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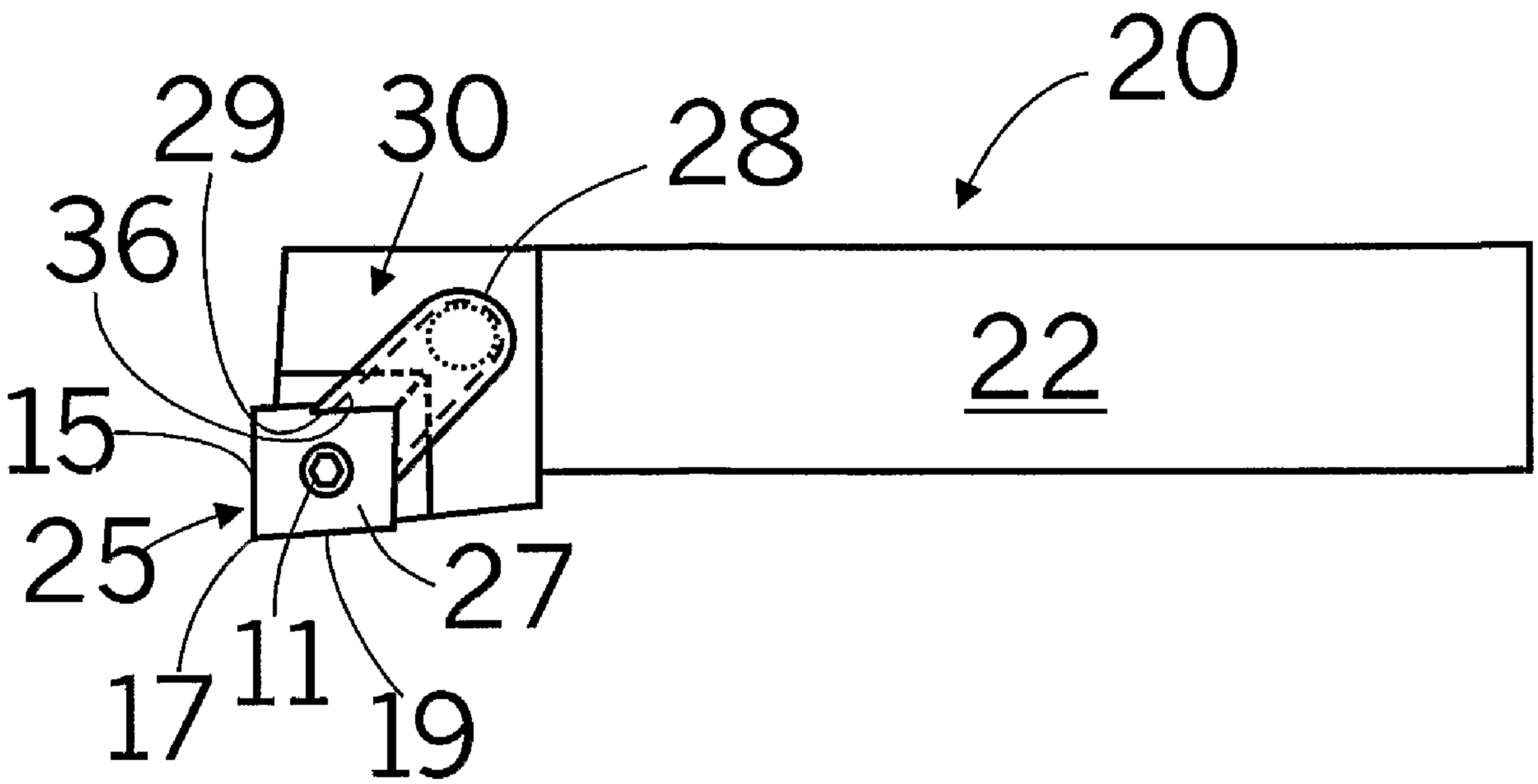


(57) **Abrégé/Abstract:**
Fluid passageway (36''') are defined by the top plate (30), tool holder body (22) and the cutting insert (27) to permit the optimum cooling of the interface between the insert and the word piece reducing degradation of the cutting edge of the insert. A number of top plate designs with channel configurations are disclosed to provide the desired coolant flow distribution and accommodate the desired flow rate.

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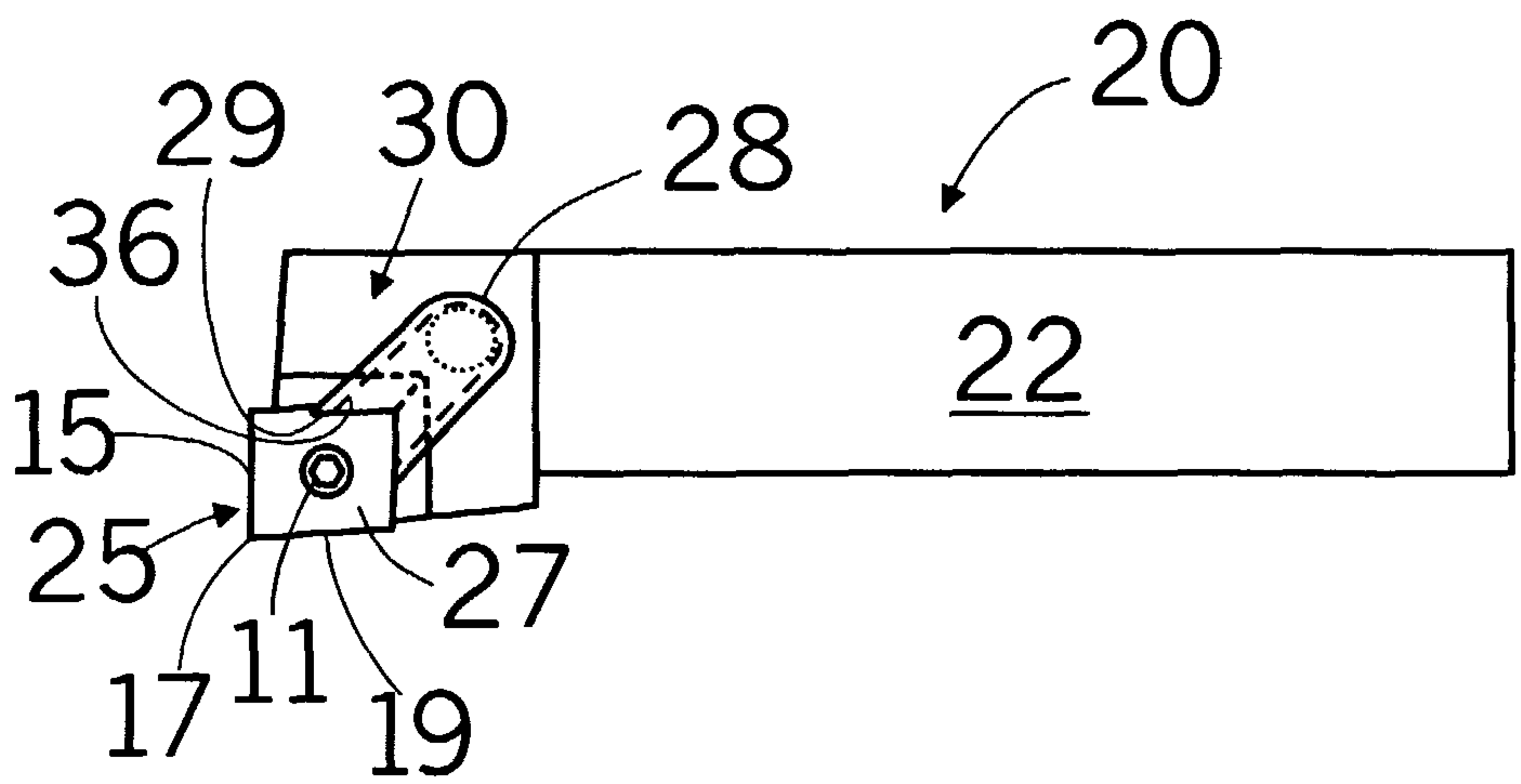
**(54) Title:** TOOL HOLDER WITH COOLANT SYSTEM

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# TOOL HOLDER WITH COOLANT SYSTEM

## Background and Summary of the Invention

The present invention is a cutting tool holder for an insert used with a lathe or the like. More particularly, the present invention is directed to a tool holder which incorporates a fluid passageway to direct coolant to at least one critical zone of the insert.

In rotary cutting of metal work pieces such as on a lathe, or the like, the life of the cutting tool insert is an important factor in determining 1) the number of work pieces completed in a fixed time period, and 2) the cost of operating the machine. A determining factor in wear life of the insert is the effectiveness of the coolant in preventing the interface of the cutting tool insert and work piece from reaching elevated temperatures. A number of coolant systems have been devised in an attempt to remove heat from this interface and, thereby, extend tool life. The chief problem with most of these systems is that the delivery system is too far from the interface. This results in ingestion of air into the flow stream which significantly detracts from the cooling effectiveness of the fluid coolant. Further, the more distant the delivery point is from the interface, the lower the percentage of coolant that will actually contact the interface. These two factors detract from the overall efficiency of these cooling systems.

One patent attempts to remedy these problems by providing the insert with a passageway through which high pressure fluid is directed. This patent, US pat. no. 5,237,894 issued to Lindeke, can get fluid near the interface but, obviously, can not focus coolant fluid directly at the interface between the cutting edge and the work piece without compromising the integrity of the cutting edge. A second patent, US pat. no. 6,053,669 to Lagerberg, uses a porous material for the insert. This patent also cannot focus a stream of coolant fluid at the interface; in addition, the fluid can only ooze out of this porous material. A fluid stream is not possible due to the material itself offering resistance. In addition, while Lagerberg hopes to avoid the clogging of a passageway by contamination in the coolant fluid, the presence of sludge from bacteria, large particles and/or small chips, in supply line 16 will result in clogging of the system and blocking off of flow into the porous insert.

The tool holder with coolant system of the present invention overcomes these defects by using portions of the holder to channel the coolant and focus the delivery point(s) toward at least one critical zone of the cutting tool insert. These critical zones may include, for example, a first and a second cutting edge and a nose portion positioned between the two cutting edges. The coolant system can be designed to handle either high or low pressure fluid delivery. The tool holder of the present invention includes a tool holder body, the body having a recess formed therein; a cutting tool insert seated in the recess, the insert having at least one critical zone; a top plate at least partially overlying and securing the insert in the recess; means securing the top plate to the tool holder body; and coolant passageway means formed in at least one of the tool holder body and the top plate, the coolant passageway means being focused on at least one of three critical zones. In one embodiment, the critical zone is selected from the group consisting of a first cutting edge, a second cutting edge, and a nose positioned between the pair of cutting edges. Preferably, the coolant passageway means focuses coolant on each of the first cutting edge, the second cutting edge and the nose.

The coolant passageway means comprises open sided channels cut in one of said tool holder body and the top plate, the open side being closed by at least one of i) the other of the tool holder and the top plate and ii) the insert. In one embodiment, the means to retain the top plate on the tool holder body comprises some welded portions. In another embodiment, the tool holder body is configured with a dovetail slot while the top plate has a complementary dovetail configuration on its lateral edges. A recess in one lateral edge of the top plate receives a pin that is engaged in the tool holder body to prevent movement of the top plate. Other means of securing the top plate such as soldering, gluing, conventional threaded fasteners, etc., could also be used.

The cutting tool insert is retained in the tool holder body by a combination of the top plate overlapping one edge of the insert and a conventional tilt pin which extends through an opening in the insert. Both the axial rake angle (10°) and the radial rake angle (7°) are increased from conventional tool configurations increasing tool life. Alternatively, a screw (beveled headed, flat head, Torx® drive) could be used to secure the insert in the tool holder body.

Other features, advantages and characteristics of the present invention will become apparent after a reading of the following specification.

## Brief Description of the Drawings

The preferred embodiment(s) of the present invention are set forth in the drawings, like items bearing like reference numerals and in which

**Fig. 1A** is a top view of a first embodiment of the tool holder of the present invention;

**Fig. 1B** is a side view of the first embodiment of the present tool holder;

**Fig. 1C** is a front view of the first embodiment of the present tool holder;

**Fig. 2** is a bottom view of a top plate of a second embodiment of the tool holder of the present invention;

**Fig. 3A** is a side view of a third embodiment of the tool holder of the present invention;

**Fig. 3B** is a top view of the third embodiment of the present tool holder;

**Fig. 3C** is a front view of the third embodiment of the present tool holder as seen looking directly at nose **17**;

**Fig. 4A** is a front view of the top plate of a fourth embodiment of the present tool holder;

**Fig. 4B** is a front view of the top plate of the first embodiment of the present tool holder; and,

**Fig. 4C** is a front view of a sixth embodiment of the present tool holder looking directly at nose **17**.

## Detailed Description of the Preferred Embodiment(s)

A first embodiment of the indexable tool holder with coolant system is depicted in **Figs. 1A, 1B** and **1C** generally at **20**. Tool holder **20**, which is designed for use in conjunction with a lathe, or the like, includes i) tool holder body **22** with a recess **24**, ii) a cutting tool insert assembly **25** that includes a spacer shim **26** and cutting tool insert **27**, and iii) top plate **30**. Recess **24** receives spacer shim **26** and insert **27**. In this first embodiment, a separate center portion **28** of top plate **30** houses the coolant fluid delivery system **36** and an edge portion **29** overlies insert **27** to prevent its working its way loose. As shown, only a single edge portion **29** overlies the insert **27**. Obviously, both edges of the top plate **30** could be machined to perform this function. A conventional tilt pin **11** is used to clamp the insert assembly 25 to the holder body **22**. Overlying edge portion **29** provides a safety function in preventing the insert **27** from inadvertently popping off. If the alternative securing method of a bevel-headed clamping screw were used in place of the tilt pin **11**, the overlying edge portion **29** would be typically be unnecessary. The cutting insert **27** may be indexed between four possible positions to maximize the useful life thereof. The tool holder is designed with higher radial rake angle α (7°) and axial rake angle β (10°) than normal in order to achieve enhanced tool life.

A second embodiment is depicted in **Fig. 2**. In this embodiment, top plate **30'** has a reservoir **34'** machined therein which distributes coolant to three nozzle shaped conduits **36'** that deliver coolant fluid to at least one critical zone of insert **27**. Preferably, one of the conduits **36a'** is focused at first cutting edge **15** (**Fig. 1A**), one **36c'** at the second cutting edge **19**, and the third conduit **36b'** at the nose **17**. In this manner, these three critical zones are kept bathed in coolant which prevents the temperature of the interface between insert **27** and the work piece (not shown) from reaching an elevated temperature which would greatly accelerate deterioration of the cutting edge(s) of insert **27** significantly reducing its wear life. Since the top plate **30'** is mounted to match the rake angles α and β, and since the conduits **36'** are positioned so close to the insert **27** the maximum amount of coolant arrives at the insert/work piece interface insuring optimum cooling. Most other delivery systems are positioned farther from the cutting edge and deliver fluid at a higher approach angle which has proven to be less effective at cooling. This is necessarily the case since the tool holder **20** with coolant system of the present invention delivers coolant at the lowest possible approach angle from a point immediately proximate the cutting zone. While the coolant reservoir and conduits are preferably formed in the top plate **30'**, it will be appreciated that these passages could be formed in the upper face of the tool holder body **22** with the top plate merely forming the upper surface thereof.

The tool holder **20** of **Figs. 1A**, **1B** and **1C** is particularly designed to be used with diamond shaped inserts **13** and may be used with high pressure, high volume coolant fluid, or low pressure, low volume coolant fluid. The principles of the invention, however, can be used with any shaped insert and any desired fluid flow, with the configuration of the holder and top plate that are adjusted accordingly. For example, **Figs. 3A**, **3B**, and **3C** depict a third embodiment of the tool holder **20"** capable of delivering high or low pressure coolant fluid along the length of a straight cutting edge of an insert which could be one of any of a number of shapes. In this embodiment, tool holder **20"** has a dovetailed slot **23"** above the recess **24"** that receives the insert assembly **25"**. Once the top plate **30"** is slipped into the dovetailed slot **23"**, a set screw **38"** is threaded into an opening (not shown) in tool holder body **22"** to secure it top plate **30"** in position against movement. In this embodiment, top plate **30"** has a plurality of half round channels **31"** grooved into its underneath surface and the bottom of the channels **36"** are formed by both the bottom of dovetail slot **23"** and the insert **27**, whichever is underlying the channels **36"**. End **37"** is shown beveled which is the configuration of the blank from which top plate **30"** is formed. The actual final configuration of end **37"** will be determined by the shape of the insert **27"** and the desired distribution of the coolant fluid. It will further be understood that while three channels are shown, any number, one or more, is contemplated by the invention.

Other variations are depicted by **Figs. 4A**, **4B**, and **4C**. **Fig. 4A** shows channels **36'"** which are trangular shaped. This configuration has been shown to be particularly effective, in high pressure, high volume applications, at delivering coolant fluid to the targeted zone. **Fig. 4B** shows a channel **36** for high volume, low pressure coolant fluid delivery. This is actually the configuration depicted in the **Fig. 1A** embodiment. Finally, **Fig. 4C** depicts a plate center section **28**$^{iv}$ that is secured with welded portions rather than with a dovetail and set screw.

The tool holder **20** permits coolant fluid to be delivered from short range at the same rake angles as the surface of the cutting insert **27** to optimize cooling of the insert/work piece interface thereby keeping the insert **27** below degradation temperatures. The top plate **30** may be modified in its entirety to provide coolant passageways or an insert **28** can be machined and then secured in place by either of two methods.

Various changes, alternatives and modifications will become apparent to a person of ordinary skill in the art after a reading of the foregoing specification. It is intended that all such changes, alternatives and modifications as fall within the scope of the appended claims be considered part of the present invention.

## Claims

I claim:

1. An indexable insert tool holder comprising

a) a tool holder body, said body having a recess formed therein;

b) a cutting tool insert assembly seated in said recess, said insert having at least one critical zone;

c) a top plate at least partially overlying and securing said insert assembly in said recess;

d) means securing the top plate to the tool holder body; and

e) coolant passageway means formed in at least one of said tool holder body and said top plate, said coolant passageway means being focused on said at least one critical zone.

2. The tool holder of Claim 1 wherein said critical zone is selected from the group consisting of a first cutting edge, a second cutting edge, and a nose positioned between the pair of cutting edges.

3. The tool holder of Claim 2 wherein said coolant passageway means focuses coolant on each of said first cutting edge, said second cutting edge and said nose.

4. The tool holder of Claim 1 wherein said coolant passageway means comprises open sided channels cut in one of said tool holder body and said top plate, said open side being closed by at least one of

i) the other of said tool holder and said top plate and

ii) said insert assembly.

5. The tool holder of Claim 1 further comprising means to retain said top plate engaged with said tool holder body.

6. The tool holder of Claim 5 wherein said means to retain said top plate engaged with said tool holder body comprises welded portions between said top plate and said tool holder body.

7. The tool holder of Claim 5 wherein said means to retain said top plate engaged with said tool holder body comprises a dove tail slot in said tool holder body with a complementary shape on a pair of lateral edge portions on said top plate.

8. The tool holder of Claim 7 wherein said means to retain said top plate engaged with said tool holder body further comprises a recess in a lateral edge of said top plate and a pin secured in said tool holder body which seats in said recess to prevent movement of said top plate.

9. The tool holder of Claim 1 further comprising means to secure said cutting tool insert in said tool holder body.

10. The tool holder of Claim 9 wherein said means to secure said cutting tool insert in said tool holder body comprises an overhanging lip of said top plate.

11. The tool holder of Claim 10 wherein said means to secure said cutting tool insert in said tool holder body further comprises a tilt pin positioned in an opening therein.

12. The tool holder of Claim 1 wherein said cutting tool insert has an axial rake angle of 10° and a 7° radial rake angle for superior tool life.

13. The tool holder of Claim 1 wherein said cutting tool insert assembly comprises a spacer shim and a cutting insert.

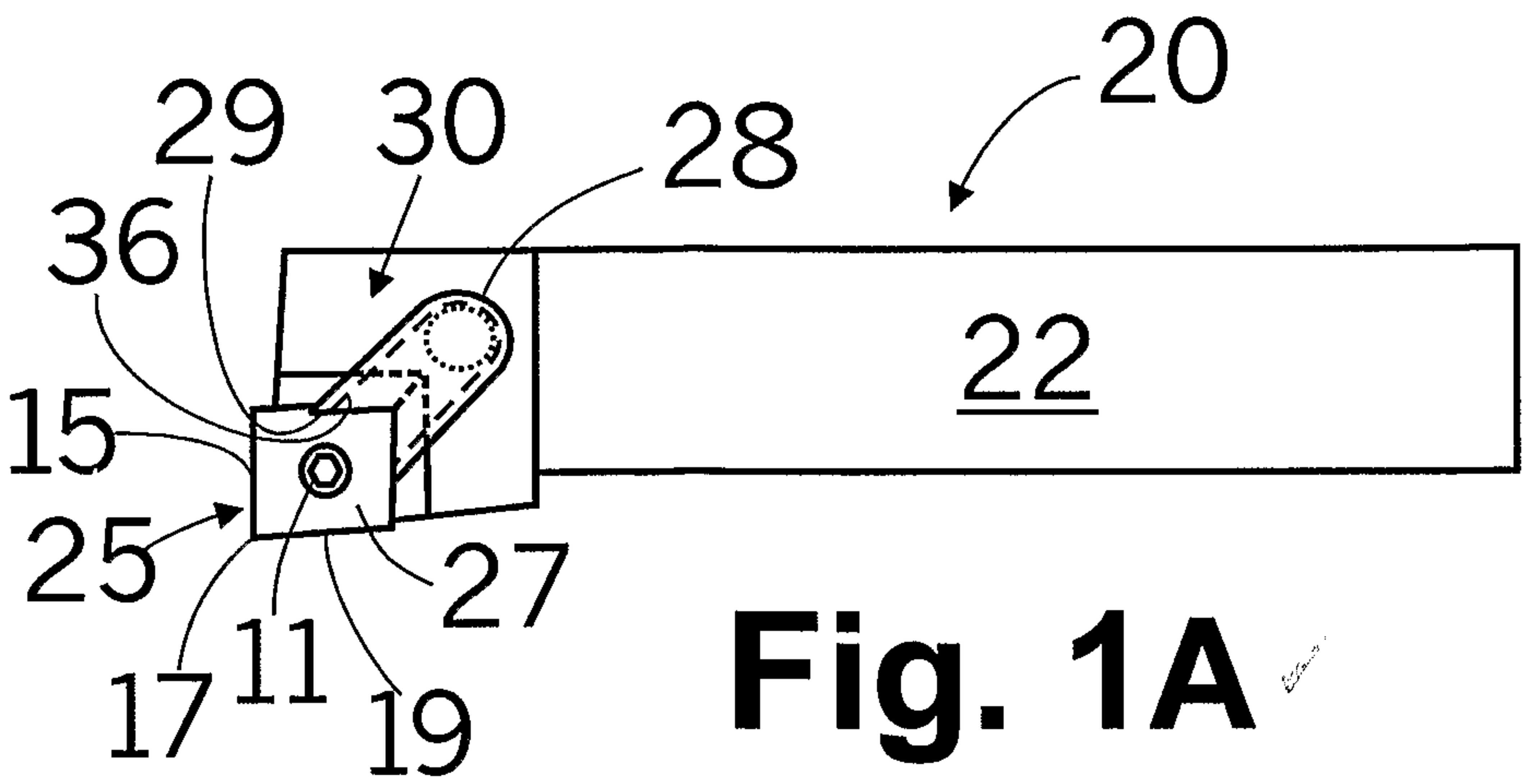



Fig. 1A

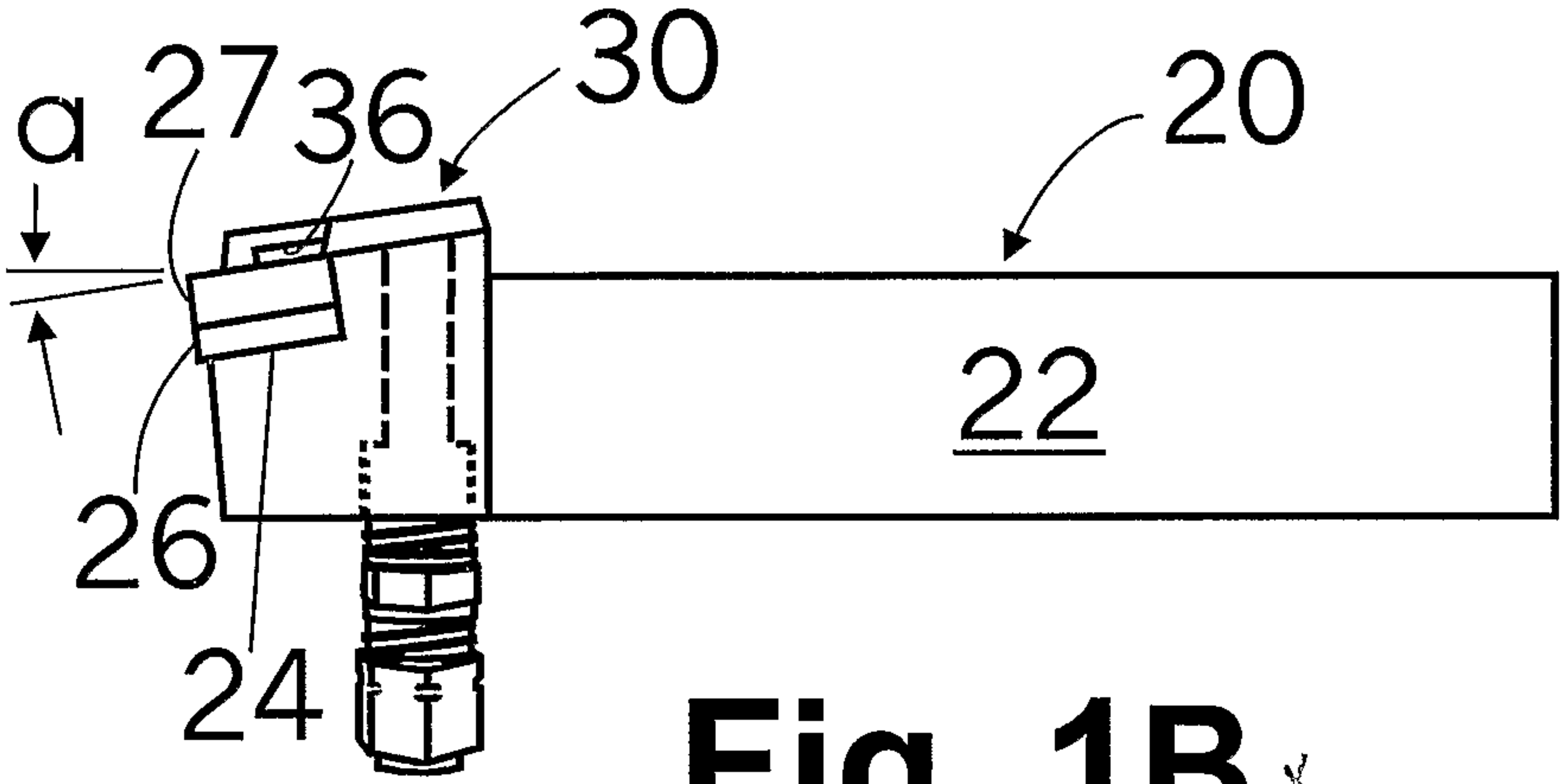



Fig. 1B

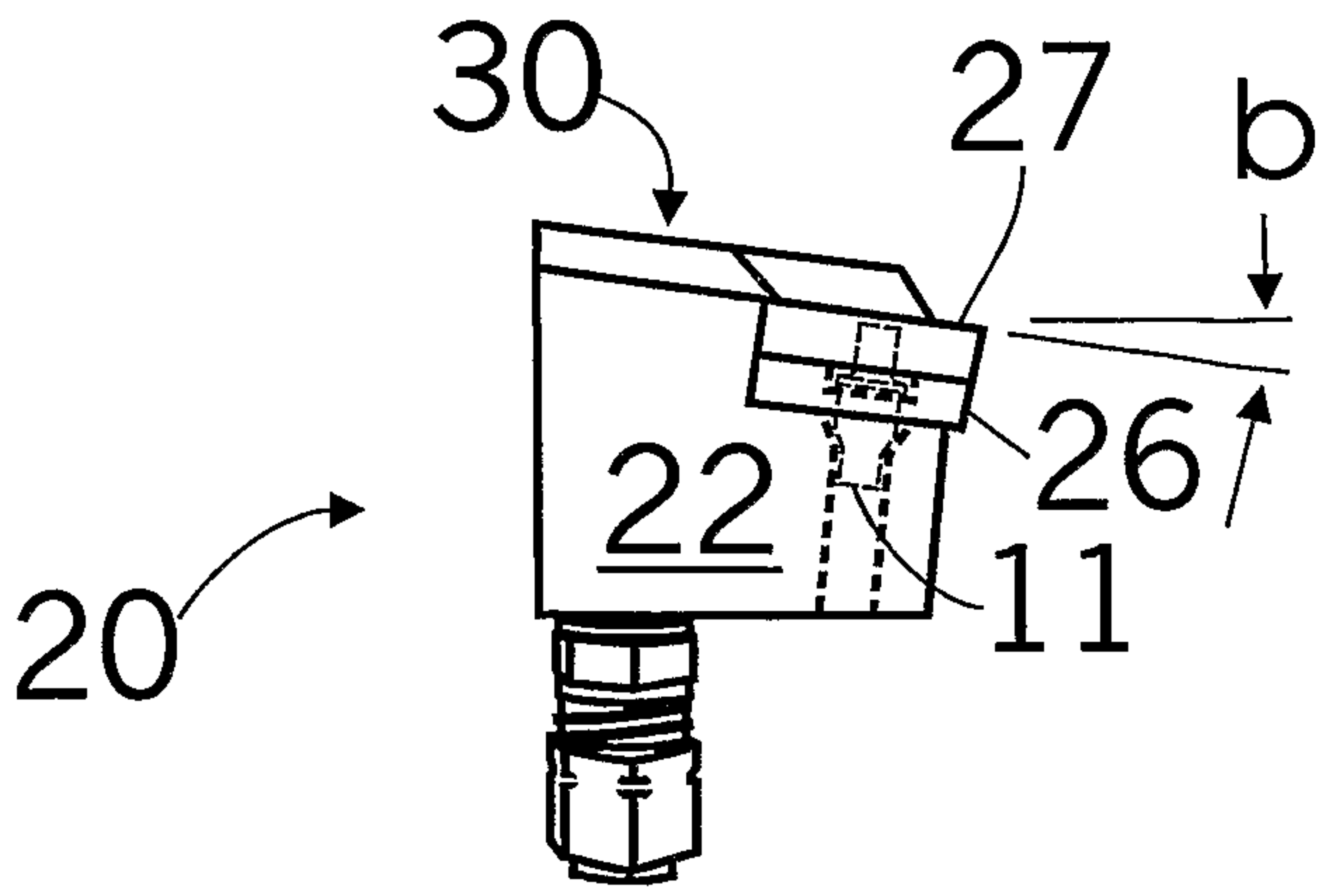



Fig. 1C

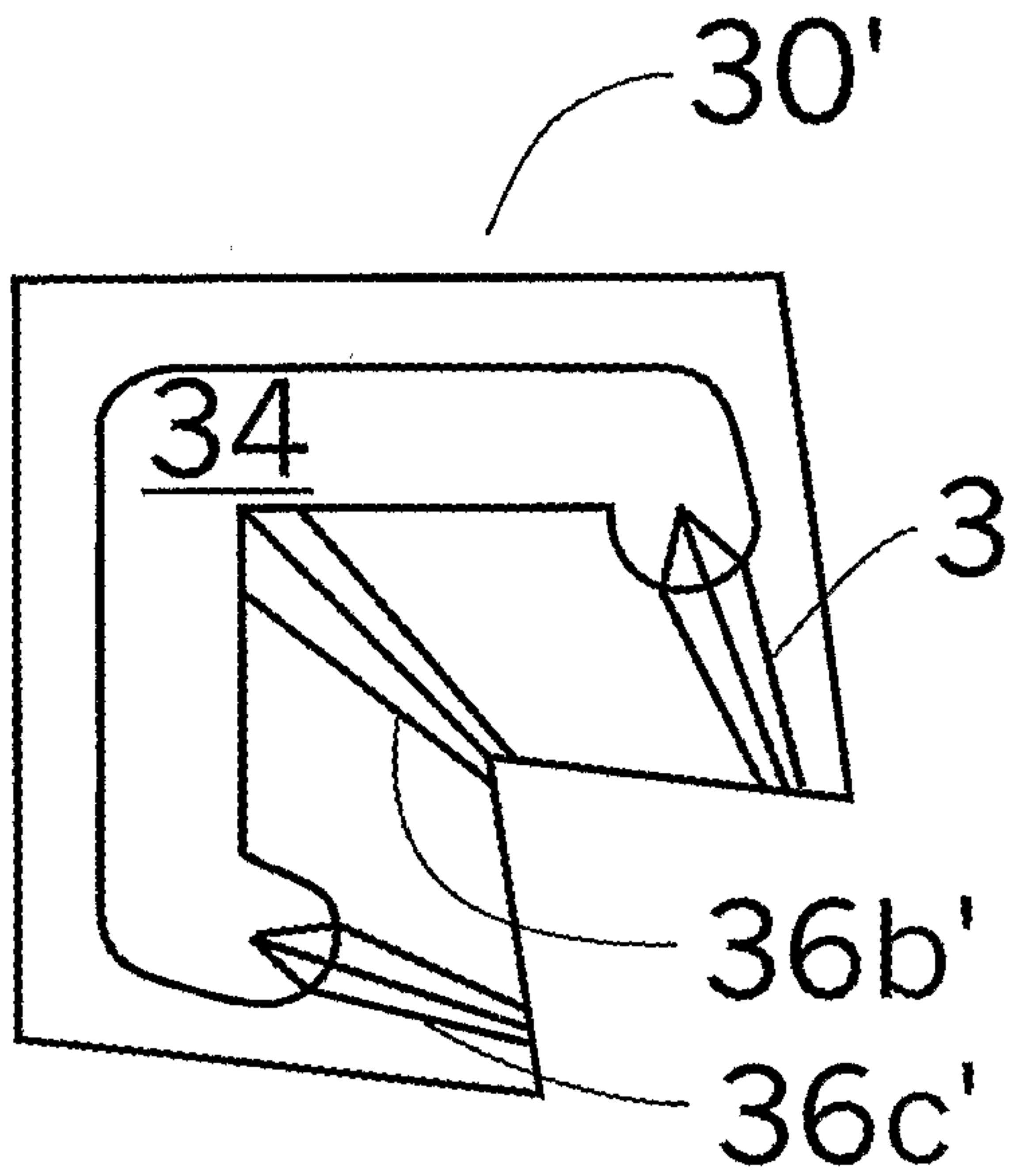



Fig. 2

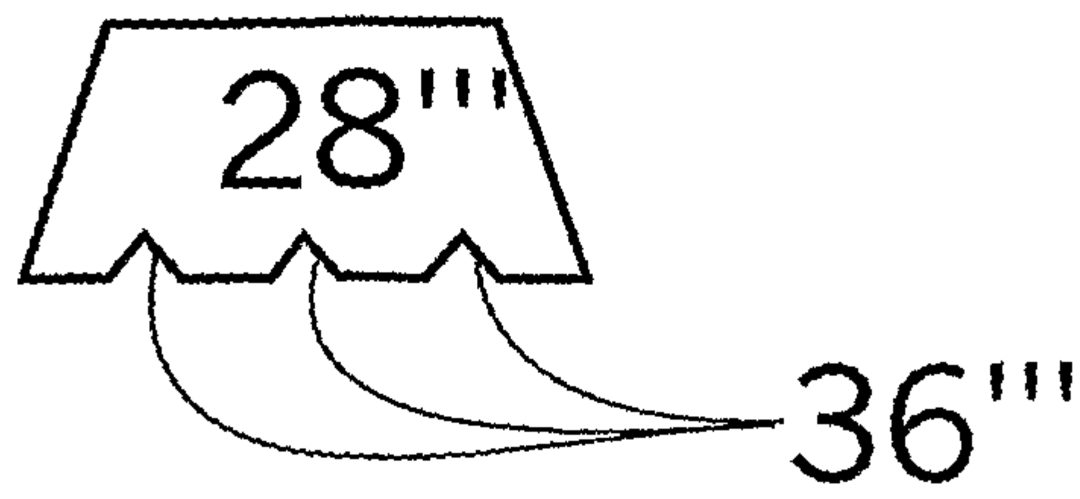



Fig. 4A

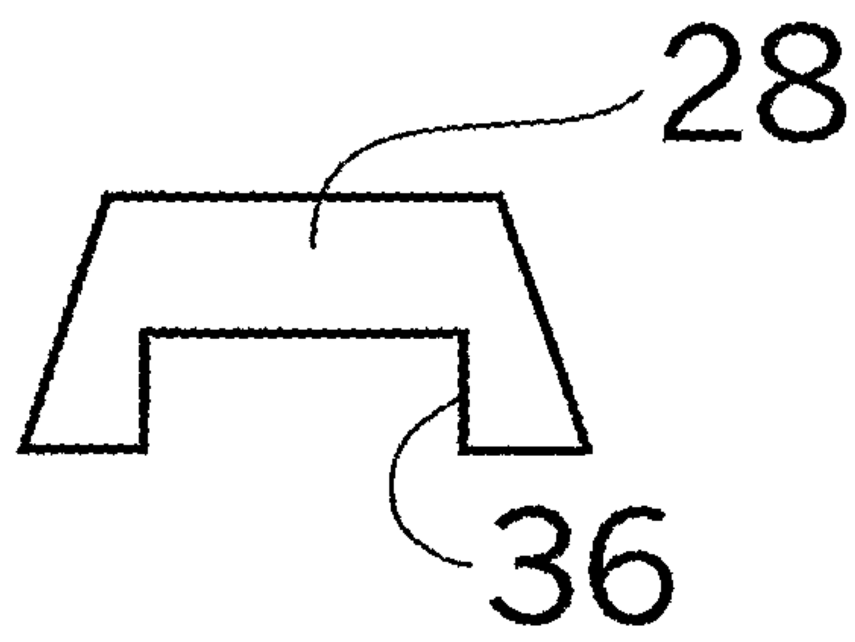



Fig. 4B

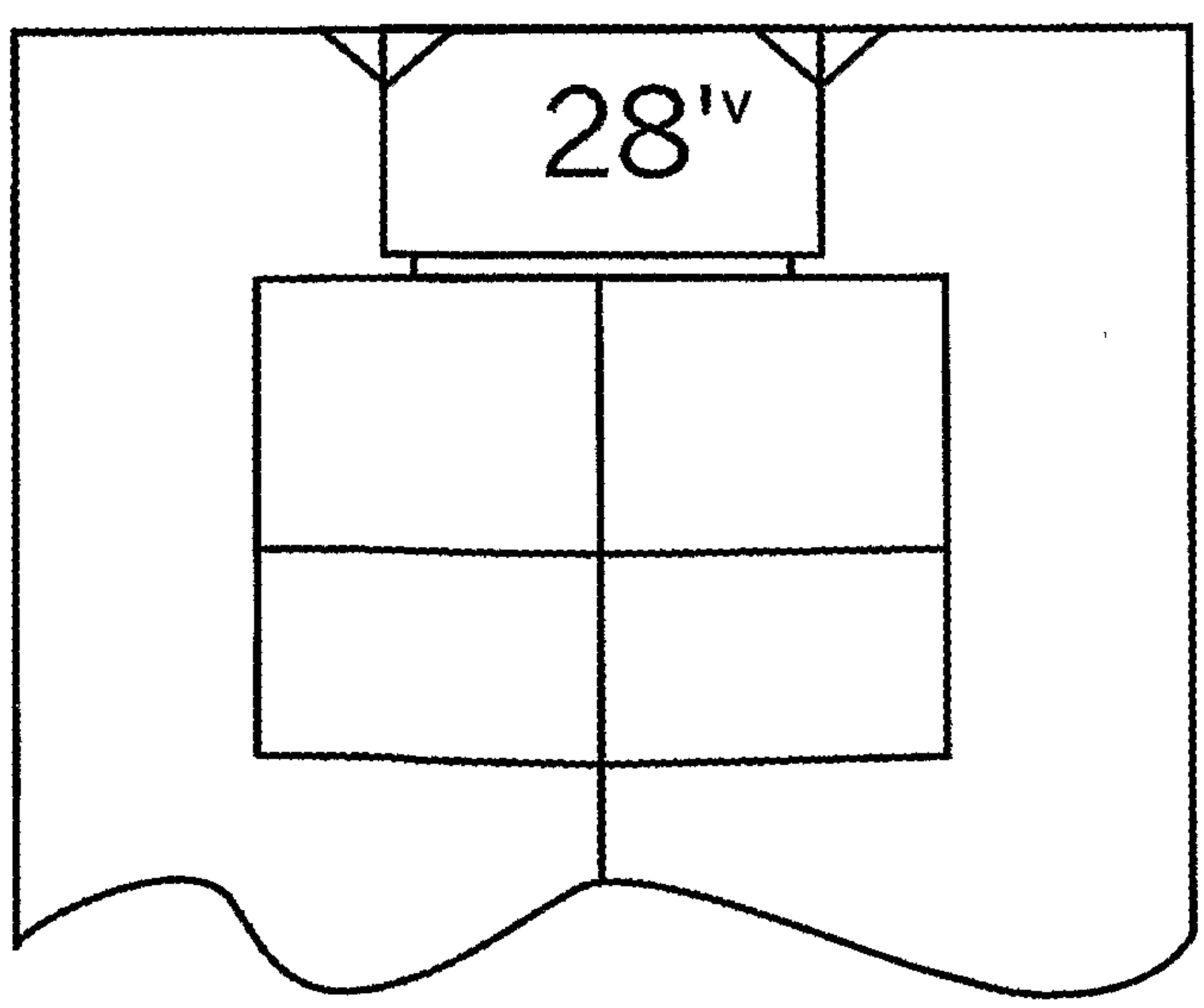



Fig. 4C

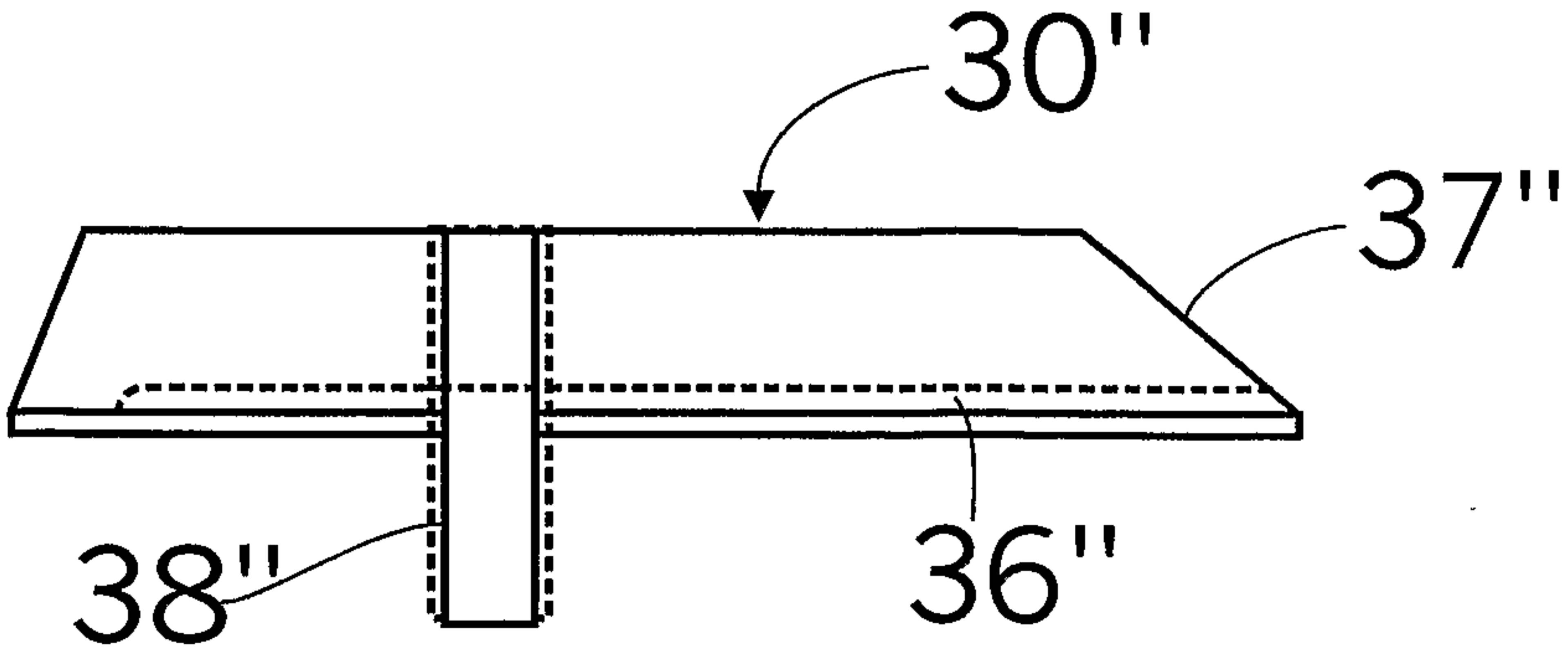



Fig. 3A

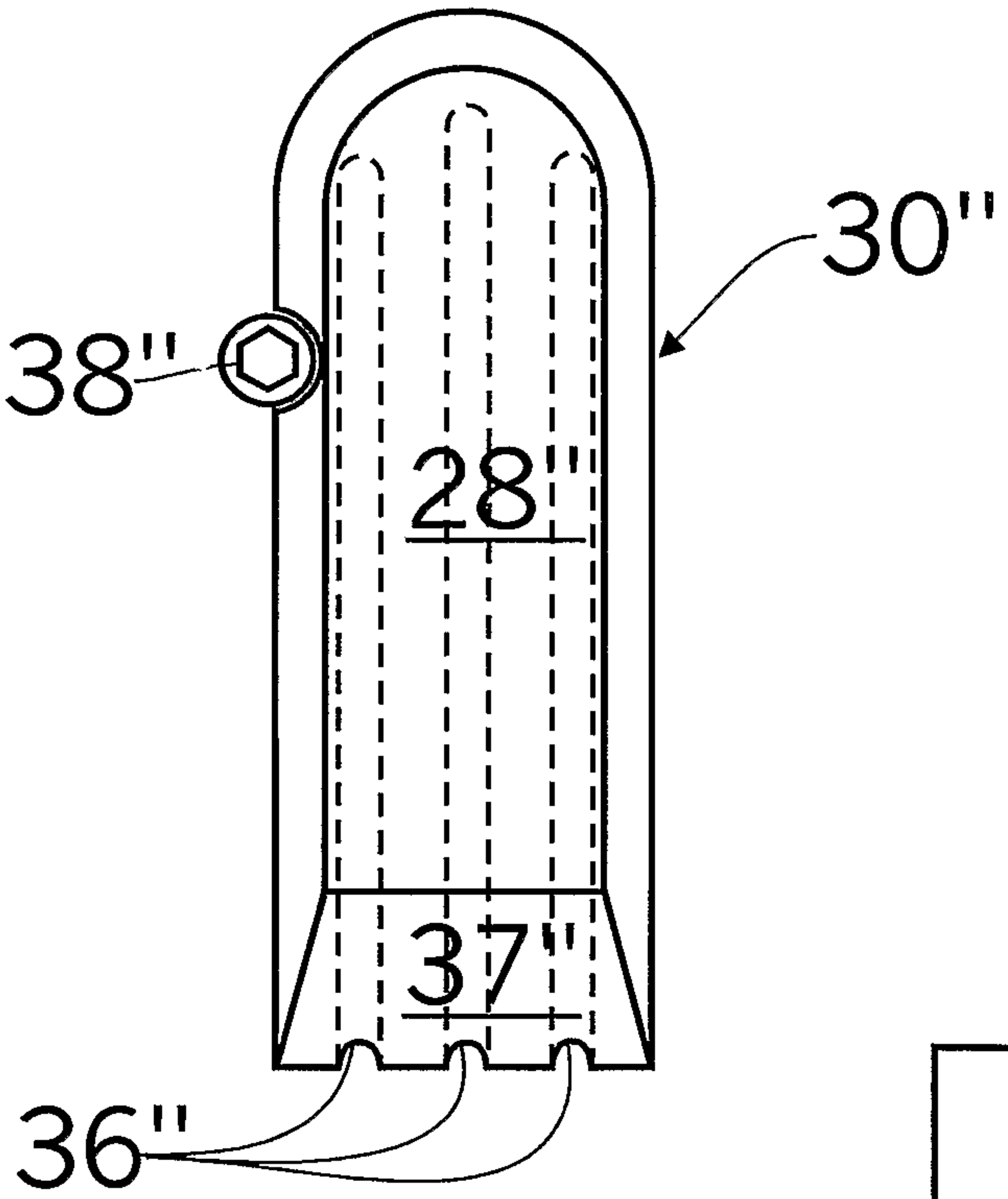



Fig. 3B

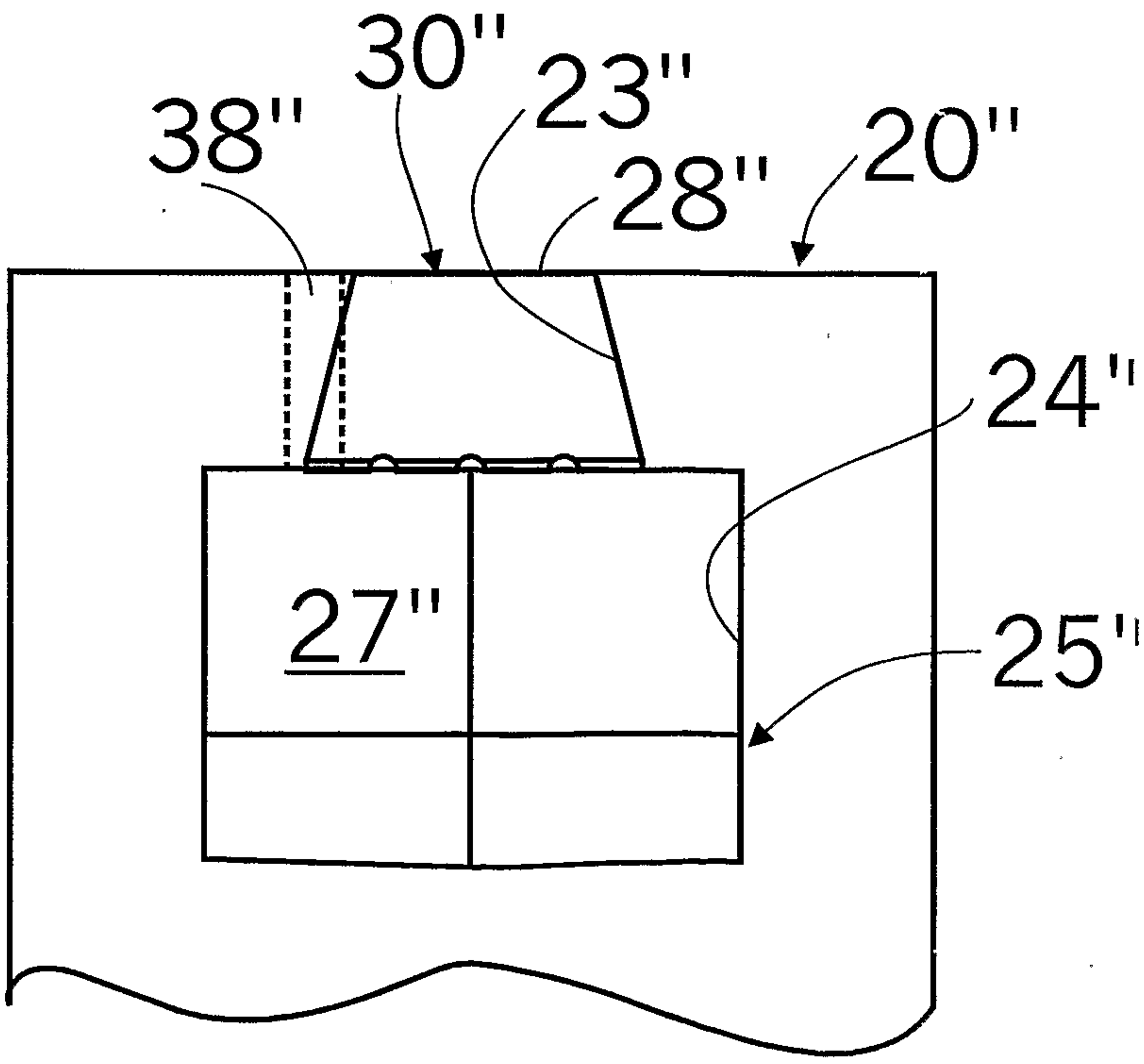
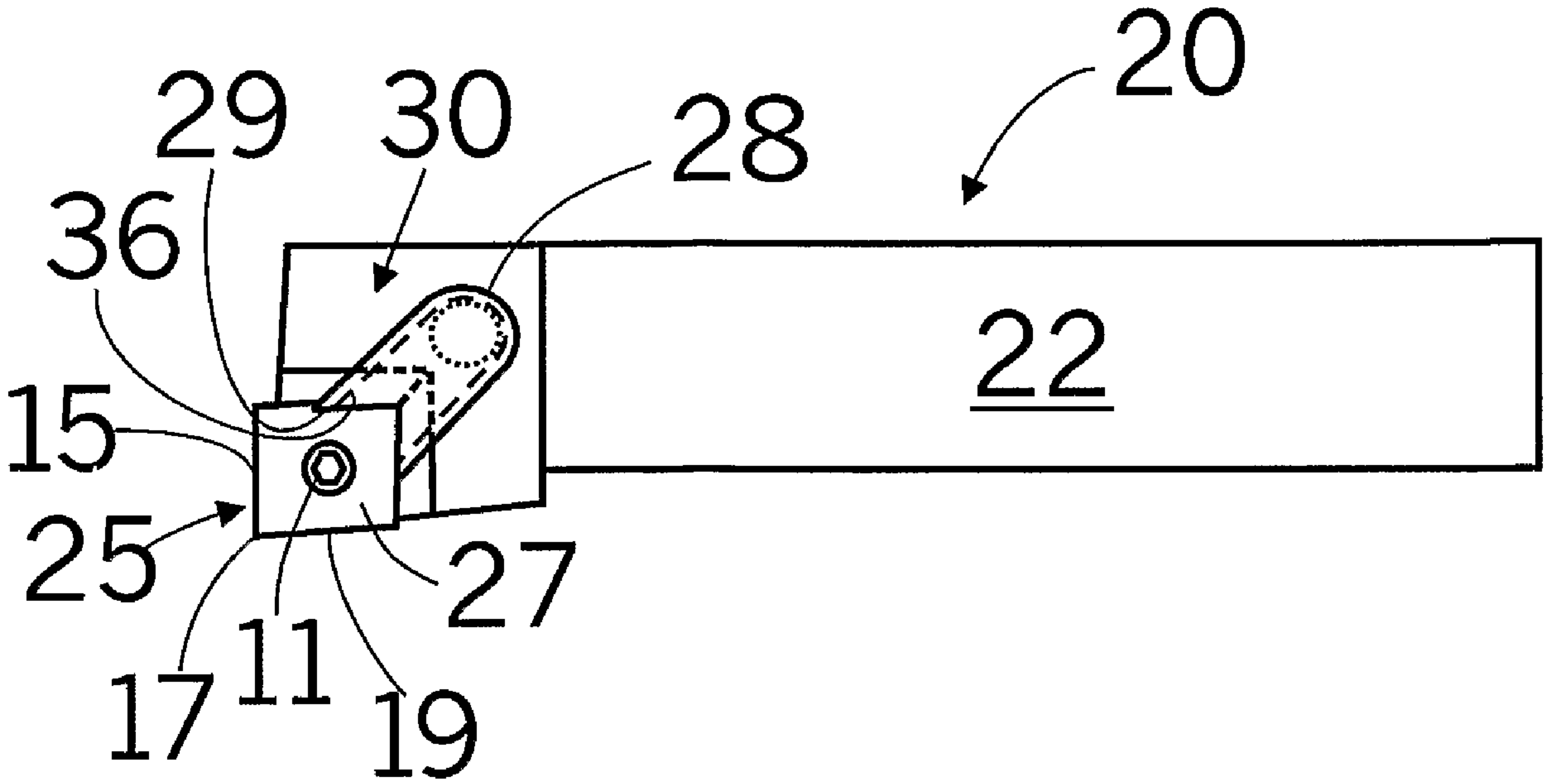



Fig. 3C



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