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Hildebrand

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[54] **FORCEPS, PLIERS OR THE LIKE AND METHOD OF PRODUCING THE SAME**

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[51] **Int. Cl.** **B25b 7/06**

[58] **Field of Search** ..... 81/416, 415, 428 R; 30/266; 287/101; 76/104 A

[56] **References Cited**

UNITED STATES PATENTS

271,043	1/1883	Davis	81/416
2,305,156	12/1942	Grubel	81/416 X
2,939,214	6/1960	Anderson et al.	81/416 X

FOREIGN PATENTS OR APPLICATIONS

335,243	2/1959	Switzerland	81/416
604,813	5/1960	Italy	81/416

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[57] **ABSTRACT**

A forceps or similar tool having two arms pivotably connected to each other by a box lock comprising a male lock member on one arm and a female lock member on the other arm, forming a longitudinal slot, the male lock member extending through the slot and having a transverse bearing bore or coaxial bearing recesses in its opposite sides, and the walls of the slot being pressed against the opposite surfaces of the male member with such a force that the material of the slot walls starts to flow and a part thereof passes into the bore or the recesses and forms therein studs together serving as a pivot pin which therefore does not extend through the walls of the slots but only projects from these walls and integrally therewith into the bearing bore or recesses.

13 Claims, 7 Drawing Figures

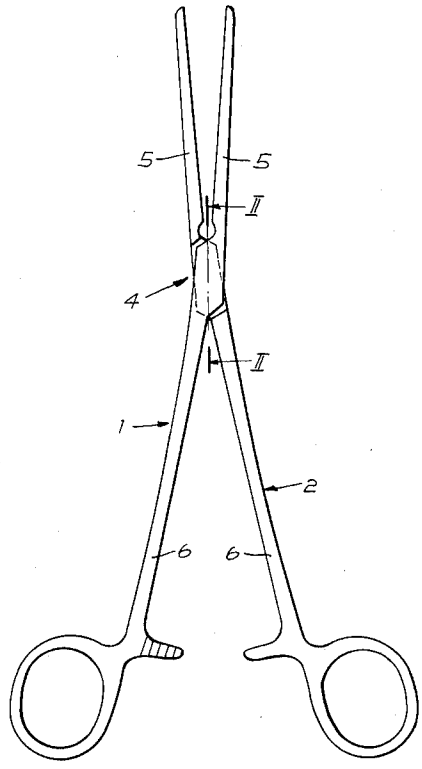


Fig. 1.

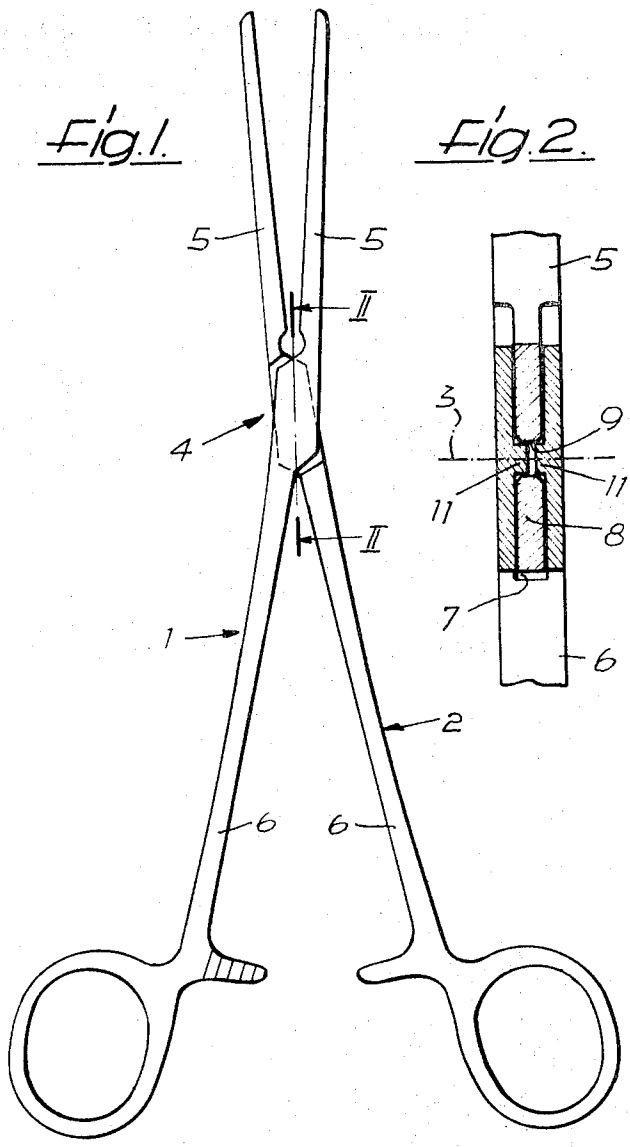


Fig. 2.

Fig. 3.

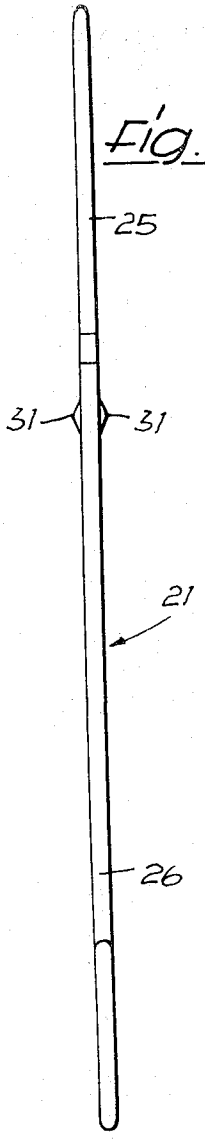


Fig. 4.

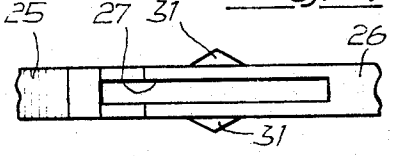


Fig. 5.

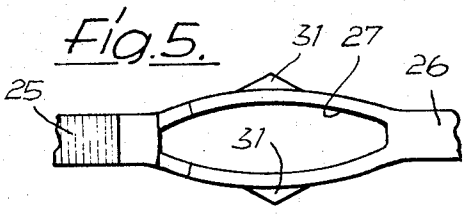


Fig. 6.

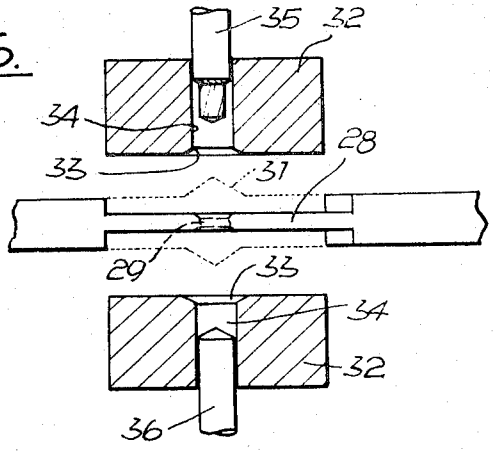
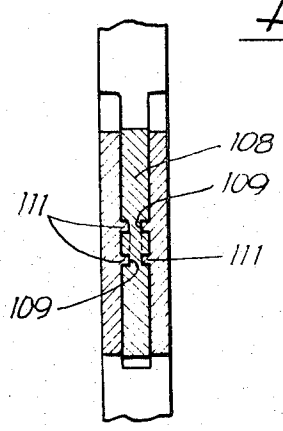


Fig. 7.



FORCEPS, PLIERS OR THE LIKE AND METHOD OF PRODUCING THE SAME

The present invention relates to improvements in forceps, tongs, pliers or similar tools, especially for medical purposes, in which the tool comprises two arms which are pivotably connected to each other by a so-called box lock.

Such a box lock of the known tools of this kind consists of a male lock part of a reduced thickness on one tool arm intermediate its handle part and the part forming a jaw or the like and a female lock part in a corresponding position on the other tool arms in the form of a slotted part. For assembling the tool, the slot of the slotted arm is widened and the other arm is passed through the slot so that the reduced part of this arm is located within the slot, whereupon the widened walls of the slot are pressed toward each other and against the opposite surfaces of the reduced part. For pivotably connecting the two arms to each other, coaxial bores are provided in the two lock parts and a rivet or screw serving as a pivot pin is passed through these bores and secured to one or both walls of the slot.

A tool which is provided with a box lock of this construction has considerable disadvantages, especially when it is designed as a surgical or dental instrument. Such instruments include, for example, hemostatic forceps, polypus forceps, clamp forceps, kidney-stone forceps, stomach clamps, auricle clamps, intestinal forceps, sponge, tampon and towel-holding forceps, clip-applying forceps, bronchus clamps, ananstomosis clamps, coarctation clamps, mosquito forceps, dissecting and ligature forceps and the like, and also tooth pliers, technical pliers, needle holders, bone rongeurs, and bone-cutting forceps.

Generally speaking such instruments or at least parts thereof must during their production be subjected to a hardening process and must also subsequently be capable of withstanding considerable stresses which result from sterilizing them after each use by steam or boiling water. Such heat treatments may cause the formation of cracks in the material of such instruments, especially directly adjacent to the coaxial bores for the pivot pin in the walls of the slot of the slotted arm. The occurrence of such cracks render the instrument no longer fit for practical use. If the pivot pin which connects the two arms to each other consists of a rivet, the riveting operation may also cause tensions to occur in the material which may later lead to cracks.

The production of forceps and similar tools which are provided with box locks of the type as described above is also relatively complicated since the pivot pin in the form of a rivet or screw which connects the two arms to each other must be inserted into the coaxial bores in the walls of the slot of one arm and must then be tightly riveted or screwed, whereupon one or both ends of the pin must be ground off.

It is an object of the present invention to produce a forceps or similar tool which is provided with a box lock which does not have the disadvantages of the box locks as were previously known and which particularly reduces or completely avoids the danger that cracks might be formed in the walls of the slot.

A further object of the invention consists in designing such a forceps or similar tool in a manner so as to permit it to be produced much more easily and quickly

than one of the known tools in which the two arms are likewise connected by a box lock.

For attaining these and additional objects, the invention provides that, instead of employing a pivot pin in the form of a rivet or screw which extends through coaxial bores in the two lock parts and pivotably connects the two arms of the tool to each other, at least one of the two main wall surfaces of the slot in one arm is provided with a studlike projection which is integral with this surface and engages pivotably into a bearing bore or bearing recess in the male lock part of the other arm which is located within the slot.

This construction has the advantage that the walls of the slot are not weakened by a bore but that, on the contrary, at least the wall of the slot with which the studlike projection is integral may be reinforced by this projection. Furthermore, there is no longer any danger that a crevice or contact corrosion may occur between the walls of the slot and the pivot or connecting element since the latter now forms an integral part of a wall of the slot.

While for avoiding the formation of cracks in the walls of the slot of one of the known tools as above described it was necessary to make the bores in these walls and thus also the pivot pin of the smallest possible diameter, these considerations are now no longer necessary since in the tool according to the invention these bores in the slotted arm and such a pivot pin are omitted. The studlike projection on at least one wall of the slot may therefore be made of any desired diameter.

The invention further provides that in place of such a studlike projection on at least one wall of the slot, this projection may be of an annular shape which engages into a corresponding annular recess in the male lock part of the other arm. While this male lock part of one arm which is passed through the slot of the other arm will be weakened only very slightly by this annular recess, this construction results in a very secure connection and a very accurate pivoting between the two arms of the tool since both the radially inner and outer wall surfaces of the annular projection form bearing surfaces which are rotatable around the corresponding walls of the annular recess.

The present invention further concerns a method of producing a forceps or similar tool which is designed in the manner as previously described. This method consists in producing a slotted blank for one tool arm and an unslotted blank for the other arm which is provided with a male lock part which is to be located within the slot in the first arm and has a transverse bearing bore or a bearing recess in at least one side thereof, in sufficiently widening the slot of the slotted blank and in passing the unslotted blank so far through the widened slot that the male lock part of this unslotted blank will be located within the slot of the other blank and the axis of the bearing bore or recess will be in alignment with the points of the slotted walls through which the pivot axis of the two arms should extend, in then pressing the walls of the slot toward each other with such a force that they engage with the opposite surfaces of the male lock part of the arm which is passed through the slot and the material of at least one wall of the slot starts to flow and forms a projection which extends into the bearing bore or recess of the male lock part of the arm extending through the slot. This has the advantage that, after one arm blank has been inserted through the slot in the other arm blank, the two blanks may be piv-

otably connected to each other by a single operation, that is, by a pressing operation. If at least one main wall which defines the slot of the slotted blank arm is provided on its outer side, that is, the side opposite to that defining the slot, with a projection which is used for the purpose of properly positioning this blank arm relative to the male lock part of the other blank arm when the two arms are to be connected to each other, the invention has the further advantage that, when the walls of the widened slot are being pressed against the outer surfaces of the male lock part so that the material of the walls of the slot start to flow, this projection will be transposed from the outer side to the inner side of the slot wall and engage into the bearing bore or recess in the male lock part. Therefore, without being reduced in thickness by the compression, the slot wall carrying the projection will be reinforced by the latter.

These and additional features and advantages of the present invention will become further apparent from the following detailed description thereof which is to be read with reference to the accompanying drawings, in which

FIG. 1 shows a plan view of a forceps or similar tool according to the invention;

FIG. 2 shows an enlarged cross section which is taken along the line II - II of FIG. 1;

FIG. 3 shows a side view of an original blank for each of the arms of a forceps as shown in FIG. 1 and seen in a direction at a right angle to FIG. 1;

FIGS. 4 and 5 show enlarged side views of a part of one of the arm blanks as shown in FIG. 3 in the condition after the slot has been milled into this blank and after the slot has been widened, respectively;

FIG. 6 shows an enlarged side view similar to FIGS. 4 and 5 of the unslotted or male part of the other arm blank which is to be inserted into the slot of the arm blank as shown in FIG. 5; while

FIG. 7 shows a cross section similar to FIG. 2 of a box lock according to a modification of the invention.

In the drawings, FIGS. 1 and 2 illustrate a surgical forceps or similar tool which comprises two arms 1 and 2 which are pivotably connected to each other by means of a box lock 4 so as to be pivotable relative to each other about an axis 3. Each of these arms 1 and 2 consists of a jaw 5 and a handle 6 which are integrally connected by one or the other of the two members of the box lock 4. One of these members is a female member which is formed by a slot 7 which is provided in the arm 1 intermediate its jaw 5 and handle 6 and extends through this arm at a right angle to the pivot axis 3. The male member of the box lock 4 consists of a flat part 8 of the other arm 2 which extends through the slot 7 of the first arm 1 and likewise connects the jaw 5 with the handle 6 of this arm 2. This lock member 8 is provided with a transverse bore 9 which is coaxial to the pivot axis 3 and serves as a bearing aperture the two outer edges of which are preferably beveled so as to diverge outwardly. For maintaining the two arms 1 and 2 of the forceps at all times in the proper positions relative to each other, the two main wall surfaces of slot 7 facing each other are provided with coaxial studlike projections 11 which engage into the opposite ends of bore 9 in the lock member 8 and together act like a pivot pin in this bore 9 so as to permit the two arms 1 and 2 to pivot relative to each other about the axis 3.

FIG. 7 illustrates a modification of the box lock of a forceps or similar tool as shown in FIG. 1. Those parts in FIG. 7 which functionally correspond to the parts as shown in FIGS. 1 and 2 are also designated by corresponding reference numerals which, however, for distinction are increased by 100 over those as applied in FIGS. 1 and 2.

The embodiment of the invention as shown in FIG. 7 differs from that as previously described merely by the fact that instead of providing the male lock member 108 with a bearing aperture in the form of a continuous bore like the bore 9 as shown in FIG. 2, each side of this lock member 108 is merely provided with an annular recess 109 into which an annular projection 111 engages. These projections 111 again extend coaxially to each other and to the annular recess 109 and project toward each other from the main walls of the slot in the slotted arm 1 of a forceps as shown in FIG. 1 and surround like bearing races the small studs remaining at the inside of the annular recesses 109 on the opposite sides of the lock member 108. This embodiment of the invention has therefore the advantages over the embodiment as illustrated in FIGS. 1 and 2 that the male lock member 108 of one forceps arm is not weakened by a continuous bore 9 and that the walls of the slot in the other forceps arm are not only reinforced by the annular projections 111, but these projections are also guided on their radially inner and outer sides by the walls of the annular recesses.

For producing a forceps or similar tool as illustrated in FIGS. 1 and 2, equal original blanks 21 are first produced by drop forging for the two forceps arms 1 and 2. Each of these original blanks 21 is provided between its jaw part 25 and the handle part 26 with two equal warlike projections 31 which extend coaxially to each other from the opposite sides of the blank. For producing these projections 31, it is only necessary to provide corresponding recesses in the upper and lower dies between which each blank 21 if forged. These projections 31 serve as centering points for mounting each original blank 21 in the exact position in which it is to be machined. In this machining operation in which the jaw 25 and handle 26 of each blank 21 are milled, ground and machined in any other manner as much as required, the respective blank 21 is at first clamped in a very accurate position between a pair of jaws 32, as shown in FIG. 6, which are provided with coaxial bores 34 the edges 33 of which facing each other are beveled in accordance with the projections 31 on each original blank 21 which in this clamping position engage into the bores 34 and abut against their beveled end surfaces 33.

When the jaw 25 and handle 26 of the original blank 21 have been machined which should subsequently form the slotted forceps arm 1, the slot 27 as shown in FIG. 4 is milled into this blank. Thereafter, this slot is widened to a shape substantially as shown in FIG. 5 so as to permit, for example, the machined jaw 5 of the blank for the other forceps arm 2 to be passed through this widened slot 27 until the male lock member 8 or 28 of this forceps arm 2 is disposed within this slot.

When the jaw 25 and handle 26 of the original blank 21 for this other forceps arm 2 have also been machined, this blank while still being gripped by the clamping jaws 32 is also gripped at its jaw and handle parts, whereupon the clamping jaws 32 are opened so that the released section of this blank 21 is free for being machined so as to form the male lock member 28, as shown in full lines in FIG. 6. The coaxial bores

34 in the clamping jaws 32 serve as guides for the smooth shanks of two drills 35 and 36. While drill 35 has a drill part of a smaller diameter than its shank and a chamfering shoulder on the upper end of this drill part, the other drill 36 is merely a chamfering drill. By means of drill 35, the flat lock member 28 is first provided with a bore 29, the upper end of which is then chamfered by the chamfering shoulder of drill 35. Thereafter, this drill 35 is retracted and by means of the other drill 36 the lower edge of bore 29 is chamfered.

When the male lock member 28 of the forceps arm 2 has thus also been machined, this arm is passed through the widened slot 27 in the manner and to the extent as previously mentioned. The two arm blanks are then inserted into a press in such a position that bore 29 in the male lock member 28 will be in axial alignment with the common axis of the projections 31 on the female lock member, i.e. the slotted part of the blank for the forceps arm 1. The press is then closed to such an extent that the walls 27 of the widened slot as shown in FIG. 5 will be pressed so tightly against the flat surfaces of the male lock member 8 or 28 that the material of these walls including the projections 31 will start to flow and the amount of material which previously formed these projections will be transposed toward the inner sides of the slot walls and enter the opposite ends of bore 9 or 29 of lock member 8 or 28 and thus form the opposite studlike projections 11 in this bore, as shown in FIG. 2, which are integral with the slot walls 27 and have the function of a pivot pin which, however, does not also extend through the walls of the slot of the forceps arm 1 as was required in the box locks of forceps and similar tools as were made prior to this invention.

For producing the coaxial annular recesses 109 in the opposite sides of the male lock member 108 as shown in FIG. 7, the drills 35 and 36 according to FIG. 6 are replaced in the clamping jaws 32 by crownlike drills or mills which are adapted to cut these annular recesses to a predetermined depth into the opposite sides of the lock member 108. When subsequently the male lock member 108 is inserted into the widened slot 27 of the female lock member as shown in FIG. 5 and the walls of the slot are pressed against the flat walls of the male lock member 108 so that the material of the slot walls will start to flow, the material of the original projections 31 on the outer sides of the female lock member will form annular studs 111 which project from the inner sides of the slot walls into the annular recesses 109 of the male lock member 108. The radially inner and outer wall surfaces of these studs will then be rotatably guided by the corresponding inner and outer wall surfaces of the annular coaxial recesses 109 in the male lock member 108. Thus, the two arms 1 and 2 of a forceps or similar tool which is provided with a box lock according to FIG. 7 will be pivotably guided on each other twice as securely and accurately as those of a forceps or a similar tool which is provided with a box lock according to FIG. 2.

As previously indicated, the invention is not only applicable to medical or dental instruments which must be sterilized by steam or in boiling water after each use, but it is also applicable to any other tools such as tongs, pliers, scissors or the like the two arms of which are to be connected by a box lock.

Although my invention has been illustrated and described with reference to the preferred embodiments thereof, I wish to have it understood that it is in no way limited to the details of such embodiments but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed my invention, what I claim is:

1. A tool comprising a pair of arms, and a box lock having a male lock member and a female lock member each integral with one of said arms and intermediate its opposite ends for pivotably connecting said arms to each other, said female member comprising a part of the first of said arms having a pair of seamless walls extending in the longitudinal direction of said arm and spaced from each other so as to define a slot, and a projection on at least one of said walls and integral therewith, said male member comprising a part of the second arm having a round cutout and disposed within said slot, said projection extending into and being coaxial with said cutout and together with said cutout forming a pivot bearing between said two arms.

2. A tool as defined in claim 1, in which said cutout forms a bore extending transversely through said male member, said projection extending at least to a certain depth into said bore and being rotatable relative to and guided by the wall of said bore.

3. A tool as defined in claim 2, in which each of said walls of said slot has a projection integral thereon, said projection being coaxial to each other and to said bore and extending into the opposite ends of said bore toward each other.

4. A tool as defined in claim 1, in which said cutout forms a recess in at least one wall surface of said male member, said projection extending into said recess and being rotatable relative to and guided by the wall of said recess.

5. A tool as defined in claim 4, in which each of two opposite wall surfaces of said male member has one of said recesses therein, said recesses being coaxial to each other and each having a bottom surface separated by a solid part of said male member from the bottom surface of the other recess, each of said walls of said slot having one of said projections integral thereon, said projections being coaxial to each other and to said recesses and each extending into one of said recesses.

6. A tool as defined in claim 4, in which said recess has an annular shape with radially inner and outer wall surfaces coaxial to each other and said projection has a corresponding annular shape extending into said annular recess.

7. A tool as defined in claim 5, in which each of said recess has an annular shape with radially inner and outer wall surfaces coaxially to each other, each of said projections having an annular shape corresponding to the shape of said annular recesses and extending into one of said recesses.

8. A tool as defined in claim 1, in which the outer edge of said round cutout is beveled so as to diverge outwardly.

9. In a method of producing a tool having a pair of arms and a box lock having a male lock member and a female lock member each integral with one of said arms and forming a part intermediate its opposite ends for connecting said arms so as to be pivotable about a common axis relative to each other, the steps comprising the first step of producing a pair of blanks for said arms, and further steps of machining said intermediate part of a first of said blanks so as to form a slot therein

extending in the longitudinal direction of said blank and defined by walls connected without seams to each other and forming said female member, widening said slot, machining said intermediate part of the second blank so as to form said male member, forming a round cutout in said male member extending at least to a certain depth into said male member from one side thereof and having an axis coinciding with said common axis, passing said second blank so far through said widened slot in said first blank that said male member is disposed within said slot and then pressing the walls of said widened slot toward each other and against the opposite surfaces of said male member with such a force that the material of at least one of said walls of said slot starts to flow and a part of said material passes into said cutout in the form of a stud having an outer peripheral surface rotatably engaging with at least a part of the axial length of said cutout and together with said cutout forming a pivot bearing between said arms.

10. A method as defined in claim **9,** in which in said first step of producing said blanks said intermediate part of each of said blanks is provided with a small projection on and integral with at least one outer side thereof, and further comprising the steps preceding the machining of said intermediate parts of clamping said part of each blank between opposite clamping surfaces of a pair of clamping jaws, said clamping surface of at least one of said jaws having a recess for receiving said projection and for thus accurately positioning said blank relative to said jaws, and then machining the parts of said blank at both sides of said intermediate part.

11. A method as defined in claim **10,** in which said intermediate part of each of said blanks in provided with said projection on each of its opposite sides, said projections on each blank having a common axis extending substantially at a right angle to the longitudinal axis of said blank, each of said clamping surfaces having one of said recesses adapted to receive one of said projections when said intermediate part is clamped between said jaws.

12. A method as defined in claim **11,** in which after said intermediate part of said second blank has been clamped in said position in which said projections engage into said recesses in said clamping surfaces and after said parts of said second blank at both sides of said intermediate part have been machined, said last parts are clamped, whereupon said clamping surfaces are withdrawn from said intermediate part and said projections, and said projections and said parts of said intermediate part adjacent to said projections are then milled off so as to form said male member, whereupon by means of at least one tool said cutout is drilled into at least one side of said male member in a position coaxial to said position in which said projections were located before being milled off.

13. A method as defined in claim **9,** in which in said first step of producing said blanks, said intermediate part of said first blank which subsequently provided with said slot is also provided with a small projection on and integral with at least one outer side thereof, said projection projecting outwardly from one longitudinal wall of said slot when said slot has been formed in said first blank and has been widened, said projection being fully compressed into the material of said longitudinal wall when both of said walls of said widened slot are pressed against said surfaces of said male member and said stud is thereby formed which engages into said cutout, said stud having a volume substantially corresponding to the volume of said projection before being compressed.

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