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(54) Machine for cropping and press-forming material fed in wire form

(57) A machine (1) for cropping and press-forming material fed in wire form, which comprises a supporting structure (2) which slidingly supports a first assembly (3) which comprises a support (4) for at least one cropping and pressing punch. The supporting structure (2) further slidingly supports a second assembly (5) whose mass is suitable to counterbalance the mass of the first assembly (3). The machine (1) further comprises means for the synchronized actuation of the first assembly (3) and of the second assembly (5) with respect to the supporting structure (2) with a reciprocating motion along a sliding path in mutually opposite directions. The first assembly (3) and the second assembly (5) are arranged one above the other and the sliding path of the second assembly (5) is parallel and vertically spaced with respect to the sliding path of the first assembly (3).

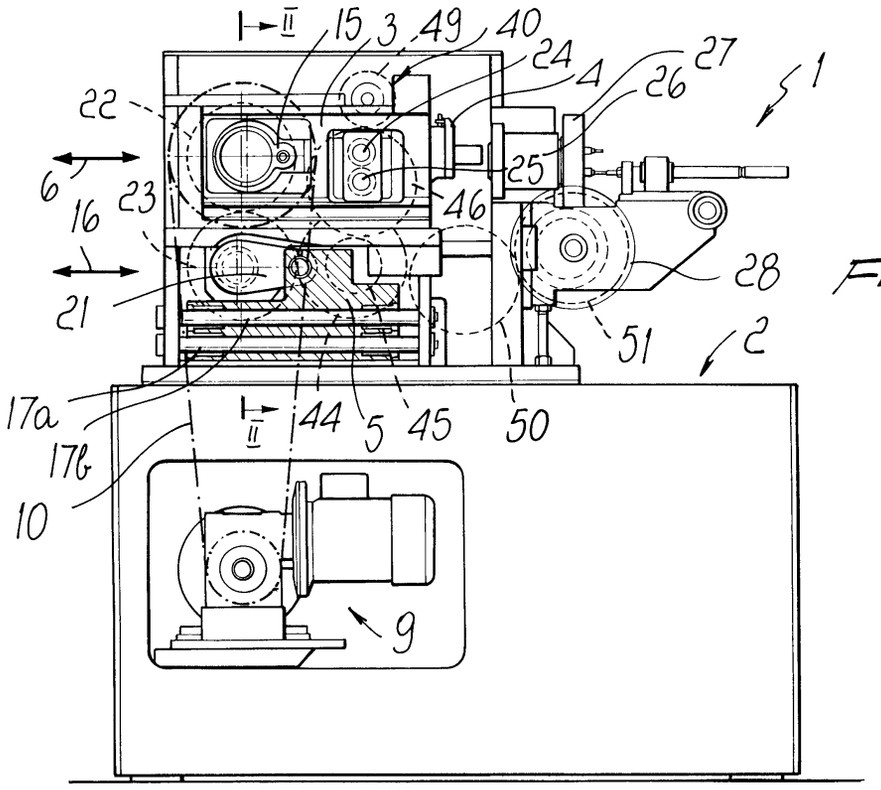

Fig. 1

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Description

[0001] The present invention relates to a machine for cropping and press-forming material fed in wire form.

[0002] Machines are known which can cut and press-form material which is fed to the machine in the form of a wire, for example to produce small mechanical parts such as rivets, nails or the like.

[0003] These machines are generally constituted by a supporting structure which supports, so that it can slide in a substantially horizontal direction, an assembly provided with a support for one or more cropping and pressing punches which face a die in which suitable forming cavities are provided. The support of the cropping and pressing punches is actuated with a reciprocating translatory motion so as to sequentially crop the material fed in wire form into segments having a preset length and then press-form these wire segments inside the forming cavities of the die.

[0004] The die is usually actuated with an intermittent rotary motion about a substantially horizontal axis, so as to cyclically arrange one or more forming cavities in front of the punch or punches supported by the support, which moves with a reciprocating motion.

[0005] The assembly that supports the cropping and press-forming punch support is actuated intermittently at high speed and its motion is reversed at a high rate, so as to achieved high productivity for the machine.

[0006] As a consequence of this fact, in view of the mass of the assembly that supports the cropping and press-forming punch support, intense vibrations are generated and discharged onto the supporting structure of the machine.

[0007] In order to solve the problem of vibration, European patent EP-138.758 discloses a machine provided with a second assembly which has the same characteristics and mass as the assembly that supports the cropping and press-forming punch support and is arranged on the same line. In practice, the first assembly and the second assembly can slide with respect to the supporting structure of the machine along a same path and are actuated along said sliding path synchronously but in mutually opposite directions. In this manner the translatory motion of the second assembly perfectly counterbalances the vibration generated by the translatory motion of the first assembly.

[0008] In the above-mentioned machine this reduction in vibration is offset by considerable longitudinal dimensions, i.e., parallel to the sliding direction of the first and second assemblies, and by a more complicated kinematic system used to actuate the two assemblies and the other elements required for the operation of the machine, such as for example the wire feeding rollers and the actuation of the die with an intermittent rotary motion.

[0009] The aim of the present invention is to solve the above problems, by providing a machine for cropping and press-forming material fed in wire form which ensures high productivity while containing vibration to acceptable levels although having limited longitudinal dimensions.

[0010] Within the scope of this aim, an object of the invention is to provide a machine for cropping and press-forming material fed in wire form in which the kinematic system used for synchronizing the movements of the various elements that compose the machine is relatively simple.

[0011] Another object of the invention is to provide a machine which is structurally simple, can be manufactured with competitive costs and ensures high reliability in operation.

[0012] This aim, these objects and others which will become apparent hereinafter are achieved by a machine for cropping and press-forming material fed in wire form, which comprises a supporting structure which slidingly supports a first assembly which comprises a support for at least one cropping and pressing punch, said supporting structure further slidingly supporting a second assembly whose mass is suitable to counterbalance the mass of said first assembly, means being provided for the synchronized actuation of said first assembly and of said second assembly with respect to said supporting structure with a reciprocating motion along a sliding path in mutually opposite directions, characterized in that said first assembly and said second assembly are arranged one above the other and in that the sliding path of said second assembly is parallel and vertically spaced with respect to the sliding path of said first assembly.

[0013] Further characteristics and advantages of the present invention will become apparent from the following detailed description of a preferred but not exclusive embodiment of the machine according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a schematic partially sectional lateral elevation view of the machine according to the invention;

Figure 2 is a schematic sectional view of Figure 1, taken along the plane II-II;

Figure 3 is a diagram of the kinematic system for the synchronized actuation of the various elements that compose the machine according to the invention.

[0014] With reference to the above figures, the machine according to the invention, generally designated by the reference numeral 1, comprises a supporting structure 2 which supports, so that it can slide along a preferably horizontal path indicated by the arrow 6, a first assembly 3 which comprises a support 4 for at least one cropping and press-forming punch of a known type which is not shown for the sake of simplicity.

[0015] The supporting structure 2 further supports, so that it can slide along a preferably horizontal path indi-

cated by the arrow 16, parallel to the sliding path of the first assembly 3, a second assembly 5 whose mass is suitable to counterbalance the mass of the first assembly 3.

[0016] The machine is provided with means for the synchronized actuation of the first assembly 3 and of the second assembly 5 along the corresponding sliding paths 6 and 16 with respect to the supporting structure 2.

[0017] According to the invention, the first assembly 3 and the second assembly 5 are arranged one above the other and the sliding path 16 of the second assembly 5 is parallel and vertically spaced with respect to the sliding path 6 of the first assembly 3.

[0018] The second assembly 5 is preferably arranged below the first assembly 3.

[0019] More particularly, the first assembly 3 is mounted on a slider 7 which slidingly engages a dovetail guide 8 which is rigidly coupled to the supporting structure 2 and runs parallel to the sliding path 6.

[0020] The actuation means for the first assembly 3 comprise a gearmotor 9 which is supported by the footing of the machine and is connected, for example by means of a belt transmission 10, to a pulley 11 which is keyed on an end of a first shaft 12.

[0021] The shaft 12 is supported by the supporting structure 2, so that it can rotate about its own axis 12a, for example by interposing bearings 13a and 13b. The axis 12a of the first shaft 12 is arranged horizontally and is perpendicular to the sliding path 6.

[0022] The first shaft 12 has, proximate to the end that lies opposite to the end on which the pulley 11 is keyed, an eccentric portion 14 which is connected to the first assembly 3 for example by means of a link rod 15.

[0023] The second assembly 5 is slidingly mounted on guiding bars 17a and 17b which are rigidly coupled to the supporting structure 2 of the machine and run parallel to the sliding path 16.

[0024] The sliding of the second assembly 5 along the guiding bars 17a and 17b is achieved by means of a second shaft 18 which is arranged below the first shaft 12 and is orientated so that its axis 18a is parallel to the axis 12a of the first shaft 12.

[0025] The second shaft 18 is supported, so that it can rotate about the corresponding axis 18a, by the supporting structure 2 for example by means of a pair of bearings 19a and 19b. The second shaft 18 too has, proximate to one of its axial ends, an eccentric portion 20 which is connected to the second assembly 5 for example by means of a link rod 21.

[0026] The first shaft 12 and the second shaft 18 are kinematically mutually connected so that the actuation of the first shaft 12 also causes the synchronized actuation of the second shaft 18 in the opposite direction.

[0027] The kinematic connection of the first shaft 12 to the second shaft 18 is provided by a first gear 22 which is keyed on an intermediate portion of the first shaft 12 and meshes with a second gear 23 which is keyed on the second shaft 18.

[0028] The machine further comprises a pair of wire feeding rollers 24 and 25 which are orientated so that their axes are parallel to the axes of the shafts 12 and 18.

[0029] In front of the support 4, the supporting structure 2 supports a die 26 in which the forming cavities for the wire fed by the rollers 24 and 25 are provided.

[0030] Said die 26 is rigidly coupled to a star conveyor 27 which can rotate, with respect to the supporting structure of the machine, about an axis which is parallel to the sliding paths 6 and 16.

[0031] The star conveyor 27 and therefore the die 26 are actuated with an intermittent rotary motion about their own axis, for example by means of an hourglass-shaped cam 28, so as to cyclically place a forming cavity or a set of forming cavities in front of the punch or set of punches supported by the support 4.

[0032] For the sake of completeness in description, it should be noted that the machine is further provided with a conventional punch extractor 40 which is not described further for the sake of brevity.

[0033] With reference to Figure 3, which illustrates the kinematic layout that mutually and synchronously connects the various elements of the machine, it can be noted that the various elements of the machine are connected to the first shaft 12 and therefore to the gearmotor 9 by means of a gear train.

[0034] More particularly, in addition to the first gear 22 and to the second gear 23, which mesh together and provide the connection of the first shaft 12 to the second shaft 18, there is provided a third gear 44 which meshes with the second gear 23 and is rigidly coupled to a fourth gear 45 which meshes with a fifth gear 46. The fifth gear 46 is rigidly coupled to a sixth gear 47 which is rigidly coupled to the wire feed roller 25. The sixth gear 47 meshes with a seventh gear 48 which is rigidly coupled to the other wire feed roller 24.

[0035] The fifth gear 46 further meshes with an eighth gear 49 which actuates the extractor 40.

[0036] The third gear 44 meshes with a ninth idler gear 50, which in turn meshes with a tenth gear 51 which actuates the hourglass-shaped cam 28.

[0037] The operation of the machine according to the invention is as follows.

[0038] The rotary actuation of the first shaft 12, performed by the gearmotor 9, causes the reciprocating translatory motion of the first assembly 3 along the sliding path 6.

[0039] Simultaneously, owing to the connection between the first shaft 12 and the second shaft 18, the second assembly 5 is actuated with a reciprocating motion along the sliding path 16 in the opposite direction with respect to the translatory motion of the first assembly 3.

[0040] In this manner, the vibration generated by the reciprocating motion of the first assembly 3 along the sliding path 6 is counterbalanced and therefore damped by the vibration generated by the translatory motion of the second assembly 5 along the sliding path 16.

[0041] Owing to the fact that the second assembly 5

is arranged below the first assembly 3, the machine according to the invention, although ensuring excellent vibration damping during operation, has limited longitudinal dimensions.

[0042] The actuation of the first assembly 3 with a reciprocating motion causes the punches mounted on the support 4 to crop the material in wire form which is fed by the rollers 24 and 25 and to form the material by pressing inside the forming cavities provided in the die 26.

[0043] The formed parts are then extracted from the forming cavities provided in the die 26 and the die 26 is cyclically rotated about its own axis in order to place new forming cavities in front of the punch or punches supported by the support 4.

[0044] In practice it has been observed that the machine according to the invention fully achieves the intended aim and objects, since the particular mutually superimposed arrangement of the first assembly and of the second assembly allows to achieve optimum vibration damping while maintaining compact longitudinal dimensions for the machine.

[0045] This containment of the longitudinal dimensions of the machine allows to considerably simplify the kinematic chain that mutually connects the various elements of the machine.

[0046] The machine thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept; all the details may also be replaced with other technically equivalent elements.

[0047] In practice, the materials used, as well as the dimensions, may be any according to requirements and to the state of the art.

[0048] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A machine for cropping and press-forming material fed in wire form, comprising a supporting structure which slidingly supports a first assembly which comprises a support for at least one cropping and pressing punch, said supporting structure further slidingly supporting a second assembly whose mass is suitable to counterbalance the mass of said first assembly, means being provided for the synchronized actuation of said first assembly and of said second assembly with respect to said supporting structure with a reciprocating motion along a sliding path in mutually opposite directions, characterized in that said first assembly and said second assembly are arranged one above the other and in that the sliding path of said second assembly is parallel and vertically spaced with respect to the sliding path of said first assembly.

2. The machine according to claim 1, characterized in that said sliding paths are horizontal.

3. The machine according to claim 1, characterized in that said first assembly and said second assembly are kinematically connected to each other.

4. The machine according to one or more of the preceding claims, characterized in that it comprises a first shaft and a second shaft which are supported by said supporting structure so that they can rotate about their respective axes; said shafts being arranged so that their axes are substantially perpendicular to the sliding path of said first assembly and of said second assembly; said two shafts being provided with an eccentric portion which is respectively connected to said first assembly and to said second assembly; said two shafts being mutually vertically spaced and being mutually connected in their rotation about their respective axes by means of a pair of gears.

5. The machine according to one or more of the preceding claims, characterized in that said actuation means comprise a single gearmotor which is connected to said first shaft or to said second shaft.

6. The machine according to one or more of the preceding claims, characterized in that it comprises at least one pair of rollers for the intermittent feeding of the wire which are supported by said supporting structure so that they can rotate about their respective axes and are kinematically connected to said first shaft or to said second shaft.

7. The machine according to one or more of the preceding claims, characterized in that it comprises a forming die which can rotate intermittently about an axis which is parallel to said actuation paths in order to cyclically make at least one forming cavity face said at least one punch; said forming die being kinematically connected to said first shaft or to said second shaft.

8. The machine according to one or more of the preceding claims, characterized in that it comprises punch extraction means which are kinematically connected to said first shaft or to said second shaft.

Fig. 1

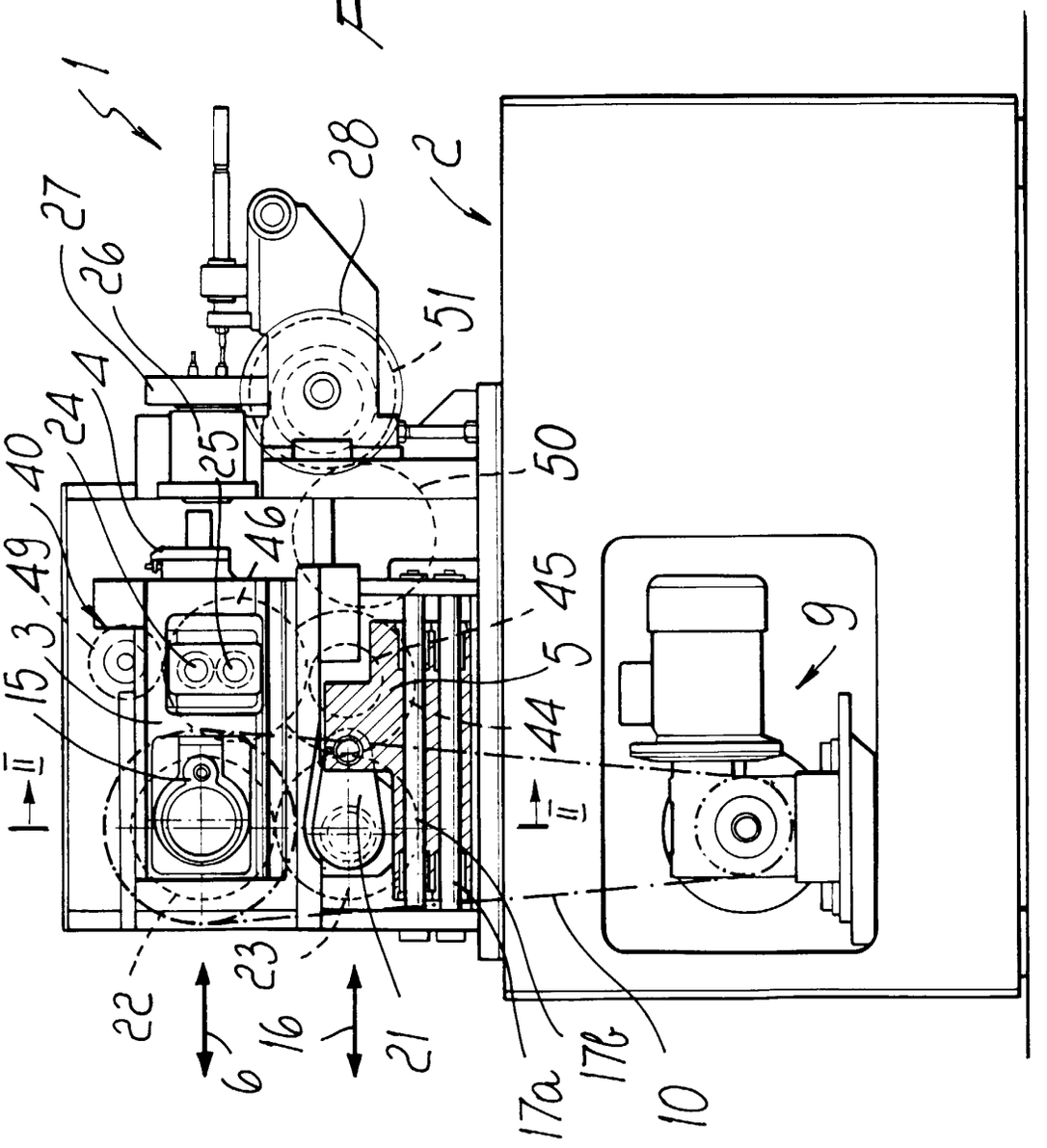
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Fig. 2

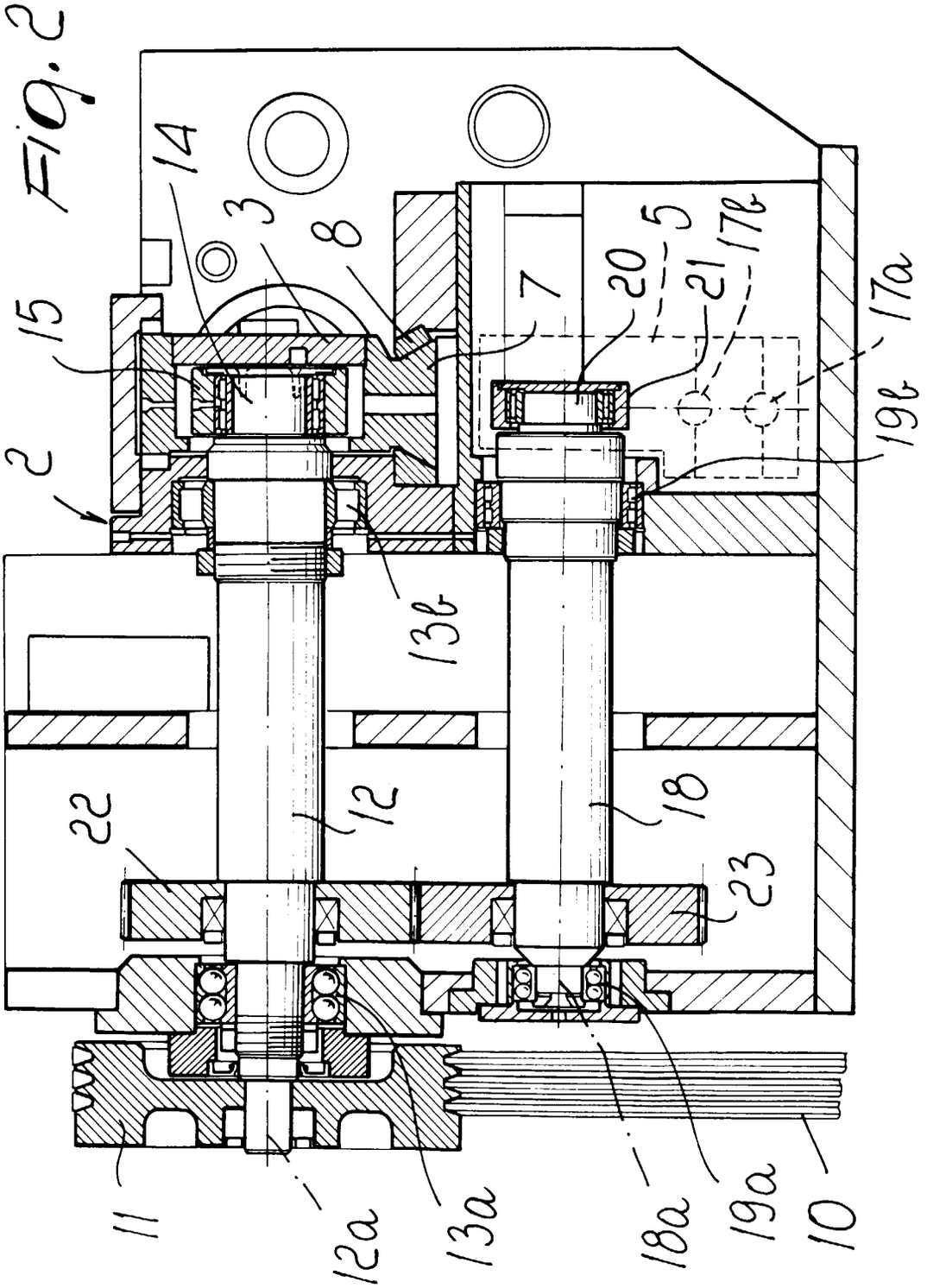
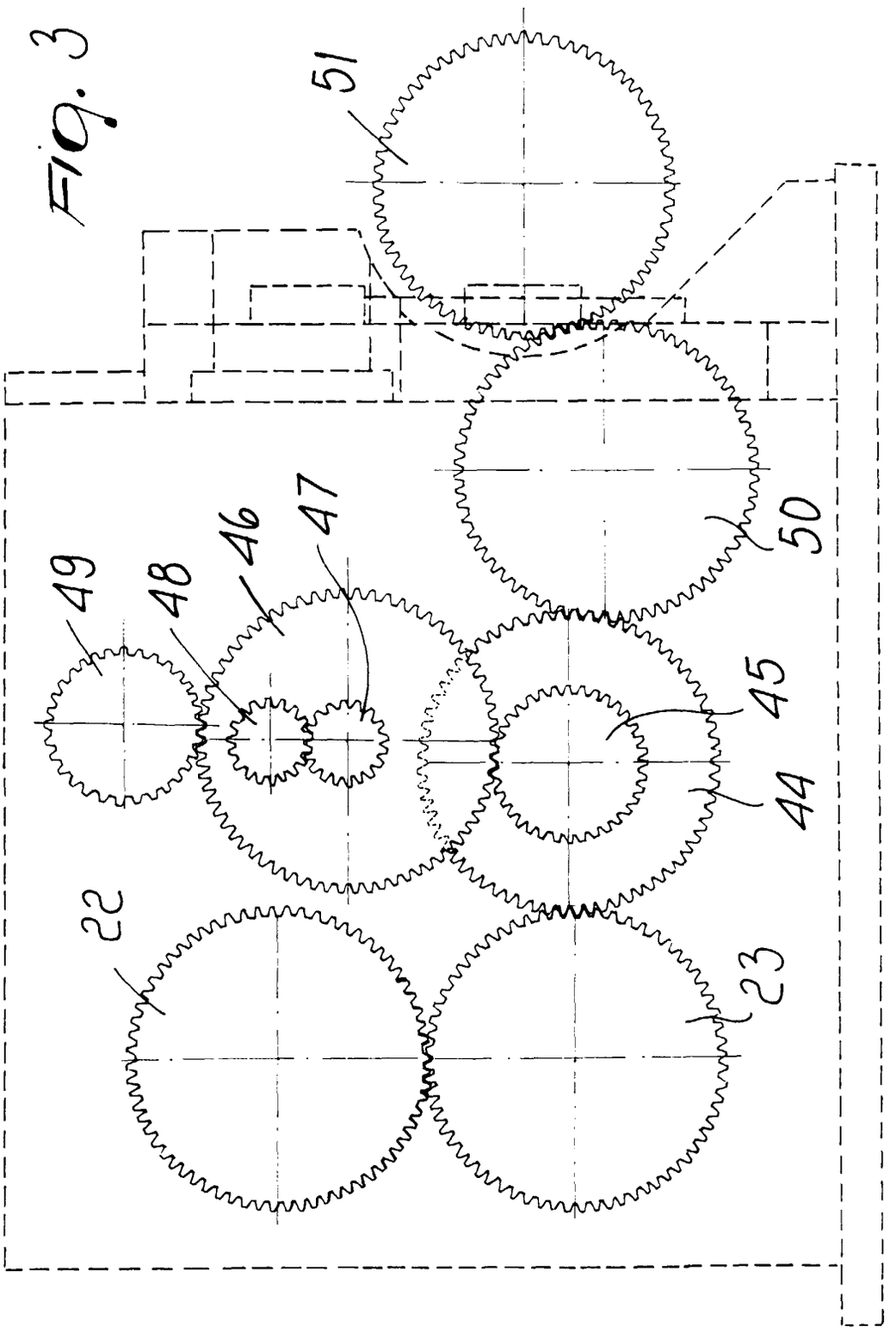


Fig. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 99 10 3978

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TECHNICAL FIELDS SEARCHED

B21K
B21J
F16F
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	5 August 1999	Barrow, J

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