Sept. 16, 1969 W. H. PHILLIPS, JR 3,466,922

DIE ASSEMBLIES

Filed Nov. 30, 1967 2 Sheets-Sheet 1

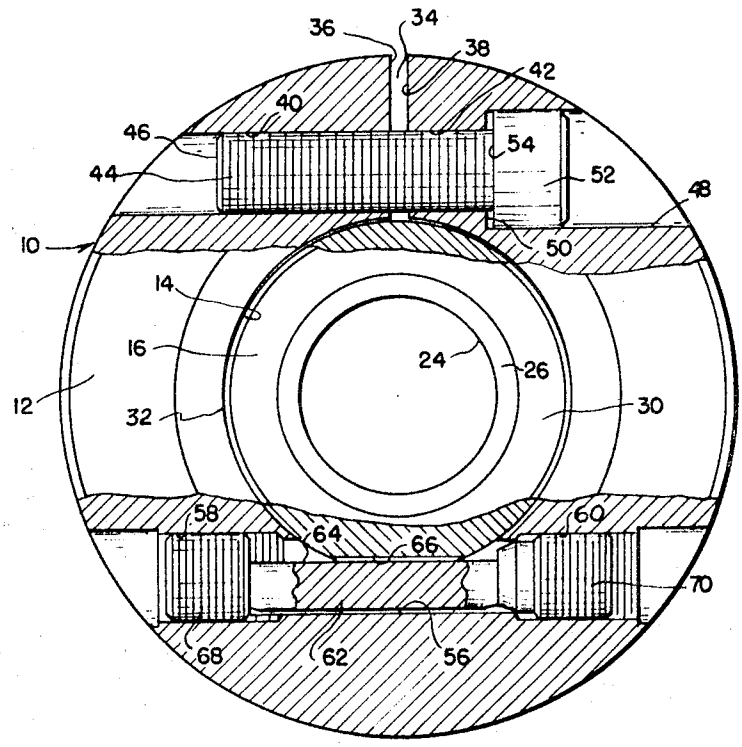


FIG. 1

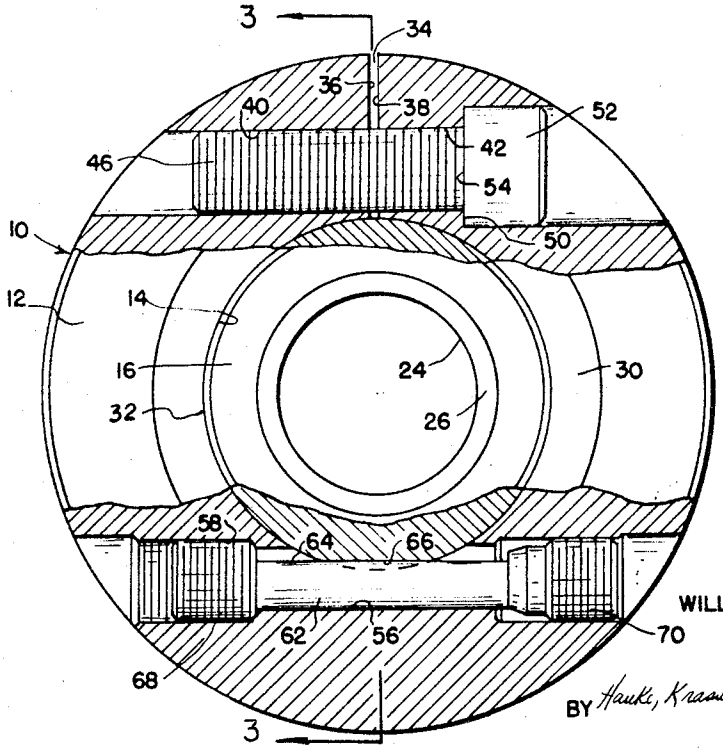


FIG. 2

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FIG. 3

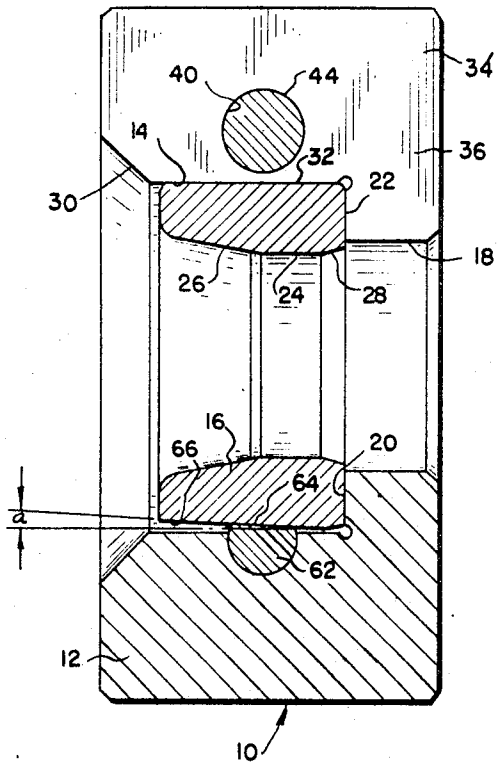


FIG. 5

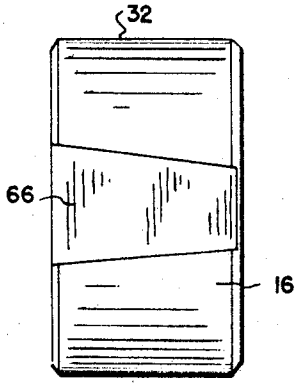
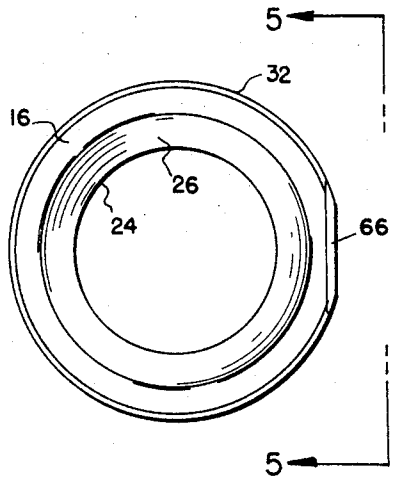


FIG. 4



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DIE ASSEMBLIES

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Int. Cl. B21c 3/00; B23b 31/12, 5/22
U.S. Cl. 72—467 13 Claims

ABSTRACT OF THE DISCLOSURE

A die assembly having a split holder or casing provided with a stepped longitudinal bore and a die insert disposed in the longitudinal bore in the holder or casing. The die insert is held solidly within the bore as a result of applying a compressive force upon the split casing for causing compressive engagement of the bore surface with the die insert peripheral surface and by engaging a chordal transverse wedge with a flat surface on the periphery of the die insert. The die insert is removed from the split casing by relieving the compressing force and by backing the wedge member.

Background of the invention

It is known to make drawing dies and the like consisting of die inserts of cemented metal carbides and the like assembled in a holder by means of either the so-called "hot shrink" method or the "cold press" method. With die assemblies formed by either the hot shrink method or the cold press method, the assemblies are sold as units, and when the die inserts are worn, the whole units are scrapped or the die inserts are ground to larger die openings for use for drawing larger diameter workpieces.

In United States Letters Patent No. 3,109,663, issued Nov. 5, 1963 to William H. Phillips, Jr., there is disclosed and claimed a demountable die assembly comprising a holder adapted to maintain a die insert in an operative position and permitting the removal of the die insert from the holder for replacement by a die insert of a different size or for replacement with a new die insert when worn beyond acceptable tolerances. The holder is in the form of a split casing adapted to support a split removable annular spacer disposed in the holder for receiving and supporting a cylindrical die insert made of refractory cemented metal carbide, or the like, the casing having means for applying a compressive force to the split spacer for rigidly holding the die insert in assembled position in the casing, and means for applying a positive force to spread the split casing so as to remove the compressive force from the split spacer to permit the removal of the die insert and split spacer from the casing. The present invention provides an improvement on the invention in the above mentioned United States Letters Patent which permits omitting the split annular spacer by holding a die insert directly within a longitudinal bore in a split holder or casing with one end of the die insert engaging a shoulder disposed within the bore in the casing, and with a chordal transverse wedge member having a flat surface arranged to engage a flat surface on the periphery of the die insert. The die insert is thus held within the bore in the casing by the combined effect of a compressive force exerted upon the split casing causing a reduction of diameter of its die insert receiving bore, and of the wedging and locking action of the wedge member. Additionally, the flat surface on the periphery of the die insert is in a plane inclined with respect to the axis of the die assembly in an appropriate direction that causes the end of the die insert to be drawn against a shoulder in the holder internal bore when the wedge member is driven to its locking position.

The above mentioned objects and advantages of the invention, and further objects and advantages thereof, will become apparent when the following description of an illustrative example of a structure according to the principles of the invention is read in conjunction with the accompanying drawings wherein like numerals refer to like parts in the diverse views and in which:

Brief description of the drawings

FIG. 1 is a top plan view, with portions broken away to show the internal construction, of a die assembly embodying the features of the present invention, showing the die insert in a released position;

FIG. 2 is a view similar to FIG. 1, but showing the die insert in a locked position;

FIG. 3 is a view in section from line 3—3 of FIG. 2;

FIG. 4 is a top elevation view of the die insert; and

FIG. 5 is a side elevation view thereof, substantially from line 5—5 of FIG. 4.

Detailed description of a preferred embodiment

Referring now to the drawings, a die assembly according to the present invention, shown generally at **10** in FIGS. 1–3, comprises an outer supporting holder or casing **12**, made preferably of a metal such as steel and the like, having a longitudinal bore **14** disposed for freely accepting a die insert **16** made of cemented refractory metal carbide or the like. The longitudinal bore **14** in the holder or casing **12** is stepped in such manner as to be provided with a decreased diameter end portion **18** forming an annular support shoulder **20** against which is normally engaged an end **22** of the die insert **16**, as best shown in FIG. 3. The example of die insert shown has an internal sizing bore **24** for a workpiece, not shown, to be drawn through such die, a tapered entry surface **26** and an appropriate outlet surface **28**. The diameter of the reduced diameter bore portion **18** of the holder or casing **12** is wide enough so as to afford appropriate clearance from the peripheral surface of the workpiece when the latter is drawn through the die. The casing **12** is provided with an appropriate truncated entrance surface **30**. The peripheral surface **32** of the die insert is substantially cylindrical and of a diameter freely admitted within the longitudinal bore **14** in the casing **12**.

The casing **12** is split by being provided with a slot **34** longitudinally disposed through a side wall thereof in a radial plane and thus defining substantially radially disposed opposed flat faces **36** and **38**. It is obvious that slot **34** may be formed in a non-radial plane or, alternately, in a generally longitudinal plane at an angle with respect to a plane of symmetry of the casing **12**. A pair of aligned bores **40** and **42** having a common axis are disposed on a chord of the cylindrical casing **12** adjacent the inner bore **14** thereof. Transverse chordal bore **40** is internally threaded for accepting the threaded portion **44** of a threaded member or cap screw **46**, while bore **42** has a smooth internal surface for freely aceepting the body of the threaded member **46**. Bore **42** is provided with an enlarged diameter portion **48** proximate the periphery of the casing **12** and forming an annular abutment surface or shoulder **50**, such as to interfere with the enlarged head **52** of the threaded member or cap screw **46** presenting an annular abutment surface **54** adapted for engagement with the annular shoulder surface **50** when the threaded member or bolt is appropriately drawn in.

Diametrically opposed to aligned bores **40** and **42** there is a chordal transverse bore **56** disposed with its axis substantially parallel to the axis of the aligned bores **40** and **42**, such axis of the chordal transverse bore **56** being substantially tangent to the inner bore **14** in the casing **12**, and the bore **56** being open to such inner bore **14**.

Both ends of chordal transverse bore **56**, proximate the periphery of holder or casing **12** are internally threaded as shown at **58** and **60**, and the bore **56** is adapted to accept an elongated partly cylindrical wedge member **62** having a wedging flat surface **64** disposed for engagement with a flat surface **66**, also shown in FIGS. 4 and 5, on the peripheral surface **32** of the die insert **16**. The wedging flat surface **64** on the elongated wedge member **62** is disposed on a plane forming a slight angle, for example of the order of 1°, with the longitudinal axis of the elongated wedge member, such that when the wedge member is displaced longitudinally in bore **56** by way of the differential action of threaded plugs **68** and **70** disposed on the ends thereof in threaded portions **58** and **60**, respectively, of bore **56**, the wedging flat surface **64** is caused to firmly engage the flat surface **66** on the peripheral surface **32** of the die insert **16**.

As best shown in FIG. 3, the flat surface **66** on the peripheral surface **32** of the die insert **16** is preferably in a plane forming a slight angle *a* of the order, for example, of ½°, relatively to a generatrix of the cylindrical peripheral surface **32** of the die insert. Consequently, when the wedging flat surface **64** of elongated wedge member **62** is caused to firmly engage the flat surface **66** on the periphery of the die insert there is generated upon the body of the die insert **16** a force that tends to firmly apply the die insert annular end surface **22** with the casing annular shoulder **20**.

As shown in FIG. 1, the die insert **16** is inserted in the longitudinal bore **14** of the holder or casing **12** with the threaded member or cap bolt **46** backed off such that the annular abutting surface **54** of the bolt is disengaged from the annular shoulder **50** between transverse bores **42** and **48**. Under such conditions the casing internal bore **14** has a diameter freely accepting the die insert **16**, and the elongated wedge member **62** being in the position indicated in FIG. 1 has its wedging flat surface **64** clear of the die insert flat surface **66**. The only precaution for introducing the die insert **16** in the bore **14** of the holder or casing **12** is to properly align the flat surface **66** on the peripheral surface **32** of the die insert substantially parallel to the axis of the chordal transverse bore **56**, the wedging flat surface **64** of elongated wedge member **62** being oriented towards the internal bore **14** of the casing. The die insert **16** is inserted in the casing bore **14** such that the annular end surface of the die insert engages the abutment surface of annular shoulder **20**.

The threaded member or cap bolt **46** is subsequently tightened to apply a slight compressive force upon the split casing **12** such that the surface of the bore **14** in the casing slightly engages the peripheral surface **32** of the die insert **16**. Threaded plug or set screw **70** is backed off, and threaded plug or set screw **68** is advanced such that the elongated wedge member **62** is displaced towards the right, as seen in the drawing, to a position such as shown in FIG. 2 wherein the wedging flat surface **64** of the wedge member firmly engages the flat surface **66** on the periphery of the die insert **16** for proper locating and clamping of the die insert within the split casing **12** with the annular end surface **22** of the insert in abutting engagement with the annular shoulder **20** in the casing. Threaded member or cap bolt **46** is further advanced such as to apply further compressive force upon the split casing **12** by drawing closer to each other the faces **36** and **38** of the slot **34**, as shown in FIG. 2.

In order to remove the die insert **16**, the preceding operation is effected in a reverse order such that when the elongated wedge member **62** has been displaced to the left to the position shown in FIG. 1, as a result of threaded plug or set screw **64** being backed off and threaded plug or set screw **70** being advanced, with the threaded member or cap screw **46** backed off to the position shown, the compressive force applied on the split casing **12** is relieved and the casing inner bore **14** spring back to its original size, permitting the die insert to be slipped from the bore **14** in the casing for removal and replacement by another die insert.

Having thus described the invention by way of an illustrative example of an embodiment incorporating the principles thereof, modifications whereof will be apparent to those skilled in the art, what is sought to be protected by United States Letters Patent is as follows:

I claim:

1. A die assembly comprising a support casing having a longitudinal cylindrical bore therethrough, a reduced diameter end portion in said longitudinal bore forming a shoulder, a longitudinally extending radial slot through a sidewall of said casing and defining a pair of opposed faces, a removable cylindrical die insert disposed within the longitudinal bore in said casing with an end thereof in abutment with said shoulder, a flat surface on the periphery of said die insert, a transverse wedge member disposed substantially tangentially to said die insert and displaceable in a corresponding transverse bore in said casing for engagement with said flat surface and means for drawing toward each other the faces of the slot in said casing.

2. The die assembly of claim **1** wherein the axis of said transverse bore is disposed substantially normal to a diameter of said die insert passing through the slot in said casing.

3. The die assembly of claim **1** wherein said wedge member has a longitudinally disposed flat surface at a slight angle to the axis thereof and the flat surface on the periphery of said die insert is in a plane disposed at a slight angle to the longitudinal axis of said insert for urging said insert with the end thereof in abutting engagement with the shoulder in said casing when the flat surface of said wedge member is engaged with said flat surface on the periphery of said die insert.

4. The die assembly of claim **1** wherein the means for drawing toward each other the faces of the slot in said casing comprises a pair of aligned bores extending in opposite directions from the faces of said slot, one of said bores being threaded for accepting a threaded member having an enlarged head and the other of said bores having an enlarged shoulder forming portion communicating with the exterior of said casing, and a threaded member disposed in said aligned bores in threaded engagement with the threaded one of said bores, said threaded member having an enlarged head adapted for engagement with the shoulder in the other bore for drawing the faces of said slot toward each other.

5. The die assembly of claim **1** wherein the means for axially displacing the wedge member comprises a pair of threaded plug members each disposed in an internally threaded end portion of said transverse bore on an end of said wedge member.

6. A die assembly comprising a support casing having a longitudinal stepped bore therethrough for defining a supporting shoulder therein, a longitudinally extending slot through a sidewall of said casing and defining a pair of opposed faces, a removable cylindrical die insert disposed within the longitudinal bore in said casing with an end thereof in abutting engagement with said supporting shoulder, a flat surface on the periphery of said die insert, a chordal transverse bore through said casing having an axis substantially tangent to the longitudinal bore in said casing and open to said longitudinal bore, an axially displaceable elongated wedge member disposed in said transverse bore, said wedge member having an inclined flat surface disposed for engagement with the flat surface on the periphery of said die insert, means for drawing toward each other the faces of the slot in said casing and means for axially displacing said wedge member for engagement of the inclined flat surface thereof with the flat surface on the periphery of said die insert.

7. The die assembly of claim **6** wherein the axis of said chordal transverse bore is disposed substantially normal

to a diameter of said die insert passing through the slot in said casing.

8. The die assembly of claim **6** wherein the flat surface on the periphery of said die insert is in plane disposed at a small angle to the longitudinal axis of said insert for urging said insert with the end thereof in abutting engagement with the supporting shoulder in said casing when the inclined flat surface of said wedge member is in engagement with said flat surface on the periphery of said die insert.

9. The die assembly of claim **6** wherein the means for drawing toward each other the faces of the slot in said casing comprises a pair of aligned bores extending in opposite directions from the faces of said slot, one of said bores being threaded and the other having an enlarged shoulder forming portion communicating with the exterior of said casing and a threaded member disposed in said aligned bores in threaded engagement with the threaded one of said bores, said threaded member having an enlarged head adapted for engagement with the shoulder in the other bore for drawing the faces of said slot toward each other.

10. The die assembly of claim **6** wherein the means for axially displacing the wedge member comprises a pair of threaded plug members each disposed in an internally threaded end portion of said chordal transverse bore on an edge of said wedge member.

11. The die assembly of claim **7** wherein the means for drawing toward each other the faces of the slot in said casing comprises a pair of aligned bores extending in opposite directions from the faces of said slot, one of said bores being threaded and the other having an enlarged shoulder forming portion communicating with the exterior of said casing and a threaded member disposed in said aligned bores in threaded engagement with the threaded one of said bores, said threaded member having an enlarged head adapted for engagement with the shoulder in the other bore for drawing the faces of said slot toward each other.

12. The die assembly of claim **11** wherein the means for axially displacing the wedge member comprises a pair of threaded plug members each disposed in an internally threaded end portion of said chordal transverse bore on an end of said wedge member.

13. The die assembly of claim **12** wherein the flat surface on the periphery of said die insert is in a plane disposed at a small angle to the longitudinal axis of said insert for urging said insert with the end thereof in abutting engagement with the supporting shoulder in said casing when the inclined flat surface of said wedge member is engaged with said flat surface on the periphery of said die insert.

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279—41; 287—52.09