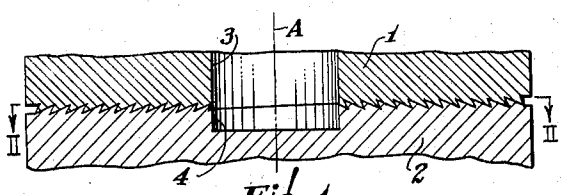


Fig. 1

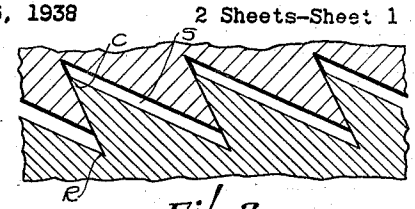


Fig. 3

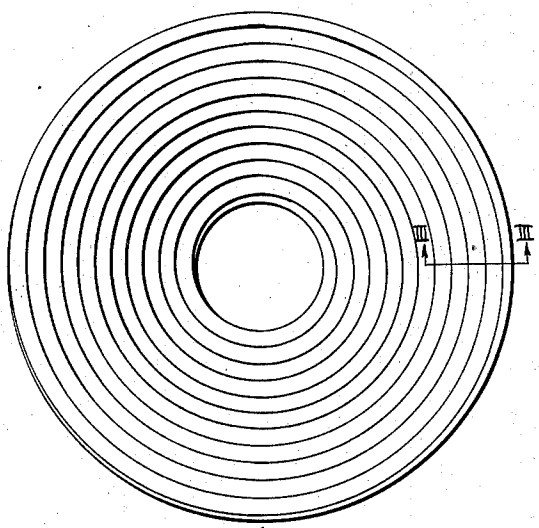


Fig. 2

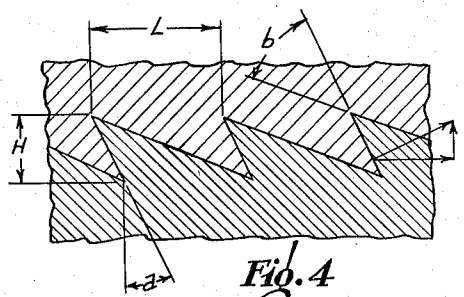


Fig. 4

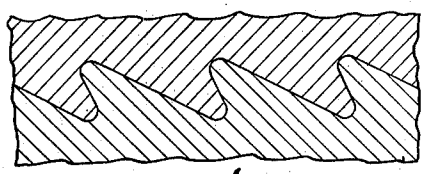


Fig. 5

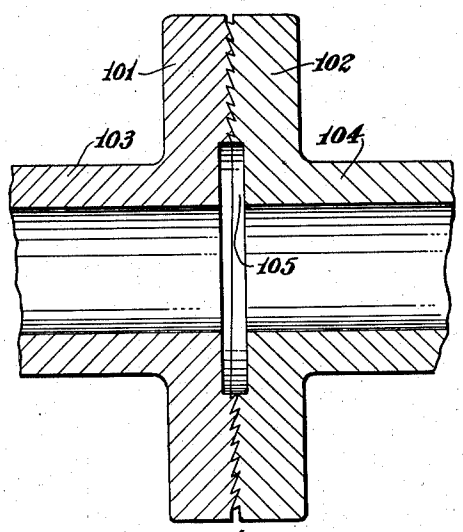


Fig. 8

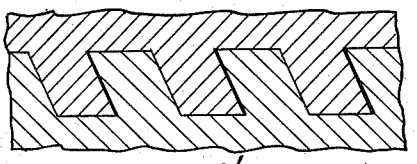


Fig. 6

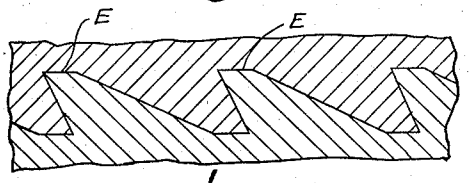


Fig. 7

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FASTENING MEANS

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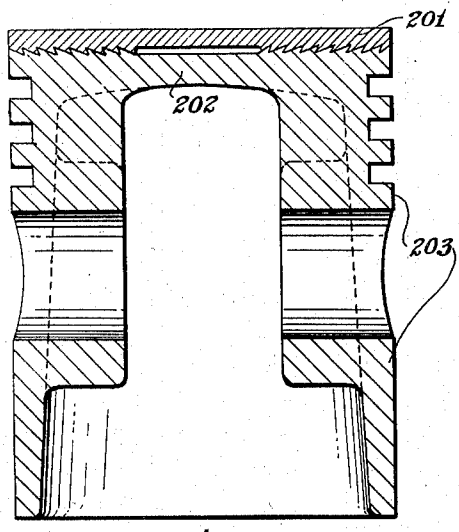


Fig. 9

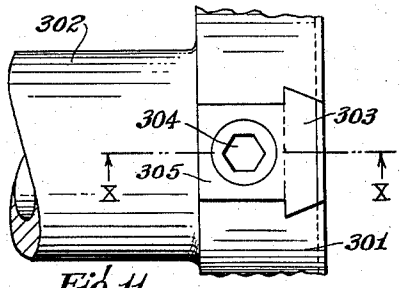


Fig. 11

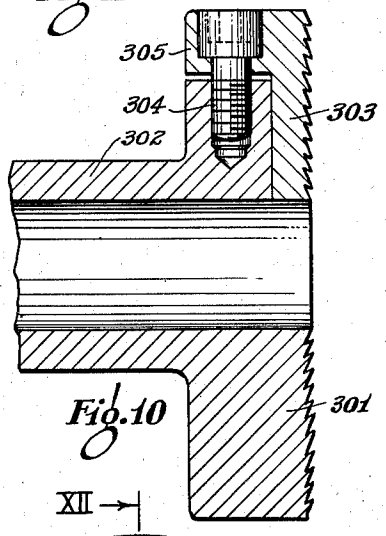


Fig. 10

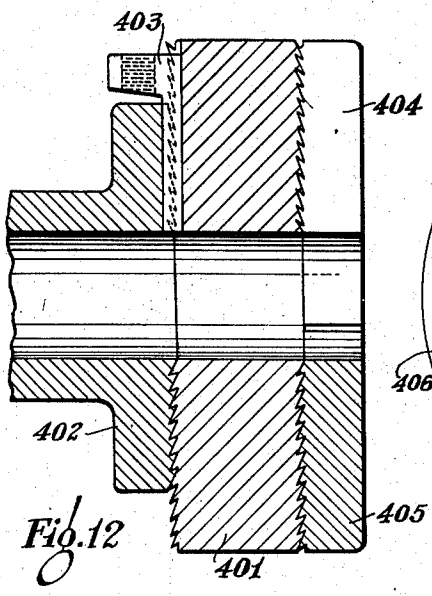


Fig. 12

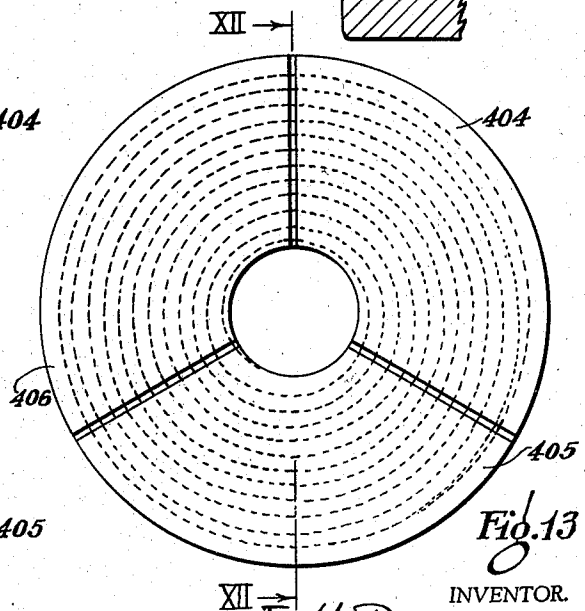


Fig. 13

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Patented July 2, 1940

2,206,223

UNITED STATES PATENT OFFICE

2,206,223

FASTENING MEANS

Joseph Herbert Dearborn, Cleveland, Ohio

Application February 26, 1938, Serial No. 192,835

11 Claims. (Cl. 287—130)

This invention relates to fastening means and to a means which has a broad field of application, both in releasable and permanently fastening pieces or articles together.

It is an object of my invention to provide an improved fastening means for fastening two or more articles or parts together.

Another object is to provide an improved fastening means which will firmly hold articles fastened thereby.

Another object is to provide an improved fastening device which will be easily attached or detached.

Another object is to provide an improved fastening means by which articles may be permanently and securely fastened together.

Another object is to provide an improved fastening means which will occupy relatively little space.

Another object is to provide an improved fastening means which may be easily and economically produced.

Another object is to provide an improved fastening means which will hold objects or articles of different sizes.

Another object is to provide an improved fastening means by which objects or articles may be readily interchanged.

Another object is to provide an improved fastening means which will definitely locate articles in a desired position.

Another object is to provide an improved fastening means which will be strong and will distribute forces over substantial areas.

Another object is to provide an improved fastening means which will hold substantial areas in close contact.

Another object is to provide an improved fastening means which will readily transmit heat.

Another object is to provide an improved fastening means which will tightly seal together two or more objects.

Another object is to provide an improved fastening means which will preclude loosening by expansion or contraction.

Another object is to provide an improved fastening means by which objects may be assembled or disassembled without the use of tools.

Other objects will hereinafter appear.

The invention will be better understood from the description of several practical embodiments thereof, illustrated in the accompanying drawings, in which;

Figure 1 is a fragmentary axial sectional view of two round portions of objects, secured together by a means embodying my invention;

Figure 2 is a plan view of the lower piece, taken on the line II—II of Figure 1;

Figure 3 is a fragmentary cross-sectional view taken on the line III—III of Figure 2 to an enlarged scale, and showing the pieces or objects in position at the start of the operation of connecting them together;

Figure 4 is a view similar to Figure 3 showing the parts in the position they occupy at the completion of the connecting operation;

Figure 5 is a view similar to Figure 4, but showing a modified form of connection;

Figure 6 is a similar view, showing another modification of form for the connection;

Figure 7 is a third view similar to Figure 4, and showing a third modified type of formation;

Figure 8 is a fragmentary central sectional view of two shafts or pipes having flanged ends connected by means embodying the invention;

Figure 9 is a central sectional view of a piston for an internal combustion motor having a head applied according to the invention;

Figure 10 is a sectional view of a part such as a machine tool spindle embodying my invention, and showing a form of locking means;

Figure 11 is a fragmentary plan view of the parts shown in Figure 10;

Figure 12 is a central longitudinal sectional view of the end of a machine tool spindle and chuck including the invention; and

Figure 13 is an end elevation of parts shown in Figure 12.

In Figure 1 is shown an upper cylindrical piece 1 and a lower cylindrical piece 2, the upper piece having a central hole 3 therethrough, and the lower piece a central recess 4 in alinement therewith. While the hole and recess are not essential, I find that it is unnecessary, generally, to carry the fastening means to the exact center of the articles, and that the central portions of their surfaces can more conveniently be left to clear each other, than be provided with fastening means throughout.

The fastening means itself is provided by forming the surfaces of the parts 1 and 2 in such manner that they may be interlocked by a slight relative rotation.

Thus, the substantially plane surfaces of these parts are provided with two conjugate series of lands or grooves extending from the central recesses to the periphery of the parts.

These lands or grooves, in their simplest form, are better illustrated in the larger scale draw-

ings of Figures 3 and 4, and are defined by two continuous surfaces inclined in the same direction but at different inclinations so as to produce lands, as shown in the plan view in Figure 2, in general of spiral contour.

Two surfaces which form the lands may well be defined as those made by inclined lines intersecting an axis A through the center of the two pieces 1 and 2 and normal to their contacting surfaces, at the same side (above, with the parts as shown in Figure 1), but different distances from such contacting surfaces, these inclined lines being rotated about the axis at a constant rate and simultaneously retreating from the axis at a constant rate, or simultaneously moving along the axis at a constant rate.

The surfaces defined by the motions above indicated will be hereinafter referred to as "conico-spiral," and this term also may be used to include modified forms, where the inclined surfaces are joined by flat surfaces, curved filets, or the like.

In a sense, these surfaces may be said to define lands which might be called spiral threads, differentiating from the conventional thread, which is helical.

The spiral on one of the blocks will of necessity be a right hand spiral, and that on the other, a left hand spiral.

It will be noted that due to the inclination of both surfaces of the land or thread, the apex or crest C overhangs to a slight extent the base or root R thereof, and that while on the lower piece 2 crests are inwardly directed, pointing toward the axis of the piece, on the upper piece 1 these crests are outwardly directed. This formation of land whereby the crest overhangs the root is hereinafter referred to as undercut. It will be understood that the use of the word "undercut" applies to the shape of the surface, irrespective of the manner in which it is formed. This surface may conveniently be formed by cutting, and may also be formed by other processes, such as molding, grinding, and the like, and the word "undercut" where it appears hereinafter is therefore not limited to a surface formed by a cutting process. When the two parts are placed in such a position as shown in Figure 3, the two threads do not accurately aline themselves, but there are spaces S between either their longer sides or their shorter sides.

However, upon a slight relative rotation of parts, generally a quarter of a revolution or less, the shorter faces are brought into contact, and, due to their inclination, the pressure between them resolves itself into a component axially and one circumferentially, the former of which draws the parts together by a kind of wedging action until the threads are firmly interlocked as shown in Figure 4. In this position they form an extremely tight connection between the parts, any pressure being distributed all the way from the central holes 3 and 4 to the periphery of the parts. Thus these parts are very positively held together. Not only are they drawn together tightly in an axial direction, but they are brought into very accurate concentric relation, in regard to the axis A about which the threads are formed.

This feature is very useful in accurately positioning chucks, tools, jigs, and other devices, they being much more accurately located than has been possible with tapered shanks and other devices now in use.

While the inclination and proportion of the lands may be very considerably varied, I find an inclination for the steeper faces, as indicated by the angle A in Figure 4, of about 25° to be very satisfactory, while a ratio of the height H of the lands to their pitch L of one to two is quite satisfactory. In practice, on articles of a few inches in diameter, threads ⅛ of an inch in pitch (L) from crest to crest and 1/16 of an inch in height (H) have proven very good in all respects.

With the proportions above given, it will be apparent that the longer side of the land is composed of elements disposed at approximately 68° to the axis.

In Figure 5 a modification of the thread of Figures 1 to 4 is shown, in which the corners have been rounded.

The rounded edges of the crests of this figure are a trifle easier to cut than the sharper ones of the previous figures, while it operates about the same in actual practice.

In Figure 6, a thread having parallel sides both at an inclination of about 25 is shown. This thread is somewhat stronger against axial pull than the threads of the preceding figures, but is more difficult to engage and disengage.

In Figure 7 is shown a thread which lies about intermediate that of the first four figures and that of Figure 6, in that the inclination of the longer sides is more like the first described form, while plane ends are provided which strengthen the crests or narrower portions of the land.

Figure 8 shows the invention applied to two flanges 101 and 102 formed on the ends of shafts or pipes 103 and 104 and by which they may be very readily connected together.

If desired, recesses 105 may be formed between the flanges for the reception of a gasket or other packing material.

Figure 9 shows a head 201 fixed to the top 202 of a piston 203 by lands or threads as above described, which is particularly advantageous when it is desired to provide a head capable of resisting the combustion above it on a piston of a material which has been chosen for other characteristics and which is not particularly adapted to exposure to heat and the like. In this form, the interengaging lands serve the dual purpose of holding the head in place and of providing a large contacting surface for the transfer of heat from the head to the skirt of the piston, and firmly holds the head in place, even in view of the relatively great expansion and contraction which takes place in the parts.

Figures 10 and 11 show the end 301 of a machine tool spindle 302 which resembles very much one of the flanges or parts above described, excepting that a dove-tailed shaped slot is cut radially in the face of the spindle, and in this slot is a slidable piece 303 on the front face of which are cut continuations of the lands on the flange 301. When a chuck or other tool has been secured to the spindle, and it is desired to lock it in any given place, it is only necessary to tighten the cap screw 304 threaded into flange 301 and passing through the projecting lug 305, formed integrally with the lock 303, which causes the portion of the lands upon the lock to bind upon those of the article being held, and so retain it firmly in place until the cap screw is released.

Figures 12 and 13 show a chuck including two applications of the invention. In the first place, it is used to hold the chuck or collet 401 to the tool spindle 402, a key or other locking means as indicated at 403 being provided to prevent loosen-

ing of these parts after secured and adjusted in position. Then, the jaws themselves consist merely of three sector-shaped pieces **404**, **405**, and **406** held by lands similar to those previously described to the face of the chuck or collet body **401**, and which may, by rotation, be loosened or tightened and moved radially inwardly and outwardly by these lands. Of course, such jaws can be used only for relatively limited motion unless additional means are provided to hold them, but it will be apparent that they do away with a great many parts of the usual type of chuck for holding the jaws in place and for actuating the jaws and the like.

While the lands are shown as cut into plane surfaces, it is only necessary that they be nearly so, and a slightly conical or spherical form may be used. In fact, the device can be more quickly centered if a slightly conical form is used. It will, of course, be apparent that with such forms, either part may be the convex one, and the other may be the concave one.

While I have described the illustrated embodiments of my invention in some particularity, obviously many others will readily occur to those skilled in this art, and I do not, therefore, limit myself to the precise details shown and described, but claim as my invention all embodiments, variations, and modifications thereof coming within the scope of the appended claims.

I claim:

1. A joint comprising two pieces provided with conjugate surfaces, the surfaces being the loci of two lines inclined with respect to an axis about which the lines move, each line intersecting the axis at a fixed angle, and both lines intersecting the axis to the same side of the surfaces, the lines rotating uniformly about the axis and uniformly moving in a radial direction away therefrom.

2. A joint comprising two pieces provided with conjugate surfaces, the surfaces being the loci of two lines inclined with respect to an axis about which the lines move, each line intersecting the axis at a fixed angle, and both lines intersecting the axis to the same side of the surfaces, the lines rotating uniformly about the axis and uniformly moving in a radial direction away therefrom, one of the lines forming with the axis an angle of approximately twenty-five degrees and the other of said lines forming with the axis a substantially greater angle.

3. A joint comprising two articles adapted to be joined together, each being provided with a spirally arranged land extending through a plurality of convolutions, the lands being conjugate and overhanging one side by substantially one-quarter of their pitch.

4. A joint comprising two articles adapted to be joined together, each being provided with a substantially flat spirally serrated surface, the serrations having the same lead and overhanging crests, and the serrations on one of said articles being oppositely disposed to those of the other whereby the serrations are conjugate to each other.

5. A joint comprising two articles provided with conjugate surfaces defined by conico-spiral surfaces extending through a plurality of convolutions.

6. A joint comprising two articles provided with conjugate surfaces defined by conico-spiral surfaces extending through a plurality of convolutions, said conico-spiral surfaces having the same lead and being differently inclined to the axis of the spiral.

7. A joint comprising two articles provided with conjugate surfaces defined by conico-spiral surfaces extending through a plurality of convolutions, said conico-spiral surfaces having the same lead and both inclined in the same direction and at different angles to the axis of the spiral.

8. A joint comprising two articles to be joined together, a spirally arranged land on each article, each land extending throughout a plurality of convolutions, both lands being of the same lead and of opposite hand, the land on one article being undercut on the side toward the center of the convolutions, and the land on the other article being undercut on the side away from the center of the convolutions.

9. A joint comprising two articles to be joined together, a spirally arranged land on each article, each land extending throughout a plurality of convolutions, both lands being of the same lead and of opposite hand, the land on one article having an inwardly directed crest, and the land on the other article having an outwardly directed crest.

10. A joint comprising two articles adapted to be joined together, the articles being provided with conjugate surfaces defined by similarly inclined conico-spiral surfaces, and locking means preventing the rotation of the articles comprising a member movably carried by one of said articles and having a surface capable of selectively being brought within said inclined conico-spiral surfaces and movable out of alignment therewith.

11. A joint comprising an article having a joining surface defined by two conico-spiral surfaces extending through a plurality of convolutions, a plurality of parts each having a surface arranged to engage said first mentioned joining surface, each of said last mentioned parts being conjugate to a portion of said first mentioned surface throughout parts of each of several convolutions thereof.

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