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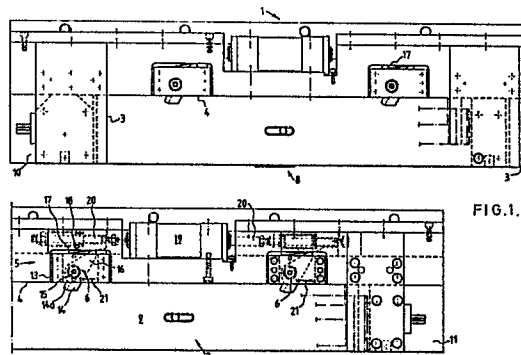
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⑤④ **Machines for forming configurations on a rotary workpiece.**

⑤⑦ Apparatus 1 for holding a tool (not shown) of a rotary work-piece (that is one which rotates during the forming operation, though it could also rotate in use) comprising an elongate member 2 on which the tool is mountable and which member has a plurality of support surfaces 3 and 4, and means 5 to engage and urge the tool bodily against the support surfaces 3 and whereby to clamp the tool in an operative position.



Description

MACHINES FOR FORMING CONFIGURATIONS ON A ROTARY WORKPIECE

The invention relates to machines for forming configurations on or in a rotary workpiece, and particularly relates to apparatus for holding a forming tool of such a machine.

The machines may be pressure forming machines, used for forming grooves, splines or gear teeth on a rotary shaft such as a gear or crank shaft of an internal combustion engine. Again, the machines may be broach turning or cutting machines, in which a rack-like cutter is moved over a rotary workpiece to form a desired shape therein, for example a surface channel.

In such machines metal workpieces are formed between a pair of opposed, substantially parallel reciprocating dies, tools or tool members. As the tools reciprocate (in opposite directions usually) they apply pressure to the workpiece and form or shape it. One disadvantage of these machines is that the tools (mounted on supports) have to be mounted and dismounted from the machines using a time consuming manual operation, which is also the case when the tools are required to be adjusted in position relative to one another.

It is thus among the objects of the invention to seek to mitigate these disadvantages of the prior art.

According to a first aspect, the invention provides apparatus for holding a tool of a machine for forming configurations of a rotary workpiece, comprising an elongate member on which a tool is mountable and which member has a plurality of support surfaces, and means to engage and urge the tool bodily against the support surfaces whereby to clamp the tool in an operative position.

The means may comprise a rotatable lever device having a part which engages a complementary part of the tool.

The lever device may have a gear-tooth surface profile. The lever device may be mounted for rotation on a spindle with a further part projecting away from the first-mentioned part and being engageable by a slide means to rotate the lever device.

The slide may have a wedge profile engaging the further part.

There may be biasing means connected to the lever device to bias said device for rotation in a direction to disengage from the tool.

The biasing means may comprise a coil spring.

The slide means may be carried by an elongate carrier which may be reciprocable longitudinally by actuating means.

The actuating means may comprise a hydraulic piston and cylinder arrangement.

There may be two spaced apart clamping means driven by the hydraulic cylinder which is a double-acting piston and cylinder arrangement having two coaxial carriers extending on either side of the cylinder to actuate the two clamping devices.

According to a second aspect of the invention there is provided a tool for forming configurations of a rotary workpiece, comprising a surface profile for forming a desired configuration on a workpiece,

surfaces for abutting support surfaces of a machine, and a clamping surface complementary to a device of the machine having a clamping surface so that when the complementary clamping surfaces are engaged, the tool is clamped in an operative position.

The clamping surface may be part of a channel which is adapted to receive the device of the machine in a direction substantially at 90° to a bed of the machine.

The invention also extends to a machine including apparatus and a tool as defined hereinbefore, in combination.

Using the invention it is possible to provide a simple, yet efficient and effective, way in which to achieve rapid interchangeability of tools used in the machine.

Apparatus embodying the invention is hereinafter described, by way of example, with reference to the accompanying drawings.

Figure 1 is a plan view, partly in section, of the apparatus, with a tool used in the apparatus removed for clarity; and

Figure 2 is a front elevational view of the apparatus.

Referring to the drawings, there is shown apparatus 1 for holding a tool (not shown) of a rotary workpiece (that is one which rotates during the forming operation, though it could also rotate in use) comprising an elongate member 2 on which the tool is mountable and which member has a plurality of support surfaces 3 and 4, and means 5 to engage and urge the tool bodily against the support surfaces 3 and whereby to clamp the tool in an operative position.

The means 5 in the embodiment shown is a rotatable lever device 6. There are in the embodiment shown two lever devices 6 for each tool, and there are two tools in line, at 7 and 8, in upper and lower elongate members, of which the lower member 2 only is shown in the drawings. The devices 6 are identical and so only one will be described in detail. Also, the elongate member 2 in which each tool is mounted is identical in having a bed 9, which is inclined, with a heel 10 and toe plate 11 and heel/toe plate 12 which provide support surfaces 3 and 4 which rise at substantially 90° to one other from the bed 9. In the embodiment shown there are two tools 24" (60.96cm) long though there could be one tool 48" (121.92cm) long or indeed as many tools as are desired along a bed of the machine.

The lever device 6 is mounted in a recess 13 and has a part 14 which has a gear tooth surface profile or configuration 14a and in use engages a complementary part of the tool. The lever device 6 is mounted on a spindle or shaft 15 for rotation, and has a further part 16 projecting away from the first-mentioned part 14 and which further part 16 is of bull-nose shape and is engageable by a slide means in the form of a wedge 17 to rotate the lever device 6. The wedge 17 is carried by an elongate

carrier 18 which is reciprocable longitudinally by an actuating means in the form of a double acting piston and cylinder arrangement 19. The piston 19 is a hydraulic piston situated between the two respective lever devices 6 for each tool, the carriers 18 being carried by the piston rods 20. The devices 6 include biasing means 21 in the form of coil tension springs which bias the levers to the position shown in Figure 1.

A tool for forming a configuration such as gear profiles in the surface of a rotary workpiece, such as a metal shaft, is an elongate metal block with transverse surface grooves in it so that it is in the form of a rack, and is known as such or as a rack cassette. In use, the grooved surface would be uppermost when the rack is on the lower bed 2 shown. The rack is of generally square cross-section and in the rear (as considered in use) surface there are two channel-shaped blind slots, terminating at a position remote from the grooved surface, in other words adjacent the in use lower surface 9, in an enlarged part so that the channel is effectively of T-shape. The enlarged part has an angled and tapered surface profile which is effectively a camming surface of complementary shape to that of the gear tooth configuration 14a of the projecting part 14 of the lever device 6.

In use to mount a tool in the machine, the piston and cylinder arrangement 19 is actuated to move the wedge 17 to rotate the lever device 6 so that that device is effectively at right angles to the surface 4. The tool is then offered up to the bed, above it, with the channels aligned with a respective part 14, and is then lowered to rest on the bed 9. The piston and cylinder arrangement 19 is then actuated to move the piston to the right as viewed in Figure 1. This action results in the wedges 17 moving to the right and they in turn rotate their respective lever devices 6 clockwise, as viewed, against the bias of the springs 21 so that the parts engage in the enlarged parts of the tool channels, ride over the camming surfaces and force the tool to the left as viewed, and to the rear, to abut the support surfaces 3 and 4 firmly. The tool is thus clamped in an operative position. In this position, hydraulic female connectors (not shown) projecting from the end of piston and cylinder arrangement 19 and moving with the piston rods automatically engage in a leak proof manner with fixed male hydraulic connectors which are mounted on the frame of the machine and which are also part of the hydraulic circuit. The female parts have non-return valves which are normally closed, but which are opened by the male parts, or drogues, to complete the hydraulic circuit so that there is thus a "solid" hydraulic connection throughout the system and it is therefore unnecessary to maintain hydraulic force and the wedges 17, which are effectively self-locking, remain in position to clamp the tool via the lever devices 6. This saves on energy as a pump for the system can be closed down, and meanwhile the lever devices 6 remain in position to maintain the tool clamped, as described. A forming operation can then be carried out, usually by reciprocating the upper tools in unison longitudinally in an opposite

direction to the lower tools while a workpiece between them is rotated. As many passes as are necessary are carried out to form the desired configuration. The operation is then repeated on a succeeding workpiece, and so on. If it is necessary to change a tool, for example because a different configuration is to be formed on a workpiece, or because a tool is worn, it is merely necessary to pressurize the cylinder of the piston and cylinder arrangement 19 to move the lever devices 6 to the substantially 90° position, when the tool can simply be slid clear and replaced by another one using the sequence already described. The apparatus thus provides a simple yet efficient method of interchangeability of tools in machines of the kind described.

In a modification, it is possible to mount and dismount a tool with the lever devices in the position shown. Also, other means than hydraulic means for the piston and cylinder arrangement may be used, for example pneumatic, mechanical or electro-mechanical.

Claims

1. Apparatus for holding a tool of a machine for forming configurations of a rotary workpiece, comprising an elongate member on which a tool is mountable and which member has a plurality of support surfaces, and means to engage and urge the tool bodily against the support surfaces whereby to clamp the tool in an operative position.

2. Apparatus according to Claim 1, the means comprising a rotatable lever device having a part which engages a complementary part of the tool.

3. Apparatus according to Claim 2, the part having a gear-tooth surface profile.

4. Apparatus according to Claim 2 or Claim 3 the lever device being mounted for rotation on a spindle with a further part projecting away from the first-mentioned part and being engageable by a slide means to rotate the lever device.

5. Apparatus according to Claim 4, the slide having a wedge profile engaging the further part.

6. Apparatus according to any of Claims 2 to 5, there being biasing means connected to the lever device to bias said device for rotation in a direction to disengage from the tool.

7. Apparatus according to Claim 6, the biasing means comprising a coil spring.

8. Apparatus according to any of Claims 4 to 7, the slide means being carried by an elongate carrier which is reciprocable longitudinally by actuating means.

9. Apparatus according to Claim 8, the actuating means comprising a hydraulic piston and cylinder arrangement.

10. Apparatus according to Claim 9, there being two spaced apart clamping means driven by the hydraulic cylinder which is a double-ac-

ting piston and cylinder arrangement having two coaxial carriers extending on either side of the cylinder to actuate the two clamping devices.

11. Apparatus for holding a tool of a machine for forming configurations of a rotary workpiece, substantially as hereinbefore described with reference to the accompanying drawings.

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12. A tool for forming configurations of a rotary workpiece, comprising a surface profile for forming a desired configuration on a workpiece, surfaces for abutting support surfaces of a machine, and a clamping surface complementary to a device of the machine having a clamping surface so that when the complementary clamping surfaces are engaged, the tool is clamped in an operative position.

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13. A tool according to Claim 12, the clamping surface being part of a channel which is adapted to receive the device of the machine in a direction substantially at 90° to a bed of the machine.

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14. A machine comprising the apparatus of any one of Claims 1 to 11.

15. A machine according to Claim 14, including a tool mounted thereon.

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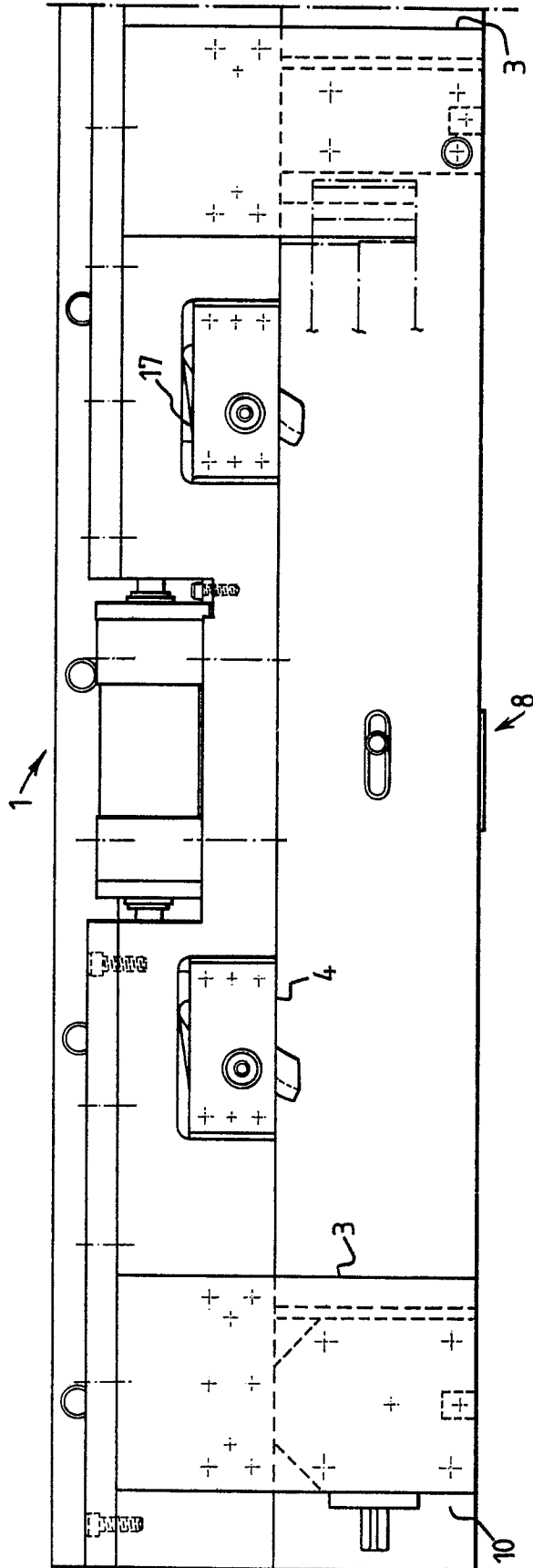
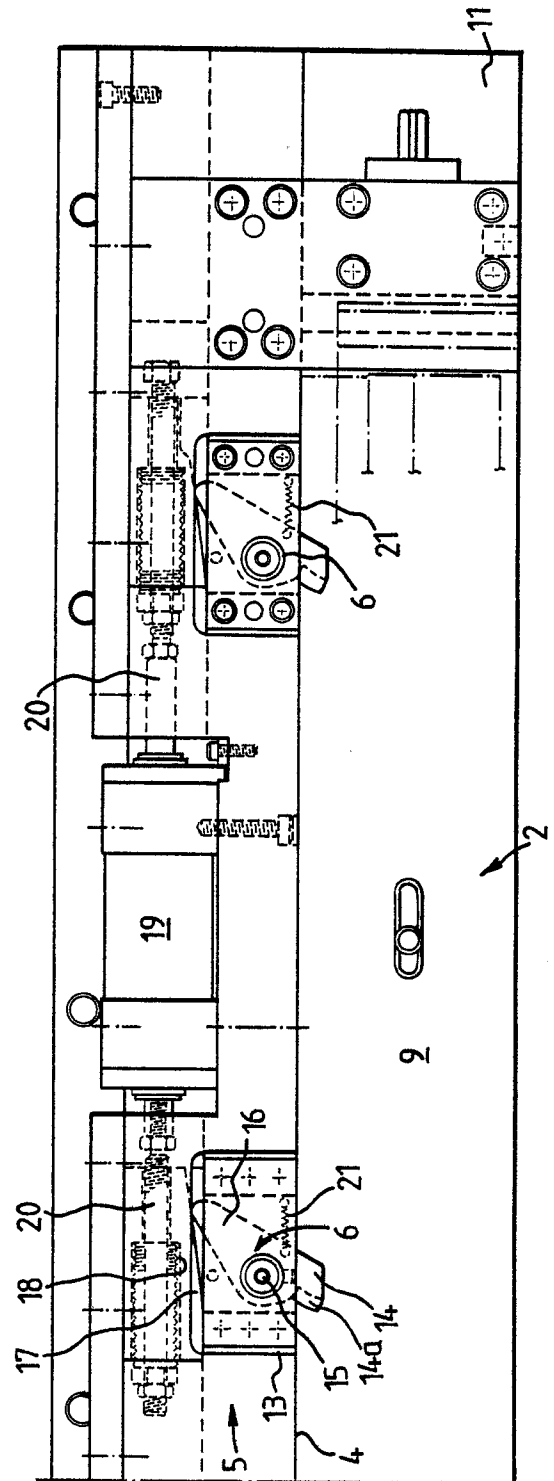


FIG. 1.



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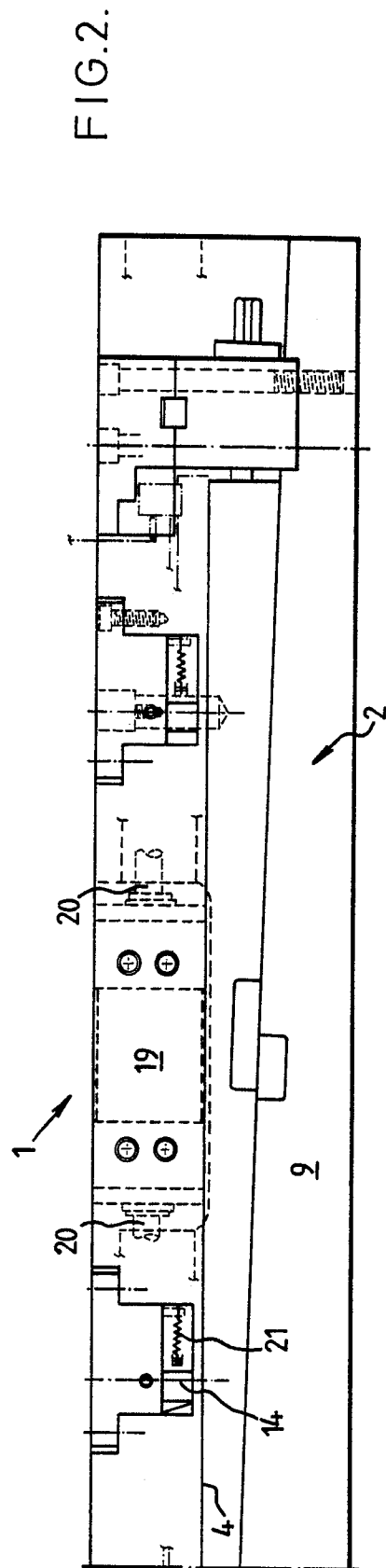
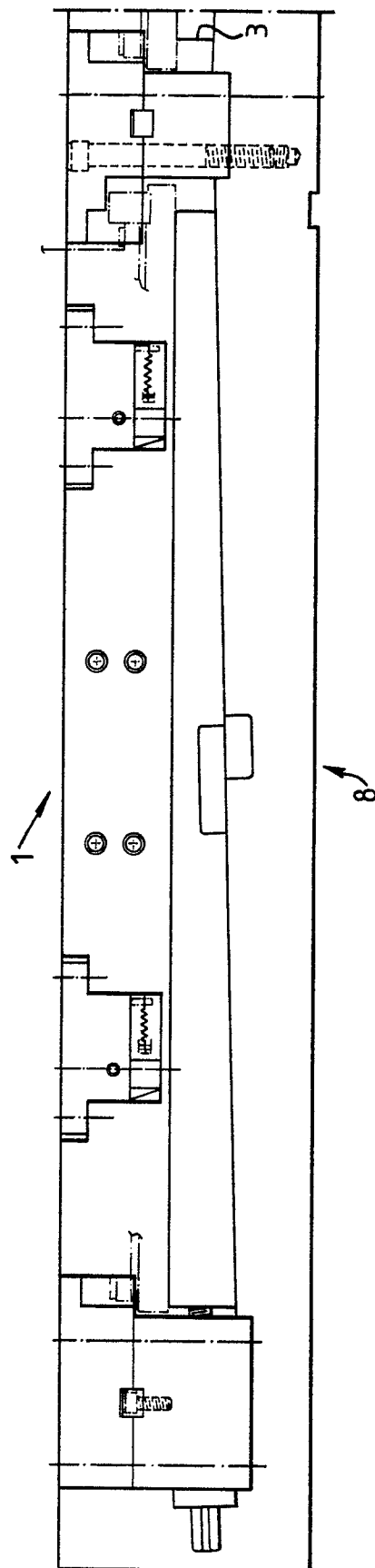


FIG.2.