Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2763045 C 2012/08/21

(11)(21) 2 763 045

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(22) Date de dépôt/Filing Date: 2012/01/05

(41) Mise à la disp. pub./Open to Public Insp.: 2012/03/13

(45) Date de délivrance/Issue Date: 2012/08/21

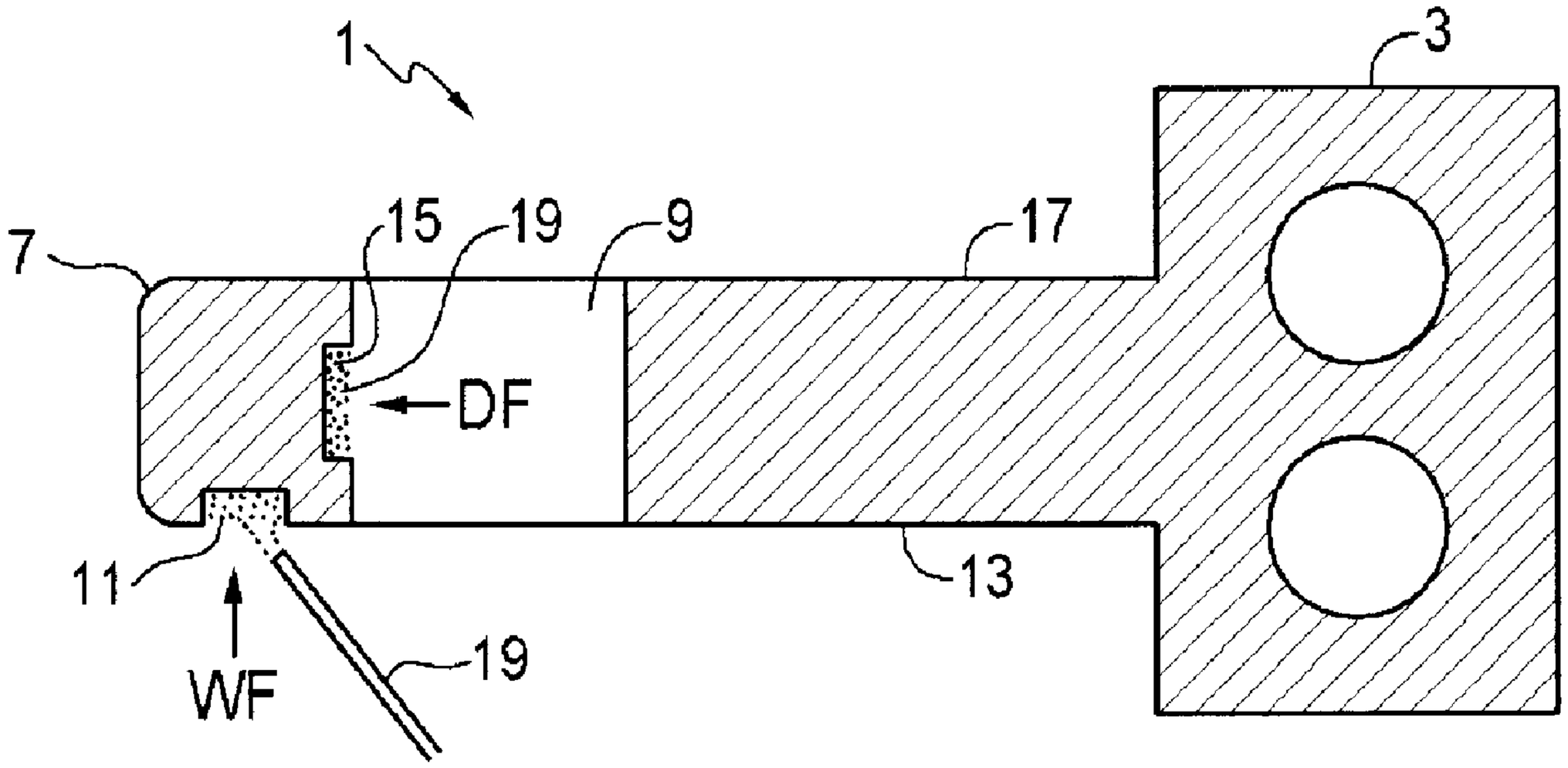
(51) Cl.Int./Int.Cl. *B60D 1/01* (2006.01),
B60D 1/58 (2006.01)

(72) Inventeur/Inventor:
OLSON, BRIAN R., CA

(73) Propriétaire/Owner:
POWER PIN INC., CA

(74) Agent: MACPHERSON LESLIE & TYERMAN LLP

(54) Titre : ATTELAGE A SURFACES DURCIES
(54) Title: HITCH WITH HARDENED SURFACES



(57) Abrégé/Abstract:
An implement hitch tongue apparatus has a nodular cast iron tongue member defining a vertical drawpin hole. A bottom recess is defined in a bottom surface of the tongue member forward of the drawpin hole, and a pin hole recess is defined in a front portion of the drawpin hole. The recesses are filled with hard surfacing welding electrode material by welding with a hard surfacing welding electrode. A grease conduit can provide grease to the bottom surface of the tongue member. A hardened pin hole insert can be removably installed in the drawpin hole instead of hard surfacing, and the insert can provide different drawpin hole sizes.

ABSTRACT

An implement hitch tongue apparatus has a nodular cast iron tongue member defining a vertical drawpin hole. A bottom recess is defined in a bottom surface of the tongue member forward of the drawpin hole, and a pin hole recess is defined in a front portion of the drawpin hole. The recesses are filled with hard surfacing welding electrode material by welding with a hard surfacing welding electrode. A grease conduit can provide grease to the bottom surface of the tongue member. A hardened pin hole insert can be removably installed in the drawpin hole instead of hard surfacing, and the insert can provide different drawpin hole sizes.

HITCH WITH HARDENED SURFACES

This invention is in the field of agricultural implements and in particular a hitch assembly for attaching an implement to a towing tractor.

BACKGROUND

An agricultural implement is typically connected to a tractor drawbar by a clevis and tongue connection. The clevis provides upper and lower clevis members each defining a draw pin hole, and the tongue defines a draw pin hole and is inserted between the clevis members to align the draw pin holes such that a draw pin can be inserted through them and thereby connect the clevis and tongue.

The clevis may be mounted to the tractor drawbar and the tongue provided by the implement hitch, or vice versa. In either event, the tractor drawbar supports the weight of the front end of the implement being towed, which can be considerable. Thus the tongue of the implement hitch must be connected to the drawbar so that the implement tongue rests on the drawbar. Thus where the hammer strap is mounted to the tractor drawbar, the hammer strap is above the drawbar and the implement hitch tongue rests on the drawbar, and where the hammer strap is mounted to the implement hitch tongue , the hammer strap is under the implement hitch tongue, and again the implement hitch tongue rests on the drawbar.

A predominant area of wear on an implement hitch tongue is the front surface of the draw pin hole. It is this surface against which the draw pin bears when exerting the draft force necessary to pull the implement in the operating travel direction, and thus where full load is placed on the draw pin. Also the bottom of the implement hitch tongue rests on the tractor drawbar, often with considerable downward force. As the tractor and implement turn and pivot about the vertical draw pin, the bottom of the implement hitch tongue

wears against the top of the tractor drawbar, and the drawpin wears against the front surface of the drawpin hole. As tractor and implement widths have increased, draft forces necessary to pull the implement, and in many cases tongue weight as well, have increased significantly, with a corresponding increase in hitch wear. With some implements, such as tub grinders, bale processors, grain carts and the like, while the draft forces are not excessive, tongue weight is significant and in operation the tractor and implement are constantly turning, such that wear on the bottom weight bearing surface of the tongue is pronounced.

Tractors come in a wide variety of sizes, and the draw pin hole in the drawbar of each is typically sized for a pin of sufficient strength to match the power of the tractor. Implements also come in a wide variety, and similarly have a implement hitch tongue with a draw pin hole that is sized for a pin of sufficient strength to match the power requirement of the implement. It is desirable to have the draw pin holes all the same size so that a corresponding size of draw pin can be inserted to connect the clevis and tongue in the preferred manner such that there is only minimal movement at the connection. Agricultural implement hitches are categorized by size, with a Category 3 hitch using a drawpin with a diameter of 1.50 inches and Category 4 using a drawpin with a diameter of 2.00 inches. As the diameter of the drawpin increases, the bearing surface that carries the draft force pulling the implement also increases, reducing wear. Recently Category 5 hitches have been introduced using a pin with a diameter of 2.75 inches to address the problem of increased wear in agricultural implements.

Implement hitch tongues are typically made from ductile or nodular cast iron, which is inexpensive and resists cracking, as opposed to more wear resistant materials which are brittle. It is known to temper these cast iron implement hitch tongues to resist this wear, and prolong their useful life, however such tempering significantly increases the cost of the implement hitch tongues. Similarly for increased wear resistance, implement hitch tongues can be made from cast steel, however this also significantly increases the cost.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a hitch tongue member that overcomes problems in the prior art.

In a first embodiment the present invention provides an implement hitch tongue apparatus adapted at a rear end thereof for attachment to an implement to be towed in an operating travel direction. The apparatus comprises a nodular cast iron tongue member defining a drawpin hole extending substantially vertically therethrough. A bottom recess is defined in a bottom surface of the tongue member forward of the drawpin hole, and a pin hole recess is defined in a front portion of the drawpin hole between a top surface of the tongue member and the bottom surface thereof. The bottom recess and the pin hole recess are substantially filled with hard surfacing welding electrode material by welding with a hard surfacing welding electrode.

In a second embodiment the present invention provides a method of reducing wear in a nodular cast iron tongue member of an implement hitch tongue apparatus that is adapted at a rear end thereof for attachment to an implement to be towed in an operating travel direction, wherein the nodular cast iron tongue member defines a drawpin hole extending substantially vertically therethrough. The method comprises forming the tongue member with a bottom recess in a bottom surface thereof forward of the drawpin hole, and with a pin hole recess in a front portion of the drawpin hole between a top surface of the tongue member and the bottom surface thereof, and substantially filling the bottom recess and the pin hole recess with hard surfacing welding electrode material by welding with a hard surfacing welding electrode.

In a third embodiment the present invention provides a hitch tongue apparatus comprising a tongue member defining an insert hole extending substantially vertically therethrough,

the insert hole having a spherical inner surface segment between top and bottom surfaces of the tongue member that has a shape of a segment of a sphere taken from a center of the sphere. First and second slots extend along opposite edges of the insert hole from one of the top and bottom surfaces of the tongue member to a mid point of the spherical inner surface segment. A pin hole insert member defines a drawpin hole therethrough, and has a spherical outer surface configured to correspond to the spherical inner surface segment of the insert hole. The insert member is removably installed in the insert hole such that the drawpin hole is substantially vertical.

The invention significantly reduces wear on the drawpin hole and bottom surface of the tongue member of a hitch assembly at a reasonable cost, and can also provide a hitch tongue member with different sizes of drawpin holes. The tongue member of the invention can be made harder than the drawpin, such that the relatively inexpensive and easily replaceable drawpin wears out faster than the tongue member.

DESCRIPTION OF THE DRAWINGS

While the invention is claimed in the concluding portions hereof, preferred embodiments are provided in the accompanying detailed description which may be best understood in conjunction with the accompanying diagrams where like parts in each of the several diagrams are labeled with like numbers, and where:

Fig. 1 is a schematic sectional side view of an embodiment of an implement hitch tongue apparatus of the present invention;

Fig. 2 is a schematic bottom view of the embodiment of Fig. 1;

Fig. 3 is a schematic side view of the embodiment of Fig. 1 attached to an implement at the rear end thereof and connected to a tractor drawbar to tow the implement with the tractor;

Fig. 4 is a schematic sectional side view of a different embodiment of an implement hitch tongue apparatus of the present invention;

Fig. 5 is a schematic top view of the embodiment of Fig. 4;

Fig. 6 is a schematic sectional front end view of the embodiment of Fig. 4;

Fig. 7 is a schematic side view of a pin hole insert member for use with the embodiment of Fig. 4 where the drawpin hole has a different diameter.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

Figs. 1 - 3 schematically illustrate an embodiment of an implement hitch tongue apparatus 1 of the present invention. The apparatus 1 is adapted at a rear end 3 thereof for attachment to an implement 5 to be towed in an operating travel direction T. The apparatus 1 comprises a cast iron tongue member 7 defining a drawpin hole 9 extending vertically therethrough. Such a nodular cast iron tongue member 7 is well known in the hitch art, and is favored because it is not brittle but is rather somewhat elastic, and also has a relatively low cost.

A major drawback with nodular cast iron is that it is relatively soft, with a Rockwell Scale hardness of about HRC 21, and so it can wear excessively, especially where forces exerted thereon are large, and where there is considerable movement, such as when the operation requires frequent turning. It is known to austemper such tongue members,

which can increase the hardness to about HRC 43 however tempering significantly increases the cost of the apparatus 1.

The present invention provides a bottom recess 11 defined in a bottom surface 13 of the tongue member 7, and a pin hole recess 15 defined in a front portion of the drawpin hole 9 between the top surface 17 of the tongue member 7 and the bottom surface 13 thereof. The bottom recess 11 and the pin hole recess 15 are filled with hard surfacing welding electrode material 19 by welding with a hard surfacing welding electrode 19 which deposits the electrode material into the recesses 11, 15.

The electrode material has a Rockwell Scale hardness of about HRC 62, much harder than both the regular nodular cast iron at HRC 21 and the tempered nodular cast iron at HRC 43. While welding is generally speaking not an acceptable method of actually joining pieces to cast iron, in the present invention the recesses 11, 15 provide a receptacle for the molten electrode material 19, which simply needs to stick in the recesses. The configuration of the recesses 11, 15 is also such that the forces exerted on the electrode material 19 push the material into the recesses. Weight force WF is exerted on the material 19 in the bottom recess 11 by the tongue member 7 resting on the tractor drawbar 23, as seen in Fig. 3. Draft force DF is exerted on the material 19 in the pin hole recess 15 by the drawpin 25 pushing against the front area of the drawpin hole 9 to tow the implement 5 in the operating travel direction T, also as seen in Fig. 3. Thus the adhesion between the electrode material 19 and the nodular cast iron of the tongue member 7 is not required to resist forces that would tend to pull the electrode material 19 out of the recesses 11, 15.

While the depth of the recesses 11, 15 can vary, it is contemplated that on a Category 3, 4, or 5 hitch, a satisfactory result can be obtained where the bottom and pin hole recesses 11, 15 have a depth of about 0.125 inches to about 0.250 inches.

In the illustrated apparatus 1, the bottom recess 11 forms an arc N1 with a center AC substantially at a center of the drawpin hole 9, and extending substantially equally on each side of an axis TA of the tongue member 7 aligned with the operating travel direction T. Although it could be much longer if desired, it is contemplated that a degree of arc greater than about 90 degrees will satisfactorily reduce wear on the bottom surface of the tongue member 7 caused by friction with the top surface of the drawbar 23. It is also contemplated that the width of the bottom recess 11 will be selected to be about 50% of the bearing width of the bottom surface 13 of the tongue member 7 forward of the drawpin hole 9.

Similarly the pin hole recess 15 forms an arc N2 with a center substantially at a center CA of the drawpin hole, and extending substantially equally on each side of the axis TA. Again although it could be much larger if desired, it is contemplated that a degree of arc greater than about 50 degrees will satisfactorily reduce wear on the inner front surface of drawpin hole 9 caused by friction with the drawpin 25. The pin hole recess 15 extends about equally upward and downward from about a mid-point of a depth of the drawpin hole 7. It is contemplated that the recess could extend from the bottom surface 13 to the top surface 17, but it is contemplated that satisfactory results will be obtained wear the distance from a top edge of the pin hole recess 15 to a bottom edge thereof is about one half the thickness of the tongue member 7. Such a length should provide a large enough bearing surface to avoid excessive wear on a sort length of the drawpin 25.

The electrode material 19 will also typically have a rough surface that, due to the hardness of the material 19, is resistant to machining smooth. The surface however will smooth with use and function satisfactorily. The drawpin 25 may be marked or grooved somewhat by the harder ridges in the surface of the electrode material 19, but this should not be problematic.

Wear on the bottom surface 13 of the tongue member 7, and also on the top surface of the drawbar 23, can further be reduced by periodically applying grease between the surfaces. Fig. 2 shows a grease conduit 27 defined in the tongue member 7 and connected at an input end thereof to a grease fitting 29 and having an output end 31 oriented to deposit grease at a location on the bottom surface 13 of the tongue member 7, generally forward of the drawpin hole 9. Greasing the surfaces will reduce friction and wear on each surface.

In the illustrated apparatus 1, the electrode material has a Rockwell Scale hardness of about HRC 62. The drawpin 25 will typically have a hardness of about HRC 53. Beneficially then the drawpin has a Rockwell hardness less than that of the hard surfacing welding electrode material 19 in the pin hole recess 15, such that the relatively inexpensive drawpin 25 will wear before the pin hole recess wears, and then the drawpin 25 can simply be replaced when such wear exceeds an acceptable wear amount.

The present invention provides a method of reducing wear in a nodular cast iron tongue member 7 of an implement hitch tongue apparatus 1 that is adapted at a rear end 3 thereof for attachment to an implement 5 to be towed in an operating travel direction T. The tongue member 7 defines a drawpin hole 9 extending substantially vertically therethrough, and the method comprises forming the tongue member 7 with a bottom recess 11 in a bottom surface 13 thereof forward of the drawpin hole 9, and with a pin hole recess 15 in a front portion of the drawpin hole 9 between the top surface 17 of the tongue member 7 and the bottom surface 13 thereof, and filling the bottom recess 11 and the pin hole recess 15 with hard surfacing welding electrode material 19 by welding with a hard surfacing welding electrode 19.

The method can further comprise defining a grease conduit 27 in the tongue member 7 with a grease fitting 29 at the input end of the grease conduit, and an output end 31 of the grease conduit 27 oriented to deposit grease at a location on the bottom surface 13 of the

tongue member 7, beneficially forward of the drawpin hole 9, where the maximum wear occurs. The rear end 3 of the implement hitch tongue apparatus 1 is attached to the implement 5 to be towed, and the tongue member is connected to a tractor drawbar 23 such that the bottom surface 13 of the tongue member 7 rests on a top surface of the tractor drawbar 23, and periodically directing grease into the grease fitting 29 to deposit grease between the top surface of the tractor drawbar 23 and the bottom surface 13 of the tongue member 7.

The invention significantly reduces wear on the drawpin hole and bottom surface of the tongue member of a hitch assembly at a reasonable cost.

Figs. 4 - 6 schematically illustrate an alternate hitch tongue apparatus 101 comprising a tongue member 7 defining a substantially circular insert hole 135 extending substantially vertically therethrough. The insert hole 135 has a spherical inner surface segment 137 between top and bottom surfaces 117, 113 of the tongue member 107. The spherical inner surface segment 137 has the shape of a segment of a sphere taken from the middle of the sphere.

First and second slots 139A, 139B extend along opposite edges of the insert hole 135 from the top surface 117 of the tongue member 107 to a mid point M1 of the spherical inner surface segment 137.

A hardened pin hole insert member 141 defines a drawpin hole 109 therethrough, and has a spherical outer surface 143 configured to correspond to the spherical inner surface segment 137 of the insert hole 135. The insert member 141 is removably installed in the insert hole 135 such that the drawpin hole 109 is substantially vertical. In the illustrated embodiment the insert member 141 is removably installed in the insert hole 135 by orienting the insert member 141 such that top and bottom surfaces 145A, 145B of the insert member 141 are within the first and second slots 139A, 139B, as schematically

illustrated in Fig. 4, moving the insert member 141 down along the slots 139A. 139B until a mid point M2 of the insert member 141 is substantially at the midpoint M1 of the spherical inner surface segment 137 of the insert hole 135.

At this point the center C of the sphere corresponding to the outer surface 143 of the insert member 141 coincides with the center C' of the sphere corresponding to the spherical inner surface segment 137 of the insert hole 135 such that the insert member 141 can be rotated in the insert hole 135. The insert member 141 is then rotated about 90 degrees as shown in Fig. 4 from the orientation 141A to the orientation 141B with the outer surface 143 of the insert member 141 sliding along the spherical inner surface segment 137 of the insert hole 135.

Once rotated to the orientation 141B, the spherical outer surface 143 of the insert member 141 is in close sliding proximity to the corresponding spherical inner surface segment 137 of the insert hole 135, and the insert member 141 is prevented from moving upward out of the insert hole 135 by the upper portions of the spherical portion of insert hole 135 that are between the slots 139A, 139B.

Those skilled in the art will recognize that the configuration of the insert member 141 and insert hole 135 and the installation of the insert member 141 are the same as commonly used to install an insert bearing into a pillow block bearing support.

The insert member 141, or at least the inner surface thereof, has a Rockwell Scale hardness greater than that of the inner surface of the insert hole 135. Typically the insert member can have a Rockwell Scale hardness of greater than about HRC 58, while the inner surface of the insert hole 135 will have a Rockwell Scale hardness of about HRC 21 where the tongue member 7 is made from nodular cast iron. The drawpin hole 109 is defined in the insert member 141, and thus is relatively hard compared to the tongue member 107. The insert member 141 remains substantially stationary with respect to the

spherical inner surface segment 137 of the insert hole 135, and during towing operations the drawpin will turn and move with respect to the hard surface of the drawpin hole 109 and wear will thus be on the hard material of the insert member 141 and not on the softer material of the tongue member 107. Wear is thus considerably reduced compared to a conventional tongue member without the insert 141.

Also as described above, a typical drawpin inserted through the drawpin hole 109 will have a Rockwell Scale hardness less than that of at least the inner surface of the insert hole 109, such that the drawpin will wear more than the insert member 141.

The apparatus 101 provides a further benefit in that insert members 141 with the same outer surface 143 can be provided with different drawpin sizes. For example while Figs. 4 - 6 schematically illustrate a first pin hole insert member 141 that defines a first drawpin hole 109 with a first diameter D1, Fig. 7 schematically illustrates a second pin hole insert member 141' that defines a second drawpin hole 109' with a second diameter D2 that is smaller than the first diameter D1. Thus larger or smaller drawpins can be accommodated simply by removing one insert member and installing another.

An insert arrangement such as described could be used where the tongue member 107 is attached to the implement, or where the tongue member 107 is the drawbar of a tractor. Either such hitch member could benefit from the ability to reduce wear and also accommodate different drawpin diameters.

Wear on the bottom of the tongue member 107 can be reduced by providing a bottom recess 111 defined in a bottom surface of the tongue member 107 and filled with hard surfacing welding electrode material 119 by welding with a hard surfacing welding electrode as described above.

Also as described above, a grease conduit 127 can be defined in the tongue member 107 and connected at an input end thereof to a grease fitting 129 and having an output end 131 oriented to deposit grease at a location on the bottom surface 113 of the tongue member 107. To facilitate installation and removal of the insert member 141, the grease conduit 127 can also have an opening 133 on the spherical inner surface segment 137 of the insert hole 135 to lubricate the outer surface 143 of the insert member 141 and the spherical inner surface segment 137 of the insert hole 135.

The hardened pin hole insert member 141 significantly reduces wear on the drawpin hole 109 of the tongue member 7 of a hitch assembly at a reasonable cost, and also can be used to provide drawpin holes 109 with different diameters.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous changes and modifications will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all such suitable changes or modifications in structure or operation which may be resorted to are intended to fall within the scope of the claimed invention.

CLAIMS

What is claimed is:

1. An implement hitch tongue apparatus adapted at a rear end thereof for attachment to an implement to be towed in an operating travel direction, the apparatus comprising:

a nodular cast iron tongue member defining a drawpin hole extending substantially vertically therethrough;

a bottom recess defined in a bottom surface of the tongue member forward of the drawpin hole;

a pin hole recess defined in a front portion of the drawpin hole between a top surface of the tongue member and the bottom surface thereof;

wherein the bottom recess and the pin hole recess are substantially filled with hard surfacing welding electrode material by welding with a hard surfacing welding electrode.

2. The apparatus of claim 1 further comprising a grease conduit defined in the tongue member and connected at an input end thereof to a grease fitting and having an output end oriented to deposit grease at a location on the bottom surface of the tongue member.

3. The apparatus of claim 2 wherein the location on the bottom surface of the tongue member is forward of the drawpin hole.

4. The apparatus of any one of claims 1 - 3 wherein the bottom recess has a depth of about 0.125 inches to about 0.250 inches.

5. The apparatus of any one of claims 1 - 4 wherein the pin hole recess has a depth of about 0.125 inches to about 0.250 inches.

6. The apparatus of any one of claims 1 – 5 wherein the bottom recess forms an arc with a center substantially at a center of the drawpin hole, and extending substantially equally on each side of an axis of the tongue member aligned with the operating travel direction.

7. The apparatus of claim 6 wherein the arc is greater than 90 degrees.

8. The apparatus of any one of claims 1 - 7 wherein the pin hole recess forms an arc with a center substantially at a center of the drawpin hole.

9. The apparatus of claim 8 wherein the arc is greater than 50 degrees.

10. The apparatus of any one of claims 1 - 9 wherein the pin hole recess extends up ward and downward from a mid-point of a depth of the drawpin hole.

11. The apparatus of claim 10 wherein a distance from a top edge of the pin hole recess to a bottom edge thereof is about one half a thickness of the tongue member.

12. The apparatus of any one of claims 1 – 11 further comprising a drawpin inserted through the drawpin hole, and wherein at least the surface of the drawpin has a Rockwell Scale hardness less than a Rockwell Scale hardness of the hard surfacing welding electrode material in the pin hole recess.

13. A method of reducing wear in a nodular cast iron tongue member of an implement hitch tongue apparatus that is adapted at a rear end thereof for attachment to an implement to be towed in an operating travel direction, wherein the nodular cast iron tongue member defines a drawpin hole extending substantially vertically therethrough, the method comprising:

forming the tongue member with a bottom recess in a bottom surface thereof forward of the drawpin hole, and with a pin hole recess in a front portion of the drawpin hole between a top surface of the tongue member and the bottom surface thereof; and

substantially filling the bottom recess and the pin hole recess with hard surfacing welding electrode material by welding with a hard surfacing welding electrode.

14. The method of claim 13 comprising:

defining a grease conduit in the tongue member;

connecting a grease fitting to an input end of the grease conduit;

orienting an output end of the grease conduit to deposit grease at a location on the bottom surface of the tongue member;

attaching the rear end of the implement hitch tongue apparatus to the implement to be towed, and connecting the tongue member to a tractor drawbar such that the bottom surface of the tongue member rests on a top surface of the tractor drawbar;

periodically directing grease into the grease fitting to deposit grease between the top surface of the tractor drawbar and the bottom surface of the tongue member.

15. The method of claim 14 wherein the location on the bottom surface of the tongue member is forward of the drawpin hole.

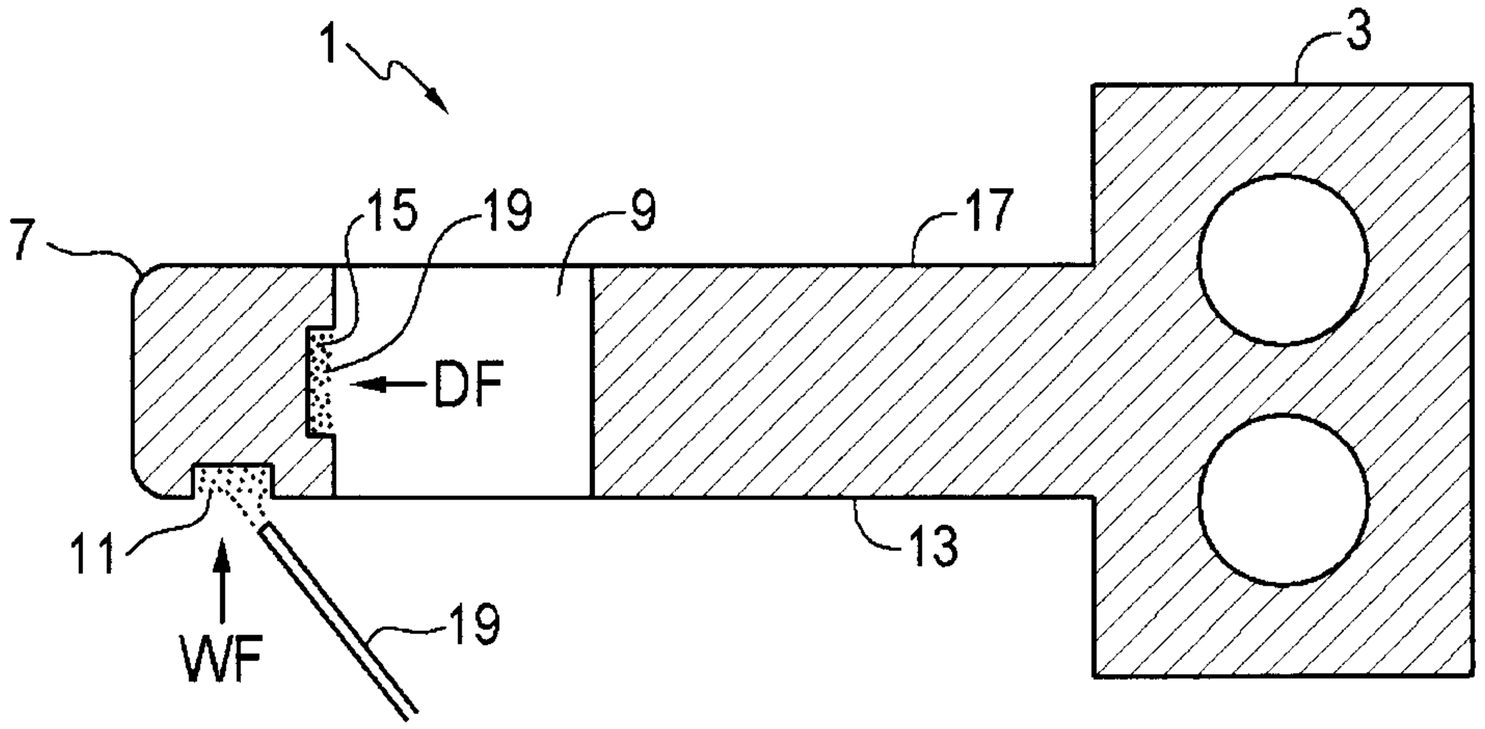


FIG. 1

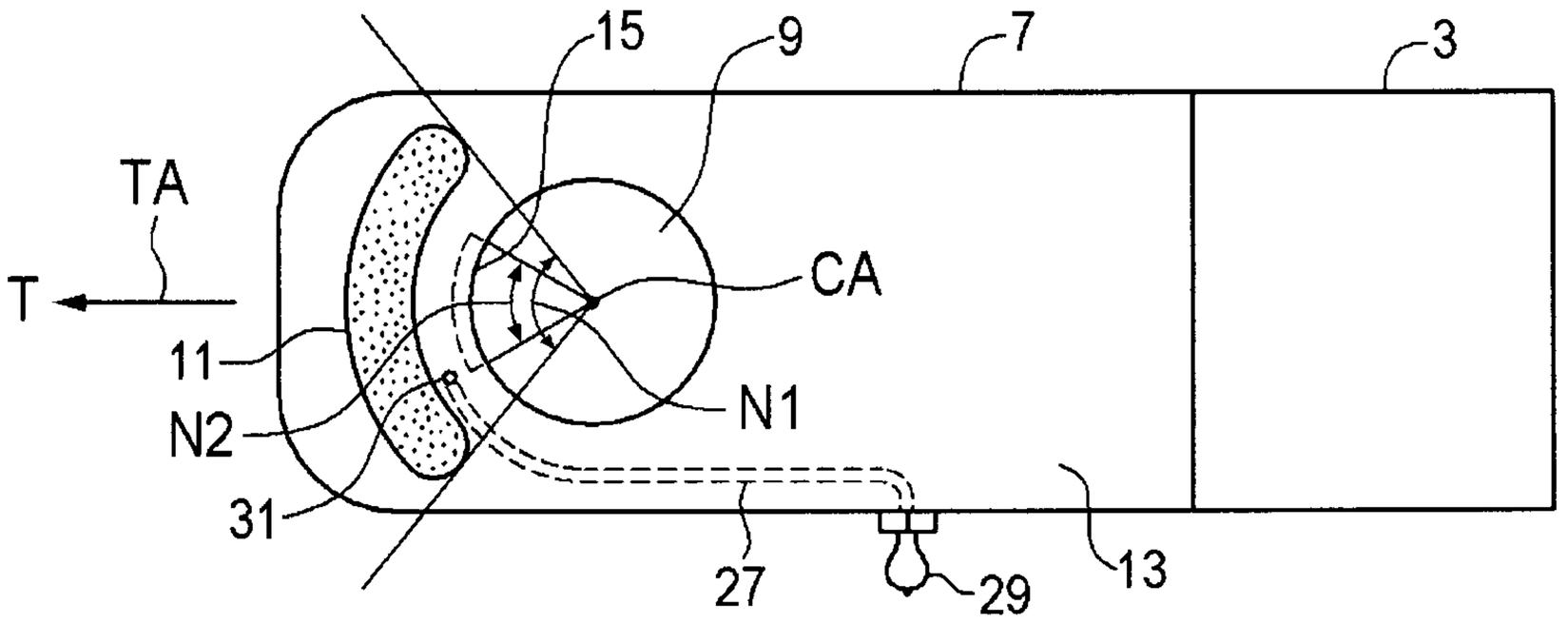


FIG. 2

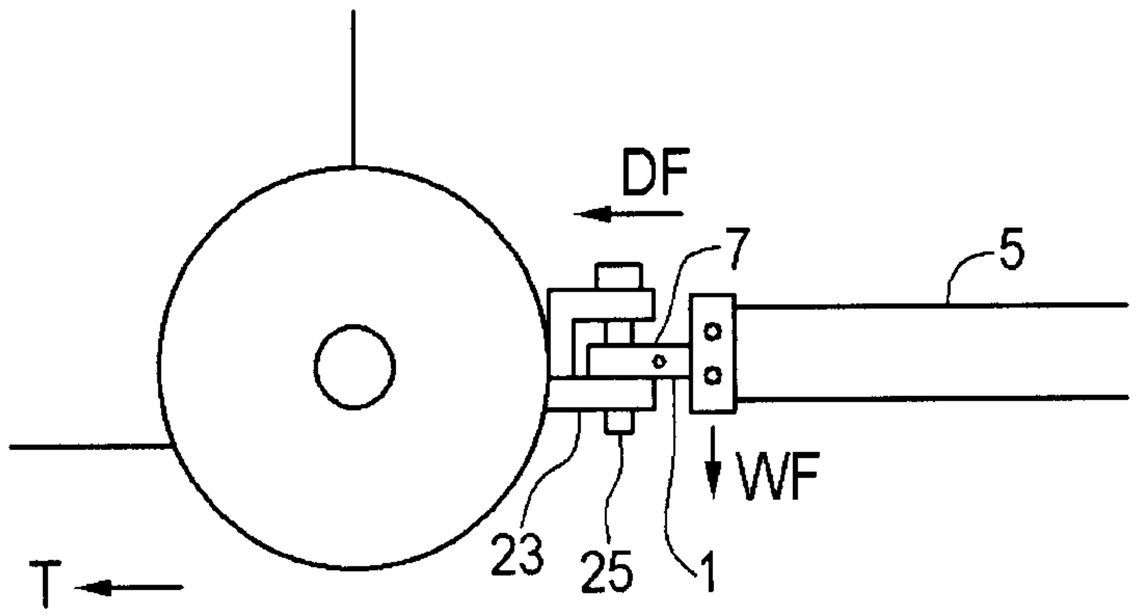


FIG. 3

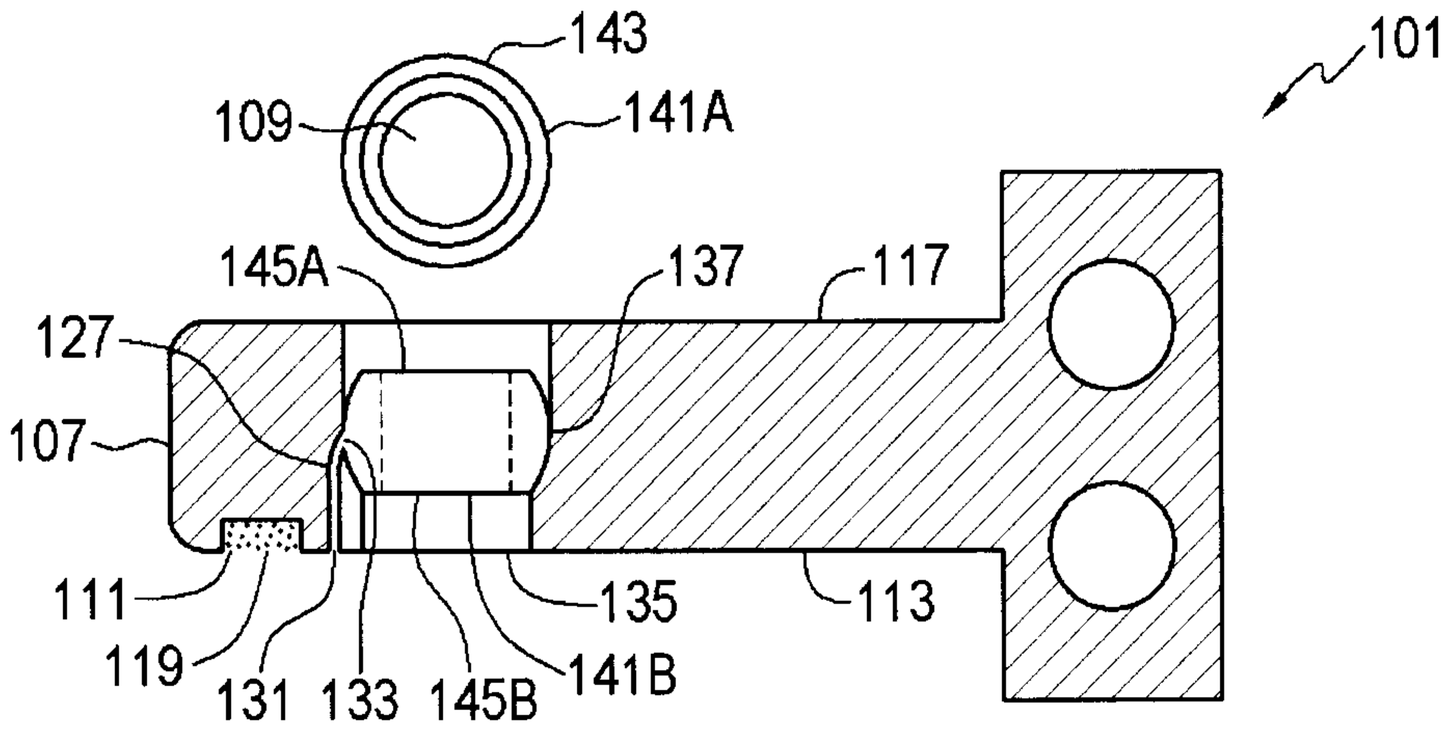


FIG. 4

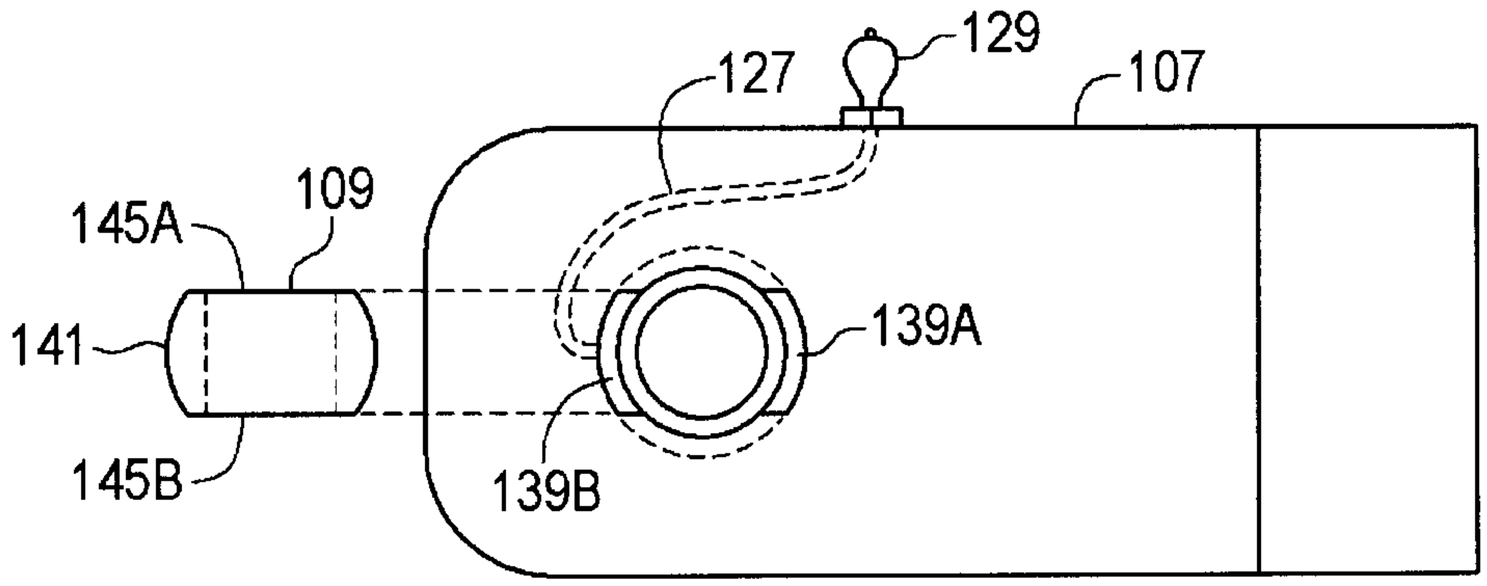


FIG. 5

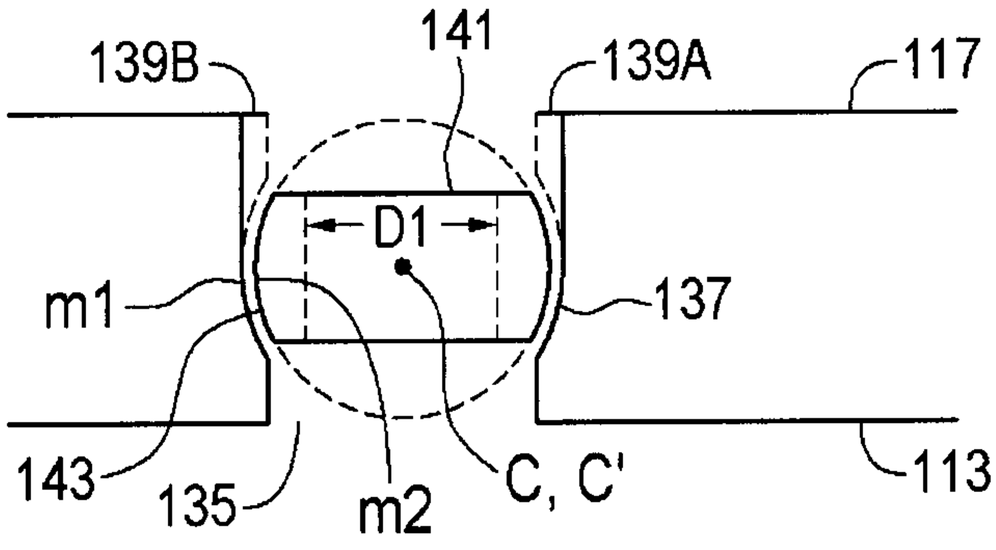
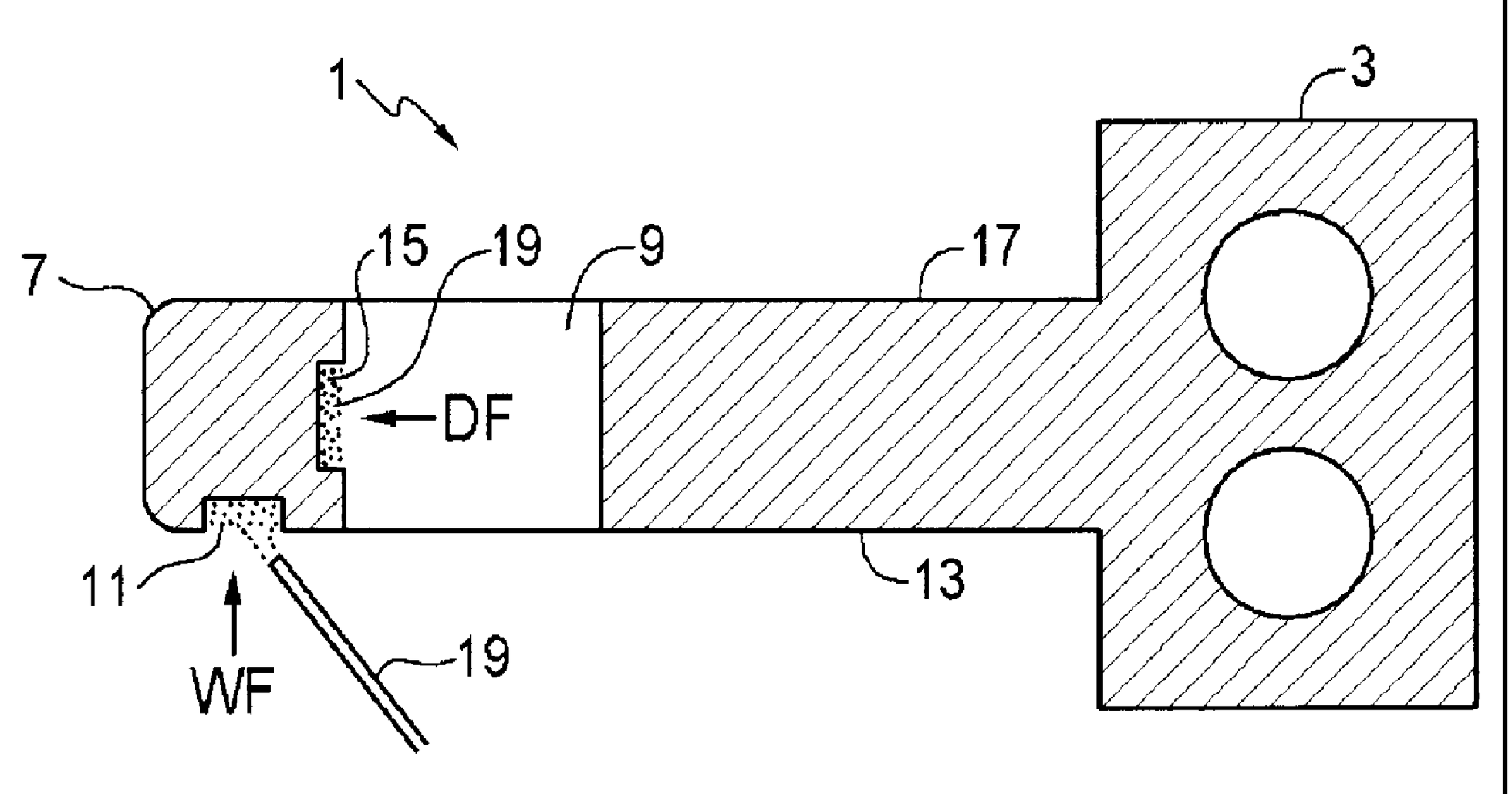


FIG. 6

FIG. 7


1
3
7
15
19
9
17
DF
11
13
WF
19