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(54) **METHOD AND APPARATUS FOR DETERMINING AND SETTING MATERIAL RELEASE MECHANISM TIMING FOR A MATERIAL FEED MECHANISM**

VERFAHREN UND VORRICHTUNG ZUR BESTIMMUNG UND EINSTELLUNG DES MATERIALFREIGABEMECHANISMUS-ZEITPUNKTS FÜR EINEN MATERIALZUFÜHRMECHANISMUS

PROCEDE ET APPAREIL PERMETTANT DE DETERMINER ET D'ETABLIR LA SYNCHRONISATION D'UN MECANISME DE LIBERATION DE MATERIAU D'UN MECANISME D'INJECTION DE MATERIAU

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates generally to stamping systems having material feed mechanisms and, in particular, to a method and apparatus for determining and setting a material release mechanism timing for a material feed mechanism.

2. Description of the Prior Art

[0002] Typically, parts made with an automated stamping press utilize a progressive die set. The progressive die set uses multiple stations, each station typically containing at least one piercing or forming punch and a mating die or dies. Continuous strip material, from which the part will be made, is incrementally fed through the die set, progressing from station to station with an automated feeding device. A material feed mechanism intermittently moves the strip material a distance, corresponding to the distance between each die station, while the die set is open. This mechanism then stops the material at each station when the die set closes. Examples of prior art material feed mechanisms may be found in U.S. Patent Nos. 5,755,370; 5,868,296; 5,915,293; and 5,808,465.

[0003] Alignment devices are commonly used in a progressive die set to position the strip in the die set for each subsequent operation more accurately than is possible with the material feed mechanism. The most commonly used and most easily understood alignment device is a tapered or beveled point pilot positioning pin or a plurality of such pins. The pilot positioning pin is mounted in the moving, usually the upper, die shoe. Typically, a hole of slightly larger diameter than the diameter of the pilot positioning pin is pierced in the continuous strip material in a first station during the first closure of the die. The automated material feed mechanism then moves the material a predetermined distance corresponding to the distance between subsequent die stations. Upon subsequent die closures, the pilot positioning pin, which is longer in length than the working punches, enters the hole created by the punch and locates the material accurately.

[0004] Pilot positioning pins may be used at any number of subsequent die stations. In order for the pilot positioning pin, or other alignment device, to effectively position the material accurately, the material feed mechanism must relinquish its grip on the strip material. The timing of the release function of the material feed mechanism is critical, as premature release may allow the material to move out of position too far for the pilot positioning pin to be effective. Alternatively, if the material feed mechanism releases the strip material too late or not at all, tension will be developed in the strip material when the pilot positioning pin enters the hole. This may cause hole deformation with resulting improperly positioned material. This improperly positioned material will cause the manufacture of malformed parts and can damage the pilot positioning pin as well as the die set.

[0005] Various methods of releasing the strip material from the material gripping mechanism are well known in the prior art. Typically, these methods utilize cams, air cylinders, or various other devices. Technology currently exists for both setting and maintaining precise material release mechanism timing between the material feed mechanism and the stamping press. For example, see United States Patent No. 5,720,421. Furthermore, this technology provides for infinite variation in release timing, as well as a convenient means for adjusting this timing. However, no technology exists for determining the precise press slide or press mechanism position when the alignment device contacts the material and the material gripping mechanism release should occur.

[0006] . Determining the precise point in the press stroke when the material feed mechanism should release its grip on the strip material is difficult due to two primary problems. First, the alignment device is typically located in a position which makes it difficult or impossible to visually inspect. Second, the nature of a flywheel driven mechanical stamping press makes it difficult to precisely position the press slide in small increments. The process of moving the press slide in small incremental movements is called "inching" or "jogging" and is accomplished by repeated engagement of the press clutch for short periods of time. This causes a motion that is very erratic and makes it difficult to precisely position the press slide, in order to verify the correct position of the alignment device relative to the strip material. The difficult nature of the current methods is best illustrated by example.

[0007] Current methods exist for determining and setting the correct material release mechanism timing, but these methods typically require the press operator to locate the material in the die in a position which will allow the piercing of the initial locating hole. The operator must then effect movement of the press ram, to close the die, piercing the locating hole in the material. The material is then progressed a single progression, thereby positioning the material correctly to allow the alignment device to contact the material on a subsequent closure of the die. The operator then "inches" or "bars" the press to the point at which the material alignment device begins to contact the material. The point at which the material alignment device begins contact with the material is determined visually or, alternatively, by grasping the material in hand, moving or trying to move the material, and feeling for resistance to movement of the material provided by the alignment device. Having determined the press position where the material alignment device begins to contact the material, the operator then adjusts the material feed mechanism to release the hold on the material at this point or slightly before this point in the press stroke. This process is then repeated and adjustments are made until proper timing of the material release mechanism is

verified.

United States Patent No. 4,788,908 to Sugiyama, et al. describes an automatic release timing control system for use with a press and a cooperating feeder for feeding a web of sheet material wherein a sheet release timing and a sheet grip timing of a release mechanism in the feeder are corrected in response to the varying revolution of the press and the response time of the release mechanism, so that, even when the working speed of the press is high, the sheet releasing operation and the sheet gripping operation of the release mechanism can follow up the working speed of the press.

SUMMARY OF THE INVENTION

[0008] It is, therefore, an object of the present invention to provide a method for determining the correct timing of the material release mechanism. It is another object of the present invention to provide a method for setting the correct timing of the material release mechanism. It is a further object of the present invention to provide an automated system for accurately determining release mechanism timing. It is a still further object of the present invention to provide a method and apparatus that is capable of disengaging contact with a material immediately prior to engagement by an alignment device.

The present invention is directed to a stamping system according to claim 1.

[0009] The present invention includes also a method for determining the correct timing of a material release mechanism of a material feed mechanism, according to claim 9.

[0010] The present invention, both as to its construction and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Fig. 1 is a side schematic view of a stamping system according to the present invention;

[0012] Fig. 2 is a front view of a material feed mechanism of the stamping system in Fig. 1;

[0013] Fig. 3 is an edge view of the material feed mechanism in Fig. 2;

[0014] Fig. 4 is a side schematic view of a tooling mechanism according to the present invention;

[0015] Fig. 5 is a flow diagram of a method according to the present invention; and

[0016] Fig. 6 is a graph of press mechanism position versus material position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0017] As illustrated in Figs. 1-3, the present invention is directed to a stamping system 10, which includes a press mechanism 12, a material feed mechanism 14 and a material dispenser 16. The material feed mechanism 14 is used to feed an elongated strip of material 18 from the material dispenser 16 through the material feed mechanism 14 and into the press mechanism 12. This press mechanism 12 typically includes a tooling mechanism 17 having an upper die shoe 20 and lower die shoe 22. The upper die shoe 20 is mounted to a press slide 24 in the press mechanism 12. The upper die shoe 20 of the tooling mechanism 17 has a punching device 26 and an alignment device 28 mounted on its underside. The punching device 26 is constructed so that it is capable of piercing or punching the material 18. In the preferred embodiment, the alignment device 28 is a pilot positioning pin 30. As discussed above, this upper die shoe 20 is mounted to the press slide 24 which, in turn, moves up and down in relation to the lower die shoe 22. The lower die shoe 22 of the tooling mechanism 17 is mounted to a bolster plate 32 rigidly mounted to a fixed press bed 34.

[0018] The material 18, typically, but not exclusively, in the form of a continuous strip, is fed to and moves between the upper die shoe 20 and the lower die shoe 22. Further, the press mechanism 12 also includes a driver having a crankshaft 36 to drive or move the press slide 24 towards and away from the lower die shoe 22, as represented by arrow A. As detailed in Figs. 1-3, the material feed mechanism 14 includes a feed drive roll motor 38, typically a servo motor, to power and drive the feed drive roll 40, which advances the material 18 through the material feed mechanism 14.

[0019] A material release mechanism 42 includes a material gripping mechanism 44, which works along with the feed drive roll 40 to grip the material 18. Typically, this material gripping mechanism 44 is a secondary drive roll. The material gripping mechanism 44 is mounted in a pivot frame 46, which is pivotably mounted to a material feed mechanism frame 48. The material release mechanism 42 also includes an actuator 50, typically pneumatic, capable of applying downward pressure on the pivot frame 46, thereby allowing the material gripping mechanism 44 to grip the material 18 between the material gripping mechanism 44 and the feed drive roll 40.

[0020] As seen in Fig. 3, it is also envisioned that the material feed mechanism 14 includes a motor 52 to drive a release screw 54, which mates with a nut 56, for effecting the movement of the pivot frame 46 against the force of actuator 50. It is this release screw 54 and nut 56 arrangement which allows the material gripping mechanism 44 to move away from the feed drive roll 40, thereby releasing the grip pressure on the strip material 18.

[0021] In order to determine a desired material release mechanism timing, the stamping system 10 also includes a location device 58. In the preferred embodiment, this location device 58 includes a controller 60 that monitors the press mechanism 12 position and determines the desired timing for the material release mechanism 42 to

release contact with the material 18. Further, this controller 60 can perform the correlation between the desired material release mechanism 42 timing to the press mechanism 12 position. It is also envisioned that the location device 58 include a first feedback device 62 to monitor, collect and transmit information regarding the press mechanism 12, as well as its parts, to the controller 60. Similarly, a second feedback device 64 may be used to monitor, collect and transmit information regarding the material feed mechanism 14, and its parts, to the controller 60.

[0022] In a preferred embodiment, the location device 58 uses the first feedback device 62 to monitor the crankshaft 36 of the press mechanism 12. Next, this first feedback device 62 communicates the angular position information of the crankshaft 36 to the controller 60. The second feedback device 64 is mounted to the feed drive roll motor 38 and is used to monitor and communicate the angular position of the feed drive roll motor 38 to the controller 60. Finally, the controller 60 computes position error information based on the required motion of the feed drive roll motor 38, and the measured actual motor angular position. Controller 60 may also compute the required torque command for the feed drive roll motor 38, based on the position error information computed above. This torque command is sent to the motor 38. Also, the required torque commands, by definition, may be used and/or referred to as the measured torque of the motor 38. Although the location device 58 has been described as monitoring the specific equipment discussed above, it is envisioned and discussed in greater detail hereinafter, that this location device 58 may be used to monitor and determine the desired material release mechanism 14 timing and press mechanism 12 position based upon any of the physical characteristics of the stamping system IO parts and equipment, including the feed mechanism and the press itself.

[0023] As illustrated in Fig. 5, the present invention also includes a method for determining the correct timing of the material release mechanism 14. In order to determine this timing, the press mechanism 12 is cycled through the working portion of the alignment device 28 of the tooling mechanism 17. The press mechanism 12 position is monitored. The above-described location device 58 may be used to determine the desired timing for the material release mechanism 42 to release contact with the material 18. Typically, the desired timing for release is immediately prior to contact with the material 18 by the alignment device 28, or in this embodiment, the pilot positioning pin 30. Next, the determined desired material release mechanism 14 timing is correlated to the press mechanism 12 position. Overall, this will allow the material release mechanism 42 to disengage the material 18,allow the pilot positioning pin 30 to contact the material 18 and align it, before the material gripping mechanism 44 again contacts the material 18 and the material feed mechanism 14 continues the feed. After the desired timing has been determined, the actual material release mechanism 42 timing may be adjusted to the determined desired material release mechanism 42 timing.

[0024] In the preferred embodiment, the strip material 18 is positioned with the leading edge through the first die station, containing the punching device 26. The press mechanism 12 is then cycled through one complete press stroke, with the punching device 26 piercing or punching a hole 66 into the strip material 18. The material 18 is then advanced by the material feed mechanism 14 a predetermined distance, short of the die progression. This will position the material 18, such that the pilot positioning pin 30 is located substantially above the previously punched hole 66, but slightly misaligned. This condition is illustrated in Fig. 4, with the misalignment greatly exaggerated. In practice, this misalignment is small, typically only 0.0762 mm (.003 inches) to 0.2032 mm (.008 inches).

[0025] The next step is to cycle the press mechanism 12 through the worming portion of the alignment device 28, and typically through a complete press stroke, while the controller 60 simultaneously monitors the position of the feed drive roll motor 38. When the upper die shoe 20 closes, the pilot positioning pin 30 enters the prepunched hole 66, and the material 18 is forced into a final aligned position. This causes movement of the material gripping mechanism 44 and the feed drive roll motor 38, which are gripping the material 18. When the press cycle is complete, the controller 60 analyzes the information gathered and correlates the movement of the material release mechanism 42 (including the material gripping mechanism 44) and the feed drive roll motor 38 to the position of the press mechanism 12, thereby determining the press mechanism 12 position where the pilot positioning pin 30 entered the strip 18. An example of this correlated data is shown in Fig. 6. Finally, the material feed mechanism 14, specifically the material release mechanism 42, is programmed to release the material 18 at the calculated press mechanism 12 position for subsequent press cycles. In this preferred embodiment, the controller 60 automatically sets the correct release point and stores the information for future use.

[0026] The pilot positioning pin 30 has a guide end 68, which is typically beveled. When the press mechanism 12 enters the working portion of the tooling mechanism 17, the guide end 68 of the pilot positioning pin 30 is partially engaged with the hole 66. Due to the misalignment, a side wall of the guide end 68 contacts an inner edge of the hole 66, such that the material 18 is moved along a first axis (arrow B) as the side wall of the guide end 68 continues through the hole 66. The desired material release mechanism 42 timing is based upon the linear movement of the material 18 along this first axis B. Further, the linear movement of the material 18 along this first axis B after the guide end 68 has fully engaged the hole 66 may be measured. The linear movement of the material 18 may then be correlated to the position of the press mechanism 12, to determine the desired material release mechanism 42 timing. It is also envisioned

that the angular rotation of the feed drive roll 40 caused by the linear movement of the material 18 may be correlated to the position of the press mechanism 12, to determine the desired material release mechanism 42 timing. If the press mechanism 12 includes a press ram, the linear movement of the press ram position may be measured and correlated to the movement of the material 18, to determine the desired material release mechanism 42 timing.

[0027] It is also envisioned that the disturbance force produced upon contact of the pilot positioning pin 30 with the material 18 may be measured. As above, this measurement may be used to determine the desired material release mechanism 42 timing. The torque exerted upon the feed drive roll 40 after the guide end 68 of the pilot positioning pin 30 has fully engaged the hole 66 may also be measured. Similarly, the force exerted upon the material gripping mechanism 44 may be measured. These measurements may then be used to determine the desired material release mechanism 42 timing. Material 18 movement at the material dispenser 16 may also be measured and used to determine the desired material release mechanism 42 timing. The torque exerted upon the feed drive roll 40, the force exerted upon the material gripping mechanism 44, as well as the feed drive roll motor 38 - position-error may all be used to determine the desired material release mechanism 42 timing. It is envisioned that the controller 60, together with appropriate feedback devices (62, 64) may be used to monitor, transmit, and calculate the desired release mechanism 42 timing based upon any of these measurements.

[0028] Overall, the present invention is a stamping system 10 and method for determining and adjusting the desired timing of a material release mechanism 42. When using the controller 60, the present invention is an automated system, which eliminates the prior art guesswork previously used by operators to set the material release mechanism 42 timing. This, in turn drastically increases productivity and reduces both operator error and possible operator safety concerns.

[0029] The present invention determines the precise press mechanism 12 (typically the press slide 24) position when the alignment device 28 is about to contact the material 18 and the material release should occur. It is this precise point in the press stroke when the material feed mechanism 14 should release its grip on the strip material 18. This precise point, as described in detail above, is determined by the controller 60 based upon the linear or angular movements of certain components and subcomponents of the stamping system 10. However, it is also envisioned that one or more sensors can be used and positioned adjacent or in the vicinity of the punching device 26 or the alignment device 28. Such sensors could sense contact or exact positioning of the alignment device 28 and/or the punching device 26, and this information could be used to determine the material release mechanism 42 timing. For example, the contact of either the punching device 26 or the alignment device 28 could be sensed when an electrical circuit is complete, thereby determining the timing for material 18 release. Also, sensors could be used to directly measure the movement of material 18 to determine the timing of material 18 release. Alternatively, the material 18 could be mechanically dithered (or moved back and forth) as the alignment device 28 is entering the hole 66. Using the forward and backward contact of sidewalls of the guide end 68 of the pilot positioning pin 30, the controller 60 could determine the material release mechanism 42 timing.

[0030] Furthermore, although the aforementioned preferred embodiments reference feed drive roll 38 and/or drive rolls in the material feed mechanism 14 and the material gripping mechanism 44, it is envisioned that the material feed mechanism 14 could utilize sliding gripper (s) for advancing the strip material 18 and/or sliding or stationary gripper(s), as a part of the material feed mechanism 14 and/or the material gripping mechanism 44 and/or as a part of the material release mechanism 42.

Claims

1. A stamping system (10) for working a material (18), comprising:

   a press mechanism (12) having a tooling mechanism (17) configured to punch holes in, or form shapes in, the material (18);
   a material feed mechanism (14) having a material release mechanism (42) and configured to feed the material (18) to the press mechanism (12);
   characterized in that the stamping system (10) also comprises a location device (58) configured to monitor the press mechanism position and sense contact between the press mechanism (12) and the material (18) and thereby determine a desired material release mechanism timing.

2. A stamping system according to claim 1, wherein the press mechanism further comprises a punch and die set.

3. A stamping system according to claim 2, wherein the punch and die set further comprises:

   a piercing punch pin (26) configured to punch holes in the material (18); and
   and a pilot positioning pin (30) configured to align the material (18).

4. A stamping system according to any preceding claim, wherein the guide end of the pilot positioning pin (30) is beveled.

5. A stamping system according to any preceding claim, wherein the material release mechanism (42)

further comprises:

a pivot frame (46) in pivotal relationship with a material feed mechanism frame (48);
an actuator (50) configured to move the pivot frame in a first direction;
a nut/screw arrangement (546/54) configured to move the pivot frame in a second direction;
a motor (52) configured to drive the nut/screw arrangement; and
a material gripping mechanism (44) rigidly attached to the pivot frame and configured to frictionally engage the material (18).

6. A stamping system according to any preceding claim, wherein the material feed mechanism (14) further comprises at least one feed drive roll (40) configured to engage and move the material (18) through the material feed mechanism (14) to feed the press mechanism (12).

7. A stamping system according to any preceding claim, further comprising a controller (60) in communication with the material release mechanism (42) and configured to control the desired material release mechanism timing of the material release mechanism (42).

8. A stamping system according to any preceding claim, further comprising at least one feedback device (60, 64) in communication with the controller and configured to monitor the physical characteristics of one of the press mechanism (12), the tooling mechanism, the punching device, the material feed mechanism (14), the material release mechanism (42), a crankshaft driving the press mechanism (12), a motor and a material gripping mechanism.

9. A method for determining the correct timing of a material release mechanism (42) of a material feed mechanism (14), comprising the steps of

cycling a press mechanism (12) through a working portion of a tooling mechanism (17);
monitoring the press mechanism position;
determining, by a location device (58), the desired timing for the material release mechanism (42) to release contact with the material (18) by sensing contact between the press mechanism (12) and the material (18); and correlating the desired material release mechanism timing to the press mechanism position.

10. A method according to claim 9, further comprising the step of adjusting the timing of the material release mechanism (42) to the determined desired material release mechanism timing.

11. A method according to claim 9 or 10, wherein the tooling mechanism comprises a punch and die set.

12. A method according to any of claims 9 to 11, wherein the material feed mechanism (14) further includes at least one feed drive roll (40) in frictional engagement with the material (18), the method further comprising the steps of:

measuring the angular rotation of the feed drive roll (18) after the guide end of the pilot positioning pin (30) has engaged the first hole (66); and correlating the measured angular rotation with the desired material release mechanism timing.

13. A method according to any of claims 9 to 12, wherein the press mechanism (12) further includes a crankshaft (36) for driving the tooling mechanism, the method further comprising the steps of:

measuring the angular rotation of the crankshaft (36) after the guide end of the pilot positioning pin (30) has engaged the first hole (66); and
correlating the measured angular rotation of the crankshaft (36) with the desired material release mechanism timing.

14. A method according to any of claims 9 to 13, further comprising the steps of:

measuring a disturbance force produced upon contact of the pilot positioning pin (30) with the material (18); and
determining the desired material release mechanism timing based upon the measured disturbance force.

15. A method according to any of claims 9 to 13, wherein the material feed mechanism (14) further includes at least one feed drive roll (40) in frictional engagement with the material (18), the method further comprising the step of measuring the torque exerted upon the feed drive roll (40) after the guide end of the pilot positioning pin (30) has fully engaged the first hole (66).

16. A method according to any of claims 9 to 13, wherein the material release mechanism (42) further includes a material gripping mechanism (44) in frictional engagement with the material (18), the method further comprising the step of measuring the force exerted upon the material gripping mechanism (44) after the guide end of the pilot positioning pin (30) has fully engaged the first hole (66).

17. A method according to any of claims 9 to 13, wherein the material release mechanism (42) further includes a material gripping mechanism (44) having a mate-

rial gripping device actuator, the material gripping mechanism (44) in frictional engagement with the material (18), the method further comprising the steps of:

measuring actuator position error after the guide end of the pilot positioning pin (30) has engaged the first hole (66); and
determining the desired material release mechanism timing based upon the measured actuator position error.

18. A method according to any of claims 9 to 13, wherein the material release mechanism (42) further includes a material gripping mechanism (44) in frictional engagement with the material (18), the method further comprising the steps of

measuring the force exerted upon the material gripping mechanism (44) after the guide end of the pilot positioning pin (30) has engaged the first hole (66); and
determining the desired material release mechanism timing based upon the measured force.

19. A method according to any of claims 9 to 13, wherein the material release mechanism (42) further includes a material gripping mechanism (44) in frictional engagement with the material (18), the method further comprising the steps of:

measuring material gripping mechanism (44) position error after the guide end of the pilot positioning pin (30) has fully engaged the first hole (66); and
determining the desired material release mechanism timing based upon the measured the material gripping device position error.

20. A method according to any of claims 9 to 13, wherein the material release mechanism (42) further includes a material gripping mechanism (44) in frictional engagement with the material (18), the method further comprising the steps of:

measuring the linear movement of the material gripping mechanism (44) along the first axis after the guide end of the pilot positioning pin (30) has engaged the first hole (66); and
correlating the linear movement of the material gripping mechanism (44) with the desired material release mechanism timing.

Patentansprüche

1. Stempelsystem (10) zum Bearbeiten eines Materials (18), umfassend:

einen Pressmechanismus (12), der ein Fertigungsmittel (17) aufweist, ausgelegt zum Stanzen von Löchern oder Bilden von Formen in dem Material (18);
einen Materialzuführungsmechanismus (14), der einen Materialabgabemechanismus (42) aufweist und konfiguriert ist, um Material (18) zu dem Pressmechanismus (12) zuzuführen;
gekennzeichnet dadurch, dass das Stempelsystem (10) auch eine Lagevorrichtung (58) umfasst, ausgewählt, um die Pressmechanismusposition zu überwachen und Kontakt zwischen dem Pressmechanismus (12) und dem Material (18) zu detektieren und **dadurch** eine gewünschte Materialabgabemechanismus-Zeitsteuerung zu bestimmen.

2. Stempelsystem gemäß Anspruch 1, wobei der Pressmechanismus weiter ein Stanze- und Matrizenset umfasst.

3. Stempelsystem gemäß Anspruch 2, wobei das Stanze- und Matrizenset weiter umfasst:

einen Lochstanzstift (26), ausgelegt, um Löcher in das Material (18) zu stanzen;
und
einen Pilotpositionierungsstift (30), ausgelegt, um das Material (18) auszurichten.

4. Stempelsystem gemäß einem der vorangehenden Ansprüche, wobei das Führungsende des Pilotpositionierungsstifts (30) abgeschrägt ist.

5. Stempelsystem gemäß einem der vorangehenden Ansprüche, wobei der Materialabgabemechanismus (42) weiter umfasst:

einen Schwenkrahmen (26) in schwenkbarer Beziehung mit einem Materialzuführungsmechanismusrahmen (48);
einen Aktuator (50), ausgelegt, um den Schwenkrahmen in eine erste Richtung zu bewegen;
ein Mutter-/Schrauben-Arrangement (546/54), ausgelegt, um den Schwenkrahmen in eine zweite Richtung zu bewegen;
einen Motor (52), ausgelegt, um das Mutter-/Schrauben-Arrangement anzutreiben; und
einen Materialgreifmechanismus (44), starr angebracht an dem Schwenkrahmen und ausgewählt, um in das Material (18) durch Reibung einzugreifen.

6. Stempelsystem gemäß einem der vorangehenden Ansprüche, wobei der Materialzuführmechanismus (14) weiter zumindest eine Zuführungsantriebsrolle (40) umfasst, ausgelegt, um in das Material (18) einzugreifen und es durch den Materialzuführmecha-

nismus (14) zu bewegen, um es dem Pressmechanismus (12) zuzuführen.

7. Stempelsystem gemäß einem der vorangehenden Ansprüche, weiter umfassend eine Steuerung (60) in Kommunikation mit dem Materialabgabemechanismus (42) und ausgewählt, um die gewünschte Materialabgabemechanismus-Zeitsteuerung des Materialabgabemechanismus (42) zu steuern.

8. Stempelsystem gemäß einem der vorangehenden Ansprüche, weiter umfassend zumindest eine Rückkopplungsvorrichtung (60, 64) in Kommunikation mit der Steuerung und ausgelegt, um die physikalischen Charakteristika von einem der Pressmechanismen (12), dem Fertigungsmittel, der Stanzvorrichtung, dem Materialzuführungsmechanismus (14), dem Materialabgabemechanismus (42), einer Kurbelwelle, die den Pressmechanismus (12) antreibt, einem Motor und einem Materialgreifmechanismus zu überwachen.

9. Verfahren zum Bestimmen der korrekten Zeitsteuerung eines Materialabgabemechanismus (42) eines Materialzuführmechanismus (14), umfassend die Schritte:

periodisches Durchlaufen eines Pressmechanismus (12) durch einen Arbeitsbereich eines Fertigungsmittels (17);
Überwachen der Pressmechanismusposition;
Bestimmen der gewünschten Zeitsteuerung für den Materialabgabemechanismus (42) durch eine Lagevorrichtung (58), um den Kontakt mit dem Material (18) zu lösen durch Detektieren von Kontakt zwischen dem Pressmechanismus (12) und dem Material (18);
und
Korrelieren der gewünschten Materialabgabemechanismus-Zeitsteuerung mit der Pressmechanismusposition.

10. Verfahren gemäß Anspruch 9, weiter umfassend den Schritt des Einstellens der Zeitsteuerung des Materialabgabemechanismus (42) auf die vorbestimmte gewünschte Materialabgabemechanismus-Zeitsteuerung.

11. Verfahren gemäß Anspruch 9 oder 10, wobei die Fertigungsmittel ein Stanze- und Matrizenset umfassen.

12. Verfahren gemäß einem der Ansprüche 9 bis 11, wobei der Materialzuführmechanismus (14) weiter zumindest eine Zuführungsantriebsrolle (40) beinhaltet, in Eingriff durch Reibung mit dem Material (18), wobei das Verfahren weiter umfasst die Schritte von:

Messen der Winkelrotation der Zuführungsantriebsrolle (18), nachdem das Führungsende des Pilotpositionierungsstifts (30) in das erste Loch (66) eingegriffen hat; und
Korrelieren der gemessenen Winkelrotation mit der gewünschten Materialabgabemechanismus-Zeitsteuerung.

13. Verfahren gemäß einem der Ansprüche 9 bis 12, wobei der Pressmechanismus (12) weiter eine Kurbelwelle (36) beinhaltet, um die Fertigungsmittel anzutreiben, wobei das Verfahren die Schritte umfasst von:

Messen der Winkelrotation der Kurbelwelle (36), nachdem das Führungsende des Pilotpositionierungsstifts (30) in das erste Loch (66) eingegriffen hat; und
Korrelieren der gemessenen Winkelrotation der Kurbelwelle (36) mit der gewünschten Materialabgabemechanismus-Zeitsteuerung.

14. Verfahren gemäß einem der Ansprüche 9 bis 13, weiter umfassend die Schritte von:

Messen einer Störungskraft produziert bei Kontakt des Pilotpositionierungsstifts (30) mit dem Material (18); und
Bestimmen der gewünschten Materialabgabemechanismus-Zeitsteuerung basierend auf der gemessenen Störungskraft.

15. Verfahren gemäß einem der Ansprüche 9 bis 13, wobei der Materialzuführmechanismus (14) weiter zumindest eine Zuführungsantriebsrolle beinhaltet in Eingriff durch Reibung mit dem Material (18), wobei das Verfahren weiter umfasst den Schritt des Messens des Drehmoments ausgeübt auf die Zuführungsantriebsrolle (40), nachdem das Führungsende des Pilotpositionierungsstifts (30) vollständig in das erste Loch (66) eingegriffen hat.

16. Verfahren gemäß einem der Ansprüche 9 bis 13, wobei der Materialabgabemechanismus (42) weiter einen Materialgreifmechanismus (44) beinhaltet in Eingriff durch Reibung mit dem Material (18), wobei das Verfahren weiter umfasst den Schritt vom Messen der Kraft ausgeübt auf den Materialgreifmechanismus (44), nachdem das Führungsende des Pilotpositionierungsstifts (30) vollständig in das erste Loch (66) eingegriffen hat.

17. Verfahren gemäß einem der Ansprüche 9 bis 13, wobei der Materialabgabemechanismus (42) weiter einen Materialgreifmechanismus (44) beinhaltet, der einen Materialgreifvorrichtungs-Aktuator aufweist, wobei der Materialgreifmechanismus (44) in Eingriff durch Reibung mit dem Material (18) ist, wobei das

Verfahren weiter umfasst die Schritte von:

Messen eines Aktuator-Positionsfehlers, nachdem das Führungsende des Pilotpositionierungsstifts (30) in das erste Loch (66) eingegriffen hat; und
Bestimmen der gewünschten Materialabgabemechanismus-Zeitsteuerung basierend auf dem gemessenen Aktuator-Positionsfehler.

18. Verfahren gemäß einem der Ansprüche 9 bis 13, wobei der Materialabgabemechanismus (42) weiter beinhaltet einen Materialgreifmechanismus (44) in Eingriff durch Reibung mit dem Material (18), wobei das Verfahren weiter umfasst die Schritte von:

Messen der Kraft ausgeübt auf den Materialgreifmechanismus (44), nachdem das Führungsende des Pilotpositionierungsstifts (30) in das erste Loch (66) eingegriffen hat; und
Bestimmen der gewünschten Materialabgabemechanismus-Zeitsteuerung basierend auf der gemessenen Kraft.

19. Verfahren gemäß einem der Ansprüche 9 bis 13, wobei der Materialabgabemechanismus (42) weiter einen Materialgreifmechanismus (44) beinhaltet in Eingriff durch Reibung mit dem Material (18), wobei das Verfahren weiter umfasst die Schritte von:

Messen eines Materialgreifmechanismus (44) -Positionsfehlers, nachdem das Führungsende des Pilotpositionierungsstifts (30) vollständig in das erste Loch (66) eingegriffen hat; und
Bestimmen der gewünschten Materialabgabemechanismus-Zeitsteuerung basierend auf dem Materialgreifvorrichtungs-Positionsfehler.

20. Verfahren gemäß einem der Ansprüche 9 bis 13, wobei der Materialabgabemechanismus (42) weiter beinhaltet einen Materialgreifmechanismus (44) in Eingriff durch Reibung mit dem Material (18), wobei das Verfahren weiter umfasst die Schritte von:

Messen der linearen Bewegung des Materialgreifmechanismus (44) entlang der ersten Achse, nachdem das Führungsende des Pilotpositionierungsstifts (30) in das erste Loch (66) eingegriffen hat; und
Korrelieren der linearen Bewegung des Materialgreifmechanismus (44) mit der gewünschten Materialabgabemechanismus-Zeitsteuerung.

Revendications

1. Système d'estampage (10) pour oeuvrer un matériau (18), comprenant :

un mécanisme de presse (12) ayant un mécanisme d'outillage (17) configuré pour poinçonner des trous ou pour réaliser des formes dans le matériau (12) ;
un mécanisme d'alimentation de matériau (14) ayant un mécanisme de relâchement de matériau (42) et configuré pour alimenter le matériau (18) au mécanisme de presse (12) ;
caractérisé en ce que le système d'estampage (10) comprend également un dispositif de localisation (58) configuré pour surveiller la position du mécanisme de presse et détecter un contact entre le mécanisme de presse (12) et le matériau (18) et ainsi déterminer une temporisation désirée du mécanisme de relâchement de matériau.

2. Système d'estampage selon la revendication 1, dans lequel le mécanisme de presse comprend en outre un groupe poinçon-matrice.

3. Système d'estampage selon la revendication 2, dans lequel le groupe poinçon-matrice comprend en outre :

une broche de poinçon de perçage (26) configurée pour poinçonner des trous dans le matériau (18) ; et
une broche de positionnement pilote (30) configurée pour aligner le matériau (18).

4. Système d'estampage selon l'une quelconque des revendications précédentes, dans lequel l'extrémité de guidage de la broche de positionnement pilote (30) est biseautée.

5. Système d'estampage selon l'une quelconque des revendications précédentes, dans lequel le mécanisme de relâchement de matériau (42) comprend en outre :

un cadre-pivot (46) en relation de pivotement avec un cadre (48) du mécanisme d'alimentation de matériau ;
un actionneur (50) configuré pour déplacer le cadre-pivot dans une première direction ;
un agencement vis-écrou (546/54) configuré pour déplacer le cadre-pivot dans une seconde direction ;
un moteur (52) configuré pour entraîner l'agencement vis-écrou ; et
un mécanisme d'agrippement de matériau (44) attaché rigidement au cadre-pivot et configuré pour engager en friction le matériau (18).

6. Système d'estampage selon l'une quelconque des revendications précédentes, dans lequel le mécanisme d'alimentation de matériau (14) comprend en

outre au moins un rouleau d'entraînement d'alimentation (40) configuré pour engager et déplacer le matériau (18) à travers le mécanisme d'alimentation de matériau (14) pour alimenter le mécanisme de presse (12).

7. Système d'estampage selon l'une quelconque des revendications précédentes, comprenant en outre un contrôleur (60) en communication avec le mécanisme de relâchement de matériau (42) et configuré pour commander la temporisation désirée du mécanisme de relâchement de matériau (42).

8. Système d'estampage selon l'une quelconque des revendications précédentes, comprenant en outre au moins un dispositif à rétroaction (60, 64) en communication avec le contrôleur et configuré pour surveiller les caractéristiques physiques d'un organe parmi le mécanisme de presse (12), le mécanisme à outillage, le dispositif poinçon, le mécanisme d'alimentation de matériau (14), le mécanisme de relâchement de matériau (42), un vilebrequin entraînant le mécanisme de presse (12), un moteur et un mécanisme d'agrippement de matériau.

9. Procédé pour déterminer la temporisation correcte d'un mécanisme de relâchement de matériau (42) d'un mécanisme d'alimentation de matériau (14), comprenant les étapes consistant à :

amener un mécanisme de presse (12) à faire des cycles à travers une portion de travail d'un mécanisme à outillage (17) ;
surveiller la position du mécanisme de presse ;
déterminer, par un dispositif de localisation (58), la temporisation désirée pour le mécanisme de relâchement de matériau (42) afin de relâcher le contact avec le matériau (18) par détection d'un contact entre le mécanisme de presse (12) et le matériau (18) ; et
effectuer une corrélation de la temporisation désirée du mécanisme de relâchement de matériau avec la position du mécanisme de presse.

10. Procédé selon la revendication 9, comprenant encore l'étape consistant à ajuster la temporisation du mécanisme de relâchement de matériau (42) à la temporisation déterminée pour celui-ci.

11. Procédé selon la revendication 9 ou 10, dans lequel le mécanisme à outillage comprend un groupe poinçon-matrice.

12. Procédé selon l'une quelconque des revendications 9 à 11, dans lequel le mécanisme d'alimentation de matériau (14) inclut en outre au moins un rouleau d'entraînement d'alimentation (40) en engagement de friction avec le matériau (18), le procédé comprenant encore les étapes consistant à :

mesurer la rotation angulaire du rouleau d'entraînement d'alimentation (18) après que l'extrémité de guidage de la broche de positionnement pilote (30) a engagé le premier trou (66) ; et
mettre en corrélation la rotation angulaire mesurée avec la temporisation désirée du mécanisme de relâchement de matériau.

13. Procédé selon l'une quelconque des revendications 9 à 12, dans lequel le mécanisme de presse (12) inclut en outre un vilebrequin (36) pour entraîner le mécanisme à outillage, procédé comprenant encore les étapes consistant à :

mesurer la rotation angulaire du vilebrequin (36) après que l'extrémité de guidage de la broche de positionnement pilote (30) a engagé le premier trou (76) ; et
mettre en corrélation la rotation angulaire mesurée du vilebrequin (36) avec la temporisation désirée du mécanisme de relâchement de matériau.

14. Procédé selon l'une quelconque des revendications 9 à 13, comprenant encore les étapes consistant à :

mesurer une force perturbatrice produite lors du contact de la broche de positionnement pilote (30) avec le matériau (18) ; et
déterminer la temporisation désirée du mécanisme de relâchement de matériau en se basant sur la force perturbatrice mesurée.

15. Procédé selon l'une quelconque des revendications 9 à 13, dans lequel le mécanisme d'alimentation de matériau (14) inclut en outre au moins un rouleau d'entraînement d'alimentation (40) en engagement de friction avec le matériau (18), le procédé comprenant encore l'étape consistant à mesurer le couple exercé sur le rouleau d'entraînement d'alimentation (40) après que l'extrémité de guidage de la broche de positionnement pilote (30) a totalement engagé le premier trou (66).

16. Procédé selon l'une quelconque des revendications 9 à 13, dans lequel le mécanisme de relâchement de matériau (42) inclut en outre un mécanisme d'agrippement de matériau (44) en engagement de friction avec le matériau (18), le procédé comprenant encore l'étape consistant à mesurer la force exercée sur le mécanisme d'agrippement de matériau (44) après que l'extrémité de guidage de la broche de positionnement pilote (30) a totalement engagé le premier trou (66).

17. Procédé selon l'une quelconque des revendications

9 à 13, dans lequel le mécanisme de relâchement de matériau (42) inclut en outre un mécanisme d'agrippement de matériau (44) ayant un actionneur de dispositif d'agrippement, le mécanisme d'agrippement de matériau (44) étant en engagement de friction avec le matériau (18), le procédé comprenant encore les étapes consistant à :

mesurer une erreur de position d'actionneur après que l'extrémité de guidage de la broche de positionnement pilote (30) a engagé le premier trou (66) ; et
déterminer la temporisation désirée du mécanisme de relâchement de matériau en se basant sur l'erreur de position mesurée de l'actionneur.

18. Procédé selon l'une quelconque des revendications 9 à 13, dans lequel le mécanisme de relâchement de matériau (42) inclut en outre un mécanisme d'agrippement de matériau (44) en engagement de friction avec le matériau (18), le procédé comprenant encore les étapes consistant à :

mesurer la force exercée sur le mécanisme d'agrippement de matériau (44) après que l'extrémité de guidage de la broche de positionnement pilote (30) a engagé le premier trou (66) ; et déterminer la temporisation désirée du mécanisme de relâchement de matériau en se basant sur la force mesurée.

19. Procédé selon l'une quelconque des revendications 9 à 13, dans lequel le mécanisme de relâchement de matériau (42) inclut en outre un mécanisme d'agrippement de matériau (44) en engagement de friction avec le matériau (18), le procédé comprenant encore les étapes consistant à :

mesurer une erreur de position du mécanisme d'agrippement de matériau (44) après que l'extrémité de guidage de la broche de positionnement pilote (30) a totalement engagé le premier trou (66) ; et
déterminer la temporisation désirée du mécanisme de relâchement de matériau en se basant sur l'erreur de position mesurée du dispositif d'agrippement de matériau.

20. Procédé selon l'une quelconque des revendications 9 à 13, dans lequel le mécanisme de relâchement de matériau (42) inclut en outre un mécanisme d'agrippement de matériau (44) en engagement de friction avec le matériau (18), le procédé comprenant encore les étapes consistant à :

mesurer le mouvement linéaire du mécanisme d'agrippement de matériau (44) le long du premier axe après que l'extrémité de guidage de la broche de positionnement pilote (30) a engagé le premier trou (66) ; et
mettre en corrélation le mouvement linéaire du mécanisme d'agrippement de matériau (44) avec la temporisation désirée du mécanisme de relâchement de matériau.

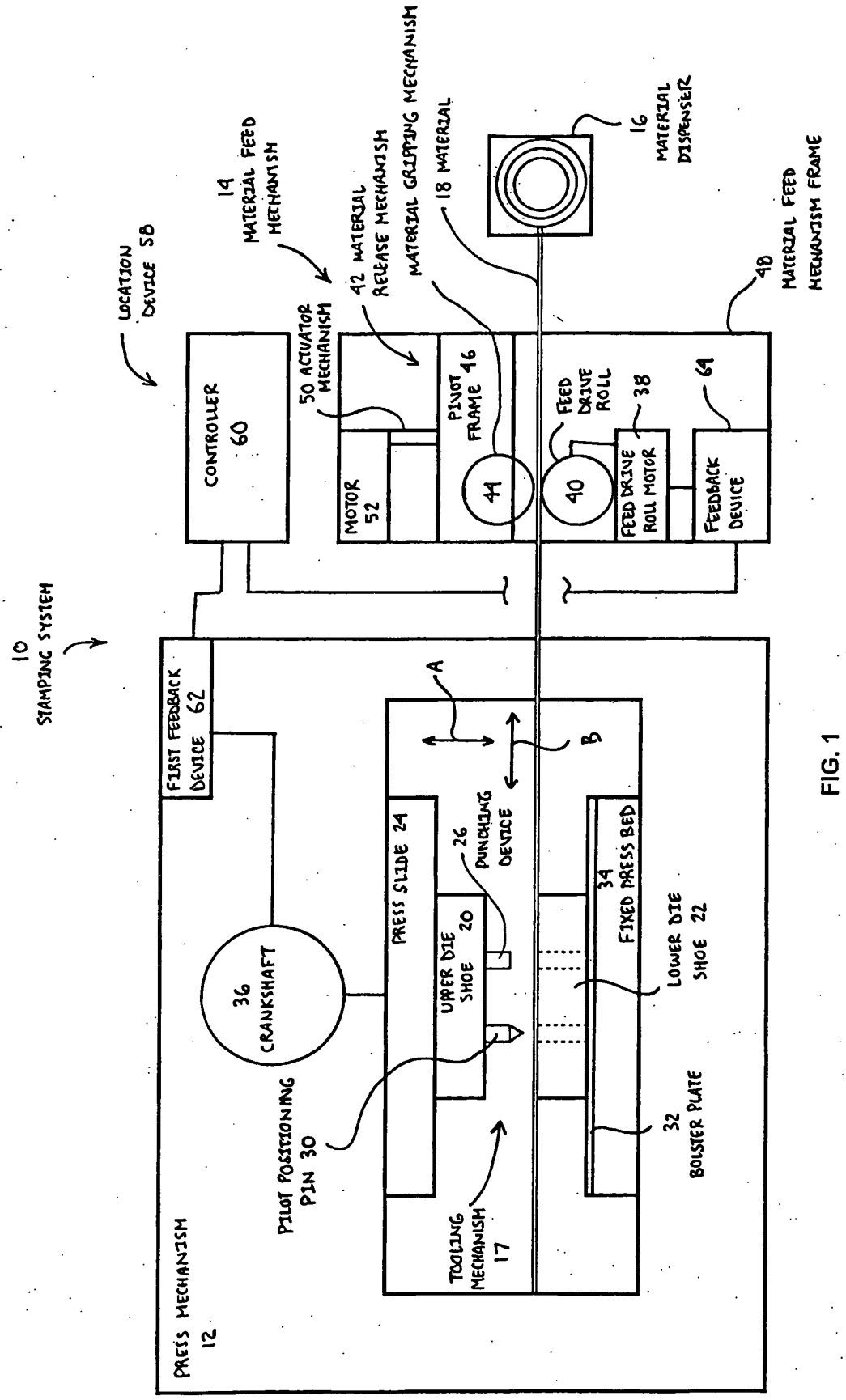
10
STAMPING SYSTEM
LOCATION DEVICE 58
CONTROLLER 60
14
MATERIAL FEED MECHANISM
50 ACTUATOR MECHANISM
42 MATERIAL RELEASE MECHANISM
MATERIAL GRIPPING MECHANISM
18 MATERIAL
16
MATERIAL DISPENSER
48
MATERIAL FEED MECHANISM FRAME
MOTOR 52
PIVOT FRAME 46
44
40
FEED DRIVE ROLL
38
FEED DRIVE ROLL MOTOR
64
FEEDBACK DEVICE
FIRST FEEDBACK DEVICE 62
A
B
PRESS SLIDE 24
26
PUNCHING DEVICE
UPPER DIE SHOE 20
34
FIXED PRESS BED
LOWER DIE SHOE 22
36
CRANKSHAFT
PILOT POSITIONING PIN 30
TOOLING MECHANISM 17
32
BOLSTER PLATE
PRESS MECHANISM 12

FIG. 1

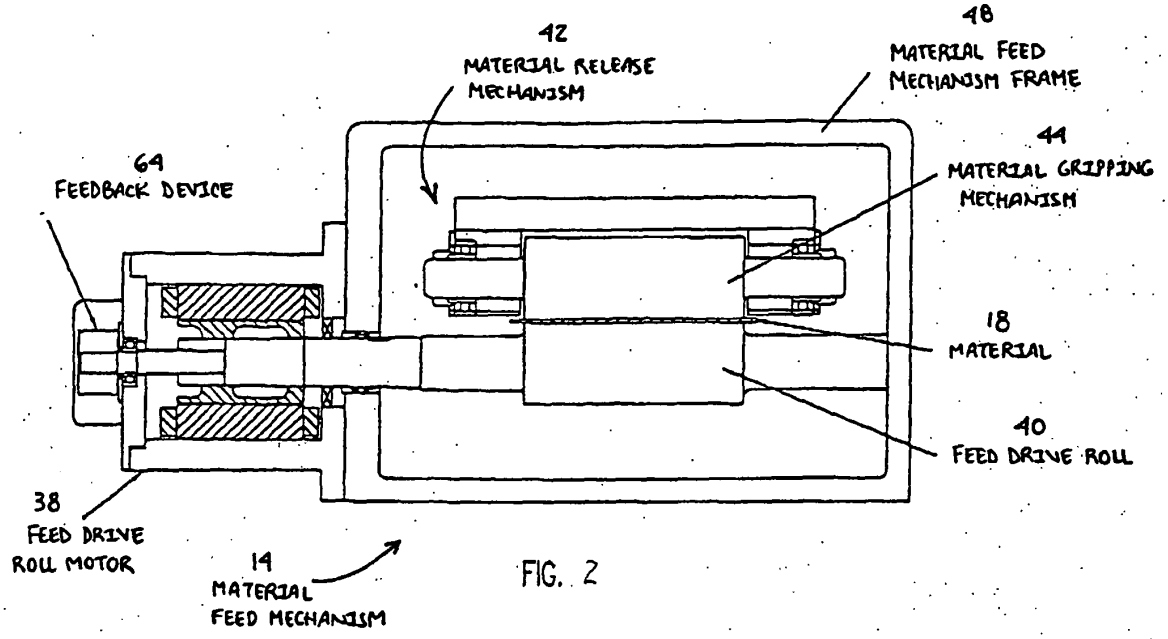
42
MATERIAL RELEASE MECHANISM
48
MATERIAL FEED MECHANISM FRAME
64
FEEDBACK DEVICE
44
MATERIAL GRIPPING MECHANISM
18
MATERIAL
40
FEED DRIVE ROLL
38
FEED DRIVE ROLL MOTOR
14
MATERIAL FEED MECHANISM

FIG. 2

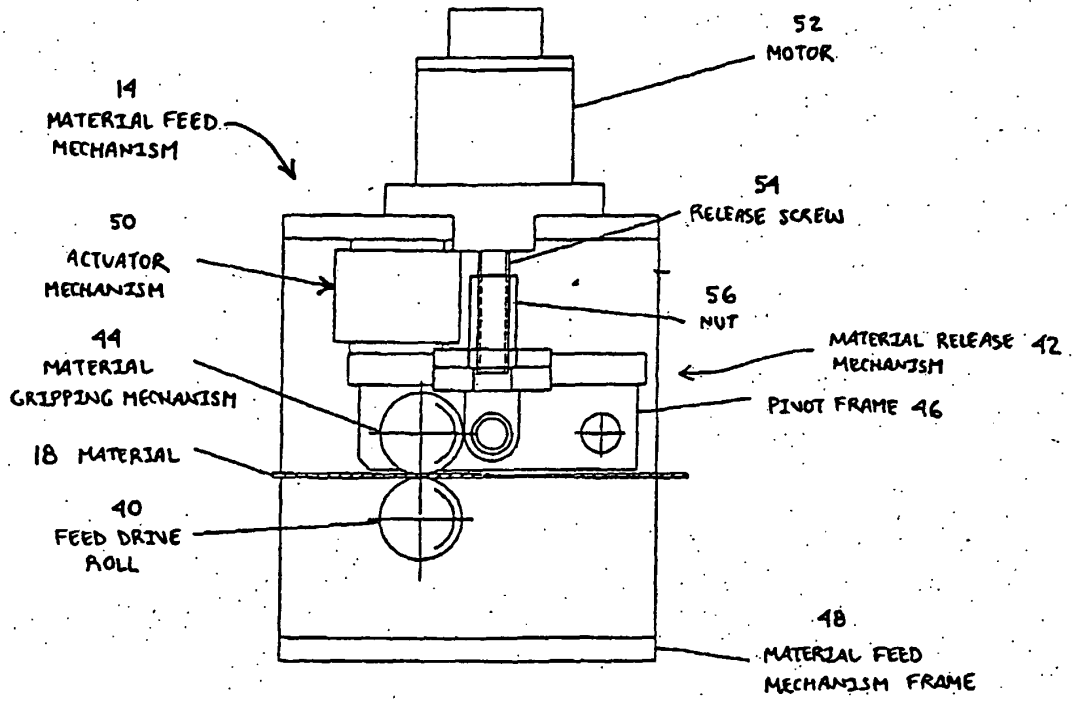
52
MOTOR
14
MATERIAL FEED MECHANISM
51
RELEASE SCREW
50
ACTUATOR MECHANISM
56
NUT
44
MATERIAL GRIPPING MECHANISM
MATERIAL RELEASE 42 MECHANISM
PIVOT FRAME 46
18 MATERIAL
40
FEED DRIVE ROLL
48
MATERIAL FEED MECHANISM FRAME

FIG. 3

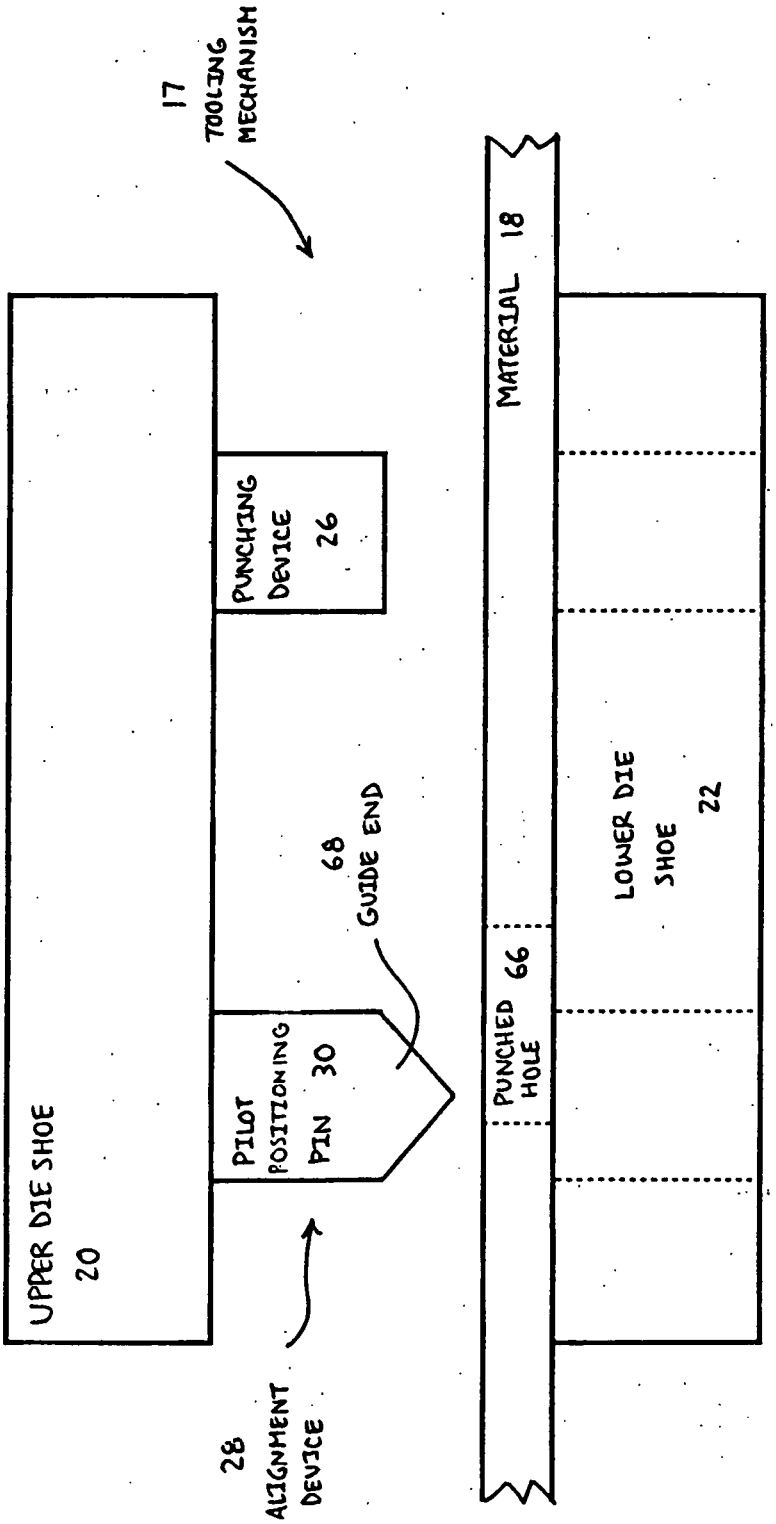
17
TOOLING MECHANISM
MATERIAL 18
PUNCHING DEVICE 26
UPPER DIE SHOE 20
68
GUIDE END
PILOT POSITIONING PIN 30
PUNCHED HOLE 66
LOWER DIE SHOE 22
28
ALIGNMENT DEVICE

FIG. 4

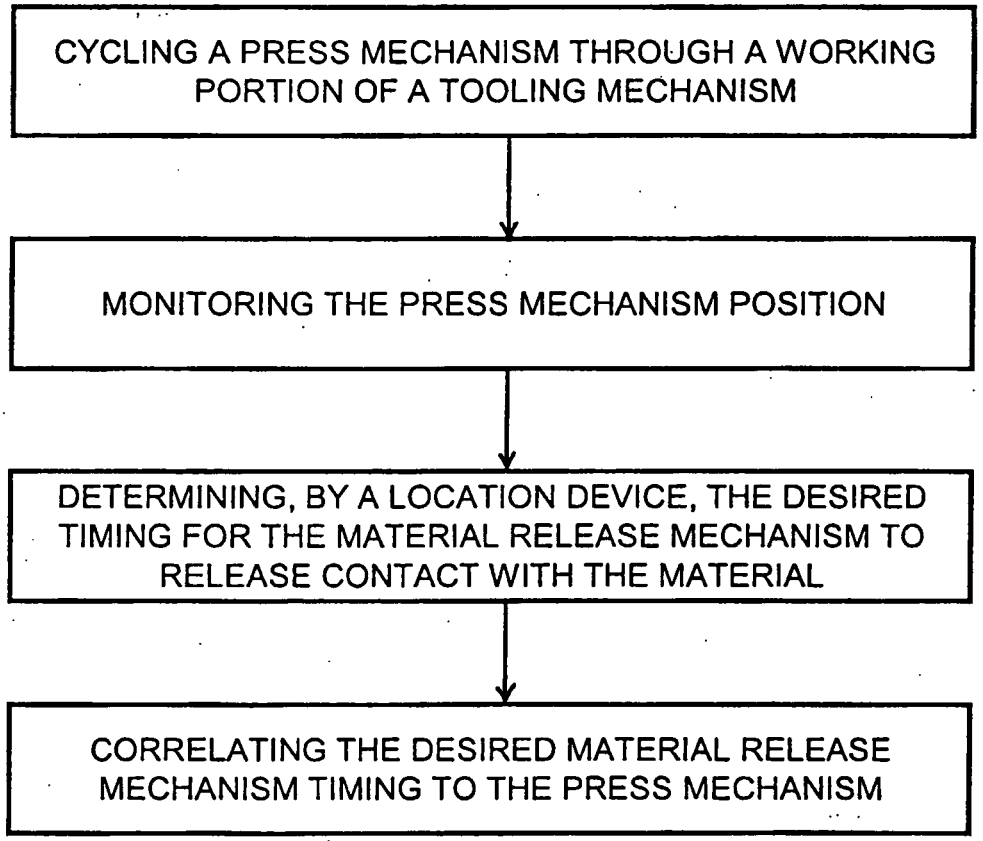
CYCLING A PRESS MECHANISM THROUGH A WORKING PORTION OF A TOOLING MECHANISM
MONITORING THE PRESS MECHANISM POSITION
DETERMINING, BY A LOCATION DEVICE, THE DESIRED TIMING FOR THE MATERIAL RELEASE MECHANISM TO RELEASE CONTACT WITH THE MATERIAL
CORRELATING THE DESIRED MATERIAL RELEASE MECHANISM TIMING TO THE PRESS MECHANISM

FIG. 5

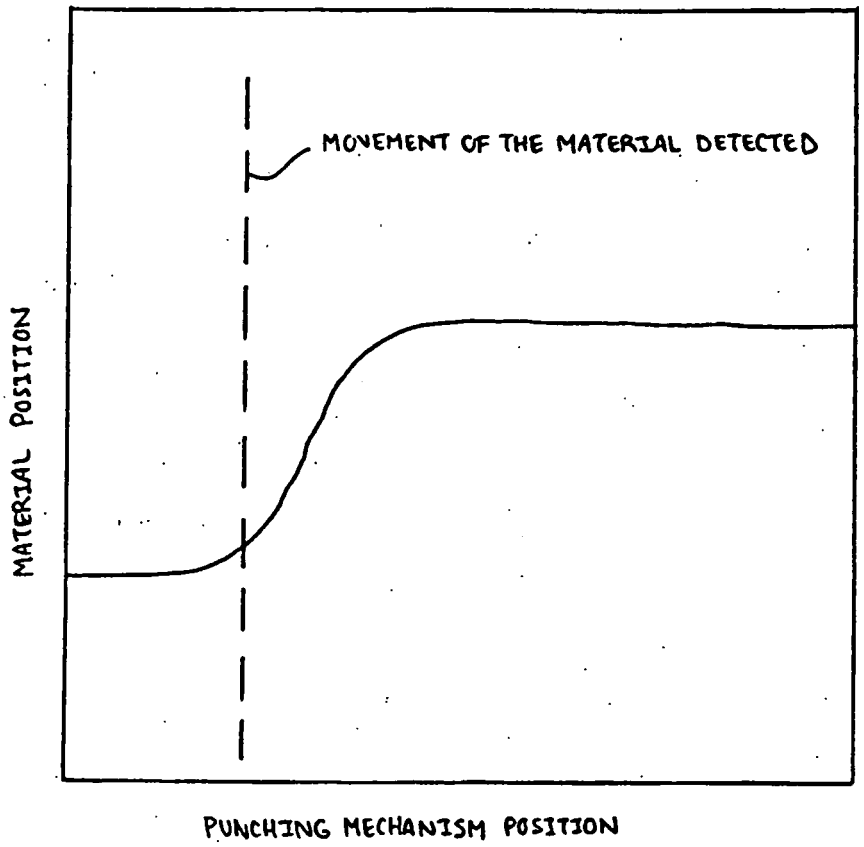
MOVEMENT OF THE MATERIAL DETECTED
MATERIAL POSITION
PUNCHING MECHANISM POSITION

FIG. 6

REFERENCES CITED IN THE DESCRIPTION

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