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(54) Title: RIM CENTER MEASUREMENT TOOL

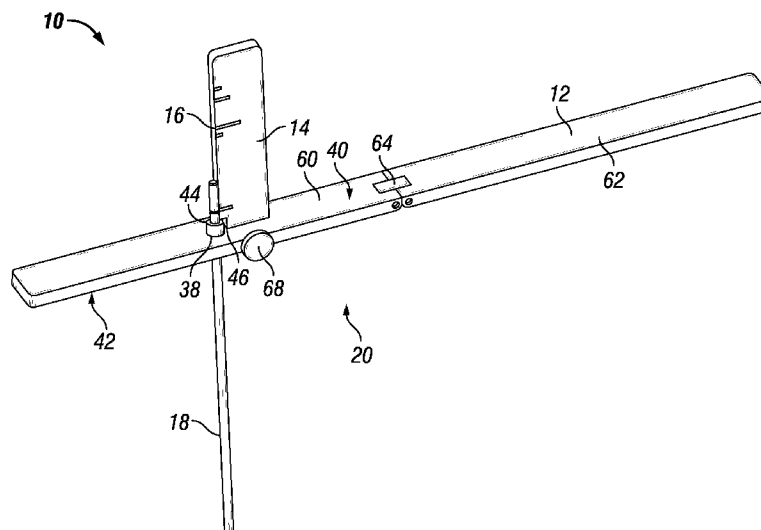


FIG. 4

(57) Abstract: A rim center measurement tool with a cross bar (12), a scale member (16) with scale (14), and a plunger (18) is provided. In an operative orientation the tool is used to measure an expandable rim, and the scale member (16) is rigidly mounted to the cross bar (12) such that the relative position between the cross bar (12) and the scale member (16) does not change. Also in the operative position the plunger (18) slides relative to the cross bar (12) to a point of engagement with the expandable rim (22). The relative position between the plunger (16) after engaging the point of engagement with the expandable rim (22) and the scale (14) of the scale member denotes a measurement of the expandable rim (22).

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TITLE

RIM CENTER MEASUREMENT TOOL

FIELD OF THE INVENTION

[0001] The present invention relates generally to a tool used to determine whether a rim is or is not out of center. More particularly, the present application involves a rim centering tool used to determine whether an expandable rim used in conjunction with a buffing machine or a building machine in a tire retread process is out of center and thus needs to be corrected.

BACKGROUND

[0002] Tire retreading involves the replacement of worn tire tread with new tire tread onto a tire carcass currently in use. The tire carcass can be supplied with new tread a number of times before it is taken out of service. The retread process first involves the inspection of the tire to verify its integrity and to determine whether the tire has sustained any damage. Next, the remaining tread on the tire can be removed through the utilization of a buffing machine. The tire is mounted onto the buffing machine and rotated while one or more brushes engage the tread and wear the remaining tread off of the tire. The removed tread is collected by a vacuum or other device, and the tread is removed until only a smooth or roughened surface of the tire carcass with no tread remains.

[0003] The tire may be removed from the buffing machine and next installed onto a building machine, although in some instances the tire may first be inspected or measured after utilization of the buffing machine by an intermediate machine or process. Once on the building machine, cushion gum can be applied to the surface of the tire carcass and a new cured strip of tread can be wrapped around and positioned onto the tire carcass. The assembly may be subsequently inspected and cured in order to effect permanent attachment between the new tire tread and the previously used tire carcass to result in a finished product.

[0004] In order to accommodate tires of different sizes, it is known to employ expandable rims in tire retreading plants. Expandable rims are capable of expanding outward in the radial direction in order to accept differently sized tires. The expandable rims have a series of mounting

members located within their interiors that engage mounting pins located on the buffing machine and the building machine. In this manner, the expandable rim can be mounted onto either the buffing machine or the building machine without having to add or change the mounting members as they are compatible with the mounting pins on both the buffing machine and the building machine.

Unfortunately, repeated placement of the expandable rim onto the buffing machine and building machine causes, over time, damage to the mounting members. This damage causes the mounting members to be pushed out of place or otherwise deformed. The damaged mounting members in turn cause the tire when mounted onto the buffing machine or building machine not to be properly centered. This improper centering causes errors to be made in the buffing and building process as these processes require the tire to be centered or otherwise positioned at a known location. There is no current way known to verify whether or not expandable rims exhibit the correct centerline or are damaged and thus in need of repair. As such, there remains room for variation and improvement within the art.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] A full and enabling disclosure of the present invention, including the best mode thereof, directed to one of ordinary skill in the art, is set forth more particularly in the remainder of the specification, which makes reference to the appended Figs. in which:

[0006] Fig. 1 is a side schematic view of a tire buffing machine.

[0007] Fig. 2 is a side view of an expandable rim.

[0008] Fig. 3 is a cross sectional view taken along line 3-3 of Fig. 2.

[0009] Fig. 4 is a perspective view of a rim center measurement tool.

[0010] Fig. 5 is a side view of the rim center measurement tool of Fig. 4.

[0011] Fig. 6 is a top view of the rim center measurement tool of Fig. 4.

[0012] Fig. 7 is an exploded perspective view of the rim center measurement tool of Fig. 4.

[0013] Fig. 8 is a perspective view of the expandable rim and the rim center measurement tool measuring the axial distance of the expandable rim.

[0014] Fig. 9 is a top view of the expandable rim and the rim center measurement tool of Fig. 8.

[0015] Fig. 10 is a cross sectional view taken along line 10-10 of Fig. 9.

[0016] Fig. 11 is a perspective view of the rim center measurement tool in a storage orientation.

[0017] Repeat use of reference characters in the present specification and drawings is intended to represent the same or analogous features or elements of the invention.

DETAILED DESCRIPTION OF REPRESENTATIVE EMBODIMENTS

[0018] Reference will now be made in detail to embodiments of the invention, one or more examples of which are illustrated in the drawings. Each example is provided by way of explanation of the invention, and not meant as a limitation of the invention. For example, features illustrated or described as part of one embodiment can be used with another embodiment to yield still a third embodiment. It is intended that the present invention include these and other modifications and variations.

[0019] It is to be understood that the ranges mentioned herein include all ranges located within the prescribed range. As such, all ranges mentioned herein include all sub-ranges included in the mentioned ranges. For instance, a range from 100-200 also includes ranges from 110-150, 170-190, and 153-162. Further, all limits mentioned herein include all other limits included in the mentioned limits. For instance, a limit of up to 7 also includes a limit of up to 5, up to 3, and up to 4.5.

[0020] The present invention provides for a rim center measurement tool 10 that is capable of taking a measurement of an expandable rim 22. The measurement taken may be an axial distance 26 that is the distance from the center 28 of the expandable rim 22 to an axial end 30 of the expandable rim 22. This axial distance 26 designates the size of the expandable rim 22 and may in some instances be designated as the width of the expandable rim 22. The rim center measurement tool 10 has a cross bar 12 that is placed onto the axial end 30. A scale member 14 with a scale 16 protrudes vertically upwards from the cross bar 12. A plunger 18 is positioned through the cross bar

12 and falls vertically downward to a point of engagement 24 of the expandable rim 22. Once the plunger 18 engages it, the plunger 18 is located at a position relative to the scale 16 and the reading on the scale 16 can be taken to ascertain the axial distance 26 that is measured. The rim center measurement tool 10 can be broken down from its operative orientation 20 to a storage orientation 66 for easier storage and transport.

[0021] Fig. 1 shows a schematic view of a buffing machine 56 that can be used in a retread process to remove tread from a tire. The tire is mounted onto a mounting fixture 72 and can be rotated. A brush 70 of the buffing machine 56 may be moved into position with the tread of the tire in order to grind the tread off so that the surface of the tire is smooth or roughened for subsequent treatment as desired. The various components of the buffing machine 56 shown in Fig. 1 are located inward from the mounting fixture 72 so that in reality the mounted tire will not engage or be interfered with by these displayed components. The mounting fixture 72 has a plurality of mounting pins 58 that are adapted to receive corresponding mounting members 52 of the expandable rim 22. Continued engagement of the mounting member 52 with the mounting pins 58 through mounting and dismounting of the tire onto and off of the buffing machine 56 causes damage and displacement of the mounting member 52. This will result in the expandable rim 22 and its tire to be located at different locations on the buffing machine 56 when mounted. The buffing machine 56 is set up to grind the tread with the assumption that the tire is at a particular centerline. If the tire is not at the expected centerline, then the buffing operation will not be performed in the intended manner and may result in non-uniformity in the finished process. Although not shown in the figures, a tread building machine may also include a series of mounting pins 58 with a mounting fixture 72 to mount the expandable rim 22 and tire to the tread building machine. In a similar manner, if the mounting member 52 is damaged through repeated use the centerline placement of the tire on the tread building machine will be off center and the tread will be placed onto it in a non-uniform manner.

[0022] The rim center measurement tool 10 allows the operator to determine whether the expandable rim 22 has sustained any damage to the mounting member 52 and thus whether the expandable rim 22 is outside of an acceptable tolerance range so that it must be repaired instead of being used then and there on the buffing machine 56 or the building machine. The expandable rim 22 is shown in Fig. 2. The expandable rim 22 is made of a plurality of sectors, two of which a first sector 48 and a second sector 50 are identified. The expandable rim 22 illustrated has 12 sectors

although any number of sectors can be present in other exemplary embodiments such as 6 sectors, 14 sectors, 16 sectors, 18 sectors, or from 20-46 sectors. Although not shown for sake of simplicity, a rubber air tight layer may be wrapped circumferentially around the sectors so that the tire mounted onto the expandable rim 22 can be inflated and not lose air during the retreading process. A pair of axial ends are located at two opposite terminal sides of the expandable rim 22 in the axial direction 32. One of the axial ends 30 is identified. The expandable rim 22 also has a radial direction 34 that is at a ninety degree angle to the axial direction 32. The two identified sectors 48 and 50 are located opposite from one another the maximum distance in the radial direction 34.

[0023] The expandable rim 22 has a center 28 that extends through the expandable rim 22 in the center in the axial direction 32. In this manner, the terminal ends of the axial ends are located the same distance from the center 28 in the axial direction 32. As shown, an axial distance 26 is identified and is the distance from the center 28 to the terminal end of the identified axial end 30. This axial distance 26 may be the distance measured by the rim center measurement tool 10. However, any distance of the expandable rim 22 in the axial direction 32 may be measured by the rim center measurement tool 10. So long as this measurement is consistent between successive expandable rims 22 relative to the buffing machine 56 and the building machine, the proper centering of the tire can be ascertained. As such, although described as measuring the axial distance 26, any distance in the axial direction 32 can be measured and the center 28 and/or the axial end 30 may not be the points of reference that are measured. Distances above or below the center 28 in the axial direction 32 can be measured, and the axial end 30 may not be measured in other embodiments.

[0024] Fig. 3 is a cross-sectional view taken along line 3-3 of Fig. 2 and shows the first sector 48 of the expandable rim 22 from the interior of the expandable rim 22. Each one of the sectors has thereon a mounting member that is used to attach the expandable rim 22 to the mounting fixture 72. The first sector 48 has a mounting member 52 that has a receiving feature that accepts one of the mounting pins 58 of the mounting fixture 72 for attachment thereto. The mounting member 52 has a surface 54 that is flat with a surface normal that points upwards in the axial direction 32. This surface 54 is used at a point of engagement 24 with the rim center measurement tool 10. All of the mounting members 52 of the expandable rim 22 are arranged in a similar fashion. Although described as using surface 54 as the one to engage the rim center measurement tool 10, any other surface of the mounting member 52 can be used in other exemplary embodiments.

[0025] Figs. 4-7 show an exemplary embodiment of the rim center measurement tool 10 in an operative orientation 20 that is the orientation used when measuring the axial distance 26 and interacting with the expandable rim 22. The rim center measurement tool 10 has a cross bar 12 that extends generally in a longitudinal direction of the rim center measurement tool 10. The cross bar 12 can be a single component or may be made out of multiple components that can move relative to one another. In the embodiment shown, the cross bar 12 is made out of a first piece 60 and a second piece 62 that are attached to one another by a hinge 64. The hinge 64 allows the first piece 60 to pivot relative to the second piece 62. The hinge 64 is made of a hinge piece and a pair of rods in that one rod extends through the hinge piece and the first piece 60, while the other rod extends through the hinge piece and the second piece 62. Other arrangements of the hinge 64 are possible in accordance with other exemplary embodiments.

[0026] The rim center measurement tool 10 also has a scale member 14. The scale member 14 has a scale 16 located thereon. The scale member 14 is mounted to the cross bar 12 and in the operative orientation 20 is rigidly mounted to the cross bar 12 so that it does not move relative to the cross bar 12. The scale member 14 extends vertically upward above the cross bar 12 and may be located completely on and above a first side 40 of the cross bar 12. Depending upon what distance is measured, the scale 16 can be variously configured. In some arrangements, the scale 16 does not even provide a distance of the expandable rim 22, but instead only provides information as to whether the measurement of the expandable rim 22 is or is not out of tolerance for use in the buffing or building operation. The scale member 14 may be permanently attached to the cross bar 12 or may be selectively attached so that it can be removed as needed. In this regard, a set screw 68 can be used to attach and remove the scale member 14 from the cross bar 12.

[0027] The rim center measurement tool 10 may also include a bushing 44 disposed within an aperture 38 of the cross bar 12. The aperture 38 extends completely through the cross bar 12 and is located in the first piece 60 of the cross bar 12. The aperture 38 extends from the first side 40 to the oppositely disposed second side 42 and thus extends completely through the cross bar 12. The bushing 44 may be located within the aperture 38 along all of or some of its length. The bushing 44 may be pressed within the aperture 38 to be held therein. The bushing 44 may also extend upwards from the cross bar 12 above the first side 40. The scale member 14 may have a notch 46 defined therein. The mounting position of the scale member 14 on the cross bar 12 may be such that the

notch 46 is positioned relative to the bushing 44 so that the bushing 44 is located inside of the notch 46. The scale member 14 may or may not engage the bushing 44.

[0028] The rim center measurement tool 10 also has a plunger 18 that can be configured as an elongated rod with a circular cross-sectional shape. The plunger 18 can move relative to the cross bar 12 and the scale member 14 in the operative orientation 20 and is not rigidly connected to any component of the rim center measurement tool 10 such that it can be completely removed and detached from the other components of the rim center measurement tool 10. The plunger 18 can move vertically upwards and downwards relative to the cross bar 12 and the scale member 14 and in use is placed through the bushing 44 and falls via gravity until it hits the point of engagement 24 of the expandable rim 22. The bushing 44 allows the plunger 18 to slide. Once the plunger 18 hits the point of engagement 24 and does not fall farther in the vertical direction, its position relative to the scale 16 can be read. The plunger 18 may have one or more marks or the very top of the plunger 18 can be used to determine its location relative to the scale 16. The scale 16 is located close to the plunger 18 by way of the notch 46 and the reading can be easily ascertained. The scale 16 can be noted in order to determine the axial distance 26 and/or can be read in order to determine whether the expandable rim 22 has been damaged to such a degree that it is out of tolerance and in need of repair or replacement.

[0029] Portions of the plunger 18 can be below the second side 42 in the vertical direction while simultaneously other portions of the plunger 18 may be above the first side 40 in the vertical direction. The plunger 18 may be located through the first piece 60 and not through the second piece 62. Although described as being completely removable from the aperture 38 and thus completely detachable from the cross bar 12, it is to be understood that in other arrangements that the plunger 18 could be permanently attached to the cross bar 12 so that it cannot be removed from the aperture 38.

[0030] Fig. 8 shows the interaction between the expandable rim 22 and the rim center measurement tool 10 as it is used to measure the axial distance 26. The cross bar 12 is positioned across the open center of the expandable rim 22. The first sector 48 and the second sector 50 are located 180 degrees from one another in the circumferential direction 36. The cross bar 12 engages both the first sector 48 and the second sector 50 at the axial end 30 of the expandable rim 22. Only a single one of the mounting members 52 is measured by the rim center measurement tool 10. However, it is to be understood that in accordance with other exemplary embodiments, 2, 3, 4, from

5-10, or up to 18 mounting members 52 may be measured by the rim center measurement tool 10. The plunger 18 can be arranged so that it only engages the expandable member 22 at the point of engagement 24 and at no other points of the expandable member 22. Alternatively, the plunger 18 may brush up against and contact the mounting member 52 at various points but move all the way down onto the surface 54 before being stopped and thus may engage multiple locations of the mounting member 52 besides only at the point of engagement 24 at the surface 54.

[0031] In use one will first position the cross bar 12 across the axial end 30 so that it engages the axial end 30 at opposite locations, such as the first and second sectors 48 and 50. Next, the user will drop the plunger 18 through the bushing 44 and aperture 38 until it contacts and stops at the point of engagement 24. The bushing 44 may function to better constrain the plunger 18 so that its falling is in a more controlled manner and so that it does not twist or otherwise move radially within the aperture 38. Next, the user may read the scale 16 as the plunger 18 is located next to the scale 16 and is at its point of measurement. Based upon the axial distance 26 measured, the user may verify that the expandable rim 22 is within tolerance so that it will be centered properly onto the mounting fixture 72 to which it will be subsequently mounted. The user may then remove the entire rim center measurement tool 10 from the expandable rim 22.

[0032] Fig. 9 is a top view of Fig. 8 and shows the twelve sectors of the expandable rim 22 arranged in a symmetrical manner about its center. The sectors move inward and outward radially in the radial direction 34 so that different sized tires can be mounted thereon. However, the radial distances of the expandable rim 22 are not measured, so it does not matter whether the expandable rim 22 is in a fully expanded or fully contracted position when measured. Only some axial distance of the expandable rim 22 is measured by the rim center measurement tool 10. Only a single one of the twelve mounting members 52 is measured in the illustrated embodiment. The first sector 48 is located 180 degrees from the second sector 50 in the circumferential direction 36. However, other embodiments are possible in which the two sectors engaged are not 180 degrees from one another in the circumferential direction 36. In this regard, the cross bar 12 could engage two sectors that are 90 degrees from one another in the circumferential direction 36, for example, and the measurement in the axial direction 32 could be realized.

[0033] Fig. 10 is a cross sectional view that shows the arrangement of the plunger 18 within the recessed features of the mounting member 52 so that it slides through the mounting member 52

until hitting the surface 54. As stated, any feature or surface of the mounting member 52 may be measured by the plunger 18 in accordance with various exemplary embodiments in order to ascertain some axial distance of the expandable rim 22. Compensations may be made to the scale 16 so that it reads a measurement of any distance of the expandable rim 22 in the axial direction. The axial direction 26 of the expandable rim 22 is perpendicular to the axis of rotation of the expandable rim 22.

[0034] In some embodiments, the rim center measurement tool 10 can be capable of being broken down for ease of storage and transport. Fig. 11 shows the rim center measurement tool 10 broken down into a storage orientation 66. The scale member 14 has a projection 74 that is received within an aperture 76 of the first piece 60 of the cross bar 12. The set screw 68 may be loosened in order to allow the projection 74 to be removed from the aperture 76. The scale member 14 may thus be removed from the cross bar 12. The plunger 18 is not attached to the bushing 44 or aperture 38 and may thus be slid out of these elements and removed completely from the cross bar 12. The first piece 60 can be pivoted with respect to the second piece 62 via the hinge 64 connection between these pieces 60 and 62 until they lay on top of one another. In this regard, the second piece 62 can be rotated 180 degrees with respect to the first piece 60 to effectively cut in half the longitudinal length of the cross bar 12. In other arrangements, the cross bar 12 could be made of any number of pieces to effect a size reduction in the storage orientation 66.

[0035] The rim center measurement tool 10 may be used to verify whether different types and sizes of expandable rims 22 have the same center. The centerline of the tire on the buffing machine 56 or the building machine may be thus verified. The cross bar 12, scale member 14, and plunger 18 may all be made of 6061-T6 aluminum alloy to afford a light design for ease of carrying and use. In other arrangements, the cross bar 12, scale member 14, and/or plunger 18 may be made out of A36 steel and could, if desired, be welded into a permanent form so that a storage orientation 66 is not possible.

[0036] While the present invention has been described in connection with certain preferred embodiments, it is to be understood that the subject matter encompassed by way of the present invention is not to be limited to those specific embodiments. On the contrary, it is intended for the subject matter of the invention to include all alternatives, modifications and equivalents as can be included within the spirit and scope of the following claims.

CLAIMS

What is claimed is:

1. A rim center measurement tool, comprising:

a cross bar;

a scale member, wherein the scale member has a scale thereon;

a plunger;

wherein the rim center measurement tool has an operative orientation in which the rim center measurement tool is used to measure an expandable rim, wherein in the operative orientation the scale member is rigidly mounted to the cross bar such that the relative position between the cross bar and the scale member does not change, wherein in the operative orientation the plunger slides relative to the cross bar to a point of engagement with the expandable rim, wherein the relative position between the plunger after engaging the point of engagement with the expandable rim and the scale of the scale member denotes a measurement of the expandable rim.

2. The rim center measurement tool as set forth in claim 1, wherein the measurement of the expandable rim denoted by the relative position between the plunger after engaging the point of engagement with the expandable rim and the scale of the scale member is the axial distance from the center of the expandable rim to an axial end of the expandable rim in an axial direction of the expandable rim.

3. The rim center measurement tool as set forth in claims 1 or 2, wherein the cross bar has an aperture therethrough, wherein the plunger extends through the aperture of the cross bar when the rim center measurement tool is in the operative orientation.

4. The rim center measurement tool as set forth in claim 3, wherein the cross bar has a first side and an oppositely disposed second side, wherein the plunger is located both above the first

side and below the second side of the cross bar when the rim center measurement tool is in the operative orientation and the plunger engages the point of engagement with the expandable rim.

5. The rim center measurement tool as set forth in claims 3 or 4, further comprising a bushing that is located in the aperture of the cross bar, wherein the plunger engages the bushing when the rim center measurement tool is in the operative orientation and the plunger engages the point of engagement with the expandable rim.

6. The rim center measurement tool as set forth in claim 5, wherein the scale member defines a notch, wherein the bushing is located in the notch of the scale member and engages the scale member when the rim center measurement tool is in the operative orientation.

7. The rim center measurement tool as set forth in any one of claims 1-6, wherein the expandable rim has a first sector and a second sector that are located 180 degrees from one another in a circumferential direction of the expandable member, wherein the cross bar engages both the first sector and the second sector when the rim center measurement tool is in the operative orientation and the plunger engages the point of engagement with the expandable rim.

8. The rim center measurement tool as set forth in any one of claims 1-7, wherein the expandable rim has a mounting member that engages a mounting pin of a buffing machine, wherein the point of engagement is a surface of the mounting member.

9. The rim center measurement tool as set forth in any one of claims 1-8, wherein the cross bar has a first piece, a second piece, and a hinge, wherein the hinge attaches the first piece to the second piece and renders the first piece pivotal with respect to the second piece, wherein the rim center measurement tool has a storage orientation in which the second piece is folded onto the first

piece, wherein in the operative orientation the first piece and the second piece are unfolded from one another.

10. The rim center measurement tool as set forth in any one of claims 1-9, further comprising a set screw, wherein in the operative orientation the set screw engages the scale member in order to rigidly mount the scale member to the cross bar, wherein the rim center measurement tool has a storage orientation in which the set screw is disengaged from the scale member and the scale member is dismounted from the cross bar.

11. The rim center measurement tool as set forth in any one of claims 1-10, wherein the rim center measurement tool has a storage orientation in which the plunger is disengaged from the cross bar and in which the plunger is disengaged from the point of engagement with the expandable rim.

12. The rim center measurement tool as set forth in any one of claims 1-11, wherein the cross bar is made of 6061-T6 aluminum.

13. The rim center measurement tool as set forth in any one of claims 1-11, wherein the cross bar is made out of A36 steel, and wherein the scale member is made out of A36 steel.

14. The rim center measurement tool as set forth in any one of the preceding claims wherein the expandable rim has a plurality of mounting members, wherein the plunger engages only the point of engagement which is a single point of engagement located at one of the mounting members and no other points of contact are made between the plunger and the expandable rim and no other points of contact are made between any other component of the rim center measurement tool and the mounting members of the expandable rim besides the plunger.

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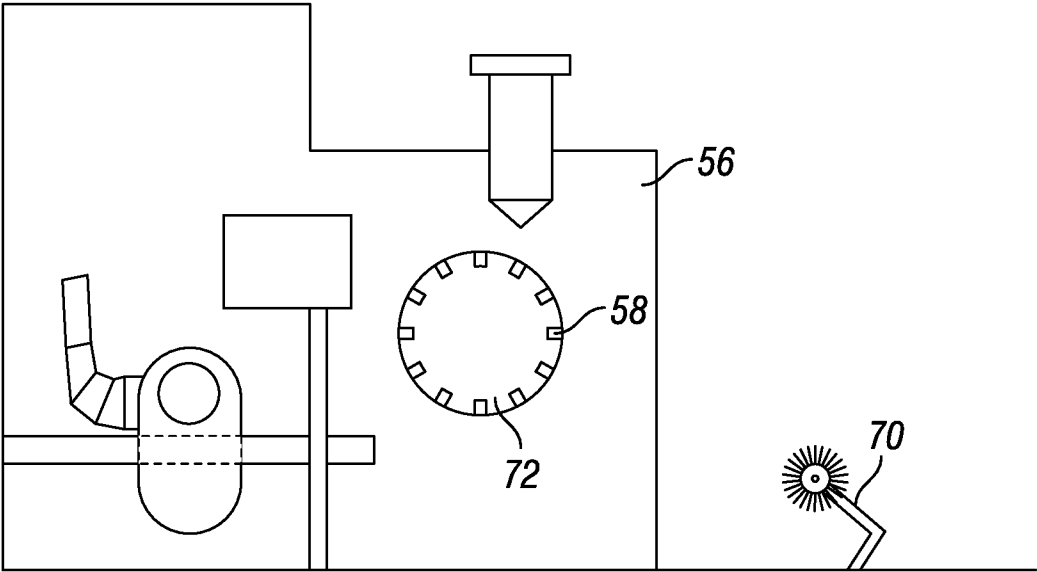


FIG. 1

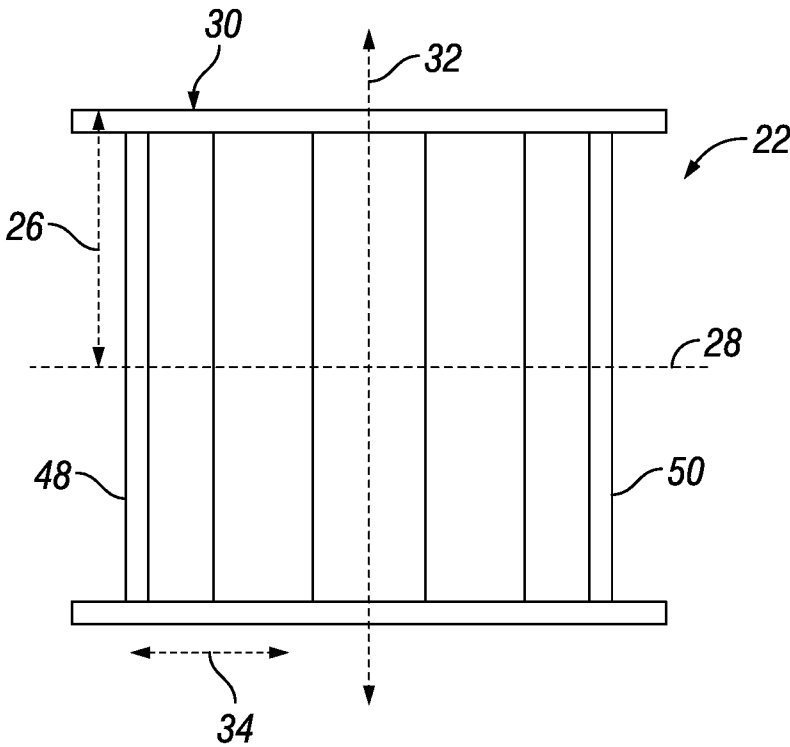


FIG. 2

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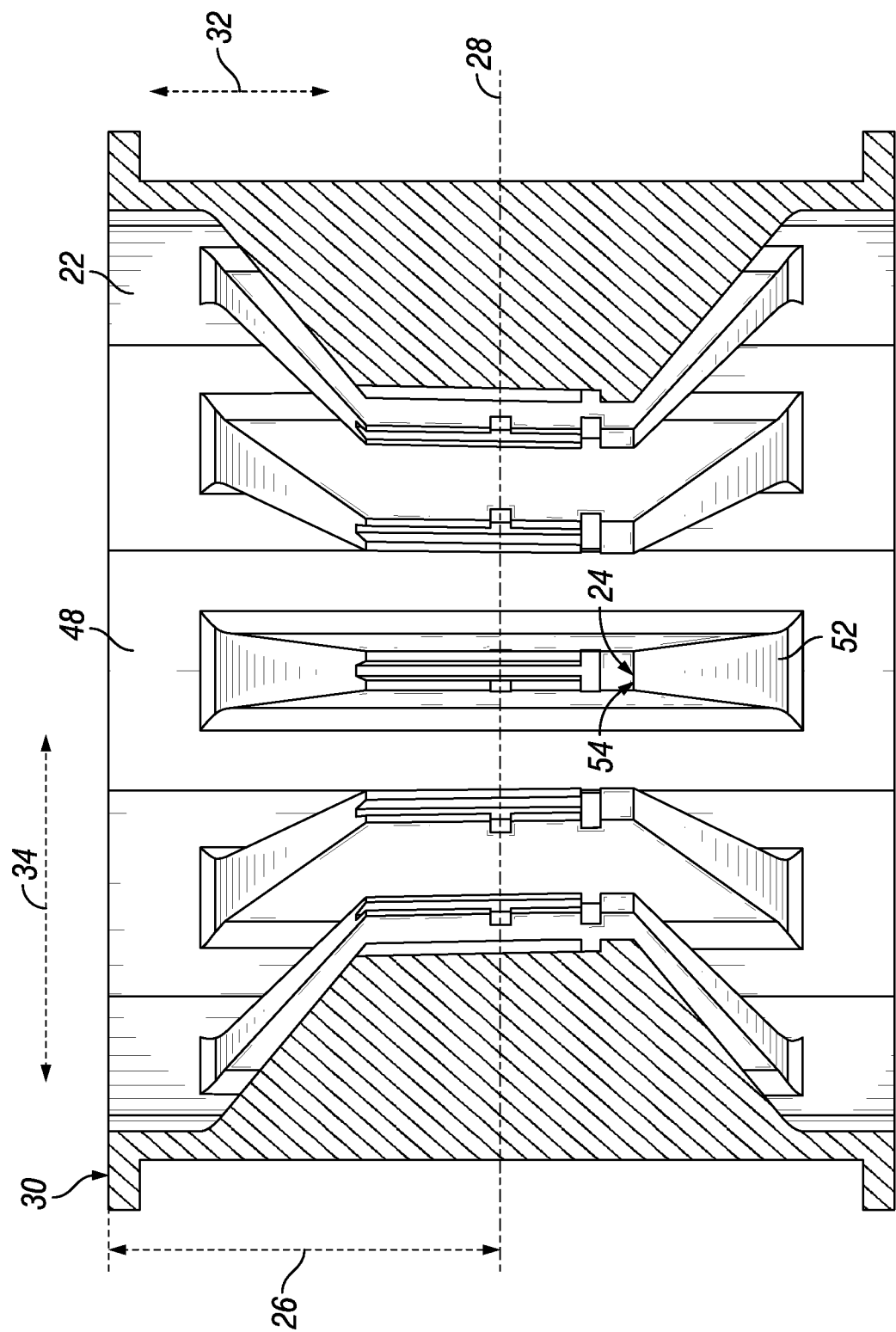


FIG. 3

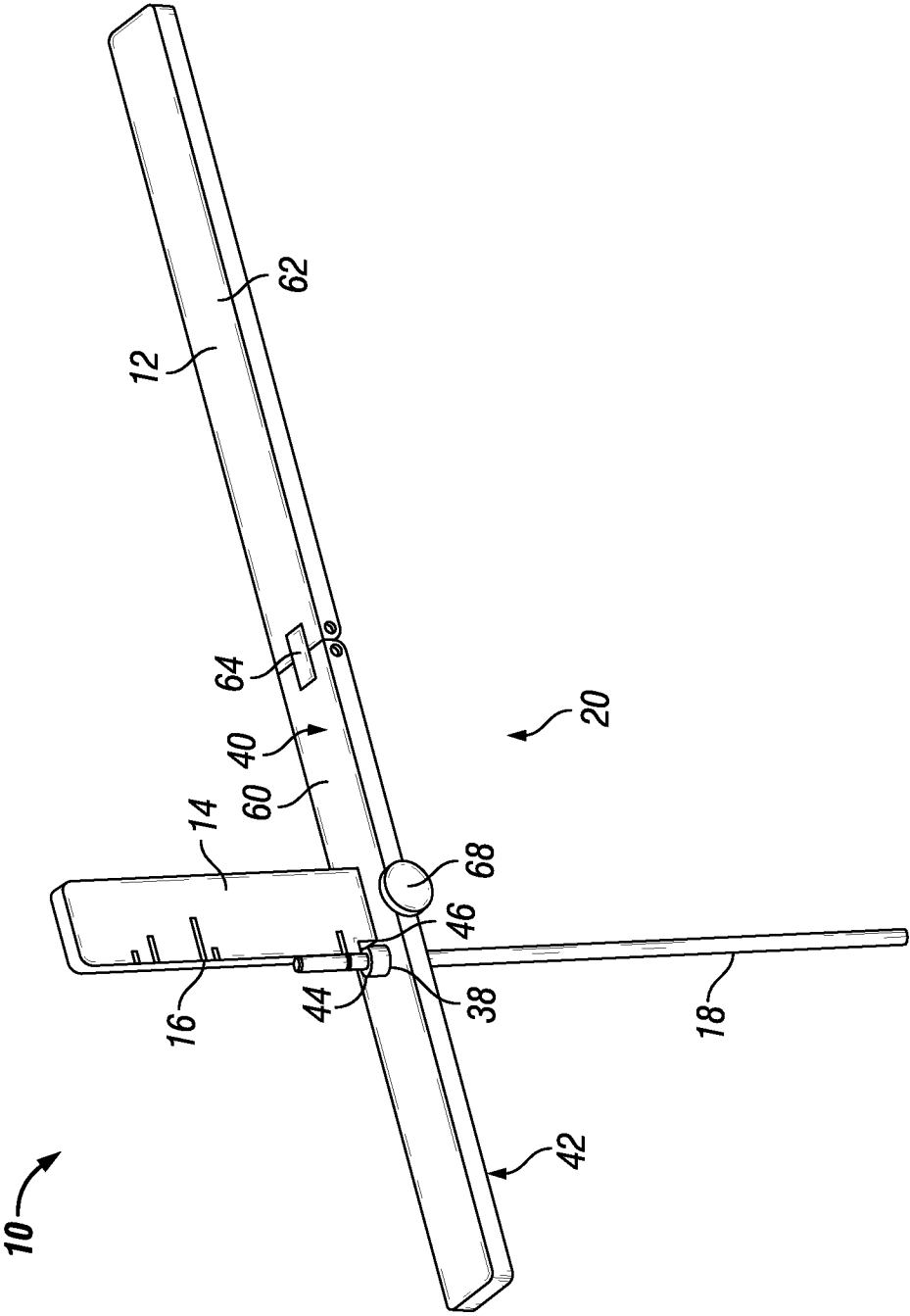


FIG. 4

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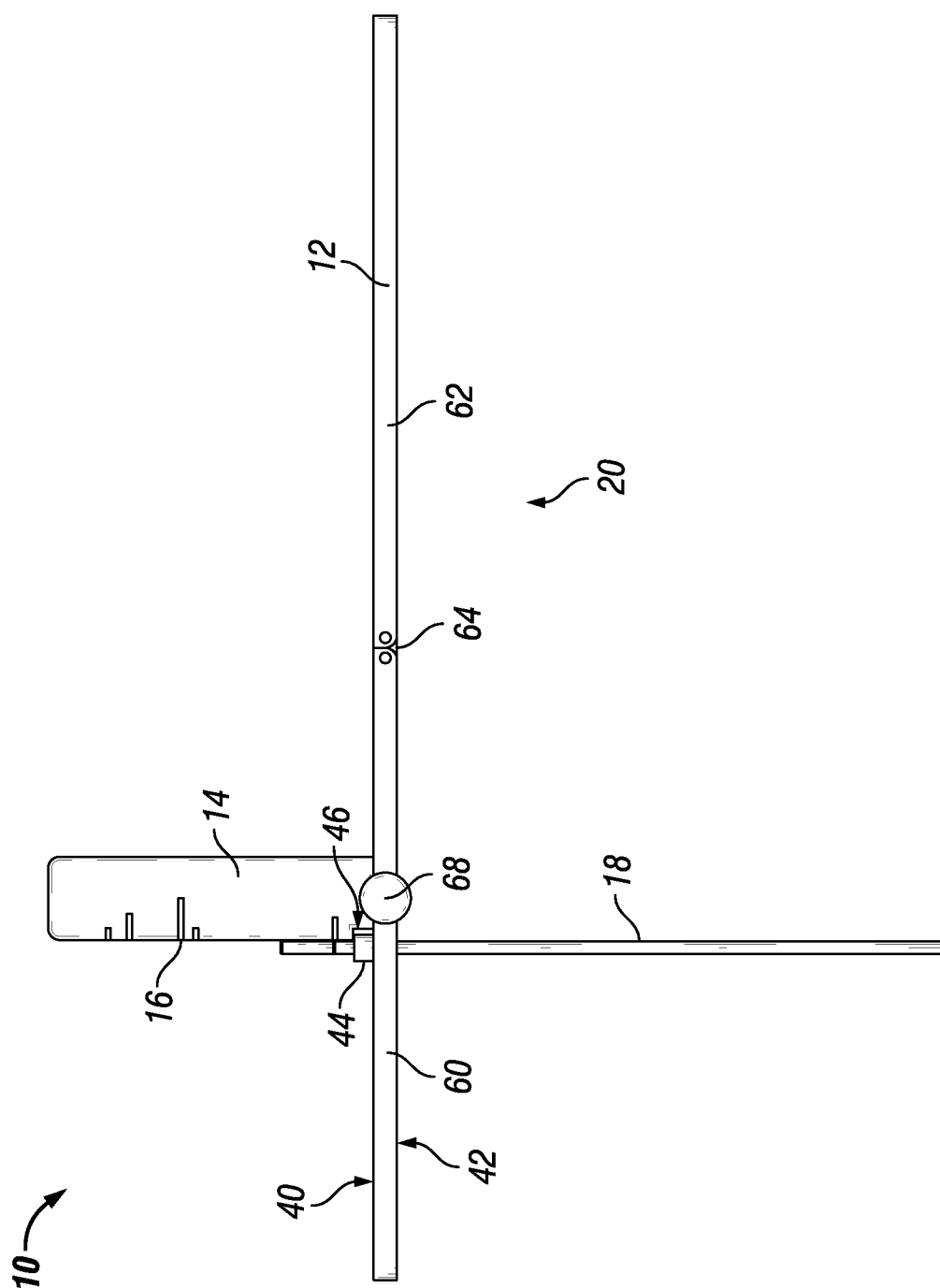


FIG. 5

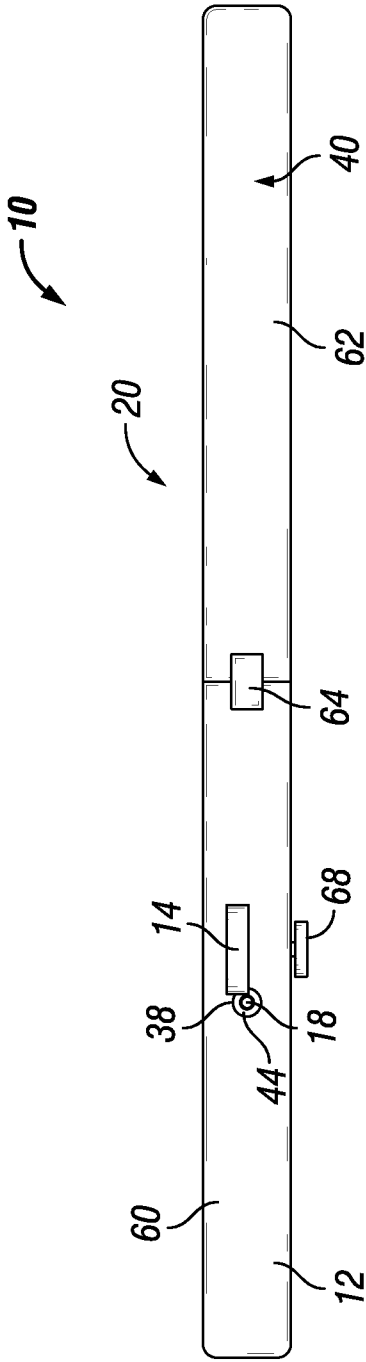


FIG. 6

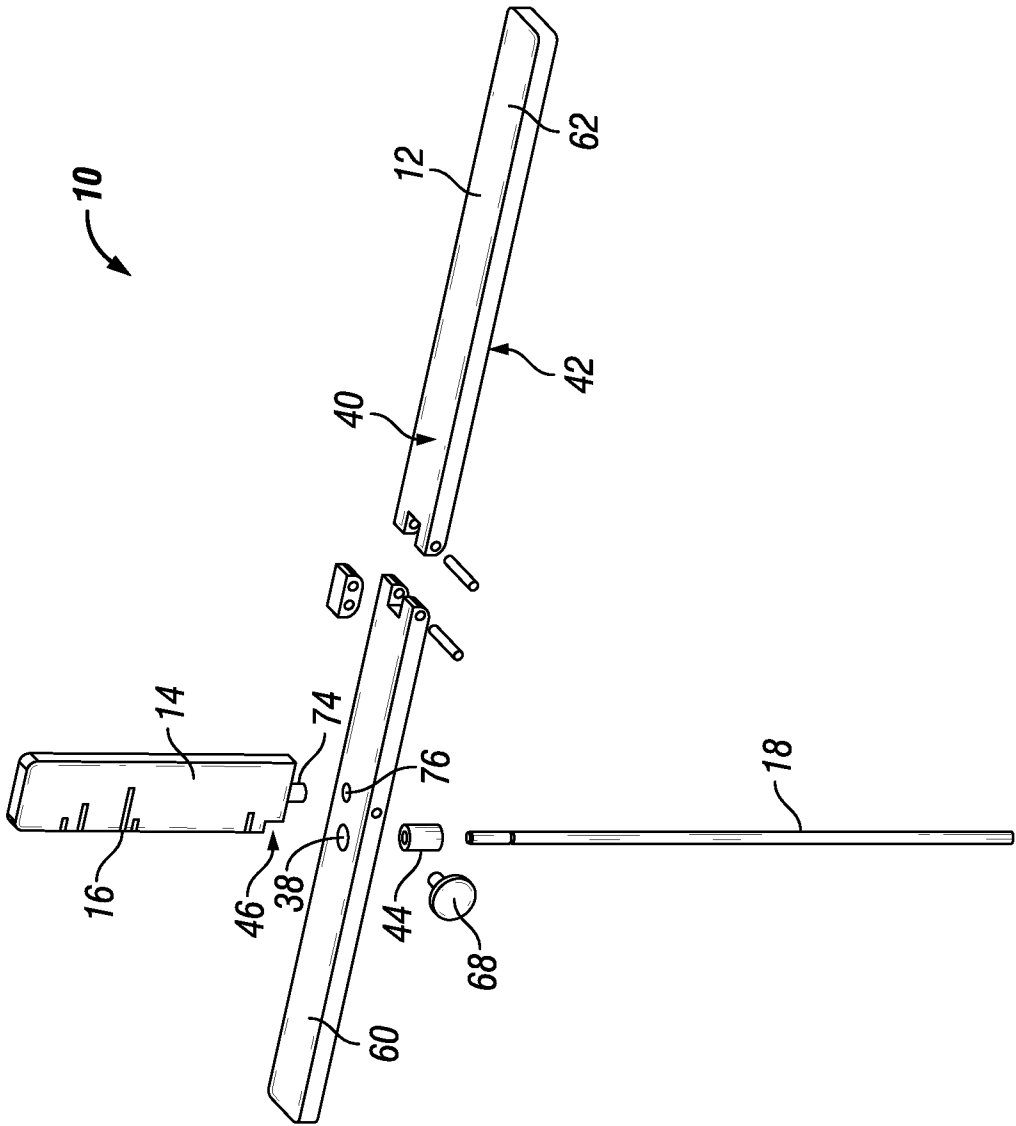


FIG. 7

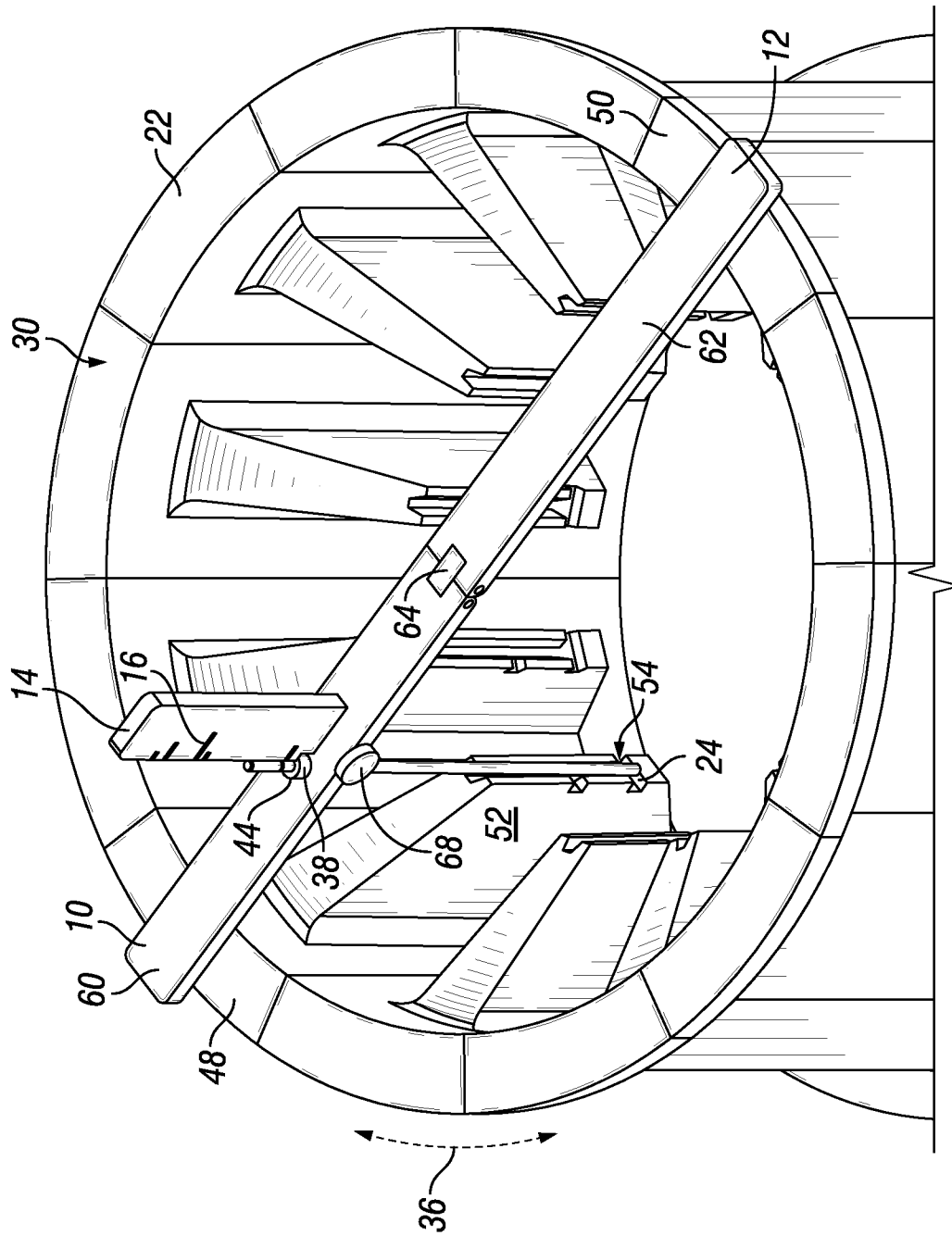


FIG. 8

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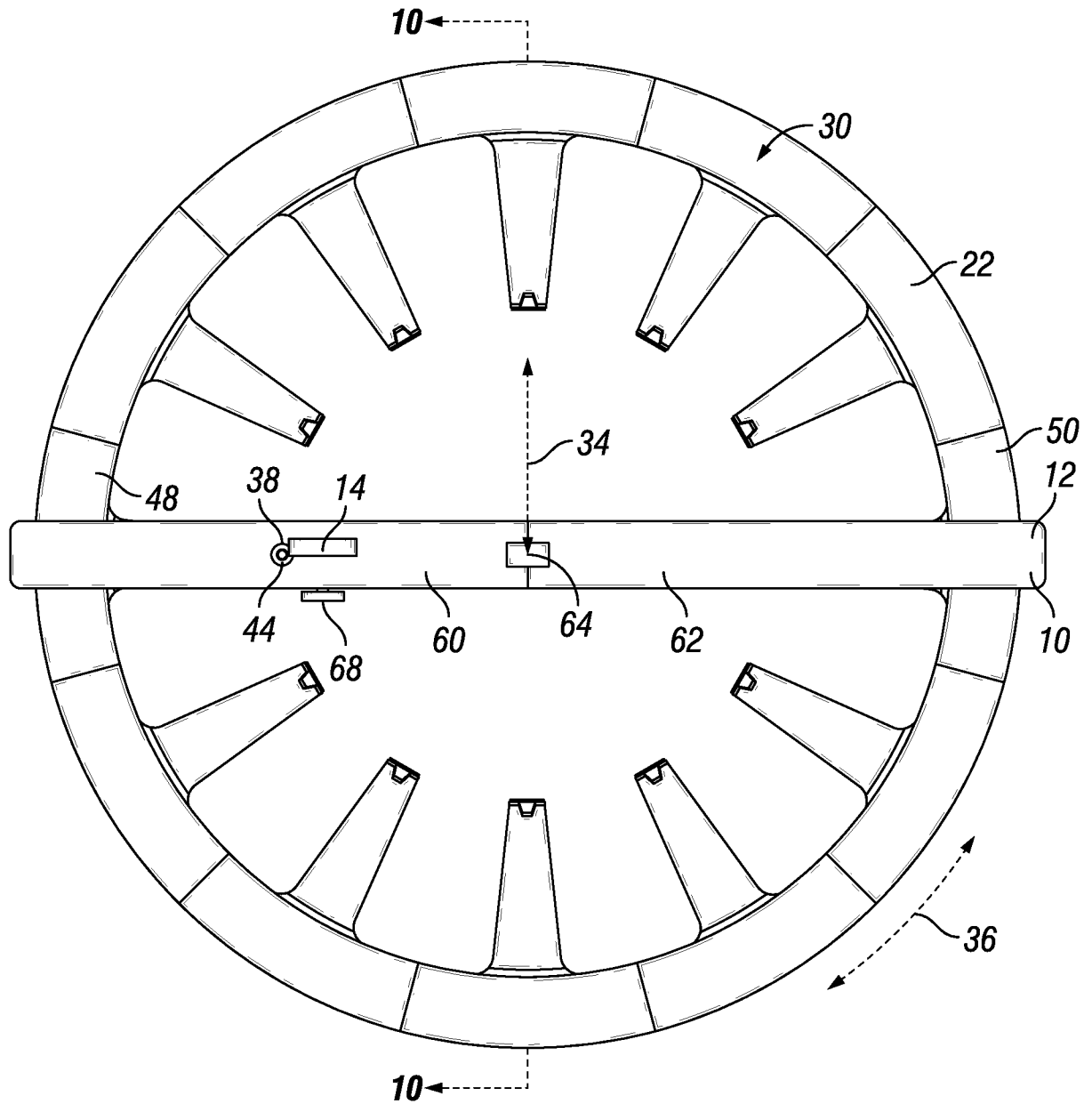


FIG. 9

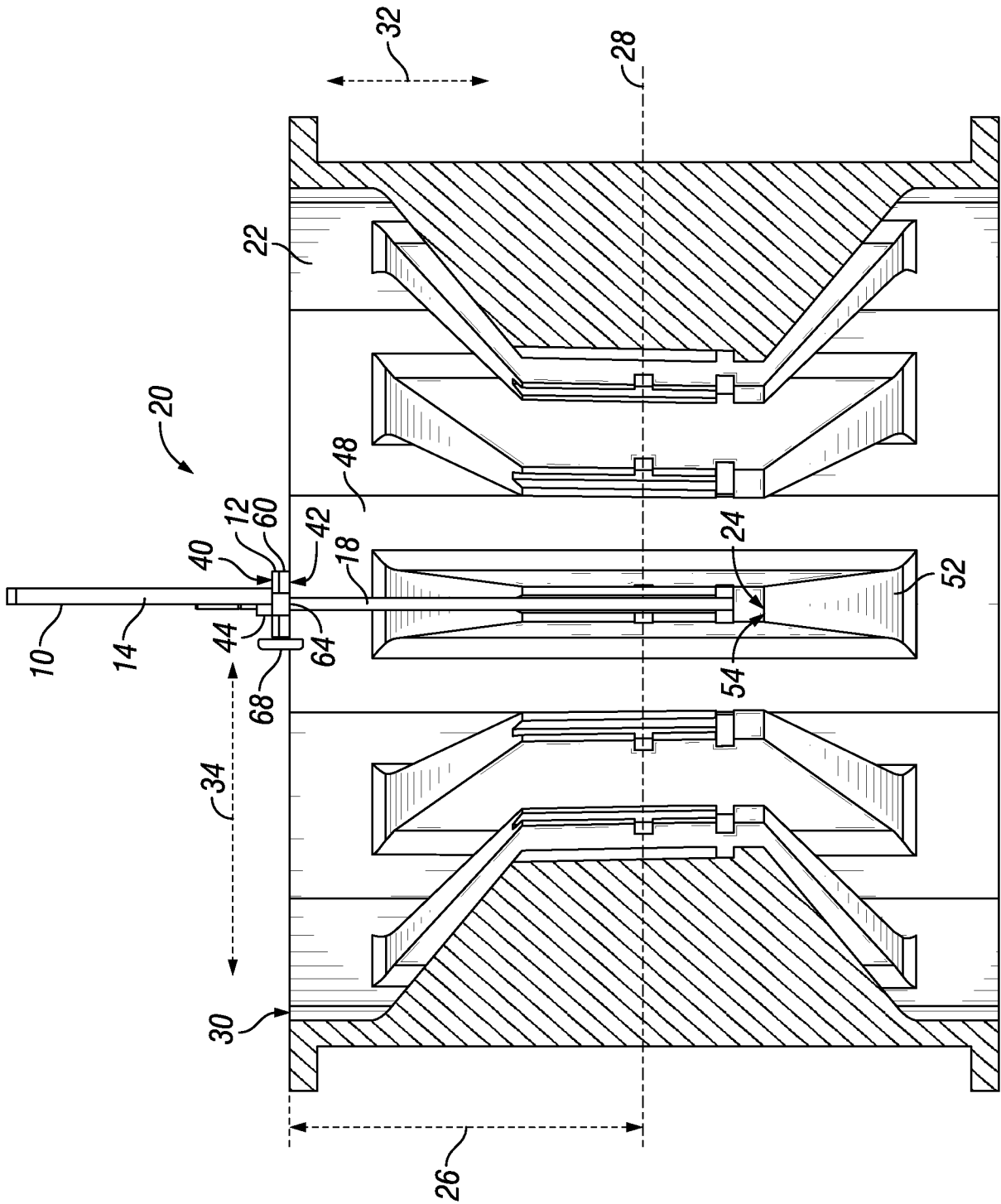
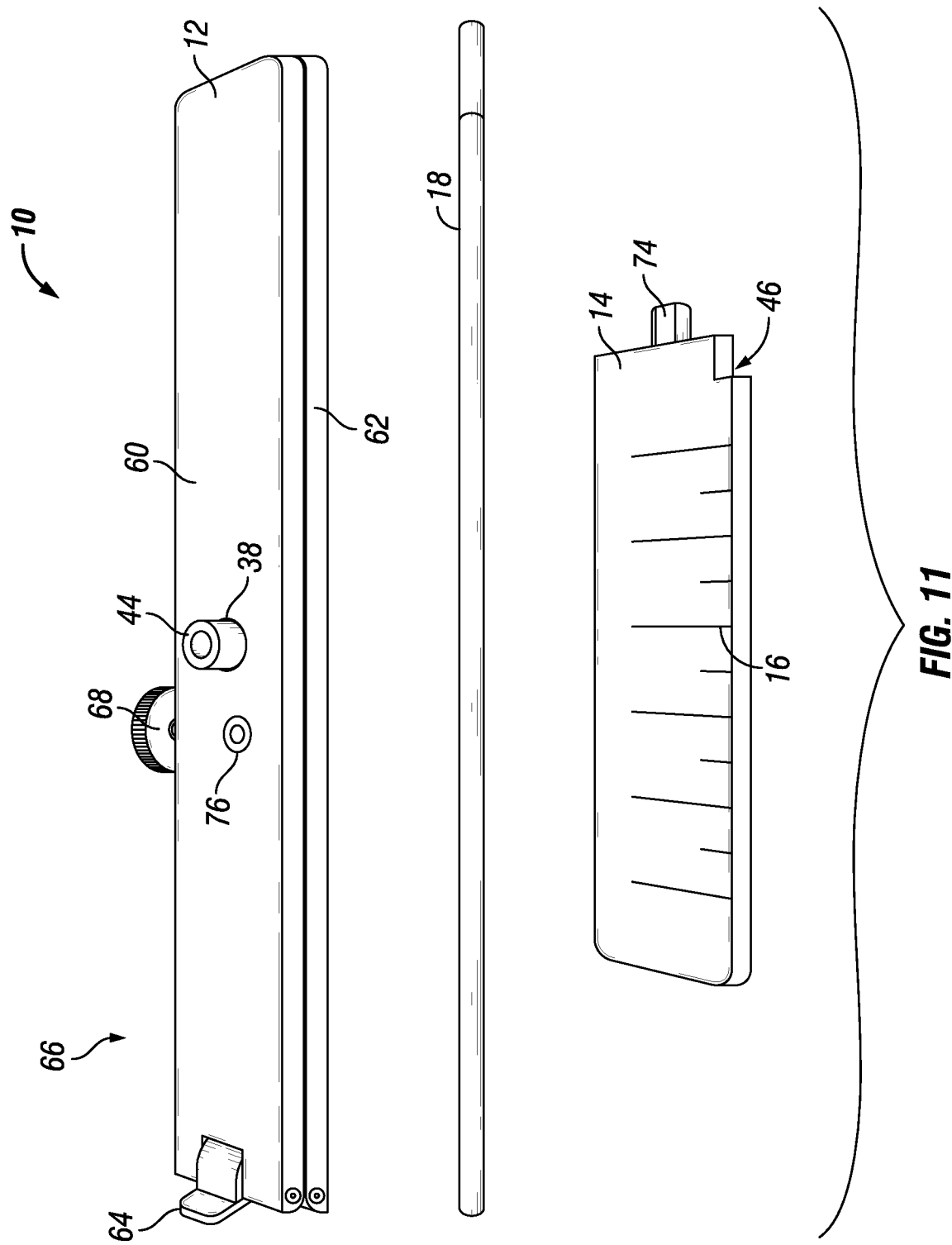


FIG. 10



INTERNATIONAL SEARCH REPORT

International application No
PCT/US2017/013664

A. CLASSIFICATION OF SUBJECT MATTER
INV. B29D30/54
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B29D B60C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 375 153 A (ROGER ANTRAIGUE) 26 March 1968 (1968-03-26)	1-6
Y	column 3, line 19 - line 23; figure 1 -----	7-14
X	DE 11 27 071 B (NANNO TH J COLLMANN) 5 April 1962 (1962-04-05)	1-5
Y	figure -----	6-14
Y	GB 1 155 188 A (COLLMANN GMBH & CO [DE]; HANS TIES [DE]) 18 June 1969 (1969-06-18) figures -----	7-14
Y	WO 2015/153002 A1 (BRIDGESTONE BANDAG LLC [US]) 8 October 2015 (2015-10-08) paragraph [0039]; figures 3,4 -----	7-14
	-/--	



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search

22 March 2017

Date of mailing of the international search report

30/03/2017

Name and mailing address of the ISA/

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Authorized officer

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2017/013664

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 037 171 A1 (BRANICK MFG INC [US]) 7 October 1981 (1981-10-07) figures -----	7-14
Y	US 3 614 969 A (BREINER CARL M) 26 October 1971 (1971-10-26) figures -----	7-14
Y	GB 555 060 A (GENEVOISE INSTR PHYSIQUE) 3 August 1943 (1943-08-03) claim 1; figures -----	6
Y	DE 12 01 044 B (JAMES ARNOLD SMYSER) 16 September 1965 (1965-09-16) figures -----	7-14
Y	EP 2 674 289 A1 (BRIDGESTONE CORP [JP]) 18 December 2013 (2013-12-18) figures -----	7-14

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2017/013664

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3375153	A	26-03-1968	DE 1299413 B 17-07-1969
		FR 1443061 A 24-06-1966	
		US 3375153 A 26-03-1968	
DE 1127071	B	05-04-1962	NONE
GB 1155188	A	18-06-1969	DE 1579154 A1 29-01-1970
		GB 1155188 A 18-06-1969	
WO 2015153002	A1	08-10-2015	CA 2944344 A1 08-10-2015
		CN 106163836 A 23-11-2016	
		EP 3126164 A1 08-02-2017	
		WO 2015153002 A1 08-10-2015	
EP 0037171	A1	07-10-1981	AU 540372 B2 15-11-1984
		DE 3160910 D1 27-10-1983	
		DK 498480 A 28-09-1981	
		EP 0037171 A1 07-10-1981	
		JP S56137945 A 28-10-1981	
		NO 803295 A 28-09-1981	
		US 4298420 A 03-11-1981	
US 3614969	A	26-10-1971	NONE
GB 555060	A	03-08-1943	NONE
DE 1201044	B	16-09-1965	NONE
EP 2674289	A1	18-12-2013	CN 103347687 A 09-10-2013
		EP 2674289 A1 18-12-2013	
		JP 5675403 B2 25-02-2015	
		JP 2012162014 A 30-08-2012	
		US 2014020813 A1 23-01-2014	
		WO 2012108286 A1 16-08-2012	