United States Patent

[11] 3,548,700

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54] **PUNCH HOLDER AND DRIVE ASSEMBLY**
28 Claims, 13 Drawing Figs.

52] **U.S. Cl.** **83/698**
51] **Int. Cl.** **B26d 7/26**
50] **Field of Search** 83/698

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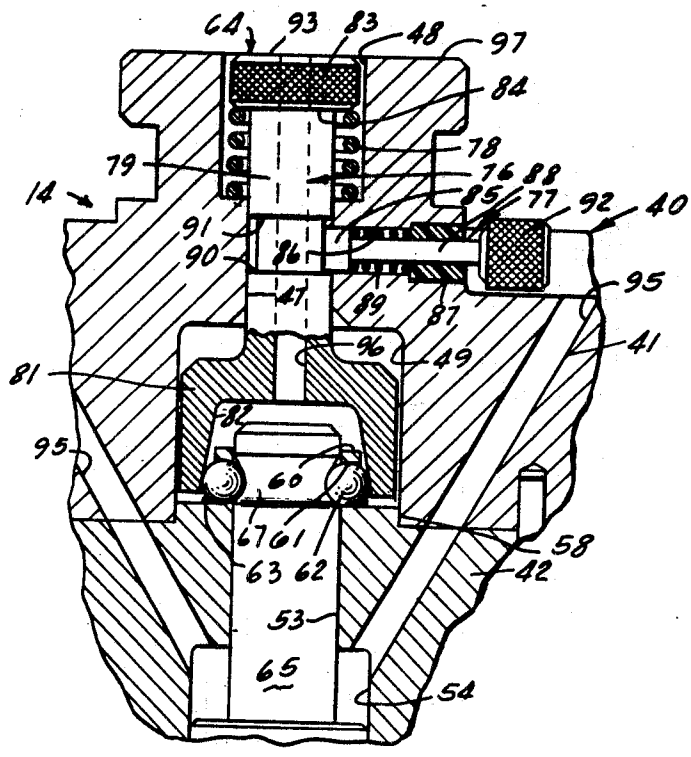
ABSTRACT: A punch holder and drive assembly for a press having a body which carries a gripping member which engages an attachment portion of a punch received in a socket of the body. The assembly further includes releasable means such as a cage, pin or sleeve which maintains the gripping member in engagement with attachment portion of the punch. When removed from the press, the punch, stripper sleeve and die member are nested together to form a nestable tool assembly which can be rapidly inserted and removed from the punch holder and drive assembly as a unit.



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SHEET 1 OF 5

Fig. 1

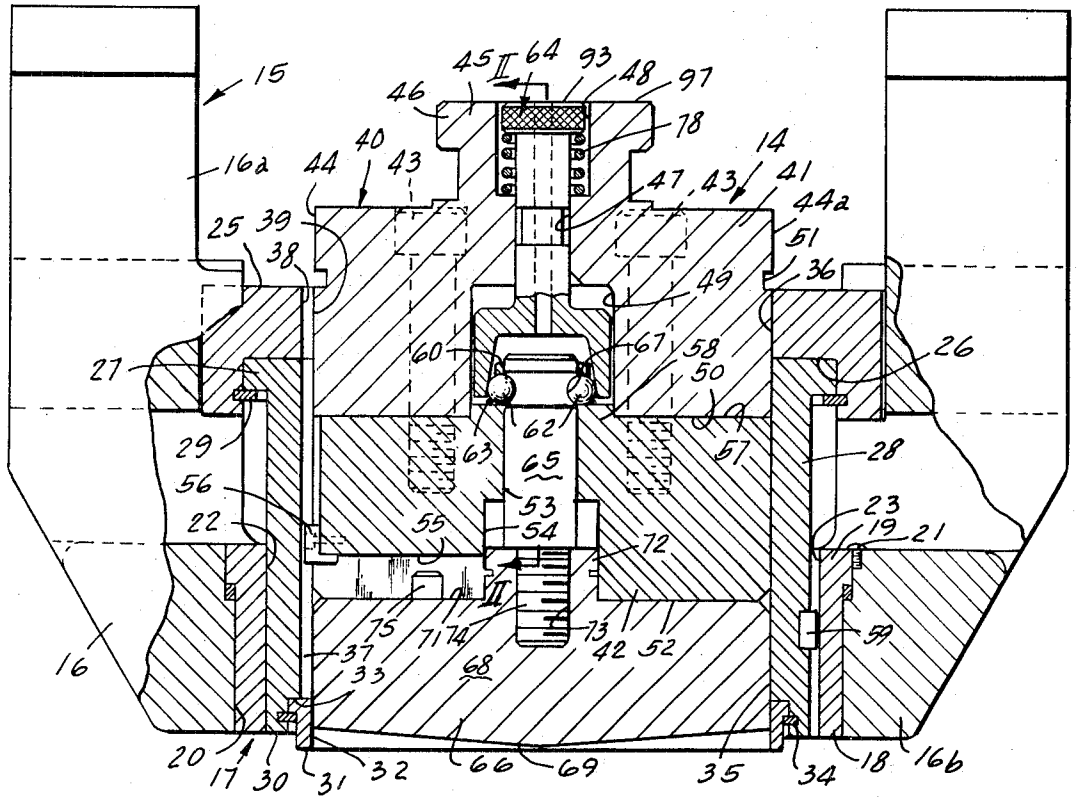

Fig. 2

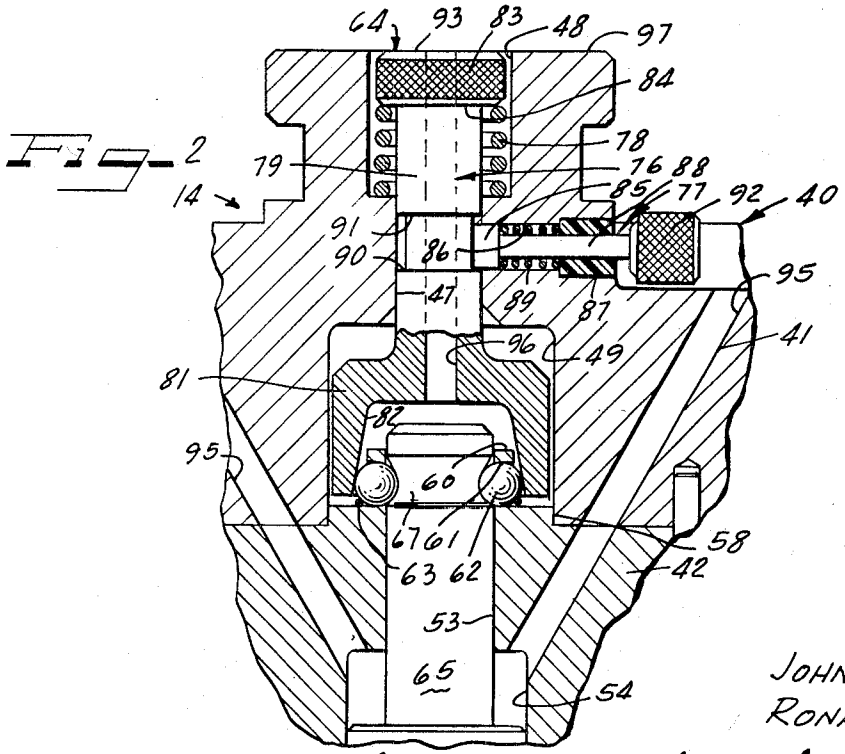

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Fig. 3

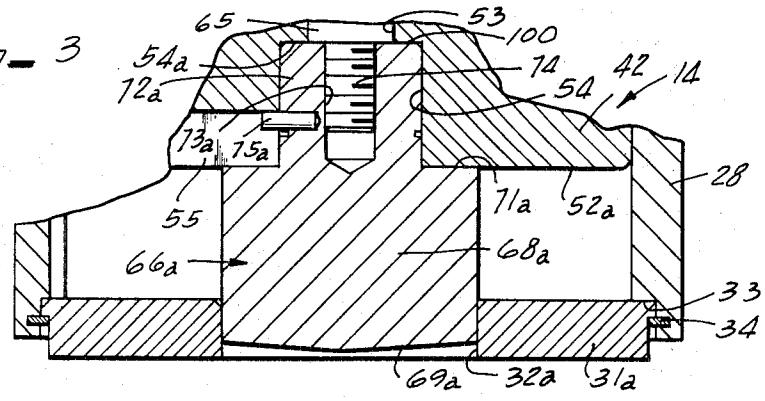

Fig. 4

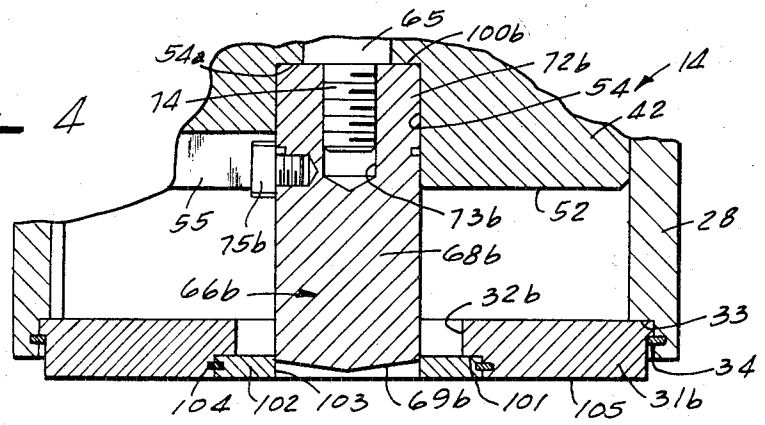

Fig. 5

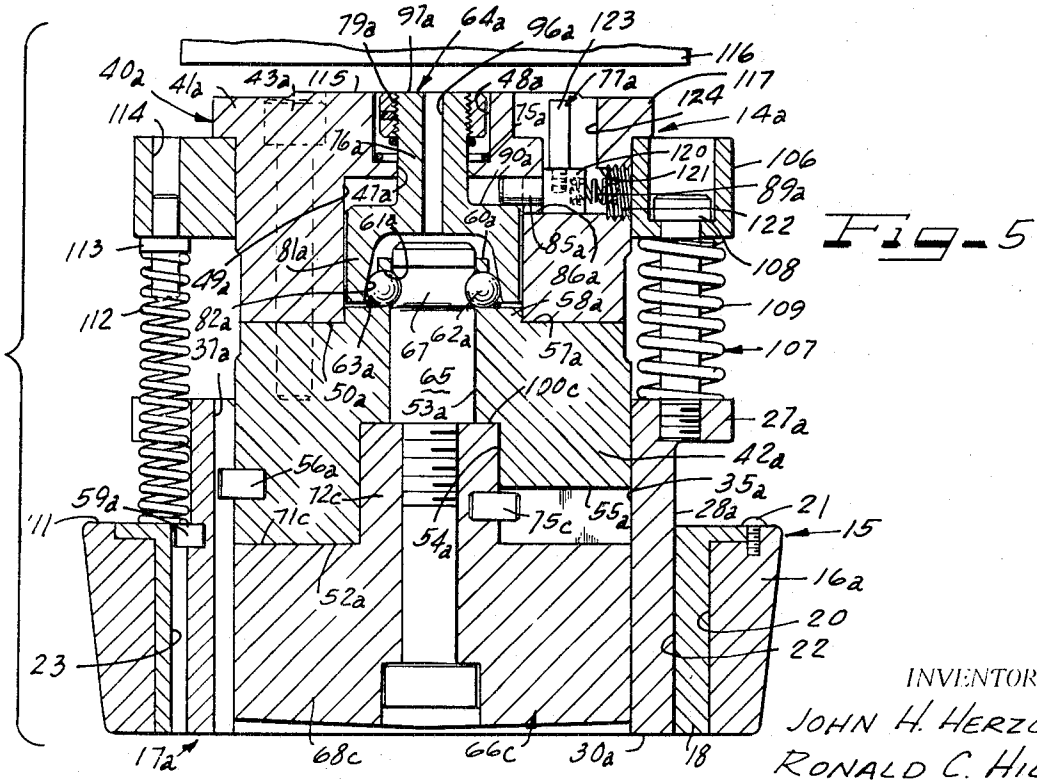

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Fig. 6

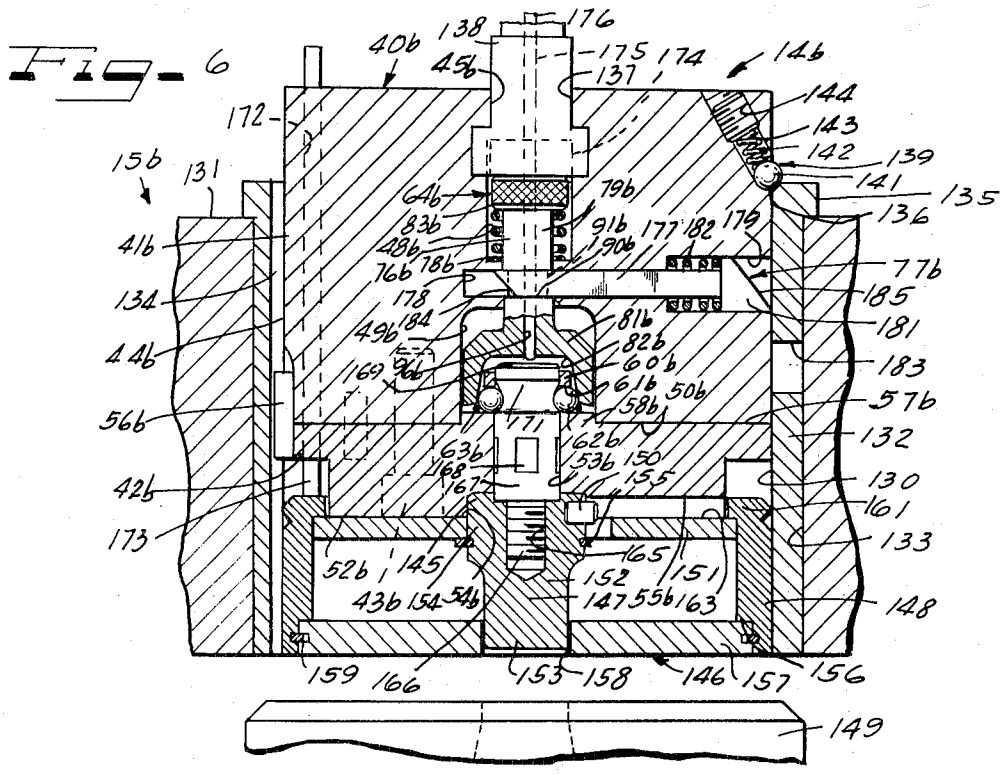

Fig. 7

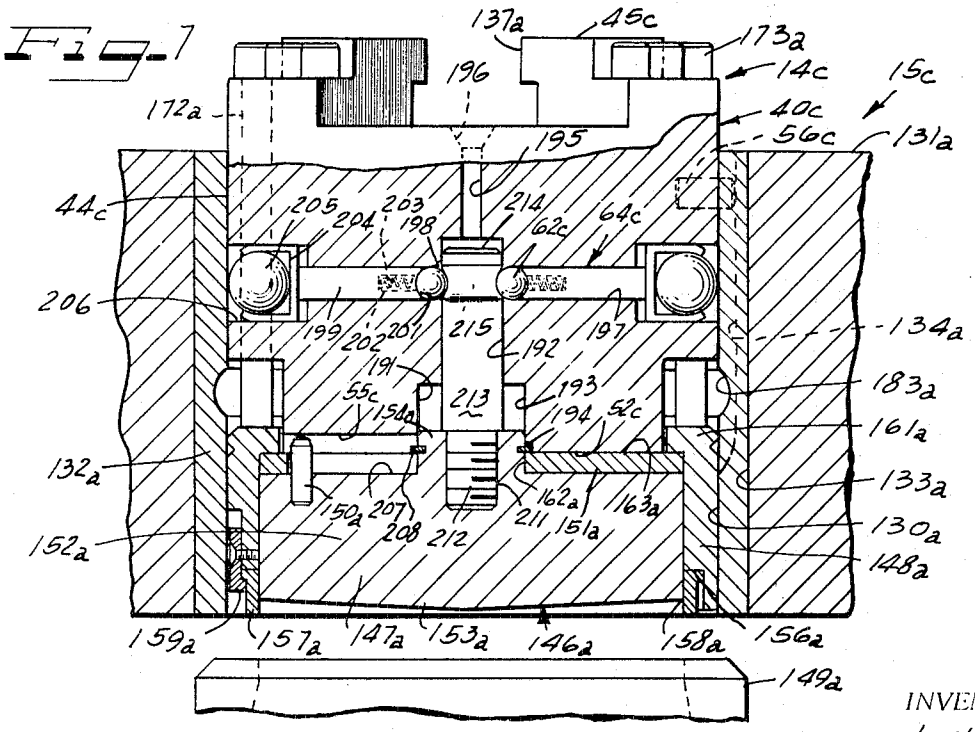

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Fig. 8

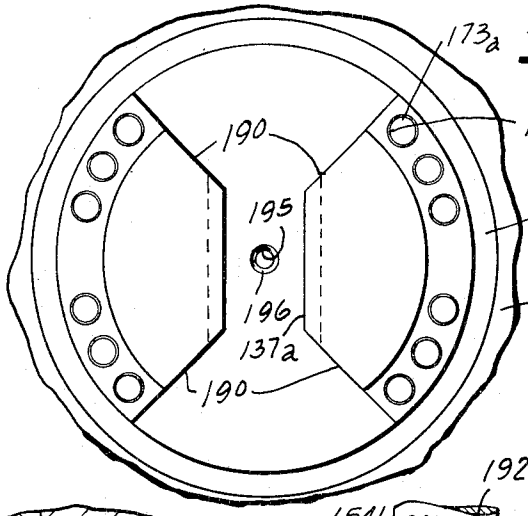
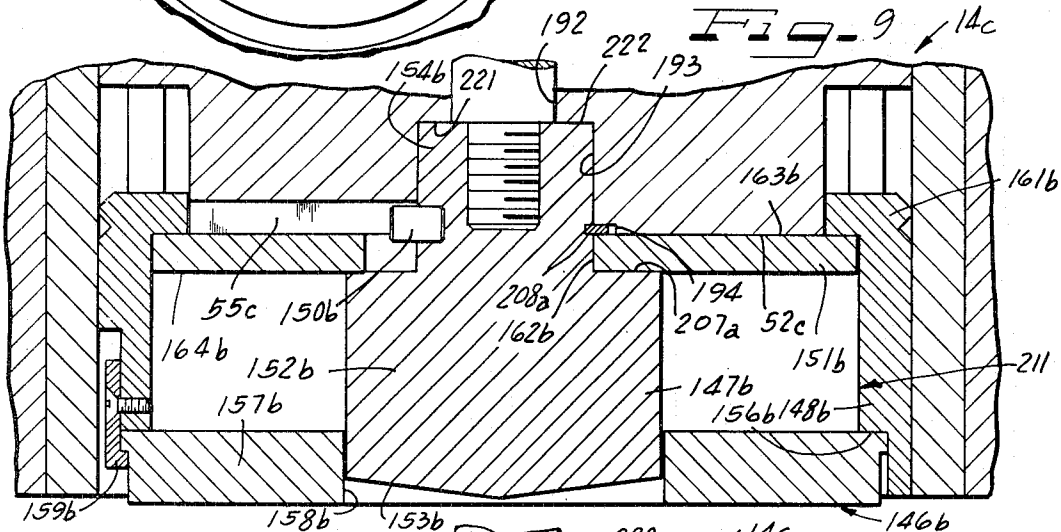


Fig. 9



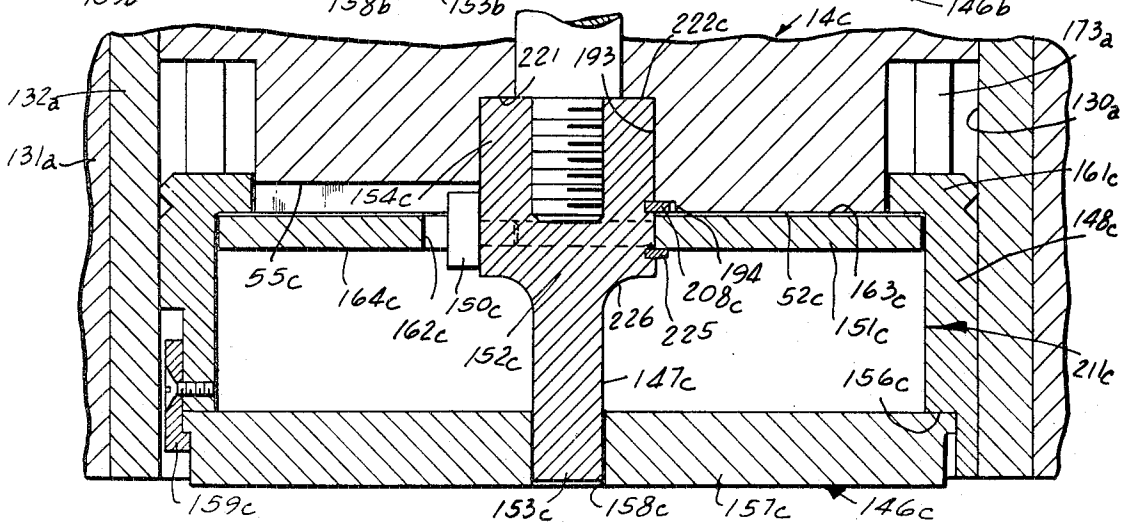


Fig. 10

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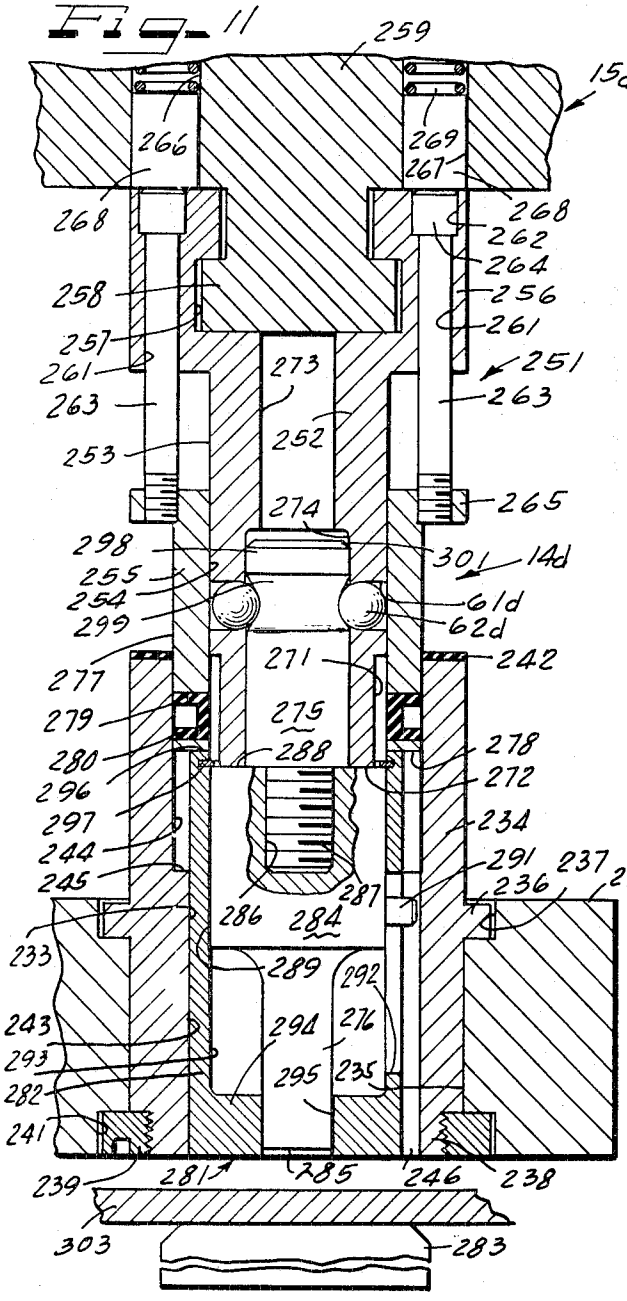
Fig. 11



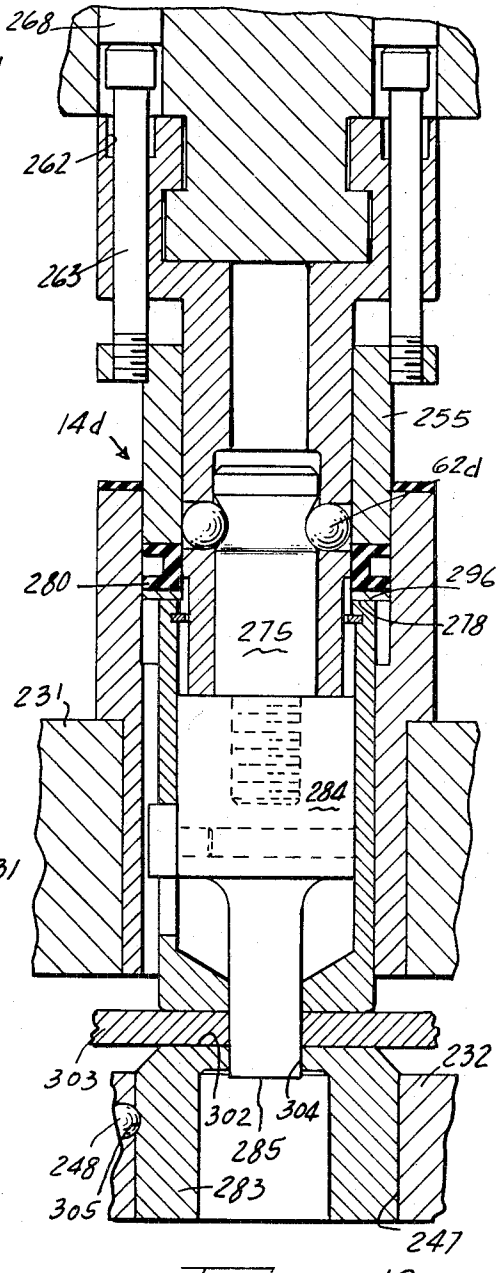


Fig. 12

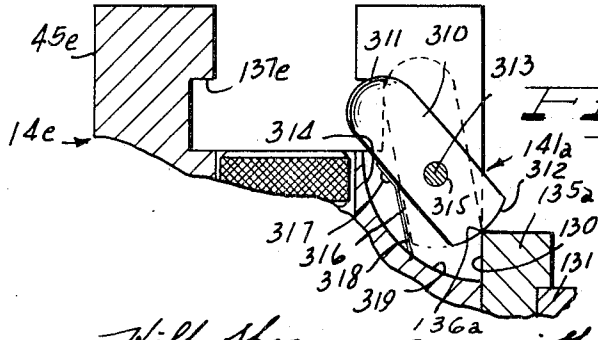


Fig. 13

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PUNCH HOLDER AND DRIVE ASSEMBLY

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is directed to a punch holder and drive assembly particularly one which quickly engages a nested tool assembly comprising a die member, punch and stripper sleeve.

2. Prior Art

In punch presses, a problem of performing rapid tool loading with a minimum amount of press-down time has arisen. Heretofore, punch members were connected to the punch drive assembly by threaded fasteners which required considerable time to detach the punch member from the assembly.

SUMMARY OF THE INVENTION

A punch holder and drive assembly includes a body means which has a socket for receiving an attachment portion of a punch and which carries gripping members to engage the portion to detachably interconnect the assembly and punch. The punch holder and drive assembly further includes lock means to maintain the gripping members in a normal locking position to maintain the connection between the punch and the punch holder and drive assembly. The lock means are selectively removable from the locking position and the gripping member may be moved to an unlocked position to allow the removal of the punch. The invention further includes a tool assembly comprising a punch with attachment means which is nestable in a stripper sleeve with the punch extending through an aperture of the 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 or unloaded from a press in a single operation.

Accordingly, it is an object of the present invention to provide a punch holder and drive assembly which can be rapidly connected or disconnected from a punch for use in a press.

Another object of the present invention is to provide a punch holder and drive assembly of standard dimensions for use in a press and for connecting and supporting a tool assembly having standardized outer dimensions with interchangeable punches and dies of different cutting dimensions in the press.

A still further object of the present invention is to provide a tool assembly which can be loaded and unloaded in a 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 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 embodiments incorporating the principles of the present invention are shown by way of illustrative examples.

On the drawings

FIG. 1 is a fragmentary cross-sectional view of a punch holder and drive assembly constructed in accordance with the principles of the present invention disposed in a press yoke;

FIG. 2 is a fragmentary cross-sectional view taken on line II–II of FIG. 1;

FIG. 3 is a fragmentary cross-sectional view in enlarged scale of a modified form of a punch used with the punch holder and die assembly of FIG. 1;

FIG. 4 is a fragmentary cross-sectional view in enlarged scale of a third embodiment of the punch;

FIG. 5 is a fragmentary cross-sectional view of a modified form of the punch holder and drive assembly;

FIG. 6 is a fragmentary cross-sectional view of a third embodiment of the punch holder and drive assembly;

FIG. 7 is a view of a fourth embodiment of the punch holder and drive assembly;

FIG. 8 is a plan view of the punch holder and die assembly of FIG. 7;

FIG. 9 is a fragmentary cross-sectional view in enlarged scale of a modified form of the tool assembly illustrated in FIG. 7;

FIG. 10 is a fragmentary cross-sectional view of a third embodiment of the tool assembly;

FIG. 11 is a fragmentary cross-sectional view of a fifth embodiment of the punch holder and drive assembly disposed in a press;

FIG. 12 is a fragmentary cross-sectional view of a punch holder and die assembly similar to FIG. 11 at the completion of the punching stroke; and

FIG. 13 is a fragmentary cross-sectional view of the head portion of a punch holder and drive assembly illustrating a modification in a support detent.

As shown on the drawings

The principles of the present invention are particularly useful in a punch holder and drive assembly generally indicated at **14** disposed in an upper tool support generally indicated at **15**. The upper tool support **15** is comprised of a U-shaped yoke **16** having arms **16***a*, **16***a* interconnected by a bight portion **16***b* which supports a guide portion generally indicated at **17** of the upper tool support structure **15**.

The guide portion **17** includes a fixed annular sleeve **18** having a flange **19** which is received in a counterbored passageway **20** in the bight portion **16***b* and is secured therein by a screw **21**. The sleeve **18** has an internal guide surface **22** having an axially extending groove **23**. The guide portion **17** further includes a stripper sleeve support ring **25** having a counterbore **26** receiving a flanged end **27** of a stripper sleeve **28**. The flanged end **27** is held in the counterbore portion by a retainer means **29** which comprises a snap ring partially disposed in a groove formed in the counterbore **26**.

The stripper sleeve **28** which is slidably received in the guide surface **22** has at the end **30** opposite the flanged end **27** a stripper plate **31** which has an aperture **32** detachably disposed in a counterbore **33** and held there by a retainer or a snap ring **34**. The stripper sleeve **28** has an internal surface **35** which, in this embodiment has the same diameter as an internal surface **36** of the stripper support ring **25**. The surface **35** has an axially extending groove **37** while the surface **36** has an aligned axially extending groove **38** and the two surfaces **35** and **36** coact together to form a continuous inner guide surface **39** of the guide portion **17**.

The punch holder and drive assembly **14** comprises a body means generally indicated at **40** which is made up of an upper body portion **41** and a lower body portion **42** which are interconnected by a number of threaded fastening means **43,43** which are illustrated as being machine screws. The body portions **41** and **42** have a combined outer surface **44** which is slidably received in the inner guide surface **39** of the guide portion **17** to guide the punch holder and drive assembly **14** as it reciprocates in the punch press.

The upper body portion **41** has a head portion **45** having oppositely extending flanges **46,46** which are provided for reception in a T-slot (not shown) of the ram of the punch press to reciprocate the punch holder and drive assembly **14** in the guide portion **17**. The upper body portion **42** has an axially extending passageway **47** having a counterbore **48** at the head portion **45** and a counterbore **49** at the opposite end **50** to form an internal cavity when the lower body portion **43** is secured thereto. The outer surface **44***a* of the upper portion **41** has an annular groove **51** for receiving a holding means (not shown) to maintain the punch holder and drive assembly **14** in the upper position illustrated in FIG. **1** when the head portion **45** is detached from the ram of the press.

The lower body portion **42** has a lower end surface **52** and an axially extending passageway **53** having a counterbore **54** adjacent the lower surface **52** to form a socket having locating surfaces. The lower surface **52** has a radially extending groove **55** which intersects the counterbore **54**. A pin **56** extends radially outwardly from the lower portion **42** and is received in the axially extending grooves **37** of the stripper sleeve **28** to

prevent relative rotation between the punch holder and drive assembly **14** and the stripper sleeve **28** which in turn has a pin **59** received in the groove **23** to prevent rotation between sleeve **18** and stripper sleeve **28**. The lower body portion **42** has an upper surface **57** with a cylindrical projection **58** which is received in the counterbore **49** of the upper body portion **41** as the surface **57** engages the lower end surface **50**. Extending upwardly from the projection **58** is a second projection **60** having a plurality of passageways **61** best seen in FIG. **2**. Disposed in each passageway **61** is a gripping member **62** which is illustrated to be a ball. The gripping member **62** is movable in the passageway **61** between a normal locking position in which the ball extends into the passageway **53** and an unlocked position in which the ball is retracted in the passageway **61** so as to be clear of the passageway **53**. A resilient means **63** which comprises a snap ring is disposed about the projection **60** to urge or bias the gripping members **62** toward the normal locking position. To hold or maintain the gripping member **62** in the normal locking position, a locking means generally indicated at **64** is disposed in the upper body portion **41**.

The punch holder and drive assembly **14** is detachably connected to an attachment portion **65** of a punch **66** by the gripping members **62** engaging a neck or annular groove portion **67** of the attachment portion **65**. The punch **66** has a body portion **68** having a punch tip **69** and an upper surface **71**. The body portion **68** has an upper cylindrical projection **72** which as illustrated has a threaded bore **73** to receive a threaded end **74** of the attachment portion **65** to connect the attachment portion **65** to the body portion **68**. As the punch **66** is connected to the punch holder and drive assembly **14**, the projection **72** is received in the counterbore **54** as the attachment portion **65** is received in the passageway **53**. The engagement between the surfaces of the attachment portion **65** and the projection **72** with the locating surfaces formed by the passageways **53** and **54** axially align the punch **66** with the punch holder and drive assembly **14**. The upper surface **71** of the punch body **68** is provided with a pin **75** which is received in the groove **55** to prevent relative rotation between the punch **66** and the punch holder and drive assembly **14**.

As best illustrated in FIG. **2**, the lock means **64** comprises a lock member **76**, a stop means generally indicated at **77** and a spring **78**. The lock member **76** has a stem portion **79** and a head or cage **81** at one end. The head **81** has an internally directed frustoconical cam surface **82** which engages each gripping member **62** to urge and maintain it in the normal locking position as illustrated.

The lock member **76** is supported in the upper body portion **41** with the stem **79** being slideably disposed in the passageway **47** and the head **81** being freely disposed in the counterbore **49**. The locking member **76** is reciprocable between a first position illustrated in the FIGS. in which the cam surface **82** holds or maintains the gripping members **62** in engagement with the neck **67** of attachment portion **65** and a second position in which the head **81** is moved upwardly in the counterbore **49** to allow an outward movement of the gripping members **62** to the unlocked position. The other end of the stem **79** has a annular ring **83** which is either force fitted or threaded thereon. The annular ring **83** has a lower abutment **84** on which the spring **78** disposed in the counterbore **48** acts to bias or move the lock member **76** toward the second position.

To prevent the lock member **76** from moving to the second position, the stop means **77** has a pin **85** which is disposed in a passageway **86** which extends transversely to the direction of reciprocation of the lock member **79**. The passageway **86** has a plastic bearing **87** which slideably receives a stem portion **88** of the pin **85**. A spring **89** is disposed about the stem portion **88** to urge the pin **85** into engagement with an abutment or shoulder **90** formed by a groove **91** in the stem **79** of the lock member **76**. The stem portion **88** terminates in a knob **92** which enables the pin **85** to be manually moved out of engagement with the shoulder **90** to permit the lock member **76** to move to the second position.

As illustrated the gripping members **62** are held in the lock position by a resilient means **63**, and thus will not disengage the attachment portion **65** of the punch **66** even when the lock member **76** is in the second position. To remove the punch **66** from the punch holder and drive assembly **14**, the body portions **42**, **43** are provided with a pair of angularly extending passageways **95**, **95** and the stem **79** of the lock member **76** is provided with an axially extending passageway **96**. Once the lock member **76** is moved to the second position, a rod or pin may be inserted through one of the passageways **95**,**95**, or **96** to tap the punch **66** to move the gripping member **62** against the resilient means **63** a to allow the withdrawal or ejection of the punch **66**.

To insert a punch **66** into the punchholder and drive assembly **14**, the stop means **77** is disengaged from the shoulder **90** to allow the lock member **76** to move to the second position freeing the gripping member **62**. The punch **66** is then inserted with the the attachment portion **65** being positioned in the passageway **53** and with the pin **75** in alignment with the groove **55**. Upward movement of the punch **66** until the surface **52** is in contact with the surface **71** of the punch will force the gripping members **62** outwardly against the resilient means **63**. When the neck **67** of the attachment portion **65** is aligned with the gripping member **62**, the resilient means **63** urges the gripping member into the neck to temporarily hold the punch **66** in place. Then by applying pressure to the outer end of the stem **79** against the force of the spring **78**, the lock member **76** is moved to the first position and the spring **89** will move the pin **85** of the stop means **77** into contact and engagement with the shoulder **90**. It should be noted that the outer end **93** of the stem **79** is flush with an upper surface **97** of the head portion **45** of the body portion **41** of the body means **40** so that a punch ram may be used to force the lock member **76** to the first position against the pressure of the spring **78**. However, normally when the lock member is in its outer unlocked position, it projects and prevents reception of the T-head portion into a T-slotted ram until positive locking has been effected.

FIGS. **3** and **4** illustrate different size punches **66***a* and **66***b* respectively used with the punch holder and drive assembly **14**. In FIG. **3** a punch **66***a* has a body portion **68***a* which has a punch cutting edge **69***a* at one end and an upper surface **71***a* at the opposite end. The body portion **68***a* has a cylindrical upwardly extending projection **72***a* which is received in the socket formed by the counterbore **54** in the lower body portion **42** of the punch holder and drive assembly **14**. The projection **72***a* has a threaded bore **73***a* for receiving a threaded end **74** of the attachment portion **65** of the punch an and an upper surface **100** which abuts against a shoulder **54***a* formed by the counterbore **54** in the body portion **42**. To prevent axial rotation between the assembly **14** and the punch member **66***a*, a pin **75***a* which is disposed in a radial bore in the projection **73***a* is engaged in the groove **55** of the lower body portion **42**. While secured in the punch holder and drive assembly **14**, the punch **66***a* has surfaced **71***a* and **100** engaging the surfaces **52** and **54***a* respectively to transmit the punching force from the assembly **14** to the punch. The stripper sleeve **28***a* has a stripper plate **31***a* disposed in a counterbore **33** and held there by the retaining means **34**. The stripper plate **31***a* has an aperture **32***a* which is complementary to the punch cutting edge **69***a*.

As shown in FIG. **4**, the punch **66***b* is of a smaller size than the punch **66***a*. The punch **66***b* has a body portion **68***b* which has a cutting edge **69***b* at one end and an upper body portion **72***b* at the other end. The upper body portion **72***b* is cylindrical and is received in the counterbore **54** with an upper surface **100***b* in engagement with the shoulder **54***a*. The upper portion **72***b* has a threaded bore **73***b* which has a threaded projection **74** of the attachment portion **65** threadedly engaged therein. To prevent relative rotation, a pin **75***b* is threaded into the upper portion **72***b* and coacts with the groove **55** of the lower body portion **42**. Punching forces are applied to the upper surface **100***b*.

The stripper sleeve **28** has a first stripper plate **31***b* disposed at one end in the counterbore **33** and held there by the

76*a*, either by hand or by use of the ram **116**, the lock member **76***a* is moved to the first position allowing the pin **85***a* of the stop means **77***a* to engage the abutment **90***a*. When the lock member **76***a* is in the first position, the gripping member **62***a* forms a positive connection between the punch **66***c* and the punch holder and drive assembly **14***a*.

FIG. **6** illustrates a third embodiment of the punch holder and drive assembly generally indicated at **14***b*, disposed in a station or guide portion **130** of an upper turret **131** of a press generally indicated at **15***b*. The turret **131** has a plurality of stations or guide portions **130** each of which is comprised of a sleeve **132** disposed in a bore **133** of the turret **131**. The sleeve **132** has an axially extending groove **134** and an upper flange **135** having an upwardly directed edge or surface **136**.

The punch holder and drive assembly **14***b* has a body means generally indicated at **40***b* which has an upper body portion **41***b* and a lower body portion **42***b*. The body portions **41***b* and **42***b* are held together by a plurality of machine screws **43***b* to form an outer surface **44***b* of the body means **40***b*. To prevent relative rotation between the assembly **14***b* and the guide portion **130**, the outer surface **44***b* has a pin **56***b* engaged in the groove **134**.

The upper body portion **41***b* has a head portion **45***b* which has a transversely extending T-shaped groove or slot **137** for receiving in one turret position a complementary head of a press ram (not shown) and for alternatively receiving an unloading ram **138** in another turret position. The head portion **45***b* also includes a detent generally indicated at **139** comprising a ball **141** urged by a spring **142** into engagement with the upwardly directed edge portion **136**. The ball **141** and spring **142** are trapped in a bore **143** which is closed at one end by a threaded plug **144**, and which is of converging size at the other end.

The upper body portion **41***b* has an axially extending passageway **47***b* having a counterbore **48***b* adjacent to the T-slot **137** and a second counterbore **49***b* extending inwardly from a lower end surface **50***b*.

The body portion **42***b* has an axially extending passageway **53***b* having a counterbore **54***b* extending inwardly from a lower end surface **52***b* to define a socket. A radial slot **55***b* in the lower end surface **52***b* extends outwardly from the counterbore **54***b*. The passageway **53***b* and the counterbore **54***b* have an internal shoulder **145** which is the base of the counterbore **54***b*. The lower body portion **42***b* has an upper surface **157***b* which has a cylindrical concentric projection **58***b* extending upwardly therefrom to be received in the counterbore **49***b* as the two body portions **41** **41***b* and **42***b* are joined together. The projection **58***b* has a second projection **60***b* having passageways **61***b* extending transversely to the direction of reciprocation of the punch holder and die assembly **14***b*. Each of the passageways **61***b* contains a gripping means **62***b* which is illustrated as a ball. A resilient means such as a snap ring **63***b* urges the balls inwardly toward a normal locking position.

The punch holder and drive assembly **14***b* cooperates with a nestable tool assembly generally indicated at **146**. The nestable tool assembly **146** comprises a punch **147**, a stripper sleeve **148**, an apertured die member **149** and a spacer plate **151**. The punch **147** has a punch body **152**, a cutting end **153** and an upper portion **154**. The upper portion **154** has a retainer **155**, namely a snap ring disposed in a groove, and a locating pin **150** which is received in the groove **55***b* to prevent relative rotation between the punch **147** and the assembly **14***b*.

The stripper sleeve **148** at one end has a counterbore **156** in which a stripper plate **157** having an aperture **158** complementary to the cutting end **153** is disposed and hold by a retaining means **159**, namely a snap ring, disposed in grooves of both the stripper plate **157** and the wall of the counterbore **156**. The stripper sleeve **148** at an end opposite the counterbore **156** has a retainer **161** which comprises an inwardly extending flange. The spacer plate **151** has an aperture **162** which is received on the upper portion **154** of the punch **147**. The spacer plate **151** has an upper surface **163** and a lower surface **164** which act as abutment surfaces for engaging the retainer **161** of the stripper sleeve and the retainer **155** of the punch respectively. The punch **147** has a threaded socket **165** to receive a threaded portion **166** of an attachment member or portion **167**. The attachment portion **167** is provided with wrench flats **168** and has a head **169** defined by a neck **171**.

The tool assembly **146** is connected to the punch holder and drive assembly **14***b* by the attachment portion **167** being inserted into the passageway **53***b* and having its neck **171** engaged by the gripping member **62***b*. When the tool assembly **146** is connected to the punch holder and drive assembly **14***b*, the upper portion **154** engages a locating surface defined by the counterbore **54***b*. The body means **50** **40***b* is provided with a plurality of passageways **172** adjacent the outer surface **44***b* which contain a plurality of stripper pin rods **173** which act against the stripper a sleeve **148** to force the sleeve into contact with the workpiece during the punching operation.

To maintain the gripping member **62***b* in firm engagement with the neck **171** of the attachment portion **167**, a locking means generally indicated at **64***b* is disposed in the body means **40***b b*. The locking means **64***b* include a lock member **76***b*, a stop means **77***b* and a spring **78***b*. The lock member **76***b* has a stem **79***b* and a head or cage **81***b* which has an inwardly directed cam surface **82***b* which engages and holds the gripping members **62***b* in the normal locking position as the lock member **76***b* assumes a first position illustrated in the FIG. When the lock member **76***b* moves to a second position the cam surfaces **82***b* are moved out of contact with the gripping members **62***b*. The stem **79***b* is provided on the end opposite the head **81***b* with a ring **83***b* and the spring **78***b* which is disposed in the counterbore **48***b* contacts the ring **83***b* to urge the lock member **76***b* toward the second position. Only the unloading ram **138** has a hollowed out portion **174** to provide clearance for the head **83***b* as the lock member **76***b* moves to the second position. The stem **79***b* is provided with an axially extending bore **96***b* which is axially aligned with a bore **175** in the ram **138** and the ram **138** carries an ejection pin **176** which is moved in the bore **175** to enter the bore **96***b*.

The stop means **77***b* comprises a pin **177** preferably of rectangular cross section which is slidably disposed in a corresponding transversely extending passageway **178**. The passageway **178** has a counterbore portion **179** adjacent the outer surface **44***b*. The pin **177** has an enlarged head **181** slidably disposed in the counterbore **179** and is biased toward the guide portion **130** by a spring **182**. The pin **177** engages a shoulder or abutment **90***b* formed by a groove **91***b* in the stem **79***b* to hold the lock member **76***b* in the first position.

The guide portion **130** is provided with a depression or groove **183** which will receive the enlarged head **181** when the punch holder and drive assembly **14***b* is axially moved within the station **130** until the depression **183** and the counterbore **179** are aligned. When the alignment which defines an unloading/loading position for the punch holder and drive assembly **14***b* is obtained, the head **181** moves into the depression to withdraw the pin **177** from the engagement with the shoulder **90***b* to allow the lock member **76***b* to move to the second position. Both the pin **177** and the head **181** are provided with cam ends or surfaces **184** and **185** respectively. The cam surface **185** acts against an edge of the depression **183** to bias the head **181** against the spring **182** to force the pin **177** into engagement with the abutment or shoulder **90***b*. During the cam action of the cam surface **185**, the cam surface **184** of the pin **177** acts against the shoulder **90***b* to force the lock member **76***b* against the spring **78***b* to the first position. Thus, the upward movement of the die holder and drive assembly **14***b* from the unloading/loading position will automatically force the lock means **64***b* into the normal locking position, and such movement in the opposite direction automatically effects unlocking.

During a punching operation the punch holder and drive assembly **14***b* is reciprocated in the guide portion **130** by a punching ram having a T-head similar to the ram **138**. During reciprocation the surface **145** transfers the punching force to the upper surface of the punch **157** to force the punch into en-

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 a 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 is 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*.

FIG. 5 illustrates a second form or embodiment of the punch holder and drive assembly generally indicated at 14*a* disposed in an upper tool support indicated at 15, having a bight portion 16*b* and shown more fully in FIG. 1. The bight portion 16*b* supports a guide portion generally indicated at 17*a* of the upper tool support 15. The guide portion 17*a* includes a fixed annular sleeve 18 which is received and secured in a passageway 20 by a series of screws 21. The sleeve 18 has an internal guide surface 22 having an an axially extending groove 23. The guide portion 17*a* further includes a stripper sleeve 28*a* having a flange 27*a* and has a radially extending pin 59*a* engaged in the groove 23 to prevent rotation between the stripper sleeve 28*a* and the annular sleeve 18. The stripper sleeve 28*a* is interconnected with an annular ring 106 by an axial lost-motion connection 107 which comprises a series of bolts 108 threaded into the flange 27*a* and a like number of stripping springs 109 which are telescopically received on the bolts 108 and extend between the ring 106 and the flange 27*a*. The springs 109 urge the stripper sleeve 28*a* away from the ring 106 which in turn is urged away from the upper surface 111 of the bight portion 16*a* by a plurality of lifter springs 112 each of which bears on a pin 113 disposed in a bore 114 of the ring 106.

The stripper sleeve 28*a* at an end opposite the flange 27*a* has an end 30*a* and has an internal surface 35*a* which forms the internal guide surface of the guide portion 17*a*. The surface 35*a* is provided with an axially extending groove 37*a*.

The punch holder and drive assembly 14*a* includes a body means generally indicated at 40*a* which has an upper portion 41*a* and a lower portion 42*a* which are interconnected by a number of threaded fasteners such as bolts 43*a*. The upper body portion 41*a* has an upper surface 115 which is contacted by a ram 116 of the punch press to apply the reciprocal motion to the punch holder and drive assembly 14*a*. The upper portion is also provided with an annular flange 117 which supports the assembly 14*a* on the ring 106. The upper body portion 41*a* has an axial passageway 47*a* having a counterbore 48*a* extending inwardly from the surface 115 and a counterbore 49*a* extending inwardly from a lower end surface 50 50*a*.

The lower body portion 42*a* has a socket defined by a passageway 53*a* having a counterbore 54*a* extending inwardly from a lower surface 52*a* which has a radial groove 55*a* extending into the counterbore 54*a*. Extending outwardly from the lower body portion 42*a* is a radial pin 56*a* which is received in the groove 37*a* of the stripper sleeve 28*a* to prevent relative rotation between the punch holder and drive assembly 14*a* and the stripper sleeve 28*a*. The lower body portion 42*a* has an upper surface 57*a* having a cylindrical projection 58*a* which is disposed in the counterbore 49*a* as the surface 57*a* engages the lower surface 50*a* of the upper body portion 41*a*. The projection 58*a* has a second projection 60*a* having passageways 61*a* extending transversely to the passageway 53*a* and to the direction of reciprocation of the body means 40*a*. Gripping means 62*a* comprising balls are disposed in the passageway 61*a* and are movable from a normal locking position, in which the balls are projecting into the passageway 53*a*, to an unlocked position in which the balls are withdrawn into the passageway 61*a* to be clear of the passageway 53*a*. Disposed about the second projection 60 is a resilient means 63*a* comprising a snap ring which biases the gripping member 62*a* toward the normal locking position.

A lock means generally indicated at 64*a* engages the gripping means 62*a* to maintain them in the normal locking position to engage the neck portion 67 of the attachment portion 65 of a punch 66*c*. The punch 66*c* has a body portion 68*c* having a cylindrical projection 72*c* which is received in the counterbore 54*a* and has a pin 75*c* mounted in a bore and received in the groove 55*a* to prevent relative rotation between the punch 66*c* and the punch holder and drive assembly 14*a*. The punch 66*c* has an upper surface 71*c* contacting the surface 52*a* as an upper surface 100*c* is received in the base of the counterbore 54*a*.

The lock means 64*a* has a lock member 76*a* which is essentially the same as the precedingly described lock member 76. The lock member 76*a* is movable between a first and a second position and is urged toward the second position by a spring 78*a*. A stop means generally indicated at 77*a* holds the lock member 76*a* in the first position. A shoulder or abutment 90*a* is provided by the upper surface of the head or cage 81*a* which has an internally directed cam surface 82*a*.

The stop means 77*a* has a pin 85 *a* which engages the abutment or shoulder 90*a* to maintain the lock member 76*a* in the first position to maintain the gripping member 62*a* in the normal locking position. The pin 85*a* is disposed in a bore 86*a* and is attached to an enlarged block 120 which is movable in a passageway 121 leading to the bore 86*a*. A spring 89*a* acting between a threaded plug 122 and the block 121 urges the stop means 77*a* into engagement with the abutment 90*a*. A second pin 123 extends at a right angle to the pin 85*a* through a slot 124 and is threaded into the block 120. The pin 123 terminates below the upper surface 115 and therefore is not engaged by the ram 116 when the ram is in contact with the punch holder and drive assembly 14*a*. By manual movement of the pin 123 in a radially outward direction, the pin 85*a* is disengaged from the shoulder 90*a*, thereby allowing the lock member 76*a* to move to a second position in which the cam surfaces 82*a* are withdrawn from contact with the gripping member 62*a*.

In operation, the punch holder and drive assembly 14*a* is supported in the upward position, as illustrated, by the lifting springs 112. When the ram 116 contacts the surface 115 and reciprocates the punch holder and drive assembly 14*a* downwardly, the springs 112 are compressed. The spring 109 forces the stripper sleeve 28*a* into contact with the workpiece and once contact is made, the spring 109 begins to be compressed until the end of the downward stroke. Upon upward movement of the ram 116, the stripper springs 109 maintain the stripper sleeve 28*a* in contact with the workpiece until the punch 66*c* is withdrawn therefrom.

When the head of the bolt 108 contacts or abuts against the ring 107, the sleeve 28*a* is carried with the punch holder and drive assembly 14*a* by the lifter springs 112 to the position illustrated.

To release the punch 66*c* from the punch holder and drive assembly 14*a*, the stop means 77*a* is disengaged by forcing the second pin 123 radially outwardly from the position illustrated to withdraw the pin 85*a* from engagement with the abutment 90*a* to allow the lock member 76*a* to move to the second position. Although the lock member 76*a* is in the second position, the gripping members 62*a* are yieldably held in the normal locking position by the force of the resilient means 63*a*. Any force which is applied to the punch 66*c*, such as by a rod (not shown) being pushed down through a passageway 96*a* in the stem 79*a*, will move the attachment portion 65 out of engagement with the gripping member 62*a*.

To load a punch 66*c* into the punch holder and drive assembly 14*a*, the lock member 76*a* must be in the second position. Insertion and movement of an attachment portion 65 into the passageway 53*a* and past the gripping means or balls 62*a* forces the balls to the unlocked position until the neck portions 67 become aligned with the passageway 61*a*. Then the resilient means 63*a* will urge the gripping members 62*a* into the normal locking position and temporarily hold the punch 66*c* in the punch holder and drive assembly 14*a*. By applying a force to the upper surface 97*a* of the lock member

gagement with and through the workpiece. During the downward movement of the punch holder and drive assembly 14*b*, a force is applied to the stripper pins 173 (by means not shown) which force the stripper sleeve 148 into engagement with the workpiece to grip the workpiece between the stripper sleeve 145 and the die member 149. The stripper sleeve 145 also is held in contact with the workpiece by the stripper pins 173, while the punch 157 is withdrawn from the workpiece. As the punch 157 is moved upwardly, the upper surface 163 of the spacer plate 151 contacts the retainer 161 and draws the stripper sleeve 148 back into the guide portion or station 130 of the turret 131.

To unload the tool assembly 146 from the punch holder and drive assembly 14*b*, the turret 131 is angularly rotated from beneath the punching ram to the unloading/loading station and the unloading/loading ram 138 is engaged in the T-shaped slot 137 of the head portion 45*b* of the assembly 14*b*. The ram 138 then vertically moves the die holder and punching assembly 14*b* to the unloading/loading position with the counterbore 179 in alignment with the depression or groove 183. Upon reaching the unloading/loading position, the spring 182 forces the stop means 77*b* to the disengagement position to allow the lock member 76*b* to move to the second position to enable the gripping members 62*b* to be moved to the unlocked position. Once the lock member 76*b* is in the second position, the ejection pin 176 carried by the ram 138 moves through the passageway 96*b* to contact the head 169 of the attachment portion 167 to force the head past the gripping members 62*b*. By applying a force to the head portion 169, the gripping members 62*b* are cammed outwardly by the curvature of the neck portion 171 to the unlocked position and the tool assembly 146 is removed from the station 130. It should be noted that when lowering the punch holder and drive assembly 14*b* to the unloading/loading position, the stripper sleeve has contacted the die member 149 and has moved it in its station in the lower turret. The punch press is provided with a mechanical means (not shown) to catch the nested tool assembly 146, which assembly may be also received by hand.

To load a tool assembly such as 146, the tool assembly is lifted through the station in the lower turret with the pin 150 aligned with the groove 55*b* until the attachment portion 167 is received in the bore 53*b* of the punch holder and drive assembly 14*b*. By continuing the upwardly lifting of the tool assembly, the head 169 contacts the gripping members 62*b* forcing them to the unlocked position to allow passage of the head 169 until the neck portion 171 is in alignment with the gripping members 62*b* which are then urged by the spring 63*b* into temporary engagement with the attachment portion 167. Once the temporary connection has been completed, the punch holder and drive assembly 14*b* is moved upwardly from the unloading/loading position and the cam surface 185, coacting with the depression 183, forces the pin 177 of the lock means 77*b* into engagement with the shoulder 90*b* to force the lock member 76*b* to the first position to lock the gripping members 62*b* in contact with the attachment portion 167 of the tool assembly 146. When the punch holder and drive assembly 14*b* is moved to the position illustrated in FIG. 6, the detent 139 engages the upwardly directed surface 136 of the 139 or guide portion 130 and holds the punch holder and drive assembly in this position while the turret 131 is rotated to remove the station 130 from beneath the loading/unloading ram 138. It should be noted that the detent 139 will yield in response to a force applied to the punch holder and drive assembly 14*b* by any one of the rams and functions to hold the assembly 14*b* while it is being rotated away from a position where it receives ramsupport.

FIG. 7 illustrates a fourth modification of 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 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 143*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. As best illustrated in FIG. 8, the slot 137*a* has a pair of diverging lead-in surfaces 190 at each end which surfaces facilitate the engagement 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*c* 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 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 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 130*a* has a depression or groove 183*a* which receives the ball follower 205 when the punch holder and drive assembly 14*c* are 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 urged or biased by the spring 203 to the normal locking position.

The punch holder and drive assembly 14*c* coact 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 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 resting on a shoulder 207 formed by the projection 154*a* and the body portion 152. 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 the 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 an 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 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 14*c* when the neck 215 is engaged by the gripping means 62*c*.

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

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

To remove the tool assembly 146*a* from the punch holder and drive assembly 14*c*, the turret 131*a* is rotated until the assembly 14*c* in the station 130*a* is positioned beneath a loading/unloading ram similar to the ram 138 illustrated in FIG. 6. The unloading/loading ram lowers the punch holder and drive assembly 14*c* to the unloading/loading position in which the ball followers 205 may enter the depressions 183*a* in the guide portion 130*a*. This movement of the ball follower removes the positive locking of the gripping means 62*c* by the lock means 64*c*. Next, an ejection pin similar to the pin 176 moves through the ejection pin bore 195 to apply force to the head 214 of the attachment portion 213 of the punch 147*a*. In response to such force, the surfaces of the neck 215 cam or move the gripping members 62*c* against the springs 203 to an unlocked position which allows the passage of the head 214 past the gripping members 62*c*. When the punch holder and drive assembly 14*c* is lowered to the unloading/loading position, the movement causes the die member 149*a* to be removed from the holding means of the lower turret so that once attachment portion 213 of the punch 147*a* is disconnected from the punch holder and drive assembly 14*c*, the nested tool assembly 146*a* can be removed through the station of the lower turret.

To insert a tool assembly 146*a*, 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 62*c* and 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 62*c* into a temporary connection with the attachment portion 213. Once the tool assembly 146*a* has been temporarily connected to the punch holder and drive assembly 14*c*, the ram of the unloading/loading station moves upwardly causing the cam followers 205 to be withdrawn from the depression 183*a* and to move the locking means 64*c* into contact with the gripping members 62*c* to maintain them in the normal locking position.

FIG. 9 illustrates a modified form of the tool assembly generally indicated at 146*b*, held in a punch holder and drive assembly generally indicated at 14*c*. The tool assembly 146*b* comprises a punch 147*b*, a stripper plate 148*b*, and a spacer plate 151*b*. The die associated with the tool assembly 146*b* is not illustrated but is similar to die members 149 and 149*a*.

The punch 147*b* has a punch body 152*b* having a cutting edge 153*b* at one end and an upper portion 154*b* at the other end. The upper portion 154*b* and the body portion 152*b* form a shoulder 207*a* which acts as a lower retainer which coacts with an upper retainer 208*a* to hold the spacer plate 151*b* in a locked position on the punch 147*b*. The upper portion 154*b* has a pin 150*b* extending outwardly and engaged in the groove 55*c* to prevent rotation between the punch 149*b* and the punch holder and drive assembly 14*c*.

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

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

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

FIG. 10 illustrates a nestable tool assembly generally indicated at 146*c* attached to a punch holder and drive assembly 14*c*, both of which are disposed in a guide portion 130*a* formed by a sleeve 132*a* disposed in an upper turret 131*a* of a punch press.

The tool assembly 146*c* comprises a punch 147*c*, a stripper sleeve 148*c*, and a spacer plate 151*c*. The die which is similar to the die 149 is not illustrated. The punch 147*c* has a punch body 152*c* terminating in a punch end 153*c* at one end and having an upper portion 154*c* at the other end. The upper portion 154*c* has a pair of retainers 208*c* and 225 which maintain the spacer plate 151*c* in position on the upper portion 157*c*. The upper portion 157*c* is also provided with a pin 150*c* which is received in the groove 55*c* of the punch holder and drive assembly 14*c* to prevent relative rotation therebetween. The spacer plate 151*c* has an upper surface 163*c* and a lower surface 164*c* which form abutments which coact with the retainers 208*c* and 225 to maintain the plate in its fixed position with an aperture 162*c* disposed about the punch member 147*c*.

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

An axial lost-motion connection generally indicated at 211*c* is formed by the coaction of an abutment 226 of the punch body 152*c* with the stripper plate 157*c* and by the coaction of the retainer 161*c* with the spacer plate 151*c*. The lost-motion connection enables the stripper sleeve 148*c* to move relatively to the punch 147*c* during the punching operation and 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 222c in contact with the shoulder or bottom 221 and the upper retainer 208c 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 222c to drive the punch into the workpiece. The spacer plate 151c is of a thickness such that the upper surface 163c is not in contact with the lower end surface 52c of the punch holder and drive assembly 14c and therefore doesn't receive any of the punching force.

FIGS. 11 and 12 illustrate a fifth embodiment of the punch holder and drive assembly generally indicated at 14d used in conjunction in a punch press generally indicated at 15d, which has an upper turret 231 and a lower turret 232.

The upper turret 231 has a plurality of stations or guide portions 233 which comprise an annular sleeve 234 disposed in a bore 235 of the upper turret. The sleeve 234 has an annular extending flange 236 which is received in a counterbore 237 of the bore 235. The lower end portion of the sleeve 234 has a threaded portion 238 on which a hub nut 239 is threadedly engaged and received in a lower counterbore 241. The hub nut 239 maintains the sleeve 234 in a fixed relationship within the bore 235 of the upper turret 231. On an end opposite the threaded end 238 the sleeve 234 has a layer or cushion 242 of resilient material. The inner surface of the sleeve 234 which defines the guide portion or station 233 is divided into a lower cylindrical surface 243 and an upper cylindrical surface 244 which are interconnected by a shoulder 245. The lower surface 243 has an axially extending groove 246.

The lower turret 232 illustrated in FIG. 12 has a plurality of lower stations which are defined by a number of bores 247. Each of the lower stations has a ball detent 248 in a surface of the bore.

The punch holder and drive assembly 14d has a body means generally indicated at 251 comprising an inner body portion 252 having an outer surface 253 which is engaged by an inner surface 254 of an annular sleeve 255. The body portion 252 has a head portion 256 which has a greater diameter than the outer surface 253. The head portion 256 has a T-shaped slot 257 which is connectable with a T-shaped end 258 of a punch ram 259. The head portion 256 has a pair of axially extending bores 261, 261 each of which has a counterbore 262. A pair of pins 263 having heads 264 are slidably received within the bores 261 with the head received in the counterbore 262 and the end opposite the head 264 being threadedly engaged in a flange 265 of the sleeve 255 to form a lost motion connection generally indicated at 266 between the sleeve 255 and the body portion 252.

The punch ram 259 has a pair of bores 267, 267 which are in axial alignment with the bores 261,261. Each of the bores 267 has a piston or spacer 268 slidably received and retained therein and urged by resilient means 269 such as a spring into contact with the head 264 of the pin 263. The springs 269 acting through the pins 263, 263 urge the sleeve 255 axially away from the head portion 256 of the inner body portion 252.

The body portion 252 opposite the head portion 256 has a reduced diameter end portion 271 having an end surface 272. The body portion 252 has an axially extending passageway 273 having a counterbore 274 extending inwardly from the end surface 272 to form a socket for receiving an attachment portion 275 of the punch 276. The body portion 252 has a pair of passageways 61d which extend transversely to the counterbore 274 and to the direction of reciprocation of the punch holder and drive assembly 14d. The passageways 61d extend to the outer surface 253 of the body portion 252 and each passageway has a gripping ball member 62d disposed therein.

The sleeve 255 has an outer surface 277 which is slidably engaged in the upper inner surface 244 of the station 233 to guide the punch holder and drive assembly 14d. The sleeve 255 adjacent the other end 278 is provided with a pair of passageways or depressions 279, 279 which extend transversely to the direction of reciprocation of the punch holder and drive assembly 14d. The passageways or depressions 279 each have a plug 280 of resilient material disposed therein.

The punch holder and drive assembly 14d is illustrated as being connected with a nestable tool assembly generally indicated at 281 which comprises a punch 276, a stripper sleeve 282, and a die 283. The punch 276 has a body portion 284 which has a punch end 285 and a threaded socket 286 engaging a threaded projection 287 of an attachment portion 275. The body portion 284 has an upper surface 288 which is in contact with the end surface 272 of the inner body portion 252, and a cylindrical outer surface 289 which has a radially extending locating pin 291 which extends through a slot 292 in the stripper sleeve 282 and into the slot 246 of the guide portion 233 to prevent relative rotation between the stripper sleeve, punch and guide portion.

The stripper sleeve 282 has an inner surface 293 slidably engaging the outer surface 289 of the body portion 284. At one end the stripper sleeve has an integral stripper plate 294 having an aperture 295 complementary to the punch end 285. At an end 296 opposite the stripper plate 294, the stripper sleeve 282 has a snap ring retainer 297 partially disposed in a groove in the inner wall surface 293.

The attachment portion 275 has a head portion 298 which is defined by a groove or neck portion 299. The head portion 298 is provided with an upper peripheral cam surface 301.

As illustrated in FIG. 12, the die 283 has a workpiece engaging surface 302 to support a workpiece 303. The workpiece engaging surface 302 has a die aperture 304 which is complementary to the cutting edges of the punch. The die 283 also has a depression 305 to receive the ball detent 248 to hold the die member in the station 247 of the lower turret 232. The die member 283 may be provided with an angular locating pin to be received in a groove in the lower station 247 to prevent relative rotation, therebetween.

In operation the punch holder and drive assembly 14d is reciprocated in the guide portion 233 by the punch ram 259. After a workpiece 303 has been placed on the surface 302, the ram 259 begins its downward movement or punching stroke to force the punch 276 into contact and through the workpiece 303. The punching force of the ram 259 is transferred via the inner body portion 252 to the upper surface 288 of the punch member 276. During the punching stroke, the stripper sleeve 282 moves with the punch member 276 until the sleeve contacts the workpiece as illustrated in FIG. 12. Further downward movement of the stripper sleeve 282 is prevented by the workpiece 303 and a resisting force is transmitted by the upper surface 296 through the end surface 278 to the outer sleeve 255. With the arresting of the movement of the stripper sleeve 282 and the outer sleeve 255, the pins 263, 263 move in the bores 261 with their heads 264 forcing the pistons 267 upwardly against the pressure exerted by the springs 269. It should be noted that the springs 269 insure that a stripping force is placed upon the workpiece 303 by the stripper sleeve 282. Upon completion of the punching of of the ram 259 and the beginning of the return stroke, the punch 276 is withdrawn from the workpiece and the stripper sleeve 282 is maintained in engagement or in a down position by the force applied by the springs 269 to the pistons 268 until the retainer 297 of the stripper sleeve 282 is engaged on the upper surface 288 of the punch 276. When the retainer becomes engaged by the punch 276 the stripper sleeve 282 is carried with the punch against the force of the springs 269 back into the guide portion 233 of the upper turret 231.

To unload the tooling from the punch holder and drive assembly 14d, the upper and lower turrets 231 and 232 are rotated to an unloading/loading station which has a ram similar in structure to the ram 259 with the exception that an ejection pin is provided therein. The ram of the unloading/loading station moves downwardly causing the punch holder and drive assembly to move down towards the die 283 and to displace it, the movement continuing until the flange 265 of the sleeve 255 contacts the cushion 242. After the flange 265 of the sleeve 255 abuts the cushion 242, the ram of the unloading/loading station continues to move downward until the passageway 61d is in alignment with the passageway

279. At this time the gripping members 62*d* may be moved radially outwardly against the plugs 280 of resilient material from their normal locking position to an unlocked position. Once the passageway 61*d* is aligned with the passageway 279, the ejection pin is moved into contact with the head 298 of the attachment portion 275 to force the head past the gripping members 62*d*. The surface of the neck 299 acts as a cam surface to move the gripping members 62*d* against the plugs 280. Once the head 298 is past the gripping members 62*d*, the tool assembly 281 is disconnected from the punch holder and drive assembly 14*d* and can be lowered through the lower station 247 either manually or by a tool loader.

To load a tool assembly into the stations 247 and 243, the tool assembly is lifted through the station 247 of the lower turret 232 with the attachment portion 275 entering the counterbore 274. Continuation of lifting of the punch 276 causes the head portion 298 of the attachment portion 275 to contact the gripping members 62*d* and cam them outwardly against the plugs 280 disposed in the passageways 279. Once the head portion 298 is past the gripping members, the resilient material of the plugs 280 forces the gripping members into engagement with the neck portion 299 of the attachment portion. At this time, the gripping members are resiliently held by the resilient material in the normal locking position; however, the gripping members 62*d* can be easily moved to the unlocking position. Once the gripping members 62*d* are in the normal locking position, the loading/unloading ram begins to lift the punch holder and drive assembly upwardly with the inner body portion 252 moving with respect to the sleeve 255 so that the inner surface 254 closes the opening of the passageway 61*d* to positively maintain the gripping members 62*d* in the normal locking position. Upon completion of the upward stroke, the punch holder and drive assembly 14*d* will assume a position similar to that illustrated in FIG. 11.

FIG. 13 shows a modified detent generally indicated at 141*a* used with a head portion 45*e* which has a T-shaped groove 137*e*. The detent 141*a* comprises a dog 310 having a rounded end 311 which is illustrated as being substantially hemispherical in shape and a curved surface 312 at the opposite end. The dog 310 is pivotally mounted by a pin 313 in a slot 314 in the head portion 45*e*. The pin 313 passes through a bore 315 in the dog which is off center with respect to the ends 311, 312, so that the end 311 tends to tilt to the position shown in the bold lines. The detent 141*a* includes a leaf spring 316 connected to the dog by a fastening means 317. The spring 316 has an end 318 which contacts a surface 319 of the groove 314 to load the spring as the dog is moved to the position illustrated in the dotted lines.

When the ram such as 138 moves into engagement with the T-shaped slot 137*e* of the head portion 45*e*, it contacts the rounded end 311 and rotates or pivots the dog 310 about the pin 313 to a nonsupporting position shown in the dotted lines. In the nonsupporting position the curved surface 312 has been rotated or pivoted out of engagement with an upwardly directed edge 136*a* of the guide surface 130 of the sleeve 135 of the upper turret 131. When the turret 131 is rotated to disconnect the ram from the T-shaped slot 137*e* the force of the spring 313 plus the weight of the dog adjacent the end 311 causes the dog to pivot or rotate to the supporting position illustrated in the bold lines in which the curved surface 312 engages the upwardly directed edge 136*a* of the guide surface 130 to prevent the punch holder and drive assembly 14*e* from dropping downwardly in the station or guide surface 130 while disconnected from a ram.

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:

1. A punch holder and drive assembly for being reciprocated in a fixed guide portion of a punch press, said assembly comprising:

a. body means having an outer surface for being slidably guided during reciprocation by the guide portion of the punch press, a socket at one end of said body means opening in the direction of reciprocation, said socket having a locating surface receptive of a grooved portion of the punch, and a passageway in said body means extending transversely to the direction of reciprocation and intersecting said socket;

b. a gripping member disposed in said passageway and movable between a normal locking position in which said gripping member extends into said socket for engaging the punch, and a retracted unlocked position in which said gripping member is retracted from any punch in said socket, said gripping member having a surface engageable in the grooved portion of the punch, said gripping member being movable out of said locking position in direct response to relative movement between the punch and said body means during both insertion and removal of the punch from said assembly; and

c. lock means carried by said body means and surrounding the axis of said socket for maintaining said gripping member in said locking position and for selectively enabling said gripping member to be moved to said unlocked position.

2. A punch holder and drive assembly according to claim 1, said passageway extending transversely to the direction of reciprocation and extending to said outer surface; said lock means including a pin slidably disposed in said passageway for acting between said gripping member and the fixed guide portion of the punch press.

3. A punch holder and drive assembly according to claim 2, wherein said pin has a ball-follower disposed for contact with the guide portion of the punch press.

4. A punch holder and drive assembly according to claim 2, wherein said pin has within it a spring biasing said gripping member toward said engagement position.

5. A punch holder and drive assembly according to claim 2, wherein the outer end of said pin is receivable in a depression in the guide portion of the punch press to thereby effect the unlocking of said gripping member.

6. A punch holder and drive assembly for being reciprocated in a punch press, said assembly comprising:

a. body means for being slidably guided during reciprocation by the punch press, a socket at one end of said body means opening in the direction of reciprocation, said socket having a locating surface receptive of a grooved portion of the punch, and a passageway in said body means extending transversely to the direction of reciprocation and intersecting said socket;

b. a gripping member disposed in said passageway and movable between a normal locking position in which said gripping member extends into said socket for engaging the punch, and a retracted unlocked position in which said gripping member is retracted from any punch in said socket, said gripping member having a surface engageable in the grooved portion of the punch, said gripping member being movable out of said locking position in direct response to relative movement between the punch and said body means during both insertion and removal of the punch from said assembly;

c. a lock member carried by said body means for maintaining said gripping member in said locking position, said lock member having a head, a shoulder, a stem, and a cam surface on said head, said lock member being movable in said body means between a first position in which said cam surface urges and maintains said gripping member in said normal locking position and a second position in which said cam surface enables said gripping member to be moved out of said locking position; and

d. a stop means movable in said body means in a direction transverse to the direction in which said lock member is movable and engageable with said shoulder for maintaining said lock member in said first position.

7. A punch holder and drive assembly according to claim 6, wherein said lock means includes a spring biasing said lock member toward said second position.

8. A punch holder and drive assembly according to claim 6, wherein said shoulder is formed by a groove on said stem.

9. A punch holder and drive assembly according to claim 6, wherein said shoulder is a surface of said head.

10. A punch holder and drive assembly according to claim 6, wherein said stop means includes a pin slidably disposed in a second passageway in said body means extending transversely to the direction of movement of said lock member.

11. A punch holder and drive assembly according to claim 10, wherein said stop means further includes a spring biasing said pin toward engagement with said shoulder.

12. A punch holder and drive assembly according to claim 10, wherein said pin terminates at one end in a knob for enabling manual disengagement of the stop means from said shoulder.

13. A punch holder and drive assembly according to claim 10, wherein said pin has a second pin angularly extending through a slot in said body means and being manually accessible to enable releasing of said stop means from engagement with said shoulder.

14. A punch holder and drive assembly according to claim 10, in which said body means has an outer surface slidably engageable with a fixed guide portion of the punch press, a second passageway extending from said lock member to said outer surface, said pin having a length for acting between said shoulder and the guide.

15. A punch holder and drive assembly according to claim 10, wherein said stop means includes a spring urging said pin out of engagement with said shoulder.

16. A punch holder and drive assembly according to claim 10, in which said body means has an outer surface slidably engageable with a fixed guide portion of the punch press, the outer end of said pin being receivable in a depression in the guide portion of the punch press to effect the disengagement of said stop means from said shoulder.

17. A punch holder and drive assembly according to claim 10, wherein said pin has a cam surface at each end to effect movement of said pin to move said lock member to said first position.

18. A punch holder and drive assembly according to claim 1, comprising:

a. a body portion forming part of said body means and having a second outer surface, having said passageway, and having said socket; and

b. a sleeve comprising a part of said body means, said sleeve having an inner surface serving as said lock means and slidably received on said second outer surface of said body portion.

19. A punch holder and drive assembly according to claim 18, wherein said passageway extends outwardly to said second outer surface of said body portion.

20. A punch holder and drive assembly according to claim 19, wherein said gripping member surface is a ball slidably disposed in said passageway for acting between said inner surface of said sleeve and said punch.

21. A punch holder and drive assembly according to claim 20, wherein said inner surface of said sleeve has means for receiving said ball to enable said ball to move to said unlocked position.

22. A punch holder and drive assembly according to claim 21, wherein said receiving means includes resilient material to urge said ball toward said normal locking position.

23. A punch holder and drive assembly according to claim 18, wherein a portion of said inner surface is a resilient plug receptive of a portion of said gripping member.

24. A punch holder and drive assembly according to claim 1, wherein said body means include a head portion to form a detachable connection with a ram of the press, and a detent on said body means for coacting with an upwardly directed surface of the press at the guide portion to support said assembly while it is disconnected from the ram.

25. A punch holder and drive assembly according to claim 24, wherein said detent comprises a dog pivotally mounted adjacent to said head portion and movable between supporting and nonsupporting positions, means normally acting to move said dog into said supporting position, said dog having a portion engageable by the ram of the press to pivot said dog to the nonsupporting position as the ram is connected to said assembly.

26. A punch holder and drive assembly according to claim 6, in which said lock member is substantially concentric with said socket.

27. A punch holder and drive assembly according to claim 6, in which said cam surface is disposed internally of said head and encircles an end of said socket.

28. A punch holder and drive assembly according to claim 1, including a plurality of said gripping members disposed about said socket.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,548,700 Dated December 22, 1970

Inventor(s) John H. Herzog and Ronald C. Hill

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 4, l. 48, delete "an" (first occurrence);

Col. 5, l. 53, delete "50";

Col. 7, l. 67, change "hold" to --held--;

Col. 8, l. 13, delete "50";

Col. 8, l. 16, delete "a";

Col. 8, l. 21, change "40bb" to --40b--;

Col. 9, l. 60, delete "139" and insert --station--;

Col. 9, l. 74, change "143a" to --134a--;

Col. 14, l. 54, delete "of" (either occurrence); and

Col. 17, l. 29, after "guide" insert --portion of the punc press--.

Signed and sealed this 26th day of October 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Patents