Title: STRIPPER ASSEMBLIES AND COMPONENTS THEREOF FOR MULTI-TOOL PUNCH ASSEMBLIES

Abstract: A multi-tool punch assembly includes one or more types of quick-release-type engagement members for a stripper assembly thereof. Strippers (101-103) of the stripper assembly may be formed by individual stripper members reversibly coupled to a plate (110) of the stripper assembly; and the stripper assembly may further include an information storage device (13) for storing punch tool information.
before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.
The present invention pertains to multi-tool punch tool assemblies and more particularly to stripper assemblies thereof.

Multi-tool punch assemblies are known in the art to provide a selection from a plurality of punch tools at a single station of a punch press. Multi-tool punch assemblies typically employ a punch guide that is adapted to move each punch tool, of the plurality of punch tools carried by the guide, into and out from a working position, for example, via rotation about its own axis within a turret press station in which the guide is mounted.

Those skilled in the art are familiar with the stripping function that is fundamental to the operation of punch assemblies in order to ensure that punched material is separated from the punch tip; several types of stripper assemblies for mounting onto multi-tool punch guides have been previously disclosed. However, there is still a need for new stripper assemblies, and components thereof, that can facilitate more efficient and simpler methods for assembling multi-tool punch assemblies.

The following drawings are illustrative of particular embodiments of the present invention and therefore do not limit the scope of the invention. The drawings are not to scale (unless so stated) and are intended for use in conjunction with the explanations in the following detailed description. Embodiments of the present invention will hereinafter be described in conjunction with the appended drawings, wherein like numerals denote like elements.

Figure 1 is perspective view of a multi-tool punch assembly for use in a punch press, according to some embodiments of the present invention.
Figure 2 is an exploded perspective view of a portion of the multi-tool punch assembly shown in Figure 1, according to some embodiments.

Figure 3 is a perspective view of a plate of the assembly shown in Figures 1-2, according to some embodiments of the present invention.

Figure 4 is a perspective view of a plate for a stripper assembly, according to some alternate embodiments of the present invention.

Figure 5 is a block diagram for an exemplary information storage device and reader which may be employed by embodiments of the present invention.

Figure 6 is a perspective view of an alternative embodiment of a stripper assembly.

Figure 7 is a flow chart outlining some methods of the present invention.

DETAILED DESCRIPTION

The following detailed description is exemplary in nature and is not intended to limit the scope, applicability, or configuration of the invention in any way. Rather, the following description provides practical illustrations for implementing exemplary embodiments of the present invention. Examples of constructions, materials and dimensions are provided for selected elements, and all other elements employ that which is known to those of skill in the field of the invention. Those skilled in the art will recognize that many of the examples provided have suitable alternatives that can be utilized.

Figure 1 is perspective view of a multi-tool punch assembly for use in a punch press, according to some embodiments of the present invention; and Figure 2 is an exploded perspective view of a portion of the multi-tool punch assembly shown in Figure 1. The assembly of Figures 1 and 2 may be a rotary indexing type, which may be mounted, for example, in an upper turret of a rotary turret punch press in conjunction with a corresponding die set mounted in a lower turret of the press. It should be noted that embodiments of the present invention may be employed by other types of multi-tool punch assemblies, which are compatible for mounting in
alternative types of ram-driven presses, for example, a Trumpf-style press, known to those skilled in the art, that brings tool assemblies, held in a cartridge, one at a time from a rail into a working position of the press. Figures 1 and 2 illustrate the assembly including a punch holder, or guide 160, which carries a plurality of punch tools 51, 52, 53, and a stripper assembly 100, which includes a plate 110 and plurality of strippers 101, 102, 103; each stripper 101, 102, 103 includes a punch port 151, 152, 153 through which a corresponding punch tool 51, 52, 53 extends when activated.

According to the illustrated embodiment, individual stripper members, which are approximately coplanar with plate 110, form each stripper 101, 102, 103, when reversibly coupled to plate 110. Figure 2 further illustrates plate 110 including a plurality of grippers 25 for reversibly coupling members 101, 102, 103; and Figure 1 shows each gripper 25 extending about a perimeter of a corresponding stripper member 101, 102, 103. Grippers 25 will be described in greater detail below, in conjunction with Figure 3.

Figure 2 further illustrates a surface 26 of punch guide 160 including flanges 216 and recesses 246 providing for a quick-release-type engagement with mating features of plate 110. Figure 3 is a perspective view of plate 110 illustrating a plurality of resilient members 24 protruding from a first face 111 thereof, for engagement within recesses 246, and illustrating a plurality of grooves 21 located about a perimeter of first face 111, for engagement with flanges 216. According to the illustrated embodiment, plate 110 is reversibly mounted to punch guide 160 by, first, bringing first face 111 into close proximity with surface 26 of guide 160, and, then, by rotating plate 110, about a centerline axis 10 (Figures 1-2), to engage grooves 21 with flanges 216 and to simultaneously bring protruding resilient members 24 into a quick-release-type engagement with recesses 246. With reference to Figures 2-3, it may be appreciated that engagement of grooves 21 with flanges 216 provides a holding force in a direction approximately parallel to centerline axis 10, while resilient members 24,
engaged within recesses 246, provide a holding force in a direction
approximately orthogonal to axis 10, for example, preventing rotation of
plate 110 about axis 10.

[16] Preferably, each of stripper members 101, 102, 103 is inserted into a
corresponding gripper 25 of plate 110 after plate 110 is mounted to guide
160, but the invention is not so limited, and members 101, 102, 103 may be
inserted prior to mounting, according to alternate embodiments. Figures 2-
3 further illustrate each gripper 25 formed by a slot extending through plate
110 from first face 111 to a second face 112. Figure 3 shows each slot
formed by a sidewall 35 that is terminated at opposite ends thereof by a
pair of reliefs 350, wherein each relief 350 terminates a corresponding end
of sidewall 35 and the ends are spaced apart by a gap. Sidewalls 35 are
resilient to provide an adequate gripping force about each member 101,
102, 103, and, according to some embodiments, are sized to extend within
an optional groove 15 of each member 101, 102, 103; each relief 350
allows an adjacent or flexing portion 355 of sidewall 35 to flex and thus
spread for insertion, as well as subsequent withdrawal, of the
corresponding stripper member 101, 102, 103. The gripping force of
grippers 25 is sufficient to hold stripper members 101, 102, 103 in the
proper position, as shown in Figure 1, during punching operations in a
punch press, without a need for additional retaining forces that can
complicate the multi-tool punch assembly, such as from a ring component
extending about a perimeter of plate 110, or from an extension of punch
tools 51, 52, 53 through corresponding ports 151, 152, 153 of members
101, 102, 103. Grippers 25 may be described as providing a secure, yet
reversible and quick-release-type engagement for stripper members 101,
102, 103 in order to facilitate simple and efficient exchange of any of
stripper members 101, 102, 103 for an alternative stripper member, without
having to disassemble other components of the multi-tool assembly.

[17] Stripper members 101, 102, 103 may be inserted into the corresponding
gripper 25 axially (in a direction approximately parallel to axis 10), or
radially, per arrows A of Figure 2, either before or after mounting plate 110
to punch guide 160. With reference to Figure 1, when stripper members 101, 102, 103 are inserted into grippers 25, an exposed surface of each stripper member 101, 102, 103 may be recessed with respect to second face 112 of plate 110, flush with second face 112 of plate 110, or protruding from second face 112 of plate 110.

[18] It should be noted that the present invention is not limited to any particular number of tools held in punch guide 160 and, according to alternate embodiments, plates for stripper assemblies are compatible with guides that can hold a fewer or a greater number of tools, than that which is illustrated in Figure 2. For example, inventive plates for stripper assemblies may accommodate three tools, four tools, five tools, eight tools, ten tools, sixteen tools, twenty tools, twenty-four tools, and thirty tools, these numbers of tools being typical in the industry for multi-tool assemblies.

[19] Figure 4 is a perspective view of another plate 710 which is configured to reversibly receive a greater number of stripper members than the number received by plate 110, in order to provide a stripper assembly for a multi-tool punch guide that has an increased capacity to carry a greater number of tools than punch guide 160. Figure 4 illustrates plate 710 including a first plurality of grippers 75 and a second plurality of grippers 750; grippers 75 and 750 are each formed by a slot extending through plate 710 from a first face 711 to a second face 712, similar to grippers 25 of plate 110. Like grippers 25, the slots that form grippers 75 and 750 are each formed by a sidewall 85 that has opposite ends spaced apart by a gap, and wherein each end is terminated by a relief 850 that allows an adjacent or flexing portion 855 of sidewall 85 to flex and thus spread for insertion, as well as subsequent withdrawal, of a corresponding stripper member. According to the illustrated embodiment, the gap of each of the first plurality of grippers 75 faces away from a centerline axis 70 of plate 710, similar to each of grippers 25 of plate 110, but the gap of each of the second plurality of grippers 750 faces in an opposite direction, toward axis 70.
Figure 4 further illustrates plate 710 including grooves 71, which are located about a perimeter of first face 711, and resilient members 74, which protrude from first face 711. According to the illustrated embodiment, resilient members 74 engage within recesses of a corresponding punch guide, similar to the previously described engagement of members 24, of plate 110, within recesses 246 of guide 160, when grooves 71 of plate 710 engage with flanges of the corresponding punch guide. Like plate 110, plate 710 is reversibly mounted to the corresponding punch guide by, first, bringing face 711 into close proximity with a surface of the guide that includes the mating flanges and recesses, and, then, by rotating plate 710, about centerline axis 70, to engage grooves 71 with the flanges and to simultaneously bring resilient members 74 into quick-release-type engagement with the recesses.

According to preferred embodiments of the present invention, stripper plates, for example, either of plates 110, 710, are formed from a relatively stiff, yet resilient polymer material, examples of which include, without limitation, Nylon 66, such as Zytel 103 HSL, Polyethylene terephthalate (PET), such as Rynite 530-BK503, and an acetal resin engineering plastic, such as Delrin 100KM NCOOO, which are all available from DuPont®. Stripper members that are received by either of plates 110, 710, for example, stripper members 101, 102, 103 (Figure 2), may be formed from tool steels, such as 4140, M2 or D2, known to those skilled in the art, or from any of the aforementioned exemplary polymer materials. An embodiment of either of plates 110 and 710, which at least includes a polymer forming the respective second face 112, 712, is not as likely, as one formed entirely from metal, to mar a surface of a workpiece, if there is any contact between plate 110, 710 and the workpiece during punching operations. Furthermore, if a slug from the workpiece is inadvertently pulled up with one of the punch tools, for example, one of punch tools 51, 52, 53, it may become embedded in second face 112 of plate 110 that is formed by a polymer, and, thus, be less likely to significantly mar the workpiece; also, a polymer material, which forms either part of or all of
plate 110, 710, may absorb shock and vibration that can cause unwanted noise and/or damage to components of the corresponding multi-tool punch assembly.

For those embodiments of plates 110, 710 formed from a resilient polymer, protruding resilient members 24, 74 and/or flexing portions 355, 855 of sidewalls 35, 85 may be integrally formed with plate 110, 710. Alternatively, plates 110, 710 may be formed from a material that is distinct from that which forms resilient members 24, 74 and flexing portions 355, 855, for example, a stiffer and less resilient material such as a hardened metal, like aircraft grade aluminum or titanium. Exemplary dimensions, for either of plates 110, 710, wherein the plate is wholly formed from Nylon 66, are as follows: an average thickness of plate 110, 710 ranges from approximately 1/16 inch to approximately 5/16 inch (thickness in direction approximately parallel to axis 10, 70); a length L of flexing portions 355, 855 ranges from approximately 1/8 inch to approximately 3/8 inch; and a maximum thickness of flexing portions 355, 855 is between approximately 1/4 inch and approximately 5/16 inch, while a minimum thickness thereof is between approximately 1/16 inch and approximately 1/8 inch (thicknesses in the flexing direction, approximately orthogonal to axis 10, 70).

According to another aspect of the present invention, stripper assembly 100 includes an information storage device to help to manage implementations of various punch tools, for example, tools 51, 52, 53 (Figure 2). With reference to Figure 3, such an information storage device 310 is shown coupled to first face 111 of plate 110. According to some embodiments of the present invention, information storage device 310 is adapted to store punch tool identification/characterization information, and/or punch tool prior usage information, and/or punch tool maintenance information. Storage device 310 may store tool information as a coded data pattern, for example, in the form of a bar code tag, but is preferably programmable, including a read/write memory, and has a capacity for wireless communications, for example, being a type of radio-frequency (RF) identification tag that includes an antenna and an integrated circuit for
storing and processing information and for modulating and demodulating an RF signal. Figure 5 is a block diagram for such an information storage device 310, and for an associated reader 520.

[24] Figure 5 illustrates storage device 310 including a read/write memory 531 linked to a transceiver 533 for sending information to, and receiving information from reader 520. Figure 5 further illustrates storage device 310 including a controller 532, for example, a processor unit, in communications with both read/write memory 531 and transceiver 533 to perform reprogramming operations. According to the illustrated embodiment, reader 520, which includes a processor 521 and a transceiver 523, is linked to a press control center 510, and to an auxiliary storage 570 for data collected from information storage device 310 and for information sent to information storage device 310 from press control center 510. Examples of storage device 310 and reader 520, in conjunction with press control center 510 and auxiliary storage 570, which may be employed by embodiments of the present invention, are described in detail in U.S. Patent 6,047,579, which is hereby incorporated by reference in its entirety.

[25] Returning now to Figures 1-3, it may be appreciated that information storage device 310, being mounted to first face 111 of plate 110, is contained between plate 110 and surface 26 of punch guide 160, when plate 110 is mounted to guide 160, and that wireless data transmission therefrom is not hindered by the containment. Thus, during punching operations, when the complete multi-tool punch assembly is mounted in a punch press, storage device 310 is enclosed, within the assembly, for protection from the environment of the press. In addition to protecting information storage device 310 from exposure to processing materials of the press, such as lubricants and coolants, if at least portions of plate 110 are formed from a resilient polymer, as mentioned above, plate 110 can further protect storage device 310 by absorbing shock and vibration that may result when any of the punch tools form the workpiece, and when stripper members 101, 102, 103 and/or plate 110 contact the workpiece during punching operations.
[26] With further reference to Figure 1, a passive information storage device, being embodied as a bar code tag 13, is shown attached to second face 112 of plate 100; tag 13 may contain encoded data corresponding to permanent identification information associated with plate 110. According to the illustrated embodiment, tag 13 is exposed, when plate 110 is mounted to guide 160, in order that a bar code reader may obtain the information therefrom, and is not as susceptible to punch press environmental damage as information storage device 310 would be if similarly exposed.

[27] Figure 6 is a perspective view of an alternative embodiment of a stripper assembly 400. Figure 6 illustrates assembly 400 including a plate 410 having a plurality of strippers 401, 402, 403 integrally formed therein, and wherein each stripper 401, 402, 403 includes a punch port 451, 452, 453. According to some preferred embodiments of stripper assembly 400, punch ports 451, 452, 453 are formed, after plate 410 is initially mounted to a punch guide, for example, punch guide 160 (Figures 1-2), by tools 51, 52, 53, which are mounted in guide 160 and driven by a press in which the entire multi-tool punch assembly is mounted.

[28] Like plate 110, previously described, plate 410 may be mounted to punch guide 160 by bringing a first face 411 thereof into close proximity with surface 26 of guide 160 and rotating plate 410, about a centerline axis 40 to engage grooves 21 with flanges 216 and to simultaneously engage protruding resilient members 24 with recesses 246. Also, like plate 110, plate 410 may be formed, all, or in part, from a resilient polymer material.

[29] Figure 6 further illustrates stripper assembly 400 including information storage device 310, as previously described, which is coupled to first face 411 of plate 410, so that when plate 410 is mounted to guide 160, storage device 310 is contained between plate 410 and punch guide surface 26.

[30] Figure 7 is a flow chart outlining some methods of the present invention related to the information storage aspect thereof. Figure 7 illustrates an initial step 601 wherein strippers are formed in a plate of a stripper assembly; formation of strippers may be performed by inserting individual
stripper members into a the plate, for example, members 101, 102, 103 into grippers 25 of plate 110, as previously described in conjunction with Figures 1-3, or by punching ports into the plate, for example, ports 451, 452, 453, as previously described in conjunction with Figure 7. In a subsequent step 603, punch tool information is entered into an information storage device, for example, storage device 310, which is coupled to the plate of the stripper assembly; the information may be dictated by the formed strippers and includes information identifying a geometry and unique position of each tool, for example, tools 51, 52, 53 (Figure 2), within a punch guide to mate up with the corresponding punch port 151, 152, 153. The punch tool information may further include a length of each selected punch tool, material properties thereof, a usage history thereof, and/or a maintenance history thereof; this additional information may be collected from an information storage device, which is coupled to each punch tool and is similar to device 310, as previously described.

[30] The stripper assembly may be mounted to the punch guide, as previously described in conjunction with Figures 1-3, either before or after each of the punch tools is mounted into the corresponding unique position in the punch guide; and the strippers may be formed in the stripper assembly plate either before or after the stripper assembly plate is mounted to the punch guide. According to some alternate embodiments of the present invention, step 603 precedes step 601.

[31] Figure 7 further illustrates a step 605, following step 603, in which the storage device transfers the information to a control center of the press, for example, via wireless RF transmission to reader 520, which is linked to press control center 510, as previously described in conjunction with Figure 5. The control center of the press uses the transferred information to control punching operations, which are carried out by the punch tools mounted in the guide of the multi-tool punch assembly, which has been mounted in the press. The multi-tool punch assembly may be mounted in the press at any time following step 601, unless the stripper assembly plate, which is mounted to the guide, initially includes no strippers and the
strippers are to be formed by punching, as previously described in conjunction with Figure 6.

[32] After a workpiece has been processed in the punch press, the control center of the press transfers, back to the information storage device of the corresponding stripper assembly plate, per step 607, data concerning the operation of each punch tool, for example, punching frequency, forces applied, die penetration, jobs processed, index angle, etc... Thus, the punch tool information, which is contained in the information storage device, is updated to reflect the usage history of each punch tool mounted in the corresponding multi-tool punch assembly; the updated information may be subsequently transferred back to the control center of the same press, or another press, when the multi-tool assembly is employed again to process another workpiece.

[33] In the foregoing detailed description, the invention has been described with reference to specific embodiments. However, it may be appreciated that various modifications and changes can be made without departing from the scope of the invention as set forth in the appended claims.
CLAIMS:
1. A stripper assembly for a multi-tool punch guide, the stripper assembly
comprising:
   a plate including a first face, a second face and a centerline axis extending
   through the first and second faces;
   a plurality of strippers approximately coplanar with the plate, each stripper
   including a punch port extending therethrough, from the first face of the
   plate to the second face of the plate;
   a plurality of grooves located around a perimeter of the first face of the plate
   and facing toward the centerline axis of the plate, each groove adapted to
   engage with a corresponding flange of the punch guide when aligned
   therewith; and
   a plurality of resilient members protruding from the first face of the plate, each
   resilient member adapted to reversibly engage within a corresponding
   recess located on a surface of the punch guide when each groove engages
   with the corresponding flange of the punch guide, the surface of the punch
   guide being that through which each punch tool, of a plurality of punch tools
   carried by the punch guide, extends, when activated;
   wherein the plurality of grooves and the plurality of resilient members are each
   engaged by rotating the plate, about the centerline axis thereof, with
   respect to the surface of the punch guide, after bringing the first face of the
   plate into close proximity with the surface of the punch guide;
   each punch port of the plurality strippers is aligned with a corresponding punch
   tool of the plurality of punch tools carried by the punch guide, when the
   plurality of grooves and the plurality of resilient members are each
   engaged;
   the engaged grooves provide a holding force in a direction approximately
   aligned with the centerline axis of the plate; and
   the engaged resilient members provide a holding force in a direction
   approximately orthogonal to the centerline axis of the plate.
2. The stripper assembly of claim 1, wherein each groove of the plurality of grooves is located between adjacent strippers of the plurality of strippers.

3. The stripper assembly of claim 1, wherein each resilient member of the plurality of resilient members is located between adjacent strippers of the plurality of strippers.

4. The stripper assembly of claim 1, wherein each groove of the plurality of grooves is integrally formed in the plate.

5. The stripper assembly of claim 1, wherein the plate is formed from a resilient polymer material.

6. The stripper assembly of claim 5, wherein each resilient member of the plurality of resilient members is integrally formed in the plate.

7. The stripper assembly of claim 1, wherein the plurality of strippers and the plate are integrally formed.

8. The stripper assembly of claim 1, wherein each stripper of the plurality of strippers is formed by an individual stripper member reversibly coupled to the plate.

9. The stripper assembly of claim 8, wherein:
   the plate further includes a plurality of grippers; and
   each gripper of the plurality of grippers extends about at least a portion of a perimeter of a corresponding individual stripper member of the plurality of strippers to reversibly couple each stripper member to the plate.

10. The stripper assembly of claim 9, wherein:
    each individual stripper member includes a groove extending about the perimeter thereof; and
    each gripper member extends into the groove of the corresponding individual stripper member when reversibly coupling each stripper member to the plate.

11. The stripper assembly of claim 9, wherein:
    each gripper of the plurality of grippers is formed by a slot extending through the plate from the first face of the plate to the second face of the plate;
    each slot is formed by a sidewall, the sidewall including a first end and a second end, the second end being spaced apart from the first end by a
gap, and each of the first and second ends being terminated by a relief; and
the reliefs allowing for an insertion and a withdrawal of each individual stripper member into a corresponding gripper.

12. The stripper assembly of claim 11, wherein the gap of at least some of the grippers faces away from the centerline axis of the plate.
13. The stripper assembly of claim 11, wherein the gap of at least some of the grippers faces toward the centerline axis of the plate.
14. The stripper assembly of claim 11, wherein each resilient member of the plurality of resilient members is located between adjacent grippers of the plurality of grippers.
15. The stripper assembly of claim 8, wherein each groove of the plurality of grooves is integrally formed in the plate.
16. The stripper assembly of claim 8, wherein the plate is formed from a resilient polymer material.
17. The stripper assembly of claim 16, wherein each resilient member of the plurality of resilient members is integrally formed in the plate.
18. The stripper assembly of claim 1, further comprising an information storage device coupled to the first face of the plate.
19. The stripper assembly of claim 18, wherein the information storage device is adapted to store at least one of: punch tool identification information, punch tool prior usage information, and punch tool maintenance information.
20. The stripper assembly of claim 18, wherein the information storage device comprises a read/write memory and a communications transceiver.
21. The stripper assembly of claim 18, wherein the information storage device is selected from the group consisting of: a radiofrequency identification tag and a bar code tag.
22. A stripper assembly for a multi-tool punch guide, the stripper assembly comprising:
   a plate including a first face, a second face and a centerline axis extending through the first and second faces;
a plurality of strippers approximately coplanar with the plate, each stripper
including a punch port extending therethrough, from the first face of the
plate to the second face of the plate;
a plurality of grooves located around a perimeter of the first face of the plate
and facing toward the centerline axis of the plate, each groove adapted to
engage with a corresponding flange of the punch guide when aligned
therewith; and
an information storage device coupled to the first face of the plate;
wherein the plurality of grooves are engaged by rotating the plate, about the
centerline axis thereof, with respect to the surface of the punch guide, after
bringing the first face of the plate into close proximity with a surface of the
punch guide, the surface of the punch guide being that through which each
punch tool, of a plurality of punch tools carried by the punch guide,
extends, when activated; and
each punch port of the plurality strippers is aligned with a corresponding punch
tool of the plurality of punch tools carried by the punch guide, when the
plurality of grooves and the plurality of resilient members are each
engaged.

23. The stripper assembly of claim 22, wherein the plate is formed from a resilient
polymer material.
24. The stripper assembly of claim 22, wherein the plurality of strippers and the
plate are integrally formed.
25. The stripper assembly of claim 22, wherein each stripper of the plurality of
strippers is formed by an individual stripper member reversibly coupled to the
plate.
26. The stripper assembly of claim 25, wherein:
the plate further includes a plurality of grippers; and
each gripper of the plurality of grippers extends about at least a portion of a
perimeter of a corresponding individual stripper member of the plurality of
strippers to reversibly couple each stripper member to the plate.
27. The stripper assembly of claim 26, wherein:
   each individual stripper member includes a groove extending about the
   perimeter thereof; and
   each gripper member extends into the groove of the corresponding individual
   stripper member when reversibly coupling each stripper member to the
   plate.

28. The stripper assembly of claim 26, wherein:
   each gripper of the plurality of grippers is formed by a slot extending through
   the plate from the first face of the plate to the second face of the plate;
   each slot is formed by a sidewall, the sidewall including a first end and a
   second end, the second end being spaced apart from the first end by a
   gap, and each of the first and second ends being terminated by a relief;
   and
   the reliefs allowing for an insertion and a withdrawal of each individual stripper
   member into a corresponding gripper.

29. The stripper assembly of claim 28, wherein the gap of at least some of the
   grippers faces away from the centerline axis of the plate.

30. The stripper assembly of claim 28, wherein the gap of at least some of the
   grippers faces toward the centerline axis of the plate.

31. The stripper assembly of claim 25, wherein the plate is formed from a resilient
   polymer material.

32. The stripper assembly of claim 22, wherein the information storage device is
   adapted to store at least one of: punch tool identification information, punch tool
   prior usage information, and punch tool maintenance information.

33. The stripper assembly of claim 22, wherein the information storage device
   comprises a read/write memory and a communications transceiver.

34. The stripper assembly of claim 22, wherein the information storage device is
   selected from the group consisting of: a radiofrequency identification tag and a bar
   code tag.

35. A stripper assembly plate for a multi-tool punch guide, the plate comprising:
   a first face, a second face and a centerline axis extending through the first and
   second faces;
a plurality of gripper slots extending through the plate from the first face to the second face thereof, each gripper slot of the plurality of gripper slots being formed by a sidewall, the sidewall including a first end and a second end, the second end being spaced apart from the first end by a gap, and each of the first and second ends being terminated by a relief; and

5 a plurality of grooves located around a perimeter of the first face and facing toward the centerline axis of the plate, each groove adapted to engage with a corresponding flange of the punch guide when aligned therewith; wherein the reliefs of each gripper slot allows for insertion and withdrawal of a corresponding stripper member, such that each gripper slot reversibly couples the corresponding stripper member to the plate; each coupled stripper member is approximately coplanar with the plate such that a punch port of each coupled stripper member extends from the first face to the second face; and

10 wherein the plurality of grooves are engaged by rotating the plate, about the centerline axis thereof, with respect to the surface of the punch guide, after bringing the first face of the plate into close proximity with a surface of the punch guide and then, the surface of the punch guide being that through which each punch tool of a plurality of punch tools, carried by the punch guide, extends when activated.

36. The plate of claim 35, wherein the gap of at least some of the grippers faces away from the centerline axis of the plate.

37. The plate of claim 35, wherein the gap of at least some of the grippers faces toward the centerline axis of the plate.

38. The plate of claim 35, wherein each groove of the plurality of grooves is integrally formed in the plate.

39. The plate of claim 35, wherein the plate is formed from a resilient polymer material.

40. The plate of claim 35, further comprising a plurality of resilient members protruding from the first face, each resilient member of the plurality of resilient members being adapted to reversibly engage within a corresponding recess.
located on the surface of the punch guide, when each groove engages with the corresponding flange of the punch guide.

41. The plate of claim 40, wherein each resilient member of the plurality of resilient members is located between adjacent gripper slots of the plurality of gripper slots.

42. The plate of claim 40, wherein the plate is formed from a resilient polymer material.

43. The plate of claim 42, wherein each resilient member of the plurality of resilient members is integrally formed in the plate.

44. The plate of claim 35, further comprising an information storage device coupled to the first face of the plate.

45. The plate of claim 44, wherein the information storage device is adapted to store at least one of: punch tool identification information, punch tool prior usage information, and punch tool maintenance information.

46. The plate of claim 44, wherein the information storage device comprises a read/write memory and a communications transceiver.

47. The plate of claim 44, wherein the information storage device is selected from the group consisting of: a radiofrequency identification tag and a bar code tag.

48. A method for assembling a multi-tool punch assembly, the method comprising:

- mounting a plurality of punch tools into a punch guide, each tool of the plurality of punch tools being mounted in an unique position within the guide;
- entering punch tool information into an information storage device, the information storage device being coupled to a face of a plate of a stripper assembly, and the punch tool information corresponding to the plurality of punch tools; and
- mounting the plate of the stripper assembly to the punch guide such that the information storage device is enclosed between the plate and a surface of the punch guide, the surface of the punch guide being that through which each tool of the plurality of punch tools extends, when activated.
49. The method of claim 48, wherein the punch tool information comprises an association of each unique position with identification information for the corresponding mounted tool.

50. The method of claim 48, wherein the punch tool information comprises prior usage information for each tool of the plurality of punch tools.

51. The method of claim 48, wherein the punch tool information comprises maintenance information for each tool of the plurality of tools.

52. The method of claim 48, wherein a reader wirelessly receives the punch tool information from the plurality of punch tools, and wirelessly enters the information into the information storage device.

53. The method of claim 48, further comprising transferring the programmed punch tool information from the information storage device to at least one of: a control center of a punch press and an auxiliary storage of the press.

54. The method of claim 48, further comprising punching with each tool of the plurality of punch tools being mounted in the punch guide to form a plurality of corresponding punch ports through the mounted plate of the stripper assembly.

55. The method of claim 48, wherein:

   mounting the plate of the stripper assembly to the punch guide comprises:
   bringing the face of the plate of the stripper assembly into close proximity with the surface of the punch guide; and
   rotating the plate to engage grooves thereof with flanges of the punch guide and to simultaneously engage resilient members thereof with recesses in the surface of the punch guide; and
   the grooves of the plate are located about a perimeter of the face of the plate, facing a centerline axis of the plate, and the resilient members of the plate protrude from the face of the plate.

56. The method of claim 48, further comprising:

   inserting each of a plurality of individual stripper members into a corresponding gripping slot of a plurality of gripping slots formed in the plate of the stripper assembly;
wherein each inserted individual stripper member is approximately coplanar with the plate and is held in place with respect to the punch guide by the corresponding gripping slot of the plate.

57. A method for assembling a multi-tool punch assembly, the method comprising:
mounting a plate of a stripper assembly to a punch guide;
forming a plurality of strippers in the mounted plate of the stripper assembly;
and
mounting a plurality of punch tools into the guide, each punch tool of the plurality of punch tools being mounted in an unique position within the guide.

58. The method of claim 57, wherein mounting the plurality of punch tools precedes forming the strippers.

59. The method of claim 58, wherein forming the plurality of strippers comprises punching through the plate with the plurality of punch tools.

60. The method of claim 57, wherein forming the plurality of strippers comprises inserting each of a plurality of individual stripper members into a corresponding gripping slot of a plurality of gripping slots formed in the mounted plate of the stripper assembly;

61. The method of claim 57, wherein mounting the plate of the stripper assembly comprises bringing a face of a plate of the stripper assembly into close proximity with a surface of the punch guide, the surface of the punch guide being that through which each punch tool of the plurality of punch tools, mounted in the guide, extends, when activated, and rotating the plate to engage grooves thereof with flanges of the punch guide and to simultaneously engage resilient members thereof with recesses in the surface of the punch guide.

62. A method for mounting a stripper assembly onto a multi-tool punch guide, the method comprising:
bringing a face of a plate of the stripper assembly into close proximity with a surface of the punch guide, the surface of the punch guide being that through which each punch tool of a plurality of punch tools, mounted in the guide, extends, when activated; and
rotating the plate to engage grooves thereof with flanges of the punch guide and to simultaneously engage resilient members thereof with recesses in the surface of the punch guide;
wherein the grooves are located about a perimeter of the face of the plate, facing a centerline axis of the plate, and the resilient members protrude from the face of the plate.

63. The method of claim 62, further comprising:
inserting each of a plurality of individual stripper members into a corresponding gripping slot of a plurality of gripping slots formed in the plate of the stripper assembly;
wherein each inserted individual stripper member is approximately coplanar with the plate and held in place with respect to the punch guide by the corresponding gripping slot of the plate.
Form stripper zones in stripper assembly plate

Enter punch tool information into information storage device

Transfer punch tool information from information storage device to control center of press

Transfer punch tool usage information from control center of press to information storage device

FIG. 7
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

INV. B21D28/12 B21D45/00

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)
B21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data database consulted during the international search (name of database and, where practical, search terms used)
EPO-Internal, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
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<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tr>
<td>X</td>
<td>US 5 848 563 A (SAITO HIROSHI [JP]) 15 December 1998 (1998-12-15) column 5, paragraph 1, figures 2-4, 6 column 9, lines 25-32</td>
<td>57, 58, 60</td>
</tr>
<tr>
<td>A</td>
<td>US 4 976 180 A (OTTO GERHARD [DE]) 11 December 1990 (1990-12-11) column 6, lines 54-68; figure 3</td>
<td>1-47, 61-63</td>
</tr>
<tr>
<td>A</td>
<td>FR 2 267 170 A (BEAUPLAT PHILIPPE [FR]) 7 November 1975 (1975-11-07) figures 2-4</td>
<td>1-47, 57, 58, 60-63</td>
</tr>
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X See patent family annex.

Further documents are listed in the continuation of Box C.

Date of the actual completion of the international search 10 December 2008

Date of mailing of the international search report 09/02/2009

Name and mailing address of the ISA/European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV RIVIERA Tel. (+31-70) 340-2940, Fax: (+31-70) 340-3016

Authorized officer Knecht, Frank

**Box No. II  Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. 
   
   - **Claims Nos.:**
   - because they relate to subject matter not required to be searched by this Authority, namely:

2. 
   
   - **Claims Nos.:**
   - because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. 
   
   - **Claims Nos.:**
   - because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box No. III  Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

- see additional sheet

1. 
   - As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. 
   - As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. 
   - As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. 
   - No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

   - see annex

**Remark on Protest**

- The additional search fees were accompanied by the applicant’s protest and, where applicable, the payment of a protest fee.

- The additional search fees were accompanied by the applicant’s protest but the applicable protest fee was not paid within the time limit specified in the invitation.

- No protest accompanied the payment of additional search fees.
This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-21, 22-34, 35-47, 57, 58, 60-63

- A stripper assembly for a mutli-tool punch guide, the stripper assembly comprising:
  a plate with a plurality of grooves facing towards the centerline of the plate, a plurality of strippers approximately coplanar with the plate, wherein the plurality of grooves are each engaged in a corresponding flange and a corresponding recess of the punch guide by rotating the plate (claims 1-21 and 22-34)
- A stripper assembly plate for a multi-tool punch guide, the plate comprising: a plurality of gripper slots with ends terminated by a relief to hold the strippers; and a plurality of grooves facing towards the centerline of the plate and adapted to engage with a corresponding flange of the punch guide when the plate is rotated (claims 35-47)
- A method of assembling a multi-tool punch assembly the method comprising: mounting a plate of a stripper assembly to a punch guide; forming a plurality of strippers in the mounted plate of the stripper assembly; and mounting a plurality of punch tools into the guide, each punch tool of the plurality of punch tools being mounted in an unique position within the guide (claims 57, 58, 60, 61).
- A method for mounting a stripper assembly onto a multi-tool punch guide, the method comprising: bringing a face of a plate of the stripper assembly into close proximity with a surface of the punch guide and rotating the plate to engage grooves thereof with flanges of the punch guide and to simultaneously engage resilient members thereof with recesses in the surface of the punch guide; wherein the grooves are located about a perimeter of the face of the plate, facing a centerline axis of the plate, and the resilient members protrude from the face of the plate (claims 62-63).

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2. claims: 48-56

A method for assembling a multi-tool punch assembly, the method comprising: mounting a plurality of punch tools into a punch guide; entering punch tool information into an information storage device, the information storage device being coupled to a face of a plate of a stripper assembly, and the punch tool information corresponding to the plurality of punch tools; and mounting the plate of the stripper assembly to the punch guide such that the information storage device is enclosed between the plate and a surface of the punch guide.

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3. claim: 59
A method for assembling a multi-tool punch assembly, the method comprising: mounting a plate of a stripper assembly to a punch guide and after mounting a plurality of punch tools into the guide, forming the plurality of strippers by punching through the plate with the plurality of punch tools.
<table>
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<th>Patent family member(s)</th>
<th>Publication date</th>
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</thead>
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<tr>
<td>US 5848563 A</td>
<td>15-12-1998</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 3720777 A1 05-01-1989</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>FI 882353 A 25-12-1988</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>FR 2617068 A1 30-12-1988</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IT 1224334 B 04-10-1990</td>
<td></td>
</tr>
<tr>
<td>FR 2267170 A</td>
<td>07-11-1975</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>AU 4267689 A 15-11-1990</td>
<td></td>
</tr>
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<td></td>
<td></td>
<td>CA 1327881 C 22-03-1994</td>
<td></td>
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<td></td>
<td></td>
<td>EP 0396817 A2 14-11-1990</td>
<td></td>
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<td></td>
<td>EP 0556876 A2 25-08-1993</td>
<td></td>
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<td></td>
<td></td>
<td>FI 894773 A 13-11-1990</td>
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<td></td>
<td></td>
<td>JP 2303636 A 17-12-1990</td>
<td></td>
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<td></td>
<td></td>
<td>US 5062337 A 05-11-1991</td>
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