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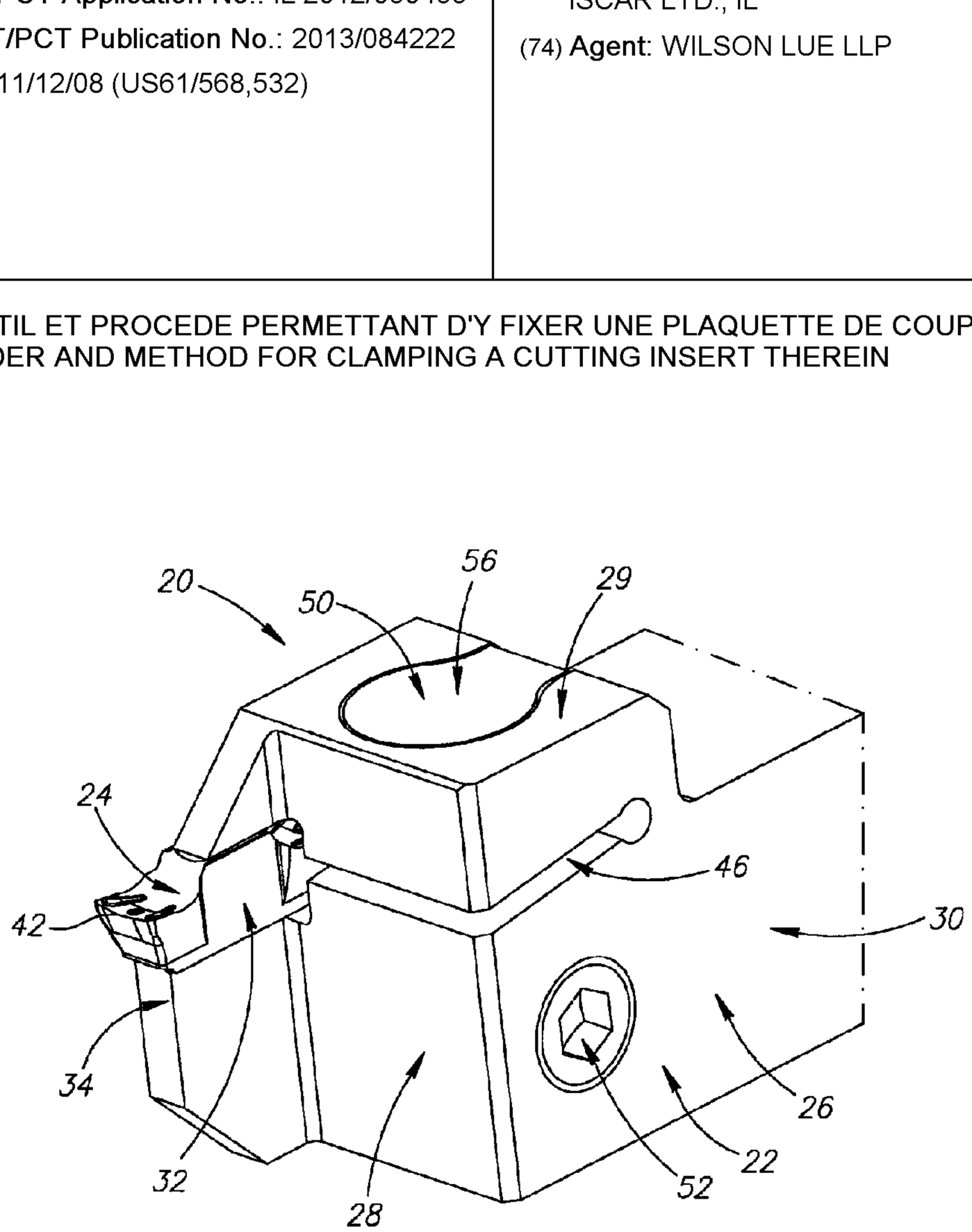


(57) Abrégé/Abstract:
A tool holder has a main body having a holder head extending away from a holder shank in a forward direction, a clamping member non-threadingly retained in the holder head, and a locking member operatively engaging a single abutment surface of the clamping member. The holder head has an insert receiving pocket at a forward end thereof with a pocket support surface substantially facing in an upward direction, and the clamping member is located entirely rearward of the pocket support surface with the abutment surface facing generally upwardly. The tool holder is configured to direct a clamping force towards, and clamp a cutting insert against, the pocket support surface.

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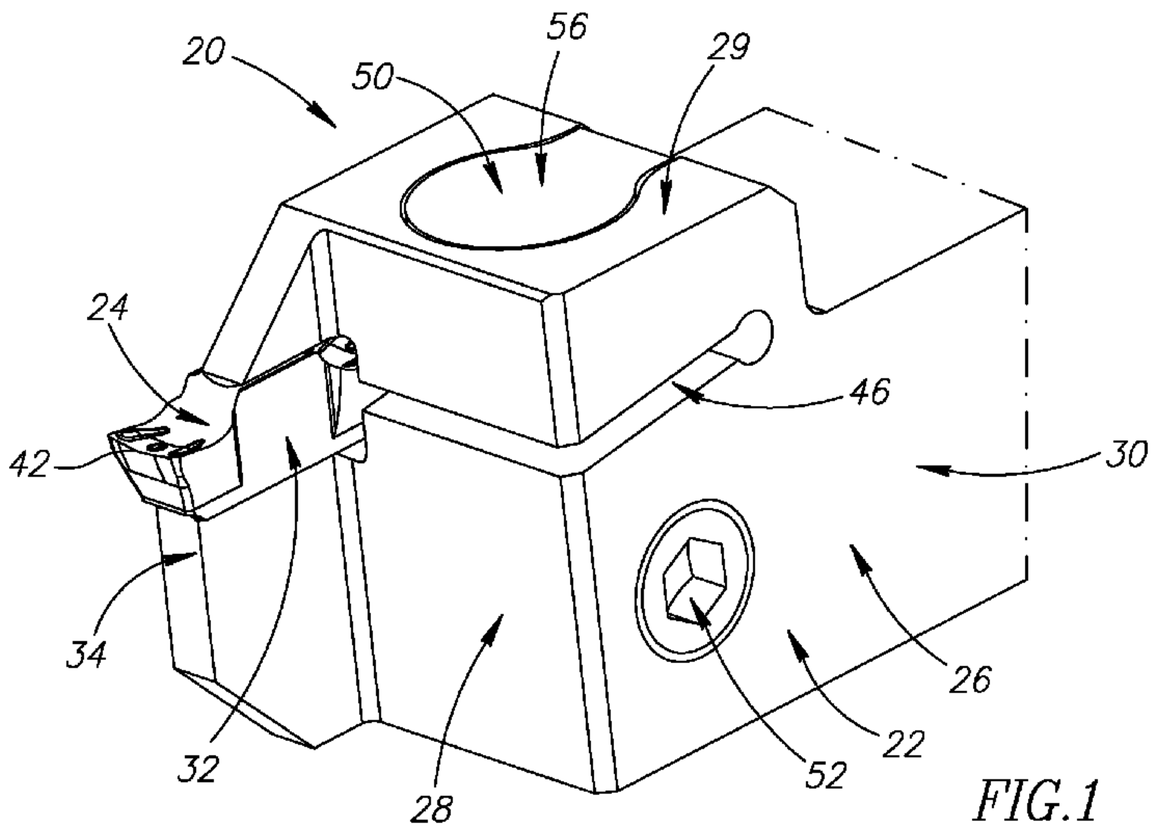


FIG.1

(57) Abstract: A tool holder has a main body having a holder head extending away from a holder shank in a forward direction, a clamping member non-threadingly retained in the holder head, and a locking member operatively engaging a single abutment surface of the clamping member. The holder head has an insert receiving pocket at a forward end thereof with a pocket support surface substantially facing in an upward direction, and the clamping member is located entirely rearward of the pocket support surface with the abutment surface facing generally upwardly. The tool holder is configured to direct a clamping force towards, and clamp a cutting insert against, the pocket support surface.

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# TOOL HOLDER AND METHOD FOR CLAMPING A CUTTING INSERT THEREIN

## FIELD OF THE INVENTION

The present invention relates to a tool holder for use in metal cutting processes in general, and for grooving, turning and parting operations in particular.

## BACKGROUND OF THE INVENTION

Within the field of tool holders used in grooving, turning and parting operations there are many examples of cutting inserts being clamped in an insert receiving pocket of a tool holder having an upper pocket clamping surface and a lower pocket support surface. Some of these tool holders are configured such that a clamping force is actively applied to clamp the cutting insert between the upper pocket clamping surface and the lower pocket support surface.

US 5,360,298 discloses such a tool holder, having a clamping member in the form of a clamping screw. The clamping screw passes through a through bore in an upper part of the tool holder associated with the upper pocket clamping surface, bisects a clamping slot extending rearwardly from the insert receiving pocket, and engages a threaded bore in a lower part of the tool holder associated with the lower pocket support surface. The clamping screw is tightened in order to clamp the cutting insert in the insert receiving pocket.

US 6,814,526 also discloses such a tool holder, having a clamping member in the form of a drawbar and a locking member in the form of a locking screw. The drawbar comprises a head and a shaft, the shaft having a threaded end portion distal from the head. The shaft bisects a clamping slot extending rearwardly from the insert receiving pocket and is threadingly retained in an upper part of the tool holder associated with the upper pocket clamping surface. The head is located in a lower part of the tool holder associated with the lower pocket support surface, and the locking screw operatively engages the head to clamp the cutting insert in the insert receiving pocket.

US 6,139,227 also discloses such a holder, having a clamping member in the form of a transmission pin and a locking member is in the form of an eccentric cam. The transmission pin is slidably retained in a first bore in a lower part of the tool holder associated with the lower

pocket support surface. The first bore intersects a clamping slot located rearward of the insert receiving pocket, above which is situated an upper part of the tool holder associated with the upper pocket clamping surface. The eccentric cam is located in a second bore transverse to the first bore in the lower part of the tool holder, and operatively engages the transmission pin to clamp the cutting insert in the insert receiving pocket.

It is an object of the present invention to provide an improved tool holder.

It is also an object of the present invention to provide a tool holder having a locking screw accessible from at least one lateral surface.

It is a further object of the present invention to provide a tool holder with optimal transmission of a clamping force and efficient active clamping of a cutting insert.

It is yet a further object of the present invention to provide a tool holder with an advantageously high level of cutting insert clamping repeatability.

## SUMMARY OF THE INVENTION

In accordance with the present invention, there is provided a tool holder comprising:

a main body having a holder head extending away from a holder shank in a forward direction, the holder head having an insert receiving pocket at a forward end thereof, with a pocket support surface substantially facing in an upward direction;

a clamping member non-threadingly retained in the holder head and located entirely rearward of the pocket support surface; and

a locking member operatively engaging a single abutment surface of the clamping member,

wherein the abutment surface faces generally upwardly, and

wherein the tool holder is configured to direct a clamping force towards, and clamp a cutting insert against, the pocket support surface.

Also in accordance with the present invention, there is provided a method of clamping a cutting insert in a tool holder, the tool holder comprising:

a main body having a holder head extending away from a holder shank in a forward direction, the holder head having an insert receiving pocket at a forward end thereof, with a pocket support surface substantially facing in an upward direction;

a clamping member non-threadingly retained in the holder head; and

a locking member operatively engaging a single abutment surface of the clamping member, wherein the abutment surface faces generally upwardly,

the cutting insert having opposing first and second insert surfaces with an operative cutting edge associated with the first insert surface,

the method comprising the steps of:

positioning the cutting insert adjacent the forward end of the holder head with a portion of the second insert surface in contact with the pocket support surface,

sliding the cutting insert in a rearward direction into the insert receiving pocket, and

actuating the locking member until a clamping force is applied between the second insert surface and the pocket support surface.

Further in accordance with the present invention, there is provided a tool holder assembly comprising:

a main body having a holder head extending away from a holder shank in a forward direction, the holder head having a top surface, at least one lateral surface having a locking bore formed therein, and an insert receiving pocket at a forward end thereof, the insert receiving pocket comprising a pocket support surface and an opposing pocket clamping surface;

a clamping member configured to be received into the holder head and located entirely rearward of the pocket support surface, the clamping member having an abutment surface; and

a locking member configured to be received into the locking bore formed in the holder head's lateral surface and engage the clamping member's abutment surface to thereby apply an abutment force which urges the pocket clamping surface in a direction of the pocket support surface, when the clamping member is received in the holder head's top surface and non-threadingly retained in the holder head by said locking member.

A cutting tool in accordance with the present invention may thus comprise the aforementioned tool holder assembly and a cutting insert clampingly retained in the insert receiving pocket between the pocket support surface and the pocket clamping surface, wherein:

the clamping member is non-threadingly retained in the holder head and

the locking member occupies the locking bore and engages the clamping member's abutment surface to thereby apply the aforementioned abutment force.

## BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding, the invention will now be described, by way of example only, with reference to the accompanying drawings in which chain-dash lines represent cut-off boundaries for partial views of a member and in which:

**Fig. 1** is a perspective view of a cutting tool in accordance with some embodiments of the present invention;

**Fig. 2** is a side view of the cutting tool shown in Fig. 1;

**Fig. 3** is a side view of a tool holder in accordance with some embodiments of the present invention;

**Fig. 4** is a top view of the tool holder shown in Fig. 3, without a clamping member;

**Fig. 5** is a partial cross-sectional view of the tool holder shown in Fig. 4 taken along the line V-V;

**Fig. 6** is a detailed view of the tool holder shown in Fig. 5;

**Fig. 7** is a side view of a clamping member in accordance with some embodiments of the present invention; and

**Fig. 8** is a side view of a locking member in accordance with some embodiments of the present invention.

## DETAILED DESCRIPTION OF THE INVENTION

Attention is first drawn to Figs. 1 and 2, showing a cutting tool **20** in accordance with some embodiments of the present invention. The cutting tool **20** comprises a tool holder **22** and a cutting insert **24** removably secured in the tool holder **22**.

As shown in Fig. 3 and 4, the tool holder **22**, which may be manufactured from hardened steel, has a main body **26** with a holder head **28** extending away from a holder shank **30** in a forward direction **F**, the holder head **28** having an insert receiving pocket **32** at a forward end **34** thereof, with a pocket support surface **36** substantially facing in an upward direction **U**.

In some embodiments of the present invention, the holder head **28** may be rigidly fixed to the holder shank **30**.

As shown in Fig. 5, the pocket support surface **36** may be generally V-shaped when viewed from a position forward of the insert receiving pocket **32**.

As shown in Fig. 1 and 2, the cutting insert **24**, which may be manufactured by form press and sintering a cemented carbide, has opposing first and second insert surfaces **38**, **40**, with an operative cutting edge **42** associated with the first insert surface **38**, and the second insert surface **40** in clamping contact with the pocket support surface **36**.

The tool holder **22** is configured to direct a clamping force **f** towards, and clamp the cutting insert **24** against, the pocket support surface **36**.

In some embodiments of the present invention, the insert receiving pocket **32** may include a pocket clamping surface **44** substantially facing in a downward direction **D** and making clamping contact with the first insert surface **38**.

It should be understood that throughout the description and claims of the present invention, the downward direction **D** is generally opposite to the upward direction **U**, and the forward direction **F** is generally perpendicular to both the upward and downward directions **U**, **D**.

As shown in Fig. 3, a clamping slot **46** may extend away from the insert receiving pocket **32** in a rearward direction **R**, with the pocket support surface **36** and the pocket clamping surface **44** being separated by a slot plane **P1** longitudinally bisecting the clamping slot **46**.

It should be understood that throughout the description and claims of the present invention, the rearward direction **R** is generally opposite to the forward direction **F**.

In some embodiments of the present invention, the pocket clamping surface **44** may be formed on an elongated clamping jaw **48** having a resilience axis of rotation **A1** adjacent a rear end **74** of the clamping slot **46**, with the cutting insert **24** being actively clamped between the pocket clamping surface **44** and the pocket support surface **36**.

It should be understood that throughout the description and claims of the present invention, the term "actively clamped" denotes the application of the clamping force **f** which has to overcome the 'resilience' of the elongated clamping jaw **48** and displace the elongated clamping jaw **48** about its resilience axis of rotation **A1** before clamping of the cutting insert **24** can occur.

Also, in some embodiments of the present invention, the cutting insert **24** may be blade shaped, and suitable for grooving, turning and parting operations.

A clamping member **50** is non-threadingly retained in the holder head **28**, via a top surface **29** thereof, and located entirely rearward of the pocket support surface **36**.

A locking member **52** operatively engages a single abutment surface **54** of the clamping member **50**, with the abutment surface **54** facing generally upwardly, the term "generally upwardly" denoting a direction having an angle of less than 45° with the upward direction **U**.

A method of clamping the cutting insert **24** in the tool holder **22** comprises the steps of:

positioning the cutting insert **24** adjacent the forward end **34** of the holder head **28** with a portion of the second insert surface **40** in contact with the pocket support surface **36**,

sliding the cutting insert **24** in the rearward direction **R** into the insert receiving pocket **32**, and

actuating the locking member **52** until the clamping force **f** is applied between the second insert surface **40** and the pocket support surface **36**.

It should be understood that throughout the description and claims of the present invention, the term "actuating" describes the act of initiating movement of the locking member **52** in a predetermined direction or along a predetermined path.

As shown in Figs. 5 and 7, the clamping member **50** may be in the form of a clamping pin **56** having a pin shaft **58** and a pin head **60**, with the pin shaft **58** being slidably retained in a through bore **62** in the holder head **28**. Thus, holder head's through bore **62** is open to the holder head's top surface **29** and extends in a first direction transverse to the forward direction **F**, the through bore **62** being configured to receive the clamping member **50**.

In some embodiments of the present invention, the through bore **62** may have a through bore axis **A2** extending in the upward direction **U**.

Also, in some embodiments of the present invention, the pin shaft **58** may be cylindrical shaped having a shaft radius **r**, extending away from the pin head **60** along a shaft axis **A3**.

As shown in Fig. 5, the shaft axis **A3** may be coaxial with the through bore axis **A2**, and the pin head **60** may be located in the elongated clamping jaw **48**.

In some embodiments of the present invention, the pin head **60** may be countersunk in a jaw recess **64** of the elongated clamping jaw **48**, and have a single fixed rotational position within the said jaw recess **64**.

As also shown in Fig. 5, the pin head **60** may have a head under surface **66** immediately adjacent the pin shaft **58** facing in the downward direction **D**, and the abutment surface **54** may form a portion of a shaft recess **68** in the pin shaft **58**, with the abutment surface **54** and the head under surface **66** being separated by the clamping slot **46**.

The clamping pin **56** being slidably retained in the holder head **28**, results in the pin head **60** having a fixed translational position relative to the elongated clamping jaw **48** when the locking member **52** is operatively engaged with the abutment surface **54**, which beneficially provides a high level of clamping repeatability.

As shown in Figs. 3 and 4, the head under surface **66** may engage the elongated clamping jaw **48** at a single clamping zone **70** located entirely forward of the through bore axis **A2**.

The single clamping zone **70** being located on only a portion of the jaw recess **64** around the through bore axis **A2**, beneficially contributes to the high level of clamping repeatability.

The single clamping zone **70** being located entirely forward of the through bore axis **A2**, provides optimal transmission of the clamping force **f** through the elongated clamping jaw **48**.

As shown in Figs. 5 and 6, the abutment surface **54** may extend inwardly to an inner recess end **72** of the shaft recess **68**, with the inner recess end **72** being located at a perpendicular recess distance **d1** from a shaft plane **P2** containing the shaft axis **A3**.

In some embodiments of the present invention, **d1** is less than **r/2**, and preferably **d1** is less than **r/5**.

Also, in some embodiments of the present invention, the pin shaft **58** may exhibit mirror symmetry about the shaft plane **P2**.

As shown in Figs. 5 and 6, the shaft recess **68** may be conical shaped, extending along a recess axis **A4**, with the recess axis **A4** intersecting the shaft axis **A3**.

The abutment surface **54** thus forms a concave portion of the conical shaped shaft recess **68**.

In some embodiments of the present invention, the recess axis **A4** may be perpendicular to the shaft axis **A3**, with the abutment surface **54** forming an external acute abutment angle $\alpha$ with the recess axis **A4**.

Also, in some embodiments of the present invention, the abutment angle $\alpha$ may be less than 45° and greater than 20°.

The recess distance **d1** of the shaft recess **68** being less than **r/2**, and preferably less than **r/5**, provides an advantageously long path length for the locking member **52** to operatively engage with the abutment surface **54**, which allows selection of the most suitable abutment angle $\alpha$ to transform the locking member **52** movement into deflection of the elongated clamping jaw **48** and achieve efficient active clamping of the cutting insert **24**.

The locking member **52** may have a central axis **A5**, whereby rotation of the locking member **52** in one direction about its central axis **A5** causes the clamping member **50** to move in the downward direction **D** and a decrease in a clamping distance **d2** between the pocket clamping surface **44** and the pocket support surface **36** until the clamping force **f** is applied between the second insert surface **40** and the pocket support surface **36**, and rotation of the locking member **52** in an opposite direction about its central axis **A5** causes an increase in the clamping distance **d2**.

As shown in Fig. 8, the locking member **52** may be in the form of a locking screw **76** having a threaded section **78** and a non-threaded section **80**.

As shown in Figs. 5 and 6, the threaded section **78** of the locking screw **76** may engage a screw bore **82** ("locking bore") in the holder head **28**, the screw bore **82** extending towards and opening out to at least one lateral surface **84**, **86** of the holder head **28** and having a screw bore axis **A6** transverse to the upward direction **U**.

For embodiments of the present invention, where the pin shaft **58** exhibits mirror symmetry about the shaft plane **P2**, the screw bore **82**, although 'interrupted' by the through bore **62**, may extend towards and open out to opposing first and second lateral surfaces **84**, **86**, thus allowing the locking screw **76** to operatively engage with either of the two mirror symmetrical abutment surfaces **54** and the operator to access the locking screw **76** from either of the first and second lateral surfaces **84**, **86**.

Also as shown in Figs. 5 and 6, the non-threaded section **80** of the locking screw **76** may include an abutting surface **88** having a generally frusto-conical shape, with a portion of the abutting surface **88** contacting the abutment surface **54** of the clamping member **50**.

The abutting surface **88** having a generally frusto-conical shape, and the abutment surface **54** forming a concave portion of the conical shaped shaft recess **68**, results in operative engagement between the abutting surface **88** and the abutment surface **54** being 'centralized' towards an imaginary line of contact **L1** of the shaft recess **68**, which beneficially contributes to the high level of clamping repeatability.

Thus, the locking member **52** is configured to be received into the locking bore **82** formed in the holder head's lateral surface **84, 86** and engage the clamping member's abutment surface **54** to thereby apply an abutment force **G** which urges the pocket clamping surface **44** in a direction of the pocket support surface **42**, when the clamping member **50** is received in the holder head's top surface **29** and non-threadingly retained in the holder head **28** by said locking member **52**. As such,

the locking bore **82** extends in a second direction transverse to the forward direction **F** and intersects the through bore **62**.

The imaginary line of contact **L1** may be contained in a contact plane **P3** perpendicular to the shaft plane **P2**. In some embodiments of the present invention, the abutting surface **88** may be outwardly convex in a side view of the locking screw **76**, which results in an optimally short length of simultaneous contact along the imaginary line of contact **L1**.

# CLAIMS

**What is claimed is:**

**1.** A tool holder comprising:

a main body having a holder head extending away from a holder shank in a forward direction (F), the holder head having an insert receiving pocket at a forward end thereof, with a pocket support surface substantially facing in an upward direction (U);

a clamping member non-threadingly retained in the holder head and located entirely rearward of the pocket support surface; and

a locking member operatively engaging a single abutment surface of the clamping member,

wherein:

the clamping member is in the form of a clamping pin having a pin shaft and a pin head, and the pin shaft is slidably retained in a through bore in the holder head;

the abutment surface forms a portion of a shaft recess in the pin shaft and faces generally upwardly; and

the tool holder is configured to direct a clamping force (f) towards, and clamp a cutting insert against, the pocket support surface.

**2.** The tool holder according to claim 1, wherein the through bore axis (A2) extends in the upward direction (U).

**3.** The tool holder according to claim 1 or 2, wherein the pin head has a head under surface immediately adjacent the pin shaft facing in a downward direction (D).

**4.** The tool holder according to claim 3, wherein the pin shaft is cylindrical shaped having a shaft radius r, extending away from the pin head along a shaft axis (A3), and

wherein the shaft recess is conical shaped, extending along a recess axis (A4), and the recess axis (A4) intersects the shaft axis (A3).

**5.** The tool holder according to claim 4, wherein the recess axis (A4) is perpendicular to the shaft axis (A3), and the abutment surface forms an external acute abutment angle ($\alpha$) with the recess axis (A4), and

wherein the abutment angle ($\alpha$) is less than 45° and greater than 20°.

**6.** The tool holder according to any one of claims 3 to 5, wherein the insert receiving pocket includes a pocket clamping surface substantially facing in the downward direction (D), and

wherein the locking member has a central axis (A5), and a clamping distance d2 between the pocket clamping surface and the pocket support surface is decreased by rotation of the locking member in one direction about its central axis (A5) and increased by rotation of the locking member in an opposite direction about its central axis (A5).

**7.** The tool holder according to any one of claims 1 to 6, wherein the locking member is in the form of a locking screw having a threaded section and a non-threaded section, and

wherein the non-threaded section includes an abutting surface having a generally frusto-conical shape, and a portion of the abutting surface contacts the abutment surface of the clamping member.

**8.** A method of clamping a cutting insert in a tool holder, the tool holder comprising:

a main body having a holder head extending away from a holder shank in a forward direction (F), the holder head having an insert receiving pocket at a forward end thereof, with a pocket support surface substantially facing in an upward direction (U);

a clamping member non-threadingly retained in the holder head; and

a locking member operatively engaging a single abutment surface of the clamping member,

wherein:

the clamping member is in the form of a clamping pin having a pin shaft and a pin head, and the pin shaft is slidably retained in a through bore in the holder head;

the abutment surface forms a portion of a shaft recess in the pin shaft and faces generally upwardly; andthe cutting insert has opposing first and second insert surfaces with an operative cutting edge associated with the first insert surface,

the method comprising the steps of:

positioning the cutting insert adjacent the forward end of the holder head with a portion of the second insert surface in contact with the pocket support surface,

sliding the cutting insert in a rearward direction (R) into the insert receiving pocket, and

actuating the locking member until a clamping force (f) is applied between the second insert surface and the pocket support surface.

**9.** The method according to claim 8, wherein the clamping member is located entirely rearward of the pocket support surface.

**10.** The method according to claim 8 or 9, wherein the locking member has a central axis (A5), and

wherein rotation of the locking member in one direction about its central axis (A5) causes the clamping member to move in a downward direction (D) and the clamping force (f) to be applied between the second insert surface and the pocket support surface.

**11.** The method according to claim 10, wherein the pin head has a head under surface immediately adjacent the pin shaft facing in the downward direction (D).

**12.** The method according to any one of claims 8 to 11, wherein the pin shaft is cylindrical shaped, extending away from the pin head along a shaft axis (A3), and

wherein the shaft recess is conical shaped, extending along a recess axis (A4), and the recess axis (A4) intersects the shaft axis (A3).

**13.** The method according to claim 12, wherein the recess axis (A4) is perpendicular to the shaft axis (A3), and

wherein the abutment surface forms an external acute abutment angle ($\alpha$) with the recess axis (A4).

**14.** The method according to any one of claims 8 to 13, wherein the insert receiving pocket includes a pocket clamping surface, and

wherein the pocket clamping surface makes clamping contact with the first insert surface.

**15.** A tool holder assembly comprising:

a main body having a holder head extending away from a holder shank in a forward direction (F), the holder head having a top surface, at least one lateral surface having a locking bore formed therein, and an insert receiving pocket at a forward end thereof, the insert receiving pocket comprising a pocket support surface and an opposing pocket clamping surface;

a clamping member configured to be received into the holder head and located entirely rearward of the pocket support surface, the clamping member having an abutment surface; and

a locking member configured to be received into the locking bore formed in the holder head's lateral surface and engage the clamping member's abutment surface to thereby apply an abutment force (G) which urges the pocket clamping surface in a direction of the pocket support surface, when the clamping member is received in the holder head's top surface and non-threadingly retained in the holder head by said locking member,

wherein:

the clamping member is in the form of a clamping pin having a pin shaft and a pin head, and the pin shaft is slidably retained in a through bore in the holder head; and

the abutment surface forms a portion of a shaft recess in the pin shaft.

**16.** The tool holder assembly according to claim 15, wherein:

the holder head comprises a first bore open to the holder head's top surface and extending in a first direction transverse to the forward direction (F), the first bore configured to receive the clamping member; and

the locking bore extends in a second direction transverse to the forward direction (F), the locking bore intersecting the first bore and configured to receive the locking member.

**17.** A cutting tool comprising:

the tool holder assembly according to claim 15 or 16; and

a cutting insert clampingly retained in the insert receiving pocket between the pocket support surface and the pocket clamping surface; wherein:

the clamping member is non-threadingly retained in the holder head and

the locking member occupies the locking bore and engages the clamping member's abutment surface to thereby apply said abutment force (G).

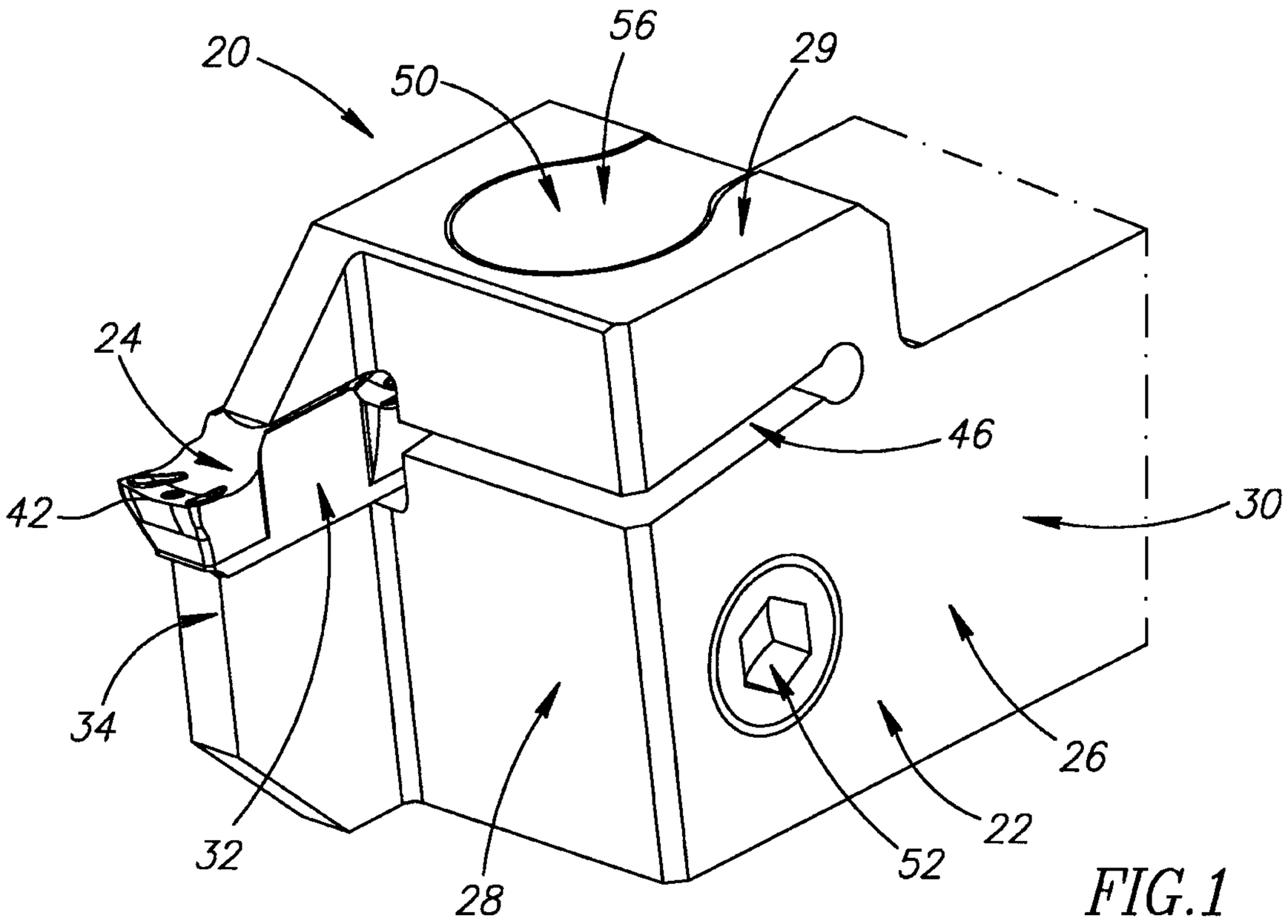
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FIG.1

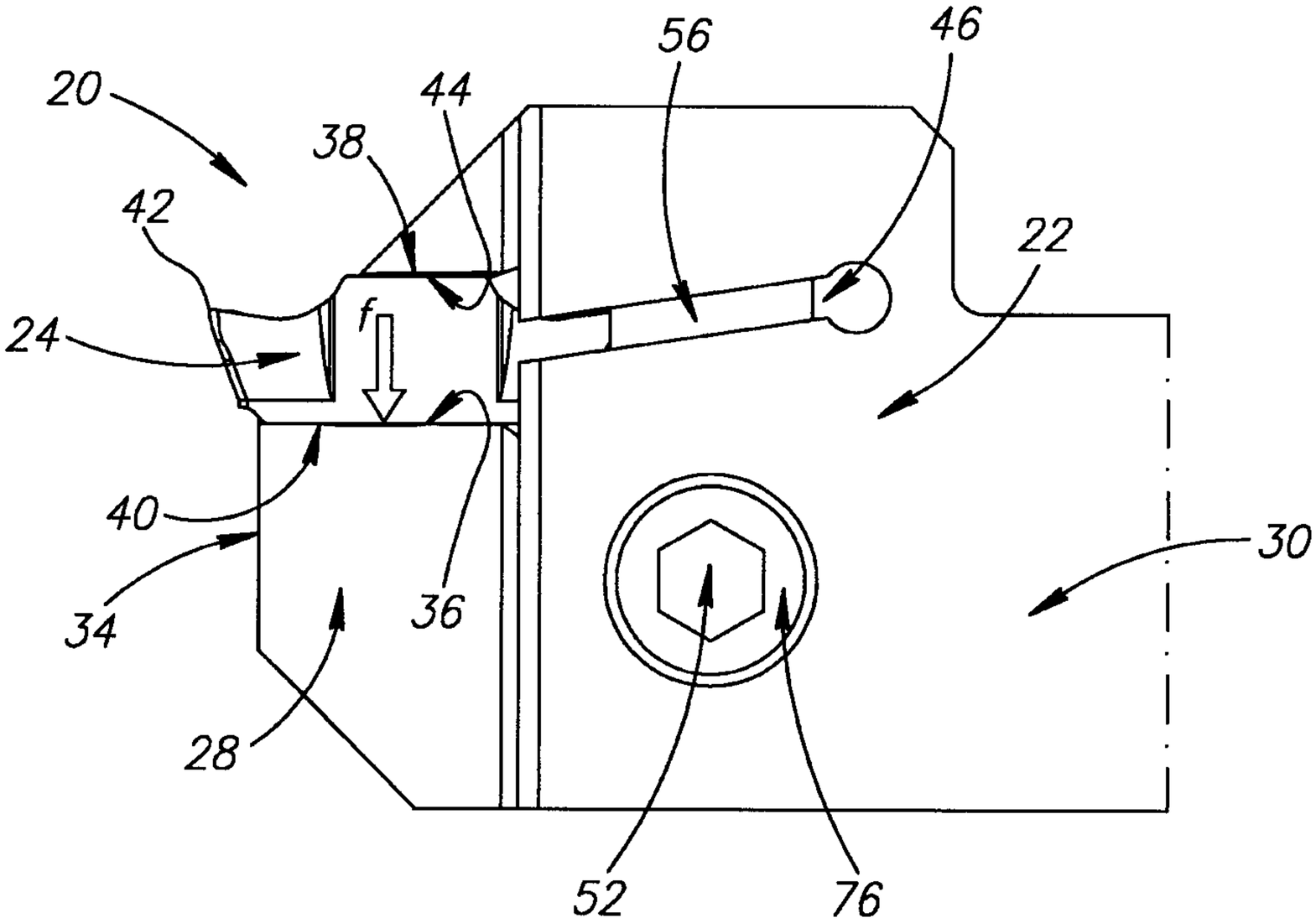

20
44
38
56
46
42
22
24
f
40
30
34
36
28
52
76

FIG.2

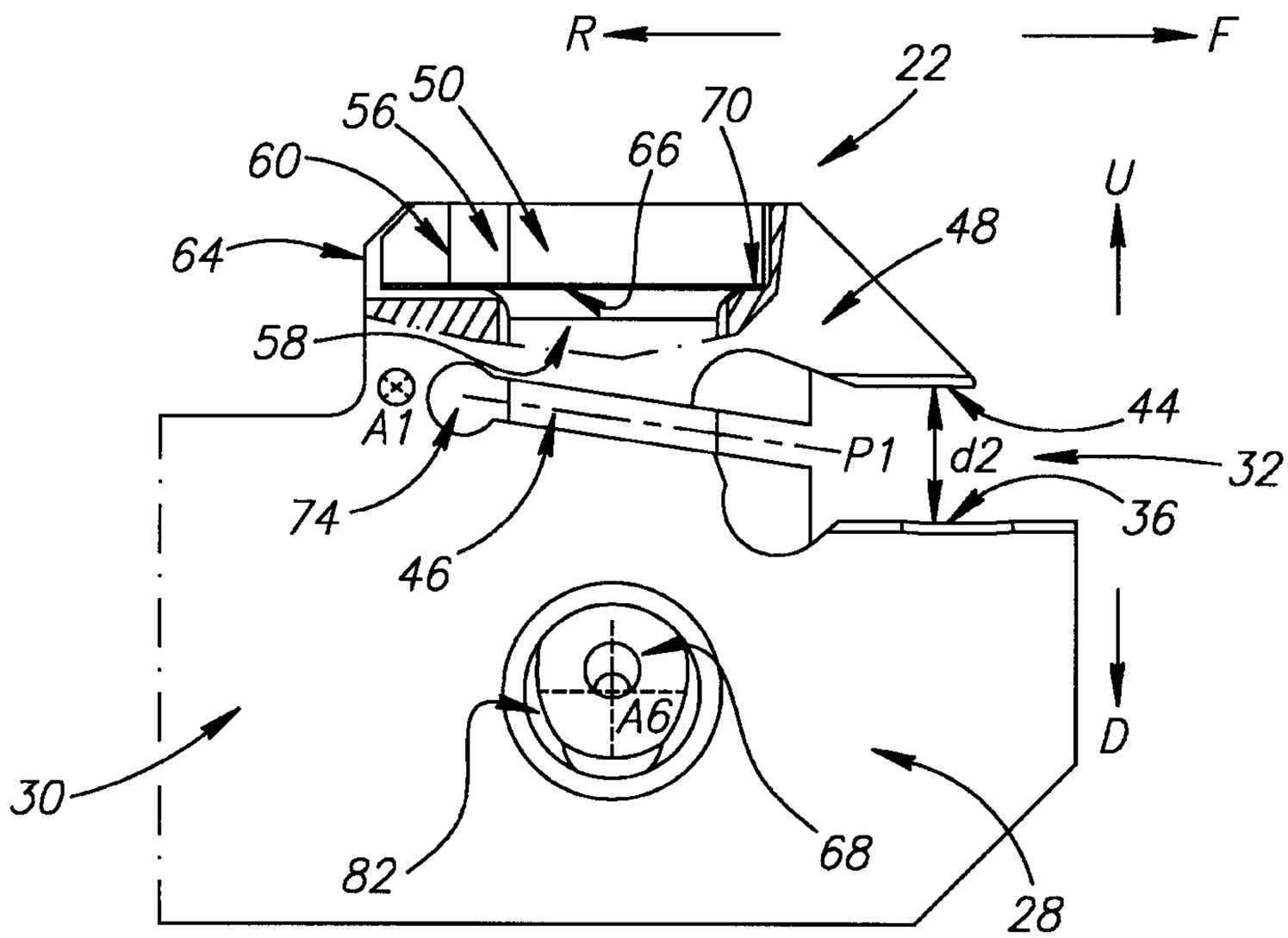

R
F
22
50
56
60
66
70
U
64
48
58
A1
44
P1
d2
32
74
46
36
D
30
A6
82
68
28

FIG.3

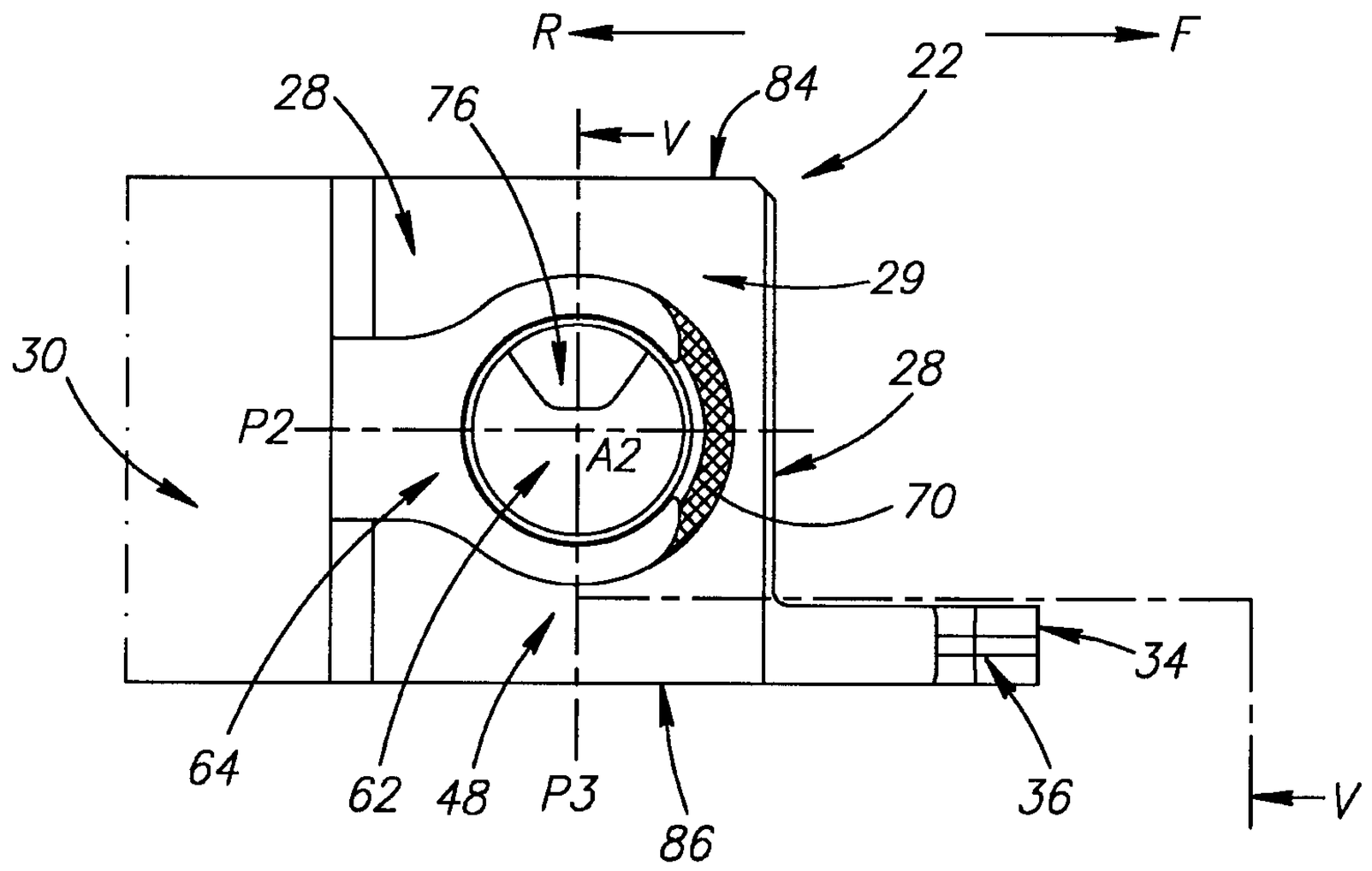

R
F
28
76
V
84
22
29
30
28
P2
A2
70
34
64
62
48
P3
86
36
V

FIG.4

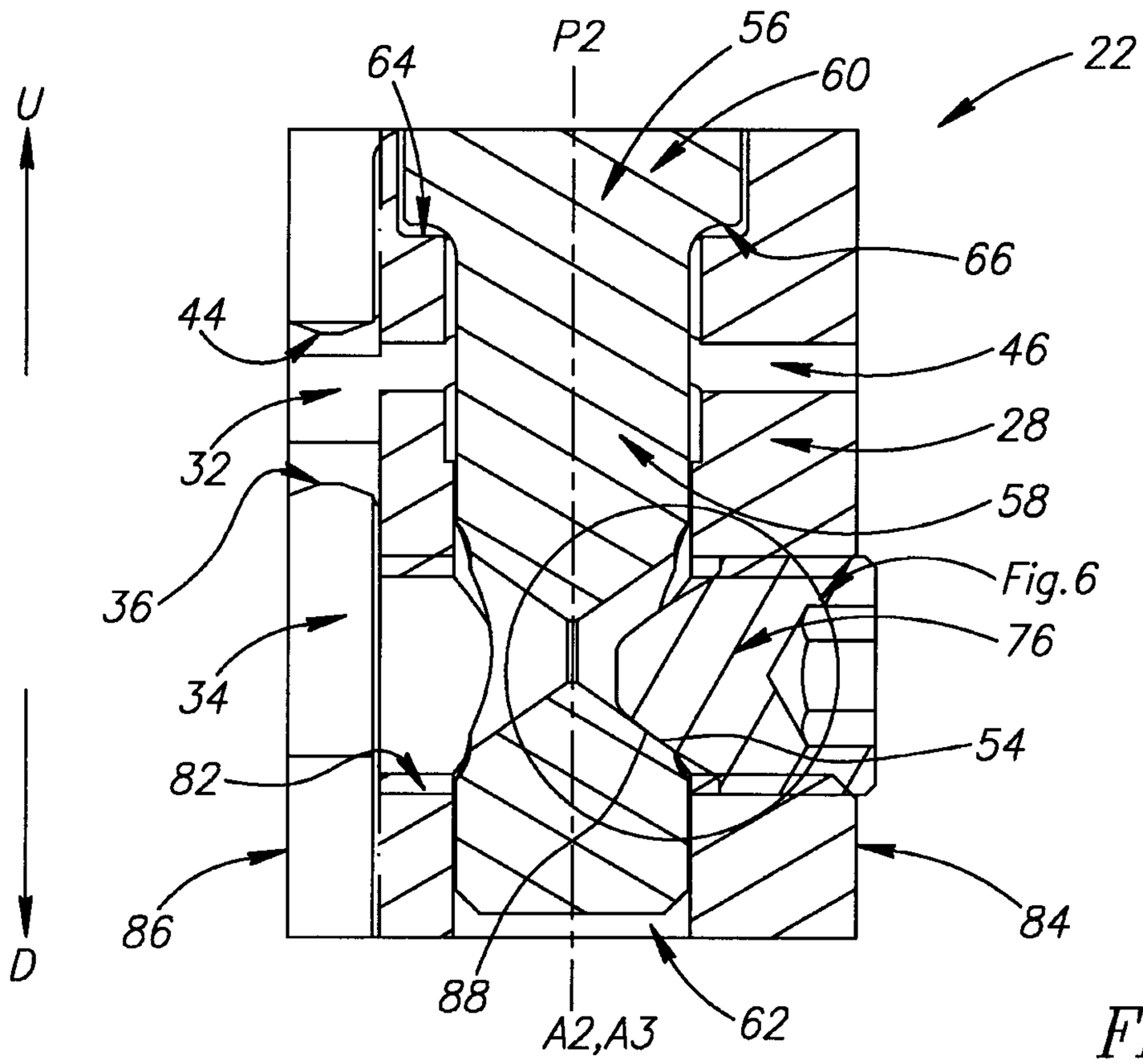

U
D
P2
64
56
60
22
66
44
46
32
28
58
36
Fig.6
76
34
54
82
86
84
88
A2,A3
62

FIG.5

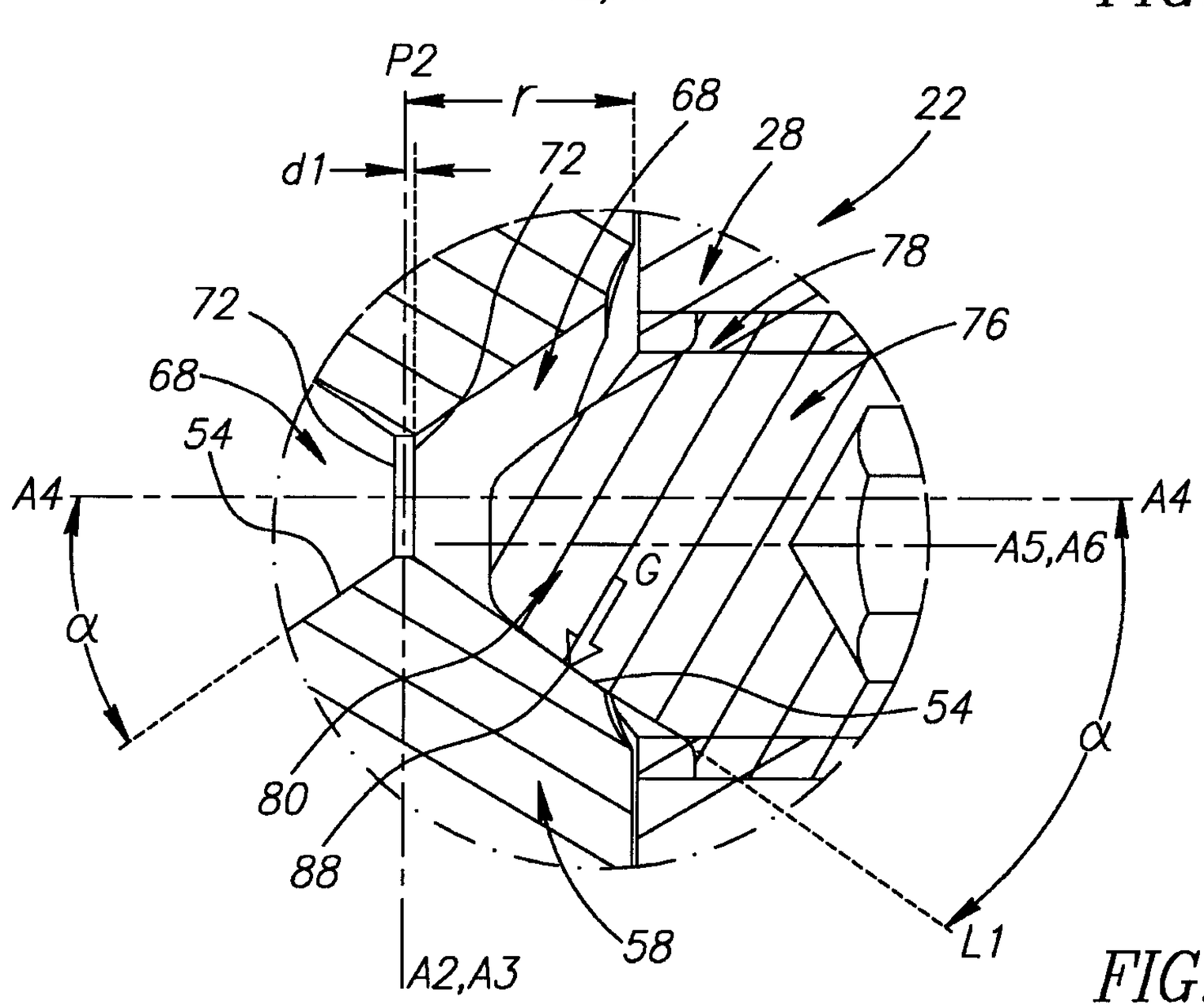

P2
r
68
22
d1
72
28
78
72
76
68
54
A4
A4
A5,A6
G
α
54
α
80
88
58
L1
A2,A3

FIG.6

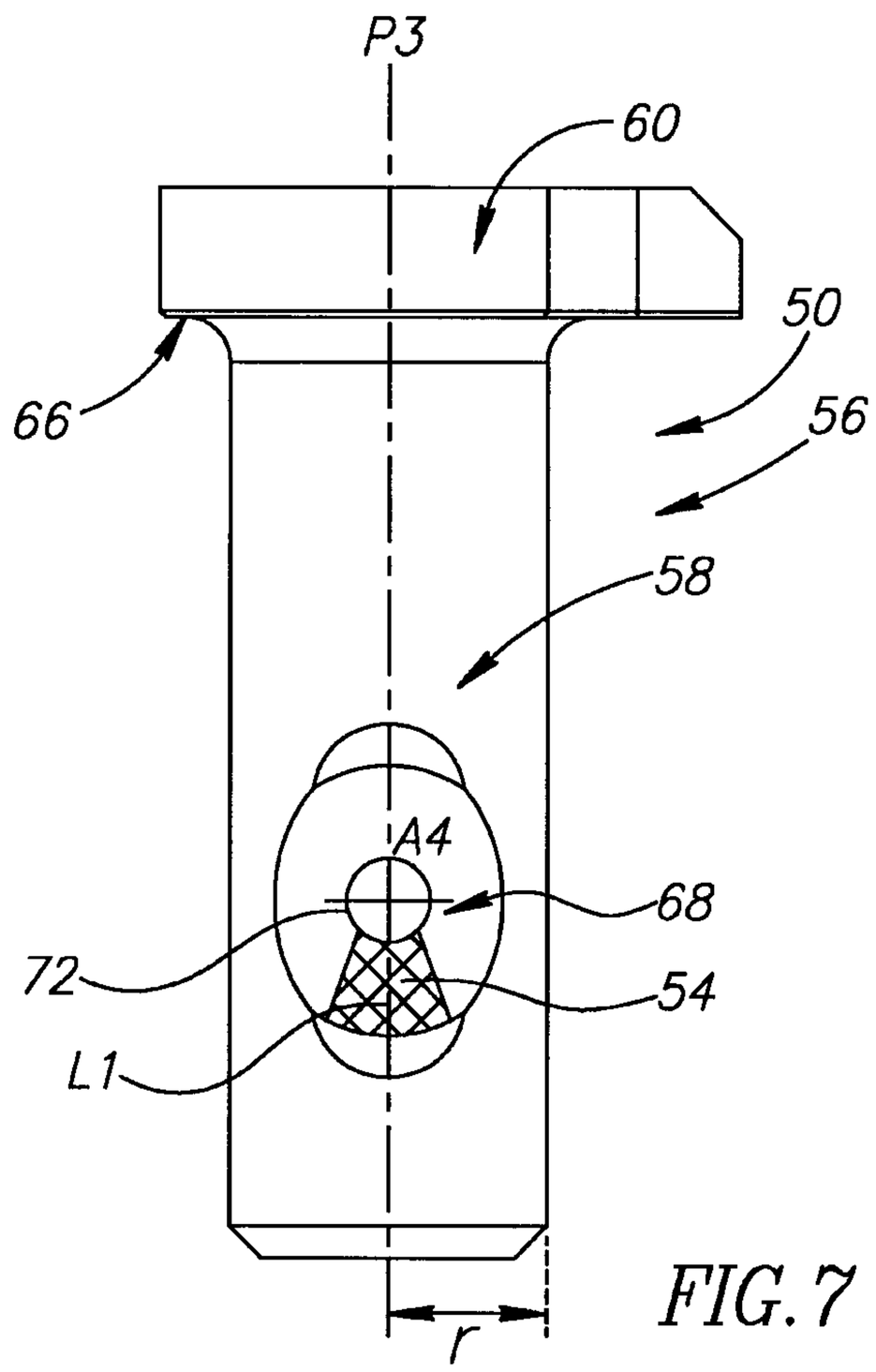



FIG. 7

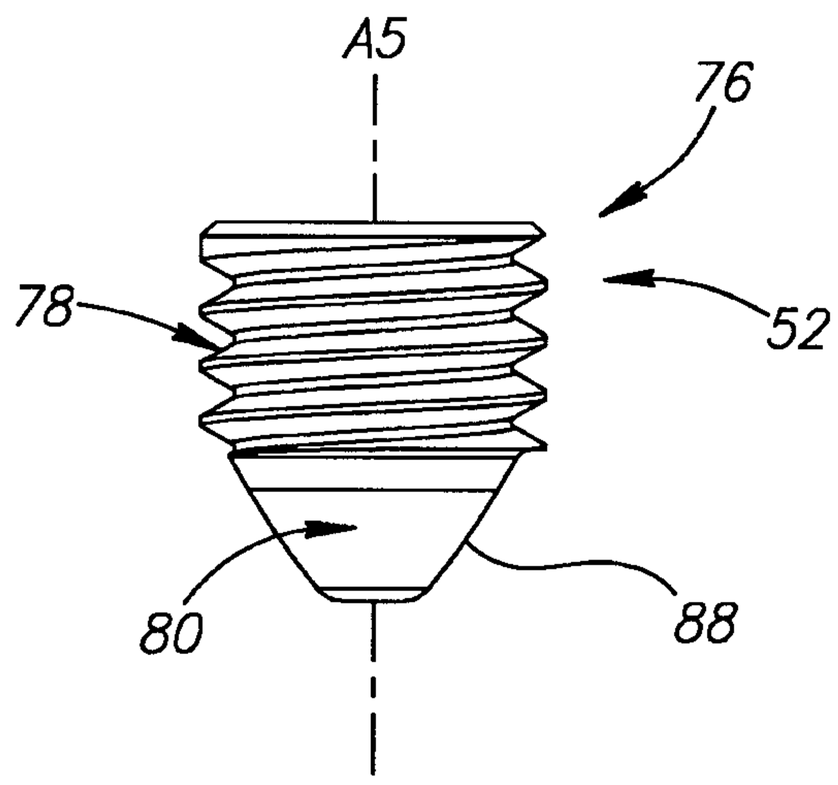
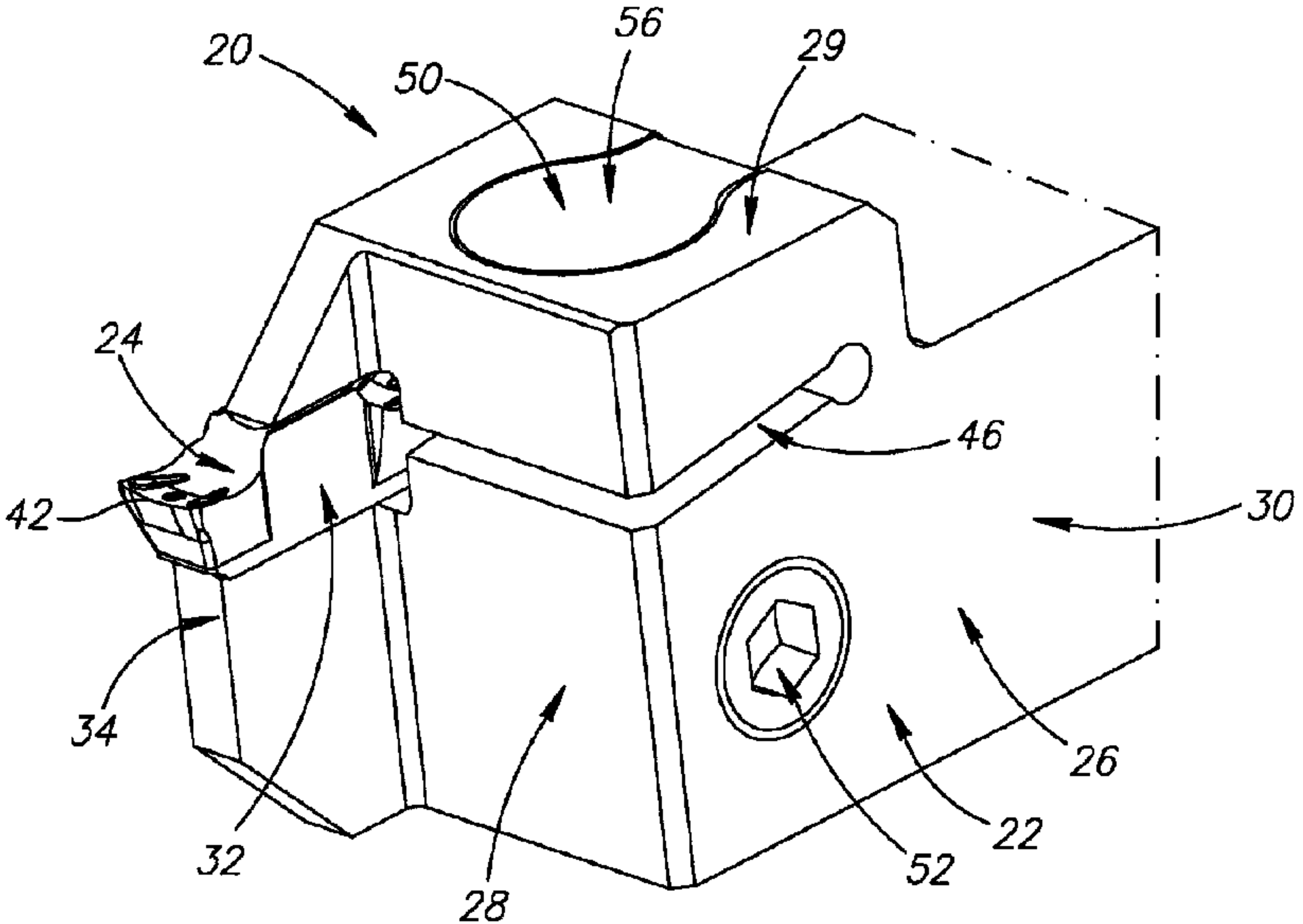



FIG. 8


20
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52
22
26