United States Patent

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[72] Inventors **John H. Herzog**
Red Wing, Minn.;
Ronald C. Hill, Corfu, N.Y.

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[73] Assignee **Houdaille Industries, Inc.**
Buffalo, N.Y.

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[54] **PUNCH PRESS TOOLING**
5 Claims, 4 Drawing Figs.

[52] U.S. Cl. **83/136, 83/146**

[51] **Int. Cl.** **B26d 7/18**
[50] **Field of Search** 83/136, 146

[56] **References Cited**

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Primary Examiner—William S. Lawson
Attorney—Hill, Sherman, Meroni, Gross & Simpson

ABSTRACT: A punch, stripper sleeve and die member, when out of the press, are nested together to form a nestable tool assembly which can be rapidly handled as a unit and inserted and removed from a punch holder and drive assembly of a punch press.

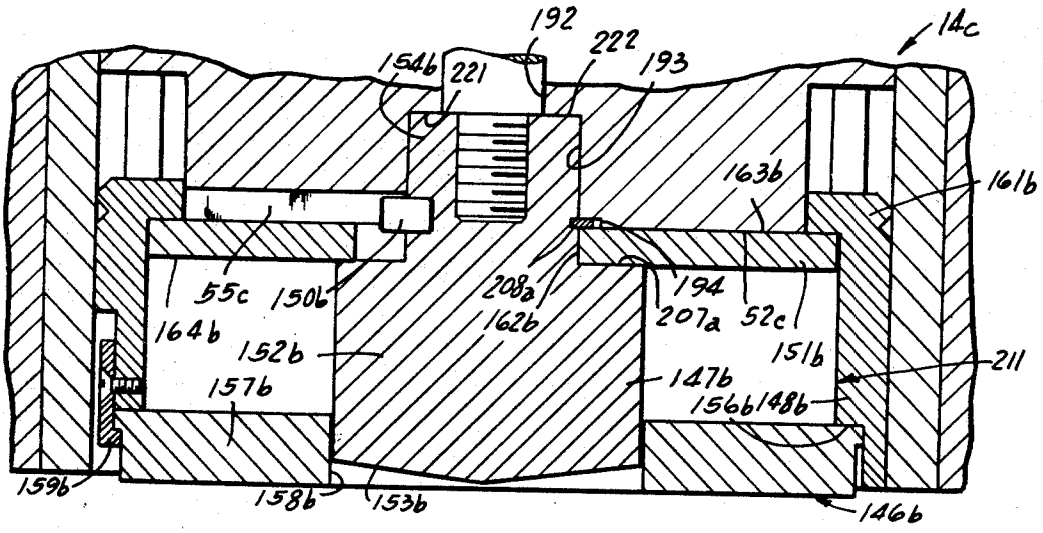


FIG. 1

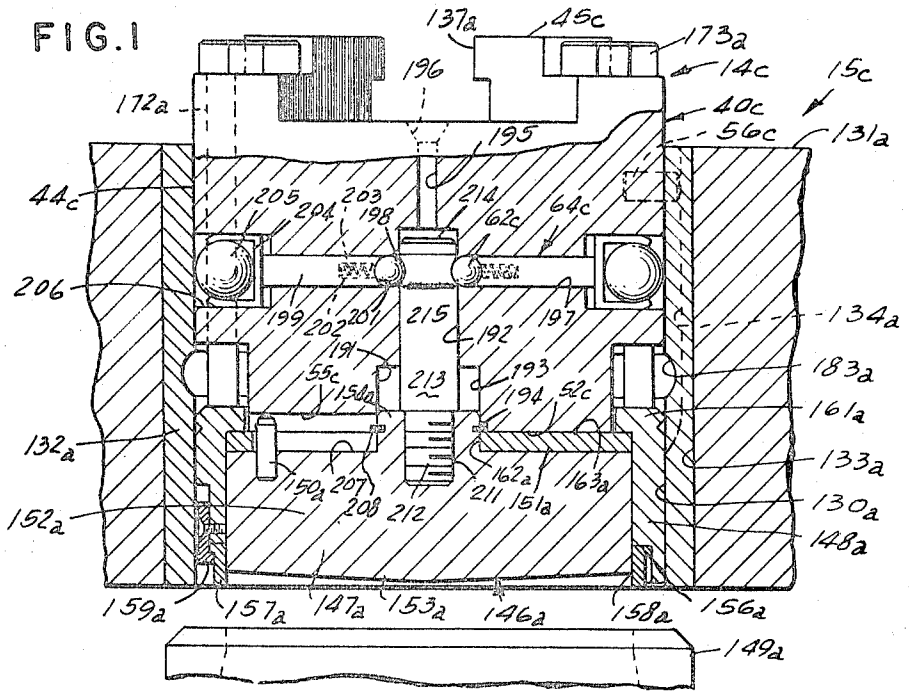
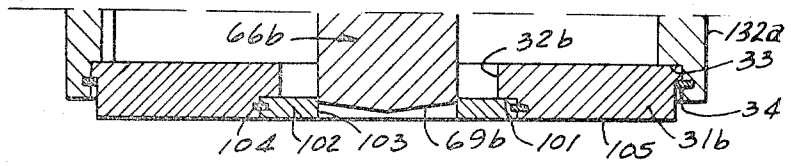


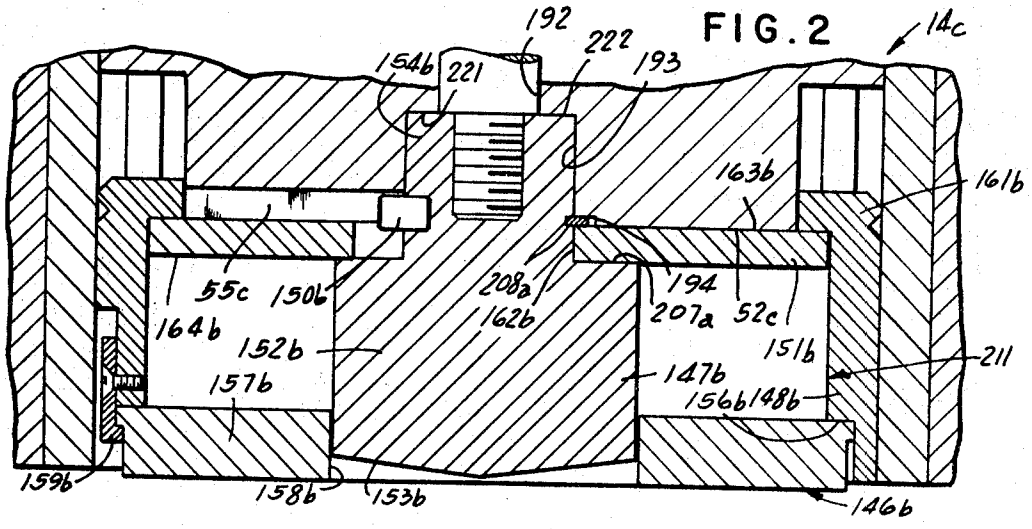
FIG. 4



INVENTORS
JOHN H. HERZOG
RONALD C. HILL

Hill, Sherman, Meroni, Gross & Simpson ATTORNEYS

FIG. 2



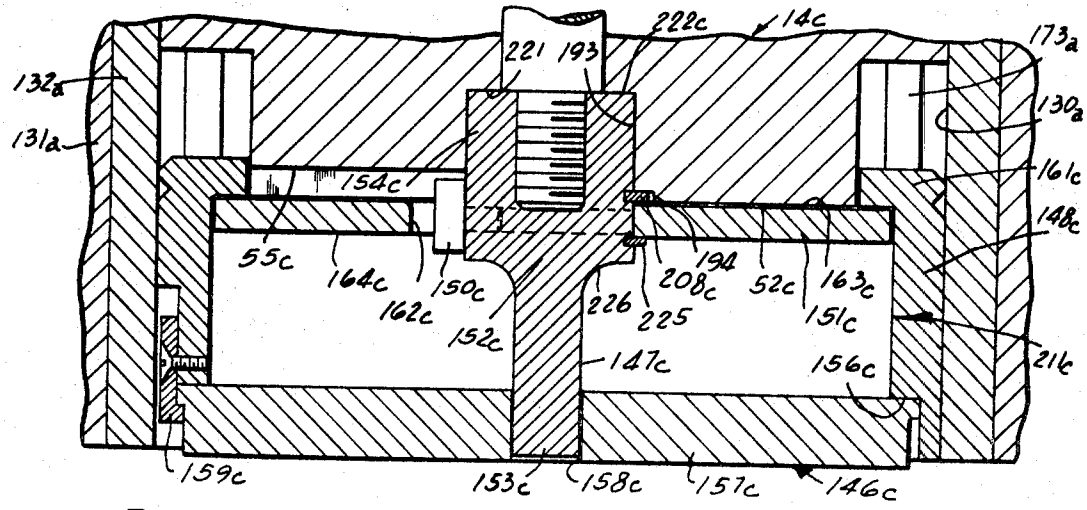


FIG. 3

INVENTORS
JOHN H. HERZOG
RONALD C. HILL

Hill, Sherman, Meroni, Gross & Simpson ATTORNEYS

PUNCH PRESS TOOLING

RELATED APPLICATION

This application is a division of our copending application for U.S. Patent on a "Punch Holder and Drive Assembly," filed Mar. 21, 1968, Ser. No. 714,957, now U.S. Pat. No. 3,548,700.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is directed to interchangeable tooling for a punch press, and particularly one which is a nested tool assembly comprising a die member, a punch and a stripper sleeve.

2. Prior Art

In a punch presses, it is desirable to perform rapid tool loading with a minimum amount of press downtime. Heretofore, punch tolling was so constructed that it required considerable time to detach the punch member from the assembly. Further, small and large punches occupied various space rendering interchangeability difficult.

SUMMARY OF THE INVENTION

The invention includes a tool assembly comprising a punch with attachment means which is nestable in a stripper sleeve with the punch extending through an apertured stripper plate of the sleeve into the aperture of a die member to provide a single assembly which may be handled as a unit and loaded and unloaded from a press in a single operation.

An object of the present invention is to provide a punch press tool assembly having standardized outer dimensions with interchangeable punches and dies of different cutting dimensions.

A further object of the present invention is to provide a tool assembly which can be loaded and unloaded in a punch press as a unit.

Yet another object of the present invention is to provide a construction which can be standardized as to external dimension for interchange with a similar construction having different cutting dimensions and shapes for the punch and die.

Many other advantages, novel features and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description and accompanying sheets of drawings in which preferred structural embodiment incorporating the principles of the present invention are shown by way of illustrative examples.

On the Drawings

FIG. 1 is a view of an embodiment of a punch holder and drive assembly having one type of tooling provided in accordance with this invention.

FIG. 2 is a fragmentary cross-sectional view in enlarged scale of a modified form of the tool assembly illustrated in FIG. 1;

FIG. 3 is a fragmentary cross-sectional view of a further embodiment of the tool assembly; and

FIG. 4 is a fragmentary cross-sectional view of a form of stripper plate for use in the devices of FIGS. 1, 2 and 3.

As shown on the Drawings

The tooling of the present invention is particularly useful in a punch holder and drive assembly generally indicated at 14*c* disposed in an upper tool support generally indicated at 15*c*. The upper tool support 15*c* is comprised of a normally stationary U-shaped yoke or a turret disposed beneath a press ram.

FIG. 1 illustrates a punch holder and drive assembly generally indicated at 14*c* disposed in a station or guide portion 130*a* of an upper turret 131*a* of the tool support part of a punch press generally indicated at 15*c*. The guide portion 130*a* comprises an inner surface of a sleeve 132*a* disposed in the bore 133*a* of the turret 131*a*. The sleeve 132*a* has an axial groove 134*a* extending a portion of the axial length of the sleeve 132*a*.

The punch holder and drive assembly 14*c* comprises a body means generally indicated at 40*c* which is a one-piece member having a head portion 45*c* which has a T-shaped slot 137*a* for reception and engagement with a punching ram or an unloading/loading ram. The slot 137*a* engages with the punching ram when the turret 131*a* is rotated with respect to the rams. The punch holder and drive assembly 14*c* is also provided with four groups of three axially extending bores 172*a* which have stripping pins 173*a* therein.

The body means 40*c* of the punch holder and drive assembly 14*c* has a lower surface 52*c* which has a socket 191 defined by a passageway 192 extending axially inwardly from the surface 52*c*. The passageway 192 has a first counterbore 193 and a second counterbore 194. In communication with the passageway 192 is an ejection pin passageway 195 which has a countersunk portion 196 adjacent the T-shaped slot 137*a*.

The body means 40*c* has a passageway 197 extending transversely to the passageway 192 and to the direction of reciprocation of the punch holder and drive assembly 14*c*. In each of the passageways 197 is disposed a gripping member 62*c*, illustrated to be a ball, and a lock means generally indicated at 64*c*. The passageway 197 is provided with an inwardly extending retainer lip 198 adjacent to the passageway 192 to limit the inward movement of the gripping means 62 to a normal locking position.

The lock means 64*c* comprises a shaft or pin 199 slidably disposed in the passageway 197. The shaft 199 has an end surface 201 which is concave and is in contact with the gripping member 62*c*. Each end surface 201 has a bore 202 which receives a spring 203 which urges the gripping member and the end surface 201 apart. At an end opposite to the end surface 201, the shaft 199 has a cage 204 holding a ball follower 205. The passageway 197 has a counterbore 206 adjacent the outer surface 44*c* to receive the cage 204.

The guide portion has a depression or groove 183*a* which receives the ball follower 205 when the punch holder and drive assembly 14*c* is lowered to a loading/unloading position. When the ball follower 205 is received in the depression 183*a*, the gripping means 62*c* is still resiliently urges or biased by the spring 203 to the normal locking position.

THe punch holder and drive assembly 14*c* coacts with a nestable tool assembly 146*a* which has a punch 147*a*, a stripper sleeve 148*a*, a die 149*a* and a spacer plate 151*a*. The punch 147*a* has a body portion 152*a* having a cutting end 153*a* and an upper portion or projection 154*a* which is cylindrical and is received in the counterbore 193. The spacer plate 151*a* has an aperture 162*a* which is disposed around the projection 154*a*, the plate 151*a* resting on a shoulder 207 formed by the projection 154*a* and the body portion 152*a*. The shoulder 207 acts as a lower retainer for the spacer plate 151*a* and a second or upper retainer 208 is provided to prevent the plate from being removed from the punch 147*a*. When the punch 147*a* is connected to the assembly 14*c*, the second counterbore 194 receives the upper retainer 208 and provides a clearance so that retainer 208 does not receive any of the punching force of the assembly 14*c*. The punch 147*a* is provided with a locating pin 150*a* extending through a branch of the aperture 162*a* into a groove 55*c* in the lower surface 52*c* of the body means 40*c* to prevent relative rotation of the punch 147*a* and the assembly 14*c*. The upper portion 154*a* has a threaded socket 211 receiving a threaded projection 212 of and attachment portion 213. The attachment portion 213 at the opposite end from the threaded projection 212 has a head portion 214 which is defined by a neck 215. The attachment portion 213 and upper portion 154*a* are received in locating surfaces defined by the passageway 192 and counterbore 193 of the body means 40*c*, and the attachment portion 213 forms a connection between the tool assembly 146*a* and the punch

holder and drive assembly 14c when the neck 215 is engaged by the gripping means 62c.

The stripper sleeve 148a of the tool assembly 146a has a counterbore 156a at one end receiving a stripper plate 157a which has an aperture 158a which is complementary to the cutting end 153a of the punch. The stripper plate 157a is retained in the counterbore by a retainer 159a comprising a grip or clip secured to the stripper sleeve 148a by a screw. At the end opposite the counterbore 156a, the stripper sleeve 148a has a retainer 161a which is an inwardly extending flange. An upper surface 163a of the spacer plate 151a contacts the retainer 161a and prevents the withdrawal of the punch 147a past the end opposite the counterbore 156a.

During the punching operation, a punch ram is engaged in the slot 137a of the punch holder and drive assembly 14c to reciprocate the assembly in the guide portion 130a. The punching force is transferred from the assembly 14c to the punch 147a through the surfaces 52c to the spacer plate 151a and then to the punch body 152a. During the downward stroke of the punching ram, the stripper pins 173a are urged downwardly by means (not shown) to force the stripper sleeve 148a into engagement with a workpiece and to clamp the workpiece between the stripper plate 157a and the die member 149a. Continuation of movement of the punch holder and drive assembly 14c causes the punch end 153a to penetrate the workpiece to perform the desired operation. As the punching ram completes its downward movement and starts its upward movement, the punch end 153a is withdrawn from the workpiece while the stripper pins 173a maintain the stripper plate 157a in engagement with the workpiece to assist the stripping of the punch end 153a from the workpiece. As the punch 147a is withdrawn, the upper surface 163a of the spacer plate 151a contacts the retainer 161a and carries the stripper sleeve 148a with the punch 147a into the station 130a to the position illustrated.

To remove the tool assembly 146a from the punch holder and drive assembly 14c, the turret 131a is rotated until the assembly 14c in the station 130a is positioned beneath a loading/unloading ram. The unloading/loading ram lowers the punch holder and drive assembly 14c to the unloading/loading position in which the ball followers 205 may enter the depressions 183a in the guide portion 130a. This movement of the ball follower removes the positive locking of the gripping means 62c by the lock means 64c. Next, an ejection pin moves through the ejection pin bore 195 to apply force to the head 214 of the attachment portion 213 of the punch 147a. In response to such force, the surfaces of the neck 215 cam or move the gripping members 62c against the springs 203 to an unlocked position which allows the passage of the head 214 past the gripping members 62c. When the punch holder and drive assembly 14c is lowered to the unloading/loading position, the movement causes the die member 149a to be removed from the holding means of the lower turret so that once attachment portion 213 of the punch 147a is disconnected from the punch holder and drive assembly 14c, the nested tool assembly 146a can be removed through the station of the lower turret.

To insert a tool assembly 146a, the tool assembly is lifted through the station of the lower turret until the attachment portion 213 is positioned in the passageway or bore 192. Continuation of lifting of the tool assembly causes the head 214 to contact the gripping members 62c and to move them against the springs 203 to the unlocked position until the neck 215 is in alignment with the passageways 197. At that time, the springs 203 bias the gripping members 62c into a temporary connection with the attachment portion 213. Once tool assembly 146a has been temporarily connected to the punch holder and drive assembly 14c, the ram of the unloading/loading station moves upwardly causing the cam followers 205 to be withdrawn from the depression 183a and to move the locking means 64c into contact with the gripping members 62c to maintain them in the normal locking position.

FIG. 2 illustrates a modified form of the tool assembly generally indicated at 146b, held in a punch holder and drive assembly generally indicated at 14c. The tool assembly 146b comprises a punch 147b, a stripper sleeve 148b, and a spacer plate 151b. The die associated with the tool assembly 146b is not illustrated but is similar to the die members 149a.

The punch 147b has a punch body 152b having a cutting edge 153b at one end and an upper portion 154b at the other end. The upper portion 154b and the body portion 152b form a shoulder 207a which acts as a lower retainer which coacts with an upper retainer 208a to hold the spacer plate 151b in a locked position on the punch 147b. The upper portion 154b has a pin 150b extending outwardly and engaged in the groove 55c to prevent rotation between the punch 147b and the punch holder and drive assembly 14c.

The stripper sleeve 148b at one end has a counterbore 156b receiving a stripper plate 157b having an aperture 158b which is complementary to the punch end 153b. THe stripper plate 157b is held in the counterbore by a retainer clip 159b secured by a screw to the stripper sleeve 148b. The stripper sleeve 148b at an end opposite the counterbore 156b has an inwardly extending flange or retainer 161b.

The spacer plate 151b has an upper surface 163b and a lower surface 164b which act as abutments for engaging the retainer 161b and the stripper plate 157b to form an axial lost-motion connection generally indicated at 211 which prevents the removal of the punch 147b from the stripper sleeve 148b. The spacer plate 151b also has an aperture 162b which allows the positioning of the spacer plate about the projection 154b.

When the punch holder and drive assembly 14c is driving the punch 147b into a workpiece, the punching force is transmitted by the lower end surfaces 52c to the upper surface 163b of the spacer plate 151b which in turn transfers the force to the punch 147b. Force is also transmitted by a shoulder 221 to an upper surface 222 of the punch 147b. The second counterbore 194 provides space to receive the upper retainer 208a when the tool assembly 146b is connected to the punch holder and drive assembly 14c.

FIG. 3 illustrates a nestable tool assembly generally indicated at 146c attached to the punch holder and drive assembly 14c, both of which are disposed in the guide portion 130a formed by the sleeve 132a disposed in the upper turret 131a of the punch press.

The tool assembly 146c comprises a punch 147c, a stripper sleeve 148c, and a spacer plate 151c. The die which is similar to the die 149a is not illustrated. The punch 147c has a punch body 152c terminating in a punch end 153c at one end and having an upper portion 154c at the other end. The upper portion 154c has a pair of retainers 208c and 225 which maintain the spacer plate 151c in position on the upper portion 154c. The upper portion 154c is also provided with a pin 150c which is received in the groove 55c of the punch holder and drive assembly 14c to prevent relative rotation therebetween. The spacer plate 151c has an upper surface 163c and a lower surface 164c which form abutments which coact with the retainers 208c and 225 to maintain the plate 151c in its fixed position with an aperture 162c disposed about the punch 147c.

The stripper sleeve 148c has a counterbore 156c adjacent to one end which receives a stripper plate 157c having an aperture 158c complementary to the punch end 153c. The stripper plate 157c is held in the counterbore 156c by a retaining clip 159c fastened by a screw to the stripper sleeve 148c. The stripper sleeve 148c at the other end has an inwardly extending retainer flange 161c.

An axial lost-motion connection generally indicated at 211c is formed by the coaction of the an abutment 226 of the punch body 152c with the stripper plate 157c and by the coaction of the retainer 161c with the spacer plate 151c. The lost-motion connection 211c enables the stripper sleeve 148c to move relatively to the punch 147c during the punching operation and during the stripping of the punch from the workpiece.

In connecting the punch **147***c* to the punch holder and drive assembly **14***c*, the upper portion **154***c* is disposed in the first counterbore **193** with an upper surface **222***c* in contact with the shoulder or bottom **221** and the upper retainer **208***c* is received in the second counterbore **194**. The punching force of the punch holder and drive assembly is transmitted by the surface **221** to the upper surface **222***c* to drive the punch into the workpiece. The spacer plate **151***c* is of a thickness such that the upper surface **163***c* is not in contact with the lower end surface **52***c* of the punch holder and drive assembly **14***c* and therefore does not receive any of the punching force.

As shown in FIG. **4**, the punch **66***b* is of a smaller size than can be accommodated by the stripper plate **31***b*. The punch **66***b* has a tip or a cutting edge **69***b* at one end and an upper end such as shown in FIG. **1**, **2** or **3**. To prevent relative rotation, the punch is keyed to the body means.

The stripper sleeve **132***a* has a first stripper plate **31***b* disposed at one end in the counterbore **33** and held there by a retainer means **34**. The stripper plate **31***b* has an aperture **32***b* which is substantially larger than the punch **66***b*. The aperture **32***b* has an shoulder **101** formed by a counterbore which receives a second stripper plate **102** which has an aperture **103** complementary to the cutting edge **69***b* of the punch **66***b*. The second stripper plate **102** is held in the counterbore against the shoulder **101** by a retaining means or ring **104** to form a combined stripper plate **105**. The advantages of the combined stripper plate **105** are that it saves material when providing a small aperture such as **103** for a small punch **66***b* and that it allows the formation of a stripper plate which can be adapted to handle punch tips of any size up to the size of the aperture **32***b*.

Although various minor modifications might be suggested by those versed in the art, it should be understood that we wish to employ within the scope of the patent warranted hereon, all such embodiments as reasonably and properly come within the scope of our contribution to the art.

We claim as our invention:

1. 1. A tool assembly comprising:

a. an apertured die;

b. a stripper sleeve having an apertured stripper plate disposed at one end of said sleeve and a retainer disposed at the other end of said sleeve;

c. an apertured spacer plate having an upper and lower abutment surface;

d. a punch having a body portion being mountable in the aperture of said spacer plate and having a pair of retaining means coacting with said plate to limit axial movement therebetween, said body portion terminating in a punch cutting edge, said punch being nestable in said stripper sleeve and extendable through the aperture of said stripper plate and into the aperture of said die, said upper abutment surface of said spacer plate coacting with said sleeve retainer and preventing removal of said punch from said sleeve at said other end.

2. A tool assembly according to claim **1**, wherein said upper and lower abutment surfaces of said spacer plate coact with said sleeve retainer and said stripper plate, respectively to provide an axial lost-motion connection between said punch and said stripper sleeve.

3. A tool assembly according to claim **1**, wherein one of said pair of retaining means of said punch body portion is a shoulder surrounding a projection and the other of said pair of retainers is a ring partially disposed in a groove in said projection.

4. A tool assembly according to claim **1**, wherein said pair of retaining means are a pair of rings partially disposed in a pair of grooves in said punch body portion, said punch body portion having an abutment directed toward and coacting with said stripper sleeve to thereby provide an axial lost-motion connection between said punch and said stripper sleeve.

5. A punch assembly according to claim **1**, wherein said stripper plate includes a first stripper plate member having an aperture provided with a shoulder disposed at one end of said stripper sleeve, and a second apertured stripper plate member disposed in said aperture of said first stripper plate, so that said first stripper plate member can receive punches having various sizes and shapes of cutting edges within its aperture along with corresponding second stripper plate members.