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(71) Applicant: **Castiglioni, Albino**
CH-6900 Lugano (CH)

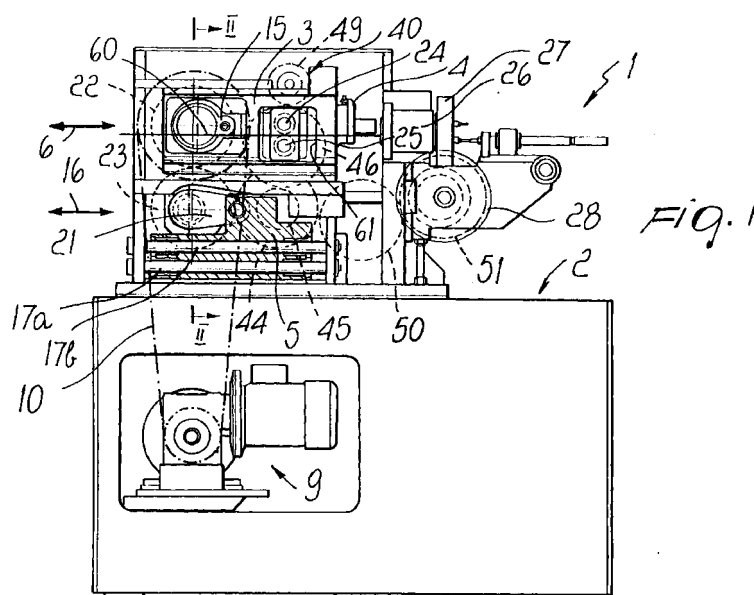
(72) Inventor: **Castiglioni, Albino**
CH-6900 Lugano (CH)

(74) Representative:
Modiano, Guido, Dr.-Ing. et al
Modiano & Associati SpA
Via Meravigli, 16
20123 Milano (IT)

(54) **Machine for cutting and press-forming material fed in the form of wire**

(57) A machine (1) for cutting and press-forming material fed in the form of wire, which comprises a supporting structure (2) which supports elements (24,25) for intermittently feeding material in the form of wire (60) in an advancement direction. The supporting structure (2) supports, so as to allow sliding in a first sliding direction which is substantially parallel to the advancement direction, a first assembly (3) which is provided with a holder (4) for at least one punch which faces a forming die. Elements for cutting the material in the form of wire

fed by the feeder into segments of preset length are arranged between the forming die and the at least one punch. Actuators are provided for actuating the first assembly (3) with a reciprocating motion along the first sliding direction with respect to the supporting structure (2). The feeder comprises at least one pair of counter-rotating rollers (24,25) which are arranged within the dimensions of the first assembly (3) in a direction which is parallel to the first sliding direction.



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Description

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

[0002] Conventional machines are capable of cutting and press-forming material fed to the machine in the form of wire in order to produce small mechanical parts such as rivets or the like, for example as disclosed in EP 78.775.

[0003] These machines are generally constituted by a supporting structure which supports, so as to allow sliding in a substantially horizontal direction, an assembly which is provided with a holder for one or more pressing punches which face a die in which adapted forming cavities are formed. The holder of the press-forming punches is actuated with a reciprocating translatable motion so as to sequentially press-form segments of wire of preset length which are cut and inserted in the forming cavities of the die.

[0004] The die is usually actuated so as to rotate intermittently about a substantially horizontal axis so as to cyclically arrange several forming cavities in front of the punch or punches supported by the holder, which performs a reciprocating translatable motion.

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

[0006] Accordingly, in view of the mass of the assembly that supports the holder of the press-forming punches, intense vibrations are generated and discharged onto the supporting structure of the machine.

[0007] In order to solve the problem of vibrations, EP 138.758 disclosed a machine provided with a second assembly which has the same characteristics and mass as the assembly that supports the press-forming punch holder and is arranged along the same line. In practice, the first and the second assembly are slideable with respect to the supporting structure of the machine in a same direction and are actuated, in this sliding direction, in step but with mutually opposite directions of translatable motion. In this manner, the translatable motion of the second assembly perfectly counterbalances the vibrations generated by the translatable motion of the first assembly.

[0008] The material in the form of wire is fed to the die by means of a pair of counter-rotating feeder rollers arranged upstream of the assembly that actuates the holder of the punch or punches with an intermittent translatable motion, in the direction along which the holder advances toward the die.

[0009] Consequently, the distance between the feeder rollers and the region at which the wire is cut and shaped is relatively large, and in the case of wire having a small diameter or low resistance to deformation the wire can undergo an undesirable deformation in this region, and may cause problems in the correct opera-

tion of the machine thus limiting its actuation speed and therefore its productivity.

[0010] The aim of the present invention is to solve the above problems, providing a machine for cutting and press-forming material fed in the form of wire which effectively avoids deformation of the fed wire even in case of wire having a small diameter or low resistance to deformation.

[0011] Within the scope of this aim, an object of the invention is to provide a machine which, by assuredly avoiding deformation of the fed wire, can achieve high actuation speeds without any problem and can therefore achieve higher productivity.

[0012] Another object of the invention is to provide a machine which reduces the vibrations within acceptable limits in despite of reduced overall longitudinal dimensions.

[0013] Another object of the invention is to provide a machine for cutting and press-forming material fed in the form of wire in which the kinematic system used to synchronize the movements of the various elements that compose the machine is relatively simple.

[0014] Another object of the invention is to provide a machine which is structurally simple, can be manufactured at competitive costs and ensures high reliability in operation.

[0015] This aim, these objects and others which will become apparent hereinafter are achieved by a machine for cutting and press-forming material fed in the form of wire, comprising a supporting structure which supports means for intermittently feeding material in the form of wire in an advancement direction; said supporting structure supporting, so as to allow sliding in a first sliding direction which is substantially parallel to said advancement direction, a first assembly which is provided with a holder for at least one punch which faces a forming die; means for cutting the material in the form of wire fed by said feeder means into segments of preset length being arranged between said forming die and said at least one punch; means being provided for actuating said first assembly with a reciprocating motion along said first sliding direction with respect to said supporting structure; characterized in that said feeder means comprise at least one pair of counter-rotating rollers which are arranged within the dimensions of said first assembly in a direction which is parallel to said first sliding direction.

[0016] Further characteristics and advantages of the invention will become apparent from the 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 partially sectional schematic 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 schematic view of the kinematic system for the synchronized actuation of the various elements that compose the machine according to the invention.

[0017] 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 as to allow sliding in a first preferably horizontal sliding direction designated by the arrow 6, a first assembly 3 which is provided with a holder 4 for at least one conventional punch which is not shown for the sake of simplicity.

[0018] The supporting structure 2 also supports, so as to allow sliding in a second preferably horizontal sliding direction, which is designated by the arrow 16 and is parallel to the first sliding direction 6 of the first assembly 3, a second assembly 5 whose mass is adapted to counterbalance the mass of the first assembly 3.

[0019] The machine is provided with means for the synchronized actuation of the first assembly 3 and of the second assembly 5 in the corresponding sliding directions 6 and 16 with respect to the supporting structure 2.

[0020] The first assembly 3 and the second assembly 5 are preferably arranged one above the other and the sliding direction 16 of the second assembly 5 is parallel to, and vertically spaced from, the sliding direction 6 of the first assembly 3.

[0021] Preferably, the second assembly 5 is arranged below the first assembly 3.

[0022] More particularly, the first assembly 3 comprises a slider 7 which slidably engages a dovetail guide 8 which is rigidly coupled to the supporting structure 2 and runs parallel to the sliding direction 6.

[0023] The means for actuating 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 drive 10, to a pulley 11 which is keyed to one end of a first shaft 12.

[0024] 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 at right angles to the sliding direction 6.

[0025] The first shaft 12 has, proximate to its end that lies opposite the end to which the pulley 11 is keyed, an eccentric portion 14 which is connected to the first assembly 3 for example by means of a linkage 15.

[0026] The second assembly 5 is slideably fitted on guiding bars 17a and 17b which are rigidly coupled to the supporting structure 2 of the machine and run parallel to the sliding direction 16.

[0027] 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.

[0028] 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 two bearings 19a and 19b. The second shaft 18 also is provided, proximate to one of its axial ends, with an eccentric portion 20 which is connected, for example by means of a linkage 21, to the second assembly 5.

[0029] The first shaft 12 and the second shaft 18 are kinematically connected to each other so that the actuation of the first shaft 12 also produces the actuation of the second shaft 18 in step but with an opposite direction of rotation.

[0030] The kinematic connection of the first shaft 12 to the second shaft 18 is performed 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.

[0031] The machine according to the invention comprises means for feeding the material in the form of wire 60 in an advancement direction which is substantially parallel to the first sliding direction 6. Said means for feeding the wire 60 are constituted by at least one pair of rollers 24 and 25 which are orientated so that their axes are parallel to the axes of the shafts 12 and 18.

[0032] In front of the holder 4, the supporting structure 2 supports a forming die 26 in which the forming cavities for the wire 60 fed by the rollers 24 and 25 are formed.

[0033] The die 26 is rigidly coupled to a star 27 which can rotate, with respect to the supporting structure of the machine, about an axis which is parallel to the sliding directions 6 and 16.

[0034] The star 27 and therefore the die 26 are actuated with an intermittent rotary motion about their own axis, for example by means of an hourglass cam 28, so as to periodically arrange a forming cavity or a set of forming cavities in front of the punch or set of punches supported by the holder 4.

[0035] According to the invention, the means for feeding material in the form of wire 60, constituted by at least one pair of counter-rotating rollers 24 and 25, are arranged within the dimensions of the first assembly 3 in a direction which is parallel to the first sliding direction 6.

[0036] More particularly, the rollers 24 and 25 are advantageously arranged between the holder 4 for the punch or punches and the first shaft 12, which is spaced from the end of the slider 7 that supports the holder 4 and is directed toward the die 26.

[0037] Conveniently, the rollers 24 and 25, which are arranged so that their axes are perpendicular to the first sliding direction 6 and are supported so that they can rotate about said axes by the supporting structure 2, are arranged in a compartment 61 which is formed in the body of the slider 7 and has dimensions which allow the free alternating translatory motion of the slider 7 in the direction 6 despite the presence of said rollers.

[0038] The rollers 24 and 25, which can be provided substantially as disclosed in EP 78.775 in order to ensure intermittent advancement of the material in the form of wire 60 despite continuous rotation about their respective axes, are kinematically connected to the first shaft 12, as will become apparent hereinafter.

[0039] For the sake of completeness in description, it should be noted that the machine is also provided with a conventional punch extractor 40 which is not described further for the sake of brevity.

[0040] With reference to Figure 3, which illustrates the kinematic layout that mutually connects the various elements of the machine so that they are synchronized, 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.

[0041] More particularly, in addition to the first gear 22 and to the second gear 23, which mesh together and connect the first shaft 12 to the second shaft 18, there is 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 roller 25 for feeding the wire 60. The sixth gear 47 meshes with a seventh gear 48 which is rigidly coupled to the other roller 24 for feeding the wire 60.

[0042] The fifth gear 46 furthermore meshes with an eighth gear 49 which actuates the extractor 40.

[0043] The third gear 44 meshes with a ninth idler gear 50, which in turn meshes with a tenth gear 51 which actuates the hourglass cam 28.

[0044] The operation of the machine according to the invention is as follows.

[0045] The rotary actuation of the first shaft 12, provided by the gearmotor 9, causes the reciprocating translatory motion of the first assembly 3 in the sliding direction 6.

[0046] At the same time, due to the connection between the first shaft 12 and the second shaft 18, the second assembly 5 is actuated with a reciprocating motion in the sliding direction 16 with the opposite orientation with respect to the translatory motion of the first assembly 3.

[0047] In this manner, the vibrations generated by the reciprocating motion of the first assembly 3 along the sliding direction 6 are counterbalanced and thus damped by the vibrations generated by the translatory motion of the second assembly 5 along the sliding direction 16.

[0048] Simultaneously with the translatory motion of the assemblies 3 and 5, due to the above-described kinematic connections the material in the form of wire 60 is pushed by the rollers 24 and 25 intermittently toward the die 26. The material in the form of wire 60 is cut, in each instance, by cutting means which are interposed between the holder 4 and the die 26, which are known for example from EP-78.775 and not shown for the sake of simplicity, and is arranged inside the forming

cavities, where it is pressed and formed by the advancement of the punch or punches supported by the holder 4 due to the advancement of the first assembly 3 toward the die 26.

[0049] 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 offer new forming cavities in front of the punch or punches supported by the holder 4.

[0050] It should be noted that the particular arrangement of the rollers 24 and 25 for feeding the material in the form of wire 60, closer to the die 26 than in conventional machines, effectively avoids deformation of the wire 60 due to the thrust of the rollers 24 and 25 even in the case of a wire 60 having a small diameter or low resistance to deformation.

[0051] In practice it has been observed that the machine according to the invention fully achieves the intended aim, since the particular arrangement of the means for feeding the material in the form of wire effectively avoids deformation of the wire during feeding and therefore achieves high operating precision even at high operating speeds.

[0052] 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 furthermore be replaced with other technically equivalent elements.

[0053] In practice, the materials used, as well as the dimensions, may be any according to requirements and to the state of the art.

[0054] The disclosures in European Patent Application No. 99103978.5 from which this application claims priority are incorporated herein by reference.

[0055] 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 cutting and press-forming material fed in the form of wire, comprising a supporting structure which supports means for intermittently feeding material in the form of wire in an advancement direction; said supporting structure supporting, so as to allow sliding in a first sliding direction which is substantially parallel to said advancement direction, a first assembly which is provided with a holder for at least one punch which faces a forming die; means for cutting the material in the form of wire fed by said feeder means into segments of pre-set length being arranged between said forming die and said at least one punch; means being provided for actuating said first assembly with a reciprocating

motion along said first sliding direction with respect to said supporting structure; characterized in that said feeder means comprise at least one pair of counter-rotating rollers which are arranged within the dimensions of said first assembly in a direction which is parallel to said first sliding direction.

2. The machine according to claim 1, characterized in that said first assembly comprises a first slider which is supported by said supporting structure so that it is slideable along said first sliding direction, said actuation means comprising a first shaft which is supported by said supporting structure so that it is rotatable about its own axis and is orientated so that its axis is perpendicular to said first sliding direction; said first shaft having an eccentric portion which is kinematically connected to said slider of the first assembly; said first shaft being spaced with respect to the end of said first slider that supports said holder for at least one punch which is directed toward said forming die; said feeder rollers being orientated so that their axes are perpendicular to said first sliding direction and being arranged between said first shaft and said holder for at least one punch.
3. The machine according to claim 1, characterized in that said counter-rotating rollers of the feeder means are arranged in a compartment formed in the body of said first slider.
4. The machine according to one or more of the preceding claims, characterized in that said counter-rotating rollers are kinematically connected to said first shaft.
5. The machine according to one or more of the preceding claims, characterized in that said supporting structure also supports, so as to allow sliding in a second sliding direction which is parallel to said first sliding direction, a second assembly whose mass is adapted to counterbalance the mass of said first assembly; said actuation means being kinematically connected to said second assembly for its actuation along said second sliding direction in step and so as to move in the opposite direction of translatory motion with respect to the actuation of said first assembly relative to said supporting structure.
6. The machine according to one or more of the preceding claims, characterized in that said first assembly and said second assembly are arranged one above the other and in that the sliding direction of said second assembly is parallel to, and vertically spaced from, the sliding direction of said first assembly.
7. The machine according to one or more of the pre-

ceding claims, characterized in that said sliding directions are horizontal.

8. The machine according to claim 1, characterized in that said first assembly and said second assembly are kinematically connected to each other.
9. The machine according to one or more of the preceding claims, characterized in that it comprises a second shaft which is supported by said supporting structure so that it can rotate about its own axis, said second shaft being arranged so that its axis is substantially perpendicular to said second sliding direction, said second shaft being provided with an eccentric portion which is connected to said second assembly, said second shaft being vertically spaced with respect to said first shaft; said first shaft and said second shaft being mutually connected in their rotation about their respective axes by means of a pair of gears.
10. 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.
11. The machine according to one or more of the preceding claims, characterized in that said forming die can rotate intermittently about an axis which is parallel to said sliding directions 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.

