Sept. 13, 1966 L. MONTANDON 3,271,848

PROCESS AND APPARATUS FOR DETACHABLY FIXING A DEVICE ON A MACHINE AND INSTALLATION FOR PUTTING THIS PROCESS INTO PRACTICE

Filed Aug. 15, 1963

5 Sheets-Sheet 1

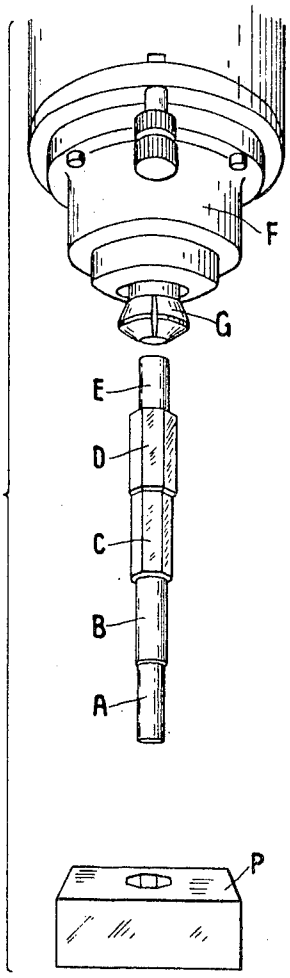

FIG.1

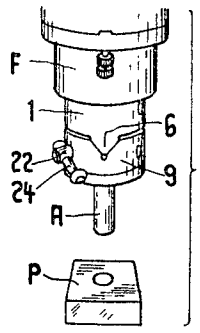

FIG.2

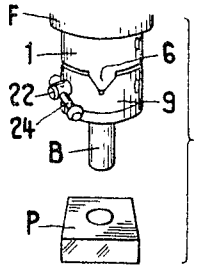

FIG.3

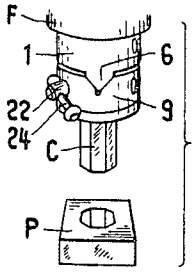

FIG.4

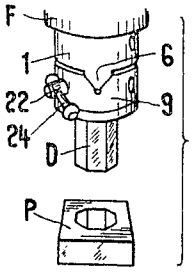

FIG.5

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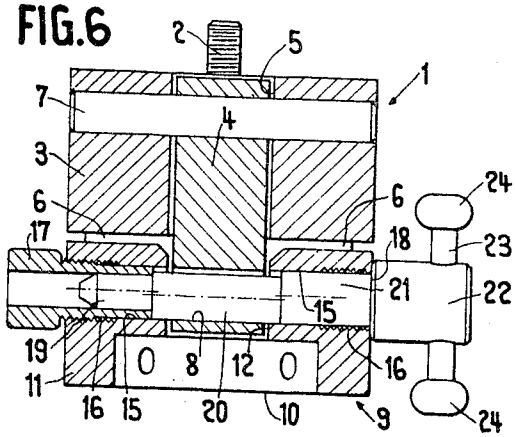
Sept. 13, 1966 L. MONTANDON 3,271,848

PROCESS AND APPARATUS FOR DETACHABLY FIXING A DEVICE ON A MACHINE AND INSTALLATION FOR PUTTING THIS PROCESS INTO PRACTICE

Filed Aug. 15, 1963

5 Sheets-Sheet 2

FIG.6



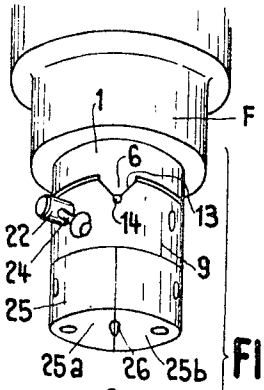
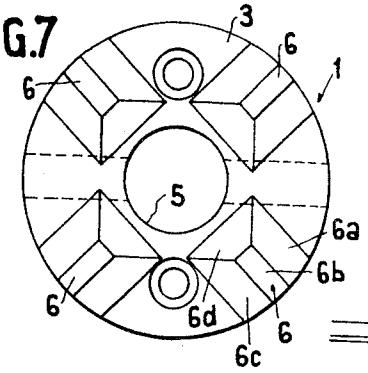


FIG.9

FIG.7



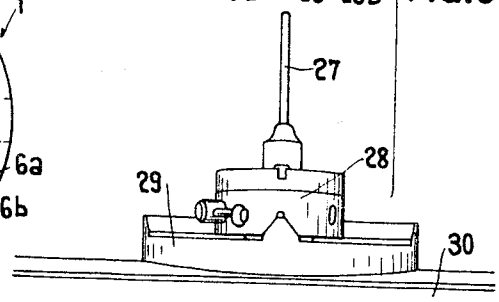
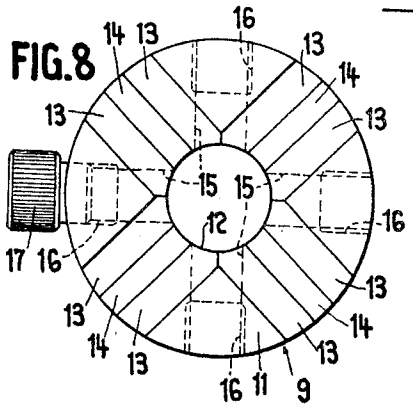
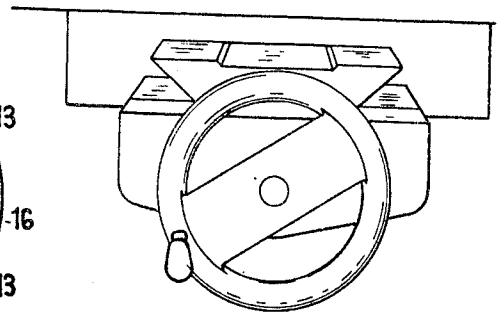


FIG.8





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Filed Aug. 15, 1963

5 Sheets-Sheet 3

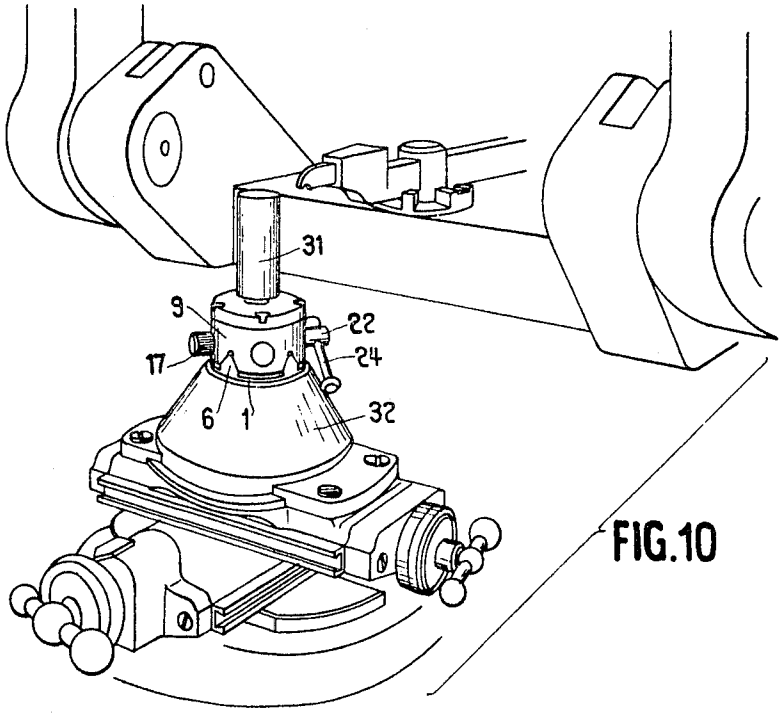

FIG.10

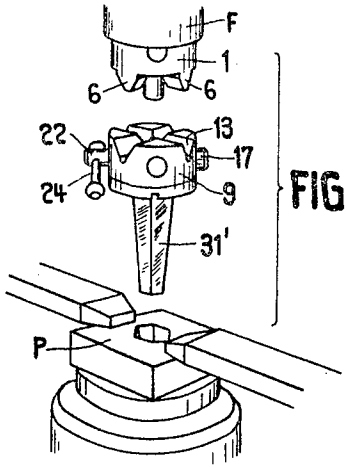

FIG.11

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Sept. 13, 1966 L. MONTANDON 3,271,848

PROCESS AND APPARATUS FOR DETACHABLY FIXING A DEVICE ON A MACHINE AND INSTALLATION FOR PUTTING THIS PROCESS INTO PRACTICE

Filed Aug. 15, 1963

5 Sheets-Sheet 4

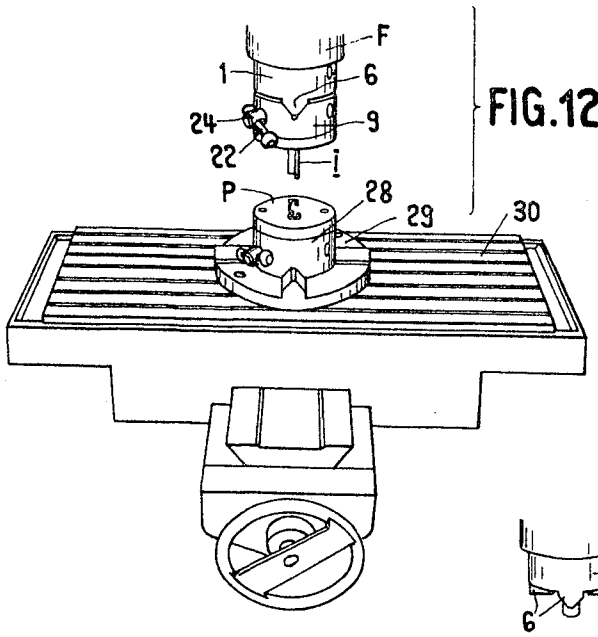
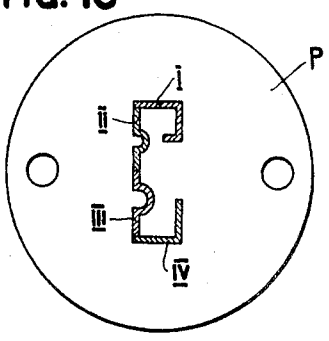


FIG. 12

FIG. 13



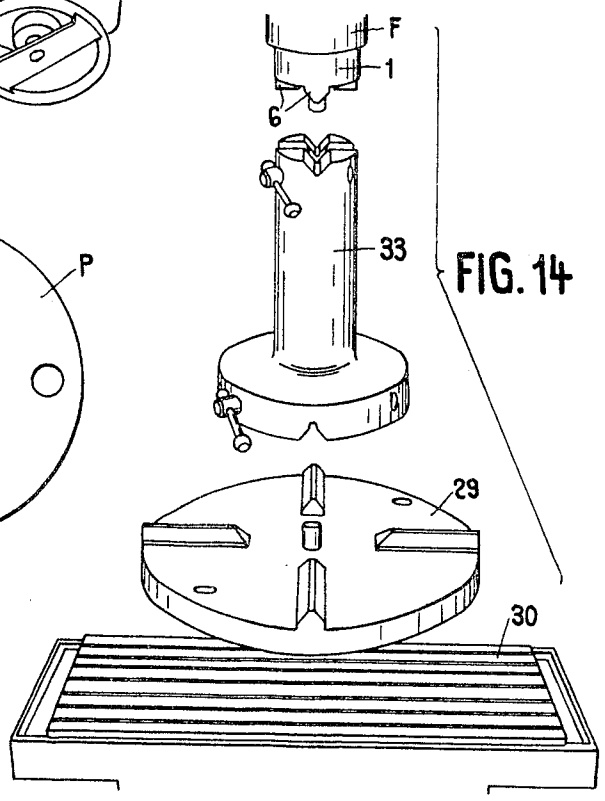


FIG. 14

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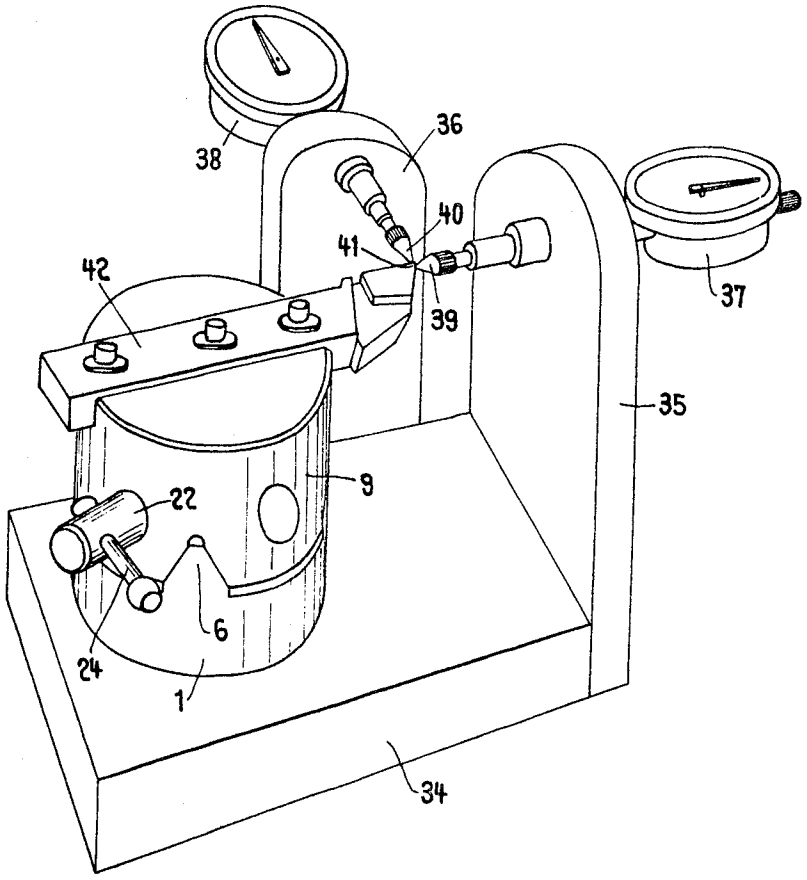
Sept. 13, 1966 L. MONTANDON 3,271,848

PROCESS AND APPARATUS FOR DETACHABLY FIXING A DEVICE ON A MACHINE AND INSTALLATION FOR PUTTING THIS PROCESS INTO PRACTICE

Filed Aug. 15, 1963

5 Sheets-Sheet 5

FIG.15



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United States Patent Office 3,271,848 Patented Sept. 13, 1966

3,271,848

PROCESS AND APPARATUS FOR DETACHABLY FIXING A DEVICE ON A MACHINE AND INSTALLATION FOR PUTTING THIS PROCESS INTO PRACTICE

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Claims priority, application Switzerland, Aug. 25, 1962, 10,131/62; June 1, 1963, 6,905/63
19 Claims. (Cl. 29—407)

The present invention concerns a process for detachably fixing a device for example, a work-piece to be machined or a tool on a machine in a specified position.

It often occurs that it is necessary, on a machine tool, to regulate the equipment with reference to the work-piece itself to be machined. This operation is almost inevitable for restarting on any machine for removal of swarf or on a machine for electro-erosion machining. This adjustment is costly, as it obligatorily necessitates the stopping of the machine, which reduces by that much its profitability. Moreover, it is sometimes very difficult to find a sound reference surface, for example, when the surface is convex and it is then necessary to proceed with the adjustment by very complicated means, as a synchronisation dye for example.

An object of the present invention is to avoid in many cases of the adjustment of a tool or other device on the machine itself with respect to another device fixed on the machine, and to replace the direct adjustment by a preliminary indirect adjustment outside and independent of the machine.

According to the present invention, a process for detachably fixing a device on a machine is characterized in that there is connected with the machine, in a specified position, one of two complementary brackets, adapted to be connected together in at least one mutual, perfectly specified position, and in that there is specified in advance the said prescribed position of the device with respect to the machine, once the brackets are assembled, in placing it on the other bracket in a perfectly specified position.

Because one of the brackets is connected with the machine in a known specified position, it is possible to specify exactly in advance the relative position of the device with respect to any part of the machine in specifying the position of the device with respect to the other bracket, because the relative position of the two assembled brackets is equally predetermined and known.

In a machine tool, it is preferable to fix not only one or several tools and one or several work-pieces to be machined by these tools by means of a pair of brackets as described above, so that the relative positions of the tools and of the work-pieces to be machined can be predetermined in advance outside the machine.

The importance of this possibility will be illustrated in several examples.

The installation for putting into practice the process described above is characterised by two types of complementary brackets, adapted to be connected together in pairs in at least one mutual perfectly specified position, one of the said types of brackets comprising means permitting the fixing of a device on this bracket in a perfectly specified position and the other of the said types of brackets comprising means permitting its fixing on the machine in a specified position, several brackets belonging to the same type of bracket, so that at least one bracket connected with a device can successively be connected with several complementary brackets or that several brackets carrying devices can be connected successively with at least one complementary bracket.

The invention will now be described further, by way of

example, with reference to the accompanying drawings, in which:

FIG. 1 is a perspective exploded view of a known machine for machining by electro-erosion;

FIGS. 2 to 5 are perspective details of the machine, in accordance with the invention, for executing the same operations;

FIG. 6 is a vertical section showing the assembled brackets;

FIG. 7 is a bottom plan view of the upper bracket;

FIG. 8 is a top plan view of the lower bracket;

FIG. 9 is a perspective view of an alternative embodiment of the invention;

FIGS. 10 and 11 are perspective views of machine showing the making and utilization of a device respectively;

FIG. 12 is a view of a machine similar to that shown in FIGS. 2 to 5;

FIG. 13 is a plan of the profile to be machined shown in FIG. 12;

FIG. 14 is a perspective view of a special device for the fixing of a pair of brackets on two parts of the machine; and

FIG. 15 is a perspective view of a device for truing up or adjustment.

FIG. 1 shows schematically a spindle F of an electro-erosion machine. A cylindrical part E of the electrode can be fixed in a clamp G of the spindle F and the parts A to D of the elongated tool can then be advanced successively into a prepared hole in a work-piece P fixed on a table (not shown) of the machine. As indicated in FIG. 1, the parts A to D of the electrode serve successively to machine the hole in the work-piece P in a manner becoming more and more fine and precise. It is difficult to manufacture electrodes of the type as shown in FIG. 1 with precision, moreover, if the diameter of the electrode is very small with respect to its length. It is thus useful to replace the elongated electrode represented in FIG. 1 by several electrodes each only comprising one of the parts A to D. Nevertheless, at least the parts C and D must be fixed in the spindle F in an exactly co-axial position and in an exact specified angular position. It is thus necessary to adjust exactly the position of each electrode only comprising one of the parts C or D in a specified angular position, which necessitates time and qualified personnel. The device in accordance with the invention permits the subdivision of the elongated electrode shown in FIG. 1 into four electrodes, whilst avoiding the above mentioned disadvantages. As shown in FIGS. 2 to 5, a first male bracket 1 is fixed in a perfectly specified position on the spindle F of the machine. The tools or electrodes A to D are fixed in a position equally perfectly specified on female brackets 9 complementary with the male brackets 1. One embodiment of these brackets 1 and 9 is shown in detail in FIGS. 6 to 8.

The male bracket 1 is formed of a main body member 3 and a central tie-rod 4 fixed to the body 3. The body 3 is in the form of a cylinder presenting a central bore 5 and comprising on its free end face several trued prisms 6, the axes of which are perpendicular to the axis of the body 3. In the embodiment shown, the body 3 presents four prisms 6 arranged at equal distances from each other on the face of the body 3; there could however, be conceived only three or a number greater than four. Each of the prisms 6 presents two inclined faces 6*a*, 6*c* and a horizontal face 6*b*, the faces 6*a*, 6*b* and 6*c* being parallel to the axis of the prism 6 (FIG. 7). A fourth face 6*d* is inclined with respect to the axis of the prism 6 and truncates this latter on the side of the axis of the body 3. This face 6*d* could, if necessary, be omitted.

The central tie-rod 4 is constituted by a cylindrical rod housed with play in the bore 5 of the body 3 and fixed to

this latter by means of a cotter pin 7. There results by this method of fixing that the tie-rod 4 can lightly oscillate around the axis of the cotter pin 7, within the limits permitted by the diameter of the bore 5. As is seen in FIGS. 5 and 6, the central tie-rod 4 projects beyond the prisms 6 of the body 3 and presents a transverse hole 8 parallel to the cotter pin 7 near its free end.

A lower face 10 of the female bracket 9 is trued to permit the adjustment of the tool, for example, by means of a screw or any other means of fixing. The female bracket 9 is formed by a body 11 in the form of cylinder presenting a central bore 12 of diameter equal to that of bore 5 of the body 3. On its upper face, the body 11 presents a replica of the prisms 6 of the male bracket, that is to say hollow prisms 13 marrying exactly the form of the prisms 6. Meanwhile, as shown in FIG. 8, the bases of the prisms 13 are hollowed more deeply at 14, this hollowing permitting the perfect application of the inclined faces 6*a* and 6*b* on the corresponding faces of the prisms 13 when the device is assembled.

The body 11 of the female bracket 9 presents several radial bores 15 (the number of which is equal to that of the prisms 13), these bores 15 being tapped at 16 over a part of their length. In the example shown, the axis of each bore 15 is directed in accordance with the bi-section of the angle formed by the axes of two adjacent prisms 13. A barrel bolt 17 having a knurled head is adapted to be screwed in one of the bores 15.

The connection between the male bracket and the female bracket is effected by means of a spindle 18. This latter presents an end 19 of small diameter, adapted to be engaged in the bore of the barrel bolt 17, a central eccentric part 20 adapted to be engaged in the hole 8 of the central tie-bolt 4, a concentric part 21 of larger diameter, adapted to be engaged in one of the bores 15 of the body 11, and a head 22 traversed freely by a rod 23 at the ends of which are riveted two studs 24.

To assemble the female bracket 9 to the male bracket 1, the following procedure is adapted:

The female bracket 9 is applied against the male bracket 1 in such a manner that the hollow prisms 13 marry with the projecting prisms 6, then the spindle 18 is introduced into the bores 15 of the body 11 in such a manner that its end 19 penetrates into the bore of the barrel bolt 17 previously screwed into the opposite bore 15. It is clear that the axes of these two bores 15 must be chosen in such a manner as to coincide with the axis of the hole 8 of the central tie-rod 4. It then suffices to turn the spindle 18 in either direction with the aid of the rod 23 so that the eccentric part 20 is wedged in the hole 8 of the central tie-rod 4 and ensures an efficacious locking of the two brackets 1 and 9. After rotation of the spindle 18, the tie-rod 4 oscillates slightly around the cotter pin 7. The axes of the two brackets are thus obliged to be perfectly aligned and the female bracket 9 takes up a perfectly specified angular position with respect to the male bracket 1.

It is obvious that the fixing of the brackets 9 carrying the tools A to D on the male bracket 1 secured to the spindle F of the machine is effected in the same manner as the fixing of the bracket 9 described above. As the bracket 1 always remains fixed on the spindle F in the same position and that the relative position of each bracket 9 fixed on the bracket 1 is perfectly specified, the position of the tools A to D are automatically perfectly specified by a simple successive fixing of the brackets 9 carrying the tools on the bracket 1. The exchange of the tools A to D to effect the different operations thus takes very little time and can be given to a semi-skilled person. Long and delicate tools, difficult to manufacture, such as are shown in FIG. 1 can thus be avoided.

If the polygonal hole in the work-piece P must be in a specified position with respect to this work-piece, it is advantageous to fix each work-piece to be machined on a female bracket 9 and to fix a male bracket 1 on the base or table of the machine on which the work-piece P is disposed. Each work-piece can thus be mounted on a bracket 9 in a perfectly specified position with respect to this bracket, so that the position of the work-piece with respect to the machine or with respect to the tools A to D is automatically specified when the female bracket carrying the work-piece is connected to the male bracket fixed on the table of the machine. Thus the manufacture of work-pieces P can be rationalised considerably because it suffices to prepare the required number of work-pieces on brackets, which can be executed by a skilled person in a simple and rapid manner, whilst a semi-skilled person can tend the machine, the exchange of the tools and of the work-pieces to be machined only necessitates very simple operations. The stopping times of the machine can be reduced to a minimum, because not only the tools but also the work-pieces can be prepared in advance on brackets and fixed in a very short time on the machine.

In the example shown in FIG. 9 the bracket 9 carries a hollow electrode 25 subdivided in two parts 25*a* and 25*b*. In this manner, it is possible to conceive a slot 26 of irregular shape formed by two grooves in the parts 25*a* and 25*b*. The electrode 25 serves to form an electrode 27 by electro-erosion. The electrode 27 is fixed on a female bracket 28 which is connected to a male bracket 29 of larger diameter in the manner described above for the brackets 1 and 9. The bracket 29 is fixed in a well specified position on the table of the machine 30. To machine the electrode 27 which can itself serve later as a tool, the spindle F with the devices fixed thereon is lowered until this electrode 27 enters into the hollow 26 of the electrode 25, so that the profile of the hollow 26 is reproduced on the electrode 27 by electro-erosion. Whilst a single electrode tool 25 is shown in FIG. 9, several electrodes presenting hollows becoming smaller and smaller can be used successively to obtain by approximation the required profile of the electrode 27. It is equally possible that several electrodes 27 are manufactured successively with the same electrode tool or the same set of electrode tools 25. It is thus advantageous to fix not only the electrode tools, but also the workpieces 27 on brackets, because these electrode tools 25 and the work-pieces 27 can be prepared on associated brackets in exactly specified positions so that the definite fixing of the electrodes on the electro-erosion machine can be effected in a very simple and rapid manner by non-skilled personnel. Finally, the exact positioning of these electrodes 25 and of the work-pieces 27, positioning which would necessitate fairly difficult operations on the machine itself, can be executed with special instruments and processes more simple outside the machine, so that the stopping time of the machine for the mounting and the adjustment of the tools and of the work-pieces can be reduced to a minimum.

FIGS. 10 and 11 show another example of the application of the process in accordance with the invention. A cylindrical work-piece 31, already fixed on a female bracket 9 in a well specified position, is fixed in a planing machine by the assembly of the bracket 9 with a complementary male bracket 1 fixed on a divider 32 of the support of the machine tool. By known operations of the planing machine, the work-piece 31 is then machined to form for example a hexagonal pyramid. This pyramid can then serve as a tool in an electro-erosion machine, without being removed from the bracket 9. When the tool is finished in the planing machine, the bracket 9 is separated from the bracket 1 of the planing machine to be fixed on the bracket 1 of the spindle F of an electro-erosion machine in the manner indicated in FIG. 11. The finished tool 31', which has already been fixed on the bracket 9 during its manufacture, is thus without further action fixed in a predetermined position on the spindle of the electro-erosion machine. Consequently, the tool is ready to be sunk into the work-piece P fixed on the base of the electro-erosion machine. As indicated

above, the work-piece P can equally well be mounted with the aid of brackets 1 and 9.

FIG. 12 shows another application of the process in accordance with the invention, similar to the use in accordance with FIGS. 2 to 5. Here it concerns the machining of a very complex profile, comprising profile parts I to IV in a work-piece P mounted on the table 30 of the machine with the aid of brackets 28 and 29 in the manner indicated above in FIG. 9. It is extremely difficult to manufacture a single electrode-tool to machine at the same time all the parts I to IV of the profile. It is much easier to provide several simple tools to machine successively the different parts of the profile. These tools, designated by I to IV in accordance with the parts I to IV of the profile to be machined, are each mounted in the corresponding positions indicated in FIG. 13 on female brackets 9 which can be successively connected with the bracket 1 fixed on the spindle F of the machine. The exchange of tools and of prepared work-pieces P on the brackets 9 and 28 respectively, is simple and necessitates very little time.

In the examples in accordance with FIGS. 9 and 12, male brackets 1 and 29 must be fixed on the spindle F and on the table 30 of the machine in a specified relative position. This operation can be effected easily by means of an intermediate part 33 of the required length shown in FIG. 14, this part presenting hollow prisms such as the prisms 13 on both its ends. This intermediate part 33 is inserted between the male brackets 1 and 29 facing each other in such a manner that the female prisms are applied narrowly against the projecting prisms of the male brackets. The male brackets are then fixed in the obtained position. The spindle F is then lowered until the bracket 29 rests on the table 30 of the machine in a well specified position with respect to that of the bracket 1. The bracket 29 is then fixed on the table 30 in this position and the intermediate part 33 is then separated from the brackets 1 and 29. In this manner, it is extremely easy to fix the brackets 1 and 29 in the relative required position on the machine.

The examples which precede refer to the fixing of tools or of work-pieces to be machined in electro-erosion machines. Only FIG. 10 shows a work-piece mounted in a planing machine. Of course, the process and the installation in accordance with the invention can equally well be utilised in all other machine-tools or in all other applications where any device is to be removably fixed on a machine. The or each tool of a machine tool wears and must be adjusted and ground from time to time. Normally, this adjustment necessitates fairly considerable stopping times of the machine tool and the presence of skilled personnel to effect this work. With the use of the installation and of the process in accordance with the present invention, it is possible to simplify and rationalise this work greatly. The or each tool is fixed on a bracket which is itself connected to a fixed bracket on the machine tool. During the normal functioning of the machine, at least one exchange tool is prepared on a similar bracket and the position of this tool on the bracket is adjusted in advance in such a manner that the position of the tool, once its bracket is assembled with the bracket mounted on the machine tool, corresponds exactly to the prescribed position of the tool. It is thus possible to change one or several tools of the machine tool by semi-skilled personnel, whilst the skilled personnel can be strictly limited to the adjustment and/or the grinding of the tools outside the machine with appropriate auxiliary instruments.

FIG. 15 shows schematically an example of such a truing device or adjusting of a tool. A male bracket is fixed on a base 34 of this device, whilst supports 35 and 36 carry measuring instruments 37 and 38 feelers 39 and 40 of which are adapted to measure the limits of the point of travel 41 of a tool 42. The tool is fixed on a female bracket 9 connected to the male bracket 1 of the truing device. To adjust a used tool, it suffices to

mount the bracket 9 carrying this tool on the bracket 1 and to adjust the tool 42 until the limits indicated by the instruments 37 and 38 correspond to the limits prescribed. The tool is then fixed on the bracket 9 in this adjusted position and the limits thus adjusted determine in advance the position that the tool will take when the bracket 9 is again connected to the bracket 1 fixed on the machine tool.

In the examples shown in FIGS. 2 to 5, 9, 12 and 13 it is assumed that several tools are successively put in the working position, whilst the work-piece always remains in the same position. It is equally possible to fix the tools in several positions and to transport the work-pieces successively into the different working positions, the positioning of the work-pieces in each working position being predetermined by the assembly of the bracket carrying the work-piece with complimentary brackets fixed in the working positions.

What I claim is:

1. A process for removably fixing a device on a machine in a prescribed position, comprising providing a pair of complementary brackets, said pair of brackets including a male bracket having trued prisms on its one end face with the trued prism surfaces inclined relatively to the general plane of said free end face and a female bracket having trued prismatic grooves of a shape complementary to the said trued prisms on its one end face and inclined relatively to the general plane of said one end face, fixing the one of said brackets to the machine in a perfectly specified position relatively to the machine and with its said end face fully accessible, fixing said device on the other of said brackets in a perfectly specified position relatively to said other bracket and with said end surface of said other bracket fully accessible, interconnecting said brackets with their complementary end faces engaging each other without clearance, the relative position of said brackets being thereby perfectly specified in three dimensions, the position of said device on the machine being thus perfectly predetermined by fixing it on said other bracket in a perfectly specified position and by interconnecting said brackets in a perfectly specified relative position.

2. A process for removably fixing a device on a machine in a prescribed position, comprising providing a pair of complementary brackets having profiled end faces with complementary prismatic portions having surfaces inclined relatively to the general plane of said end faces, said brackets being engageable in a perfectly defined relative position with their inclined surfaces of complementary prismatic portions engaging each other without clearance, fixing the one of said brackets to the machine in a perfectly specified position relatively to the machine and with its said profiled end face fully accessible, fixing said device on the other of said brackets in a perfectly specified position relatively to said other bracket and with said end face of said other bracket fully accessible, interconnecting said brackets with their complementary profiled end faces engaging each other without clearance, the position of said device on the machine being thus perfectly predetermined by fixing it on said other bracket in a perfectly specified position and by interconnecting said brackets in a perfectly specified relative position.

3. A process as claimed in claim 2, in which the device is placed on the other bracket outside the machine and without reference thereto.

4. A process as claimed in claim 3, in which the other bracket is connected with a complementary fixed bracket in a truing mechanism, the device then being orientated on the other bracket with the aid of the truing device with respect to the complementary fixed bracket, the member thus orientated being then fixed to the other bracket.

5. A process as claimed in claim 2, in which at least one tool and at least one work-piece to be machined

is fixed on the machine, for example a machine tool, by means of pairs of brackets.

6. A process as claimed in claim 5, in which brackets are fixed on two relatively displaceable associated supports of a machine tool by fixing one bracket on one of the supports and placing another bracket on the other support in a movable manner, an orientation device being interposed between the brackets, the end faces of which are complementary to the faces of the brackets, the end faces of the orientation device being engaged with the brackets applied to the supports to give a well specified relative orientation to the two brackets, the other bracket thus orientated being fixed on the other support.

7. A process as claimed in claim 2, in which the other bracket with the member fixed thereon is successively connected to complementary brackets fixed on at least one machine.

8. A process as claimed in claim 7, in which a tool is manufactured or ground and is then used in a machine tool, this tool being fixed in an invariable position on the other support during its machining and its use in the machine tool.

9. A process as claimed in claim 4, in which detachable devices or tools of a machine are prepared and fixed in position in a perfectly specified position on the other bracket, the devices or tools used likewise fixed on a bracket being removed from the machine with their support brackets, a bracket with a prepared device or tool being connected to the bracket fixed to the machine.

10. An installation for removably fixing a device on a machine in a prescribed position, comprising at least one pair of complementary male and female brackets, each of said brackets having a main body and a profiled coupling surface at the one end of the main body, said male bracket having prismatic portions extending in a direction perpendicular to the axis of the main body and having trued surfaces inclined relatively to said axis of the main body, and said female bracket having prismatic grooves complementary to said prisms, extending in a direction perpendicular to the axis of the main body and having trued surfaces inclined relatively to said axis of the main body, a coupling mechanism in each pair of brackets for interconnecting said brackets in a perfectly defined relative position with their complementary inclined surfaces engaging each other without clearance, each of said brackets having a surface allowing fixing of the bracket on a machine in a specified position and fixing a device on the bracket in a specified position while the said coupling surface of the bracket remains fully accessible for coupling a pair of complementary brackets of which the one is fixed on the machine and the other is interconnected with a device to be attached to the machine.

11. An installation as claimed in claim 10, in which a truing mechanism is provided for orientating devices with respect to the brackets in view of fixing the orientated devices on these brackets, this device being separated from the fixing point of the mechanism on the machine.

12. An installation as claimed in claim 11, in which the truing device comprises a fixed bracket with which complementary brackets can be connected during the fixing of the devices on these complementary brackets.

13. An installation as claimed in claim 10, in which the one bracket has a central tie-rod fixed to its main body and the other bracket of each pair of brackets has a member engageable with the tie-rod for interconnecting the pair of brackets.

14. A device as claimed in claim 13, in which the central tie-rod is housed with play in a bore or the body of the male bracket and is fixed to this latter by means of a cotter pin.

15. A device as claimed in claim 14, in which the central tie-rod projects from the prisms of the male bracket and presents a transverse hole parallel to the cotter pin near its free end.

16. A device as claimed in claim 15, in which the female bracket presents a central bore adapted to receive the free end of the tie-rod.

17. A device as claimed in claim 13, in which the female bracket presents several radial bores tapped over a part of their length, one of these bores being adapted to receive a barrel bolt.

18. A device as claimed in claim 17, in which the connecting member is constituted by a spindle presenting an end adapted to be engaged in the bore of the barrel bolt, an eccentic part adapted to be engaged in the transverse bore of the central tie-rod, a concentric part of larger diameter, adapted to be engaged in one of the radial bores of the female bracket and a finger piece, one rotation of the spindle having the effect of locking the two brackets one on the other.

19. An installation as claimed in claim 10, comprising a male bracket having two sets of prisms extending at right angles to each other and a female bracket having two sets of grooves extending at right angles to each other.

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