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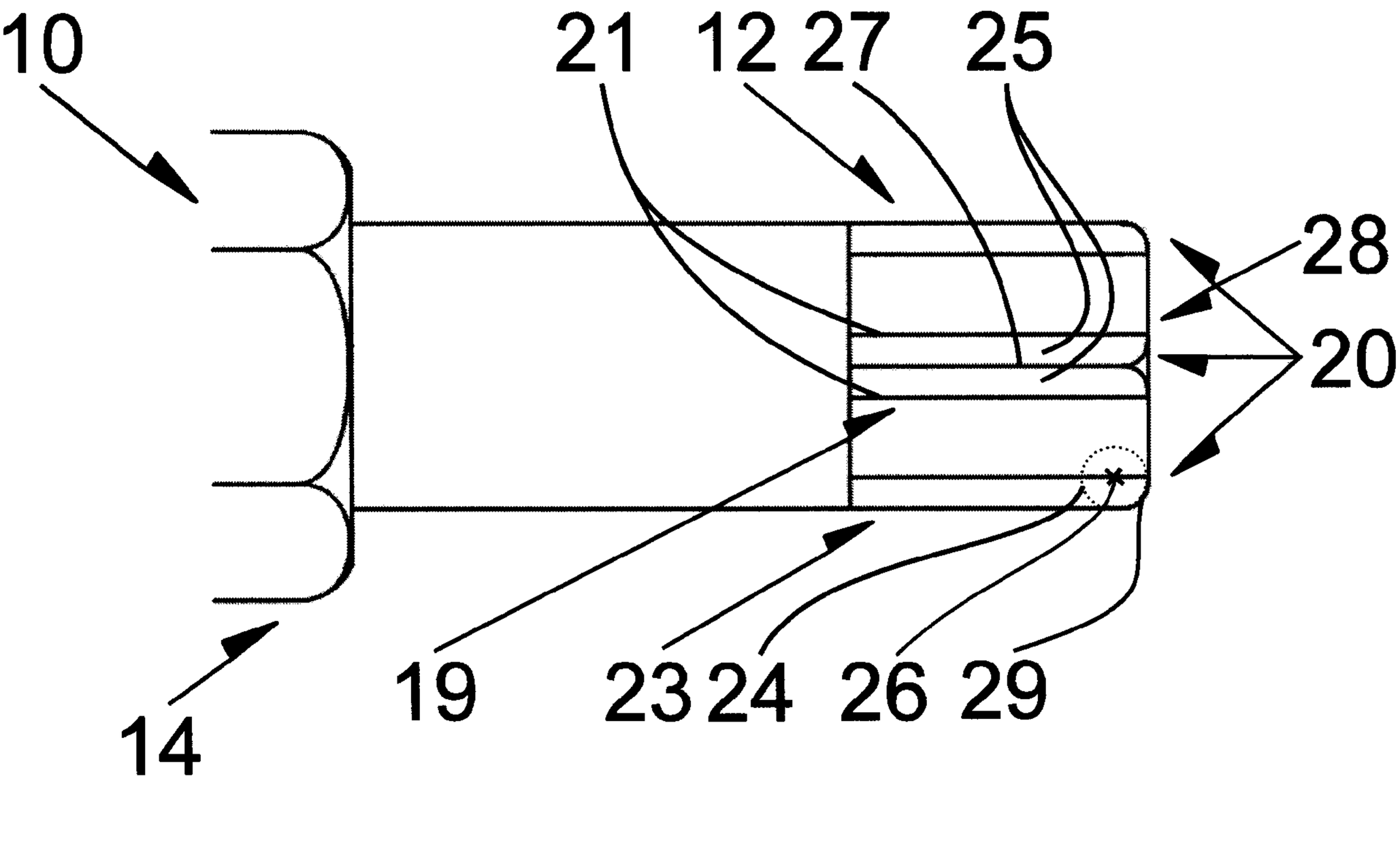
(54) **Titre : DISPOSITIF D'ENTRAINEMENT POUR FIXATIONS A CARRES CONDUCTEURS ET A TRAVERSES**
(54) **Title: DRIVER FOR USE WITH SQUARE-DRIVE AND CROSS-HEAD FASTENERS**



(57) **Abrégé/Abstract:**
A screwdriver having a tip configuration suitable for use with both square- drive fasteners and cross-head fasteners. The tip having four radiating blades having surfaces for engaging the inner walls of the cross arms of the cruciform recess of a cross- head fasteners and peripheral edges for engaging the inner walls of the square recess of a square-drive fastener in the vicinity of corners of the recess. A set of two or more such drivers suitable for common square-head fastener sizes and generally similarly sized cross-head fasteners.

ABSTRACT

A screwdriver having a tip configuration suitable for use with both square-drive fasteners and cross-head fasteners. The tip having four radiating blades having surfaces for engaging the inner walls of the cross arms of the cruciform recess of a cross-head fasteners and peripheral edges for engaging the inner walls of the square recess of a square-drive fastener in the vicinity of corners of the recess. A set of two or more such drivers suitable for common square-head fastener sizes and generally similarly sized cross-head fasteners.

TITLE

Driver For Use With Square-Drive And Cross-Head Fasteners

FIELD OF THE INVENTION

[0001] The present invention relates to drivers suitable for rotating screws, and more particularly to drivers for square-drive and cross-head fasteners.

BACKGROUND

[0002] In this specification: the expression "screw" means a fastener used to fasten two objects together; having a corkscrew-shaped groove formed on its surface such that the fastener or a threaded mating component (e.g. a nut) is rotated so as to secure or release the fastener; and having a recess or receptacle for engaging a driver; and "driver" and "screwdriver" mean a device for engaging and rotating a screw.

[0003] A screwdriver comprises a head or tip which engages with a screw, a mechanism to apply torque by rotating the tip, and some way to position and support the screwdriver. A typical manual screwdriver comprises an approximately cylindrical handle of a size and shape to be held by a human hand, and an axial shaft fixed to the handle, the tip of which is shaped to fit a particular type of screw. The handle and shaft allow the screwdriver to be positioned and supported and, when rotated, to apply torque. Screwdrivers are made in a variety of shapes, and the tip can be rotated manually or by an electric or other motor.

[0004] The first-developed screw-drive design is the so-called "slot head" or "slotted" or "standard" or "regular". The slot head has a single slot, and is driven by a

flat-bladed screwdriver. The slotted screw is common, but is now not often seen in applications where a power driver would be used, due to the tendency of a power driver to slip out of the head and potentially damage the surrounding material.

[0005] The square-drive, also known as the Robertson (TM), was invented in Canada in the early 1900's. Square-drive screws and drivers continue to be used mainly in Canada, though they can be found elsewhere. The square-drive is designed to maximize torque transferred from the driver, and to not slip or cam out. It is possible to hold a square-drive screw on a driver bit horizontally or even pendant, due to a slight wedge fit. Thus, square-drive screwdrivers are easy to use one-handed. Square-drive screws and screwdrivers are available in a range of standard sizes, and the drivers for each size are conventionally identified by the colour of the driver handle, as set out in following table in which the maximum and minimum dimension for a side of each square recess is given in ten thousandths of an inch, and for each size as a rough fraction of an inch:

Color	Screw types	Max	Min	Fraction
Orange (#00)	No. 1 & 2	0.0710 in.	0.0696 in.	1/16+
Yellow (#0)	No. 3 & 4	0.0910 in.	0.090 in.	3/32-
Green (#1)	No. 5, 6 & 7	0.1126 in.	0.111 in.	7/64+
Red (#2)	No. 8, 9 & 10	0.1330 in.	0.1315 in.	1/8+
Black (#3)	No. 12 and larger	0.191 in.	0.1895 in.	3/16+

[0006] The cross-head drive (also known as cross-point or cruciform), has a "+"-shaped receptacle and is driven by a cross-head screwdriver. There are at least five types of cross-head drive, the best known being the Phillips (TM), which was invented in the 1930's. The Phillips (TM) cross-head drive was designed originally for use with mechanical screwing machines and thus has slightly rounded corners in the tool recess so the driver will slip, or cam out, under high torque to prevent over-tightening. Other cross-head drive designs include: the Reed & Prince or Frearson; the JIS; and the Pozidriv (TM), all of which are designed not to cam out. Such other cross-head drive designs are frequently mis-identified as Phillips(TM) head screws.

[0007] Modern screws employ a wide variety of drive designs, each requiring a different kind of tool to drive in or extract them. The most common screw drives worldwide are likely the slotted and cross-head, and in Canada, the slotted, cross-head and square-drive. However, several other drive designs have been developed and are in use to differing degrees in different countries and in different industries. For example, the hex; the TORX (TM) (a star-shaped "hexalobular" drive with six rounded points); the TTAP (TM) (an improved "hexalobular" drive); the Tri-wing (TM) (having a triangular slotted configuration and used on some consumer electronics to discourage home repair); etc.

[0008] The various drive designs that may be encountered in most industries utilizing screws requires persons working in those industries to have at hand a variety of drivers and typically, to not infrequently switch between drivers, which slows production, particularly when the driver is being driven by a power drill or similar device, such that one driver must be removed from the drill and replaced with another.

[0009] The primary response of industry to the problems associated with having a variety of different drive designs and drivers in widespread use, has been to produce hybrid screws having heads designed to accommodate more than one kind of driver. Such screws are sometimes referred to as combo-head or combi-head. The most common of

these is a combination of a slotted and Phillips (TM) head, often used in attaching knobs to furniture drawer fronts. Because of its prevalence, there are now drivers made specifically for this kind of screw head. Other combinations are a Phillips (TM) and a square-drive; a square-drive and a slotted; a TORX (TM) and a slotted; and a triple-drive screw which can take a slotted, Phillips or a square-drive. An example of a fastener suitable for use with two different types of drivers is in US Patent 7,225,710 (Pacheco, Jr.; Combination Driver and Combination Fastener, issued 5 June 2007), which discloses fasteners that can be engaged by both a conventional lobed-head driver and a conventional hexagonal head driver. The Pacheco, Jr. patent also discloses a driver tip that can engage a conventional hexagonal-head fastener and a conventional lobed-head fastener.

[0010] An individual whose work involves fasteners, such as a tradesperson, may in the normal workday, encounter both square-drive and cross-head fasteners, particularly in Canada. For example, it is common in Canada to find cross-head fasteners on equipment (for example heating equipment) manufactured outside of Canada (or manufactured in Canada but with an export market in mind), and to find both cross-head and square-drive fasteners on associated components (for example, components associated with the installation of the heating equipment). Thus, a tradesperson working with such equipment may have to have at hand, and frequently change between, drivers suitable for square-drive fasteners and those suitable for cross-head fasteners.

SUMMARY

[0011] The present invention addresses this and other needs in the art.

[0012] In one aspect, the invention provides for a driver for use with square-drive fasteners having square recesses and cross-head fasteners having cruciform recesses, that is, recesses including cross arms, the driver including a shank having a distal end and a longitudinal axis, and a tip at the distal end of the shank and having four blades connected one to another and radiating from the longitudinal axis. Each blade includes opposed sides having wall engaging portions for engaging the inner walls of a cross arm of a cruciform recess, and an edge for engaging the inner walls of a square recess in the vicinity of a corner of a square recess. Moreover, the distal portion of each blade furthest from the longitudinal axis is a chamfer.

[0013] Each blade edge may be two planar surfaces meeting at a right-angle outer corner, the outer corner extending generally parallel to the longitudinal axis. Each blade side may be planar and may meet the blade side of the adjacent blade at a right-angle inner corner, the inner corner extending generally parallel to the longitudinal axis. Each chamfer may be a curve of a constant radius.

[0014] In a configuration suitable for #0 square-drive fasteners and generally similarly sized cross-head fasteners, the length of a side of the smallest notional square that can contain the four edges may be about 0.080 inches and the distance between the wall engaging portions of each blade may be about 0.025 inches. Further, each chamfer may be a curve of a constant radius with a radius of about 0.010 inches. As well, the configuration may include the inner corners referred to above, and the longitudinal extent of each inner corner may be at least about 0.118 inches.

[0015] In a configuration suitable for #1 square-drive fasteners and generally similarly sized cross-head fasteners, the length of a side of the smallest notional square

that can contain the four edges may be about 0.095 inches and the distance between the wall engaging portions of each blade may be about 0.038 inches. Further, each chamfer may be a curve of a constant radius with a radius of about 0.030 inches. As well, the configuration may include the inner corners referred to above, and the longitudinal extent of each inner corner may be at least about 0.133 inches.

[0016] In a configuration suitable for #2 square-drive fasteners and generally similarly sized cross-head fasteners, the length of a side of the smallest notional square that can contain the four edges may be about 0.112 inches and the distance between the wall engaging portions of each blade may be about 0.032 inches. Further, each chamfer may be a curve of a constant radius with a radius of about 0.030 inches. As well, the configuration may include the inner corners referred to above, and the longitudinal extent of each inner corner may be at least about 0.133 inches.

[0017] In a configuration suitable for #3 square-drive fasteners and generally similarly sized cross-head fasteners, the length of a side of the smallest notional square that can contain the four edges may be about 0.140 inches and the distance between the wall engaging portions of each blade may be about 0.035 inches. Further, each chamfer is a curve of a constant radius with a radius of about 0.030 inches. As well, the configuration may include the inner corners referred to above, and the longitudinal extent of each inner corner may be at least about 0.190 inches.

[0018] The shank may be attached to a handle for manual rotation of the driver. Alternatively, the shank may be configured for releasable engagement with a drive means. The shank may be hexagonal. The shank may include an annular groove for releasably engaging the shank with a suitable chuck.

[0019] In another aspect, the invention provides for a set of drivers including two or more drivers suitable for #0, #1, #2 and #3 square-drive fasteners and the associated generally similarly sized cross-head fasteners.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] There are other features that will become apparent from the following description in which reference is made to the appended drawings, the drawings are for the purpose of illustration only and are not intended to in any way limit the scope of the invention to the particular embodiment or embodiments shown, wherein:

[0021] FIG. 1 is a side-view schematic representation of drivers of the present invention.

[0022] FIG. 2 is an isolation-side-view schematic representation of the drivers of Figure 1.

[0023] FIG. 3 is an end-view schematic representation of the drivers of Figure 1.

[0024] FIG. 4 is a side view of a driver of the present invention, having a handle for manual operability.

[0025] FIG. 5 is a side view of a driver of the present invention, having a chuck groove for engaging a suitable chuck.

DETAILED DESCRIPTION

[0026] FIGS. 1 to 3 are schematic representations showing features of drivers 10 for use with square-drive and cross-head fasteners.

[0027] Referring to FIG. 1, the drivers 10 have a tip 12 for engaging fasteners and a shank 14. The shank 14 is conventional; for example, in FIGS. 1 to 3, the shank 14 is hexagonal in cross section, such that the proximal end of the drivers 10 (i.e. the end of the drivers 10 opposite the tip 12) may be releasably inserted into common chucks, as are found in manual combination screwdrivers, and in power screwdrivers or drills.

[0028] As shown in FIGS. 2 and 3, the tip 12, is generally cruciform in cross section taken normal to the longitudinal axis of the drivers 10. The tip 12 comprises four longitudinally extending blades 20, with each blade 20 defining an arm of the "cross". Each blade 20 has two opposed planar blade sides 21, parallel one to the other. Each blade side 21 meets, at its inner edge, a blade side 21 of the adjacent blade 20 so as to define a right-angle inner corner 19 extending parallel to the longitudinal axis of the drivers 10. Each blade side 21 extends in a direction normal to the longitudinal axis of the drivers 10 between the right-angle inner corner 19 and a blade edge 23. Each blade edge 23 comprises two planar blade edge surfaces 25 meeting at a right-angle outer corner 27 extending parallel to the longitudinal axis of the drivers 10.

[0029] The tip distal end 28 is generally normal to the longitudinal axis of the drivers 10, except that the distal shoulders 29, being the outer distal portion of each blade 20, are chamfered. In the embodiment shown in the drawings, the chamfer of the distal shoulders 29 is a constant curve, as indicated in FIG. 2, by notional circle 24, having its centre at notional circle centre 26. Distal shoulders 29 having a constant curve have been shown to work reliably with a range of cross-head design configurations and are relatively simple to consistently manufacture. Other chamfer configurations of the distal shoulders 29 are of course possible, including non-constant curves and straight chamfers.

[0030] By careful selection and experimentation, dimensions for drivers 10 suitable for four of the five conventional square-drive sizes (being sizes 0 through 3, the most popular sizes) and for roughly similarly sized, commonly encountered cross-head designs, have been discovered. The dimensions are set out in the following tables, in which:

a) "Bit" is the square-drive size for which the driver 10 is generally suitable;

b) "A" is the distance between adjacent outer corners 27;

c) "B" is the thickness of the blade 20, i.e. the distance between the relevant blade sides 21;

d) "C" is the distance between an inner corner 19 and an adjacent blade edge surface 24, i.e. the span of a blade side 21 measured normal to the longitudinal axis of the driver 10;

e) "D" is the distance between an outer corner 27 and an adjacent blade side, i.e. the span of a blade edge surface 25 measured normal to the longitudinal axis of the driver 10;

f) "E" is the desired minimum dimension between the tip distal end 28 and the proximal terminus of the tip 12, i.e. the minimum longitudinal extent of the tip 12 for desired operability; and

g) "F" is the radius of notional circle 24.

[0031] In the first table, the dimensions are given in inches. In the second table, the dimension for "A" is given in inches and dimensions "B" to "F" are given as ratios of "A".

[0032] Dimensions of Drivers 10 in Inches

Bit	A	B	C	D	E	F
0	0.080	0.025	0.032	0.018	0.118	0.010
1	0.095	0.038	0.029	0.027	0.133	0.030
2	0.112	0.032	0.041	0.023	0.133	0.030
3	0.140	0.035	0.064	0.025	0.190	0.030

[0033] Dimensions of Drivers 10, in Inches for “A” and as Ratio of “A” for “B” to “F”

Bit	A	B	C	D	E	F
0	0.080	0.3125	0.4	0.225	1.475	0.125
1	0.095	0.263	0.337	0.189	1.242	0.105
2	0.112	0.286	0.367	0.205	1.188	0.268
3	0.140	0.25	0.457	0.179	1.357	0.214

[0034] A set of the four drivers 10 suitable for the square-drive sizes 0 to 3, is expected to provide driver coverage for the fasteners encountered by a typical tradesperson. However, depending on the nature of the trade, a user may require only one driver 10, or any two or three of the drivers 10.

[0035] In use with a square-drive fastener, the blade edges 23 will engage with the square-drive recess in the vicinity of the corners of the recess, so as to transmit torque from the driver 10 to the fastener. Although right-angle outer corners 27 are generally preferable, in that the size of the blade edge surfaces 25, and thus the surface area bearing against the inner walls of a square-drive recess, is maximized, the blade edges 23 may be configured in any way that permits the transmission of sufficient torque to the fastener. For example, the outer corner 27 could be rounded rather than a right angle.

Further, the blade edge surfaces need not be planar. Further, the blade edges 23 could be asymmetrical so as to provide more "bite" into a square-drive recess in one rotational direction than in the other rotational direction, such as for instance if the user desires more "bite" for the removal of screws than for the insertion of screws.

[0036] In use with a cross-head fastener, the blades 20 will engage with the cruciform recess along the inner side walls of the arms of the cross, so as to transmit torque from the driver 10 to the fastener. Applying longitudinal force to the driver 10 may, depending on the size and configuration of the cruciform recess, cause the outer corner 27 to "bite" into the inner end walls of the arms of the cross, so as to enhance engagement of the driver 10 with the fastener. Although planar blade sides 21 are generally preferable, in that the surface area bearing against the inner side walls of the arms of the cross of the cruciform recess is maximized, the blade sides 21 may be configured in any way that permits the transmission of sufficient torque to the fastener. For example the blade sides 21 may be in part concave such that only a portion of the blade sides 21, presumably in the vicinity of the blade edge 23, contacts the inner side walls of the arms of the cross of the cruciform recess. Further, the blade sides 21 could be asymmetrical so as to provide more "bite" into a cruciform recess in one rotational direction than in the other rotational direction, such as for instance if the user desires more "bite" for the removal of screws than for the insertion of screws.

[0037] In use, a person using a driver 10 for square-drive fasteners who encounters a cross-head fastener of roughly the same size as the square-drive fastener, should, subject to variability in configurations and manufacturing consistency of cross-head fasteners, be able to remove or insert the cross-head fastener without changing to another driver. As the sizing and configuration of square-drive fasteners is more controlled than that for cross-head fasteners, such that in actual use, square-drive drivers generally provide a more precise fit in square-drive fasteners than cross-head drivers are expected to in cross-head fasteners, a person using a driver 10 for cross-head fasteners who encounters a square-drive fastener may or may not be able to continue without changing

drivers, as the driver 10 will either fit or it won't.

[0038] As shown in FIG. 4, each of the drivers 10 may be mated with a handle 8, either permanently or detachably, so as to permit manual operation of the drivers. As shown in FIG. 5, the drivers 10 may have an annular chuck groove 16 in the vicinity of the proximal end of the drivers 10, to facilitate releasable mating with a compatible holding device.

[0039] As will be apparent to those skilled in the relevant technology in the light of the foregoing description, variants and modifications are possible in the practice of this invention without departing from the spirit or scope thereof. Accordingly, the scope of the invention is to be determined in accordance with the accompanying claims.

CLAIMS

What is claimed is:

1. A driver for use with square-drive fasteners having square recesses and cross-head fasteners having cruciform recesses, that is, recesses including cross arms, the driver comprising:
   a) a shank having a distal end and a longitudinal axis; and
   b) a tip at the distal end of the shank and having four blades connected one to another and radiating from the longitudinal axis, wherein each blade comprises:
      i) opposed sides having wall engaging portions for engaging the inner walls of a cross arm; and
      ii) an edge for engaging the inner walls of a square recess in the vicinity of a corner of a square recess, and
   c) wherein the distal portion of each blade furthest from the longitudinal axis is a chamfer.

2. The driver of claim 1, wherein each blade edge comprises two planar surfaces meeting at a right-angle outer corner, the outer corner extending generally parallel to the longitudinal axis.

3. The driver of claim 1 or 2, wherein each blade side is planar and meets the blade side of the adjacent blade at a right-angle inner corner, the inner corner extending generally parallel to the longitudinal axis.

4. The driver of claim 1, 2 or 3, wherein the chamfer is a curve of a constant radius.

5. The driver of claim 1, wherein
   a) the length of a side of the smallest notional square that can contain the four

edges is about 0.080 inches; and

b) the distance between the wall engaging portions of each blade is about 0.025 inches.

6. The driver of claim 5, wherein each chamfer is a curve of a constant radius and the radius is about 0.010 inches.

7. The driver of claim 5 or 6, wherein each blade side is planar and meets the blade side of the adjacent blade at a right-angle inner corner, the inner corner extending generally parallel to the longitudinal axis and wherein the longitudinal extent of each inner corner is at least about 0.118 inches

8. The driver of claim 1, wherein

a) the length of a side of the smallest notional square that can contain the four edges is about 0.095 inches; and

b) the distance between the wall engaging portions of each blade is about 0.038 inches.

9. The driver of claim 8, wherein each chamfer is a curve of a constant radius and the radius is about 0.030 inches.

10. The driver of claim 8 or 9, wherein each blade side is planar and meets the blade side of the adjacent blade at a right-angle inner corner, the inner corner extending generally parallel to the longitudinal axis and wherein the longitudinal extent of each inner corner is at least about 0.133 inches

11. The driver of claim 1, wherein

a) the length of a side of the smallest notional square that can contain the four edges is about 0.112 inches; and

b) the distance between the wall engaging portions of each blade is about

0.032 inches.

12. The driver of claim 11, wherein each chamfer is a curve of a constant radius and the radius is about 0.030 inches.

13. The driver of claim 11 or 12, wherein each blade side is planar and meets the blade side of the adjacent blade at a right-angle inner corner, the inner corner extending generally parallel to the longitudinal axis and wherein the longitudinal extent of each inner corner is at least about 0.133 inches

14. The driver of claim 1, wherein
    a) the length of a side of the smallest notional square that can contain the four edges is about 0.140 inches; and
    b) the distance between the wall engaging portions of each blade is about 0.035 inches.

15. The driver of claim 14, wherein each chamfer is a curve of a constant radius and the radius is about 0.030 inches.

16. The driver of claim 14 or 15, wherein each blade side is planar and meets the blade side of the adjacent blade at a right-angle inner corner, the inner corner extending generally parallel to the longitudinal axis and wherein the longitudinal extent of each inner corner is at least about 0.190 inches.

17. The driver of any one of claims 1 to 16, wherein the shank is attached to a handle for manual rotation of the driver.

18. The driver of any one of claims 1 to 16, wherein the shank is configured for releasable engagement with a drive means.

19. The driver of any one of claims 1 to 16, wherein the shank is hexagonal.

20. The driver of any one of claims 1 to 16, wherein the shank includes an annular groove for releasably engaging the shank with a suitable chuck.

21. A set of drivers comprising two or more of the drivers of claims 5, 8, 11 and 14.

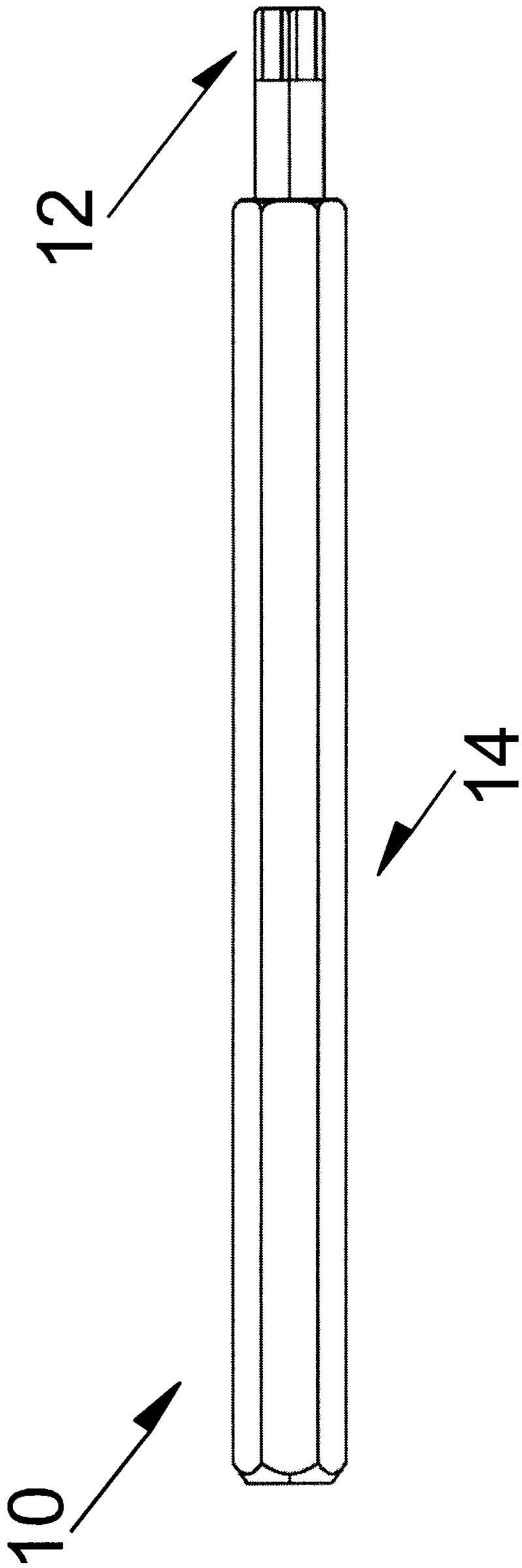


FIG. 1

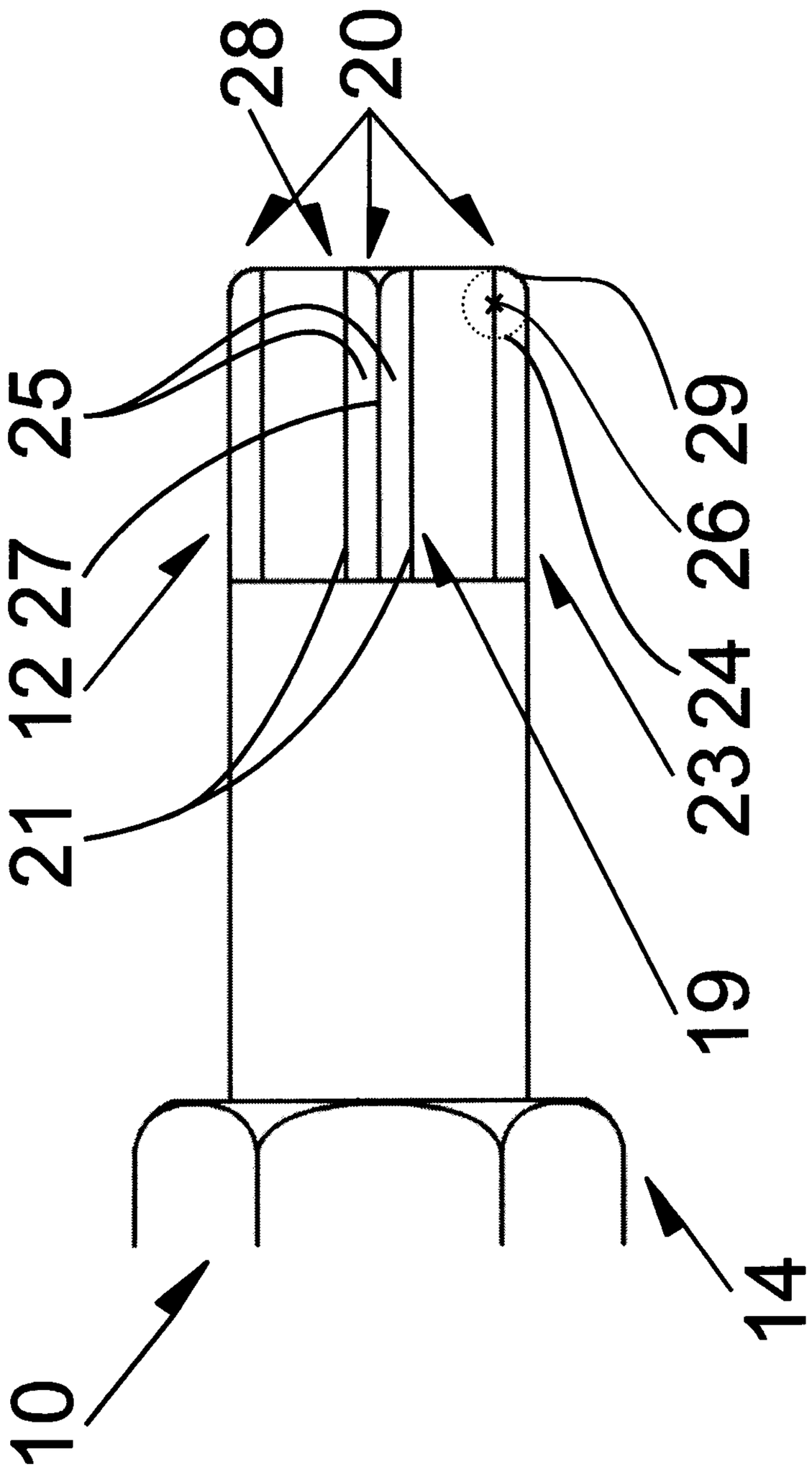


FIG. 2

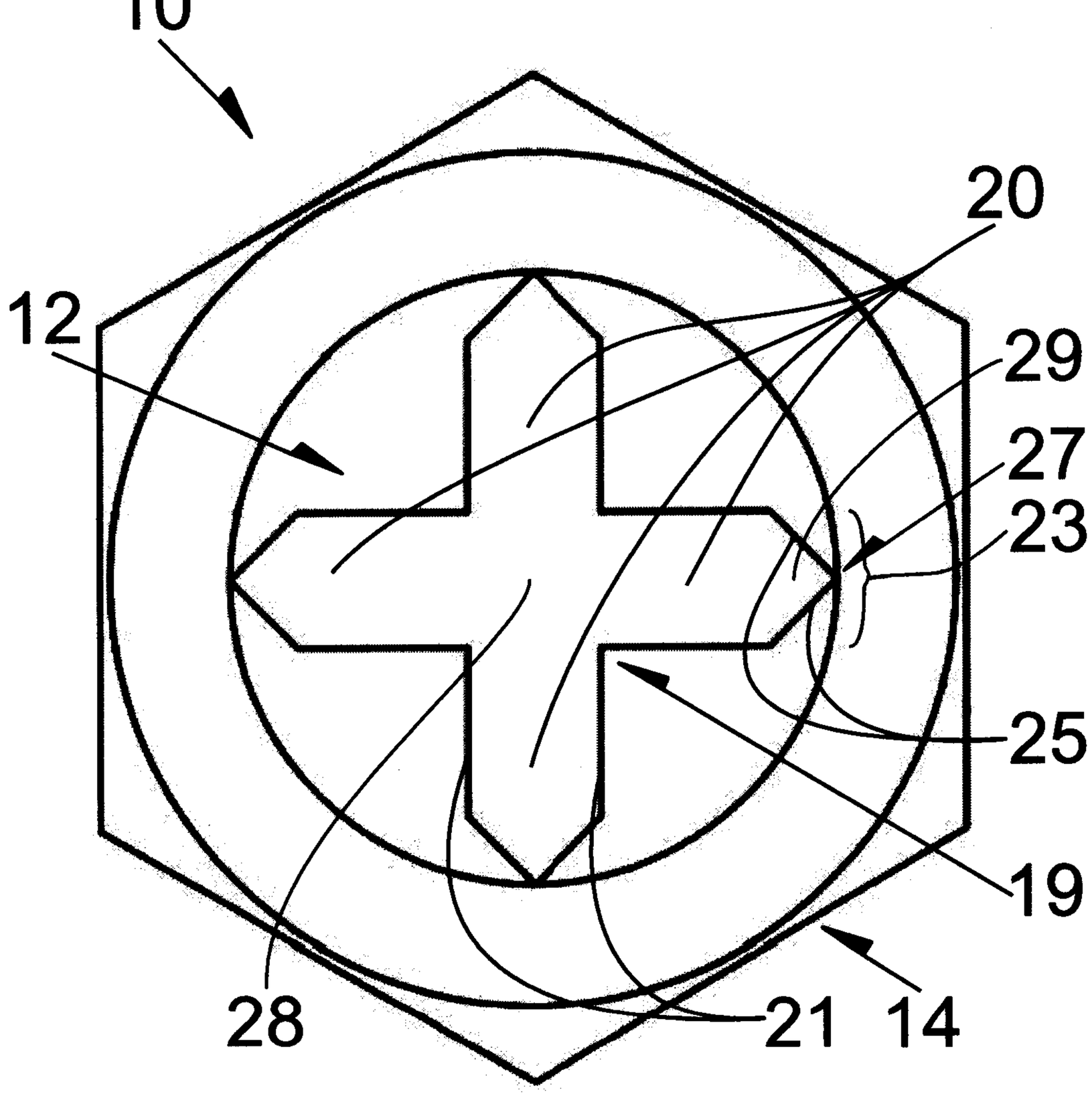


FIG. 3

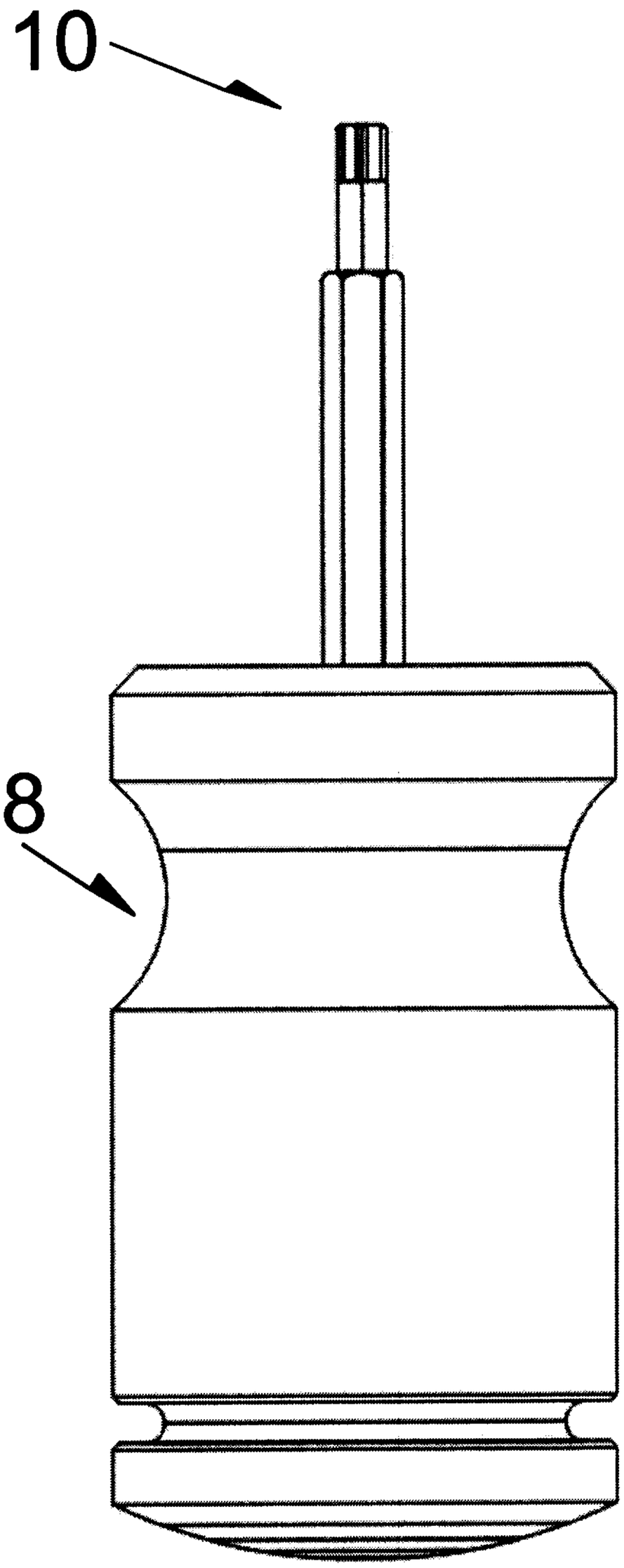


FIG. 4

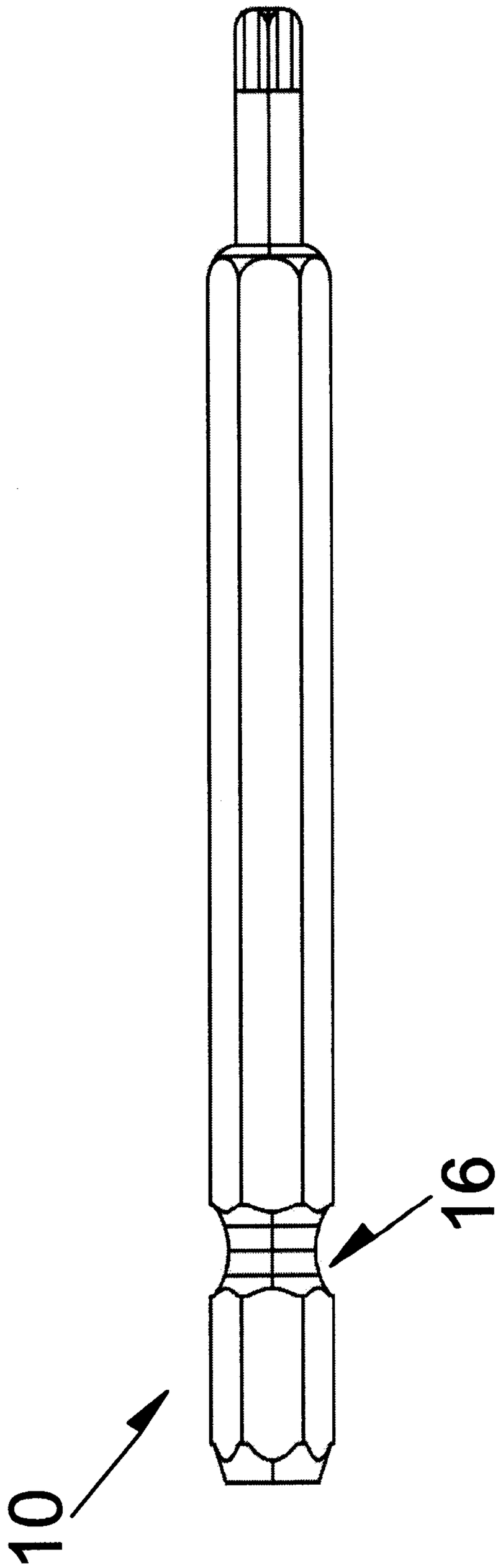
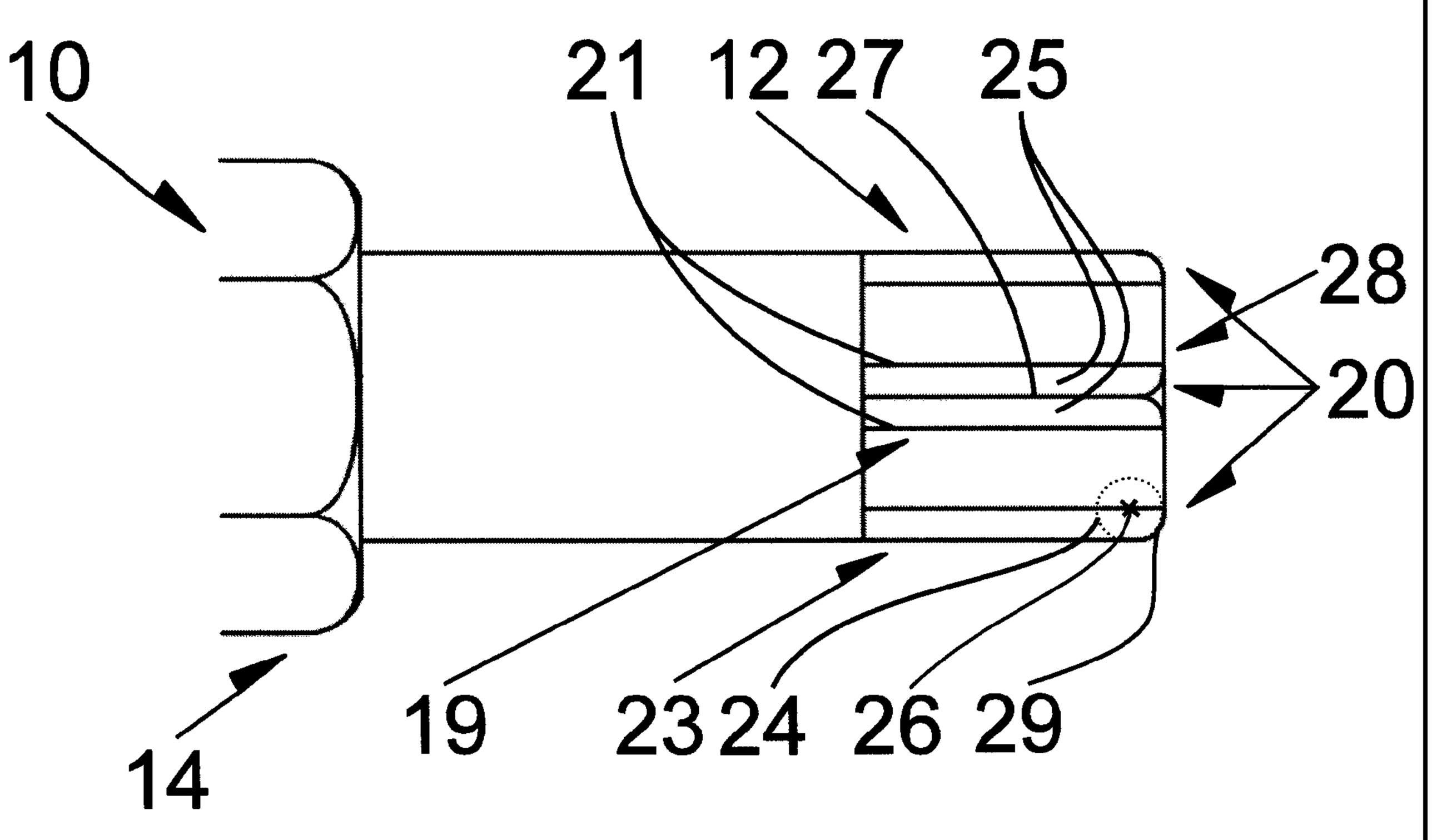


FIG. 5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